TOPICAL SUBCOMMITTEE 3 CONCEPT PAPER

Characterization of a Discovered Release

June 11, 2021

Preamble

This concept paper was prepared by Topical Subcommittee 3 – Characterization of a Discovered Release, which was created to assist the Release-Based Working Group by providing advice and perspective on the subject of characterization of releases under a release-based cleanup program. The Working Group, which is co-chaired by the Commissioners of the Connecticut Department of Energy and Environmental Protection (DEEP) and the Department of Economic and Community Development (DECD), was convened in accordance with Section 19 of Public Act 20-9 to gather information and advice from multiple stakeholders, and subsequently provide feedback to DEEP with respect to the development of regulations creating a release-based cleanup program for the State of Connecticut.

The Subcommittee is comprised of a variety of stakeholders in the environmental community, including licensed environmental professionals (LEPs), environmental scientists, members of environmental advocacy groups, environmental attorneys, employees of the Connecticut Department of Transportation (DOT) and DEEP and other interested members of the public. Specifically, the following professionals participated in preparing this concept paper.

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The Subcommittee also wishes to thank Karen Goldenberg for preparing the figures that accompany this concept document.

Table of Contents

Figures

Attachments

1 Introduction

This concept paper has been prepared by Topical Subcommittee 3 – Characterization of a Discovered Release (Subcommittee 3) to assist the Release-Based Working Group by providing advice and perspective on the subject of characterization of releases under a release-based cleanup program. The Working Group, which was created in accordance with Section 19 of Public Act 20-9[1], is co-chaired by the Connecticut Department of Energy and Environmental Protection (DEEP) and the Department of Economic and Community Development (DECD) and is comprised of a variety of stakeholders. The goal for the Working Group is to gather information and advice and provide feedback to DEEP to assist in the development of regulations for a new release-based cleanup program that will require certain investigation and remediation obligations when contamination is discovered. Other important aspects of the release-based program are being evaluated simultaneously by four other topical subcommittees (Discovery of Historical Releases [Subcommittee 1], Reporting of Historical Releases [Subcommittee 2], Immediate Removal Actions [Subcommittee 4], and Tiers [Subcommittee 5], which are referred to herein as Discovery, Reporting, IRAs, and Tiers, respectively). The Working Group will consider the information provided in this concept paper, as well as the concept papers prepared by the above topical subcommittees and additional topical subcommittees that will be created at a later date. Ultimately, regulations will be adopted by the Commissioner of the DEEP based in part on the input and advice received from the Working Group and topical subcommittees.

1.1 Purpose and Scope

The information and recommendations presented in this concept paper were developed by the members of Subcommittee 3 during weekly meetings over a period of over four months beginning in January 2021. During the course of the Subcommittee meetings, numerous topics or issues related to characterization of releases under a release-based program were considered and discussed. The scope of those discussions was directed by, but not limited to, the request from the Working Group that Subcommittee 3 consider and provide opinions on a number of characterization-related questions and issues. The specific questions or issues that the Working Group requested Subcommittee 3 to address are presented in Section 2 of this concept paper. In addition to the specific concerns identified by the Working Group, Subcommittee 3 also identified a number of topics associated with "characterization" that they believed were important to include in the concept paper to provide a more comprehensive view of the concept of characterization of a release in the context of the Release-Based Cleanup Program. The Subcommittee's evaluation of these topics has been included in this concept paper.

During the Subcommittee 3 discussions and preparation of the concept document, it became clear that a number of assumptions would be necessary in order to effectively develop the thoughts and concepts to meet the expectations of the Working Group. A summary of the assumptions that the Subcommittee used in creating this concept document are presented in Section 3.

[1] Terms defined in Public Act 20-9 are not capitalized herein, but the reader should assume that when such a term is used, it is used within the meaning set forth in Public Act 20-9.

1.2 Document Organization

This concept paper is organized to provide an overview of the primary considerations related to characterization of a discovered release that were identified during the weekly Subcommittee meetings with additional information on specific topics provided as attachments. The inclusion of a flowchart is intended to illustrate the various elements in the characterization process that would be relevant to characterization of a release under a release-based program. The concept paper prepared by Subcommittee 3 is divided into the following sections.

- Section 2 – Working Group Assignments for Subcommittee 3
- Section 3 – Assumptions
- Section 4 – Approach to Characterization
- Section 5 – Specific Characterization Topics
- Section 6 –Summary

Attachments to the concept paper provide greater detail and additional comments on topics related to characterization. Specific topics addressed in each attachment are:

- Attachment 1: Characterization Concepts
- Attachment 2: Example Language Related to Characterization from the Massachusetts Contingency Plan

Figures illustrating the range of characterization activities and flowcharts illustrating various stages in the characterization process are provided as Figures 1 and 2, respectively.

2 Working Group Assignments for Subcommittee 3

In creating the topical subcommittees that began meeting in January 2021, the Release-Based Working Group prepared a number of questions and issues for each of those subcommittees to consider in preparing their respective concept papers. Those questions and issues were specifically targeted to the topic each subcommittee was expected to address.

As indicated on the DEEP's website, the following specific questions and issues related to characterization of a discovered release have been posed by the Release-Based Working Group for Subcommittee 3's evaluation:

- Should the regulations prescribe a method or methods that must be used to characterize the nature and extent of such release and its impact upon human health and the environment before undertaking clean-up?

- Should there be a process for DEEP to approve a method of characterization selected by a licensed environmental professional, including standards to validate such a method?

- Should the regulations specify a process for identifying prevailing standards and guidelines to be used to characterize the nature and extent of such release?

The Working Group also requested that Subcommittee 3 discuss the conceptual framework for release characterization, including the relationship to any action taken before characterization and the extent to which prescribing a method or methods within the regulation could affect the use of newer or novel forms of characterization. In addition, the Subcommittee was expected to consider whether different characterization methods or standards would be necessary depending on whether immediate action has been performed, as well as the time that has passed since a release has occurred. While DEEP's current site characterization guidance document should inform the work of this subgroup, any methods or standards identified should be limited to characterization of a single release.

These primary questions and issues have been evaluated and addressed in subsequent sections of this concept paper and are presented in greater detail in the attachments to this document. Concurrent with considerations requested by the Working Group, Subcommittee 3 recognized, based on presentations by the four other active subcommittees, that many of the topics being discussed significantly overlap with topics being addressed directly by one or more of the other four subcommittees (i.e., Discovery, Reporting, IRAs, and Tiers).

3 Assumptions

In preparing this concept paper, Subcommittee 3 made the following assumptions. The listed assumptions, or in some cases, general statements, are presented below in no particular order of importance.

- The determination of when a release is "discovered" has been evaluated by the Discovery Subcommittee. Subcommittee 3 discussed and evaluated only the methods or standards for characterization of such release. The Subcommittee noted that the term "discovered" is not defined in Public Act 20-9.

- Characterization is required for both contemporaneous releases (i.e., one that is reportable under proposed R.C.S.A. 22a-450-1 to 6, inclusive and that may be subject to an immediate removal action) and historical releases, but the approach may be different. The conceptual site modeling (CSM) approach is flexible enough to accommodate differences in contemporaneous releases (where more information is known prior to characterization) and historical releases (where more information needs to be developed) without making an initial distinction between the two.

- The determination of when a release is reportable will be addressed by the Reporting Subcommittee. That determination may need to be evaluated and/or reevaluated more than once during the characterization process.

- The methods or standards evaluated are limited to the characterization of a single release (i.e., each discovered release must be characterized separately).

- The sorting of releases into tiers based on risk (as may be contemplated by the Tiers Subcommittee) may occur subsequent to when at least some characterization activities have been performed, and therefore potential risk to human health and the environment from a release may need to be evaluated at one or more points during the characterization process in order to develop an appropriate characterization strategy. The level of characterization needed to address a release should correlate with the potential risk posed by the release to human health and the environment.

- Confirmatory sampling of a release area following remediation is a form of characterization.

- The regulations will provide, to a greater or lesser degree, identification of various characterization elements or activities in order to establish a framework for a minimum set of standards or expectations for characterization of releases. Establishing expectations for some level of characterization requirements provides a degree of consistency for all persons conducting characterization, and a level of certainty to the regulated community with respect to level of effort that is required at various stages of the characterization and remediation processes.

- Notwithstanding identification of characterization requirements identified in the regulations, guidance will be necessary to provide additional information on such items as approach to characterization efforts, techniques for how to conduct various types of investigations, and expected or standard practices for investigation and remediation in various situations. Applicable guidance should be provided at the same time the regulations become effective.

- In all situations, whether in regulation or guidance, there should be allowances for alternative methodologies or approaches to those directly identified in regulation or guidance, as long as the alternative methodology or approach can be demonstrated to be scientifically defensible and will meet the characterization objectives. The regulations and guidance must be flexible enough to incorporate evolving scientific understanding and future developments in investigative approach and remedial techniques.

- Self-implementation of characterization approaches and techniques should be the rule rather than the exception, but it is understood that there may be specific circumstances related to risk or newly developed methodologies for which commissioner approval would be necessary.

- Characterization will be a less linear process than what is currently set forth in the Site Characterization Guidance Document (SCGD) because that guidance document was written with the assumption that the purposes of Phase I and Phase II activities are to identify areas where there is a potential for a release to have occurred (Phase I) and whether there is evidence that a release has occurred (Phase II). Neither of those objectives is applicable to a release-based program for which characterization activities would be focused on characterization of an already identified release. While elements of a Phase I assessment (for example, the environmental setting or potential historical activities that could have resulted in the release of the discovered contamination) may be part of necessary characterization activities, the selection of which elements are relevant to characterization of the discovered release will be based on the conceptual site model for the individual release. Elements of Phase III investigations, as described in the SCGD, will definitely be incorporated into characterization of a discovered release, but may not be as detailed in all cases, and some elements of delineation of the nature and extent of a release may occur very early in the process. A revised guidance document will be necessary to address such changes in approach to characterization of a discovered release.

- However the list of expected characterization elements or activities are identified in regulation or guidance, there should also be language indicating that not all elements of characterization described are applicable to all types of releases or release scenarios and that the default situation should not be the need for the person performing the characterization to expend undue effort explaining why certain elements are not necessary or appropriate for the specific release scenario they are tasked with characterizing. Such language could indicate the expectation that any report or documentation of characterization would focus on demonstrating why the characterization performed is appropriate and adequate to meet characterization objectives for the specific release scenario for which such characterization is being performed. Nevertheless, it is reasonable to include some language in the regulation (and guidance) to indicate certain minimum criteria for what elements or activities must at least be considered during the characterization process.

These assumptions and general statements served as a context for Subcommittee 3 discussions and were used to evaluate the topics and qualify the conclusions and recommendations presented in this concept paper.

4 Approach to Characterization

In discussing the role of characterization in the Release-Based Cleanup Program Subcommittee 3 identified several aspects of the characterization process or elements of characterization that should be considered when developing a characterization strategy for a newly discovered historical release or for a contemporaneous release (i.e., spill). The Subcommittee also came to the conclusion that some characterization activities would likely be necessary before making a determination that an historical release was discoverable or that an historical release or spill was reportable. Subcommittee 3 recognized that the outcome of the Discovery and Reporting Subcommittees could affect the characterization strategy early on in the process and that the outcome of the IRA and Tiers Subcommittees could influence characterization activities at later stages in the process.

During Subcommittee 3's discussions on the subject of characterization, the Subcommittee came up with a number of statements or observations that helped clarify the concept of clarification under the Release-Based Cleanup Program and served as the basis for more detailed discussions during the Subcommittee 3 meetings. The following paragraphs provide a summary of key concepts that were addressed during Subcommittee 3 discussions.

The Subcommittee members were unanimous in concluding that any release or spill must be characterized using the conceptual site modeling (CSM) process, which provides a framework for evaluating releases to the environment by describe how the release moves through the environment from the point of release to a potential receptor. The CSM process promotes consistency in the approach to characterization and promotes understanding among all stakeholders of how a release is addressed. The CSM process is well understood by environmental professionals in Connecticut and is flexible enough to accommodate differences in contemporaneous and historical releases without needing the regulations to distinguish between them for the purpose of characterization. Section 5.1 provides a more detailed discussion of conceptual site modeling and how it fits in the characterization process.

Adequate characterization will necessarily be a function of the actions to be taken to address a release. Factors that could vary the type and degree of characterization include initial information available about the release (e.g., contemporaneous vs. historical), the setting in which it occurred (e.g., onto pavement vs. to a water body or unpaved surface), the risk that it presents to human health and the environment (e.g., type of contaminant and setting, potential fate and receptors), the expected remedial action that will be taken (e.g., soil excavated and sent to a landfill vs. soil left in a residential area), and whether any exemptions from remediation are applicable.

Subcommittee 3 considered the following questions (among others) in developing its approach to characterization – Does the risk presented by a release drive the characterization? How is the risk ascertained without adequate characterization? These concepts overlap with the Tiers Subcommittee, as a remediation in accordance with a higher-risk tier may involve more comprehensive characterization (and vice-versa). These concepts also overlap with the Reporting Subcommittee, because the determination of whether a release must be reported may change as characterization progresses.

For newly discovered historical releases or contemporaneous releases, an exemption from reporting does not mean the absence of an obligation for remediation, including characterization. Not all releases may be discovered, and not all discovered releases may be cleaned up or reported, but it is likely that

many releases will need some level of characterization before "discovery" and nearly all are likely to require some level of characterization after discovery.

Subcommittee 3 discussed many elements that can be considered as characterization activities. Figure 1 presents examples of activities or elements of characterization. The Subcommittee members agreed that characterization element(s) that might be necessary would depend on the degree of risk that a specific situation poses. Additional discussion on the range of activities that can be considered to be characterization and how characterization elements might differ depending on the level of risk to human health or the environment posed by a release is provided in Attachment 1.

It is expected that some level of characterization will be necessary to answer several fundamental questions about a discovered release:

- What was released?
- What media were affected, and over what area?
- What risk does the release pose to human health or the environment?
- Is cleanup needed?

During Subcommittee 3 discussions, it became clear that some level of characterization may be necessary before a historical release can be identified as a discovered release. Figure 2a illustrates the conceptual characterization process that may be needed to make that determination. Specifically, characterization may be needed to conclude that a) an exemption applies (either a statutory exemption identified in Public Act 20-9or additional exemptions identified by Subcommittee 1 or 2 or the Working Group), b) the detected concentration(s) is representative of background conditions (either naturally occurring or anthropogenic), or c) from a different release. Section 5.2 provides a more detailed discussion of background considerations in the characterization process. Two possible examples of a different release are a known release already being addressed under a different regulatory program (such as the property transfer program) or a previously unknown release on an upgradient property.

Once a release is discovered, there must be enough certainty that the release has been adequately characterized to conclude whether the release is reportable and determine if any cleanup is needed to address the release. Figure 2b illustrates the conceptual characterization process for a discovered release. As noted previously, the level of characterization required may depend on the degree of risk to human health or the environment that a specific situation poses. This concept overlaps with the Tiers Subcommittee, as remediation of a higher-risk situation may involve more comprehensive characterization while lower-risk situations may need only minimal characterization. This concept is explored in more detail in Attachment 1. Evaluating whether "sufficient" characterization has been conducted should be done using the conceptual site modeling process. For releases that require cleanup, supplemental characterization may be needed to establish and/or design the cleanup approach.

The regulations should identify the information that must be considered to evaluate whether a release is considered to be "discovered" and, once determined to be a Discovered Release, whether it is reportable. The regulations should also specify the information that must considered when characterizing the nature and extent of a release and its impact upon human health and the environment, as well as when determining what, if any, remedial action should be taken to address the release.

Although the term "prevailing standards and guidelines" can be considered somewhat vague and uncertain, and open to interpretation, an overly formulaic or objective standard (e.g., the number of samples that must be collected) would render the regulations too inflexible given the myriad of types of releases and their settings.

