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PHASE II SITE ASSESSMENTS

This article reviews the background of the revised Phase II Environmental Site Assessment Standard issued in July 2011 by ASTM International. The author, who chaired the task group responsible for the revisions, reviews the background of the standard and the reasons for the revisions, outlines significant changes in the new standard, and describes the revised assessment process.

The ASTM Standard Practice for Phase II Environmental Site Assessments

BY CHRISTOPHER MCCORMACK

The idea of a ''phase I site assessment'' means roughly the same thing to property owners and buyers, lenders, insurers, environmental engineers, and regulators. A federal rule and ASTM standard issued in 2005 have cemented this understanding to a degree that these diverse constituencies can meaningfully be said to have a common understanding of what a ''phase I'' is and is not.

The same historically has not been true of ''phase II'' assessments. Beyond the general idea that a ''phase II'' involves sampling and testing of environmental media, investigative activity under the phase II label has been highly diverse. The scope of investigation has been a particularly problematic species of diversity: where Phase I assessment has long involved looking at all conditions presenting the potential for a release to have occurred, phase II assessment often is focused on addressing a single issue or group of issues, such as whether an underground tank leaked. The archetype of the resulting challenge is the property owner who presents a lender with a phase II report claiming ''the property is clean'' when in fact the investigation addressed only limited issues and resulted in findings that cannot be extrapolated to the property as a whole.

ASTM International, the source of a widely-used standard for Phase I assessments, first published a Phase II standard in 1997. In July 2011, in reaction to statutory changes and after extensive dialogue about the practical uses of phase II assessments, it published a broadly revised Phase II standard. This article explores the background of the standard, the competing considerations that had to be balanced in revising it, and the resulting systematic approach to planning, conducting, and documenting the results of phase II assessment activities.

I. Background of the Standard and Genesis of Revisions

A. The 1997 Standard Guide and Subsequent Changes in the Law

ASTM originally issued standard E1903, ''Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process,'' in 1997 and reissued it in 2002 without change. As Standard E1903-97 (2002), it remained in effect until July 2011. It now has been superseded by a wholly new E1903-11, ''Standard Practice for Environmental Site Assessments: Phase II Environmental Site Assessment Process.''

The 1997 ''standard guide'' sought to define the site assessment process as a matter of ''good commercial and customary practices,'' a concept rooted in the Comprehensive Environmental Response, Compensation, and Liability Act's ''innocent purchaser'' defense. The 1997 edition explicitly stated it was ''intended to constitute 'all appropriate inquiry into the previous ownership and uses of a property' to determine whether hazardous

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substances or petroleum products have been disposed or released there in order to satisfy one element of the innocent purchase defense to CERCLA liability.''[1]

As CERCLA stood in 1997, the Phase II standard logically could link itself to the standards for conducting a Phase I site assessment (ASTM E1527) or a due diligence transaction screen (ASTM E1528). Indeed, the standard at that time defined Phase II investigation as part of a continuum of ''all appropriate inquiry,'' i.e., ''satisfying the appropriate inquiry element of CERCLA's innocent purchaser defense . . . where a previous assessment satisfying that [element] identified recognized environmental conditions.''[2] The 1997 edition explicitly linked Phase II assessment to Phase I assessment under the ''all appropriate inquiry'' rubric, stating that the ''primary objective'' of Phase II is ''to evaluate the recognized environmental conditions identified in the Phase I ESA or transaction screen process for the purpose . . . where applicable, [of] providing the level of knowledge necessary to satisfy the innocent purchaser defense.''[3]

By 2005, the logical framework for this linkage no longer existed. The 2002 Brownfields Amendments to CERCLA[4] fundamentally restructured the ''innocent purchaser'' defense. Where the prepurchase ''all appropriate inquiry'' requirement had been undefined, the 2002 amendments gave the requirement statutory content by requiring EPA to promulgate regulations establishing ''good commercial and customary standards and practices'' and defining ''interim'' standards and practices pending adoption of regulations. The 2002 amendments expressly recognized ASTM's Phase I standard, then designated E1527-97 as satisfying the ''appropriate inquiry'' requirement.[5] Significantly, the Phase II standard was not so recognized.

The statutory acknowledgment of the ASTM Phase I standard was reinforced in the ensuing negotiated rulemaking, which culminated in the simultaneous promulgation of a revised ASTM Phase I standard, E1529-05, and a federal AAI rule that outlined a less prescriptive performance-based approach to ''all appropriate inquiry.'' The AAI rule nevertheless expressly approved the revised ASTM Phase I standard as an alternative means of satisfying the statutory requirement.

