



# Standard Practice for Environmental Site Assessments: Phase II Environmental Site Assessment Process<sup>1</sup>

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## 1. Scope

1.1 This practice<sup>2</sup> covers a process for conducting a Phase II environmental site assessment (ESA) of a parcel of property with respect to the *presence* or the likely *presence* of *substances* including but not limited to those within the scope of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (e.g., *hazardous substances*), pollutants, contaminants, petroleum and *petroleum products*, and controlled *substances* and constituents thereof. It specifies procedures based on *the scientific method* to characterize *property* conditions in an objective, representative, reproducible, and defensible manner. To promote clarity in defining *Phase II ESA* objectives and transparency in communicating and interpreting *Phase II ESA* results, this practice specifies adherence to requirements for documenting the scope of assessment and constraints on the conduct of the assessment process.

1.1.1 A *user's* interest in the *presence* or likely *presence* of *substances* in *environmental media* at a property may arise in a wide variety of legal, regulatory, and commercial contexts, and may involve diverse objectives including those listed in 1.2. This practice contemplates that the *user* and the *Phase II Assessor* will consult to define the scope and objectives of investigation in light of relevant factors, including without limitation the *substances* released or possibly released at the *property*, the nature of the concerns presented by their *presence* or likely *presence*, the portion of the property to be investigated, the information already available, the degree of confi-

dence needed or desired in the results, the degree of investigatory sampling and *chemical testing* needed to achieve such confidence, and any applicable time and resource constraints. This practice requires that Phase II activities be conducted so that the resulting scope of work is performed, and the stated objectives are achieved, in a scientifically sound manner.

1.1.2 A *Phase II ESA* in accordance with this practice may follow site assessment activities in accordance with Practice E1527 for *Phase I Environmental Site Assessments: Phase I Environmental Site Assessment Process*, Practice E2247 for *Environmental Site Assessments: Phase I Environmental Site Assessment for Forestland or Rural Property*, EPA's *All Appropriate Inquiries (AAI) Rule*, 40 C.F.R. Part 312, or Practice E1528 for *Limited Environmental Due Diligence: Transaction Screen Process*. Users of this practice should have knowledge and understanding of Practice E1527 and the *AAI Rule* because a *Phase II ESA* may address a likely *presence* of *hazardous substances* or *petroleum products* identified in previous assessment reports as a *recognized environmental condition (REC)*. In defining the scope and purposes of a *Phase II ESA*, however, previous decisions to classify *property* conditions or areas as *RECs*, or to refrain from doing so, are not determinative as to whether investigation of the same conditions or areas is appropriate to meet the objectives of the *Phase II ESA*.

1.2 *Objectives*—This practice is intended for use in any situation in which a *user* desires to obtain sound, scientifically valid data concerning actual property conditions, whether or not such data relate to property conditions previously identified as *RECs* or *data gaps* in *Phase I ESAs*. Without attempting to define all such situations, this practice contemplates that *users* may seek such data to inform their evaluations, conclusions, and choices of action in connection with objectives that may include, without limitation, one or more of the following:

1.2.1 *Objective 1*—Assess whether there has been a *release* of *hazardous substances* within the meaning of *CERCLA*, for purposes including *landowner liability protections* (i.e., *innocent landowner*, *bona fide prospective purchaser*, and *contiguous property owner*).

1.2.2 *Objective 2*—Provide information relevant to identifying, defining and implementing *landowner "continuing obligations,"* or the criteria established under *CERCLA* (e.g.,

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<sup>2</sup> As used herein, a "standard" is a document that has been developed and established within the consensus principles of the Society and that meets the approval requirements of ASTM procedures and regulations. A "practice" is a definitive set of instructions for performing one or more specific operations that does not produce a test result. A "guide," in contrast, is a compendium of information or a series of options that does not recommend a specific course of action. A guide increases the awareness of information and approaches in a given subject area. See Form and Style for ASTM Standards, [http://www.astm.org/COMMIT/Blue\\_Book.pdf](http://www.astm.org/COMMIT/Blue_Book.pdf).

taking *reasonable steps* to prevent or limit exposures to previously released *hazardous substances*) for maintaining the *CERCLA landowner liability protections*.

1.2.3 *Objective 3*—Develop threshold knowledge of the *presence* of *substances* on properties within the scope of the *CERCLA* definition of a “brownfield site” and as required for qualifying for brownfields *remediation* grants from the *EPA* Brownfields Program.

1.2.4 *Objective 4*—Provide information relevant to identifying, defining and evaluating property conditions associated with *target analytes* that may pose risk to human health or the environment, or risk of bodily injury to persons on the property and thereby give rise to potential liability in tort.

1.2.5 *Objective 5*—Provide information relevant to evaluating and allocating *business environmental risk* in transactional and contractual contexts, including transferring, financing and insuring properties, and due diligence relating thereto.

1.2.6 *Objective 6*—Provide information to support disclosure of liabilities and contingent liabilities in financial statements and securities reporting.

1.2.7 Additional information concerning these six objectives may be found in the Legal Appendix, **Appendix X1**.

1.3 *Scope of Assessment in Relation to Objectives*—The scope of a *Phase II ESA* is related to the objectives of the investigation. Both scope and objectives may require ongoing evaluation and refinement as the assessment progresses.

1.3.1 In developing the scope of work and in evaluating data and information concerning the property, the *Phase II Assessor* must determine whether the available information is sufficient to meet the objectives of the investigation. Even after conducting *Phase II* activities to generate additional data, the *Phase II Assessor* must independently evaluate the sufficiency of the data in relation to the objectives. As the investigation progresses, the objectives may be refined or redefined in consultation between the *user* and the *Phase II Assessor*.

1.3.2 A single round of sampling and *chemical testing* may not always provide data sufficient to meet the chosen objectives. If not, this practice contemplates additional sampling in an iterative sequence that concludes when the available data are sufficient. This practice also acknowledges, however, that the *user* may instead elect either to redefine the objectives so that they can be met with the data available, or to terminate the investigative process without meeting the stated objectives. The *Phase II Assessment* report must disclose any respect in which available data are insufficient to meet objectives.

1.3.3 This practice does not require full *site characterization* in every instance, but may be used to carry out an investigation sufficient for that purpose if desired to meet the *user’s* objectives.

1.4 *Needs of the User*—The *user* and *Phase II Assessor* must have a mutual understanding of the context in which the *Phase II ESA* is to be performed and the objectives to be met by the investigation, i.e. the specific questions to be answered or problems to be resolved by the *Phase II ESA*. The scope of *Phase II* activities must be defined in relation to those objectives.

1.4.1 The degree of confidence desired by the *user* influences the scope of the investigation and the evaluation of data.

More extensive testing and more iterations of sampling and analysis may be needed if the objectives require detailed conclusions with high confidence. Less testing and fewer iterations of sampling and analysis may be needed if the objectives of the assessment include only general conclusions.

1.5 *Limitations*—This practice is not intended to supersede applicable requirements imposed by regulatory authorities. This practice does not attempt to define a legal standard of care either for the performance of professional services with respect to matters within its scope, or for the performance of any individual *Phase II Environmental Site Assessment*.

1.6 *Organization of This Practice*—This practice has nine sections and four appendices. Section 1 covers the Scope of the practice. Section 2, Referenced Documents, lists ASTM and other organizations’ related standards and guidance that may be useful in conducting *Phase II ESAs* in accordance with this practice. Section 3, Terminology, contains definitions of terms and acronyms used in this practice. Section 4 addresses the Significance and Use of this practice, including the legal context into which *Phase II ESAs* may fall. Section 5 discusses development and documentation of the scope of the *Phase II ESA*, including the Statement of Objectives for the assessment. Section 6 provides a *Phase II ESA* Overview, with purpose and goal descriptions. Section 7 comprises the main body of Performing the *Phase II ESA*, and includes initiating scientific inquiry by formulating the question to be answered (7.1), collecting and evaluating information (7.2), identifying areas for investigation (7.3), developing the *conceptual model* (7.4), developing a plan and rationale for sampling (7.5), conducting the sampling (7.6), and validating the *conceptual model* (7.7). Interpretation of results is covered in Section 8. *Phase II Environmental Site Assessment* report preparation is addressed in Section 9. **Appendix X1** supports Section 4, and contains legal considerations pertaining to *Phase II Environmental Site Assessment*. **Appendix X2** contains contracting considerations between *Phase II assessor* and *user*. **Appendix X3** supports Section 9, and describes two examples and a sample table of contents illustrating possible approaches to reporting the results of a *Phase II Environmental Site Assessment*. **Appendix X4** supplements Section 2 with a list of standards and references that may be relevant in conducting a *Phase II Environmental Site Assessment*.

## 2. Referenced Documents

2.1 The standards listed below are referenced in this practice.

2.2 *ASTM Standards*:<sup>3</sup>

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

**E1528** Practice for Limited Environmental Due Diligence: Transaction Screen Process

**E2247** Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process for Forestland or Rural Property

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

2.3 *Environmental Protection Agency Documents: Standards and Practices for All Appropriate Inquiries*, Final Rule, Federal Register, Tuesday, November 1, 2005, Part III Environmental Protection Agency (codified at 40 CFR Part 312)<sup>4</sup>

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *all appropriate inquiries (AAI)*—those inquiries constituting “all appropriate inquiries... into the previous ownership and uses of the facility in accordance with generally accepted good commercial or customary standards and practices” as defined in *CERCLA*, 42 U.S.C. § 9601(35)(B), and the *AAI* Rule, 40 CFR Part 312, that must be conducted to qualify for certain *landowner liability protections (LLPs)* under *CERCLA*, and to qualify for brownfields *remediation grants* awarded under *CERCLA* section 104(k)(3)(A)(ii).

3.1.2 *background concentration*—the concentration of a *target analyte* in *groundwater*, *surface water*, air, soil gas, sediment, or soil at a reference location near an area under investigation, which is not attributable to the area under investigation. Background samples may contain the *target analyte*, due to either naturally occurring or man-made sources, but not due to the *release(s)* in question.

3.1.3 *behavior, fate, and transport characteristics*—natural attributes of a *target analyte* that can be predicted based on the distinguishing physico-chemical characteristics of the *target analyte* and the properties of the media in which the *target analyte* occurs.

3.1.4 *bona fide prospective purchaser (BFPP)*—a person who meets the criteria stated at 42 U.S.C. § 9601(40) and thereby becomes eligible for the *bona fide prospective purchaser LLP*. See Legal Appendix, **Appendix X1**.

3.1.5 *bona fide prospective purchaser (BFPP) LLP*—the *CERCLA LLP* defined in 42 U.S.C. § 9607(r) and available to persons who meet the statutory definition of *bona fide prospective purchaser*. See Legal Appendix, **Appendix X1**.

3.1.6 *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 commercial real estate, not necessarily limited to those environmental issues investigated in accordance with this practice.

3.1.7 *CERCLA*—the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. § 9601, *et seq.*, as amended.

3.1.8 *CFR*—Code of Federal Regulations.

3.1.9 *chain of custody*—a written or printed form that documents information regarding sample possession, condition, and responsibility, including the time from sample container acquisition through transportation, sample collection, and laboratory analysis.

3.1.10 *chemical testing*—measurement of the *presence* and concentration of *target analytes* by analytical chemistry meth-

ods in a laboratory; also, for purposes of this practice, measurement of certain *target analytes* by physical methods (e.g., for asbestos or radioactive isotopes).

3.1.11 *conceptual model*—a representation of hypothesized current site conditions, which describes the physical setting characteristics of a site and the likely distribution of *target analytes* that might have resulted from a known or likely *release*, and which is based on all *reasonably ascertainable* information relevant to the objectives of the investigation and the professional judgment of the *Phase II Assessor*.

3.1.12 *contiguous property owner (CPO) LLP*—a (*CERCLA*) *LLP* defined in 42 U.S.C. § 9607(q). To qualify for the *CPO LLP*, a person must (among other things) own real property that is contiguous or similarly situated to, and that is or may be contaminated by *hazardous substances* from, other real property that is not owned by that person. Furthermore, such person must have conducted *all appropriate inquiries*, at the time of acquisition of the property and must not know or have reason to know that the property was or could be contaminated by a *release* or threatened release from the contiguous *property*. The *all appropriate inquiries* must not have resulted in knowledge of contamination, or else such person did “know” or “have reason to know” of contamination and would not be eligible for the *CPO LLP*.

