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~~Standard Practice for Assessment of Vapor Intrusion into Structures on Property Involved in Real Estate Transactions~~Designation: E2600 – 10

Standard Guide for Vapor Encroachment Screening on Property Involved in Real Estate Transactions[1]

This standard is issued under the fixed designation E2600; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 *Purpose*—~~The purpose of this practice is to define good commercial and customary practice in the United States of America for conducting a *vapor intrusion assessment (VIA)* —~~The purpose of this guide is to provide practical guidance and a useful process for conducting a *vapor encroachment screen (VES)* on a property parcel involved in a *real estate transaction* ~~with respect to *in the United States of America with respect to* chemicals of concern (COC) that may migrate as vapors into existing or planned structures on a property due to contaminated soil and groundwater on the property or within *close proximity* to the property. This practice may be used as a voluntary supplement to Practice~~ that may migrate as vapors onto a property as a result of contaminated soil and groundwater on or near the property. This guide may be used in conjunction with Practice E1527 ~~and does not alter or in any way define the scope of that practice. In addition, performance of this standard is not a requirement of and does not constitute, expand, or in any way define "all appropriate inquiry" as defined or approved by U.S. EPA under CERCLA and the regulations thereunder, including 40 CFR Sec. 312.11.~~

~~1.1.1*Vapor Intrusion Condition (VIC)*—In defining a standard of good commercial and customary practice for conducting a *VIA* on a parcel of property, the goal of the process established by this practice is to identify whether or not a *vapor intrusion condition (VIC)* exists or is likely to exist on the property. The term *VIC* means the presence or likely presence of any *COC* in the indoor air environment of existing or planned structures on a property caused by the release of vapor from contaminated soil or groundwater either on the property or within *close proximity* to the property, at a concentration that presents or may present an unacceptable health risk to occupants. The term is not intended to include *de minimis conditions* that do not normally represent an unacceptable health risk to occupants and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. A condition determined to be *de minimis* does not represent a *VIC*.~~ but does not alter or in any way define the scope of that practice. In addition, performance of this guide is not a requirement of and does not constitute, expand, or in any way define "all appropriate inquiry" as defined and approved by the U.S. Environmental Protection Agency (EPA) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the regulations there under, including 40 CFR Sec. 312.11.

1.1.1 *Vapor Encroachment Condition (VEC)*—The goal of conducting a *VES*, as established by this guide, on a parcel of property is to identify a *vapor encroachment condition (VEC)*, which is the presence or likely presence of COC vapors in the sub-surface of the *target property (TP)* caused by the release of vapors from contaminated soil or groundwater either on or near the *TP* as identified by Tier 1 (see Section 8) or Tier 2 (see Section 9) procedures.

1.1.2 ~~*Other* *Federal, State, and Local Environmental Laws*~~—This ~~practice~~guide does not address requirements of any federal, state, or local laws with respect to vapor intrusion. *Users* ~~are cautioned that federal, state, and local laws, regulations or policy may impose *VIA* obligations that are beyond the scope of this practice (refer to~~ are cautioned that federal, state, and local laws, regulations, or policy may impose vapor encroachment screening or vapor intrusion assessment obligations that are beyond the scope of this guide (information is provided in Appendix X5 and Appendix X9). *Users* should also be aware that there ~~are likely~~

[1] This ~~practice~~guide is under the jurisdiction of ASTM Committee E50 on Environmental Assessment, Risk Management and Corrective Action and is the direct responsibility of Subcommittee E50.02 on Real Estate Assessment and Management.

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~~to~~may be other legal obligations, for example, disclosure, with regard to *COC* ~~discovered on the property that are not addressed in this practice and that may pose risks of civil or criminal liability, or both.~~ or *COC* vapors discovered on the *TP* that are not addressed in this guide.

1.1.3 *Documentation*—~~The scope of this practice includes investigation and reporting requirements. Sufficient documentation of all sources, records, and resources used in the inquiry required by this practice shall be provided in the *report* (refer to Section 12~~—The scope of this guide includes investigation and reporting actions. Sufficient documentation of all sources, records, and resources used in the investigation procedures that are set out in this guide should be provided in the *VES report* (refer to Section 10).

1.2 *Objectives*—Objectives guiding the development of this ~~practice~~guide are: *(1)* ~~to synthesize and put into writing good commercial and customary practice for conducting a *VIA*~~ to synthesize and put into writing a practical guide for conducting a *VES* on a property involved in a *real estate transaction* ~~,~~ *and (2)* ~~to supplement a *Phase I environmental site assessment (ESA)* conducted in accordance with Practice E1527, *(3)* to ensure that the process for assessing vapor intrusion is practical and reasonable, and *(4)* to provide an industry standard for a *VIA* on a property involved in a *real estate transaction*.~~ to provide that the process to screen for a *VEC* is practical and reasonable.

1.3 *Considerations ~~Beyond~~ Outside the Scope*—The use of this ~~practice~~guide is strictly limited to the scope set forth in this section. Section ~~13~~11 of this ~~practice~~guide identifies, for informational purposes, certain tasks (not an all-inclusive list) ~~which~~that may be conducted on a property that are beyond the scope of this ~~practice~~guide but ~~which~~that may warrant consideration by parties to a *real estate transaction*. ~~The need~~Whether to include an investigation of any such conditions in the *environmental professional's* ~~scope of services should be evaluated based upon, among other factors, the nature of the property and the reasons for performing the site assessment (for example, a more comprehensive evaluation of *business environmental risk*) and should be agreed upon between the~~ *scope of services should be evaluated by the user* and should be agreed upon between the *user* and *environmental professional* as additional services beyond the scope of this ~~practice prior to~~ guide before initiation of ~~the~~a *Phase I ESA* conducted in conjunction with a *VES* or initiation of an independent ~~*VIA*~~VES.

1.4 ~~*Organization of This Practice*—This practice has thirteen sections and nine appendices. The appendices are included for informational purposes and are not part of the procedures prescribed in this practice.~~

Units—The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *Organization of This Guide*—This guide has eleven sections and nine appendices. The appendices are included for informational purposes and are not part of the procedures prescribed in this guide.

~~Section 1~~	~~contains the scope of the practice.~~
Section 1	contains the scope of the guide.
Section 2	includes the referenced documents.
~~Section 3~~	~~has definitions of terms pertinent to this practice, terms used in this practice but defined in Practice E1527, and acronyms.~~
Section 3	has definitions of terms pertinent to this guide, terms used in this guide but defined in Practice E1527, and acronyms.
~~Section 4~~	~~is directed at the significance and use of this practice.~~
Section 4	is directed at the significance and use of this guide.
~~Section 5~~	~~discusses the relationship between this practice and the Practice E1527 *Phase I ESA* practice.~~
Section 5	discusses the relationship between this guide and Practice E1527.
~~Section 6~~	~~describes the *user's* responsibilities under this practice.~~
Section 6	describes the *user's* responsibilities under this guide.
~~Sections 7-12~~	~~are the main body of the *VIA* process, including evaluation and *report* preparation.~~
Sections 7-10	consist of the main body of the *VES* process, including evaluation and *report* preparation.
~~Section 13~~	~~provides additional information regarding non-scope considerations (see 1.3).~~
Section 11	provides information regarding non-scope considerations (see 1.3).
Appendix X1	~~provides the legal background on federal and state liability for vapor intrusion.~~
provides legal background in support of vapor encroachment screening.	
~~Appendix X2~~	~~provides guidance on suggested qualifications for the *environmental professional* conducting the *VIA*.~~
Appendix X2	provides guidance on suggested qualifications for the *environmental professional* conducting the *VES*.
~~Appendix X3~~	~~provides a sample questionnaire for the *environmental professional* to obtain pertinent information for the *VIA* from the property *owner/operator/occupants*.~~
Appendix X3	provides a sample questionnaire for the *environmental professional* to obtain pertinent information for the *VES* from the *property owner/operator/occupants*.
~~Appendix X4~~	~~provides a recommended table of contents and report format for the *VIA* investigation when not incorporated into a *Phase I ESA* report.~~
Appendix X4	provides a recommended table of contents and report format for the *VES* investigation when not incorporated into a *Phase I ESA* report.
~~Appendix X5~~	~~includes a listing of federal and state agency web sites discussing their vapor intrusion policies and guidance.~~
Appendix X5	includes a listing of federal and state agency web sites that discuss vapor intrusion assessment policies and guidance.
Appendix X6	includes a list of typical *chemicals of concern*.
Appendix X7	~~provides a table of background levels of common *chemicals of concern* in ambient and indoor air.~~
provides general guidance for vapor intrusion assessment and mitigation.	
~~Appendix X8~~	~~provides guidance and references for data collection in the conduct of a *VIA*.~~
Appendix X8	provides general guidance and references for data collection in the conduct of vapor intrusion investigations.
~~Appendix X9~~	~~provides a supplemental bibliography of federal and state vapor intrusion initiatives and other publications that may assist the *environmental professional* conducting a *VIA*.~~