These developments had significant implications for the Phase II standard. Most importantly, they decoupled Phase II from the statutory ''all appropriate inquiry'' requirement. Indeed, the federal AAI rule was announced with the clear statement that ''today's final rule does not require sampling and analysis as part of the all appropriate inquiries investigation'' (70 Fed. Reg. 66,070, 66,101 (Nov. 1, 2005)).[6] This change alone meant the Phase II standard no longer could call itself a part of ''good commercial and customary practice for conducting all appropriate inquiry.'' The 2002 Brownfields Amendments and 2005 AAI and Phase I changes also placed the sampling and analysis tasks covered by Phase II in an indefinite space—possibly useful to address data gaps, possibly a factor in determining ''degree of obviousness,'' but not definitively required for those or any other specific purpose. Collectively, these changes meant Phase I and Phase II assessments, notwithstanding the similarity implied by their nomenclature, had ceased to have any fixed relation.

Against this background, ASTM convened a Task Group to consider revising the 1997 Phase II standard.

B. The Revision Process and Significant Issues Addressed

Although the new Phase II standard reflects across-the-board rethinking, several currents ran through the revision process.

The decoupling of Phase II from AAI led the Task Group to consider how legal concerns might prompt a user to undertake Phase II assessment. Even without strict legal requirements like those that mandate investigation in accordance with AAI and the Phase I standard, it became apparent such assessments could serve a wide variety of purposes. As the final standard acknowledges, possible objectives include the following:

- determine whether a release of hazardous substances has occurred, which could be of interest for any number of reasons even in the absence of a legal obligation to follow up on a Phase I assessment;

- provide information relevant to identifying, defining, and implementing landowner ''continuing obligations''—ongoing measures to prevent exposure to hazardous substances—required to maintain certain CERCLA liability protections;

- provide information relevant to evaluating and allocating business environmental risk in a transaction setting; and

- provide information relevant to nonenvironmental legal obligations, such as the landowner's common law duty to visitors concerning premises conditions, or the obligations of securities issuers to disclose liabilities and contingent liabilities in financial statements and securities disclosures.

Although CERCLA liability protections do not necessarily require a Phase II assessment, brownfields grants

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[1] E1903-97 (2002), section 1.1.1.

[2] E1903-97 (2002), section 1.1.3.

[3] E1903-97 (2002), section 1.2

[4] Small Business Liability Relief and Brownfields Revitalization Act, Pub. L. No. 107-118, 115 Stat. 2356 (2002), codified in scattered sections of CERCLA, 42 U.S.C. § 9601 et seq.

[5] *Id.*, § 223(2), 115 Stat. 2373-74 (amending and expanding definition of ''all appropriate inquiry,'' codified as amended at 42 U.S.C. § 9601(35)). The legislative reference to ASTM E1527-97 as an interim AAI performance standard is found at Section 223(2)(B)(iv)(II) of the Public Law, 115 Stat. 2374 (codified at 42 U.S.C. § 9601(35) (B)(iv)(II)).

[6] The notice of the final rule was ambivalent on this point, cautioning that the lack of a sampling requirement in the AAI rule ''does not prevent a court from concluding that, under the circumstances of a particular case, sampling 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.'' 70 Fed. Reg. at 66,101. The federal rule also requires AAI assessments to identify ''data gaps'' and notes that ''[s]ampling and analysis may be conducted to develop information to address data gaps.'' 40 C.F.R. § 312.20(g). It is perhaps most accurate to say that while the 2005 AAI rule does not require Phase II investigation, it does not define the precise relationship, if any, between Phase I and Phase II assessment activities. In comparison, the ASTM Phase I standard expressly provides that Phase I assessment ''does not include any testing or sampling of materials (for example, soil, water, air, building materials).'' E1527-05, Section 7.4.

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administered by the U.S. Environmental Protection Agency require applicants to undertake investigation in conformity with the standard.[7] The U.S. Department of Housing and Urban Development also uses the standard.[8]

In revising the standard, the diversity and range of these objectives gave the Task Group confidence a revised standard could be broadly useful. The same diversity, however, meant different users needed very different things out of Phase II assessments.

The diversity of user needs emerged as an independent thread in the revision process. The revision and balloting process revealed a distinct polarization between two types of users regarding the scope of Phase II investigation.

Users representing the banking and lending perspective expressed frustration with the high degree of variability in the scope and methodology of ''Phase II'' reports they saw in connection with loan underwriting. Such reports often came with claims that ''the property is clean,'' but closer scrutiny revealed they were much less systematic investigations that did not hold up as clean bills of environmental health. These users supported a default requirement to investigate all known or possible release areas, which would promote consistency in performing assessments and interpreting results.