The regulations must provide sufficient flexibility to allow the characterization to be tailored to each release and setting. Guidance should be developed to clarify the regulations (for example, how exemptions may be applied) and further explain what must be considered during the characterization process. This guidance could also identify appropriate or approved investigation techniques or specific approaches for more simplistic situations, such as contemporaneous releases where existing information may answer one or more characterization questions.

Attachment 1 provides a more detailed discussion on various aspects of the characterization process that the Subcommittee considered to be relevant to developing a framework for characterization under a release-based program. Figure 1 presents examples of activities or elements of characterization. Flowcharts illustrating the various stages in the characterization process are provided as Figures 2A and 2B.

5 Specific Characterization Topics

Subcommittee 3 identified several issues or topics that they considered to be relevant with respect to the over-arching topic of "characterization of a discovered release". Each of these topics was the subject of considerable discussion during the Subcommittee meetings, and provide a context for any Subcommittee recommendations or observations on "characterization" under a release-based program. More detailed discussions on several of the topics are included in the associated attachments.

5.1 Conceptual Site Modeling

The Subcommittee members were unanimous in concluding that a discovered release must be characterized using the conceptual site modeling approach. Conceptual site modeling is a process that is well developed both nationally and internationally and is recognized by Connecticut and others as a sophisticated way to evaluate a release to the environment and to understand and describe how the release moves through the environment from the point of release to a potential receptor. In fact, conceptual site modeling has been an integral part of the investigation and site characterization process in Connecticut since 1999, when the DEEP and the Environmental Professionals' Organization of Connecticut (EPOC) jointly developed a two-day training session for LEPs and select DEEP personnel. From that time it has been the expectation of DEEP that all characterization activities in Connecticut be performed and documented using the CSM process. The Site Characterization Guidance Document (SCGD) explicitly states that expectation and describes how the CSM process is applied to characterization of releases.

The value of the CSM process is that conceptual site modeling has always been used to evaluate individual releases, as it includes taking into consideration that changes that occur to a released constituent over time and distance to develop a three-dimensional understanding of the distribution of the release in the subsurface. The CSM process addresses transformations of the released constituents as they move through the subsurface and identifies pathways to potential human and ecological receptors. The conceptual site modeling process has always been based on understanding how an individual release would behave due to the fate and transport characteristics of individual constituents that are released and specific subsurface conditions into which the constituent(s) is released, as well as the individual human and environmental receptors that could be at risk as the released constituents move through the environmental media. Because each release scenario is different, the CSM process as it is practiced must be developed for each individual release. That approach would be no different under a release-based program.

However, what would need to be addressed as Connecticut transitions from the current program that focuses on a parcel of real estate defined by a legal description or an assessor's designation to a program focused on a single release of a contaminant is the term "site," as that term has generally been used in Connecticut to describe a property under investigation. Initially during the Subcommittee meetings, there was some concern about how the word "site" would be used under the Release-Based Cleanup Program, and how that might affect use of the term "conceptual site model" because that term has most frequently been used in the context of the Property Transfer Act and in the SCGD to refer to characterization of the real estate parcel.

The Subcommittee concluded that "conceptual site model" is a widely recognized term of art that has always been based on the evaluation of individual releases. As used in the SCGD and for other purposes, depending on the focus of a particular project, conceptual site models for individual releases can be combined to present a CSM for multiple releases associated with a larger property or geographic area. Due to the focus in Connecticut on the property transfer program, which required characterization based on property boundaries, use of the word "site" may be confusing as the environmental focus shifts to single releases, rather than multiple releases or release areas on an individual property. It will be important during the transition phase to emphasize that the word "site" should be understood to mean "the area where contamination associated with a release has come to be located", rather than a parcel of real estate defined by a legal description or an assessor's designation. Among other changes to the SCGD that will be necessary to provide useful guidance for a release-based program, the SCGD will need to be modified to reflect the shift in the focus for the word "site" from a real estate parcel to an area where contamination from a single release is present in the subsurface. It is more likely that a successor guidance document will need to be developed specifically designed for the Release-Based Cleanup Program.

5.2 Background

The concept of "background conditions" is an important aspect of any characterization effort, since it is not appropriate to expect a responsible party for a particular release to cleanup conditions that existed before that particular release occurred (anthropogenic background) or to attempt to characterize the extent of conditions that are actually representative of naturally occurring concentrations (naturally occurring background). A reasonable definition for background conditions with respect to characterization of a release would be that provided in the *DRAFT DEEP Interim Background Factsheet (January 2016),* which states that background "represents conditions that would be present in the absence of a release."

Naturally Occurring Background Conditions

Because both unconsolidated materials and bedrock, as well as groundwater, contain metals at varying concentrations, it must be expected that analytical results for soil and groundwater samples will contain detectable concentrations of metals that represent naturally occurring concentrations. To distinguish a release of metals or a substance containing metals, it is necessary to recognize a range of concentrations of metals in a sample of environmental media that can be attributed to natural sources.

The Subcommittee believes much of the characterization effort associated with establishing naturally occurring background concentrations in order to evaluate whether detected concentrations of one or more metals constitutes a discoverable release could be minimized or eliminated if the DEEP were to establish an acceptable range of naturally occurring concentrations for metals in soil and groundwater. If detected concentrations of metals in a sample were within that range, it would be reasonable to conclude that the detected concentrations were representative of naturally occurring conditions, and therefore, no release of metals had occurred, ideally without further characterization. If concentrations of metals were above range established to be indicative of naturally occurring concentrations, it would still be possible to demonstrate site-specific background conditions using alternative methods, such as those described in the *DRAFT DEEP Interim Background Factsheet*.

Subcommittee 3 strongly recommends that the DEEP identify and publish ranges for naturally occurring concentrations of metals in soil[2] (and possibly groundwater), so environmental professionals can quickly determine if the concentration of a metal detected in a soil sample is within the range that can be considered to be naturally occurring for the particular metal and conclude that the detected concentration is not indicative of a release. The Subcommittee also recommends that DEEP review the Interim Fact Sheet on background, update it as appropriate, and finalize a guidance document for establishing background concentrations prior to release-based regulations being promulgated.

Anthropogenic Background

In contrast to naturally occurring concentrations of metals, anthropogenic background concentration(s) may be of varying scale and origin. Anthropogenic background can include a range of constituents from metals to semivolatile organic compounds (SVOCs) and petroleum hydrocarbons that are present in fill material or as the result of atmospheric or widespread deposition. In addition to fill material from various sources, examples of anthropogenic background include aerosol deposition of lead due to motor vehicle emissions or per-and polyfluoroalkyl substances (PFAS) present due to atmospheric deposition or a land-based source. While establishing a range of typical concentrations of anthropogenic constituents in certain types of situations will be more problematic than establishing naturally occurring concentrations of metals, Subcommittee 3 recommends that DEEP consider developing guidelines for typical ranges of anthropogenic background conditions that could be used to at least minimize characterization efforts needed to distinguish between the background conditions and a discovered historical release.

5.3 Exemptions to Characterization

Subcommittee 3 recognized early on in its discussions that for a release-based program to be effective, there were certain situations for which characterization should not necessarily be required or that such characterization could be limited to those characterization activities that would be necessary to demonstrate that exemption from further, detailed characterization would be the appropriate approach. The Subcommittee's approach took into consideration that effective use of the CSM process and multiple lines of evidence could be used to support an opinion that limited characterization would be appropriate in certain situations and that many types of information-gathering activities other than collection of samples for laboratory analysis could be considered as characterization. The Subcommittee's discussions related to the topic of exemptions from characterization (or limitations to characterization) has been organized into five categories, as summarized below.

Assumptions

Subcommittee 3 developed a number of assumptions that helped focus the discussion of exemptions from characterization under the Release-Based Cleanup Program.

- Characterization of a release is not limited solely to analytical results provided by a fixed-based laboratory. The Subcommittee recommends that the term *"analytical characterization"* be used

[2] The Subcommittee recommends the paper entitled, *Major and Trace Element Geochemistry and Background Concentrations for Soils in Connecticut*, by Craig Brown and Margaret Thomas, published in *Northeastern Geoscience*, v. 32, as a starting point for establishing a representative range for naturally occurring metals concentrations in soil.

to define scenarios that warrant collection of samples in accordance with a revised (or newly developed) characterization guidance document, with subsequent analysis at fixed-based laboratory.

- In most scenarios there will be some basic level of characterization (e.g., research, such as mapping or historical information; screening-level instrumental evidence, such as photoionization detector [PID]; visual or olfactory observations) required to identify a release in the context of being able to evaluate the applicability of an exemption for said release.

- Confirmatory sampling of a release area following remediation is a form of characterization in that the data is used to characterize the soil remaining in place after remediation has been conducted.

- The individual evaluating the applicability of an exemption must hold the protection of human health and the environment paramount. This led the Subcommittee to consider the following questions: *Should individuals other than LEPs who are governed by 22a-133v of CGS be authorized to invoke exemptions? Should risk be considered?*

- The application of certain chemicals including pesticides, herbicides, and fertilizers that are legally applied to the ground surface in accordance with State and Federal regulations and the **manufacturer's registered label instructions** does not constitute a release.

- In accordance with Public Act 20-9, no additional characterization is required for releases that have been reported to DEEP and acknowledged as complete.

- Exemptions from release characterization should be integrated into the Release-Based Cleanup Program regulations. If it is a reportable release, characterization should be required.

Characterization Exemptions

The Subcommittee identified the following situations as possibly appropriate for exemption from characterization requirements:

- An **incidental release** due to the normal operation of motor vehicles, not including refueling, repair or maintenance of a motor vehicle. The Subcommittee posed the question as to whether that exemption might be expanded to include passenger vehicle accidents.

- Normal paving and maintenance of a **consolidated** bituminous concrete surface, provided such bituminous concrete surface has been maintained for its intended purpose. The Subcommittee identified the possibility of adopting the following language from the Massachusetts Contingency Plan (MCP) dealing with "release… emanating from asphalt binder in bituminous pavement" as a means to address eroded particles emanating from parking lots, streets, and highways.

- Trihalomethanes or any other substance within drinking water released from a public water supply distribution system

Massachusetts Contingency Plan Considerations

S*ection 310 CMR 40.0317 Releases and Threats of Releases Which Do Not Require Notification*, of the Massachusetts Contingency Plan (MCP) includes a long list of exemptions from notification of releases. While none of the scenarios would result in a complete exemption from characterization, the Subcommittee noted that special consideration may be warranted as to how the following releases, which are identified as exempt from reporting under the MCP, would be treated with respect to characterization under the Release-Based Cleanup Program:

- Releases or threats of release of gasoline or diesel fuel from the rupture of a fuel tank on a passenger vehicle in the event of an accident.
- Release of hazardous material indicated by residues in the environment including point of origin of lead-based paint, exhausts of an engine, and pesticide application. *[Subcommittee 3 noted that the Connecticut Department of Health has a 400mg/kg standard for lead in soil.]*
- Releases of petroleum hydrocarbons and/or hazardous material related to coal, coal ash, or wood ash, excluding wood ash resulting from combustion of lumber or wood products that have been treated with chemical preservatives.
- Releases of petroleum hydrocarbons and/or hazardous material resulting or emanating from asphalt binder in bituminous pavement; piers, pilings and building foundation structures; landscaping timbers in use; utility poles in use; or building materials that are in good repair and still serving their original intended use.
- Arsenic, beryllium or nickel in Boston Blue Clay or arsenic in an area documented by the U.S. Geological Survey or in other scientific literature as an area of elevated arsenic measured in soil or groundwater that; is consistently present; solely attributable to natural geologic conditions; has not been mobilized or transferred to another medium as a result of anthropogenic activities. *[Subcommittee 3 noted that while the specific metals and soil type listed may be unique to Massachusetts, the idea of adopting a new procedure for handling background levels based on scientific literature, as well as other considerations, is recommended by the Subcommittee.]*
- Releases of petroleum hydrocarbons and/or hazardous material resulting from the land application, reuse, or disposal of wastewater residuals and/or dredged spoils conducted in accordance with an approval, permit or certification issued by the DEEP. *[Subcommittee 3 noted that this exemption would need to be considered in terms of such chemicals as PFAS that concentrate in wastewater residuals.]*

Additional Cases to be Considered for Modified Characterization Requirements

The Subcommittee identified additional situations for which modified or limited characterization might be appropriate.

- Eliminating the need to characterize background concentrations of metals if the detected concentrations fall within a range that the DEEP establishes as representative of naturally occurring concentrations. The Subcommittee recommends recognition of background concentration ranges as presented in existing publications (e.g., Brown & Thomas, 2014) or similar values developed by the DEEP that are consistent with published literature.
- Atmospheric deposition from anthropogenic sources.

- Contaminated groundwater in an urban setting with no definable source, provided public water is available, and no vapor encroachment, surface water, or explosion risk exists.
- Groundwater contaminated with ubiquitous chemicals such as PFAS when no readily identifiable source onsite can be established and groundwater in the vicinity is not used for drinking water.
- Imported soil purchased from a commercial retailer when there is supporting analytical documentation.

Summary

After much discussion, Subcommittee 3 came to a general consensus that while exemptions readily exist from reporting obligations and compliance criteria, there were very few, if any, situations that would be wholly exempted from characterization, especially given the assumptions presented above. Such characterization might be limited, but the Subcommittee felt that in most cases at least limited characterization would be required to demonstrate that the conditions encountered would meet the criteria for an exemption. However, scenarios may exist in which the level of characterization required to achieve compliance under new guidance/regulations could be reduced to facilitate expedited remediation/immediate response actions. Such is the case in the Targeted Brownfield Remedy, where characterization is streamlined rather than exempted (but represents an alternative site characterization based on presumptive remedy).

5.4 Qualifications for Performing Characterization Activities

The Subcommittee believes it is essential that individuals involved with the characterization are properly qualified, trained, and/or licensed, and that a process is established for the purpose of holding such individuals accountable for not properly performing their duties. It may be appropriate to establish or allow for different levels of qualifications which could correlate to releases presenting differing levels of risk. In other words, more qualified individuals could be allowed to oversee the characterization of any type or risk level of release, while lesser qualified individuals might only be allowed to oversee the characterization of lower risk releases.

Qualification Concepts

The Subcommittee members believe that all individuals involved with the characterization of a discovered release should be trained and qualified, and/or licensed to perform such characterization activities. The Subcommittee agreed that LEPs would be qualified to perform characterization for all discovered releases and any characterization necessary to determine whether a release was discoverable under the Release-Based Cleanup Program or whether detection of a constituent would meet the requirements for an exemption. However, the Subcommittee recognized that there would likely be releases of limited extent or releases for which the risk would be considered low, for which an individual other than an LEP might be qualified to perform the requisite characterization activities. While the Subcommittee did not believe that establishing a new licensing program would be in the best interest of the Release-Based Cleanup Program, members did feel strongly that there was a need for individuals performing any characterization activities to be held accountable if the activities performed were not consistent with prevailing standards and guidelines or with applicable regulations.

It was also the consensus of the Subcommittee that only LEPs should be allowed to perform characterization activities for releases in complex hydrogeologic settings or in settings that would be considered to represent a higher level risk to human health or the environment. For lower risk

situations or simple releases, the DEEP would need to establish qualifications and/or training requirements necessary for individuals involved with the characterization of simple releases or lower-risk settings. Such requirements could vary based on the risk level associated with the release. The Subcommittee discussed such potential options as self-certification each time a form or document was submitted or a more formal registration process, and that practitioners would be required to provide proof of such qualifications.

Under self-certification, a practitioner could assert/certify that they meet the required qualifications to characterize releases of certain risk levels on a form that would be submitted to the DEEP with each release investigated. Under a registration system, practitioners would register with the DEEP to be permitted to characterize releases of certain risk levels depending on their qualifications. With both methods, the DEEP could require that proof of qualification be provided with every form submitted/upon registration or merely that the practitioner maintain proof and provide it to the DEEP upon request. The Subcommittee also believed that additional requirements, such as specific initial training or continuing education, should be established and that a means to provide assurance to the public and responsible parties that individuals who were not LEPs, but who were permitted to perform limited characterization activities, would be held accountable if their actions were not in accordance with regulations or prevailing standards and guidelines.