Appendix X9 provides a supplemental bibliography of federal and state vapor intrusion guidance and other publications that may assist the *environmental professional* conducting a *VES* or vapor intrusion assessment.

1.5*This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This practice offers a set of instructions for performing one or more specific operations. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title means only that the document has been approved through the ASTM consensus process.* This guide does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this guide to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1.7 *This guide cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This ASTM guide is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this guide be applied without consideration of a project's many unique aspects. The word "Standard" in the title means only that the guide has been approved through the ASTM consensus process.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E1527 Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process

E1739Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process

2.2 *Federal Statutes: 42 U.S.C.U.S. Code, Title 42, The Public Health and Welfare, Solid Waste Disposal, Identification and Listing of Hazardous Wastes, §6901, 6903, 6921, 9605, 9601, et seq.*

42 U.S.C. U.S. Code, Title 42, The Public Health and Welfare, Solid Waste Disposal, Identification and Listing of Hazardous Wastes, §6901, 6903, 6921; 42 U.S.C. U.S. Code, Title 42, Comprehensive Environmental Response, Compensation and Liability Act, 9605, 9601, *et seq*.

2.3 *USEPA Documents:*

40 CFRPart 300, Title 40, Protection of Environment, Chapter 1, Environmental Protection Agency, Parts 300, 302, 312, 355, *et seq.seq*.

2.4 *Other Documents:*

NTPNational National Toxicology Program, "Annual Report on Carcinogens," (latest edition)

IARCInternational International Agency for Research on Cancer, "Monographs" (latest editions)

NIOSHNational National Institute for Occupational Safety and Health, "Registry of Toxic Effects of Chemical Substances"

3. Terminology

3.1 This section provides definitions and descriptions of terms used in this practiceguide and of terms used in this practiceguide extracted from Practice E1527, (some of which have been modified to be consistent with this guide), and a list of acronyms for keywords used in this practice.guide. The terms are an integral part of this practiceguide and are critical to an understanding of the practiceguide and its use.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *advective transport*—the process by which a *solute* such as a contaminant is transported by the bulk motion of a fluid such as groundwater from higher to lower hydraulic potential. approximate minimum search distance, *n*—defined in subsections 8.3.1 and 8.3.2 and is also the *area of concern (AOC)*.

3.2.2 *air change rate*—the ratio of the volumetric rate at which air enters (or leaves) a room or building divided by the volume of the room or building, usually expressed as air changes per hour. aquifer, *n*—rock or sediment in a formation, a group of formations, or part of a formation that is saturated and sufficiently permeable to transmit water to wells or springs.

3.2.3 *aquifer*—rock or sediment in a formation, group of formations, or part of a formation which is saturated and sufficiently permeable to transmit economic quantities of water to wells or springs.

3.2.4*area of concern*—the area closely and completely surrounding a *target property* (primary *area of concern*, see area of concern (AOC), *n*—defined in subsections 8.2.1, 8.3.1, and 8.3.2), plus the area further away but only hydrogeologically

[3] Whenever terms defined in 3.2 or 3.3 are used in this practice, they are in *italics*.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

up-gradient from a *target property* (secondary *area of concern*, see 8.3.3) that, if sources of known or suspect contamination with *COC* are identified within, could result in a *pVIC* or *VIC* at the *target property*. The *area of concern* is determined in Tier 1 of this practice. For Tier 1 screening purposes, the up-gradient area may be inferred by the *environmental professional* based upon groundwater flow direction experience in the area, hydrogeological and hydrologic considerations, topographical gradients, and/or available groundwater flow information collected in Phase II delineation of contamination reports associated with nearby contaminated sites. and is also the *approximate minimum search distance*.

3.2.4 *biodegradation*, *n*—process by which microbial organisms transform or alter (through metabolic, enzymatic, or other action) the structure of chemicals present in the environment.

3.2.5 *attenuation factor (also referred to as attenuation coefficient)*—a factor representing the process by which vapors in the subsurface are reduced in concentration through degradation and dilution as they migrate vertically toward the surface.

3.2.6*background level*—the concentration of chemicals commonly found in the indoor air environment that has not been impacted by chemical vapors released from contaminated soil and/or groundwater. Background levels are influenced by chemicals in ambient air, for example, generated by industrial or motor vehicle emissions, and so forth, by chemical emissions from building materials, by chemical emissions from indoor activities such as smoking, or by emissions such as radon associated with the natural geology of an area.

3.2.7*biodegradation*—a process by which microbial organisms transform or alter (through metabolic, enzymatic, or other action) the structure of chemicals present in the environment.

3.2.8*carcinogen*—a compound that has been identified in a publication of the National Toxicology Program (NTP), "Annual Report on Carcinogens" (latest edition) or of the International Agency for Research on Cancer (IARC) "Monographs" (latest editions) as causing or potentially causing cancer. (The "Registry of Toxic Effects of Chemical Substances" published by the National Institute for Occupational Safety and Health (NIOSH) indicates whether a chemical has been found by NTP or IARC to be a potential carcinogen.)

3.2.9*chemical(s) of concern (COC)*—a chemical in the subsurface environment that is known or reasonably expected to be present, that can potentially migrate as a vapor into an existing or planned structure on a property, and that is generally recognized as having the potential for an adverse impact on human health. *COC* generally meet specific criteria for *chemical(s) of concern, COC*, *n*—chemical that is present in the subsurface environment and can potentially migrate as a vapor into the sub-surface of the *TP*.

3.2.5.1 *Discussion*—COC generally meet specific criteria for *volatility* and *toxicity* , and include volatile organic compounds, semi-volatile organic compounds, petroleum hydrocarbons, and volatile inorganic analytes (such as mercury). TypicalCommon *COC* for the vapor intrusion pathway are presented in are presented in Appendix X6.

3.2.10*close proximity*—close enough to a *target property* such that there is a reasonable possibility a

3.2.6 *conduit*, *n*—preferential pathway along which vapors released from contaminated soil or groundwater may migrate onto the *TP*.

3.2.7 *contaminant*, *n*—any physical, chemical, biological, or radiological substance or matter that has an adverse effect on air, water, or soil.

3.2.8 *contaminated plume*, *n*—plume in which concentrations of *COC* vapor could migrate into the indoor air environment of existing or planned structures on the *target property* (refer to *critical distance* and 8.5.3).

3.2.11*conduit*—a preferential pathway along which vapors released from contaminated soil or groundwater may migrate to a building or into a building's indoor air space.

3.2.12*contaminant*—any physical, chemical, biological, or radiological substance or matter that has an adverse effect on air, water or soil.