While this approach would have addressed lenders' concerns with consistency, it created an equally intractable problem for transactional users who stressed that they often neither need nor want comprehensive investigation of every possible release area. A given transaction could be large enough, for example, that a possible petroleum UST release would not be material. In that same transaction, however, the possibility of large-scale chlorinated solvent contamination could be a deal breaker. In that scenario, the user could elect to ignore the UST risk and investigate only solvent or PCB areas. Conversely, a highly risk-averse party could choose to conduct a cursory investigation and walk away if the slightest hint of contamination comes to light. Given the infinite variety of sites, user risk tolerance and transactional settings, the transactional user constituency strongly favored a standard that preserved the ability to tailor the scope of assessment to the needs at hand.

Reconciling these perspectives was a major part of the revision process. An interim ballot presented a version with a default ''all releases'' scope of required investigation, together with an option to perform a ''targeted'' Phase II addressing only specific releases. A number of negative ballots persuaded the Task Group this approach was unsatisfactory because even a neutral label, such as ''targeted Phase II,'' would be perceived as limited, partial, or incomplete.

The final Phase II standard balances these concerns by permitting the user to define the scope of Phase II assessment as needed to meet its objectives while also requiring the user and Phase II assessor to consult and develop a written ''statement of objectives'' incorporated in the scope of work and replicated in the written report of the investigation. Although this approach did not eliminate the variability that concerned lenders, it standardized a process in which it is mandatory to state clearly, from start to finish, what a given Phase II assessment addresses. These additional requirements convinced lenders to accept variability as long as the scope of work is made clear in the ''statement of objectives'' and the results are reported to address those same objectives. Anyone picking up a report should be able to tell at a glance what the assessment did and whether the resulting conclusions meet its own objectives.

The ''statement of objectives'' in turn integrates with the central technical thread of the revised standard, which is that Phase II assessments are conducted in accordance with the scientific method. Once defined, the ''objective'' provides the question or hypothesis to be tested through environmental assessment activities in accordance with standard experimental methodology. This, too, is an iterative, interactive process. The nature of the question and the degree of confidence or certainty required in the answer both influence the scope of investigation.

These considerations in turn integrated with another topic that came up throughout the revision process, which is the cost of assessment activities. Not surprisingly, cost was one factor in rejecting a default ''all releases'' scope. However, even in a more user-defined framework, cost considerations remain relevant. The standard therefore encourages the user and assessor to balance cost against utility in defining the user's objectives. This balancing leaves room both for value-engineering to minimize costs as well as expansion of scope to achieve broader user objectives. The scientific method imposes a constraint on cost-based adjustments, however: if budgetary considerations impair the assessor's ability to collect information sufficient to achieve the user's objectives in a defensible manner, the objectives may have to be modified further, or the assessor may need to qualify conclusions due to data insufficiency.

These interrelated issues provide the ''why'' of the revisions to the ASTM Phase II standard. We now will see how the final standard integrates them into the ''what'' of the site assessment process under E1903-11.

II. Phase II Environmental Site Assessments Under E1903-11

The revised Phase II standard begins with this statement:

> This practice covers a process for conducting a Phase II environmental site assessment (ESA) of a parcel of property with respect to the *presence* or *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 *petro-*

[7] *See, e.g.*, ''FY13 Guidelines for Brownfields Cleanup Grants'' (U.S. EPA, EPA-OSWER-OBLR-12-09), at 5, 16. Available at http://www.epa.gov/oswer/docs/grants/epa-oswer-oblr-12-09.pdf.

[8] *See, e.g.*, ''Multifamily Accelerated Processing (MAP) Guide'' (U.S. Department of Housing and Urban Development, rev. Aug. 18, 2011), Sections 9.2.D.2 (qualifications of ''Phase II Assessor'' per ASTM E1903-11), 9.3.B.1 (defining purpose of Phase II in conformity with E1903-11); 9.3.B.5 and .6 (incorporating ''logic model'' and report format of E1903-11). Available at http://archives.hud.gov/offices/hsg/mfh/map/4430ghsgg.doc.

leum products, and controlled *substances* and constituents thereof.[9]

This simple statement marks several important points of departure from the preceding version of E1903.

First, the standard is not limited to CERCLA ''hazardous substances'' but encompasses any ''substances.'' It is deliberately broad enough to embrace not only the kinds of releases that could be of regulatory concern but also materials that may not trigger regulatory consequences (e.g. pesticides applied in accordance with manufacturer's instructions) as well as naturally occurring materials (e.g. arsenic) that may be of concern to the user.

Second, the standard is not limited to ''releases.'' The rubric of ''*presence* or *likely presence*'' derives from the Phase I standard's definition of ''recognized environmental condition'' (REC), which is couched in terms of ''the presence or likely presence of any *hazardous substances* or *petroleum products* under conditions that indicate an existing release, a past release or a *material threat* of a release.''[10] To this extent, the standard meshes with the Phase I definition of an REC and can be used in conjunction with it to evaluate areas identified as RECs in a Phase I assessment. However, the lack of linkage to Phase I means the standard works wherever the presence or likely presence of a given substance is of interest, whether to investigate a suspected release area or for any other reason.