3.1.13 *continuing obligations*—includes requirements contained in the definition of a *bona fide prospective purchaser* at *CERCLA* §101(40)(D) and (F), the requirements for maintaining the *innocent landowner LLP* at 101(35)(a), which include the “due care” provisions of §107(b)(3)(a), as well as those requirements established for maintaining the *contiguous property owner* liability protection at §107(q)(1)(A) (iii) and (iv). These requirements are collectively referenced as the “*continuing obligations*” and are necessary for a person to maintain qualification for *LLPs* after a property is acquired, including among others, the requirement to take *reasonable steps* to prevent or limit human, environmental, or natural resources exposure to any previously released *hazardous substance* (section 101(35)(B)(i)(II)).

3.1.14 *data gap*—a lack of or inability to obtain information pertinent to the identification of releases or likely releases at a *property* as required by the U.S. *EPA* All Appropriate Inquiries (*AAI*) Rule despite good faith efforts to gather such information. *Data gaps* may result from incompleteness in any of the activities required by *AAI*, including, but not limited to historical use research (e.g., incomplete or missing information on site uses, activities, operations, etc. pertaining to the potential for releases to have occurred), site reconnaissance (e.g., an inability to conduct the *site visit*), and interviews (e.g., an inability to interview the key site manager, regulatory officials, etc.).

3.1.15 *de minimis*—conditions that generally do not present a threat to human 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.

3.1.16 *diffuse anthropogenic contamination*—the *presence* of *target analytes* that results from broad-scale activities that cannot be discriminated as readily as single, site-specific discharges or releases. The most obvious of these activities is

<sup>4</sup> Available from United States Environmental Protection Agency (EPA), Ariel Rios Bldg., 1200 Pennsylvania Ave., NW, Washington, DC 20004, <http://www.epa.gov>.

agriculture, but urban land runoff, forestry, the urine of mammals, wastewater treatment plant effluent discharges, and atmospheric deposition can also be important general sources.

3.1.17 *environmental media*—soil, rock, *groundwater*, *surface water*, air, soil gas, sediment.

3.1.18 *EPA*—the United States Environmental Protection Agency.

3.1.19 *ESA*—environmental site assessment.

3.1.20 *exposure point*—a place at which a *receptor* comes into contact with a *target analyte*.

3.1.21 *field screening*—the measurement of physical properties or *presence* and approximate concentration of *target analytes* in *environmental media* by methods or techniques employed in the field during explorations and sampling. Measurements can be qualitative (positive/negative) or quantitative. Accuracy and precision of these methods generally are not equivalent to those achieved in a laboratory environment.

3.1.21.1 *Discussion*—Calibrated field analytical equipment, such as field gas chromatographs, may provide levels of detection and accuracy comparable to those of a fixed laboratory.

3.1.22 *groundwater*—water below the land surface in a zone of saturation.

3.1.23 *groundwater flow*—the movement of water in the zone of saturation.

3.1.24 *groundwater flow direction*—the compass bearing of the horizontal component, and the vertical component, of water movement in the zone of saturation.

3.1.25 *hazardous substance*—any *substance* defined as a *hazardous substance* pursuant to *CERCLA*, 42 *U.S.C.* § 9601(14). See Legal Appendix, **Appendix X1**.

3.1.26 *innocent landowner (ILO) LLP*—a (*CERCLA*) *LLP* defined in 42 *U.S.C.* § 9601(35) and § 9607(b)(3). See Legal Appendix, **Appendix X1**.

3.1.27 *Landowner Liability Protections (LLPs)*—provisions that establish limitations of or defenses to potential *CERCLA*-liability in favor of landowners who satisfy statutory conditions. See definitions in this section of *bona fide prospective purchaser*, *contiguous property owner* and *innocent landowner* and corresponding *LLPs*; see also Legal Appendix, **Appendix X1**.

3.1.28 *likely release area*—a place where a *Phase II Assessor* judges it likely that *target analytes* were first introduced into *environmental media* as a result of a *release* such that the *target analytes* may now be *present* in *environmental media* at the *property*. *Likely release areas* can include, but need not be limited to, *recognized environmental conditions* identified in a *Phase I ESA* conducted in accordance with Practice **E1527** or Practice **E2247**.

3.1.29 *migration pathway*—a route through *environmental media* taken by a *target analyte*; the physical feature allowing movement of *target analytes*.

3.1.30 *obvious*—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, or that could be deduced by a *Phase II Assessor*.

3.1.31 *petroleum products*—those *substances* included within 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 gasoline, kerosene, diesel oil, jet fuels, and fuel oil as defined in “Standard Definitions of Petroleum Statistics,” American Petroleum Institute).

3.1.32 *Phase I environmental site assessment (Phase I ESA)*—an assessment performed in accordance with the process described in Practice **E1527**, Practice **E2247**, and the *EPA* *all appropriate inquiries (AAI)* rule, 40 CFR Part 312.

3.1.33 *Phase II Assessor*—a person meeting the definition of an *Environmental Professional* as provided in Section 3.2.29 of Practice **E1527**, and possessing sufficient education, professional training, and relevant experience to conduct or be in responsible charge of environmental investigations and other activities in accordance with this practice, and to interpret the resulting data to develop opinions and conclusions regarding the *presence* of *target analytes* in *environmental media* in connection with the *property* in question. An individual’s status as a *Phase II Assessor* may be limited to the type of assessment to be performed. Overall, a *Phase II Assessor* should understand and be experienced in pertinent aspects of *the scientific method*, hydrogeology, geochemistry, environmental investigation/exploration techniques, interpretation of *chemical testing* data, and commercial and industrial operations pertaining to the use and handling of site-specific *target analytes* and production and handling of associated wastes. The *Phase II Assessor* may be an independent contractor or an employee of the *user*. Some jurisdictions may have licensing requirements for individuals who perform certain environmental investigation activities included in a *Phase II ESA*.

3.1.34 *Phase II environmental site assessment (Phase II ESA)*—an assessment performed in accordance with the process described in this practice.

3.1.35 *practically reviewable*—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 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 do not have adequate address information to be located

geographically are not generally considered *practically reviewable*. For large databases with numerous records (such as RCRA hazardous waste generators and registered underground storage tanks), the records are not *practically reviewable* unless they can be obtained from the source agency in the smaller geographic area of zip codes. Even when information is provided by zip code for some large databases, it is common for an unmanageable number of sites to be identified within a given zip code. In these cases, it is not necessary to review the impact of all of the sites that are likely to be listed in any given zip code because that information would not be *practically reviewable*. In other words, when so much data is generated that it cannot be feasibly reviewed for its impact on the *property*, it is not *practically reviewable*.

3.1.36 *present or presence*—with regard to *target analytes* in *environmental media*, *present* or *presence* refers to the existence of the *target analyte* at the *property* and to places where the *target analyte* is located. *Presence* does not imply that the total extent of the *target analyte* is known.

3.1.37 *property*—the real *property* that is the subject of the *Phase II environmental site assessment* described in this practice. Real *property* includes buildings and other fixtures and improvements located on the *property* and affixed to the land.

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

3.1.39 *quality assurance/quality control (QA/QC)*—quality control is the use of standards and procedures designed to promote and ensure the collection of samples and generation of analytical results that are of good and acceptable quality for the purposes intended; quality assurance is the use of standards and procedures to evaluate work products to determine if they achieved good and acceptable quality.

3.1.40 *reasonable steps*—those actions to prevent or limit human, environmental or natural resources exposure to previously released *hazardous substances* that are required pursuant to (CERCLA) Sections 101(35)(B)(i)II, 101(40)(D) and 107(q)(1)(A)(iii) to maintain qualification for *LLPs* after a *property* is acquired. See Legal Appendix, [Appendix X1](#).

3.1.41 *reasonably ascertainable*—information that is (1) *publicly available*, (2) obtainable from its source within reasonable time and cost constraints, and (3) *practically reviewable*.

3.1.42 *receptor*—a living organism or habitat of a community of organisms; also, an inanimate feature that, if contacted by *target analytes*, would be a proximal means of exposing living organisms to the *target analytes*, e.g., a drinking water well that could convey *groundwater* containing *target analytes* to people.

3.1.43 *recognized environmental condition (REC)*—as defined in Practice [E1527](#) and Practice [E2247](#) and determined in accordance with the process prescribed by those standard practices, the *presence* or likely *presence* of any *hazardous substances* or *petroleum products* on 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 property or into the ground,

*groundwater*, or *surface water* of the 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 do not present a material risk of harm to public health or the environment and that 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 *recognized environmental conditions*.

3.1.44 *release*—as defined by § 101(22) of CERCLA, 42 U.S.C. § 9601(22), “any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing any hazardous *substance* or pollutant or contaminant), but exclud[ing] (A) any release which results in exposure to persons solely within a workplace, with respect to a claim which such persons may assert against the employer of such persons, (B) emissions from the engine exhaust of a motor vehicle, rolling stock, aircraft, vessel, or pipeline pumping station engine, (C) release of source, by-product, or special nuclear material from a nuclear incident, as those terms are defined in the Atomic Energy Act of 1954 [42 U.S.C. § 2011 *et seq.*], if such release is subject to requirements with respect to financial protection established by the Nuclear Regulatory Commission under section 170 of such Act [42 U.S.C. § 2210], or, for the purposes of section 104 of CERCLA or any other response action, any release of source, by-product, or special nuclear material from any processing site designated under section 102(a)(1) or 302(a) of the Uranium Mill Tailings Radiation Control Act of 1978; [42 U.S.C. § 7912(a)(1) or 7942(a)], and (D) the normal application of fertilizer.”

3.1.45 *remediation/remedial action*—activities conducted or measures taken to protect human health, safety and the environment. These include evaluating risk, monitoring quality of *environmental media* over time, imposing institutional controls, constructing engineering controls, removing *environmental media* containing *target analytes* from the environment, removing *target analytes* from *environmental media*, and generally designing and operating cleanup systems to isolate, remove, reduce, or destroy *target analytes*.

3.1.46 *site*—the contiguous land area under consideration in the *Phase II ESA* that includes all or part of the *property* and that is impacted or potentially impacted by *releases*; if necessary in order to achieve the objectives of the *Phase II ESA*, the area under consideration may extend off the *property* if migrating *target analytes* originate from the *property*, or may include off-*property* sources of *target analytes* migrating to the *property*.

3.1.47 *site characterization*—evaluation of the *presence* of *target analytes* in *environmental media* throughout a *site* impacted or potentially impacted by a *release* or *releases*. The evaluation typically includes the determination of geological, hydrogeological, hydrological, and engineered aspects of the *site* that influence the *presence* of *target analytes* (e.g., *migration pathways*, *exposure points*) and the existence of *receptors* and *mechanisms of exposure*.

3.1.48 *substance*—any element, compound or chemical, or mixtures or preparations thereof, whether man-made or naturally occurring, which can be *present* in or *released* to *environmental media*, including but not limited to those within the scope of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (e.g., *hazardous substances*), pollutants, contaminants, petroleum and *petroleum products*, and controlled *substances* and constituents thereof.

3.1.49 *surface water*—water exposed to the atmosphere above the surface of the ground, including but not limited to lakes, ponds, reservoirs, artificial impoundments, streams, rivers, springs, seeps and wetlands.

3.1.50 *target analytes*—*substances* that are *present* in, or have been *released* or potentially have been released to, *environmental media* at the site, and which are of interest in the context of the particular *Phase II ESA* and its objectives, the *presence* of which will be sought and concentrations of which will be quantified through *field screening* or *chemical testing*.

3.1.51 *the scientific method*—principles and procedures for systematic discovery, which involve recognizing and stating a problem for which a solution is sought, formulating an hypothesis that might resolve the problem (which hypothesis is consistent with the body of knowledge available), collecting objective and reproducible data by performing an investigation to test the hypothesis, and interpreting the data to validate or refute the hypothesis; and, if the hypothesis cannot be validated, revising the hypothesis consistent with the updated body of knowledge and conducting an iteration of the procedure.

3.1.52 *U.S.C.*—United States Code.

3.1.53 *user*—the party seeking to use this practice to conduct a *Phase II ESA*. A *user* may include, without limitation, a potential purchaser of property, a potential tenant of property, an owner of property, a lender, an insurer, or a property manager.

3.1.54 *water table*—the surface of a *groundwater* body at which surface the water pressure equals atmospheric pressure. Earth material below the *water table* is saturated with water.