3.2.13*contaminated plume*—plume where concentrations of *COC* known to be present in the soil gas and/or groundwater exceed applicable standards established by the responsible regulatory agency. A *are known to be present in the soil or groundwater or both at concentrations exceeding levels that generally would be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.*

3.2.8.1 *Discussion*—A *contaminated plume* can take the form of a groundwater *contaminated plume* or a soil gas *contaminated plume*. In a groundwater *contaminated plume*, *COC* are conveyed as *solutes* away from the point at which they were introduced into groundwater. They move with the migrating groundwater mass in the direction of groundwater flow. When dispersion within the groundwater *contaminated plume* brings a dissolved *COC* to the groundwater-soil gas interface, the *COC* may transition from the dissolved state to the vapor state and evolvemigrate from groundwater into soil gas in the vadose zone. Once a *COC* evolves into soil gas in the vadose zone, its migration is no longer connected with groundwater movement. In a soil gas *gets into soil gas in the vadose zone, its migration may no longer be dependent on or related to groundwater movement. In a soil contaminated plume*, *COC* in their vaporous statevolatilized from the soil mix freely with soil gas that exists within soil voids in the vadose zone. *COC* in the soil gas *contaminated plume* can be introduced from underlying contaminated groundwater, as a result of a liquid spill into vadose zone soils, or by the direct release of gas from a leaking underground pressurized gas line. Migration of the soil gas *contaminated plume* through the vadose zone may be in any direction; however, it preferentially follows the path of least resistance. in the soil gas can also be introduced from underlying contaminated groundwater, as a result of a liquid spill into vadose zone soils, or by the direct release of vapors from a leaking underground source. Migration of the *COC* contaminated soil gas through the

vadose zone may be in any direction; however, it preferentially follows the path of least resistance. Fluctuations in barometric pressure may cause movement of air and vapors into and out of the vadose zone through preferential pathways.

3.2.9 *contaminated property*, *n*—property on which soil or groundwater or both contains *chemicals of concern (COC)* at concentrations exceeding levels that generally would be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.

3.2.10 *critical distance*, *n*—defined in subsection 9.2.

3.2.11 *dwelling*, *n*—structure or portion thereof used for residential habitation.

3.2.12 *environmental professional*, *n*—person meeting the education, training, and experience requirements as set forth in 40 CFR 312.10(b), which is the requirement set forth in Practice E1527 (see subsection 3.3.5).

3.2.13 *findings*, *n*—defined in subsection 10.2.2.

3.2.14 ~~*contaminant source*—the origin of the soil and groundwater contamination; may be a general property location (for example, a dry cleaner property address) or, if known, a specific location on a property (for example, the dumpster behind the dry cleaners where filters with perchloroethylene dry cleaning solvent were disposed).~~ fracture, *n*—break in a rock formation.

3.2.14.1 *Discussion*—Faults, shears, joints, and planes of fracture cleavage are all types of fractures.

3.2.15 ~~*critical distance*—lineal distance (horizontal, vertical, and so forth) from the nearest edge of a *contaminated plume* to the nearest potentially impacted structure existing or planned on the *target property* involved in the *real estate transaction*, or to the nearest property boundary if there are no planned structures on the *target property*, for example, the *target property* is undeveloped.~~ groundwater, *n*—water contained in the pore spaces of saturated geologic media.

3.2.16 ~~*de minimis conditions*—conditions, such as the presence of *COC* at trace concentrations within a structure, that generally do not present an unacceptable health risk to occupants and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. A condition determined to be *de minimis* is not a *pVIC* or *VIC*.~~ Henry's law, *n*—relationship between the partial pressure of a compound in air and the concentration of that compound in water under equilibrium conditions; *Henry's law* constants are temperature dependent.

3.2.17 ~~*dwelling*—a structure or portion thereof used for residential habitation.~~ hydrocarbon, *n*—chemical compound composed only of carbon and hydrogen atoms.

3.2.18 ~~*environmental professional*—a person meeting the education, training, and experience requirements as set forth in Practice E1527 (see 3.3.7).~~ moisture content (of soil), *n*—amount of water lost from soil upon drying to a constant weight expressed as the weight per unit weight of dry soil or as the volume of water per unit bulk volume of the soil.

3.2.18.1 *Discussion*—For a fully saturated medium, moisture content expressed as a volume fraction equals the porosity.

3.2.19 ~~*fracture*—a break in a rock formation or building concrete foundation due to structural stresses. Faults, shears, joints, and planes of fracture cleavage are all types of fractures.~~ nonaqueous phase liquid, NAPL, *n*—substances that do not dissolve readily in water and that remain in the original bulk liquid form in the subsurface.

3.2.19.1 *Discussion*—Light NAPL (LNAPL), such as gasoline, is less dense than water and can accumulate above the water table, while dense NAPL (DNAPL), such as many chlorinated solvents, including trichloroethylene and perchloroethylene, are more dense than water and can penetrate into the water table.

3.2.20 ~~*groundwater*—the water contained in the pore spaces of saturated geologic media.~~ permeability, *n*—qualitative description of the relative ease with which rock, soil, or sediment will transmit a fluid (that is, a liquid or gas).

3.2.21 ~~*hazard quotient*—the ratio of the actual concentration of a non-carcinogenic *COC* divided by its safe exposure level. The sum of the *hazard quotients* for multiple compounds is the *hazard index*.~~ petroleum, *n*—crude oil or any fraction thereof that is liquid at standard conditions of temperature and pressure (60°F at 14.7 psia).

3.2.21.1 *Discussion*—The term includes substances comprised of a complex blend of hydrocarbons derived from crude oil through the process of separation, conversion, upgrading, and finishing, such as motor fuels, jet oils, lubricants, and petroleum solvents, and also includes used oils.

3.2.22 ~~*Henry's law*—the relationship between the partial pressure of a compound in air and the concentration of that compound in water under equilibrium conditions. *Henry's law* constants are temperature dependent.~~ petroleum hydrocarbon chemicals of concern, *n*—for the purpose of this guide, those volatile petroleum hydrocarbon compounds that are a subset of *COC* and that readily biodegrade to carbon dioxide and water by soil microbes in aerated environments.

3.2.22.1 *Discussion—Petroleum hydrocarbon chemicals of concern* may be present in several forms in environmental media, including adsorbed to soil, as constituents of LNAPL above the water table, as dissolved solutes in groundwater, or as vapors in soil gas.

3.2.23 ~~*hydrocarbon*—a chemical compound composed only of carbon and hydrogen atoms.~~ Phase I environmental site assessment, ESA, *n*—process described in Practice E1527.

3.2.24 ~~*Integrated Risk Information System (IRIS)*—an EPA database of human health effects that may result from exposure to various substances in the environment.~~ porosity, *n*—volume fraction of a rock or unconsolidated sediment not occupied by solid material but usually occupied by liquids, gas, and/or air.

3.2.25 ~~*intrinsically safe building design*—building designs that significantly reduce or eliminate potential vapor intrusion concerns. Examples of *intrinsically safe building designs* include well ventilated underground parking facilities below office buildings and open air first floor parking below residential living space.~~ preferential pathway, *n*—pathway that has the least amount

of constraint on the migration of COC vapors.

3.2.25.1 *Discussion*—Preferential pathways are natural or man-made and may provide direct contact between the subsurface of a property and the vapor contaminant source (that is, the location on a property where the contaminated vapor intersects the preferential pathway). Natural preferential pathways may include, for example, vertically fractured bedrock where the fractures are interconnected and in direct contact with the subsurface of a property and the vapor contaminant source. Man-made preferential pathways may include, for example, utility conduits and sewers.

3.2.26 *moisture content (of soil)*—the amount of water lost from a soil upon drying to a constant weight, expressed as the weight per unit weight of dry soil or as the volume of water per unit bulk volume of the soil. For a fully saturated medium, moisture content expressed as a volume fraction equals the porosity.

3.2.27*necessary mitigation*—mitigation measures taken to mitigate a *VIC*.

3.2.28*non-aqueous phase liquid (NAPL)*—substances that do not dissolve readily in water and that remain in the original bulk liquid form in the subsurface. Light NAPL (LNAPL) such as gasoline can accumulate above the water table, while dense NAPL (DNAPL) such as many chlorinated solvents including trichloroethylene and perchloroethylene can penetrate into the water table.