Third, the standard no longer invokes the CERCLA rubric of ''good commercial or customary practice'' or attempts to relate itself to AAI concepts. This change reflects the altered legal context resulting from the 2002 Brownfields Amendments, as discussed above.

In all of these respects, this opening sentence positions the new Phase II standard squarely in the space defined by the revision process: as a framework adaptable to ''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*.''[11] The standard goes on to list six non-exclusive scenarios that illustrate the range of situations in which users may seek ''data to inform their evaluations, conclusions, and choices of action.''[12]

At the outset, the standard introduces a number of core concepts reflecting the fundamental principle that the user's objectives influence the scope of the investigation. Thus:

- The standard expressly acknowledges ''[t]he scope of a *Phase II ESA* is related to the objectives of the investigation.''[13]
- ''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 solved.''[14]
- The confidence desired in the result affects the scope of investigation and evaluation of data. Higher confidence may require more extensive testing and more iterations of sampling than if only general conclusions are desired.[15]

With these general concepts as a foundation, the revised standard contemplates an assessment process that proceeds as follows.

A. Developing and Documenting the Scope of Assessment: 'Statement of Objectives'

The Phase II assessment begins with a mandatory consultation between the user and the assessor[16] to develop the objectives of the assessment.[17] This step is particularly important because the objective defines the question to be answered by the assessment, which is the starting point for any ''scientific inquiry.''[18]

While the standard does not prescribe or limit the objectives that may emerge from this consultation, it does

[9] E1903-11 section 1.1. Note that in ASTM style, italics denote terms defined within a standard. In this quotation and in other direct quotations, this paper preserves this usage. Defined terms are discussed, as appropriate, in the text.

[10] E1527-05, section 3.2.74.

[11] E1903-11, section 1.2, ''Objectives.''

[12] E1903-11, sections 1.2.1 through 1.2.6. Where E1903-97 (2002) specifically related itself to CERCLA AAI compliance, a core concept of E1903-11 is that the Phase II assessment approach it defines is adaptable to ''any situation'' in which property condition data are of interest.

While CERCLA AAI compliance no longer is a primary focus, two of the six E1903-11 objectives relate to CERCLA liability concepts. Objective 1 (E1903-11, section 1.2.1) involves assessing whether a CERCLA hazardous substance release has occurred. Objective 2 (E1903-11, section 1.2.2) involves developing information that may help a user identify and define the ''continuing obligations'' that may have to be fulfilled to qualify for certain CERCLA defense under the 2002 Brownfields Amendments. *Cf.* 42 U.S.C. §§ 9601(35)(B)(i)(II), 9601(40)(D), 9607(q)(1)(A)(iii) (landowner liability protections require ''reasonable steps'' to stop continuing releases, prevent threatened future releases, and prevent or limit exposure to earlier releases).

[13] E1903-11, section 1.3.

[14] E1903-11, section 1.4.

[15] E1903-11, section 1.4.1.

[16] The balloting process revealed concerns that some users may be reluctant to engage in consultation. Commenters pointed to difficulties that often arise in discharging the informational consultation requirements of the Phase I standard, *see* ASTM E1527-05 section 6, ''User's Responsibilities'' (information to review, consider and/or share with environmental professional conducting assessment), and asked whether it is realistic to expect users to engage with the Phase II process as the standard requires. This is and was a legitimate concern. However, the notion of user control in defining assessment objectives necessarily implies—indeed, is impossible without—user involvement. The better answer would seem to be that users need to engage with the assessment process under both standards. That is consistent with the requirement of user/assessor consultation under E1903-11.

[17] E1903-11, section 5.1, 5.1.1. *Cf.* E1903-11, section 6.4.1 (question to be answered by Phase II assessment activities in light of user's objectives, including hypothesis to be confirmed or refuted by investigation).

The definition of ''Phase II Assessor'' is a hybrid concept. The Task Group initially crafted a definition specific to the standard, specifying skills and experience relevant to designing, performing, and implementing the results of a Phase II assessment. Concerns emerged that these qualifications, though appropriate, omitted others, such as academic training and professional licenses. E1903-11 resolves these concerns by invoking the E1527-05 ''environmental professional'' definition, already established and accepted (though perhaps not with universal enthusiasm), and adding the Phase II-specific skill and experience. *See* E1903-11, section 3.1.33. This ''EP Plus'' concept defines the qualifications of the Phase II Assessor.

[18] E1903-11, section 7.1.

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mandate certain parameters to provide the participants with adequate information and promote clarity in stating and defining the objectives and assessment process.