## 4. Significance and Use

### 4.1 *Uses*:

4.1.1 This practice is intended for use on a voluntary basis by parties who wish to evaluate known *releases* or *likely release areas* identified by the *user* or *Phase II Assessor*, and/or to assess the *presence* or *likely presence* of *substances*, for legal or business reasons such as those described in 1.2.

4.1.2 This practice is intended to meet the business community's need for a written, practical reference describing a scientifically sound approach to investigating a *property* to evaluate the *presence* or *likely presence* of a *substance*. It is impossible to generalize about the contexts in which a *user* may wish to conduct such investigations or the degree of confidence a *user* may require in the results. In any context, this practice, being rooted in sound scientific methodology, can assist *users* in achieving an objective and defensible assessment.

4.1.2.1 This practice does not address the evaluation of *business environmental risks* in light of data collected through the *Phase II ESA* process. Such evaluation is a function of site-

and transaction-specific variables, and of the *user's* objectives and risk tolerance. This practice contemplates that the *Phase II ESA* process will be planned and conducted with such variables in mind, and that the *user* will evaluate legal, business and environmental risks in light of known data relating to the particular site and transaction, and in consultation with legal and business advisors as well as the *Phase II Assessor*.

4.1.2.2 Likewise, this practice does not define the threshold levels at which *target analytes* pose a concern of significance to the *user*. *Users* may apply this practice not only in light of applicable regulatory criteria and relevant liability principles, but also to meet self-defined objectives.

4.1.2.3 If a *Phase II ESA* conducted in accordance with this practice provides sufficient information from which the *Phase II Assessor* can conclude, consistent with *the scientific method*, that the question to be addressed by the assessment (see 6.4.1) has been answered, then further assessment is not warranted to meet the objectives of the assessment.

4.1.3 *Use Not Limited to CERCLA*—This practice is designed to assist a *user* in developing information about the environmental condition of the property and has utility for a wide range of *target analytes* (e.g., including *diffuse anthropogenic contamination* and naturally occurring *substances*) and *users* including those who may have no actual or potential CERCLA concerns.

4.1.4 *Site- and Transaction-Specific*—The scope of a *Phase II ESA* is site-specific and context-specific. The assessment process defined by this practice is intended to generate sound, objective, and defensible information sufficient to satisfy diverse *user* objectives.

4.1.5 *Use by Other Parties*—Assumptions and limitations based on the *user's* objectives will be built into the implementation of this practice. Any party other than the *user* who seeks to use a *Phase II ESA* must therefore understand all such assumptions and objectives and independently evaluate whether the earlier assessment meets the needs of such other party. To promote such understanding and evaluation, Section 9 of this practice requires that objectives of a *Phase II ESA* be reported in a consistent format that clearly communicates them to subsequent readers.

4.1.5.1 This practice does not define whether or to what extent any person other than the *user* may use or rely upon a *Phase II ESA* prepared for the *user*. The appropriateness of third party use or reliance is a contractual matter that should be addressed between *user* and *Phase II Assessor*, see Appendix X2, section X2.4.

4.2 *Principles*—The following principles are an integral part of this practice and are intended to be referred to in resolving any ambiguity or exercising such discretion as is accorded the *user* or *Phase II Assessor*.

4.2.1 *Elimination of Uncertainty*—No *Phase II ESA* can eliminate all uncertainty. Furthermore, any sample, either surface or subsurface, taken for *chemical testing* may or may not be representative of a larger population. Professional judgment and interpretation are inherent in the process, and even when exercised in accordance with objective scientific

principles, uncertainty is inevitable. Additional assessment beyond that which was reasonably undertaken may reduce the uncertainty.

4.2.1.1 *Failure to Detect*—Even when *Phase II ESA* work is executed competently and in accordance with this practice, it must be recognized that certain conditions present especially difficult *target analyte* detection problems. Such conditions may include, but are not limited to, complex geological settings, unusual or generally poorly understood behavior and fate characteristics of certain *substances*, complex, discontinuous, random, or spotty distributions of existing *target analytes*, physical impediments to investigation imposed by the location of utilities and other man-made objects, and the inherent limitations of assessment technologies.

4.2.1.2 *Limitations of Information*—The effectiveness of a *Phase II ESA* may be compromised by limitations or defects in the information used to define the objectives and scope of the investigation, including inability to obtain information concerning historic site uses or prior site assessment activities despite the efforts of the *user* and *Phase II Assessor* to obtain such information in accordance with 5.1.3.

4.2.1.3 *Chemical Analysis Error*—*Chemical testing* methods have inherent uncertainties and limitations. The *Phase II Assessor* shall build quality control and quality assurance measures into the assessment, as outlined in Section 7. The *Phase II Assessor* should require the laboratory to report any potential or actual problems experienced, or nonroutine events which may have occurred during the testing, so that such problems can be considered in evaluating the data. The *Phase II Assessor* should subsequently identify such problems in any reports or documentation provided to the *user*. Any laboratory utilized for *chemical testing* shall be accredited in accordance with applicable state requirements.

4.2.2 *Level of Assessment*—*Phase II ESAs* do not generally require an exhaustive assessment of environmental conditions on a *property*. There is a point at which the cost of information obtained and the time required to obtain it outweigh the benefit of the information and, in the context of private transactions and contractual responsibilities, may become a material detriment to the orderly conduct of business. If the *presence of target analytes* is confirmed on a *property*, the extent of further assessment is a function of the degree of confidence required and the degree of uncertainty acceptable in relation to the objectives of the assessment.

4.2.3 *Comparison With Subsequent Inquiry*—The justification and adequacy of the findings of a *Phase II ESA* in light of the findings of a subsequent inquiry should be evaluated based on the reasonableness of judgments made at the time and under the circumstances in which they were made.

4.2.4 *Data Usability*—Investigation data generally only represent the site conditions at the time the data were generated. Therefore, the usability of data collected as part of a *Phase II ESA* may have a finite lifetime depending on the application and use being made of the data. To the extent that investigation data would fall within the scope of data used in a *Phase I ESA* conducted pursuant to Practice E1527 or Practice E2247, the lifetime limits defined by those standards apply. In all other respects, a *Phase II Assessor* should evaluate whether

previously generated data are appropriate for any subsequent use beyond the original purpose for which they were collected, or are otherwise subject to lifetime limits imposed by other laws, regulations or regulatory policies.

4.2.5 *Phase II Assessor Does Not Provide Legal or Business Advice*—The *Phase II ESA* is intended to develop and present sound, scientifically valid data concerning actual site conditions. It shall not be the role of the *Phase II Assessor* to provide legal or business advice.

## 5. Developing and Documenting the Scope of the Phase II Environmental Site Assessment

5.1 To promote clarity in defining *Phase II ESA* objectives and transparency in communicating and interpreting *Phase II ESA* results, this practice specifies adherence to the following requirements for documenting the scope of assessment and constraints on the conduct of the assessment process.

5.1.1 *Statement of Objectives*—The objective(s) of the *Phase II ESA*, including the question(s) to be answered by the assessment in accordance with 6.4.1, must be developed on the basis of consultation between the *user* and the *Phase II Assessor*, and must be stated in a written “Statement of Objectives”. The Statement of Objectives must form part of a written scope of work, proposal, contract, work order, or similar instrument.

5.1.2 The Statement of Objectives must identify and describe any schedule, cost, or budget limitations applicable to the *Phase II ESA* or to activities comprising the assessment process, including any predetermined limitation on the scope of investigation, the number of iterations of sampling, or other activities that bear on the scope, schedule, or cost of a *Phase II ESA*. In developing the Statement of Objectives, the *user* and the *Phase II Assessor* must consider whether any such limitations will compromise ability to conduct the *Phase II ESA* in accordance with this practice. If so, the Statement of Objectives must either adapt the objectives of the *Phase II ESA* so that they are achievable subject to such limitations, or describe the anticipated effect of such limitations on ability of the *Phase II ESA* to achieve such objective(s).

5.1.3 In conferring to develop and draft the Statement of Objectives, the *Phase II Assessor* should provide the *user* with information and explanation regarding the *Phase II ESA* process so that the *user* can make informed decisions and participate in formulating objectives. The *user* should provide the *Phase II Assessor* all pertinent documentation and information regarding the *property’s* environmental conditions that are known to, and reasonably and practicably available to, the *user*, including but not limited to the following: previous *ESAs*, other environmental studies, and technical reports or documents pertinent to an understanding of the known or potential *presence of target analytes* at the property; oral histories concerning releases or disposal affecting the property; and the *user’s* detailed knowledge of the nature of any specialized activities and operations conducted at the property that inherently pose the potential for the *presence of substances* on the *property*.

5.1.4 *Scope of Work*—The *Phase II Assessor* shall develop a description of the methods and work tasks to be implemented to achieve the *user’s* Phase II objectives. See Section 7. A

formal written description may not be required or appropriate in all circumstances and may be substituted by another document that contains the same elements, such as proposal or scope of work.

5.2 *Compensation Not Contingent on Results*—Payment for the *Phase II Assessor's* services as an independent contractor, or remuneration or job security for the *Phase II Assessor* as an employee of *user*, may not be contingent on the results or conclusions of a *Phase II ESA*. The *Phase II Assessor* must conduct and evaluate the results of the *Phase II ESA* objectively and without reference to whether any particular outcome or conclusion is desired by the *user*.

5.3 *Issues Beyond the Scope of the Practice*—Other than as specifically set forth in this Section 5, the content and form of the contractual relationship between a *Phase II Assessor* and *user* are not prescribed by this practice. Appendix X2 to this practice presents a discussion of some common contracting issues that may arise in the course of implementing a *Phase II ESA*, which may be useful in guiding the *user* and *Phase II Assessor* through the process. The discussion does not specify how issues or conflicts should be resolved.

## 6. Phase II ESA Overview

6.1 *Purpose*—The purpose of conducting a *Phase II ESA* in accordance with this practice is to acquire and evaluate information sufficient to achieve the objectives set forth in the “Statement of Objectives” developed by the *user* and the *Phase II Assessor* pursuant to Section 5 of this practice.

6.2 *Assessment to Determine Presence of Target Analytes*—The *Phase II ESA* is conducted to determine whether *target analytes* are present in *environmental media* at a property, mainly through *chemical testing* of samples of *environmental media* collected from locations where such *target analytes* are most likely to be present, and if present, to gain sufficient information regarding the *target analytes* to meet the objectives.

6.3 *The Degree of Assessment*—The *Phase II ESA* scope of work may warrant one or more rounds of the investigation planning, implementing, and evaluating steps, but this practice requires only as many iterations as needed to meet the *user's* objectives as reflected in the “Statement of Objectives.”

6.4 *Components of the Phase II Investigation*—The following general steps must be taken in performing a *Phase II ESA*, in the manner and level of detail appropriate to achieving the objectives set forth in the “Statement of Objectives” described in 5.1.1:

6.4.1 **Formulate the question.** The *user* and *Phase II Assessor* together must formulate the question(s) to be answered by the *Phase II ESA*. In doing so, the *user's* particular objective(s) for the *Phase II ESA* must be recognized, and the *Phase II Assessor* must formulate the hypothesis or hypotheses to be confirmed or refuted by the investigation. The question(s) to be addressed must be reflected in the written Statement of Objectives.

6.4.2 **Identify the areas** warranting Phase II investigation (i.e., sampling and *chemical testing* of *environmental media*) in order to achieve the stated objective(s) of the assessment. The *Phase II Assessor* should identify the areas to be investigated in light of all *reasonably ascertainable* information.

6.4.3 **Develop a conceptual model** that considers each area where *target analytes* are present or are likely present and that is to be investigated. The *conceptual model* describes the *target analytes* likely to be present and where the *target analytes* are likely to be located now, in light of the environmental *behavior, fate, and transport characteristics* of the particular *target analytes* and all reasonably ascertainable information about their *presence* or likely *presence*. The following tasks shall be undertaken to develop the *conceptual models*.

6.4.3.1 Identify *target analytes* associated with the particular *substances* that have, or may have, been released or may be present, based both on reported *substance* usage, generation or *presence*, and on a professional understanding of the *substances* typically used and generated in current and historical operations and activities.