3.2.29*permeability*—a qualitative description of the relative ease with which rock, soil or sediment will transmit a fluid (that is, a liquid or gas).

3.2.30*petroleum*—crude oil or any fraction thereof that is liquid at standard conditions of temperature and pressure (60°F at 14.7 psia). The term includes substances comprised of a complex blend of hydrocarbons derived from crude oil through the process of separation, conversion, upgrading, and finishing, such as motor fuels, jet oils, lubricants, and petroleum solvents, and also includes used oils.

3.2.31*petroleum hydrocarbon chemicals of concern*—for the purpose of this practice, those volatile petroleum hydrocarbon compounds that are a subset of COC and that readily biodegrade to carbon dioxide and water by ubiquitous soil microbes in aerated environments. *Petroleum hydrocarbon chemicals of concern* may be present in several forms in environmental media, including adsorbed to soil, as constituents of LNAPL above the water table, as dissolved solutes in groundwater, or as vapors in soil gas. Where present as substantial constituents in LNAPL, *petroleum hydrocarbon chemicals of concern* may constitute a significantly stronger vapor source than where present as dissolved solutes in groundwater.

3.2.32*Phase I environmental site assessment (ESA)*—the process described in Practice E1527.

3.2.33*porosity*—the volume fraction of a rock or unconsolidated sediment not occupied by solid material but usually occupied by liquids, gas and/or air.

3.2.34*potential vapor intrusion condition (pVIC)*—the potential for the presence or likely presence of any *COC* in the indoor air environment of existing or planned structures on a property caused by the release of vapor from contaminated soil or groundwater either on the property or within *close proximity* to the property, at a concentration that presents or may present an unacceptable health risk to occupants. A *pVIC* exists when the screening defined by this practice (see Tiers 1 and 2) indicates the potential for a *VIC* but where there is insufficient data to ascertain the presence or likely presence of *COC* in the indoor air environment of existing or planned structures on a *target property*. A condition determined to be *de minimis* is not a *pVIC*. Should a known or suspect source of soil and groundwater contamination with *COC* be present hydrogeologically up-gradient of the *target property* in the *area of concern*, a *pVIC* is presumed to exist if no further information is available. Should a known or suspect source of soil or groundwater contamination with *COC* suspected to be present exist within the *critical distance* of the *target property* in any direction, if no further information is available, a *pVIC* is presumed to exist.

3.2.35*pre-emptive mitigation*—mitigation measures taken to mitigate a *pVIC*, taken for precautionary reasons or taken for any other reason not related to a *VIC*.

3.2.36*preferential pathway*—the pathway that has the least amount of constraint on the migration of *COC* vapors. Preferential pathways are natural or man-made and may provide direct contact between the internal environment of a structure and the vapor contaminant source. Natural preferential pathways may include, for example, vertically fractured bedrock where the fractures are interconnected and in direct contact with the foundation of the structure and the vapor contaminant source. Man-made preferential pathways may include, for example, utility conduits and sewers. Typical arterial underground utilities are not normally considered significant preferential pathways.

3.2.37*real estate*real estate, *n*—undeveloped real property, real property used for industrial, retail, office, agricultural, other commercial, medical, or educational purposes, or property used as a single family or multi-family residential *dwelling* .

3.2.38*real estate transaction*—a transfer of title to or possession of real property or receipt of a security interest in real property.

3.2.39*risk assessment*—the evaluation of scientific information about the hazardous properties of *COC* that are known or suspected to be present, their dose-response relationships, the extent of human exposure to those *COC* and the consequential health impact.

3.2.40*risk-based concentrations (RBCs)*—acceptable concentrations of contaminants in soil, and/or soil gas, and/or groundwater that will not result in a *VIC*. Most federal and state *VIA* guidance include generic *RBCs*. Site-specific *RBCs* may be developed by the

3.2.27 *real estate transaction*, *n*—transfer of title to or possession of real property or receipt of a security interest in real property.

3.2.28 *report*, *n*—document prepared by an *environmental professional* ~~conducting the *VIA* screen in Tier 2 of this practice (refer to Guide E1739).~~

~~3.2.41*report*—a document prepared by an *environmental professional* identifying the presence or likely presence of *VIC* on a property.~~

~~3.2.42*saturated zone*—the zone in which all of the voids in the rock or soil are filled with water at a pressure that is greater than atmospheric. The~~ *pursuant to Section 10.*

3.2.29 *saturated zone*, *n*—zone in which all of the voids in the rock or soil are filled with water at a pressure that is greater than atmospheric.

3.2.29.1 *Discussion*—The *water table* is the top of the *saturated zone* in an unconfined *aquifer*.

~~3.2.43~~3.2.30 *semi-volatile organic compound*, *n*—~~a general~~ —general term for an organic compound that has ~~a high enough~~sufficient vapor pressure at standard temperature (20°C) and pressure (1 atm) to vaporize (albeit at a slower rate than *volatile organic compounds*) and enter the atmosphere.

~~3.2.44*soil gas sampling*—any one of a number of methods utilized to collect a soil gas sample from the subsurface (see Appendix X8 and Appendix X9).~~

~~3.2.45*solute*—a substance such as a contaminant that is dissolved in another substance such as groundwater.~~

~~3.2.46*sub-slab soil gas sampling*—the collection of soil gas from the zone just beneath the lowest floor slab of a building (see Appendix X8 and Appendix X9).~~

~~3.2.47*standard practice*—the application of the activities set forth in this document.~~

~~3.2.48*target property (TP)*—the property involved in the~~

3.2.31 *solute*, *n*—substance such as a contaminant that is dissolved in another substance such as groundwater.

3.2.32 *target property, TP*, *n*—property involved in the *real estate transaction* that is the subject of the ~~*VIA* defined by this practice.~~

~~3.2.49*toxic chemical*—a chemical whose vapor concentration of the pure component poses either an incremental lifetime cancer risk (ILCR) or a non-cancer hazard quotient greater than acceptable values established by applicable federal, state, or local regulatory agencies (for example, refer to U.S. EPA, 1990, National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300; Federal Register, Volume 55, No. 46, pp. 8666-8865, Washington, D.C., March 8, 40 CFR 300.430(e)(2)(i)(2)).~~

~~3.2.50*toxicity*—the effect on human health that is exhibited by a~~ *VES* defined by this guide.

3.2.33 *toxic chemical*, *n*—chemical whose vapor concentration of the pure component poses either an incremental lifetime cancer risk (ILCR) or a noncancer hazard quotient greater than acceptable values established by applicable federal, state, or local regulatory agencies.

3.2.34 *toxicity*, *n*—effect on human health that is exhibited by a *toxic chemical*.

~~3.2.51*user*—the party seeking to obtain the results of the application of this *standard practice*. Commonly, the~~

3.2.35 *user*, *n*—party who commissions the performance of a *VES* pursuant to this guide.

3.2.35.1 *Discussion*—Commonly, the *user* is the prospective purchaser of a parcel of property.

~~3.2.52~~3.2.36 *vadose zone (or unsaturated zone)*, *n*—~~the zone~~ —zone between the land surface and the water table within which moisture content is less than saturation (except in the capillary fringe) and pressure is less than atmospheric.

3.2.36.1 *Discussion*—Soil pore space typically contains air or other gases. The capillary fringe is included in the *vadose zone*.