The standard imposes responsibilities on both participants. The assessor is charged with explaining the assessment process so the user ''can make informed decisions and participate in formulating objectives.''[19] The user is charged with providing all pertinent information concerning the property's environmental condition that is ''known to, and reasonably and practicably available to,'' the user.[20]

In formulating the question to be addressed, the assessor is charged with reviewing ''all *reasonably ascertainable* information relevant to the objectives of the assessment, including any *Phase I ESA* report concerning the property.''[21] For this purpose, the Phase II standard mirrors the Phase I standard's definition of ''reasonably ascertainable.''[22] In addition, however, the Phase II assessor independently must evaluate the sufficiency of available information for ''completeness, accuracy, and sufficiency as a foundation for'' identifying the substances and locations to be investigated.[23]

Acquainted with the process and armed with available information, the user and assessor work out the question or questions the assessment needs to address. The result of their consultation is memorialized in the written ''statement of objectives,'' which in turn is integrated into the written scope of work, contract, or similar document.[24]

In keeping with the philosophy of user control, the standard does not limit the user's ability to set time or budget limitations on the assessment or define other constraints on the duration or intensity of the investigative program. Such constraints have the potential, of course, to affect the reliability of any conclusions or even compromise the integrity of the investigation. The standard addresses this potential primarily by requiring transparency: the written statement of objectives has to identify and describe schedule or cost limitations, including any predetermined limitations on the scope of assessment or iterations of sampling. In consulting to define objectives, the user and assessor have to think about whether such limitations will compromise their ability to comply with the standard. If so, they either must redefine the objectives so they are achievable despite the limitations or include in the statement of objectives an explanation of the anticipated effect the limitations will have.[25]

Defining the question to be answered also involves a discussion of how certain the answer has to be—or how approximate it can be—to meet the user's needs.[26] More confidence requires more work, at greater cost in dollars and time, whereas more general or limited conclusions may be attainable sooner at lower cost.[27]

Although the standard contemplates a systematic approach to developing the statement of objectives and the question to be answered by the assessment, it does not prescribe any particular degree of elaboration. Indeed, this is a crucial characteristic the Task Group very consciously sought to promote: while the *framework* for thinking about objectives is mandatory, the *implementation* need only be as elaborate as the needs of the project dictate. Indeed, elsewhere the standard expressly provides that the assessment process as a whole is to be undertaken ''in the manner and level of detail appropriate to achieving the objectives set forth in the 'Statement of Objectives.' ''[28]

This concept applies to all the implementation steps described below. It is important to understand that while the standard defines the assessment process at a level of detail that provides meaningful guidance for complex projects and objectives, it affords flexibility to ''right-size'' investigations to suit simpler sites and more limited objectives. Striking an appropriate balance between elaboration and objectives is integral to the assessment process and requires the exercise of professional judgment by the assessor in consultation with the user.

B. Preliminary Activities: Information Review, Target Analytes, and Conceptual Models

Early in the Phase II Assessment process, the standard calls for systematic review and analysis of information to identify the substances of interest and frame a ''conceptual model'' to guide investigative activities and aid in the interpretation of results.

Information review is important in framing the objectives but takes on added importance in identifying the areas to be investigated.[29] For that purpose, the Phase II standard articulates two distinct categories of information that may provide guidance.

One category consists of areas identified in past Phase I reports as RECs or ''data gaps.''[30] Just as any given Phase II is not necessarily linked to any prior Phase I investigation, however, the mention of this category does not mandate investigation. Rather, the assessor ''must determine which areas have to be investigated *in order to meet the objectives*.''[31] RECs or data gaps are included, in other words, only if they must be explained to achieve the objectives of the assessment.

The other category extends broadly to ''past activities and operations conducted at the property.'' In particu-

[19] E1903-11, section 5.1.3.

[20] E1903-11, section 5.1.3. ''Pertinent'' information includes not only previous assessment reports and environmental studies but also knowledge concerning activities and operations that ''inherently pose the potential'' for substances to be present.

[21] E1903-11, section 7.2.

[22] Compare E1903, section 3.1.41, with E1527-05, section 3.2.73 (''(1) publicly available; (2) obtainable from its source within reasonable time and cost constraints, and (3) practically reviewable''). The Phase II standard also mirrors the Phase I definition of ''practically reviewable.'' Compare E1903-11, section 3.1.35, with E1527-05, section 3.2.65.

[23] E1903-11, section 7.2.

[24] E1903-11, section 5.1.1.

[25] E1903-11, section 5.1.2.

[26] E1903-11, section 7.1.

[27] E1903-11, section 1.4.1. *See also* section 7.1 (''user's objectives may also dictate thresholds of concern or confidence desired in the conclusions to be derived from the investigation'').

[28] E1903-11, section 6.4 (overview of ''Components of the Phase II Investigation'').

[29] Cf. E1903-11, section 6.4.2 (assessment process includes defining areas to be investigated).

[30] E1903-11, sections 7.3.1 (RECs), 7.3.3 (data gaps).