6.4.3.2 Determine how the *target analytes* likely would have first entered the environment (i.e. first contacted *environmental media*). To do so, the *Phase II Assessor* must draw on professional knowledge of the sorts of industrial and commercial operations and activities that are inherent to the current and historic uses of the property, known or inferred. The *Phase II Assessor* must also draw on knowledge of the characteristics of engineered structures, features, and containers present or known or inferred to have been present at the property, from which or through which the *target analytes* may have been released or dispersed on the property.

6.4.3.3 Infer the *environmental media* and locations currently most likely to have the highest concentrations of the *target analytes* given the possible mechanisms of first entry into the environment, the site's physical conditions, and the *behavior, fate, and transport characteristics* of the *target analytes*, based on both known site-specific information (e.g., witness accounts of spills, location of likely releases, ground cover materials, etc.) and the *Phase II Assessor's* professional knowledge of natural environmental phenomena and processes, combined with the chemical behavior of the *target analytes*, as well as the hydrogeology and geochemistry of settings like those of the *property*.

6.4.4 **Plan the sampling and chemical testing** of *environmental media*. The data quality objective for *Phase II ESAs* is, at a minimum, to achieve reproducible *chemical testing* results for *target analytes* in samples of *environmental media* collected from locations relevant to the objectives of the assessment likely to have the highest concentration of *target analytes*. To be consistent with scientific inquiry, the work should be formulated such that another *Phase II Assessor* would be able to reproduce the assessment and obtain consistent results.

6.4.5 **Carry out the sampling and chemical testing** in accordance with the plan, making observations and note of actual physical conditions revealed by the investigation (e.g., subsurface soil and *groundwater* characteristics), and of any physical or logistical impediments to accomplishing the sampling and *chemical testing* as planned (e.g., physical barriers barring sampling at specified locations, insufficient sample volume recovered, etc.).

6.4.6 **Validate the conceptual model** by evaluating the *chemical testing* results and other investigation findings at the completion of the latest round of investigation, to determine

whether the available information is consistent with the *conceptual model* and sufficient to support sound conclusions regarding the *presence* and significance of *target analytes*.

6.4.6.1 If the results of the latest round of investigation are consistent with and support the assumptions of the *conceptual model*, and if the *Phase II Assessor* can draw sound conclusions regarding the *presence* of *target analytes*, then the *conceptual model* is validated and sufficient investigation has been demonstrated.

6.4.6.2 If the results of the latest round of investigation are inconsistent with or do not support the assumptions of the *conceptual model*, or if the *Phase II Assessor* cannot draw sound conclusions regarding the *presence* of *target analytes*, then it must be determined whether a revised *conceptual model* can be articulated in a manner that is consistent with available data and sufficient to meet the objectives of the assessment, either as originally stated or as revised in light of the results. If so, the revised *conceptual model* may be considered validated.

6.4.6.3 If the results of the latest round of investigation are not consistent with any *conceptual model* that can be articulated and the *Phase II Assessor* cannot draw sound conclusions regarding the *presence* of *target analytes*, then the *conceptual model* has not been validated and the *Phase II Assessor* and the *user* may consult to determine whether to conduct additional investigation to develop information sufficient to articulate and validate a *conceptual model*.

6.4.7 **Develop the conclusions of the *Phase II ESA***, based on an interpretation of all results and findings, and consistent with the validated *conceptual model*. The conclusions must specifically answer the question(s) the *Phase II ESA* set out to address (6.1, 6.2) or clearly state why those questions cannot be answered and what conclusions, if any, can be drawn. See Section 8.

6.4.8 **Prepare a written report of *Phase II ESA* objectives, findings**, interpretations, and conclusions, along with descriptions of the *conceptual model*, the investigation(s) performed, observations made, and data obtained, in sufficient detail to allow another *Phase II Assessor* to reproduce the assessment and obtain consistent results. See Section 9.

## 7. Performing the *Phase II ESA*

7.1 *Initiating scientific inquiry by formulating the question to be answered*—As in all scientific inquiry, the *Phase II ESA* process must begin with the formulation of the question to be answered by the *Phase II ESA*. The *user* and *Phase II Assessor* together formulate the question(s) in conjunction with the “Statement of Objectives” in accordance with 5.1.1 and 6.4.1. The *user’s* objectives may also dictate thresholds of concern or confidence desired in the conclusions to be derived from the assessment process. All relevant factors should be taken into account in formulating the “Statement of Objectives” for the assessment. Fundamental to the *Phase II ESA* is the notion that the *presence* of *target analytes* in *environmental media* may be indicative of a release unless such *presence* is due to natural origin or some other background condition. A *Phase II* objective may nonetheless call for investigation of *substances present* as a result of intentional application (e.g. pesticides) or natural origin (e.g. radon or naturally occurring metals).

7.2 *Collecting and Evaluating Information*—In formulating the question to be addressed and identifying areas to be investigated, the *Phase II Assessor* must review all *reasonably ascertainable* information relevant to the objectives of the assessment, including but not limited to any *Phase I ESA* report concerning the property, and, using his/her professional judgment, independently evaluate its completeness, accuracy and sufficiency as a foundation for identifying the *target analytes* and the areas of *presence* and likely *presence* to be addressed by the *Phase II ESA*.

7.3 *Identifying Areas for Investigation*—The *Phase II Assessor* must determine which areas have to be investigated in order to meet the objectives of the *Phase II ESA*. In doing so, the *Phase II Assessor* should exercise professional judgment based on knowledge of the types of activities, operations, and *releases* that are inherent to the past uses of the *property*.

7.3.1 To the extent needed to achieve the particular objective of the *Phase II ESA*, the *Phase II Assessor* may designate *RECs* identified in prior *Phase I ESAs* for further investigation in accordance with this practice. Not all conditions identified as *RECs* in prior *Phase I ESAs* necessarily need be designated for *Phase II* investigation. The *Phase II Assessor* may also designate conditions not identified as *RECs* in any previous *Phase I ESA* for *Phase II* investigation.

7.3.2 The *Phase II Assessor* must consider past activities and operations conducted at the property to identify the potential for *releases* to have occurred or other reasons to conclude that there is a *presence* or likely *presence* of *substances* that would be relevant to the objectives of the *Phase II ESA*. In reviewing *reasonably ascertainable* information and gaining firsthand familiarity with the *property*, the *Phase II Assessor* should exercise professional judgment based on knowledge of the manner in which releases commonly occur in connection with commercial or industrial activities and operations similar to those currently or historically conducted at the *property*, in order to identify conditions that obviously could and commonly do lead to *presence* of *substances* in circumstances such as those known to have existed at the *property*.

7.3.3 The *Phase II Assessor* must consider whether any *data gaps* identified as such in a prior *Phase I ESA* report should be addressed by conducting sampling and *chemical testing* as part of the *Phase II ESA*. If so determined, then the area of the *property* and the potentially affected *environmental media* must be identified for investigation.

7.3.4 The *Phase II Assessor* must designate all areas where there is a *presence* or likely *presence* of *substances* that would be relevant to the objectives of the *Phase II ESA* and that must be investigated to meet the objectives of the *Phase II ESA*.

7.4 *Developing the Conceptual Model*—For purposes of a *Phase II ESA*, the *conceptual model* consists of a description of the likely environmental conditions of the *property* relative to the *presence* or likely *presence* of *target analytes* in *environmental media*. The model hypothesizes (i.e., predicts) where specific *target analytes* would occur now, in light of the likely mechanisms by which *target analytes* were released or may otherwise be *present*, how and where they likely first contacted *environmental media*, the environmental *behavior*, *fate*, and *transport characteristics* of the particular *target analytes*

and/or the compounds or mixtures of which they are a part, and physical characteristics of the *site* that would influence the persistence and distribution of the *target analytes* (e.g., *transport* or *migration pathways*) should a *release* have occurred. The *conceptual model* must be conceived prior to sampling and *chemical testing* to guide the work, and must be refined throughout the investigation process to incorporate new information as the body of knowledge about site conditions evolves. The components of the *conceptual model* are described in 7.4.1 through 7.4.3, below, and include determining the *target analytes* (7.4.1), hypothesizing the mechanisms by which *substances* first entered into the environment and the points of entry (7.4.2), and hypothesizing the *behavior, fate, and transport characteristics* of the *target analytes* (7.4.3).

7.4.1 Determine the *target analytes*. In determining the *target analytes*, the *conceptual model* must consider the composition of *substances* known or likely to have been *present*, used, handled, or released in connection with past activities at the *property*, *substances* that are *present* or *likely present* as a result of other human activities, and *substances* that are naturally occurring. Such *substances* should be designated as the *target analytes* to be sought in analyses of samples of *environmental media* as needed to achieve the objectives of the assessment. Testing for broad categories of analytes is warranted when there is uncertainty as to the composition of *substances* that may have been released.

7.4.1.1 The *conceptual model* must consider the physical state in which a *target analyte* was likely released or might otherwise be *present*, as this will govern its environmental *behavior, fate, and transport characteristics*.

7.4.1.2 The *conceptual model* must consider the potential transformations of primary *target analytes* to secondary *target analytes*.

7.4.2 The *conceptual model* must consider the mechanism by which the *target analytes* first enter into the environment. The manner(s) in which a *target analyte* or the compound or mixture of which it is a part first contacted *environmental media* is a primary consideration in determining where the *target analyte* is likely to be found now, and therefore where samples should be collected. The environmental medium at the point of entry is the first that was contacted by the *target analyte*, and commonly persists as the location likely to have the highest concentration of *target analytes*.

7.4.3 The *conceptual model* must consider the *behavior, fate, and transport characteristics* of the *target analytes*. The *conceptual model* hypothesizes the likely current locations of *target analytes* at the site; for the purposes of the *conceptual model* and the sampling plan (described in 7.5, below), the locations (distribution) of *target analytes* may be shown by a map or described verbally. The *conceptual model* must hypothesize where *target analytes* would likely occur now, given what is known about the *release* or likely *presence* (including the mechanism of entry into the environment), and considering physical, chemical and environmental factors that influence the persistence and migration of *target analytes* subsequent to their entry into the environment. Having identified the *target analytes* (as in 7.4.1, above) and their means and points of entry into the environment (as in 7.4.2, above), it is necessary to

consider the probable *behavior, fate, and transport characteristics* of the *target analytes* in the particular setting of the *property*. As appropriate given the history and setting of the *property* and the objectives of the investigation, the *conceptual model* should be formulated in light of the following general principles:

7.4.3.1 *Target analytes* generally persist, and are commonly at their highest concentration, at the point of entry into *environmental media* (determined in accordance with 7.4.2, above).

7.4.3.2 Migration of *target analytes* subsequent to a *release* generally results in a three-dimensional expansion of the zone impacted by the *target analytes*.

7.4.3.3 Factors affecting the *behavior, fate, and transport* of *target analytes* should be considered in hypothesizing the probable three-dimensional distribution of the *target analytes*.

7.4.3.4 For each area where *target analytes* are *present* or are likely to be *present*, the *conceptual model* should hypothesize the point of entry location and the zone where *target analytes* are likely *present* (i.e., the *target analyte migration pathways*, the media and locations along the pathways likely to contain the highest concentrations of the *target analytes*, and locations of boundaries to *target analyte* migration). If needed to achieve the objective of the *Phase II ESA*, the *conceptual model* would also indicate the *presence* of potential *receptors, exposure points, and mechanisms of exposure*.

7.5 *Developing a Plan and Rationale for Sampling*—Develop a written plan for sampling based on the hypothesized three-dimensional distribution of *target analytes* represented by the *conceptual model* (7.4). The sampling plan may be stated in a free-standing document or as part of a document such as a proposal or scope of work that contains the same elements. However, the results of the investigation must be interpreted, and the conclusions of the *Phase II ESA* must be stated, in light of the sampling rationale that was followed (see Appendix X3 concerning optional report formats.) The data quality objective for the *Phase II ESA* is to obtain information regarding the *presence* of *target analytes* at the *property* that is accurate and reproducible, consistent with proper scientific inquiry and *the scientific method*. The *chemical testing* program must be designed, at a minimum, to seek *target analytes* specific to the area under investigation, in accordance with the *conceptual model*. To the extent that the universe of *target analytes* is uncertain, it may be appropriate to seek broad categories of analytes in addition to the site-specific *target analytes*. At each stage of sampling and *chemical testing*, the *Phase II Assessor* must use all information that has been gained to refine the *conceptual model* as warranted, and to augment the sampling plan (e.g., to select subsequent sampling points based on actual site conditions revealed). The general tasks in developing a sampling plan are described in 7.5.1 through 7.5.7, below.