~~3.2.53*vapor intrusion (VI)*—the migration of a~~

3.2.37 *vapor encroachment condition, VEC*, *n*—presence or likely presence of *COC* ~~vapor from a subsurface soil or groundwater source into the indoor air environment of an existing or planned structure.~~

~~3.2.54*vapor intrusion assessment (VIA)*—an assessment of the potential for *COC* vapors released from contaminated soil or groundwater to impact the indoor air environment of a structure and present a health risk to occupants. The objective of a *VIA* is to determine if a *pVIC* or *VIC* exists.~~

~~3.2.55*vapor intrusion condition (VIC)*—the presence or likely presence of any *COC* in the indoor air environment of existing or planned structures on a property caused by the release of vapor from contaminated soil or groundwater either on the property or within *close proximity* to the property, at a concentration that presents or may present an unacceptable health risk to occupants. (See 1.1.1.)~~

~~3.2.56*volatile organic compound (VOC)*—a general term for an organic compound that has a high enough vapor pressure (for example, greater than 0.5 to 1 mm Hg) at standard temperature (20°C) and pressure (1 atm) to significantly vaporize and enter the atmosphere.~~

~~3.2.57*volatility*—a chemical is considered to be sufficiently~~ *vapors in the subsurface of the TP* caused by the release of vapors from contaminated soil or groundwater or both either on or near the *TP* as identified by the Tier 1 (see Section 8) or Tier 2 (see Section 9) procedures in this guide.

3.2.38 *volatile organic compound, VOC*, *n*—general term for an organic compound that has sufficient vapor pressure (for example, greater than 0.5 to 1 mm Hg) at standard temperature (20°C) and pressure (1 atm) to significantly vaporize and enter the atmosphere.

3.2.39 *volatility*, *n*—chemical is considered to be sufficiently *volatile* if its *Henry's law* constant is greater than 10^{-5} atm-m^3-mol^{-1} and its vapor pressure is greater than 1 mm Hg at room temperature.

~~3.2.58*water table*—the top of the~~

3.2.40 *water table*, *n*—top of the *saturated zone* in an unconfined *aquifer*.

~~3.3*Practice E1527 Terms Used in This Standard:*~~

3.3 *Practice E1527 Terms Used in This Guide*—Some terms have been modified to be consistent with this guide.

3.3.1 ~~*adjoining properties*~~adjoining properties, *n*—any real property or properties the border of which is contiguous or partially contiguous with that of the *target property*, or that would be contiguous or partially contiguous with that of the *target property* but for a street, road, or other public thoroughfare separating them.

3.3.2 ~~*approximate minimum search distance*—the area for which records must be obtained and reviewed pursuant to Section 8 of this practice, subject to the limitations provided in that section. This may include areas beyond the *target property* and shall be measured from the nearest *target property* boundary. This term is used in lieu of radius to include irregularly shaped properties.~~

~~3.3.3*business environmental risk*—a risk which can have a material environmental or environmentally-driven impact on the business associated with the current or planned use of a parcel of~~ *business environmental risk*, *n*—risk that can have a material environmental or environmentally driven impact on the transaction or the business associated with the current or planned use of a parcel of *real estate*~~, not necessarily limited to those environmental issues required to be investigated in this practice. Consideration of~~ *, not limited to environmental issues that are investigated pursuant to this guide. Consideration of business environmental risk* issues may involve addressing one or more non-scope considerations, some of which are identified in Section ~~13~~11 of this ~~practice.~~guide.

~~3.3.4~~3.3.3 *Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS)*~~—the list~~, *n*—list of sites compiled by EPA that EPA has investigated or is currently investigating for potential *hazardous substance* contamination and for possible inclusion on the *National Priorities List*.

~~3.3.5*CORRACTS list*—a list maintained by EPA of~~

3.3.4 *CORRACTS list*, *n*—list of *hazardous waste* treatment, storage, or disposal facilities and other RCRA-regulated facilities ~~(due to~~(because of past interim status or storage of *hazardous waste* beyond 90 days) that have been notified by the EPA to undertake corrective action under RCRA. The *CORRACTS list* ~~is a subset of the EPA database that manages RCRA data.~~

~~3.3.6*engineering controls (EC)*—physical modifications to a site or facility to reduce or eliminate the potential for exposure to *hazardous substances* or *petroleum products* in the soil or groundwater on the property.~~

~~3.3.7*environmental professional*—a person meeting the education, training and experience requirements set forth in 40 CFR 312.10(b). The person may be an independent contractor or an employee of the~~ *can be derived from the EPA database that manages RCRA data.*

3.3.5 *environmental professional*, *n*—person meeting the education, training, and experience requirements as set forth in 40 CFR 312.10(b). The person may be an independent contractor or an employee of the *user*.

~~3.3.8~~3.3.6 *environmental site ~~assessment (ESA)~~assessment, ESA*~~—the process~~, *n*—process by which a person or entity seeks to determine if a particular parcel of real property (including improvements) is subject to *recognized environmental conditions* ~~(see 3.3.28~~(see subsection 3.3.22).

~~3.3.9*fire insurance maps*~~

3.3.7 *fire insurance maps*, *n*—maps produced for private fire insurance map companies that indicate uses of properties at specified dates and that encompass the property. These maps are often available at local libraries, historical societies, private resellers, or from the map companies who produced them.

~~3.3.10*hazardous substance*—a substance defined as a~~

3.3.8 *hazardous substance*, *n*—substance defined as a *hazardous substance* pursuant to CERCLA 42 U.S.C. 9601(14), as interpreted by EPA regulations and the courts.

~~3.3.11~~3.3.9 *hazardous waste*, *n*—any *hazardous waste* having the characteristics identified under or listed pursuant to Section 3001 of RCRA, as amended (42 U.S.C. 6921) (but not including any waste the regulation of which under RCRA (42 U.S.C. 6901-6992k) has been ~~suspended~~excluded by Act of Congress). RCRA defines a *hazardous waste*, at 42 U.S.C. 6903, as: "a solid waste, or combination of solid wastes, which because of its quantity, concentration or physical, chemical or infectious characteristics may (A) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness; or (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed."

~~3.3.12~~3.3.10 ~~*hazardous waste contaminated sites*~~*landfill*~~—sites on which a release has occurred, or is suspected to have occurred, of any *hazardous substance*, *hazardous waste*, or *petroleum products*, and where that release or suspected release has been reported to a government entity.~~

~~3.3.13*institutional controls (IC)*—a legal or administrative restriction (for example, deed restrictions or restrictive covenants, easements or zoning) on the use of, or access to, a site or facility to *(1)* reduce or eliminate potential exposure to *hazardous substances* or *petroleum products* in the soil or groundwater on the property, or *(2)* to prevent activities that could interfere with the effectiveness of a response action, in order to ensure maintenance of a condition of no significant risk to public health or the environment. An IC is a type of activity and use limitation (AUL).~~

~~3.3.14*landfill*—a place, location, tract of land, area, or premises used for the disposal of solid wastes as defined by state solid waste regulations. The term is synonymous with the term~~ *n*—place, location, tract of land, area, or premises used for the disposal

of solid wastes as defined by state solid waste regulations. The term is synonymous with the term *solid waste disposal site* and is also known as a garbage dump, trash dump, or similar term.

~~3.3.15*local government agencies*~~

3.3.11 *local government agencies*, *n*—those agencies of municipal or county government having jurisdiction over the *target property*. Municipal and county government agencies include but are not limited to cities, parishes, townships, and similar entities.

~~3.3.16*local street directories*~~

3.3.12 *local street directories*, *n*—directories published by private (or sometimes government) sources that show ownership, occupancy, and/or use of sites by reference to street addresses. Often *local street directories* are available at libraries, or historical societies, and/or local municipal offices.

~~3.3.17*LUST sites*—state lists of leaking *underground storage tank* sites. RCRA gives EPA and states, under cooperative agreements with EPA, authority to clean up releases from UST systems or require *owners* and *operators* to do so.~~

~~3.3.18*material threat*—a physically observable or *obvious* threat which is reasonably likely to lead to a release that, in the opinion of the *environmental professional*, is threatening and might result in impact to public health or the environment. An example might include an aboveground storage tank system that contains a *hazardous substance* and which shows evidence of damage. The damage would represent a *material threat* if it is deemed serious enough that it may cause or contribute to tank integrity failure with a release of contents to the environment.~~

~~3.3.19*National Priorities List (NPL)*—list compiled by EPA pursuant to CERCLA 42 U.S.C. §9605(a)(8)(B) of properties with the highest priority for cleanup pursuant to EPA's Hazard Ranking System. See 40 C.F.R. Part 300.~~

~~3.3.20*obvious*~~

3.3.13 *National Priorities List, NPL*, *n*—list compiled by EPA pursuant to CERCLA 42 U.S.C. §9605(a)(8)(B) of properties with the highest priority for cleanup pursuant to EPA's Hazard Ranking System. See 40 C.F.R. Part 300.