Licensed Environmental Professionals

The Subcommittee believes that Licensed Environmental Professionals (LEPs) are certainly qualified to direct the characterization of a discovered release of any risk level. The qualifications necessary to obtain an LEP license, as well as the continuing education training requirements and experience of most LEPs uniquely qualify LEPs to characterize discovered releases. Furthermore, the LEP program already has an oversight and adjudication process and the ability to sanction LEPs who do not adhere to the LEP code of conduct or other prevailing standards and guidelines. The regulations should allow for an individual who holds a valid LEP license to direct the characterization of a discovered release or characterization designed to evaluate whether a release would be deemed discoverable under the Release-Based Cleanup Program.

Other Licenses

The Subcommittee does not believe that individuals holding other licenses often encountered in the environmental investigation and remediation field (such as Massachusetts Licensed Site Professionals [LSPs], New Jersey Licensed Site Remediation Professionals [LSRPs], or Professional Engineers [PEs] and Professional Geologists [PGs]) are qualified to characterize discovered releases under the Release-Based Cleanup Program. These individuals may have limited to no experience conducting investigations in Connecticut and therefore may not perform characterization with the standard of care expected by the DEEP. However, these individuals could be allowed to characterize releases that pose lower levels of risk if they meet the qualifications established by the DEEP.

Continuing Education Requirements

Should DEEP authorize non-LEPs to perform characterization activities for lower risk releases, the Subcommittee recommends the DEEP require continuing education for all such individuals and that the continuing education be related to release characterization and associated regulations and guidance. The LEP Program already requires specific continuing education obligations for LEPs. The DEEP may

want to consider developing a course specifically on release characterization that would be required of all non-LEPs prior to being permitted to oversee characterization.

Oversight and Sanctioning

The Subcommittee believes there should be a means to establish accountability for any individual that is authorized to characterize a release under the Release-Based Cleanup Program. For LEPs, the LEP Board of Examiners provides that oversight and accountability. If other individuals are authorized to perform characterization activities, the DEEP would need to provide a level of assurance to the public and to responsible parties that the individual providing characterization services is qualified to do so. If the performance of such an individual does not meet prevailing standards and guidelines or the regulations, a mechanism must be in place to hold that person accountable for inappropriate actions related to characterization. Activities associated with maintaining accountability for individuals other than LEPs would likely need to include activities similar to that performed by the LEP Board of Examiners (approving qualifications and applications of individuals, developing or approving continuing education courses, establishing fees, issuing tests if applicable, and developing a process for oversight, review, and sanctioning of those approved to characterize releases), with similar administrative costs.

5.5 Environmental Justice

As discussed elsewhere, characterization of a release should be conducted in accordance with best practices in order to identify the degree and extent of the contamination so that the best remedy can be selected. Nonetheless, it is possible that a characterization effort could be viewed as being biased by other factors, such as race and disadvantaged economic status. For example, anthropogenic impacts may not require extensive characterization because distribution is well known based on past sampling and/or known prior uses of a property or group of properties in a particular location. However, such impacts typically occur in cities which are also areas with a greater presence of people of color and those with lower economic status. The conclusion could easily be reached by members of such a community that a reason behind limited characterization is because less value is placed on urban areas and the needs or rights of the people who reside there, rather than there being a scientific or other logical basis for limited characterization.

A proposed solution to this is to invite the public to participate at the characterization stage of addressing a release, rather than at the (later) remedial stage. Earlier communication gives stakeholders more opportunity for input and more time to assess the impact of the project, which, in turn, can potentially increase stakeholder buy-in. A communication plan that provides for updates on project status at various times during the project, as warranted based on project activities, including characterization, would provide for a better mechanism to ensure all stakeholders are given the opportunity to review and comment. The communication plan and subsequent project communication should be accessible in a variety of ways to reach the target audience, rather than a “one and done” newspaper notice.

5.6 Regulations vs. Guidance

The Release-Based Working Group specifically requested that Subcommittee 3 respond to the question “Should the regulations specify a process for identifying prevailing standards and guidelines to be used to characterize the nature and extent of a release?” The Subcommittee generally concluded that the

regulations should identify various characterization elements or activities that might be necessary to establish a framework for a minimum set of standards or expectations for characterization of releases. Establishing expectations for some level of characterization requirements provides a degree of consistency for all persons conducting characterization, and a level of certainty to the regulated community with respect to level of effort that is required at various stages of the characterization and remediation processes.

However, the DEEP should not be formulaic in its approach to how much direction for characterizing a release is included directly in the regulations (e.g., specifying the number of monitoring wells that must be installed or how many samples must be collected), since that approach would render the regulations too inflexible, given the myriad of types of releases and their settings. Rather the regulations could, and should, specify that the conceptual site modeling approach must be used when characterizing releases, since conceptual site modeling provides the necessary flexibility in developing a strategy for characterizing a release that is specific to each unique set of circumstances.

In addressing the question of how much of the characterization process should be specified in regulation vs. guidance, the Subcommittee reviewed relevant portions of the Massachusetts Contingency Plan (MCP), which provides the regulations governing a nationally recognized release-based cleanup program, for how that program addressed this question. Examples of MCP language that addresses characterization is not formulaic, but does identify the expectations of the Massachusetts Department of Environmental Protection with respect to the type of information that should be included in reports and therefore collected to address a release under that program. Examples of language related to characterization that are included in the MCP are provided in Attachment 2. Of the regulatory language in the MCP, perhaps the most useful for understanding both requirements for characterization and flexibility is the language identified as the Response Action Performance Standard (310 CMR 40.0191), as well as the language for Technical Justification (310 CMR 40.0193).

The regulations developed for the Release-Based Cleanup Program should identify the information that must be considered when evaluating whether a release is considered to be “discovered” and, once determined to be a Discovered Release, whether it is reportable. The regulations should also identify the type of information that must considered when characterizing the nature and extent of a release and evaluating the impact of a release on human health and the environment. Also potentially appropriate for inclusion in the regulation would need to be considered what information should be considered when determining what, if any, remedial action should be taken to address the release.

Although the term “prevailing standards and guidelines” can be considered somewhat vague and open to interpretation, using that language provides sufficient flexibility to allow the characterization to be tailored to each release and setting. However, if such language is used, appropriate guidance must be developed to clarify the regulations (for example, how exemptions may be applied) and further explain what must be considered during the characterization process and provide additional information on such items as approach to characterization efforts, techniques for how to conduct various types of investigations, and expected or standard practices for investigation and remediation in various situations. Such guidance should also identify appropriate or approved investigation techniques or specific approaches for more simplistic situations, such as contemporaneous releases where existing information may answer one or more characterization questions.

Both regulations and guidance must be flexible enough to incorporate evolving scientific understanding and future developments in investigative approach and remedial techniques. Guidance and regulation

should allow the opportunity for LEPs and other authorized environmental professionals to use alternative methodologies and approaches to characterization if they can demonstrate that such techniques and approaches are scientifically defensible and will meet the data quality objectives for the characterization effort. This approach to guidance is similar to what Connecticut already uses with respect to the quality of analytical data. While the reasonable Confidence Protocols (RCPs) specify procedures for the laboratory to follow to provide data of known quality, the environmental professional can use alternative laboratory methods, but must demonstrate that the quality of the data can be assessed and that it achieves the same objectives for quality that can be achieved using the RCP methods.

Applicable guidance on characterization of a release under the Release-Based Cleanup Program should be provided at the same time the regulations are promulgated.

6 Summary

While the title for Subcommittee 3 is "Characterization of a Discovered Release", the Subcommittee discussions very early in the process recognized that characterization activities can begin even before a conclusion can be made that a detection of a constituent in environmental media represents a "discovered" release. Subcommittee 3 understood that Subcommittee 1 would be addressing the issue of what constitutes a "Discovered Release"; however, the Subcommittee members felt they would be remiss in not acknowledging the role that characterization plays from the very earliest detection of a constituent. The characterization activities can be similar from the first detection of a constituent to characterization once a release has been identified as a Discovered Release, and the conceptual site modeling process would be used under both scenarios. What would likely differ would be the objectives for the characterization effort, and the level of characterization that would be performed.

Essentially, characterization could begin as soon as a constituent is detected at a concentration greater than the analytical reporting limit and could continue at varying levels of complexity as evaluation of the release proceeds. The level of characterization required will generally be based on the risk that the release poses to human health and the environment. The Subcommittee recognized that there may be circumstances where no characterization requiring collection of samples is required, but the circumstances for which at least limited characterization would not necessary would be more the exception than the norm. Such circumstances could include exemptions and readily identifiable background concentrations, but even in those circumstances, some level of characterization might be necessary.

However, the Subcommittee made the assumption that "characterization" includes many more activities than simply the collection of samples for subsequent laboratory analysis. In certain circumstances, characterization activities can be limited to gathering information from readily available regulatory or municipal records, published mapping, interviews with knowledgeable individuals, observations of the environmental and cultural setting, and identification of potential receptors. Characterization activities could also include using field screening techniques and considering visual and olfactory evidence.

The ultimate approach to characterization under the Release-Based Cleanup Program will really be no different from how characterization has been handled for at least the past 20 years in Connecticut. All characterization activities should be performed in accordance with the CSM process, and the degree of characterization that is expected should take into account the potential risk posed by the release. For discovered releases, it should be expected that characterization efforts would delineate the three-dimensional distribution of the release in the subsurface to the extent that the potential risk to human health and the environment can be appropriately evaluated. Simpler releases, representing lower risk scenarios, would be expected to require less characterization than larger, mobile releases of more toxic contaminants in complex hydrogeologic settings.

During the course of discussions, the Subcommittee also addressed the issue of whether the characterization of relatively small, straightforward releases for which it was evident that there was little to no potential risk to human health or the environment existed could be characterized and cleaned up by individuals who were not licensed as LEPs. The Subcommittee felt that LEPs should be deemed qualified to conduct all characterization activities. If non-LEPs were to be authorized to conduct

characterization under the Release-Based Cleanup Program, even of small, low-risk releases, a mechanism must be in place to provide assurance to the public and other stakeholders that the individual is qualified to perform the services and that there is accountability for that individual if the services are not performed in a manner that is consistent with prevailing standards and guidelines and regulations.

The topic of Environmental Justice came up during Subcommittee 3 discussions related to limiting the amount of characterization that might be necessary based on the lower risk of a given situation to human health and the environment. While no clear approach was identified, the Subcommittee members wanted to identify the need to consider Environmental Justice issues when developing a characterization strategy in those situations where a perceived lower risk scenario might result in a limited characterization effort and how that might appear to stakeholders in the community.

Additional observations and recommendations of Subcommittee 3 include the value of looking at other state's released-based programs to see how they have addressed characterization issues, particularly as to whether requirements for characterization appear primarily in regulations or in guidance. The Subcommittee generally believed that the regulations need to provide some basic structure as to what type of characterization effort is expected, but at the same time, provide sufficient flexibility to accommodate individual release scenarios and settings, as well as opportunities for those environmental professionals characterizing releases to use investigation and remediation techniques that are not yet in common use, but for which defensible, scientific evidence can be presented.

Although the Subcommittee believes that there is values in having some aspects of the characterization process included in regulation, the Subcommittee felt that most of the DEEP's expectations for how characterization should be conducted and what information should be considered and documented, would best be presented in appropriate guidance documents developed specifically for characterization and other activities under the Released-Based Cleanup Program. The Subcommittee also emphasized that the appropriate guidance documents should be developed concurrent with the regulations, so at least the most important guidance would be available when the regulations are promulgated.

The Subcommittee strongly recommends that the DEEP establish ranges for naturally occurring concentrations of metals in soil based on published literature values for soils in Connecticut and other well-vetted sources of information and that the DEEP review, revise as appropriate, and finalize the currently existing *DRAFT DEEP Interim Background Factsheet*. The Subcommittee also identified the clear need for a guidance document, similar to the existing SCGD, that would provide DEEP's perspective and expectations on the approach to characterization of releases and how characterization should be performed under the Release-Based Cleanup Program.

FIGURES

Desktop / Record Review Elements

Physical Setting
- Topography
- Surficial geology and soil type
- Bedrock geology
- Hydrology

Chemical Properties
- Toxicity
- Bioaccumulation
- Solubility
- Volatility
- Henry's Law Constant
- Lower and Upper Explosive Limits
- Vapor Pressure
- Corrosivity (pH)
- Radiological

Potential Receptors
- Release property land use
- Surrounding area land use(s)
- Existing use(s) and quality of area groundwater and/or surface water
- Distance to nearest water supply well
- Distance to nearest occupied building(s)
- Distance to nearest surface water and/or wetland(s)
- Sensitive receptors

Historical Information
- Topographic maps
- Aerial photographs
- Sanborn maps
- Municipal, State, and Federal records
- Site records

Field Reconnaissance and Field/Laboratory Investigation Elements

Qualitative

Observations
- Ground cover type/condition at release area
- Subsurface utility location / mapping
- Overburden lithology
- Bedrock type / fracture characteristics
- Wetland delineation
- Natural resources evaluation
- Smoke testing

Quantitative

Screening
- Measured depth to groundwater
- Measured depth to bedrock
- Groundwater flow direction
- Calculated horizontal/vertical gradients
- Percolation (Perc) testing
- Aquifer testing (slug, bailer, pump)
- Geophysical Methods (magnetic, gravity, radar, seismic)
- Cone penetrometer

Laboratory
- Geotechnical (grain size, bulk density, permeability)
- % organic carbon

These characterization elements are mostly related to understanding the specific conditions that will affect how the release will move through the environment and the pathways to potential human and ecological receptors.

Qualitative

Observations
- Visual (staining, sheen)
- Olfactory (odors)
- Soil-water shake test
- Dye test
- Ultraviolet black light

Quantitative

Screening
- Photo- or flame-ionization detector (PID/FID)
- Detector tubes (Draeger®, others)
- Test kits (petroleum hydrocarbon [TPH], polychlorinated biphenyl [PCB])
- Water quality parameters (pH, oxidation-reduction potential [ORP], dissolved oxygen [DO], specific conductance, salinity)
- Membrane interface probe (MIP)
- Laser-induced fluorescence (LIF)
- Tentatively identified compounds (TICs)
- Microscopy

Analytical
- Chemical analysis of environmental media (reasonable confidence protocol [RCP or other methods)
- Non-aqueous phase liquid (NAPL) physical properties (density, viscosity, interfacial tension, wettability)

These characterization elements are mainly related to delineating the nature and extent of a release and require the collection of samples of environmental media and observation, measurement, or testing of those samples. There may be circumstances for which collection of samples is not required for characterization, but the subcommittee believes those would be more the exception than the norm. The specific elements needed will depend on the potential risk a release poses and the complexity of the hydrogeologic setting of the release.

Recommendation: The regulations should include some basic structure as to what type of characterization effort is expected, but also provide sufficient flexibility to accommodate individual release scenarios and settings, as well as the use of characterization techniques that are not yet in common use, but for which defensible, scientific evidence can be presented.

SUBCOMMITTEE 3 CONCEPT PAPER
June 11, 2021

FIGURE 1
Elements of Characterization
Figure presents examples of various activities the subcommittee identified as possible elements of characterization.