7.5.1 At a minimum, the sampling plan must be devised to allow collection of the media associated with each area where *target analytes* are *present* or likely to be *present* at the highest concentrations.

7.5.2 The sampling plan may specify sampling beyond the minimum when the objective of the assessment presents a

question that requires knowledge of the distribution of *target analytes*, not just knowledge of the *presence* or absence of *target analytes* indicative of a *release*.

**7.5.3 Sampling Strategies**—This practice does not specify the exploration and sampling methods and techniques that the *Phase II Assessor* might find appropriate in the exercise of professional judgment.

**7.5.4 Health and Safety Considerations**—Unless addressed in a separate health and safety plan, the sampling plan should include personnel health and safety precautions to be followed in accordance with applicable federal law or state or local equivalents and any requirements imposed on the *Phase II Assessor* by the owner or occupant of the *property*, or by the *user*.

**7.5.5 Sampling Techniques**—The sampling plan shall specify appropriate techniques and methods for collecting representative samples of *environmental media* in accordance with standard practices and the objectives of the *Phase II* investigation.

**7.5.6 Field Screening**—In some instances, the selection of optimal sampling locations can be aided by *field screening* techniques that can detect, among other things, subsurface physical anomalies, potential *migration pathways*, and possible *groundwater* VOC plumes.

**7.5.7 Quality Assurance/Quality Control (QA/QC) for Sampling and Chemical Testing**—The sampling plan must include a *quality assurance/quality control (QA/QC)* plan. The *QA/QC* plan does not have to be in the form of a written document, but the *QA/QC* provisions must be known to and followed by the *Phase II Assessor*. A *quality assurance/quality control (QA/QC)* plan shall be devised and followed to provide assurance that the samples collected are representative of the *environmental media* and locations specified in the sampling plan, that sample integrity is not compromised with regard to *target analyte presence* and levels as a result of the sampling and sample handling procedures, and that the *chemical testing* results are properly evaluated to ensure reliability. The *Phase II Assessor* should incorporate provisions in the *QA/QC* plan to require appropriate sample handling prior to delivery to the laboratory, including ensuring that samples are properly preserved (e.g., refrigerated, or combined with appropriate preservative chemicals), that samples are available for *chemical testing* within required holding times, and that sample *chain of custody* is documented prior to being relinquished to an appropriately accredited laboratory. Deviations from the sampling plan must be noted and justified or reconciled prior to completion of the investigation. The data and information developed must be accurate and reproducible, consistent with normal requirements for scientific inquiry. Best practices, ASTM standards, and pertinent regulatory guidance on obtaining representative samples and protecting the integrity of the samples that are collected should be followed as warranted.

**7.6 Conducting the Sampling**—Conduct the sampling in accordance with the sampling plan and *Phase II ESA* objectives upon which the plan is based. If any deviations from the plan are necessary (e.g., forced by unforeseen circumstances) they must be noted, the *conceptual model* and plan for sampling must be revised to account for the circumstances, and any

different or additional sampling required by the revised plan must be conducted. Also, as new information is gained from the sampling and *chemical testing* results, the information and the *conceptual model* must be reconciled. This reconciliation may necessitate refinement or revisions to the *conceptual model*. Prior to any subsequent sampling, the plan must be modified or augmented in keeping with any necessary revisions to the *conceptual model*.

**7.7 Validating the Conceptual Model**—The *Phase II ESA* investigations, sampling and *chemical testing* will generate information and data on environmental conditions at the *property* that must be systematically evaluated in light of the *conceptual model* and the problem or question being addressed, to determine whether a sound and sufficient understanding of site conditions has been gained. That is, if the *conceptual model* predictions of *target analyte* points of entry, *migration pathways*, and current distribution are supported by the totality of the data, then the *conceptual model* is validated and is evidence that a sound understanding of site conditions has been achieved. The information and data often do not speak for themselves, and must be analyzed to qualify the sufficiency of the investigation. Analysis entails determining whether a *release* has occurred (e.g., whether *target analytes* are *present*), and whether the *presence* of *target analytes* is sufficiently understood to achieve the *Phase II ESA* objective (or whether iterations of sampling and *chemical testing* are warranted to gain a sufficient understanding). Only when the investigation results are consistent with the evolving, updated, *conceptual model* should the *Phase II Assessor* conclude that the investigation has been adequate to understand site conditions and resolve the question being addressed.

**7.7.1 Validation of Assumptions**—The first task in analysis of data is to consider whether the assumptions upon which the *conceptual model* and sampling plan were based were valid. That is, one asks whether samples were collected of the appropriate *environmental media* (for example, soil or *groundwater*) at the right location and depth (for example, where the highest concentrations of *target analytes* should be, if a *release* had actually occurred).

**7.7.1.1** The *conceptual model* is usually based initially upon assumptions regarding subsurface physical conditions, such as relative permeability, depth to the *water table*, and *groundwater flow direction*, as well as regarding the nature of the *target analytes* (e.g., the form and volume of a hypothesized *release*). Actual information on these conditions is usually gained through the explorations, sampling, and observations of the investigation (at least for those studies where subsurface conditions are of concern). Upon completion of a round of sampling and testing, the *Phase II Assessor* must evaluate whether the assumptions were valid, in light of the actual conditions encountered. If an assumption was not valid, then the investigation may not have accomplished its purpose and additional iterations may be warranted.

**7.7.1.2** If the results of the latest round of investigation are insufficient to support a validated *conceptual model*, determine whether an additional iteration of investigation is warranted. Any iteration should begin with a re-evaluation, by the *Phase II Assessor* in consultation with the *user*, of the question(s)

being addressed (6.4.1) and the cost and likely effectiveness of additional iterations. Depending upon that re-evaluation, additional iterations of investigation may involve repeating some or all of the component steps of a *Phase II ESA* (6.4.1 through 6.4.5) in order to support a validated *conceptual model* (6.4.6) before formulating the *Phase II ESA* conclusions (6.4.8).

7.7.2 *Validation of Chemical Testing Data*—The second task in analysis of data is to evaluate whether the quality of the *chemical testing* data is satisfactory according to the *QA/QC* plan (7.5.7). For example, any *target analytes* detected in the samples must be confirmed to be, in fact, attributable to the *presence of substances* at the site, rather than to sampling, handling, and testing artifacts. Similarly, the reported absence of detectable *target analytes* from samples must be evaluated against the detection limits and any surrogate recoveries achieved in the analyses. When data quality is determined to be acceptable, investigation results may be interpreted.

## 8. Interpretation of Results

8.1 *Interpreting Results*—The *Phase II ESA* results should be interpreted to determine the significance of the data as they relate to the objective(s) of the assessment (see 5.1.1). The results of the Phase II investigations also should be interpreted for indications of whether there may be other sources of *target analytes*, or higher concentrations of *target analytes* in *environmental media*, that exist at the site in locations, forms or quantities potentially relevant to the objective(s) of the assessment, but that were not specifically assessed. See 7.7.1.

8.1.1 If *target analytes* that can occur naturally in settings like that of the *property* are detected (e.g., heavy metals, or total petroleum hydrocarbons), the *Phase II Assessor* must consider whether the detected *target analytes* are naturally occurring (i.e., at *background concentrations*) or reflect *diffuse anthropogenic contamination*, or are *present* as a result of a *release*.

8.1.2 If *target analytes* are confirmed to be *present*, then depending on the *user's* objective(s), the *Phase II Assessor* may interpret the results in relation to numerical criteria, including regulatory criteria if relevant to such objectives, or in relation to other quantitative or qualitative criteria based upon the *user's* needs or contractually-imposed conditions. When evaluating *chemical testing* results against any such criteria, it is essential that the *Phase II Assessor* compare results to the *conceptual model* and determine whether they are representative of site conditions, including if necessary determining whether the results are representative of the highest concentration of *target analytes present* at the site. See 7.5.1. Dismissing the *target analytes* associated with a *release* on the basis that *target analyte* levels do not exceed relevant criteria is not justified unless data that represent the highest level or concentration have been considered.

8.1.3 If *QA/QC* procedures were employed in accordance with Section 7, and if *target analytes* were not detected at concentrations above laboratory reporting limits appropriate to the objectives of the assessment, then the *Phase II Assessor* can render an opinion that there is no longer any reasonable basis for believing that *target analytes* are *present*.

8.1.4 Where the objectives of the *Phase II ESA* can be met by assessing less than all *releases* and *likely release areas* at a

*property*, a conclusion equivalent to “no further inquiry warranted” applies only to the *releases* and *likely release areas* assessed, and shall be so stated in the report. Where the *user's* objectives may be otherwise satisfied (e.g., where establishing *LLPs* under (CERCLA) is not the *user's* objective), a *likely release area* may be eliminated from further assessment based on a *Phase II ESA* finding that there is no reasonable basis for believing that *target analytes* are *present* at levels that are of concern in light of the objectives of the assessment.

8.1.5 If the *Phase II ESA* fails to achieve the objectives articulated in the “Statement of Objectives” for any reason, the results must be interpreted in relation to the objectives and any difference between objectives and results must be described and evaluated. The *Phase II Assessor* should determine the need for and scope of additional Phase II activities that may achieve the stated objectives unless the *user* redefines the objectives so that they can be met with the data available.

## 9. Phase II ESA Report Preparation

9.1 *Purpose*—This practice requires a written report for the purpose of stating the objectives of the assessment, describing the work performed, explaining the rationale followed, and documenting the information and data acquired. The report conveys the *Phase II ESA* results and the conclusions of the *Phase II Assessor* in the context of the *user's* objectives, i.e., the problem(s) or question(s) addressed.

9.2 *Minimum Content Elements of Phase II ESA Report*—A written *Phase II ESA* report should have three general *characteristics*: good technical writing; accurate and complete presentation of the results and conclusions; and, all the supporting components of a scientific report. At a minimum, a *Phase II ESA* report must include the following major components: (a) an introduction stating the objective (i.e., the question to be addressed), and including a verbatim statement of the final “Statement of Objectives” for the assessment; (b) a summary of relevant background information sufficient to explain and support the approach to the problem; (c) a description of the work performed and the rationale for it; (d) a description of the methods used; (e) a presentation of the information and data acquired; (f) evaluation of the information and data; (g) interpretation of the results in relation to the objective(s) and question(s) to be answered and the conceptual site model for the assessment; and (h) the signature of the *Phase II Assessor*, together with any professional seal, license type and license number, where required by the local jurisdiction. Tables, figures and appendices are typically included and should be used as appropriate to provide a clear and complete picture of the assessment.

9.2.1 Where all of the elements of E1903 are followed, the written report shall also include the following statement: “We have performed a Phase II environmental site assessment at the property at (address) in conformance with the scope and limitations of ASTM Practice E 1903-XX and for the following objectives: [list “statement of objectives” developed pursuant to section 5.1].”

9.2.2 Other than the statement required by section 9.2.1, this practice does not prescribe a specific form of written report. Any written report that covers the elements set forth in section 9.2 complies with this practice.

9.2.3 The detail and complexity of a written Phase II Assessment report are specific to the setting of the assessment and may be influenced by factors such as the complexity of site conditions, the extent and complexity of assessment activities, the number of distinct areas assessed, and the *user's* requirements for detail or precision in the results.

9.2.4 To assist *users*, *Phase II Assessors*, and readers of Phase II Assessment reports, optional report formats are provided in [Appendix X3](#).

## APPENDIXES

### (Nonmandatory Information)

## X1. LEGAL CONSIDERATIONS PERTAINING TO PHASE II ENVIRONMENTAL SITE ASSESSMENTS

### INTRODUCTION

*Phase II Environmental Site Assessments (ESAs)* may be performed for diverse reasons and with diverse objectives. The present practice is thus unlike standards that provide frameworks for complying with specific legal obligations or that address specific technical problems of environmental science and engineering. Instead, this practice defines a scientifically sound approach to gathering information about site conditions based on sampling and analysis of *environmental media*. This approach can be applied in any setting where sound information about such conditions is useful.

A *user's* need for information about site conditions may arise from or be influenced by legal considerations to varying degrees. In many instances, however, the *user's* goals in performing the *Phase II ESA*, and the concomitant information objectives to be met by the assessment process, will be shaped by a combination of the *user's* business interests, business objectives and *business environmental risk* tolerance as much as any direct or indirect legal requirement. In every instance, the application of the standard will therefore be a product of the objectives to be accomplished and the procedures defined by the standard itself. Accordingly, legal considerations can and often will be important factors in applying the standard, but in some contexts may be less directly relevant or even peripheral to the assessment process.