3.3.14 *obvious*, *adv*—that which is plain or evident; a condition or fact that could not be ignored or overlooked by a reasonable observer while visually or physically observing the property.

~~3.3.21*occupants*~~

3.3.15 *occupants*, *n*—those tenants, subtenants, or other persons or entities using a property or a portion of the property.

~~3.3.22*operator*—a person responsible for the overall operation of a facility.~~

~~3.3.23*owner*~~

3.3.16 *operator*, *n*—person responsible for the overall operation of a facility.

3.3.17 *owner*, *n*—generally the fee *owner* of record of the property.

~~3.3.24~~3.3.18 *petroleum products*, *n*—those substances included within the meaning of the petroleum exclusion to CERCLA, 42 U.S.C. §9601(14), as interpreted by the courts and EPA, that is: petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a *hazardous substance* under Subparagraphs (A) through (F) of 42 U.S.C. §9601(14), natural gas, natural gas liquids, liquefied natural gas, and synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas). (The word fraction refers to certain distillates of crude oil, including but not limited to gasoline, kerosene, diesel oil, jet fuels, and fuel oil, pursuant to Standard Definitions of Petroleum Statistics.[3])

~~3.3.25*publicly available*~~

3.3.19 *publicly available*, *adv*—information that is *publicly available* means that the source of the information allows access to the information by anyone upon request.

~~3.3.26*practically reviewable*~~

3.3.20 *practically reviewable*, *adv*—information that is *practically reviewable* means that the information is provided by the source in a manner and in a form that, upon examination, yields information relevant to the property without the need for extraordinary analysis of irrelevant data. The form of the information ~~shall~~should be such that the *user* can review the records for a limited geographic area. Records that cannot be feasibly retrieved by reference to the location of the property or a geographic area in which the property is located are not generally *practically reviewable*. Most databases of public records are *practically reviewable* if they can be obtained from the source agency by the county, city, zip code, or other geographic area of the facilities listed in the record system. Records that are sorted, filed, organized, or maintained by the source agency only chronologically are not generally *practically reviewable*. Listings in *publicly available* records ~~which~~that do not have adequate address information to be located geographically are not generally considered *practically reviewable*.

~~3.3.27*reasonably ascertainable*~~

3.3.21 *reasonably ascertainable*, *adv*—information that is *(1) publicly available*, *(2)* obtainable from its source within reasonable time and cost constraints, and *(3) practically reviewable*. ~~3.3.28*recognized environmental condition (REC)*—the presence or likely presence of any~~

3.3.22 *recognized environmental condition, REC*, *n*—presence or likely presence of any *hazardous substances* or *petroleum products* on a *target property* under conditions that indicate an existing release, a past release, or a material threat of a release of any *hazardous substances* or *petroleum products* into structures on the *target property* or into the ground, groundwater, or surface

~~[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.~~

[3] *Standard Definitions of Petroleum Statistics*, American Petroleum Institute, Fourth Edition, 1988.

water of the *target property*. The term includes *hazardous substances* or *petroleum products* even under conditions in compliance with laws. The term is not intended to include *de minimis conditions* that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. Conditions determined to be *de minimis* are not *RECs*.

3.3.29*records review*—the part that is contained in Section

3.3.23 *records review*, *n*—that part that is contained in Section 8 of this practiceguide that addresses which records shallshould or may be reviewed.

3.3.303.3.24 *solid waste disposal site*—a place,, *n*—place, location, tract of land, area, or premises used for the disposal of solid wastes as defined by state solid waste regulations. The term is synonymous with the term *landfill* and is also known as a garbage dump, trash dump, or similar term.

3.3.313.3.25 *solvent*, *n*—achemical compound that is capable of dissolving another substance and may itself be a *hazardous substance*, used in a number of manufacturing/industrial processes including but not limited to the manufacture of paints and coatings for industrial and household purposes, equipment clean-up, and surface degreasing in metal fabricating industries.

3.3.32*standard environmental record sources*—those records specified in 8.3 of this practice.

3.3.33*standard historical sources*—those sources of information about the previous uses of a property specified in

3.3.26 *standard environmental record sources*, *n*—those records specified in subsection 8.3.1 of this guide.

3.3.27 *standard historical sources*, *n*—those sources of information about the history of uses of a property as specified in subsection 8.4 of this practice.

3.3.34*underground storage tank (UST)*—any tank, including underground piping connected to the tank, that is or has been used to contain *hazardous substances* or *petroleum products* and the volume of which is 10% or more beneath the surface of the ground. of this guide.

3.4 *Acronyms:*

3.4.1 *AST*—Aboveground Storage Tank

3.4.2*ATSDR*—Agency for Toxic Substance and Disease Registry

3.4.3*BTEX*—Benzene, Toluene, Ethylbenzene, and Xylenes

3.4.4*CERCLA*—Comprehensive Environmental Response, Compensation and Liability Act of 1980 (as amended, 42 U.S.C. §§9601 *et seq.*)

3.4.5

3.4.2 *CFR*—Code of Federal Regulations

3.4.6

3.4.3 *COC*—Chemical(s) of Concern

3.4.7—*Chemical(s) of concern*

3.4.4 *DNAPL*—Dense Non-Aqueous Phase Liquid (often referred to as a "sinker" that can penetrate the water table)

3.4.8*EC*—Engineering Controls

3.4.9—*Dense nonaqueous phase liquid (often referred to as a "sinker" that can penetrate the water table)*

3.4.5 *EPA*—United States Environmental Protection Agency

3.4.10

3.4.6 *ESA*—Environmental Site Assessment

3.4.11*HQ*—Hazard Quotient

3.4.12*IARC*—International Agency for Research on Cancer

3.4.13*IC*—Institutional Controls

3.4.14*ILCR*—Incremental Lifetime Cancer Risk

3.4.15*IRIS*—Integrated Risk Information System

3.4.16—*Environmental site assessment*

3.4.7 *LNAPL*—Light Non-Aqueous Phase Liquid (often referred to as a "floater" that can accumulate on the water table)

3.4.17*LUST*—Leaking Underground Storage Tank

3.4.18—*Light nonaqueous phase liquid (often referred to as a "floater" that can accumulate on the water table)*

3.4.8 *NAPL*—Non-Aqueous Phase Liquid

3.4.19—*Nonaqueous phase liquid*

3.4.9 *NPL*—National Priorities List

3.4.20*NTP*—National Toxicology Program

3.4.21*OSHA*—Occupational Safety and Health Administration (or Act)

3.4.22*PEL*—OSHA Permissible Exposure Limit

3.4.23*pVIC*—potential Vapor Intrusion Condition

3.4.24*RBC*—Risk-Based Concentration

3.4.25

3.4.10 *REC*—Recognized Environmental Condition

3.4.26*TSDF*—Hazardous waste treatment, storage or disposal facility

3.4.27—*Recognized environmental condition*
3.4.11 *TP*—Target property
3.4.12 *USC*—United States Code
3.4.28
3.4.13 *USGS*—United States Geological Survey
3.4.29*UST*—Underground Storage Tank
3.4.30*VI*—Vapor Intrusion
3.4.31*VIA*—Vapor Intrusion Assessment
3.4.32*VIC*—Vapor Intrusion Condition
3.4.33
3.4.14 *VEC*—Vapor encroachment condition
3.4.15 *VES*—Vapor encroachment screen
3.4.16 *VOC*—Volatile Organic Compound —Volatile organic compound