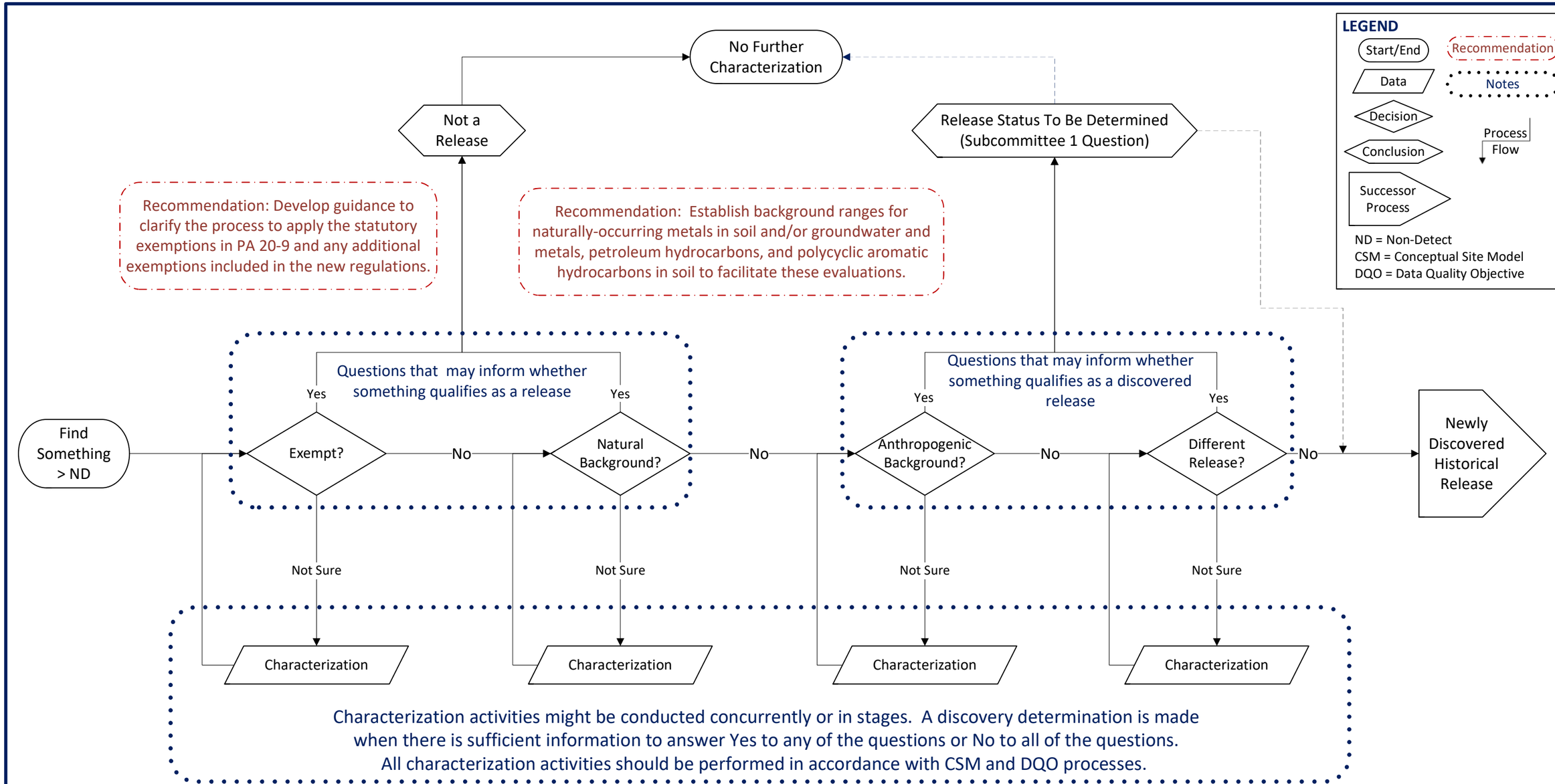

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FIGURE 2A
Characterization to Support a Release Discovery Determination
Figure illustrates the subcommittee's understanding of the role characterization might play in determining whether Something > ND is a discovered release.

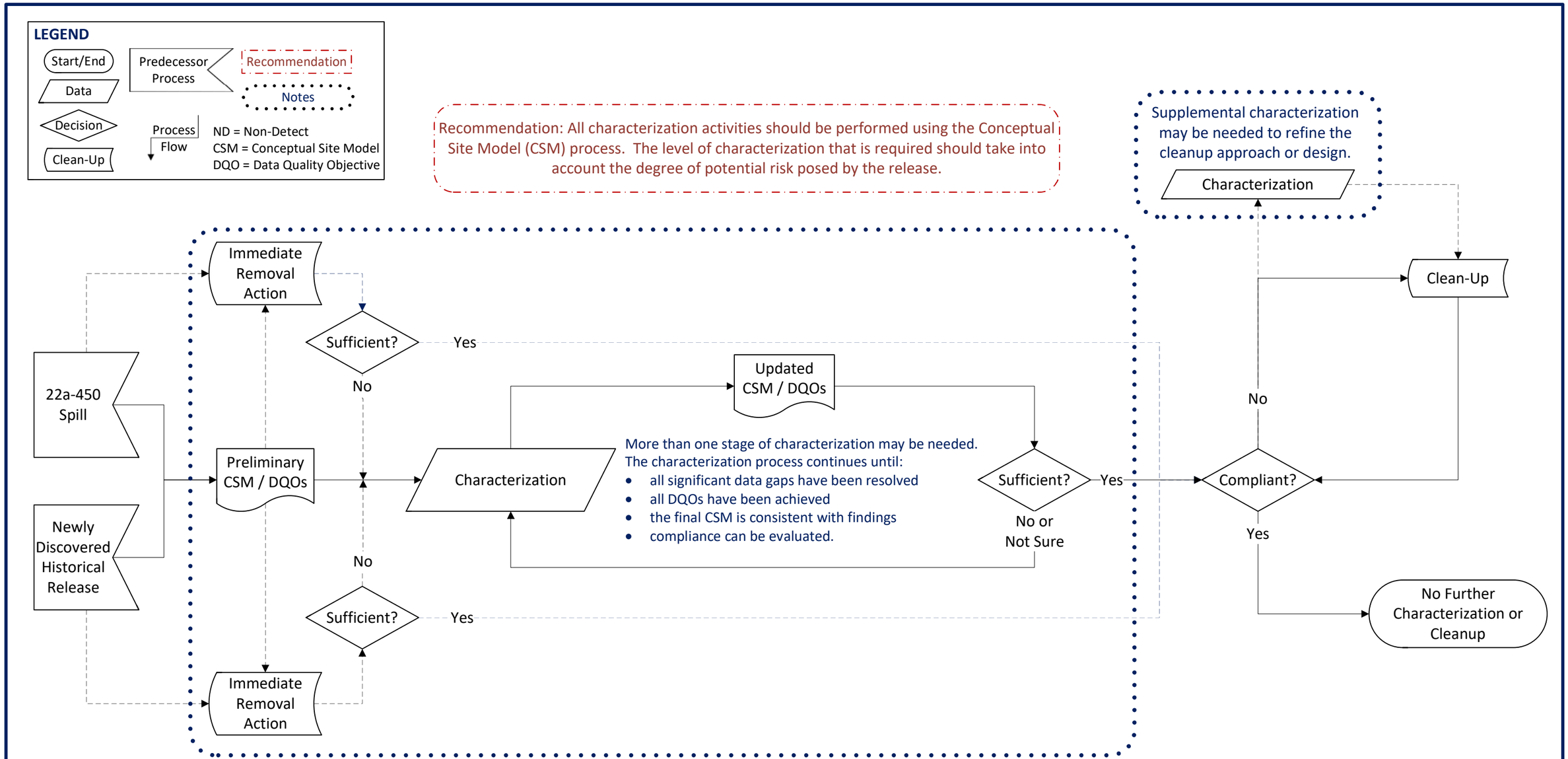

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FIGURE 2B
Characterization of a Discovered Release
Figure illustrates Subcommittee 3's interpretation of the characterization process under the Release-Based Cleanup Program.

ATTACHMENT 1
Overview of Characterization Concepts

Release Area Characterization and Risk Considerations

Once a release has been discovered, initial characterization efforts should focus on gathering sufficient information to assess the potential risks of human exposure and impacts to nearby sensitive receptors, since evaluating potential risk can help clarify the degree and type of characterization that will be needed as a release is evaluated and decisions need to be made about subsequent activities. Potential risk is affected by such factors as the volume of the release, toxicity of released constituents, mobility of released constituents, proximity of release to potential receptors, and the sensitivity of potential receptors. The degree of characterization that should be conducted would depend on several environmental factors that contribute to the overall evaluation of risk associated with the release. Factors to be considered with respect to the potential risk associated with a given release scenario include:

- Constituents released
- Area extent of release, volume of substance released, nature of the media into which the release occurred, environmental setting
- Location of release; land usage (e.g., residential, commercial, industrial-zoned public right-of-way, private property, GA vs. GB groundwater classification, rivers, farms, parkland, nature preserves, conservation areas, and other ecologically sensitive areas
- Foreseeable future land use (i.e., Brownfield redevelopment), residential or commercial/industrial
- Elapsed time from when the release occurred to the time the release was discovered
- Elapsed time from discovery to when the release is cleaned up
- Risk of exposure and impacts to sensitive receptors
- Conceptual Site Model (CSM)
- Non-LEP vs. LEP vs. DEEP involvement (dependent on risk level)

In general, the characterization for a recent spill or known release (contemporaneous release) of a specific substance with a known or estimated volume will, in most cases, require less characterization compared to a historical release about which little is known upon discovery. Where there exists an increased number of unknowns (i.e. amount released, unknown contaminants, location of source area, etc.), it is likely that more characterization will be necessary to determine potential risk and compliance with regulatory remedial goals.

For example, a small volume release with observable characteristics may require little traditional characterization in the form of sampling to demonstrate compliance with remedial goals. However, for a newly discovered historical release, some characterization may be necessary even before a determination can be made as to whether such a release is reportable or not. For example, an approved field-screening analytical method is used and a release of one or more constituents is detected. Whether the release is contemporaneous or historic, characterization needs to be considered initial to make a determination as to whether the release is discoverable and/or reportable. Subsequent characterization efforts could then be needed to identify the nature and extent of the discovered release and assess compliance with the applicable regulatory standards. Environmental professionals should also consider that additional investigations may likely be necessary beyond characterizing just

the release area characterization. Contingent upon assessing the degree and extent of any potential impacts to the environment and to human health specific to the release area, it may be necessary to perform more widespread investigations in accordance with the established CSM and a revised Characterization Guidance Document that would be directly applicable under the Release-Based Program.

Subcommittee 3 suggests that a release-based release hierarchy be developed that might provide some guidance regarding the amount and type of characterization necessary depending on the potential risk(s). A more detailed discussion of several of the above concepts is provided in the following sections.

Release-Area Risk Levels

Before conducting the release investigation/characterization effort, the environmental professional should consider applicable characterization guidance (such as a revised SCGD that would be applicable to the Release-Based Program) and the Remediation Standard Regulations (RSRs) as the primary guiding documents, assess the naturally occurring or anthropogenic background concentrations in the vicinity of the release, and evaluate the potential risks to human health and the environment. This overall characterization approach would apply consistently to both historical and contemporaneous releases. This approach should result in the identification of a risk-related characterization scenario for the release that would fall into one of the following risk/characterization categories:

Lowest-Level Health Risks/Potential Limited Characterization Effort
Releases result in contamination of environmental media at concentrations that do not exceed applicable regulatory (RSR) numerical criteria. Characterization would likely be minimal and would be performed to document minimal risks to human health and potential sensitive receptors. This risk level would be applicable in both GA and GB groundwater classification areas.

Moderate-Level Health Risks/Moderate to High Characterization Effort
Releases are assumed to reflect non-Significant Environmental Hazard (SEH) conditions initially, but could upon characterization, meet one or more of the SEH conditions. Characterization would be similar to the high risk level, but potentially less extensive, depending on the results of characterization activities as they take place. Concentrations of detected constituents may indicate additional contaminated media and/or potential impacts to sensitive receptors (day cares, playgrounds, wetlands, and watercourses). This level of characterization may also indicate indirect, ecological impacts from groundwater and runoff discharges to surface water bodies. This risk level would be applicable to both GA or GB classified areas.

Highest-Level Health Risks/High Characterization Effort
Releases that reflect one or more of the conditions set forth in the Significant Environmental Hazard Notification will generally require the highest level of characterization in order to minimize the high potential risks to human health or the environment. Characterization could include an immediate removal action based on the toxicity of the released constituent(s), detected concentrations, mobility, and risk to receptors. This risk level would primarily apply to GA classified areas.

The following paragraphs provide examples of the types of scenarios that might be applicable to each of the above risk/characterization categories

- *Low Risk Level (Minor Release*): Generally a minor amount of product released to the environment (to be determined by limited suite of and identifiable COCs [fuel oils, etc.]).

  Examples would include 0 to 5 gallons of hydraulic oil, non-PCB transformer oil, other Connecticut Regulated oils (excluding waste oil), and other liquids such as antifreeze, glycols, etc. where the constituents of concern are limited and understood, and where the aerial extent of the impacted area is small (approx. 100 square foot surface area) and distinguishable.

  For a contemporaneous release, the release was either stopped or contained and mitigation measures were initiated within several hours, released to blacktop or other impervious surface, or into containment structure, and no sensitive receptors (wetlands, water supplies, waterways (navigable) or drainage channels impacted.

  For historical releases, the assessment of the degree and three-dimensional extent would likely focus on non-intrusive methods specific to such conditions as historical and current land use and an evaluation of available analytical data to determine the risk level for the release. The risk to human exposure is considered minor or non-existent and limited characterization (if any) is required.

  If determined to be appropriate under the release-based program, the level of characterization may be determined by a non-LEP, qualified environmental professional (EP), visual confirmation of cleanup/restoration may be sufficient characterization with appropriate documentation (photo documentation, field notes).

  An example of where a low-risk characterization strategy could be used is contaminated soil and/or groundwater at concentrations which are deemed above "background" concentrations for the location based on land use (residential, commercial/industrial) and groundwater classification, but below the RSR numerical criteria. In this case, there would likely be a low risk human health risk.

- *Medium Risk Level (Moderate Release*): A larger amount (approximately 5 to 55 gallons) of product released, limited suite of and identifiable constituents (fuel oils, etc.) and the elapsed time from release and discovery is greater than low risk release.

  Examples would include a release of a larger volume (> 5 gallons) of petroleum products (including waste oil), solvents, potential carcinogenic chemicals, metals, PCBs and/or where the constituents released are more numerous and not as well understand compared to the low risk level, and where the impacted area is larger (approximately 100 to 1,000 square feet of surface area) and/or where the actual date/time of the release is not well understood, and where the release has been contained, but where there is the potential for contaminant migration into subsoil/groundwater and towards sensitive receptors (wetlands, water courses, water supplies residential and other sensitive dwellings, such as schools, daycares, community gathering areas).

  The risk of human or ecological exposure is greater than the low risk release, and field monitoring, sample collection and analysis of constituents of concern, and hydrogeological evaluation would likely be warranted for sufficient characterization and to determine potential or actual risk of impacts to the environment and potential human or ecological risks. Potential

waste characterization could provide some level of characterization with respect to constituents released, concentrations, and extent of the release. Background concentrations of applicable constituents of concern should consider both natural and anthropogenic conditions.

Characterization would be performed in accordance with the applicable characterization guidance document and would be expected to take into consideration potential Significant Environmental Hazard Notification elements. RSR exemptions would need to be evaluated with respect to their applicability in determining completion of characterization.

A few scenarios where a moderate risk characterization strategy should be used include:

- Releases from Leaking Underground Storage Tanks (LUST), predominately associated with historical releases which may have been migrating for some time and potential receptors may have been impacted.
  - Potential human health risks include dermal and inhalation (dust) exposure during earthwork below 2 feet below grade (fbg), less likely ingestion of potentially impacted drinking water supplies especially if located in a known degraded groundwater classification area where public water is available.
  - Presence of sensitive receptors; playgrounds, athletic fields, childcare facilities, etc. within the release area
  - Potential impacts to other nearby sensitive receptors; wetlands and watercourses, playgrounds, athletic fields, childcare facilities, etc.
  - Potential transport mechanisms to habitats; wetlands and watercourses

- Other releases, predominately contemporaneous, where there may have been a significant volume released, but less overall exposure risk because remediation was relatively expedited.
- Contaminated soil/fill > 2 fbg, may be associated either with contemporaneous or historical releases.

In general, releases defined in this risk level (and low risk) would not exceed the current significant environmental hazard (SEH) regulations or numerical criteria in the RSRs applicable to the environmental setting. However, the potential for SEH exceedances is a possibility in this risk category.