The comments that follow are intended to provide perspective on legal considerations that may inform the decision of whether to pursue a *Phase II ESA*, and if so, how scope and objectives are defined to satisfy the information needs at hand.

#### X1.1 CERCLA Landowner Liability Protections:

X1.1.1 A *user* may wish to evaluate *RECs* or *data gaps* identified in a *Phase I ESA*, or other *likely release areas* identified by the *Phase II Assessor*, for purposes related to certain *landowner liability protections* available under the federal Comprehensive Environmental Response, Compensation and Liability Act (“*CERCLA*”), 42 U.S.C. § 9601 et seq., as amended.

X1.1.1.1 The *landowner liability protections* provide defenses to liability that arises pursuant to *CERCLA* Section 107, 42 U.S.C. § 9607. Generally speaking, such liability attaches in connection with the *release* of “*hazardous substances*” as defined in *CERCLA* Section 101(14), 42 U.S.C. § 9601(14). Potentially responsible parties include (1) the owner and operator of a vessel or a facility from which *hazardous substances* are released, (2) any person who at the time of disposal of any *hazardous substance* owned or operated any facility at which such *hazardous substances* were disposed of, (3) any person who by contract, agreement, or otherwise arranged for disposal or treatment, or arranged with a transporter for transport for disposal or treatment, of *hazardous substances* owned or possessed by such person, by any other party or entity, at any facility or incineration vessel owned or

operated by another party or entity and containing such *hazardous substances*, and (4) any person who accepts or accepted any *hazardous substances* for transport to disposal or treatment facilities, incineration vessels or sites selected by such person, from which there is a *release*, or a threatened *release* which causes the incurrence of response costs, of a *hazardous substance*. Responsible parties may be liable for statutory categories of response and other costs associated with the *release*. See *CERCLA* Section 107(a), 42 U.S.C. § 9607(a).

X1.1.1.2 It is presumed that *users* interested in applying this practice in connection with *CERCLA landowner liability protections* have made inquiry or obtained advice of counsel as needed to determine whether they have or may have exposure to liability under (*CERCLA*) Section 107(a). Detailed consideration of circumstances giving rise to such liability is beyond the scope of this Appendix.

X1.1.2 Phase II assessment may be undertaken in order to qualify for and maintain the three types of *CERCLA* landowner liability protection (*LLP*) known as the *bona fide prospective purchaser (BFPP)*, *innocent landowner (ILO)* and *contiguous property owner (CPO) LLPs*. The *BFPP* and *CPO LLPs* were created by the Small Business Liability Relief and Brownfields Revitalization Act, Pub. L. No. 107-118, amendments to

*CERCLA*, enacted in January 2002 (“Brownfields Amendments”); the *ILO LLP* existed before 2002 but was significantly amended in 2002. All three *LLPs* require that a prospective purchaser undertake *all appropriate inquiries (AAI)* into the condition of a property before purchase. That level of inquiry is defined by federal rule, 40 C.F.R. Part 312, and by Practice [E1527](#) and Practice [E2247](#) for Phase I Environmental Site Assessments, all of which expressly provide that they do not require sampling or *chemical testing of environmental media*. If the *user’s* objective is to qualify for one of the *CERCLA LLPs*, this standard assumes that an investigation complying with *AAI* will already have been performed.

X1.1.2.1 A *bona fide prospective purchaser (BFPP)* is a person who meets the criteria stated at 42 U.S.C. § 9601(40) and thereby becomes eligible for the *bona fide prospective purchaser LLP* as defined in *CERCLA*, 42 U.S.C. § 9607(r). *BFPP* status and the corresponding defense to liability are available to a person who both conducts *all appropriate inquiries* on or before the date of purchase, and satisfies certain “*continuing obligations*” or criteria established under *CERCLA* for maintaining the (*CERCLA*) *landowner liability protections*, including taking *reasonable steps* to prevent or limit human, environmental, or natural resources exposure to any previously released *hazardous substance*. The *bona fide prospective purchaser LLP* is available only if the property was purchased after January 11, 2002, the date of enactment of the *Brownfields Amendments*.

X1.1.2.2 An *innocent landowner (ILO)* is a person within one of three categories defined by 42 U.S.C. § 9601(35) and § 9607(b)(3) and therefore eligible for the *innocent landowner defense* to *CERCLA* liability: (i) a person who “did not know and had no reason to know” that contamination existed on the *property* at the time such person acquired the *property*; (ii) a government entity which acquired the *property* by escheat, or through any other involuntary transfer of acquisition, or through the exercise of eminent domain authority by purchase or condemnation; and (iii) a person who “acquired the *property* by inheritance or bequest.” To qualify as the first type of *innocent landowner*, such person must have made *all appropriate inquiries* on or before the date of acquisition. Furthermore, the *all appropriate inquiries* must not have resulted in knowledge of contamination. If they do, then such person did “know” or “have reason to know” of contamination and would not be eligible for the *ILO defense*.

X1.1.2.3 A *contiguous property owner* is a person who meets the criteria stated at 42 U.S.C. § 9607(q) and thereby becomes eligible for the *contiguous property owner (CPO) LLP* to *CERCLA* liability. To qualify for the *CPO LLP*, a person must (among other things) own real property that is contiguous to, and that is or may be contaminated by *hazardous substances* from, other real property that is not owned by that person. Furthermore, such person must have conducted *all appropriate inquiries*, at the time of acquisition of the property and must not know or have reason to know that the *property* was or could be contaminated by a *release* or threatened *release* from the contiguous property. The *all appropriate inquiries* must not have resulted in knowledge of contamina-

tion. If they do, then such person did “know” or “have reason to know” of contamination and would not be eligible for the *CPO LLP*.

X1.1.3 The *CPO* and *ILO LLPs* are defeated if the purchaser either knew or had reason to know of contamination on the *property* at the time of acquisition. See *Interim Guidance Regarding Criteria Landowners Must Meet in Order to Qualify for bona fide prospective purchaser, Contiguous Property Owner, or Innocent Landowner Limitations on CERCLA Liability (“Common Elements”)* (United States Environmental Protection Agency Office of Enforcement and Compliance Assurance Mar. 6, 2003) (hereinafter “*Common Elements Guidance*”) at 4. The statute defines “reason to know” in terms of whether, before purchase, the purchaser conducted *AAI*, but also independently requires that the prospective purchaser neither know nor have reason to know of the contamination. See (*CERCLA*) 101(35)(A)(i), (B)(i) (*ILO*), 42 U.S.C. § 9601(35)(A)(i), (B)(i); *CERCLA* 107(q)(1)(A)(viii)(II) (*CPO*), 42 U.S.C. § 9607(q)(1)(A)(viii)(II).

X1.1.4 *EPA* has cautioned that eligibility for the *LLPs* requires compliance with “*continuing obligations*” in addition to a pre-purchase investigation constituting *AAI*. See *Standards and Practices for all appropriate inquiries; Final Rule*, 70 Fed. Reg. 66,070 (Nov. 1, 2005) (hereinafter “*AAI Preamble*”) at 66,073. “*Continuing obligations*” include compliance with land use restrictions and noninterference with institutional controls. They also include *reasonable steps* to stop continuing releases, prevent future releases, and prevent or limit human, environmental or natural resource exposure to previously-released *hazardous substances*. See *CERCLA* 101(40)(D) (*BFPP*), 42 U.S.C. § 9601(40)(D); *CERCLA* 107(q)(1)(A) (*CPO*), 42 U.S.C. § 9607(q)(1)(a); *CERCLA* 101(35)(B)(II) (*ILO*), 42 U.S.C. § 9601(35)(B)(II). *EPA* has indicated that “reasonable steps” are site-specific, fact-based, and are to be determined in light of the legislative intent to balance protection of public health and the environment with the goal of shielding landowners from liability. See *Common Elements Guidance* at 12. In addition, for the *ILO LLP*, the 2002 amendments did not alter the requirements that the purchaser exercise “due care with respect to the *hazardous substances* concerned, taking into consideration the characteristics of such *hazardous substances*, in light of all the relevant facts and circumstances.” *CERCLA* 107(b)(3), 42 U.S.C. § 9607(b)(3). *EPA* has noted that judicial decisions construing the “due care” requirement “have generally concluded that a landowner should take some positive or affirmative step(s) when confronted with *hazardous substances* on its property,” and that the “due care” precedent may be viewed as providing “a reference point for the *reasonable steps* analysis. *Common Elements Guidance* at 11. Phase II investigation may thus be undertaken to develop information about site conditions sufficient to permit compliance with these obligations.

X1.1.5 For purposes of the *landowner liability protections*, *reasonable steps* consist of actions to prevent or limit human, environmental or natural resources exposure to previously released *hazardous substances*, as required by *CERCLA* 101(40)(D), 42 U.S.C. § 9601(40)(D), *CERCLA* 107(q)(1)(A)(iii), 42 U.S.C. § 9607(q)(1)(A)(iii), and *CERCLA*

101(35)(B)(i)(II), 42 U.S.C. § 9601(35)(B)(i)(II). Such *reasonable steps* are thus within the *continuing obligations* that must be performed after property acquisition in order to preserve (*CERCLA*) *LLPs*. See Common Elements Guidance at 9-13. Investigation in accordance with this practice may be useful to identify conditions that give rise to an ongoing obligation to take *reasonable steps* in order to preserve the *landowner liability protections* and to enable the *user* to define and implement appropriate actions.

X1.1.6 The thoroughness of investigation may be relevant to the degree of *obviousness* of contamination, which is an independent factor in eligibility for the *ILO LLP*. *EPA* has expressly cautioned that the lack of a sampling and analysis requirement in the rule “does not prevent a court from concluding that, under the circumstances of a particular case, sampling and analysis should have been conducted to meet ‘the degree of obviousness of the *presence* or likely *presence* of contamination at the property, and the ability to detect the contamination by appropriate investigation’ criterion and obtain protection from *CERCLA* liability.” *AAI* Preamble at 66,101. Thus, *EPA* has acknowledged, “[i]n certain instances, depending on site-specific circumstances and the totality of the information collected during the *all appropriate inquiries* prior to the property acquisition, it may be necessary to conduct sampling and analysis, either pre- or post-acquisition, to fully understand the conditions at a property, and fully comply with the statutory requirements for the *CERCLA* liability protections. In addition, sampling and analysis may help explain existing *data gaps*.” *Id.* See also *id.* at 66089 (“Section 312.20(g) of the final rule points out that one way to address *data gaps* may be to conduct sampling and analysis.”). Phase II investigation may thus be advisable if other information about site conditions is such as to suggest that contamination discoverable through sampling and *chemical testing* could be deemed “*obvious*.”

X1.1.7 Eligibility for *CERCLA LLPs* can be tested in contexts other than direct enforcement action by *EPA*. Private parties that incur response costs can bring actions pursuant to *CERCLA* Sections 107 or 113, 42 U.S.C. §§ 9607 or 9613. A cost recovery plaintiff that has no liability itself can seek to hold defendants jointly and severally liable for all incurred costs. If such a plaintiff claims non-liability in reliance on one of the *CERCLA LLPs*, defendants faced with strict joint and several liability pursuant to Section 107 will be strongly motivated to challenge the plaintiff’s asserted status. In that context or in a contribution action pursuant to Section 113, the applicability of the available defenses therefore may be subject to judicial determination based on the facts of record, with *EPA*’s policies regarding *AAI* and site investigation carrying less weight.

### X1.2 Other Legal Objectives for Phase II Assessment:

X1.2.1 Independent of *CERCLA*, a *Phase II ESA* may be driven by considerations rooted in state statutory or common law.

X1.2.2 State statutes may contain liability provisions and defenses analogous to those under *CERCLA*. Detailed consideration of all such laws is beyond the scope of this Appendix.

X1.2.3 By statute, some states require that the condition of certain types of properties be disclosed and/or investigated in connection with transfer. New Jersey Industrial Site Recovery Act, Connecticut Transfer Act, Conn. Gen. Stat. 22a-134 et seq. Indiana Responsible Property Transfer Law, Ind. Code §§ 13-25-3-1 to 13-25-3-15. Detailed consideration of all such laws is beyond the scope of this Appendix.