4. Significance and Use

4.1 *Uses*—This practiceguide is intended for use on a voluntary basis by parties who wish to conduct a *VIAVES* on a parcel of *real estate* , or more specifically conduct a screening evaluation to determine whether or not there is potential for a *VIC*, and if so, identify alternatives for further investigation. To determine whether the vapor intrusion exposure pathway is complete and, if so, whether it poses or may pose an unacceptable risk to human health (that is, whether a *VIC* exists), this practice directs the *user* and *environmental professional* to existing federal or state vapor intrusion policy, regulation and guidance (refer to Appendix X5 and Appendix X9). The process defined in this practice begins with a reasonably conservative screening process that requires information generally collected as part of a Practice E1527 *to determine if a VEC* is identified for the *TP* (that is, the presence or likely presence of *COC* vapors in the subsurface of the *TP* caused by the release of vapors from contaminated soil and/or groundwater either on or near the TP as identified by the Tier 1 or Tier 2 procedures in this guide). The process defined in this guide is a screening process that requires information similar to information generally collected as part of a Practice E1527 *Phase I ESA* . If a *pVIC* is identified in this initial screening, the process gradually progresses toward a more complex assessment involving increasingly greater use of site-specific data. For those sites unable to be screened out, the process provides alternative methods to determine whether a *VIC* exists. If a *VIC* is found to exist, the process describes general mitigation alternatives. This practice is intended primarily as an approach to conducting an inquiry designed to identify *pVICs* or *VICs* in connection with a property involved in a *as well as additional information described in subsection 5.3 and Section 8 of this guide. If a VEC* is identified by this screening process, the *user* may conduct further investigation. This guide, however, defines a procedure for identifying in connection with a property involved in a *real estate transaction* . This practice is intended to reflect a commercially practical and reasonable inquiry (see 1.2). The practice can be applied to property with existing structures, property with structures that will be substantially rehabilitated, property without existing structures but having planned structures (for example, property in development), or property without existing structures and with no planned structures (for example, undeveloped property with no planned development). whether a *VEC* exists, likely exists, cannot be ruled out, or can be ruled out because a *VEC* does not or is not likely to exist. The guide can be applied to property with existing structures, property with structures that will be substantially rehabilitated, property without existing structures but having planned structures (for example, property in development), or property without existing structures and with no planned structures (for example, undeveloped property with no planned development).

4.2 *Clarifications on Use*:

4.2.1 *Use in Conjunction with Practice* E1527 *Phase I ESA*—This practice, when added as a supplemental scope of work to a Practice E1527 *Use in Conjunction with Practice E1527 Phase I ESA*—This guide, when used in conjunction with Practice E1527 *Phase I ESA*, is designed to assist the *, may assist the user* and *environmental professional* in developing information about *pVICs* or *VICs* VECs associated with a *target propertyTP* and, as such,. This guide has utility for a wide range of persons, including those who may not be involved in a *real estate transaction*.

4.2.2 *Independent Use*—This practice may also be used independently of any other property environmental assessment to determine if a *pVIC* or *VIC* exists. However, prior to use the *user* and *environmental professional* should be familiar with the data collection requirements associated with a Practice E1527 *—This guide may be used independent of a Practice E1527 Phase I ESA* that are referenced in this practice (see 5.3). to determine if a *VEC* exists, likely exists, cannot be ruled out, or can be ruled out because a *VEC* does not or is not likely to exist.

4.2.3 *Site-Specific*—This practice is property-specific in that it relates to assessment of *pVICs* or *VICs* in existing structures or planned structures on a specific parcel of *—This guide is property specific in that it relates to screening of VECs* associated with a specific parcel of *real estate*. Consequently, this practiceguide does not address many additional issues raised in transactions such as purchases of business entities or interests therein, or of their assets, that may well involve environmental liabilities pertaining to properties previously owned or operated or other off-site environmental liabilities. The practice isguide does not intended to replace a *Phase I ESA* conducted by an *environmental professional* , but rather to supplement it. or any obligation of the *environmental professional* under Practice E1527 to identify all *recognized environmental conditions (RECs)* related to the *TP* .

4.3 *Who May Conduct*—A *VIA* shall be performed by an *VES* should be performed by an *environmental professional*as specified

~~in 7.5.1 and Practice E1527~~. No practical standard can be designed to eliminate the role of professional judgment and the value and need for experience in the party performing the ~~inquiry.~~investigation. The professional judgment of an *environmental professional* is, consequently, vital to the performance of this ~~assessment.~~ screening.

4.4 ~~*Additional Services*—As set forth in Section 13, additional services may be contracted for between the~~ *Additional Services Contracted For*—Additional services may be contracted for between the *user* and the *environmental professional*. Such additional services may include *business environmental risk* ~~issues not included within the scope of this practice, examples of which are identified in 13.3.~~ issues not included within the scope of this guide (see subsection 11.3 for some possible examples).

4.5 *Principles*—The following principles are an integral part of this ~~practice~~guide and are intended to be referred to in resolving any ambiguity or exercising such discretion as is accorded the *user* or *environmental professional* in performing a ~~*VIA*~~VES.

4.5.1 *Uncertainty Not Eliminated in Screening*—No vapor ~~intrusion~~encroachment screen, such as included in Sections 8 and 9 ~~of this practice, can wholly eliminate uncertainty regarding the potential for identifying *VICs*~~ of this guide, can wholly eliminate uncertainty regarding the identification of *VECs* in connection with a ~~*target property*~~. ~~Screening is intended to reduce, but not eliminate, uncertainty regarding the potential for a *VIC* to exist in connection with a property.~~ TP. Screening is intended to reduce, but not eliminate, uncertainty regarding whether or not a *VEC* exists in connection with a property.

4.5.2 *Not Exhaustive*—The ~~practice~~guide is not meant to be an exhaustive ~~assessment.~~screening. There is a point at which the cost of information obtained or the time required to gather it outweighs the usefulness of the information and, in fact, may be a material detriment to the orderly completion of *real estate transactions* . One of the purposes of this ~~practice~~guide is to identify a balance between the competing goals of limiting the costs and time demands inherent in performing a ~~*VIA*~~*VES* and the reduction of uncertainty about unknown conditions resulting from additional information.

4.5.3 ~~*Level of Inquiry is Variable*—Not every property will warrant the same level of assessment. Consistent with good commercial or customary practice, the appropriate level of assessment will be guided by the type of property subject to assessment, the risk tolerance of the *user*, and the information already available or developed in the course of the inquiry.~~ Level of Investigation is Variable—Not every property will warrant the same level of screening. The appropriate level of screening should be guided by the type of property subject to screening and the information already available or developed in the course of the investigation.

4.5.4 *Comparison with Subsequent ~~Inquiry~~Investigation*—It should not be concluded or assumed that an ~~inquiry~~investigation was not adequate because the ~~inquiry~~investigation did not identify ~~*pVICs* or *VICs*~~*VECs* in connection with a property. The ~~*VIA*~~ VES must be evaluated based on the reasonableness of judgments made at the time and under the circumstances in which they were made. Subsequent ~~*VIAs*~~*VESs* should not be considered valid ~~standards~~bases to judge the appropriateness of any prior ~~assessment~~ screening if based on hindsight, new information, use of developing technology or analytical techniques, or ~~other~~similar factors.