- *High Risk Level (Complex Release):* Significant amount released (> 55 gallons) and multiple constituents of concern or constituents of concern with elevated toxicity likely present at concentrations which exceed RSR one or more criteria. Contaminant migration is evident, potential for bedrock aquifer impacts, and one or more sensitive receptors likely impacted.

The presence of measurable light or dense NAPL would be in this risk level. Degree and three-dimensional extent of impacts is unknown, age of release may not be known, and significant risk of human or ecological exposure is possible. Characterization will require LEP oversight and

possibly DEEP involvement. Background concentrations of applicable constituents should consider both natural and anthropogenic conditions.
Characterization must be performed in accordance with applicable guidance for characterization under the Release-Based Program and the likelihood of a Significant Environmental Hazard Notification is greater than for releases in the moderate risk category. RSR exemptions would need to be evaluated specific to their applicability in determining completion of characterization. Immediate removal action may be appropriate to mitigate direct exposure to human health or the environment.

A few scenarios where a high risk characterization strategy should be used include:

- Dermal (adsorption) contact with polluted and contaminated surficial (< 2 fbg) soil/fill material (i.e., direct exposure to contaminated fill/soil)
- Inhalation, contaminated dust, airborne, vapor intrusion into structures, indoor air quality (i.e., potential for contaminated groundwater to impact indoor air)
- Ingestion of polluted and contaminated drinking water/groundwater (potential for a groundwater plume to impact a private or public water supply)

The subcommittee strongly recommended that DEEP should develop "discovered release characterization guidance" as the regulations are being developed, so such guidance would be available when the regulations are promulgated. Such guidance would include including any new definitions and include characterization requirements or expectations based on the risk levels identified above.

The DEEP should also consider using similar risk-related clean-up objectives that have been implemented in other states. For instance, the New York State Department of Environmental Conservation (NYSDEC) uses specific soil cleanup objectives (SCOs) that outline overall remedial approaches depending on the risk scenario. DEEP could develop a general release characterization risk approach and then allow the LEP and responsible party to conduct the required characterization based on the defined risk level. Release-based programs from states, including Massachusetts and New Jersey, which also have a semi-privatized program allowing licensed environmental professionals perform characterization and remediation and evaluate compliance with regulatory clean-up criteria, should also be reviewed, and where appropriate, used to develop the characterization component of Connecticut's Release-Based Program.

Characterization Methodology

As applied to environmental investigations, characterization should reflect the accumulation of information, data, and knowledge in order to assess a release, the release mechanism, the areal extent (both vertically and horizontally) of the release, the degree and extent of the impacts (soil, sediment, groundwater, surface water, sensitive receptors, indoor air, etc.), and the associated potential risk level caused by the release.

There are several possible characterization activities that may be necessary to appropriately characterize a discovered release (historical release or a contemporaneous release/spill). Depending on the specific circumstances and data quality objectives, not all potential characterization activities will be necessary for all/any given release scenario. It is understood that the conceptual site modeling process

will be used to identify which characterization activities will be appropriate for each individual release scenario. The level of characterization will take into account the level of risk associated with human exposure and potential environmental impacts.

Subcommittee 3 was unanimous in believing the term "characterization" did not refer only to the collection of samples for subsequent laboratory analysis. Rather, the subcommittee believed that gathering data of all types relevant to the evaluation of the release with respect to the released constituent(s), release mechanism, media into which the release occurred and was redistributed, contaminant fate and transport, environmental setting, migration pathways, and potential human and ecological receptors should be considered to be "characterization" activities. In other words, all information necessary or useful to developing a robust CSM and evaluating risk to potential receptors would constitute "characterization".

Specific examples of characterization methods include:

- Identifying constituents of concern
- Performing municipal records review/file search
- Reviewing aerial photographs/Sanborn maps
- Reviewing prior investigations/published literature and publicly available materials
- Identifying such information as:
    - What is known about the release (how much, where, potential release mechanisms for the identified release)
    - Chemical properties of the material released (vapor pressure, solubility, pH, mobility, etc.)
    - Geochemical properties of environmental media into which the release occurred (pH, ORP, % organic carbon, TOC, etc.)
    - Characteristics of geologic media -- overburden and bedrock, as appropriate (grain-size distribution, bedrock type, fracture characteristics, depth to bedrock, etc.)
    - Hydrogeologic characteristics of overburden and bedrock, as appropriate (permeability, fracture patterns and characteristics, RQD, depth to groundwater, groundwater flow directions, etc.)
    - Environmental setting and cultural setting (surface water, wetlands, sediment, potential sources of contamination, storm drains, potential preferential pathways, etc.)
- Identifying potential receptors (human health, safety, welfare, and the environment)
- Collecting samples of various media for laboratory analysis
- Using field screening techniques (PID, field XRF, TPH screening techniques, LIF)
- Using geophysical investigation techniques (borehole and surface geophysics)
- Performing aquifer testing (including slug testing, pumping tests, dye testing, etc.)
- Considering visual and olfactory evidence

As indicated previously, the risk levels for developing characterization strategies would vary depending upon the type, location, the constituent(s) released and the magnitude of the release and associated impacts. Characterization could be limited or extensive and at the discretion of the EP/LEP. Characterization would follow the guidance presented in applicable characterization guidance developed by DEEP for the Release-Based Program and other applicable regulations and guidance documents. More specifically, the subcommittee identified examples of characterization activities that could be considered appropriate to conduct in the risk/characterization categories presented previously

in the "Release-Area Risk Levels" section of this document. Examples of characterization activities that might be associated with each risk/characterization level are presented below.

Limited Characterization

- General observations, inspection(s) and assessment
- Interviews
- Phase I ESA-type research
- Laboratory data review, if applicable
- Limited collection of media samples, as deemed appropriate to accomplish the objectives for evaluating the release

Moderate Characterization – This characterization category would likely include additional investigative tasks in addition to those listed for Limited Characterization with some intrusive media sampling.

- More specific observations, with potential follow-up interviews
- Follow-up research to assess potential complicating factors (imported contaminated fill, plume boundaries, receptor impacts, human health and ecological exposure risks)
- Subsurface investigation-type tasks to define the degree and three-dimensional extent of the release – field screening (OVM, XRF, etc.), geophysical surveying, soil, groundwater, vapor sampling performed as appropriate
- Follow-up file review and Phase I type activities to better determine specific information about the release that might be used to refine an understanding of the such release specifics as release mechanism, specific location where the release initially occurred, possible distribution of the release in the subsurface, and potential receptors
- Communication with stakeholders, regulators, and affected public

Extensive Characterization – This category of characterization requires the highest and most aggressive level of investigation. It would generally be required for release areas where a high potential for human health or ecological risk has been identified. This characterization could be in support of an emergency removal action or other high risk condition where human health exposure is likely or imminent, and could include one or more significant environmental hazards, as defined in regulations. Example characterization activities for this category could include:

- Additional subsurface investigations, hydrogeological assessments (on and off the property) where the release occurred and/or where it was discovered, taking into consideration fate and transport characteristics and migration potential)
- Updating of CSM based on new information
- Focused receptor survey(s) with associated sampling/analyses
- Dye and smoke tests to assess preferential pathways specific to contaminant migration
- Potential emergency removal of impacted media, remedial activities
- Monitoring (groundwater, soil gas, indoor air, etc.)
- Risk-based human health and ecological assessment(s)
- Communication with stakeholders, regulators and affected public to limit access to release area

Ecological Risk-Related Considerations

While not the primary focus of this subcommittee, it is important to note that where ecological receptors are present, ecological risk must be considered in the context of release characterization. Characterization activities to address potential ecological risk should be performed in settings for which the presence of ecological habitat(s) within the release area or in an area where the conceptual site model (CSM) indicates that potential migration pathways between the release area and ecological receptors can be identified. The level of characterization necessary would generally be related to the level of ecological risk posed by the released constituent(s) given the environmental setting into which the release occurred.

In addressing the level of characterization required to evaluate ecological risk, several factors must be considered. A summary of considerations to be evaluated when developing a characterization plan to evaluate potential ecological risk includes:

- Type of Habitat
  - Aquatic – freshwater or marine
  - Benthic – freshwater or marine
  - Terrestrial
  - Semi-aquatic habitats wetlands, vernal pools

- Value/Quality of Habitat
  - the presence of aquatic life
  - the nature of the bottom substrate – natural or artificial
  - aquatic and wildlife habitat value
  - setting and surrounding land use – natural or developed
  - physical and biological connections with the surrounding area
  - hydraulic regime; hydraulically connected water bodies, size, and management practices.

When determining the presence of an aquatic habitat such as surface water bodies, man-made surface water bodies, such as detention and retention basins that do not function as an ecological resource maybe evaluated using a different strategy than would be expected for natural ecological resources. When evaluating the ecological value of “man-made” surface water, the following attributes should be considered:

- Physical Size of Habitat
- Ecological Receptors in the Habitat
- Threatened and Endangered Species NDDB
- Exposure Pathway
  - Aquatic
  - Surface Water
  - Sediment
  - Terrestrial Soil

Low Ecological Risk

A truly negligible release would be in an area with no apparent or distinguishable habitat, ecological receptors or complete exposure pathways. This risk level would apply to both groundwater GA or GB classified areas.

Medium Ecological Risk

Area where habitat is present and potential exposure pathways for ecological receptors to contaminated media are identified. Exposure pathway documents transport mechanism(s) [i.e. fate/transport] for COCs associated with the release which then leads to exposure route(s) for ecological receptor(s). A COC that can bioaccumulate in ecological receptors, such as PCBs, mercury, PFAS or other constituents, is identified. The area includes threatened and endangered species, wetlands, and watercourses. Characterization may also include indirect, potential adverse effects to aquatic life in surface water bodies from groundwater and runoff discharges (refer to water quality standards). Surface water protection criteria are used to assess this risk. This risk level would apply to both groundwater GA or GB classified areas.

High Ecological Risk

Characterization will be in accordance with the SCGD and could include an immediate removal determination based on the constituents of concern (COCs) and their detected concentrations. The potential exposure pathway for a federally threatened endangered species has been identified. Transport mechanisms of the release to a valued, highly functional habitat have been identified.

ATTACHMENT 2
Example Language Related to Characterization from the Massachusetts Contingency Plan

40.0190: continued

(7) RPs, PRPs and Other Persons shall employ or engage persons having the appropriate training, and as required, currently valid licenses or certifications to conduct a response action at a disposal site.

40.0191: Response Action Performance Standard (RAPS)

(1) The Response Action Performance Standard (RAPS) is the level of diligence reasonably necessary to obtain the quantity and quality of information adequate to assess a site and evaluate remedial action alternatives, and to design and implement specific remedial actions at a disposal site to achieve a level of No Significant Risk for any foreseeable period of time and, where feasible, to reduce to the extent possible the level of oil and/or hazardous materials in the environment to background levels.

(2) RAPS shall be employed during the performance of all response actions conducted pursuant to 310 CMR 40.0000, and shall include, without limitation, the following:

(a) consideration of relevant policies and guidelines issued by the Department and EPA;

(b) use of accurate and up-to-date methods, standards and practices, equipment and technologies which are appropriate, available and generally accepted by the professional and trade communities conducting response actions in accordance with M.G.L. c. 21E and 310 CMR 40.0000 under similar circumstances; and

(c) investigative practices which are scientifically defensible, and of a level of precision and accuracy commensurate with the intended use of the results of such investigations.

(3) The application of RAPS shall be protective of health, safety, public welfare and the environment and shall include, without limitation, in the context of meeting the requirements of this Contingency Plan, consideration of the following:

(a) technologies which reuse, recycle, destroy, detoxify or treat oil and/or hazardous materials, where feasible, to minimize the need for long-term management of contamination at or from a disposal site;

(b) containment measures as feasible Permanent Solutions only where reuse, recycling, destruction, detoxification and treatment are not feasible;

(c) remedial actions to reduce the overall mass and volume of oil and/or hazardous material at a disposal site to the extent feasible, regardless of whether it is feasible to achieve one or more Temporary Solutions and/or Permanent Solutions or whether it is feasible to achieve background for the entire disposal site and not include the dilution of contaminated media with uncontaminated media;

(d) response actions to restore groundwater, where feasible, to the applicable standards of quality within a reasonable period of time to protect the existing and potential uses of such resources; and

(e) eliminating or reducing, to the extent practicable and consistent with response action requirements and objectives, total energy use, air pollutant emissions, greenhouse gases, water use, materials consumption, and ecosystem and water resources impacts, resulting from the performance of response actions through energy efficiency, renewable energy use, materials management, waste reduction, land management, and ecosystem protection.

40.0193: Technical Justification

(1) A Licensed Site Professional may provide technical justification for forgoing any specific activity required by 310 CMR 40.0000, related to Initial Site Investigation Activities performed in accordance with 310 CMR 40.0405(1), Phase I Initial Site Investigation Activities performed in accordance with 310 CMR 40.0480 through 40.0483, Phase II Comprehensive Site Investigation Activities performed in accordance with 310 CMR 40.0830, and Phase III Identification and Evaluation of Response Action Alternatives performed in accordance with 310 CMR 40.0850 through 40.0860, if in his or her professional judgment any particular requirement is unnecessary or inappropriate based upon the conditions and characteristics of a disposal site. The LSP shall employ RAPS in determining whether any such activity is unnecessary or inappropriate.

40.0810: continued

notices or documents required as part of Comprehensive Response Actions under 310 CMR 40.0800. When technical justification is used to forgo or limit an assessment or evaluation element, a description of the site-specific conditions and characteristics that make the requirement unwarranted and any documentation necessary to support any such justification shall be provided in the applicable submittal to the Department.

(8) If at any time during the conduct of response actions under 310 CMR 40.0800 an Imminent Hazard, sudden release, or other time-critical release or site condition is identified at a disposal site, as described in 310 CMR 40.0412, Immediate Response Actions shall be performed as set forth in 310 CMR 40.0400.

(9) Comprehensive Response Actions shall be conducted in a manner protective of health, safety, public welfare, and the environment, and in accordance with the Health and Safety provisions of 310 CMR 40.0018.

(10) Nothing in 310 CMR 40.0800 shall limit the ability of the Department to initiate, oversee, or order the performance of any response action deemed necessary by the Department to protect health, safety, public welfare, or the environment or impose additional requirements which are consistent with the purposes on M.G.L. c. 21E or 310 CMR 40.0000.

(11) Notwithstanding any provision to the contrary, the Department may at any time require an RP, PRP or Other Person undertaking Comprehensive Response Actions pursuant to 310 CMR 40.0800 to obtain prior Departmental approval of one or more of the response actions or submittals required pursuant to 310 CMR 40.0800. The Department may require such prior approval for submittals or response actions as they relate to the entire disposal site or to some portion thereof.

40.0830: Phase II - Comprehensive Site Assessment

310 CMR 40.0831 through 40.0849, cited collectively as 310 CMR 40.0830, contain the requirements and procedures for conducting Phase II - Comprehensive Site Assessments at disposal sites.

40.0832: General Provisions

(1) A Scope of Work, as described in 310 CMR 40.0834, shall be developed and submitted to the Department in accordance with 310 CMR 40.0510 prior to the initiation of Comprehensive Site Assessment activities at any disposal site that has been classified as Tier I or Tier II under the provisions of 310 CMR 40.0500, unless the Phase II fieldwork has been implemented prior to Tier Classification.

(2) A Phase II Report, as described in 310 CMR 40.0835, shall be prepared to document information obtained as a result of Comprehensive Site Assessment activities and support conclusions and Opinions based upon the findings of the assessment. The Phase II Report shall reference or incorporate elements of the Phase I Report, as appropriate, and may be combined with the Phase III Report described in 310 CMR 40.0850.

40.0833: Performance Standards

(1) A Phase II - Comprehensive Site Assessment shall collect, develop and evaluate sufficient information to support conclusions and Opinions regarding:

(a) the source, nature, extent, and potential impacts of releases of oil and/or hazardous material;

(b) the risk of harm posed by the disposal site to health, safety, public welfare and the environment; and

(c) the need to conduct remedial actions at the disposal site.