X1.2.4 To the extent knowledge of property conditions and diligence in their investigation is relevant to state statutory liabilities, defenses or transfer requirements, investigation of site conditions in accordance with this practice may be useful. *Users* are cautioned, however, that state administrative agencies frequently define the procedures and criteria required for site investigation. *Users* should obtain legal advice as to the nature of environmental liabilities, defenses and transfer requirements, and as to the particulars of state administrative requirements for investigation of the nature defined by this practice.

X1.2.5 At common law, possessors of land may under some circumstances have a duty “to ascertain the condition of the land.” Restatement (Second) of Torts, § 343 comment b. For such purposes, the process of defining *property* conditions may be assisted by this standard.

X1.3 Independent of investigation that may be necessary to support compliance with *CERCLA* or state statutory defenses or affirmative legal obligations, *Phase II ESA* is required to be eligible for federal brownfields cleanup grants. *EPA* grant proposal guidelines expressly provide that “a minimum of an ASTM E1903-97 or equivalent Phase II site assessment must be underway or completed prior to proposal submission.” *Proposal Guidelines for Brownfields Assessment, Revolving Loan Fund and Cleanup Grants* (*EPA* Oct. 2006) at 11.

X1.4 *Users* may elect to investigate property conditions for a variety of purposes involving estimation of environmental costs or liabilities, such as transactional due diligence, risk management, financial disclosure, and asset retirement planning. Many such purposes are rooted in legal liability considerations. Often, however, liability is assumed and the only question is the cost associated with it. That question may present itself in a variety of forms, e.g. the magnitude of contingent environmental liabilities for asset valuation purposes, or assessment of risk in connection with underwriting insurance coverage. It is impossible to generalize about the contexts in which a *user* may wish to conduct such investigations or the degree of confidence a *user* may require in the results. In any such context, this practice, being rooted in sound scientific methodology, can assist *users* in achieving an objective and defensible assessment.

X1.4.1 Investigation in accordance with this practice may be pursued to support estimation, accrual and disclosure of environmental liabilities for purposes of accounting and financial disclosure. Relevant guidance includes AICPA Statement of Position 96-1 on recognition, estimation and disclosure of environmental liability in financial statements, FASB Interpretation No. 47 on Accounting for Conditional Asset Retirement Obligations, and ASTM E2137-06 on Estimating Monetary Costs and Liabilities for Environmental Matters.

X1.4.2 Investigation in accordance with the practice may be pursued by publicly traded companies that are required by securities regulations to make disclosures concerning contingent environmental liabilities, and in support of requirements under the Sarbanes-Oxley Act concerning certification of

securities disclosures. Relevant guidance includes SEC Staff Accounting Bulletin 92 regarding accounting and disclosure obligations for contingent environmental liabilities and FASB Statement of Financial Accounting Standards No. 5 regarding loss contingencies.

## **X2. CONTRACTING CONSIDERATIONS BETWEEN ENVIRONMENTAL INVESTIGATOR AND USER**

X2.1 *Reporting Obligations*—A requirement to report observations from a *Phase II ESA* to a governmental entity or third party may be imposed by various authorities, including statutes, regulations, common law, and professional standards. In most cases, statutory, regulatory and common law requirements impose reporting obligations only on the owner, operator, or person in charge or control of the facility or property being assessed. In some circumstances, however, reporting obligations may be legally or voluntarily imposed upon a broader group, including the *Phase II Assessor*. To avoid disagreement, misunderstanding, or unexpected reporting, it may be helpful if the contract between the *user* and the investigator clarifies the obligations of and protocol for both the *user* and investigator to report to governmental entities or third parties.

X2.1.1 *Production of Written Reports and Documentation*—The production of written documentation reflecting the findings of a *Phase II ESA* raises issues of concern to the *user* and the *Phase II Assessor*. The *user* may be concerned, for example, about the potential for disclosure of sensitive information to the government or third parties and the conflicting interest of ensuring documentation to support *Landowner Liability Protections*. The *Phase II Assessor* may be concerned that the assessment is well documented to minimize misinterpretation, document uncertainty, and clearly present findings to the *user*. As a result, the agreement between the *user* and *Phase II Assessor* should address the type and scope of written documentation that will be developed to reflect the findings of the *Phase II ESA*. In this regard, consideration should be given to issues such as the attorney-client, work product and self-evaluation privileges, whether recommendations should be provided separately from the *Phase II ESA* report and the extent to which the *user* wants to review a report prior to its becoming “final”. An example format is attached in [Appendix X3](#).

X2.1.2 *Confidentiality*—Agreements for confidential treatment of the *Phase II ESA*, if any, should be included in the contract. This agreement should include any subcontractors used in performance of the assessment.

X2.2 *Work Performed by Others*—During the implementation of the *Phase II* assessment, the *Phase II Assessor* may employ others (for example, drillers, laboratories) to carry out portions of the work. The contract between the *Phase II Assessor* and the *user* may specify whether the *Phase II Assessor* or the *user* is to be responsible for selecting subcontractors. The contract also may specify that only qualified subcontractors with current and appropriate certifications and licenses may be employed. The contract also may specify the

qualifications required of subcontractors.

X2.3 *Limitation on Scope of Work, Data, Information, or Time*—Any limitations on the information, data collected or the work to be performed during the *Phase II ESA*, including time allowed for completing the work, and their effect on the results of the assessment, should be clearly understood by the *Phase II Assessor* and *user*. Such limitations may be made part of the contract.

X2.4 *Third Party Reliance on Reports and Other Documentation*—Responsibility for the use of *Phase II ESA* reports by third parties may be governed by the contractual relationship between the *user* and *Phase II Assessor* or by a reliance letter that extends the right to rely on such reports to third persons.

X2.5 *Generation of Waste*—Wastes may be generated during the assessment implemented as part of the *Phase II ESA* (for example, drill cuttings and purged *groundwater*). The contract between the *Phase II Assessor* and the *user* should clearly address the manner in which such wastes are to be handled and disposed. The contract may specify that techniques that minimize the generation of waste should be utilized to the extent feasible, consistent with the information and data quality objectives of the planned assessment and applicable regulatory requirements.

X2.6 *Damages Caused by Explorations*—Exploration activities risk damaging structures such as utility lines and underground storage tanks when such are *present*. Intrusive explorations may also create additional pathways for pollutant migration. Responsibility for identification of subsurface structures may be governed by the contractual relationship between the *user* and *Phase II Assessor*. Where the *user* is not the owner of the *property*, the owner should be consulted about the location of such structures.

X2.7 Many states have statutory obligations for contacting utilities through utility clearance programs. Coordination with utility companies or locator services should also be addressed in the contract documents.

X2.8 *Responsibility of User*—The following list of responsibilities of the *user* is not intended to be exhaustive:

X2.8.1 The *user* should provide access to appropriate areas of the site for the *Phase II Assessor*.

X2.8.2 The *user* should provide the *Phase II Assessor* a site contact name and phone number.

X2.8.3 When the property to be accessed is not owned by the *user*, the *user* should make provisions for the restoration of

landscaping damaged by investigation activities, whether through the specifically contracted services of the *Phase II Assessor* or not.

**X2.9 Responsibility of Environmental Investigator**—The following list of responsibilities of the *Phase II Assessor* is not intended to be exhaustive.

**X2.9.1** The *Phase II Assessor* should conform to the precepts of this practice and accepted industry practice. The *Phase II Assessor* should document and explain significant deviations.

**X2.9.2** The *Phase II Assessor* should provide the *user* prompt notice of environmental conditions observed.

**X2.9.3** The *Phase II Assessor* should communicate to the *user* limitations resulting from any time and cost constraints imposed by the *user*.

**X2.9.4** The *Phase II Assessor* should verify with the *user*, prior to implementation of the scope of work, any substantive deviations from the scope of work described in contract documents.

**X2.9.5** The *Phase II Assessor* should ascertain and observe all site health and safety considerations and regulations applicable to the activities of the *Phase II Assessor*.

**X2.9.6** The *Phase II Assessor* should provide the *user* a written statement of qualifications, including the qualifications of the individual *Phase II Assessor* (s) responsible for the *Phase II ESA* on request.

**X2.9.7** The *Phase II Assessor* should not undertake any activity that he or she is not qualified or licensed (where applicable) to perform.

### X3. OPTIONAL REPORT FORMATS

#### INTRODUCTION

A written report compliant with this practice may be prepared in any format including the minimum components identified at 9.2, *Minimum Content Elements of Phase II ESA Report*. The following report descriptions and tables of contents are provided to assist *users*, *Phase II Assessors*, and readers of Phase II Assessment reports.

**X3.1 Report Option A**—A written report compliant with this practice may be prepared in a format including the following components:

**X3.1.1** Statement of Objectives, including a brief summary of background information, *user* objectives or other factors which led to these objectives.

**X3.1.2** Scope of Work, including discussion of the *conceptual model* and rationale for the assessment activities.

**X3.1.3** Report on sampling activities including a description of sampling locations and their relationship to the property.

**X3.1.4** Analytical data and test results.

**X3.1.5** Interpretation and evaluation of data and test results in light of the *conceptual model*, leading to conclusions in relation to the objectives and questions to be answered.

**X3.1.6** The written report may refer to figures, tables and diagrams to present details of assessment activities, sampling locations, and analytical data and test results.

**X3.1.7** The signature of the *Phase II Assessor*, together with any professional seal, license type and license number, where required by the local jurisdiction.

**X3.1.8** Table of Contents. Report Option A is typically presented in letter format. As such, no table of contents is appropriate.

**X3.2 Report Option B**—A written report compliant with this practice may be prepared in a format including the following components:

**X3.2.1 Title and Identification**—The identifying components of a *Phase II ESA* usually include a transmittal letter, title page, and table of contents.

**X3.2.1.1 Signatures**—The report should include the signature of the assessor, together with any professional seal, license type and license number, where required by the local jurisdiction. Signatures, along with typed names and titles may appear in the transmittal letter, on the cover page, or on a signature page at the end of the main text of the report. The signature should not be transmitted independent of the *Phase II ESA* report.

**X3.2.1.2 Transmittal Letter**—A transmittal letter documents the date of a report's delivery and identifies the intended recipients of the report. It also may contain other important information including a description of the report as draft or final and a designation that the report is confidential or subject to attorney work product privilege, or both. The transmittal letter also may identify the *Phase II Assessor(s)* responsible for the work.

**X3.2.1.3 Title Page**—The title or cover page identifies the following items: the title of the report, the subject property name and address, the preparer of the report, the *user* for whom the report was prepared, and the date of the report. It may also include a statement identifying the document as subject to certain legal privileges, such as confidentiality, and attorney work product privilege.

**X3.2.1.4 Table of Contents**—The table of contents should list at least the major sections of the report, and identify the figures, tables and appendices by name or content.

**X3.2.2 Executive Summary**—Inclusion of an executive summary is optional. It should provide a concise overview of the objectives and findings of the *ESA*, and should not simply be a copy of the conclusion section of the report. As a summary, it should generally be briefer than the conclusion

section, and should not contain material not addressed in the main text or body of the report.

**X3.2.3 Main Text**—The main text, or body, of the report generally contains an introduction, a discussion of background information, a description of work performed during the *Phase II ESA* and the rationale behind it, descriptions of methods used, a presentation of the information and data acquired, an evaluation of the information and data, and interpretation of the results and conclusions drawn from them.

**X3.2.4 Introduction**—The introduction must at a minimum state the purpose and objective(s) of the *Phase II ESA* as set forth in the “Statement of Objectives,” including any conditions or limitations on the assessment that affect the ability of the assessment to achieve the stated objectives. The introduction also should identify items not included within the scope of the *Phase II ESA* that might have been expected to be included, for example, *likely release areas* that were not addressed and the reasons for not addressing them.

**X3.2.4.1** The introduction should reference this Practice E1903 and any other applicable standards to which the work was performed, contracts/agreements between the *Phase II Assessor* and *user*, regulatory requirements applicable to the work, and the general nature of the work performed (e.g., a *Phase II ESA* involving soil and *groundwater* sampling and *chemical testing*).

**X3.2.5 Background Information**—This section should include a general description of the site, its features and physical setting, a summary of site history and use and the use of adjacent properties, and a summary of the findings of previous environmental site assessments including any relevant *Phase I ESA*. Other *ESA* reports should be referenced if they provided information germane to the *Phase II ESA*.