[31] E1903-11, section 7.3 (emphasis added). The Phase II Assessor ''must designate all areas'' that have to be investigated to meet the objectives of the assessment. E1903-11, section 7.3.4.

lar, the standard calls for the assessor to ''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*'' to identify conditions that might have resulted in releases.[32] This idea bears emphasis: the standard calls on the assessor to *infer* areas to investigate based on general knowledge concerning industrial processes and historical site uses.

The next step in the assessment process involves two interrelated tasks: identifying the substances relevant to the objectives of the investigation and translating information and objectives into a conceptual model.

In the Phase II standard, the term ''Target Analytes'' denotes the substances of interest. What is ''of interest'' is defined not by reference to laws or regulations in the abstract but in relation to the stated objectives.[33] The Task Group settled on this approach and nomenclature after considering and rejecting terms, such as ''constituents of concern,'' that had well-settled meanings in other standards or regulatory contexts. Again in keeping with the concept of allowing the user to influence the assessment, the Task Group concluded it was best to use a term defined within the standard and functionally consistent with its structure. Though not completely unique to this standard, the phrase ''target analytes'' captures the concept that the subject of the investigation is defined in relation to its objectives. Compliance with legal requirements of course may be an objective, but within the framework defined by the standard, it is the objectives that dictate reference to the standards rather than the other way around.

The term ''conceptual model'' also is not unique to this standard. Indeed, ASTM publishes an entire standard devoted to the topic of ''Conceptual Site Models'' of contaminated properties.[34] Rather than mandate use of that standard or any other one-size-fits-all approach, however, the Phase II standard contains a streamlined, flexible definition that again ties into the statement of objectives via the concept of ''target analytes'':

> 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 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.[35]

The ''conceptual model'' is a crucial component of the assessment process defined by the standard. In essence, it is a hypothetical framework that assists both in designing the investigation and, as will be discussed further below, in interpreting results.

In developing the conceptual model, the assessor must consider a variety of parameters that influence the distribution of substances following release, including the physical state of target analytes;[36] transformation products;[37] mechanisms of release and point of first entry into environmental media;[38] and the behavior, fate, and transport characteristics of released substances in the setting of the assessment.[39] Importantly, this analysis includes hypothesizing where target analytes will be, including the location where the highest concentrations are likely to be.[40]

A discussion of the conceptual model component from the Task Group's deliberations provides a valuable illustration of how the standard contemplates ''right-sizing'' the assessment effort. For a simple petroleum UST investigation, one participant argued, a conceptual model isn't needed: the situation is so simple that it's ''obvious'' where the investigation should focus. When the Task Group examined this argument, however, it became apparent the term ''obvious'' was in reality the conclusion of an implicit conceptual model.

In a simple UST Phase II, the implicit objective is to determine whether the tank leaked. The ''target analytes'' are petroleum hydrocarbons and perhaps lead or MTBE. The mechanisms of release are incidental spills and leaks from the tank, fill and vent pipes, and other piping and pipe connections as well as the tank itself. A light nonaqueous phase liquid most likely will be found around the groundwater surface. If the tank is being removed, the investigation also would evaluate conditions in the tank grave. These considerations tell us where to look and what to look for—in other words, they constitute the hypothesis about where target analytes would be if a release had occurred and where they likely would be found at highest concentrations, and that hypothesis guides the investigation. The concepts that make the UST investigation ''obvious'' are, in other words, exactly those the Phase II standard integrates into the ''conceptual model.''

Having thus unpacked this simple situation, the Task Group gained confidence that the conceptual model is a workable means of channeling analysis to design a sound Phase II assessment. This example also helped the participants understand that in a simple situation, the ''conceptual model'' can be very streamlined.

The next step in the assessment process is to develop the sampling plan, ''a written plan for sampling based on the hypothesized three-dimensional distribution of

[32] E1903-11, section 7.3.2.

[33] E1903-11, Section 3.1.50.

[34] E1689, ''Guide for Developing Conceptual Site Models for Contaminated Sites.''

[35] E1903-11, Section 7.4. As a whole, Section 7.4 provides a comprehensive list of the characteristics of environmental media and released substances that influence fate and transport. Consideration of these factors is a conceptual core of the assessment process. Cf. E1903-11, section 3.1.28 (''Likely Release Area'' defined as ''place where a Phase II Assessor judges it likely that target analytes were first introduced into environmental media as a result of a release'' and ''may now be present''); E1903-11, section 6.4.3 (''conceptual model'' describes where target analytes are likely to be located in light of environmental behavior, fate and transport characteristics).

[36] E1903-11, section 7.4.1.1.

[37] E1903-11, section 7.4.12.

[38] E1903-11, section 7.4.2.

[39] E1903-11, section 7.4.3.

[40] E1903-11, section 7.4.3.4. The hypothesis about where highest levels are expected also guides formulation of the sampling plan, which ''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.'' Section 7.5.1.