(2) The Phase II Report shall thoroughly document, evaluate and discuss the findings and conclusions of the Phase II Comprehensive Site Assessment, and where applicable, provide the basis for identifying and evaluating remedial action alternatives.

40.0834: Conceptual Phase II Scope of Work

(1) Except as otherwise specified by the Department, Department approval of the conceptual Phase II Scope of Work shall not be required.

(2) Except as otherwise specified by the Department, the conceptual Phase II Scope of Work shall provide:

(a) the general scope and nature of investigative and sampling programs that will be undertaken to characterize the source, extent, and migration pathways of oil and/or hazardous material, and the risk of harm posed to health, safety, public welfare or the environment, based upon the initial Conceptual Site Model developed in Phase I;

(b) the name and license number of the LSP engaged or employed by the person conducting the Comprehensive Response Action; and

(c) a projected schedule for implementation of the Phase II - Comprehensive Site Assessment.

40.0835: Phase II Report

(1) A Phase II Report shall be submitted to the Department at the conclusion of Comprehensive Site Assessment activities pursuant to the applicable deadlines set forth in 310 CMR 40.0550 or 40.0560 or at Interim Deadlines specified by the Department.

(2) A Phase II Report shall present, contain, or append relevant information, data, findings, and Opinions related to the Comprehensive Site Assessment of the disposal site.

(3) A Phase II Report shall set forth in narrative and, to the extent possible, in maps, graphs, and tables, the disposal site Conceptual Site Model, approach, methods and results of the Phase II - Comprehensive Site Assessment.

(4) The information and assessment findings outlined in 310 CMR 40.0835(4) shall be provided in the Phase II Report. Depending upon specific site and release conditions, it may be necessary to provide additional information to adequately characterize the disposal site, consistent with the Response Action Performance Standard described in 310 CMR 40.0191, or it may be appropriate to forgo particular assessment or information gathering elements and provide Technical Justification as described in 310 CMR 40.0193.

(a) Disposal Site Name, Location and Locus Map, updated, if necessary, from what was provided in the Phase I Report;

(b) Detailed Disposal Site Map(s), updated, as necessary, from the base map(s) provided in the Phase I Report, and depicting all investigatory and sampling points relevant to the Comprehensive Site Assessment, the boundaries of the disposal site in plan view, and, as appropriate, the vertical extent of contamination at the disposal site;

(c) Disposal Site History, updated, supplemented, or modified if necessary from information provided in the Phase I Report;

(d) Site Hydrogeological Characteristics, including details of subsurface investigations conducted at the disposal site, together with a comprehensive description and depiction of site hydrogeologic conditions, including, without limitation:

1. a description of all relevant geologic, hydrologic, geophysical, and other subsurface investigations and assessments conducted at the disposal site;

2. documentation related to borings, well construction, and well development, including copies of well drilling logs, within or appended to the Phase II Report; and

3. a detailed characterization of geologic and hydrogeologic conditions at the disposal site, including:

a. groundwater potentiometric surface(s), gradients, flow rates, and flow direction(s);

b. soil type(s), stratigraphy, and permeability;

c. where appropriate, bedrock type and characteristics, depths and contours; and

d. an evaluation and description of the potential for flooding;

(e) Environmental Fate and Transport of Oil and/or Hazardous Material, including, as appropriate:

40.0835: continued

1. an evaluation of the environmental fate and transport characteristics of the oil and/or hazardous material identified at the disposal site, including, without limitation, mobility, stability, volatility, persistence and bioaccumulative potential of the oil and/or hazardous material;
2. identification and characterization of existing and potential migration pathways of the oil and/or hazardous material at and from the disposal site, including, as appropriate, air, soil, groundwater, soil gas, preferential migration pathways such as subsurface utility lines and other subsurface void spaces, surface water, sediment, and food chain pathways; and
3. an evaluation of the potential for soil, groundwater, or NAPL to be a source of vapors of oil and/or hazardous material to indoor air of occupied structures as described in 310 CMR 40.0900;

(f) Nature and Extent of Contamination, including a characterization of the nature, and vertical and horizontal extent of oil and/or hazardous material in the environment, including any and all source(s), the presence, distribution, and stability of any NAPL, tabulation of analytical testing results, and, where appropriate, a characterization of background concentrations of oil and/or hazardous material at the disposal site;

(g) Exposure Assessment, including the identification and characterization of all potential human and environmental receptors that could be impacted by oil and/or hazardous material at or migrating from the disposal site, and, as appropriate, the quantification of exposure of oil and/or hazardous material to these receptors, under current and reasonably foreseeable site conditions, as described in 310 CMR 40.0900;

(h) Risk Characterization, as set forth in 310 CMR 40.0900, for all appropriate human and environmental receptors identified at and near the disposal site; and

(i) Conclusions, including a summary of the Phase II Comprehensive Site Assessment findings. The Conclusions section shall provide the disposal site Conceptual Site Model, the reasoning and results used to support the findings, and indicate and support the outcome of the Phase II Investigation as described in 310 CMR 40.0840.

40.0836: Phase II Completion Statement

(1) A Phase II Completion Statement form, established by the Department for such purposes, shall be appended to and submitted with the final Phase II Report to the Department.

(2) In cases where the Phase II Report is combined with other Comprehensive Response Action Reports, a Completion Statement form for the combined Reports shall be appended to the documents and submitted to the Department.

(3) A Completion Statement submitted with a Phase II Report shall include the following:

(a) an Opinion from a Licensed Site Professional which states that the Phase II Comprehensive Site Assessment:

1. conforms with applicable Phase II requirements and any approval conditions specified by the Department;
2. meets the Phase II performance standards;
3. does not disclose new or additional information which may affect the site's Tier Classification or permit category without the concurrent filing of an application for a Major Permit Modification; and
4. specifies the Phase II outcome under 310 CMR 40.0840.

(b) the certification of the submittal required by 310 CMR 40.0009.

40.0839: Public Involvement

(1) Public Involvement Activities shall be conducted in accordance with 310 CMR 40.1400 through 40.1406. Public Involvement Activities relevant to Phase II specifically include 310 CMR 40.1403(3)(e), and may include, but are not limited to those activities set forth at 40.1403(3)(a) and (f) and 310 CMR 40.1406.

(2) If the disposal site where the Phase II is conducted is a Public Involvement Plan site, then a Public Involvement Plan that is consistent with 310 CMR 40.1405 shall be implemented.

40.0404: continued

(c) the limited excavation of contaminated soil associated with the closure of an Underground Storage Tank system, as specified at 310 CMR 40.0421(3); or
(d) time-critical Utility-related Abatement Measures undertaken to prevent or abate an immediate and substantial danger to public safety, as specified in 310 CMR 40.0462(3).

(5) Releases and/or threats of release that occur at a disposal site after Tier Classification of that disposal site shall not be subject to the one year time frames specified in 310 CMR 40.0404(3), provided that response actions are being conducted at the disposal site in compliance with the provisions of 310 CMR 40.0000, including, where appropriate, the submission of all necessary Immediate Response Action Plans, Status Reports, and Completion Statements.

40.0405: Overview of Preliminary Response Actions

(1) Initial Site Investigation Activities.
(a) Initial Site Investigation Activities shall consist of limited investigative and assessment actions of sufficient scope and level of effort to make and/or guide determinations on required and appropriate response actions at a site. Initial Site Investigation Activities may include, without limitation:
1. evaluation of records relating to the release, threat of release or impacted site;
2. evaluation of underground storage tank testing results;
3. testing and/or retesting of underground storage tanks;
4. evaluation of environmental monitoring data;
5. limited sampling and analysis of soil, sediment, groundwater, surface water, soil gas, indoor air or ambient air; and
6. any other limited investigations, monitoring, surveys, testing or information gathering activities necessary to evaluate releases and threats of release of oil and/or hazardous material, excluding removal and containment actions.
(b) The objective of Initial Site Investigation Activities is to obtain preliminary information and data on a release, a threat of release and/or site in order to:
1. determine the existence, source, nature and approximate extent of the release or threat of release;
2. determine if the release or threat of release poses or could pose an Imminent Hazard, as described in 310 CMR 40.0321;
3. determine if an Immediate Response Action is necessary, as described in 310 CMR 40.0412;
4. determine if a Limited Removal Action is appropriate at the site, as described in 310 CMR 40.0318;
5. determine if a Release Abatement Measure is appropriate at the site, as described in 310 CMR 40.0440;
6. identify persons who are responsible or potentially responsible for the release or threat of release;
7. obtain, assemble and record information and data needed to evaluate the release or threat of release; and
8. determine if a demonstration can readily be made that a condition of No Significant Risk exists or has been achieved at the site, before or after the completion of a Limited Removal Action, Immediate Response Action, or Release Abatement Measure.
(c) The results of Initial Site Investigation Activities shall:
1. be used to support a Permanent Solution Statement at the conclusion of Preliminary Response Actions; or
2. be used as the basis for a Phase I Report, as described in 310 CMR 40.0480, whenever a Permanent Solution Statement is not filed for a site within one year of the initial notification to the Department of a release or threat of release at the site by any person listed at 310 CMR 40.0331.
(d) When used to support a Permanent Solution Statement, the results of Initial Site Investigation Activities shall be reported in a response action report or in a Phase I Report, pursuant to 310 CMR 40.0481, and shall contain all information, data, records and documents necessary for that purpose.
(e) Assessment activities conducted at a site prior to Tier Classification, as described in 310 CMR 40.0500, shall not require approval from the Department.

40.0466: continued

(a) an LSP Opinion on whether the Utility-related Abatement Measure was conducted in accordance with 310 CMR 40.0460 and any approval conditions specified by the Department; and
(b) the certification of the submittal required by 310 CMR 40.0009.

(6) Notwithstanding the provisions of 310 CMR 40.0466(5), an LSP Opinion shall not be required for Utility-related Abatement Measure Completion Reports documenting response actions at those Utility-related Abatement Measures described at 310 CMR 40.0462(4).

40.0467: Possible Outcomes of Utility-related Abatement Measures

The following actions are possible following the initiation and/or completion of Utility-related Abatement Measures:

(1) Utility-related Abatement Measures are terminated due to the discovery of a "Two Hour" or "72 Hour" release or threat of release described in 310 CMR 40.0311 through 40.0314, and continued work on the construction project requires the implementation of an Immediate Response Action by an RP, PRP, or Other Person;

(2) Utility-related Abatement Measures have adequately remediated the release or threat of release encountered at the site, allowing for the filing of a Permanent Solution Statement, as described in 310 CMR 40.1000; or

(3) additional response actions are necessary at the site following the completion of Utility-related Abatement Measures, to be conducted by persons identified as Responsible Parties under M.G.L. c. 21E, § 5(a), or electively by PRPs or Other Persons.

40.0480: Phase I - Initial Site Investigation Report

310 CMR 40.0481 through 40.0489, cited collectively as 310 CMR 40.0480, set forth requirements and procedures for preparing a Phase I - Initial Site Investigation Report.

40.0481: General Provisions for Phase I Initial Site Investigation Report

(1) A Phase I Initial Site Investigation Report (hereinafter referred to as the "Phase I Report") is a document which contains the results of Preliminary Response Actions undertaken at a disposal site pursuant to 310 CMR 40.0400. The purpose of a Phase I Report is to record information in a standardized format in order to:
(a) facilitate the evaluation and Tier Classification of a disposal site in those cases where Comprehensive Response Actions may need to be undertaken; or
(b) where appropriate, support a Permanent or Temporary Solution Statement filed prior to Tier Classification of a disposal site.

(2) A Phase I Report shall be submitted to the Department for any disposal site undergoing Tier Classification under the provisions of 310 CMR 40.0500.

(3) The preliminary description of hydrogeologic conditions at a disposal site required in a Phase I Report pursuant to 310 CMR 40.0483(d) shall be based upon the installation of a minimum of three groundwater monitoring wells, in locations near known or likely release or source areas. This requirement may be modified or eliminated based upon the exercise of Technical Justification by a Licensed Site Professional, as described in 310 CMR 40.0193.

40.0482: Performance Standards

A Phase I Report shall provide sufficient information to meet the requirements of the Tier Classification process described in 310 CMR 40.0500 or, where appropriate, support a Permanent or Temporary Solution Statement filed for a site prior to Tier Classification.

40.0483: Content of Phase I Report

(1) Except as provided in 310 CMR 40.0483(2) and 40.0193, the following information shall be contained in all Phase I Reports submitted to the Department, in the format established below:

(a) General Disposal Site Information. The Phase I Report shall provide general information which defines and describes the disposal site and surrounding area, including:

1. the DEP Release Tracking Number(s) applicable to the disposal site under investigation;
2. the address(es) and geographical location coordinates of the disposal site and/or properties comprising the disposal site;
3. a Disposal Site Locus Map, based upon a U.S.G.S. topographic or equivalent map, depicting 500 foot and ½ mile radii from the boundaries of the disposal site;
4. an estimate of the number of on-site workers at the disposal site;
5. an estimate of the residential population within a ½ mile radius of the disposal site;
6. a general description of land uses surrounding the disposal site;
7. the number of Institutions within 500 feet of the disposal site; and
8. a listing and description of any of the following natural resource areas located within 500 feet of the disposal site:
   a. all surface waters, including wetlands, vernal pools, ponds, lakes, streams, rivers, and reservoirs;
   b. drinking water supplies consisting of Zone II areas, Interim Wellhead Protection Areas, Zone A areas, Potentially Productive Aquifers, and private wells; and
   c. Areas of Critical Environmental Concern, Sole Source Aquifers, local, state and/or federal protected open space, fish habitats, and habitats of Species of Special Concern or Threatened or Endangered Species.

(b) Disposal Site Map. Phase I Reports shall include one or more maps or plans depicting the location of the following:

1. disposal site boundaries, to the extent they have been defined by assessments conducted to date;
2. boundaries of properties located within the disposal site; and
3. the following structures, areas and monitoring points, as appropriate:
   a. on-site buildings;
   b. floor and storm drains;
   c. subsurface utilities serving or transecting the disposal site;
   d. oil and/or hazardous material storage and disposal structures and/or areas;
   e. the location of any known oil and/or hazardous material releases and/or threats of release; and
   f. monitoring wells, borings, test pits and other relevant sampling and screening points.

(c) Disposal Site History. The disposal site history shall be presented in the Phase I Report in reverse chronological order, beginning with the current use of the disposal site, and shall include the following:

1. Owner/Operator and Operations History.
   a. a list of current and relevant previous owners and operators of the properties comprising the disposal site, including dates of ownership and operation; and
   b. a description of current and historical uses of the disposal site, including residential, commercial and industrial activities and manufacturing processes, and the location of buildings and structures currently or previously located on the disposal site.
2. Release History. A description of any known and relevant releases of oil and/or hazardous material at the disposal site shall be provided. For each relevant release, the description shall include:
   a. the source and location of the release;
   b. the known or suspected cause of the release;
   c. the known or approximate date and duration of the release;
   d. the type of oil and/or hazardous material released;
   e. the known or approximate volume of the release; and
   f. any measures taken to assess, contain or mitigate the release.
3. Oil and/or Hazardous Material Use and Storage History. The Phase I Report shall describe all relevant current and past use and storage of oil and/or hazardous material at the disposal site, and shall include a description of the following:

40.0483: continued

a. types of oil and/or hazardous material, including generic names, chemical names and trade names, if available;
b. uses or oil and/or hazardous material;
c. quantities used;
d. periods of use;
e. on-site storage locations, underground storage tanks, above-ground tanks, drums, lagoons, pits and piles; and
f. age and volume of tanks and other storage containers.

4. Waste Management History. The Phase I Report shall include a general description of all known relevant waste management practices, excluding the off-site disposal of solid waste. This description shall address the types of wastes or waste streams, and the locations of points of discharge or on-site disposal or treatment with respect to the following:
a. land disposal, including landfills and lagoons;
b. subsurface disposal including drains, dry wells, septic systems and leach fields;
c. surface water discharges to natural and man-made water bodies;
d. discharges to wastewater treatment plants; and
e. any other relevant means of disposal or treatment.