**X3.2.5.1** Pre-existing information and data that led to the *Phase II ESA* should be summarized. More detailed descriptions are to be presented later, in the discussion of the *conceptual model* and rationale for the work undertaken. If the *Phase II ESA* is based on earlier environmental site assessments, the earlier *ESAs* should be precisely identified. It is often useful (but not mandatory) to include prior *ESA* reports in an appendix.

**X3.2.6 Work Performed and Rationale**—The investigation, sampling, and testing that was accomplished should be described. The rationale for the work should be presented, including by discussing the *conceptual model* (7.4) and sampling and analysis plan (7.5) that were developed for, and refined during, the work. Any agency or facility records review, historical document review, interviews, or site reconnaissance that were conducted by the *Phase II Assessor* to supplement available *Phase I ESA* information that aided in the identification of areas for investigation should be discussed. The nature and location of each area investigated should be described. The exploration and sampling locations, and samples that were field screened or tested, should be identified. The exploration, sampling, and *field screening* methods followed, the *target analytes* sought by *chemical testing*, and analytical methods, should be presented. Deviations from the intended sampling and analysis plan or from standard methodologies should be explained.

**X3.2.6.1** Methods used should be identified by reference to standard methods where applicable, such as ASTM standards, state protocols, or *EPA* methodologies. Other methods used (for example, project-specific specialized methods, or standard operating procedures for a particular *Phase II Assessor*) should be described in sufficient detail that would allow another *Phase II Assessor* to reproduce the work. Where appropriate, the details of specialized methods and procedures used can be included in an appendix.

**X3.2.7 Presentation and Evaluation of Results**—Results of the *Phase II ESA* should be organized and presented in a manner that will aid the reader in understanding the discussion and interpretation of the results in the report section to follow. The results should be presented in relation to the objective of the assessment and the question(s) addressed. Data can be tabulated and presented on figures as appropriate to aid the reader’s review and understanding. The inclusion of laboratory reports of results in an appendix shall be referenced.

**X3.2.7.1** Information regarding actual subsurface physical, geologic, and hydrogeologic features of the site setting that was revealed in the investigation should be described. The actual physical features should be reconciled with the assumptions of the *conceptual model* and sampling plan to validate the physical components of the *conceptual model*.

**X3.2.7.2** The results should be organized and presented to assist the reader’s understanding of the locations, types and levels of *target analytes* that were encountered. The presentation may be broken down to individual area assessed. The data may be further organized with respect to *environmental media* within an area, e.g., soil, *groundwater*, *surface water*, soil vapor, etc. For most objectives, the data should be organized for easy comparison to regulatory criteria. For example, if the purpose of the *Phase II ESA* was to identify conditions that might cause a regulatory response, then the data should be presented along with pertinent regulatory criteria for easy comparison. Organizational divisions also may be by target analyte type (for example, organic versus inorganic *target analytes*), or other factors (e.g., the *presence* of *target analytes* in shallow soils subject to direct human exposure criteria versus impacts to deeper soils subject only to pollutant mobilization criteria), depending on the specific problems or questions addressed. Other information that should generally be presented includes: locations of sampling points in relation to potential sources and *migration pathways* (e.g., the position of a monitoring well relative to the *target analyte* source and the direction of *groundwater flow* from the source); and, the depths to pertinent horizons (e.g., the *water table*, the fill/natural soil contact, or the overburden/bedrock contact).

**X3.2.7.3** The discussion of results should include the validation of the *conceptual model*, particularly confirmation that appropriate *environmental media* were sampled from optimal or other appropriate locations, and were tested for appropriate *target analytes*, in accordance with the sampling and analysis plan and as required to meet the objective of the assessment. The *substances* detected should be reconciled with the specific *target analytes* that were hypothesized to be *present*. Deviations from the sampling and analysis plan (e.g., intended samples could not be collected) must be explained so the

implications of the deviations can be discussed later in the report along with interpretation and conclusions.

**X3.2.8 Interpretation and Conclusions**—Interpretation of results, as performed under Section 8, should be discussed in the report in the terms of scientific logic (i.e., statement of question, hypothesis, test of hypothesis, validation of assumptions, conclusion) in relation to the “Statement of Objectives.” For each area assessed, restate the question that was to be addressed and summarize the significant attributes of the final *conceptual model* for the area (i.e., which features of the *release* or likely *release* and site setting dictated target analyte behavior, fate, and transport). Then, note the investigation tasks that were undertaken to evaluate the conditions envisioned by the *conceptual model*. Explain how the resulting data and information confirmed (or refuted) the *conceptual model*, and present the conclusions that can be drawn from the results.

**X3.2.8.1** This report section should contain a summary description of *likely release areas* and areas of *presence* or likely *presence* addressed (and those relevant to the objectives of the assessment that were not addressed, if any), and the information and data generated from the investigations (including the geologic and hydrogeologic conditions encountered).

**X3.2.8.2** The information and data pertinent to each area assessed should be discussed as they bear on the objective(s) of the *Phase II ESA*. Opinions and conclusions should be stated in terms corresponding to the objectives.

**X3.2.8.3** The conclusion section shall clearly state whether the objectives listed in the Statement of Objectives were or were not accomplished. The conclusions must explain any deviations from planned assessment activities or limitations on what was accomplished, including the effect of such deviations or limitations on the degree of confidence or completeness of the conclusions.

**X3.2.9 Recommendations**—Recommendations for further work may be included, at the option of the *user*, consistent with the objective(s) of the *Phase II ESA*.

**X3.3 Supporting Materials**—References and sources of information should be listed in sufficient detail to allow another *Phase II Assessor* to ascertain or reproduce documents and information critical to the assessment. The report should contain tables, figures and appendices as necessary or appropriate to explain and support the main text of the report.

**X3.3.1 Tables and Figures**—Tables and figures may be used as tools for summary presentation of data. Guidelines for data organization and presentation in **X3.2.7.2** apply to tables and figures as well as to text.

**X3.3.1.1** Tables summarizing analytical data should also show any numerical criteria pertinent to the objectives of the assessment.

**X3.3.1.2** Figures that show areas assessed, sampling points, and locations of surface and subsurface features affecting the *presence* and distribution of *target analyte* (e.g., *groundwater flow paths*) can significantly aid the reader’s understanding. Drawings should be dated. Site plans should include a north arrow, a scale as appropriate to the level of accuracy of the drawing (or notation that the figure is not to scale), a legend, a title, and other appropriate identification. If figures are based on the work of others, the source and its date should be referenced.

**X3.3.2 Appendices**—When generated during completion of the assessment, boring logs and laboratory reports, including the data validation package, should be included as appendices to the report. Other materials may be appropriate for inclusion in appendices to a *Phase II ESA* report, and should be included to the extent they help explain and document the assessment process: prior assessment reports; documents critical to the assessment but not generally available to other investigators; photographs; subsurface exploration logs; and laboratory quality control information and sample *chain of custody* forms.

## EXAMPLE TABLE OF CONTENTS FOR PHASE II ESA REPORT—OPTION B FORMAT

X3.4 The following Table of Contents illustrates the organization of a *Phase II ESA* report corresponding to the format described as Option B in [Appendix X3](#).

<b>Transmittal Letter</b>	
<b>Title Page</b>	
<b>Table of Contents</b>	
<b>1</b>	<b>Executive Summary [optional]</b>
<b>2</b>	<b>Introduction</b>
<b>3</b>	<b>Background (may be by reference to prior environmental reports):</b>
	3.1 Site Description and Features
	3.2 Physical Setting
	3.3 Site History and Land Use
	3.4 Adjacent Property Land Use
	3.5 Summary of Previous Assessments
<b>4</b>	<b>Work Performed and Rationale</b>
	4.1 Scope of Assessment:
	4.2 Exploration, Sampling, and Test Screening Methods
	4.3 Chemical Analytical Methods
<b>5</b>	<b>Presentation and Evaluation of Results</b>
	5.1 Subsurface Conditions
	5.2 Analytical Results
<b>6</b>	<b>Interpretation and Conclusions</b>
	6.1 <i>Recognized Environmental Condition</i> / Potential Release Area
	6.2 <i>Conceptual Model</i> Validation / Adequacy of Investigations
	6.3 Absence, <i>Presence</i> , Degree, Extent of <i>Target Analytes</i>
	6.4 Other Concerns (for example, qualifications or limitations of assessment)
	6.5 Conclusions / Objectives Met
<b>7</b>	<b>Recommendations [if applicable]</b>
<b>8</b>	<b>Signature of Phase II Assessor with typed name [and professional license number and seal, if applicable]</b>
<b>References and Sources of Information</b>	
<b>Tables [use if applicable]</b>	
	List of Explorations, Samples Collected, COCs Sought
	Test Screening Data
	Monitoring Well and Water Level Measurements
	Soil Analytical Data
	<i>Groundwater</i> Analytical Data
	Other Media Analytical Data
<b>Figures [use if applicable]</b>	
	Site Location Map
	Site Plan with <i>Likely Release</i> Areas and Exploration Locations
	<i>Groundwater</i> Contour Plan with Inferred <i>Groundwater</i> Flow Directions
	Geologic Cross-Section
	Site Plan with <i>Chemical Testing</i> Results
<b>Appendices [use if applicable]</b>	
	Prior Assessment Report(s)
	Selected Reference Documents
	Photographic Log
	Subsurface Exploration Logs and Monitoring Well Construction Details
	Laboratory Report With Quality Control Information

#### X4. STANDARDS THAT MAY BE RELEVANT IN PHASE II ENVIRONMENTAL SITE ASSESSMENT

X4.1 The following standards may be relevant in conducting a *Phase II Environmental Site Assessment*.

X4.2 *ASTM Standards:*<sup>2</sup>

- D596 Guide for Reporting Analysis of Water
- D653 Terminology Relating to Soil, Rock and Contained Fluids
- D1452 Practice for Soil Exploration and Sampling by Auger Borings
- D1586 Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils
- D1785 Specification for Poly (Vinyl Chloride) PVC Plastic Pipe, Schedules 40, 80, and 120
- D2487 Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- D2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)
- D3694 Practices for Preparation of Sample Containers and for Preservation of Organic Constituents
- D3856 Guide for Good Laboratory Practices in Laboratories Engaged in Sampling and Analysis of Water
- D4448 Guide for Sampling Ground-Water Monitoring Wells
- D4700 Guide for Soil Sampling from the Vadose Zone
- D4823 Guide for Core-Sampling Submerged, Unconsolidated Sediments
- D4840 Guide for Sampling Chain-of-Custody Procedures
- D5088 Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites
- D5092 Practice for Design and Installation of Ground Water Monitoring Wells
- D5314 Guide for Soil Gas Monitoring in the Vadose Zone

D5730 Guide for Site Characterization for Environmental Purposes With Emphasis on Soil, Rock, the Vadose Zone and Ground Water

- E678 Practice for Evaluation of Scientific or Technical Data
- E1689 Guide for Developing Conceptual Site Models for Contaminated Sites
- E1912 Guide for Accelerated Site Characterization for Confirmed or Suspected Petroleum Releases
- E2081–Guide for Risk-Based Corrective Action
- E2091–Guide for Use of Activity and Use Limitations, Including Institutional and Engineering Controls
- E2137 Guide for Estimating Monetary Costs and Liabilities for Environmental Matters
- E2531 Guide for Development of Conceptual Site Models and Remediation Strategies for Light Nonaqueous-Phase Liquids Released to the Subsurface
- E2600 Guide for Vapor Encroachment Screening on Property Involved in Real Estate Transactions

X4.3 *Environmental Protection Agency Documents:*<sup>4</sup> Recommended Analytical Procedures, Test Methods for Evaluating Solid Waste-Physical/Chemical Methods, SW 846

- Draft Field Methods Compendium, OER 9285.2-11
- Subsurface Characterization and Monitoring Techniques: A Desk Reference Practice-Vols I and II, *EPA 625/R-93/003a* and *b*
- Description and Sampling of Contaminated Soils, A Field Pocket Practice, *EPA 625/12-91/002*
- Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, May 1996
- Expedited Site Assessment Tools for UST Sites: A Practice for Regulators, *EPA 510-B-97-001*
- Guidance for Conducting Remedial Investigations and Feasibility Studies Under *CERCLA*, OSWER Directive 9355.3-01, October 1988

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