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target analytes represented by the conceptual model.''[41] In other words, the preliminary steps of defining objectives and developing conceptual underpinnings for the investigation guide development of the sampling plan,[42] but implementation proceeds along largely conventional lines. At this stage of the assessment process, however, the standard once again emphasizes that sampling must comport with sound scientific methodology:

> 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.[43]

The sampling approach of course is tailored to the stated objectives of the assessment. The plan at least must target sampling locations where target analytes are expected to be found ''at the highest concentrations.''[44] However, if the objective of the assessment requires more than a yes/no answer about the presence of target analytes, for example when the user needs to document the full range of concentrations or the three-dimensional distribution of target analytes, then sampling plan may need to go beyond the minimum.[45]

C. Implementing the Assessment and Reporting the Results

When a sampling plan suited to the objectives of the assessment has been defined, the standard contemplates implementation on conventional terms, noting collateral elements largely corresponding to basic sampling best practices.[46] The sampling itself is to be conducted in conformity with the plan and any deviations must be noted.[47]

Evaluation of sampling results proceeds in two conceptually distinct levels.

Comparison with the conceptual model and possible iterative re-sampling may be regarded as a first level of interpretation closely related to the sampling itself. In general, the standard contemplates a feedback loop between the conceptual model and sampling results. The results may prompt reconsideration of the model's assumptions about site conditions, release mechanics, or other variables affecting the conduct of the investigation and the interpretation of the results.[48]

At this level, the analysis includes ''validating'' the conceptual model. Review of sampling results should provide a basis for evaluating the operative hypotheses concerning possible releases, points of entry, migration pathways, and current distribution. If the results are consistent with the model, then the model is considered validated ''and is evidence that a sound understanding of site conditions has been achieved.''[49]

Validation of the model includes considering whether results are consistent with the assumptions on which the model was based.[50] If the model cannot be validated, the user and assessor should consult to decide whether to pursue additional investigation, revise the conceptual model, redefine the objectives of the assessment, or otherwise recycle to an earlier step in the assessment process, all in light of the cost of further work and the likelihood such work will improve understanding.[51] If they elect to do so, the assessment process continues as they decide.

Interpretation of results is the final level of review and focuses on ''the significance of the data as they relate to the objective(s) of the assessment,'' including whether the data indicate target analytes are present at unanticipated concentrations or from unanticipated sources relevant to the objectives of the assessment.[52] Interpretation may include:

- determining whether detected target analytes are naturally occurring; [53]
- comparing detected concentrations to numerical criteria, possibly including a determination whether the data are representative of site conditions;[54]
- determining whether lack of detection supports a conclusion there is no reasonable basis to believe target analytes are present;[55] and

[41] E1903-11, section 7.5.

[42] Thus, for example, testing seeks target analytes ''specific to the area under investigation, in accordance with the conceptual model.'' If the target analytes are uncertain, broader-spectrum testing may be appropriate. E1903-11, Section 7.5.

[43] E1903-11, section 7.5. Cf. E1903-11, section 1.1 (assessment objective, representative, reproducible, defensible).

[44] E1903-11, section 7.5.1. This minimum requirement is not a performance measure for the testing itself. In other words, it is not necessarily a defect in the plan if the sampling fails to document highest concentrations. The requirement is only to design the plan to target the locations where available information suggests highest concentrations most likely are to be found. This is an instance where professional judgment and the uncertainties inherent to environmental investigation play a large role. *Cf.* E1903-11, section 4.2 (noting that assessment cannot eliminate uncertainty, inherently involves professional judgment, may fail to detect relevant conditions even if performed in accordance with practice, etc.).

[45] E1903-11, section 7.5.2.

[46] Cf. E1903-11, sections 7.5.3 and 7.5.5 (sampling methods and techniques not prescribed but must be specified in sampling plan), 7.5.4 (health and safety plan), 7.5.6 (field screening), 7.5.7 (sampling quality assurance and quality control).

[47] E1903-11, section 7.6.

[48] E1903-11, section 7.6 (reconcile sampling results with conceptual model, incorporate model refinements or revisions into sampling plan or subsequent sampling).

[49] E1903-11, section 7.7. The model itself may be updated in light of the sampling results. *Id.*

[50] E1903-11, section 7.7.1; *see also* section 6.4.6. Sampling data may reveal divergence from assumptions about subsurface conditions, section 7.7.1.1.

[51] E1903-11, section 7.7.1.2.

[52] E1903-11, section 8.1. Under this standard, the Phase II Assessor's role is not to give advice about legal matters or business risk. See E1903-11, sections 4.1.2.1, 4.2.5.

[53] E1903-11, section 8.1.1.

[54] E1903-11, section 8.1.2. Note that applicable or relevant regulatory criteria may provide such numerical criteria if relevant to the objectives of the assessment but also may be dictated by user needs or contractual commitments.