5. Environmental Permits and Compliance History. The Phase I Report shall include a history of all relevant local, state and federal environmental permits and oil and/or hazardous material storage permits issued for the disposal site or on-site facilities, including without limitation information on any permit violations. Relevant permits may include but are not limited to:
a. permits for M.G.L. c. 21E response actions;
b. oil and/or hazardous material storage permits;
c. wastewater discharge permits;
d. groundwater discharges permits;
e. air quality discharges permits;
f. wetlands alteration permits;
g. Resource Conservation and Recovery Act (RCRA) permits; and
h. National Pollution Discharge Elimination System (NPDES) permits.

6. Potentially Responsible Parties. The Phase I Report may include a list of the names and addresses of all Potentially Responsible Parties identified for the disposal site.

(d) Site Hydrogeological Characteristics. The Phase I Report shall include details of subsurface investigations conducted at the disposal site, together with a preliminary or generalized description and depiction of site hydrogeologic conditions, including, without limitation:

1. a concise description of all relevant geologic, hydrologic, geophysical and other subsurface investigations and assessments conducted to date at the disposal site;
2. documentation on boring advancement, well construction and well development, including copies of well drilling logs, within or appended to the Phase I Report;
3. a characterization of general site topography, including slope, presence of bedrock outcrops and surface drainage features;
4. a characterization of geologic and stratigraphic conditions, including:
a. soil type(s), stratigraphy and evidence of filling or waste disposal;
b. where appropriate, the known or estimated depths to, and description of, bedrock; and
5. a description and graphical depiction of groundwater flow direction or potentiometric surface elevations, indicating the location of monitoring wells.

(e) Nature and Extent of Contamination. The Phase I Report shall provide information on the nature and extent of contamination, as determined by Initial Site Investigation Activities and Preliminary Response Actions undertaken to date at the disposal site, including:

1. evidence of releases of oil and/or hazardous material to the environment including visual and olfactory evidence, results of field screening and laboratory analysis, and historical knowledge;
2. the names, concentrations, and volumes (if applicable) of all released oil and hazardous material detected to date at the disposal site:

40.0483: continued

a. volumes shall be reported in gallons, pounds, tons or cubic feet, as appropriate;
b. analytical results for each media sampled shall be summarized in the text and in tables in the body of the Phase I Report;
c. for the purpose of disposal site classification, maximum and minimum concentrations for each contaminant detected shall be identified in a summary table in the body of the Phase I Report;

3. laboratory data sheets, included in an appendix to the Phase I Report;
4. information and details on the approximate horizontal and vertical extent of contamination based on best available information, as obtained from site investigations of scope and detail commensurate with release and site conditions; and
5. information and details on NAPL, if present or suspected, including NAPL stability and the approximate horizontal and vertical extent of NAPL contamination, as obtained from site investigations of scope and detail commensurate with release and site conditions.

(f) Migration Pathways and Exposure Potential. The Phase I Report shall describe and evaluate known and potential contaminant migration pathways and exposure points, to the extent that such information is known, including:

1. evidence of and the potential for oil and/or hazardous material migration by one or more of the following pathways:
   a. air;
   b. soil;
   c. groundwater;
   d. soil gas;
   e. preferential flow pathways such as subsurface utility lines and void spaces; and/or
   f. surface water, including sediments;
2. a discussion of known and potential human exposure to oil and hazardous material present at the disposal site, by inhalation, dermal contact or ingestion of contaminants; and
3. a discussion of known and potential impacts of oil and hazardous material present at the disposal site to environmental receptors, with special attention given to the natural resource areas referenced in 310 CMR 40.0483(1)(a)8.c.

(g) Evaluation for Immediate Response Actions. The Phase I Report shall include an evaluation of the need to conduct an Immediate Response Action, as described in 310 CMR 40.0412.

(h) Conclusions. The Phase I Report shall include a Conclusions section containing a summary of findings and statement of conclusions with respect to the site, a preliminary Conceptual Site Model for the disposal site and the outcome of Initial Site Investigation Activities, as documented in the Phase I Report, and as described in 310 CMR 40.0486.

(2) In addition to the Phase I Report requirements set forth in 310 CMR 40.0483(1), such additional information as may be necessary to adequately and completely characterize a disposal site in accordance with the Response Action Performance Standard described in 310 CMR 40.0191, and/or as required by unique release, threat of release and/or site conditions, shall be provided in the Phase I Report. It may also be appropriate to eliminate certain information categories, or investigation or assessment elements from the Phase I Report, as may be consistent with unique release, threat of release and/or site conditions, by application of the Technical Justification standard set forth in 310 CMR 40.0193.

40.0484: Phase I Report Completion Statement

(1) All Phase I Reports submitted to the Department in support of a Permanent or Temporary Solution Statement, or as part of Tier Classification of a disposal site pursuant to 310 CMR 40.0500, shall be appended to the appropriate transmittal form established by the Department for such purposes.

(2) The Completion Statement form submitted with a Phase I Report shall include the following:

(a) an LSP Opinion as to whether the Phase I Report conforms with applicable requirements specified in 310 CMR 40.0480;

(b) the outcome of the Phase I Report, as described in 310 CMR 40.0486; and

(c) the certification of the submittal required by 310 CMR 40.0009.

40.0483: Content of Phase I Report

(1) Except as provided in 310 CMR 40.0483(2) and 40.0193, the following information shall be contained in all Phase I Reports submitted to the Department, in the format established below:

(a) General Disposal Site Information. The Phase I Report shall provide general information which defines and describes the disposal site and surrounding area, including:

1. the DEP Release Tracking Number(s) applicable to the disposal site under investigation;
2. the address(es) and geographical location coordinates of the disposal site and/or properties comprising the disposal site;
3. a Disposal Site Locus Map, based upon a U.S.G.S. topographic or equivalent map, depicting 500 foot and ½ mile radii from the boundaries of the disposal site;
4. an estimate of the number of on-site workers at the disposal site;
5. an estimate of the residential population within a ½ mile radius of the disposal site;
6. a general description of land uses surrounding the disposal site;
7. the number of Institutions within 500 feet of the disposal site; and
8. a listing and description of any of the following natural resource areas located within 500 feet of the disposal site:
   a. all surface waters, including wetlands, vernal pools, ponds, lakes, streams, rivers, and reservoirs;
   b. drinking water supplies consisting of Zone II areas, Interim Wellhead Protection Areas, Zone A areas, Potentially Productive Aquifers, and private wells; and
   c. Areas of Critical Environmental Concern, Sole Source Aquifers, local, state and/or federal protected open space, fish habitats, and habitats of Species of Special Concern or Threatened or Endangered Species.

(b) Disposal Site Map. Phase I Reports shall include one or more maps or plans depicting the location of the following:

1. disposal site boundaries, to the extent they have been defined by assessments conducted to date;
2. boundaries of properties located within the disposal site; and
3. the following structures, areas and monitoring points, as appropriate:
   a. on-site buildings;
   b. floor and storm drains;
   c. subsurface utilities serving or transecting the disposal site;
   d. oil and/or hazardous material storage and disposal structures and/or areas;
   e. the location of any known oil and/or hazardous material releases and/or threats of release; and
   f. monitoring wells, borings, test pits and other relevant sampling and screening points.

(c) Disposal Site History. The disposal site history shall be presented in the Phase I Report in reverse chronological order, beginning with the current use of the disposal site, and shall include the following:

1. Owner/Operator and Operations History.
   a. a list of current and relevant previous owners and operators of the properties comprising the disposal site, including dates of ownership and operation; and
   b. a description of current and historical uses of the disposal site, including residential, commercial and industrial activities and manufacturing processes, and the location of buildings and structures currently or previously located on the disposal site.
2. Release History. A description of any known and relevant releases of oil and/or hazardous material at the disposal site shall be provided. For each relevant release, the description shall include:
   a. the source and location of the release;
   b. the known or suspected cause of the release;
   c. the known or approximate date and duration of the release;
   d. the type of oil and/or hazardous material released;
   e. the known or approximate volume of the release; and
   f. any measures taken to assess, contain or mitigate the release.
3. Oil and/or Hazardous Material Use and Storage History. The Phase I Report shall describe all relevant current and past use and storage of oil and/or hazardous material at the disposal site, and shall include a description of the following:

40.0483: continued

a. types of oil and/or hazardous material, including generic names, chemical names and trade names, if available;
b. uses or oil and/or hazardous material;
c. quantities used;
d. periods of use;
e. on-site storage locations, underground storage tanks, above-ground tanks, drums, lagoons, pits and piles; and
f. age and volume of tanks and other storage containers.

4. Waste Management History. The Phase I Report shall include a general description of all known relevant waste management practices, excluding the off-site disposal of solid waste. This description shall address the types of wastes or waste streams, and the locations of points of discharge or on-site disposal or treatment with respect to the following:
a. land disposal, including landfills and lagoons;
b. subsurface disposal including drains, dry wells, septic systems and leach fields;
c. surface water discharges to natural and man-made water bodies;
d. discharges to wastewater treatment plants; and
e. any other relevant means of disposal or treatment.

5. Environmental Permits and Compliance History. The Phase I Report shall include a history of all relevant local, state and federal environmental permits and oil and/or hazardous material storage permits issued for the disposal site or on-site facilities, including without limitation information on any permit violations. Relevant permits may include but are not limited to:
a. permits for M.G.L. c. 21E response actions;
b. oil and/or hazardous material storage permits;
c. wastewater discharge permits;
d. groundwater discharges permits;
e. air quality discharges permits;
f. wetlands alteration permits;
g. Resource Conservation and Recovery Act (RCRA) permits; and
h. National Pollution Discharge Elimination System (NPDES) permits.

6. Potentially Responsible Parties. The Phase I Report may include a list of the names and addresses of all Potentially Responsible Parties identified for the disposal site.

(d) Site Hydrogeological Characteristics. The Phase I Report shall include details of subsurface investigations conducted at the disposal site, together with a preliminary or generalized description and depiction of site hydrogeologic conditions, including, without limitation:

1. a concise description of all relevant geologic, hydrologic, geophysical and other subsurface investigations and assessments conducted to date at the disposal site;
2. documentation on boring advancement, well construction and well development, including copies of well drilling logs, within or appended to the Phase I Report;
3. a characterization of general site topography, including slope, presence of bedrock outcrops and surface drainage features;
4. a characterization of geologic and stratigraphic conditions, including:
a. soil type(s), stratigraphy and evidence of filling or waste disposal;
b. where appropriate, the known or estimated depths to, and description of, bedrock; and
5. a description and graphical depiction of groundwater flow direction or potentiometric surface elevations, indicating the location of monitoring wells.

(e) Nature and Extent of Contamination. The Phase I Report shall provide information on the nature and extent of contamination, as determined by Initial Site Investigation Activities and Preliminary Response Actions undertaken to date at the disposal site, including:

1. evidence of releases of oil and/or hazardous material to the environment including visual and olfactory evidence, results of field screening and laboratory analysis, and historical knowledge;
2. the names, concentrations, and volumes (if applicable) of all released oil and hazardous material detected to date at the disposal site:

40.0483: continued

a. volumes shall be reported in gallons, pounds, tons or cubic feet, as appropriate;
b. analytical results for each media sampled shall be summarized in the text and in tables in the body of the Phase I Report;
c. for the purpose of disposal site classification, maximum and minimum concentrations for each contaminant detected shall be identified in a summary table in the body of the Phase I Report;

3. laboratory data sheets, included in an appendix to the Phase I Report;
4. information and details on the approximate horizontal and vertical extent of contamination based on best available information, as obtained from site investigations of scope and detail commensurate with release and site conditions; and
5. information and details on NAPL, if present or suspected, including NAPL stability and the approximate horizontal and vertical extent of NAPL contamination, as obtained from site investigations of scope and detail commensurate with release and site conditions.

(f) Migration Pathways and Exposure Potential. The Phase I Report shall describe and evaluate known and potential contaminant migration pathways and exposure points, to the extent that such information is known, including:

1. evidence of and the potential for oil and/or hazardous material migration by one or more of the following pathways:
a. air;
b. soil;
c. groundwater;
d. soil gas;
e. preferential flow pathways such as subsurface utility lines and void spaces; and/or
f. surface water, including sediments;

2. a discussion of known and potential human exposure to oil and hazardous material present at the disposal site, by inhalation, dermal contact or ingestion of contaminants; and
3. a discussion of known and potential impacts of oil and hazardous material present at the disposal site to environmental receptors, with special attention given to the natural resource areas referenced in 310 CMR 40.0483(1)(a)8.c.

(g) Evaluation for Immediate Response Actions. The Phase I Report shall include an evaluation of the need to conduct an Immediate Response Action, as described in 310 CMR 40.0412.

(h) Conclusions. The Phase I Report shall include a Conclusions section containing a summary of findings and statement of conclusions with respect to the site, a preliminary Conceptual Site Model for the disposal site and the outcome of Initial Site Investigation Activities, as documented in the Phase I Report, and as described in 310 CMR 40.0486.

(2) In addition to the Phase I Report requirements set forth in 310 CMR 40.0483(1), such additional information as may be necessary to adequately and completely characterize a disposal site in accordance with the Response Action Performance Standard described in 310 CMR 40.0191, and/or as required by unique release, threat of release and/or site conditions, shall be provided in the Phase I Report. It may also be appropriate to eliminate certain information categories, or investigation or assessment elements from the Phase I Report, as may be consistent with unique release, threat of release and/or site conditions, by application of the Technical Justification standard set forth in 310 CMR 40.0193.

40.0484: Phase I Report Completion Statement

(1) All Phase I Reports submitted to the Department in support of a Permanent or Temporary Solution Statement, or as part of Tier Classification of a disposal site pursuant to 310 CMR 40.0500, shall be appended to the appropriate transmittal form established by the Department for such purposes.

(2) The Completion Statement form submitted with a Phase I Report shall include the following:
(a) an LSP Opinion as to whether the Phase I Report conforms with applicable requirements specified in 310 CMR 40.0480;

40.0840: Possible Outcomes

(1) The following outcomes are possible upon completion of a Phase II Comprehensive Site Assessment:

(a) Comprehensive Remedial Actions are necessary at the site to achieve a Permanent or Temporary Solution as described in 310 CMR 40.1000. A Phase III study for the identification, evaluation and selection of Comprehensive Remedial Action Alternatives as described in 310 CMR 40.0850 is necessary to select a remedial action alternative; or

(b) the requirements of a Permanent Solution under 310 CMR 40.1000 have been met, and a Permanent Solution Statement supported by information provided in the Phase II report shall be submitted to the Department.

40.0850: Phase III - Identification, Evaluation and Selection of Comprehensive Remedial Action Alternatives

310 CMR 40.0851 through 40.0869, cited collectively as 310 CMR 40.0850, contain the requirements and procedures for conducting Phase III Comprehensive Response Actions at disposal sites.

40.0852: General Provisions

(1) A Phase III evaluation shall be conducted for any disposal site for which a Phase II Comprehensive Site Assessment has been completed and a Permanent Solution in accordance with 310 CMR 40.1000 has not yet been achieved.

(2) A Phase III evaluation shall result in the selection of a remedial action alternative which is a likely Permanent Solution, except where it is demonstrated pursuant to 310 CMR 40.0850 that a Permanent Solution is not feasible or that the implementation of a Temporary Solution would be more cost-effective and timely than the implementation of a feasible Permanent Solution.

(3) Except for any Temporary Solution achieved after providing a Downgradient Property Status Submittal to the Department in accordance with 310 CMR 40.0180, a Phase III evaluation shall be conducted before any Temporary Solution pursuant to 310 CMR 40.1000 may be achieved at a disposal site.

(4) The feasibility of achieving or approaching background levels of oil and hazardous material shall be evaluated in accordance with 310 CMR 40.0860 for all disposal sites where remedial actions are or have been taken to achieve a Permanent Solution and background levels are not achieved.

(5) The results and conclusions of the Phase III evaluation shall be documented in a Remedial Action Plan, as described in 310 CMR 40.0861. Where appropriate, the Remedial Action Plan may be provided in or appended to the Phase II Comprehensive Site Assessment Report described in 310 CMR 40.0835.