4.6 *Continued Viability of ~~VIA~~VES*—Subject to subsection 4.7, a ~~*VIA* meeting or exceeding this practice and completed less than 180 days prior to the date of acquisition of the property (EPA, under "All Appropriate Inquiry," 40 C.F.R. Part 312, defines date of acquisition as the date on which a person acquires title to the property), or (for transactions not involving an acquisition) the date of the intended use of the *VIA*, is presumed to be valid. If within this period the assessment will be used by a different *user* than the *user* for whom the assessment was originally prepared, the subsequent *user* must also satisfy the *User's* Responsibilities in Section 6. Subject to~~ VES conducted according to the procedures presented in this guide and completed less than 180 days before the date of acquisition of the property or, for transactions not involving an acquisition, the date of the intended use of the *VES*, is presumed to be valid. Subject to subsection 4.7 and the ~~*User's* Responsibilities set forth in Section~~ user's responsibilities set forth in Section 6, a ~~*VIA*~~*VES* ~~meeting or exceeding~~ conducted according to the procedures presented in this ~~practice~~guide and for which the information was collected or updated within ~~1~~one year ~~prior to~~ before the date of acquisition of the property ~~or (for~~or, for transactions not involving an acquisition~~)~~, the date of the intended use of the ~~*VIA*~~*VES* may be used provided that the following components of the ~~inquiries~~investigation were conducted or updated within 180 days of the date of purchase or the date of the intended transaction:

4.6.1 Reviews of federal, tribal, state, and local government records;

4.6.2 Update on the operations existing at the ~~*target property*~~TP ;

4.6.3 Evaluation of any new significant potential preferential pathways for vapor migration;

~~4.6.4Assessment of any new plume migration that can potentially cause a *pVIC* or *VIC*~~

4.6.4 Screening of any new *contaminated plume* migration that might cause a *VEC* on the ~~*target property*~~TP; and

~~4.6.5Assessment of any new contaminant releases in the *area of concern* that can potentially cause a *pVIC* or *VIC*~~

4.6.5 Screening of any new contaminant releases in the AOC that might cause a *VEC* on the ~~*target property*~~TP.

~~4.7*Prior Assessment Usage*—This practice recognizes that *VIAs* performed in accordance with this practice will include information that subsequent~~

4.7 *Use of a Prior VES Screen*—This guide recognizes that *VESs* performed in accordance with this guide will include information that subsequent *users* may want to use to avoid undertaking duplicative ~~assessment~~screening procedures. Therefore, this ~~practice~~guide describes procedures to be followed to assist *users* in determining the appropriateness of using information in ~~*VIAs*~~*VESs* performed more than one year prior to the date of acquisition of the property ~~or (for~~or, for transactions not involving an acquisition~~)~~, the date of the intended use of the ~~*VIA*~~*VES*. The ~~system~~use of a prior ~~assessment usage~~ *VES* is based on the following principles that should be adhered to in addition to the specific procedures set forth elsewhere in this ~~practice:~~ guide:

4.7.1 *Use of Prior Information*—Subject to the ~~requirements~~criteria set forth in subsection 4.6, *users* and *environmental*

professionals may use information in a prior ~~*VIAs*~~*VES* provided such information was generated as a result of procedures that ~~meet or exceed~~are consistent with the ~~requirements of~~ procedures presented in this ~~practice.~~guide. However, such information ~~shall~~should not be used without current investigation of conditions likely to affect ~~*pVICs* or *VICs*~~*VECs* in connection with the ~~*target property*~~*TP*. Additional ~~tasks~~investigation may be necessary to document conditions that may have changed materially since the prior ~~*VIA*~~*VES* was conducted.

4.7.2 ~~*Contractual Issues Regarding Prior Assessment Usage*~~Contractual Issues Regarding Use of a Prior VES—The contractual and legal obligations between prior and subsequent *users* ~~of *VIAs*~~ of a *VES* or between *environmental professionals* who conducted the prior ~~*VIAs*~~*VES* and those who would like to use such a prior ~~*VIAs*~~*VES* are beyond the scope of this ~~practice.~~ guide.

4.8 *Actual Knowledge Exception*—If the *user* or *environmental professional* conducting a ~~*VIA*~~ VES has *actual knowledge* that the information being used from a prior ~~*VIA*~~ VES is not accurate or if it is *obvious*, based on other information obtained by means of a Phase I and/or Phase II *ESA* or known to the person conducting the Phase I and/or Phase II *ESA*, that the information being used is not accurate, such information from a prior ~~*VIA*~~ VES may not be used.

4.9 *Rules of Engagement*—The contractual and legal obligations between an *environmental professional* and a *user* (and other parties, if any) are outside the scope of this ~~practice.~~guide. No specific legal relationship between the *environmental professional* and the *user* is necessary for the *user* ~~to meet the requirements of this practice.~~

~~5.Relationship to Practice E1527 Phase I ESA~~ to implement the procedures presented in this guide.

5. Relationship to Practice E1527 Phase I ESA

5.1 ~~*Indoor Air Quality as a Non-Scope Consideration in Practice* E1527—Indoor air quality, and therefore vapor intrusion as a contributing indoor air quality issue, is a non-scope consideration in a Phase I conducted in accordance with the Practice E1527 standard. Non-scope considerations may be included in the Practice E1527~~ *Identification of a REC Pursuant to a Phase I ESA—RECs* are identified only through the performance of a Practice E1527 *Phase I ESA*~~, but only if a separate scope of work is specifically agreed to between the *user* and~~ . *Thus, a finding pursuant to this guide that a VEC* exists or likely exists at the *TP* or that a *VEC* cannot be ruled out for the *TP* is not a determination that a *REC* is identified at the *TP*. Whether a *REC* exists at a *TP* as a result of the impact of possible vapor migration to the subsurface of the *TP* is a separate determination to be made by the *environmental professional* ~~. This practice is not meant to preclude an environmental professional from providing a professional opinion in the Phase I ESA on the impact of potential vapor migration onto a target property if deemed necessary to satisfy "all appropriate inquiry."~~ pursuant to Practice E1527. This guide does not constitute or meet the requirements for conducting "all appropriate inquiry" or any part of "all appropriate inquiry" as defined by U.S. EPA under CERCLA and the regulations there under, including 40 CFR Sec. 312.11.

5.2 ~~*VIA*—This practice is intended to be used independently or as a supplement to the Practice E1527~~ *VES*—The *VES* established by this guide is intended to be used independently of or in conjunction with Practice E1527 *Phase I ESA*.

5.2.1 The ~~*VIA*~~*VES* may be conducted concurrently with the Practice E1527 *Phase I ESA*.

5.2.2 The ~~*VIA*~~*VES* may be conducted independent of a Practice E1527 *Phase I ESA*. When conducting a ~~*VIA* independent of the Phase I, the data requirements specified in this practice shall be collected (see~~ VES pursuant to this guide, the data collection actions specified in this guide should be implemented (see subsection 5.3 and Section 8).

5.3 *Use of Information Collected in a Phase I ESA Conducted in Accordance with the Practice E1527 Standard*—The ~~initial~~ screening (see Section 8~~) identified in this practice makes use of information typically collected in a Practice E1527~~ *) identified in this guide makes use of information similar to information generally collected as part of a Practice E1527 Phase I ESA* ~~, including but not limited to federal, state, local, and tribal government records, chemical use and historical records of prior uses on the *target property* and within proximity of the *target property*, soil characteristics, geological characteristics, contaminant characteristics, plume migration, significant conduits that could potentially accelerate vapor migration, groundwater depth and groundwater flow direction data, and property information data.~~ as well as additional information described in the following and Section 8 of this guide. The information that should be collected includes, but is not limited to, federal, state, local, and tribal government records, chemical use and historical records of prior uses on the *TP* and within the *AOC* surrounding the *TP* as determined by the procedures set out in Section 8, soil characteristics, geological characteristics, contaminant characteristics, *contaminated plume* migration, significant conduits that might provide preferential pathways for vapor migration, groundwater depth and groundwater flow direction data, and property information data.

5.4 *Assumptions Made in the Practice E1527 Phase I ESA*—Any assumptions or limitations made in the conduct of a *Phase I ESA* ~~and which are applicable in the *VIA* process as described in this practice shall be specifically identified.~~

~~6.~~on the *TP* and that are applicable in the *VES* process as described in this guide should be specifically identified.

6. User's Responsibilities

6.1 *Scope*—The purpose of this section is to describe tasks that should be performed by the *user* that will help the *environmental professional* ~~identify the potential for *pVICs* or *VICs*~~ identify the possibility for a *VEC* to exist in connection with the ~~*target property*~~TP. These tasks do not require the technical expertise of an *environmental professional*~~and are generally not performed by *environmental professionals* performing a *Phase I ESA*, unless directed to do so by the~~ *, although a user* could ask the