[55] E1903-11, section 8.1.3. Note that this subsection deals with the vexing problem of ''proving the negative,'' i.e., establishing that no release has occurred. The language here makes plain that lack of detection is not ''proof of no release.'' This is consistent with the axiom that absence of evidence is not evidence of absence. Rather, the standard states that if sampling is conducted in accordance with the sampling plan and QA/QC procedures, lack of detection above laboratory reporting limits provides a basis for the assessor ''to render an opinion that there is no longer any reasonable basis for believing that target analytes are present.'' The nuance of this definition is important for the assessors who conduct and report the investigations and for the users who receive the resulting reports. Similarly, the objectives of a given investigation may be met by

■ interpreting data in relation to the objectives of the assessment, including determining whether the data are insufficient to meet the objectives of the assessment in whole or part.[56]

The written report of the Phase II Assessment is the final step in the process.

Under E1903-11, a written report always is required to state the essentials of the assessment—the objectives; the work performed; the rationale for it; the resulting information and data; and most importantly, ''the conclusions of the Phase II Assessor in the context of the user's objectives, i.e., the problem(s) or question(s) addressed.''[57] The standard does not prescribe the form of report. Instead, its detail and complexity are a function of the setting, the assessment activities, and the user's need for detail or precision.[58]

The standard does, however, require the written report to cover the following minimum elements:

■ introduction stating the objective, including verbatim ''Statement of Objectives'';

■ relevant background information;

■ work performed and rationale;

■ methods used;

■ information and data acquired;

■ evaluation of information and data;

■ interpretation of results in relation to objectives and conceptual model;

■ signature of Phase II assessor; and

■ tables, figures, and appendices as appropriate.[59]

Where all elements of the standard have been followed, the report will contain a statement to that effect.[60]

III. Concluding Observations

The E1903 revision process provided an opportunity to confront a familiar but challenging conundrum: in contrast to the E1527 Phase I assessment process, ''Phase II'' assessments had no standardized meaning, with the result that users often didn't know what they were getting, readers often misinterpreted results, and assessors were left to their own devices in defining scope of work.

A standardized, one-size-fits-all Phase II standard would have solved these problems. However, it also would have been a blunt instrument and likely would have imposed costs on users whose actual information needs could be met with more focused, better calibrated effort.

E1903-11 imposes order on the assessment process not by mandating a single approach but by defining a framework that assures clear expectations and orderly implementation. Under this standard, the user is involved in defining objectives and has early opportunities for consultation to match the level of effort with risk tolerance, relevant criteria, and any other consideration relevant under the circumstances. The lack of standardization in scope is ameliorated by mandating a clear statement of scope up front and requiring the ''statement of objectives'' to frame both the design of the assessment and the reporting and evaluation of its conclusions.

The standard defines this process with a degree of detail that is superficially daunting. Indeed, concerns were raised in the revision process that strict compliance with the revised standard would complicate Phase II assessments and increase their cost. However, there was no question that assessments conducted without the clarity of purpose required by E1903-11 imposed costs in inefficiency and misunderstanding that better practices could avoid. Experience with the revised standard should increase the comfort of users and assessors alike in collaborating to define the degree and scope of assessment needed to meet the needs at hand. The standard provides enough guidance to cope with the most demanding assessment scenario but also enough flexibility to conduct limited, focused assessments efficiently and effectively. With time and experience, these benefits should more than justify the revisions.

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assessing less than all potential release areas or determining target analytes occur below levels of regulatory concern, all depending on the user's objectives and the degree of confidence required in the result. E1903-11, section 8.1.4.

[56] E1903-11, section 8.1.5.

[57] E1903-11, section 9.1. It is worth noting that in the revision process, the Task Group considered whether to make a written report optional. Conceptually, however, it proved difficult to envision an assessment process in which objectives, methods, and conclusions were not memorialized in some tangible form. In practical terms, of course, without such documentation, the concerns presented by lack of standardization never arise because the objectives, methods, and conclusions cannot be communicated with any degree of effectiveness. The final standard reflects a consensus that the performance criteria for the assessment process have to be captured in at least a basic writing that covers the essentials.

[58] E1903-11, sections 9.2.2 and 9.2.3. The standard contains sample report formats in an illustrative appendix. See E1903-11 Appendix X3.

[59] E1903-11, section 9.2. With respect to tables, appendices, and figures, the standard notes they are ''typically included'' and ''should be used as appropriate to provide a clear and complete picture of the assessment.'' Id.

[60] E1903-11, section 9.2.1 (''We have performed a Phase II environmental site assessment at the property at (address) in conformance with the scope and limitations of ASTM Practice E1903-XX and for the following objectives: [list 'statement of objectives' developed pursuant to section 5.1]'').

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