40.0853: Performance Standards

(1) A Phase III evaluation shall result in:

(a) the identification and evaluation of remedial action alternatives which are reasonably likely to achieve a level of No Significant Risk considering the oil and hazardous material present, media contaminated, and site characteristics; and

(b) the recommendation of a remedial action alternative that is a Permanent or Temporary Solution, where a Permanent Solution includes measures that reduce, to the extent feasible, the concentrations of oil and hazardous material in the environment to levels that achieve or approach background.

40.0853: continued

(2) A Phase III Remedial Action Plan shall describe and document the information, reasoning and results used to identify and evaluate remedial action alternatives in sufficient detail to support the selection of the proposed remedial action alternative.

40.0855: Identification and Evaluation of Remedial Action Alternatives

(1) An identification and evaluation of remedial action alternatives shall be undertaken for all disposal sites where a Phase III evaluation is required.

(2) The identification and evaluation of remedial action alternatives shall include:
(a) an initial screening to identify those remedial action alternatives that are reasonably likely to be feasible and achieve a level of No Significant Risk; and, where necessary
(b) a detailed evaluation of the remedial action alternatives identified by the initial screening to ascertain which alternatives will meet the performance standards and requirements set forth in 310 CMR 40.0850, 40.0900 and 40.1000, and whether these alternatives constitute Permanent or Temporary Solutions.

(3) The identification and evaluation of remedial action alternatives:
(a) shall be based on information gathered and analyzed as part of previous assessment and remedial actions, and during the Phase III evaluation;
(b) may involve bench-scale tests or pilot studies as part of an evaluation of the effectiveness of an alternative; and
(c) may incorporate innovative technologies where appropriate.

40.0856: Initial Screening of Likely Remedial Action Alternatives

(1) An initial screening of remedial technologies shall be conducted to identify remedial action alternatives for further evaluation which are reasonably likely to be feasible, based on the oil and hazardous material present, media contaminated, and site characteristics. For the purposes of 310 CMR 40.0856, remedial action alternatives are reasonably likely to be feasible if:
(a) the technologies to be employed by the alternative are reasonably likely to achieve a Permanent or Temporary Solution; and
(b) individuals with the expertise needed to effectively implement available solutions would be available, regardless of arrangements for securing their services.

40.0857: Detailed Evaluation of Remedial Action Alternatives

(1) Except as provided in 310 CMR 40.0857(2), a detailed evaluation of the remedial action alternatives identified by the initial screening described in 310 CMR 40.0856 shall be conducted to provide the basis for the selection of the remedial action alternative. The detailed evaluation shall evaluate and compare different remedial alternatives using the criteria described in 310 CMR 40.0858.

(2) A detailed evaluation is not required in those cases where a remedial action alternative identified during the initial screening:
(a) is proven to be effective in remediating the types of oil and hazardous material present at the disposal site, based upon experience gained at other disposal sites with similar site and contaminant conditions;
(b) results in the reuse, recycling, destruction, detoxification, treatment or any combination thereof of the oil and hazardous material present at the disposal site;
(c) can be implemented in a manner that will not pose a significant risk of harm to health, safety, public welfare or the environment, as described in 310 CMR 40.0900; and
(d) is likely to result in the reduction and/or control of oil and/or hazardous material at the disposal site to a degree and in a manner such that the requirements of a Permanent Solution as set forth in 310 CMR 40.1000 will be met.

40.0858: Detailed Evaluation Criteria

Except as provided in 310 CMR 40.0857(2), the remedial action alternatives identified by the initial screening shall be evaluated using the following criteria:

40.0858: continued

(1) The comparative effectiveness of the alternatives in terms of:
(a) achieving a Permanent or Temporary Solution under 310 CMR 40.1000;
(b) reusing, recycling, destroying, detoxifying, or treating oil and hazardous material at the disposal site; and
(c) reducing levels of untreated oil and hazardous material at the site to concentrations that achieve or approach background.

(2) The comparative short-term and long-term reliability of the alternatives, including:
(a) the degree of certainty that the alternative will be successful; and
(b) the effectiveness of any measures required to manage residues or remaining wastes or control emissions or discharges to the environment.

(3) The comparative difficulty in implementing each alternative in terms of:
(a) technical complexity of the alternative;
(b) where applicable, the integration of the alternative with existing facility operations and other current or potential remedial actions;
(c) any necessary monitoring, operations, maintenance or site access requirements or limitations;
(d) the availability of necessary services, materials, equipment, or specialists;
(e) the availability, capacity and location of necessary off-site treatment, storage and disposal facilities; and
(f) whether the alternative meets regulatory requirements for any likely approvals, permits or licenses required by the Department, or other state, federal or local agencies.

(4) The comparative costs of the alternatives, including:
(a) costs of implementing the alternative, including without limitation: design, construction, equipment, site preparation, labor, permits, disposal, operation, maintenance and monitoring costs;
(b) costs of environmental restoration, potential damages to natural resources, including consideration of impacts to surface waters, wetlands, wildlife, fish and shellfish habitat; and
(c) the relative total consumption of energy resources in the implementation and operation of the alternatives, and externalities associated with the use of those resources, including greenhouse gases and other air pollutants.

(5) The comparative risks of the alternatives including without limitation:
(a) the short-term on-site and off-site risks posed during implementation of the alternative associated with any excavation, transport, disposal, containment, construction, operation or maintenance activities, or discharges to the environment from remedial systems;
(b) on-site and off-site risks posed over the period of time required for the alternative to attain applicable remedial standards, including risks associated with ongoing transport, disposal, containment, operation or maintenance activities, or discharges from remedial systems; and
(c) the potential risk of harm to health, safety, public welfare or the environment posed to human or environmental receptors by any oil and/or hazardous material remaining at the disposal site after the completion of the remedial action.

(6) The comparative benefits of the alternatives including without limitation:
(a) the benefit of restoring natural resources;
(b) providing for the productive reuse of the site;
(c) the avoided costs of relocating people,
businesses, or providing alternative water supplies; and
(d) the avoided lost value of the site.

(7) The comparative timeliness of the alternatives in terms of eliminating any uncontrolled sources of oil and/or hazardous material and achieving of a level of No Significant Risk as described in 310 CMR 40.0900.

(8) The relative effect of the alternatives upon non-pecuniary interests, such as aesthetic values.

40.0859: Selection of Remedial Action Alternative

(1) Except as provided in 310 CMR 40.0857(2), remedial action alternatives shall be selected based on the detailed evaluation criteria contained in 310 CMR 40.0858 and in compliance with the provisions set forth in 310 CMR 40.0850, 40.0900 and 40.1000.

(2) A remedial action alternative which is a Permanent Solution shall be selected if a feasible Permanent Solution has been identified and its implementation is found to be more cost-effective and timely than would be the implementation of a Temporary Solution. If there is no such feasible Permanent Solution, a Temporary Solution for the elimination of substantial hazard shall be selected and implemented and a plan shall be prepared pursuant to 310 40.0861(2)(h) for the identification and development of a Permanent Solution.

(3) Any selected Permanent Solution shall, to the extent feasible, reduce the concentrations of oil and hazardous material in the environment to levels that achieve or approach background.

(4) An Engineered Barrier, cap or other remedial action alternative that relies upon on-site disposal, isolation, or containment of oil and/or hazardous material shall not be selected unless and until a Phase III evaluation performed pursuant to the provisions of 310 CMR 40.0850 demonstrates the lack of a feasible alternative.

40.0860: Feasibility Evaluations

(1) The criteria described in 310 CMR 40.0860 apply to:
(a) evaluating the feasibility of implementing a Permanent Solution;
(b) evaluating the feasibility of reducing the concentrations of oil and hazardous material in the environment to levels that achieve or approach Background;
(c) evaluating the feasibility of reducing the concentrations of oil and hazardous material in soil at a disposal site to levels at or below applicable soil Upper Concentrations Limits;
(d) evaluating the feasibility of eliminating, preventing or mitigating Critical Exposure Pathway(s); and
(e) evaluating the feasibility of eliminating or controlling each Source of OHM Contamination, controlling migration of OHM, and removing NAPL at a disposal site in support of a Permanent or Temporary Solution pursuant to 310 CMR 40.1003(5) through (7), respectively.

(2) An evaluation of the feasibility of implementing a Permanent Solution shall be performed in all cases where the selected Comprehensive Remedial Alternative will achieve a Temporary Solution.

(3) An evaluation of the feasibility of reducing the concentrations of oil and hazardous material in the environment at the disposal site or a portion of the disposal site to levels that achieve or approach Background shall be conducted in all cases where the Comprehensive Remedial Alternative is selected to achieve a Permanent Solution, unless the Permanent Solution selected is designed to achieve and achieves Background.

(4) An evaluation of the feasibility of reducing the concentrations of oil and hazardous material in soil at the disposal site to levels at or below the applicable soil Upper Concentration Limits shall be conducted before a Comprehensive Remedial Alternative is selected as a Permanent Solution that would leave oil and/or hazardous material in soil at concentrations above the soil Upper Concentration Limits at a depth greater than 15 feet below the ground surface or beneath an engineered barrier, as that term is defined in 310 CMR 40.0996.

(5) A Comprehensive Remedial Alternative that would achieve a Permanent Solution and other response actions listed in 310 CMR 40.0860(1) shall be considered feasible unless:
(a) the alternative is not technologically feasible, as specified in 310 CMR 40.0860(6);
(b) the costs of conducting, or the risks resulting from the alternative would not be justified by the benefits, considering such factors as potential damage to human health or the environment, cost of environmental restoration, long term operation and maintenance costs, and non-pecuniary values as determined by the benefit-cost analysis in 310 CMR 40.0860(7);

40.0860: continued

(c) individuals with the expertise needed to effectively implement the alternative would not be available, regardless of arrangements for securing their services;
(d) the alternative would necessitate land disposal other than at the site itself and no off-site facility is available in the Commonwealth or in other states that is in full compliance with all applicable federal and state regulatory requirements; or
(e) an alternative is selected for a portion of a disposal site for which the source of the oil and/or hazardous material is not located thereon, and the elimination or control of such source cannot currently be achieved by the party conducting the response actions at that portion of the disposal site. In such instances, a Temporary Solution shall be implemented for that portion of the disposal site to which the selected alternative applies.

(6) Technological Feasibility. A Comprehensive Remedial Alternative and other response actions listed in 310 CMR 40.0860(1) shall be considered technologically feasible unless:
(a) existing technology or reasonable modifications of existing technology cannot remediate the oil and hazardous material present at the disposal site to the extent necessary to attain a level of No Significant Risk or, when required to be considered, to levels that approach or achieve Background;
(b) the reliability of the identified alternative has not been sufficiently proven at other sites or through pilot tests and a substantial uncertainty exists as to whether it will effectively reduce risk; or
(c) the identified alternative cannot comply with or be modified to comply with applicable regulatory requirements.

(7) Benefit-cost Analysis. The benefits of implementing Comprehensive Remedial Alternatives to achieve a Permanent Solution or Temporary Solution or of implementing other response actions listed in 310 CMR 40.0860(1) shall justify the related costs unless:
(a) the incremental cost of conducting the Comprehensive Remedial Alternative or other response action is substantial and disproportionate to the incremental benefit of risk reduction, environmental restoration, and monetary and non-pecuniary values;
(b) the risk of harm to health, safety, public welfare or the environment posed by the implementation of the alternative cannot be adequately controlled; or
(c) the alternative would destroy more than 5000 square feet of wetlands or wildlife habitat, or would otherwise result in a substantial deleterious impact to the environment and:
1. other feasible Temporary or Permanent Solutions exist;
2. the oil and/or hazardous materials, if any, that have come to be located in such resources do not bio-accumulate and are not likely to migrate; and
3. the damage to such resources resulting from the implementation of the alternative would be permanent and irreparable.

40.0861: Remedial Action Plan

(1) The results of a Phase III evaluation shall be documented in a Remedial Action Plan. The Remedial Action Plan shall support the selection of the Comprehensive Remedial Alternative by providing information of sufficient detail on the process by which the recommended Comprehensive Remedial Alternative was developed and evaluated.

(2) A Remedial Action Plan shall contain:
(a) a description of all remedial alternatives initially identified and the results of the initial screening;
(b) where a detailed evaluation is required, a discussion of how the remedial alternatives remaining after initial screening compared with respect to each of the detailed criteria described in 310 CMR 40.0858, and how the criteria were weighted in the evaluation;
(c) justification for the selection of the proposed Comprehensive Remedial Alternative with respect to its anticipated effectiveness and relative to all other evaluated alternatives, including a discussion of the results of any bench-scale tests or pilot studies performed as part of an evaluation of the effectiveness of an alternative;
(d) where required, the results of the evaluation under 310 CMR 40.0860 of whether the implementation of a Permanent or Temporary Solution is feasible;

40.0861: continued

(e) if a Permanent Solution is selected as the Comprehensive Remedial Alternative, a discussion of how the alternative is likely to achieve a level of No Significant Risk and the projected timeframe, based on available information, for meeting the requirements for a Permanent Solution as specified in 310 CMR 40.1000;
(f) if a Temporary Solution is selected as the Comprehensive Remedial Alternative, a discussion of how the alternative is likely to eliminate any substantial hazards posed by the disposal site until a Permanent Solution is implemented and a plan and projected timeframe, based on available information, for meeting and maintaining the requirements for a Temp-orary Solution as specified in 310 CMR 40.1000;
(g) if a Permanent Solution is selected, the results of the evaluation under 310 CMR 40.0860 of the feasibility of reducing the concentrations of oil and hazardous material in the environment at the disposal site to levels that achieve or approach background, unless the Remedial Action Plan otherwise includes a demonstration that the selected alternative is designed to achieve background;
(h) if the selected Comprehensive Remedial Alternative is a Temporary Solution and a Permanent Solution is not currently feasible, except for those Temporary Solutions achieved after a Downgradient Property Status Submittal has been provided to the Department in accordance with 310 CMR 40.0180, a detailed description of definitive and enterprising steps pursuant to 310 CMR 40.1051 to identify and develop an alternative that is a likely Permanent Solution and a schedule for the implementation of such steps. Such steps may include, but are not limited to:
1. performing pilot tests or bench-scale studies;
2. investigating innovative ways to reduce the costs or the risks of implementing a specific alternative; and
3. developing new technologies; and

(i) a projected schedule for implementation of Phase IV activities, if applicable, pursuant to 310 CMR 40.0870 consistent with the projected timeframe for achievement of a Permanent or Temporary Solution pursuant to 310 CMR 40.0861(2)(e) or (f), as applicable.

40.0862: Phase III Completion Statement

(1) A Phase III Completion Statement form, established by the Department for such purposes, shall be appended to and submitted with the Remedial Action Plan to the Department.

(2) In cases where the Phase III Remedial Action Plan is combined with other Comprehensive Response Action Reports, a Completion Statement form for the combined Reports shall be appended to the documents and submitted to the Department.

(3) A Completion Statement submitted with a Phase III Report shall include the following:
(a) an Opinion from a Licensed Site Professional indicating whether the selected Comprehensive Remedial Alternative is likely to achieve a Permanent or Temporary Solution, and stating that the Phase III conforms with applicable Phase III performance standards and requirements and any approval conditions specified by the Department; and
(b) a certification of the submittal required by 310 CMR 40.0009.

40.0863: Public Involvement

(1) Public Involvement Activities shall be conducted in accordance with 310 CMR 40.1400 through 40.1406. Public Involvement Activities relevant to Phase III specifically include, but are not limited to, those activities set forth in 310 CMR 40.1403(3)(e).

(2) If the disposal site where the Phase III is conducted is a Public Involvement Plan site, then a Public Involvement Plan that is consistent with 310 CMR 40.1405 shall be implemented.

40.0864: Possible Outcome

Upon completion of Phase III, the selected feasible Comprehensive Remedial Alternative shall be developed and implemented pursuant to Phase IV requirements under 310 CMR 40.0870.