

**CONCEPT PAPER**

**TOPICAL SUBCOMMITTEE 7:  
LEP-Implemented, Risk-Based Alternative Cleanup Standards**

**April 4, 2022**

## TABLE OF CONTENTS

	<u>PAGE</u>
<a href="#"><u>GOALS AND ACKNOWLEDGEMENTS</u></a> .....	iii
<a href="#"><u>ACRONYMS</u></a> .....	iv
<a href="#"><u>1. INTRODUCTION</u></a> .....	1
<a href="#"><u>2. DISCUSSION ITEMS</u></a> .....	3
<a href="#"><u>3. REQUIREMENTS AND GOALS</u></a> .....	4
<a href="#"><u>4. APPROACH TO DEVELOPING ALTERNATIVE RISK-BASED CLEANUP STANDARDS</u></a> .....	5
<a href="#"><u>4.1. Summary of Current Connecticut Risk Assessment Process</u></a> .....	5
<a href="#"><u>4.2 Summary of Pennsylvania Act 2 Toxicological-Based Criteria</u></a> .....	7
<a href="#"><u>4.3. Massachusetts Risk-Based Process</u></a> .....	9
<a href="#"><u>4.4. USEPA/CERCLA Risk Assessment Process</u></a> .....	9
<a href="#"><u>4.5. Human Health Risk Assessment</u></a> .....	10
<a href="#"><u>4.6. Ecological Risk Assessment Considerations</u></a> .....	11
<a href="#"><u>5. FACTORS FOR DEVELOPMENT OF RISK-BASED ALTERNATIVE CLEANUP STANDARDS</u></a> .....	14
<a href="#"><u>5.1. Current Areas of RSRs Allowing LEP Self-Implementing Approval</u></a> .....	14
<a href="#"><u>5.2. Increasing LEP Implementability for Current Alternatives Provided of the RSRs</u></a> .....	15
<a href="#"><u>5.3. Future RSRs – Additional LEP/Commissioner Approval Options</u></a> .....	17
<a href="#"><u>5.4. Threshold Factors and Exemptions to Developing Risk-Based Alternative Cleanup Standards</u></a> .....	20
<a href="#"><u>5.5. Qualifications for Developing Alternative Risk-based Cleanup Standards</u></a> .....	21
<a href="#"><u>6. SUMMARY</u></a> .....	24

ATTACHMENT 1: *Existing Alternatives in the RSRs that Could Be Considered for Increased LEP Implementation*

ATTACHMENT 2: *MassDEP User Guide for the Method 3 Shortforms and Example of a Completed Shortform for Residential Exposure to a Petroleum Release*

## Goals and Acknowledgements

This concept paper was prepared by *Topical Subcommittee 7 – LEP Implemented, Risk-Based Alternative Cleanup Standards*. The Subcommittee was created to assist the Release-Based Working Group by providing advice and perspective on the subject of providing flexibility for licensed environmental professionals (LEPs) to establish and implement risk-based alternative cleanup standards under a release-based cleanup program in accordance with Section 19(f) of Public Act 20-9. 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(b) 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.

Subcommittee 7 is composed of a variety of stakeholders in the environmental community, including 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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## Acronyms

AOCs	Areas of Concern
APS	Additional Polluting Substances
BRRP	Brownfields Remediation and Revitalization Program
CFR	Code of Federal Regulations
CSM	Conceptual Site Model(ling)
DEC	Direct Exposure Criteria
DECD	Department of Economic and Community Development
DEEP	Department of Energy and Environmental Protection
DOT	Department of Transportation
DPH	Department of Public Health
ELCR	Excess Lifetime Cancer Risk
EPA	Environmental Protection Agency
EUR	Environmental Use Restriction
GWPC	Groundwater Protection Criteria
HI	Hazard Index
LEP	Licensed Environmental Professional
LSP	Licensed Site Professional
MassDEP	Massachusetts Department of Environmental Protection
MCP	Massachusetts Contingency Plan
MSC	Medium Specific Concentrations
PCBS	Polychlorinated Biphenyls
PFAS	Per- and Polyfluoroalkyl Substances
PMC	Pollutant Mobility Criteria
PRGs	Preliminary Remediation Goals
RAL	Remedial Action Level
RCRA	Resource Conservation and Recovery Act
RSRs	Remediation Standard Regulations
SMCLs	Secondary Maximum Contaminant Levels
SWPC	Surface Water Protection Criteria
UCLs	Upper Concentration Limits

## UNITS

µg/g	Micrograms per gram
µg/L	Micrograms per liter

## **1. Introduction**

This concept paper was prepared by *Topical Subcommittee 7 – LEP Implemented, Risk-Based Alternate Cleanup Standards*. The Subcommittee was created to assist the Release-Based Working Group by providing advice and perspective on the subject of providing flexibility for licensed environmental professionals (LEPs) to establish and implement risk-based alternative cleanup standards under a release-based cleanup program in accordance with Section 19(f) of Public Act 20-9. 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(b) of Public Act 20-9 to gather information and advice from multiple stakeholders, and subsequently provide feedback to the DEEP with respect to the development of regulations creating a release-based cleanup program for the State of Connecticut.

Previously, five subcommittees were organized and completed their evaluation and provided recommendations on the following aspects of the release-based program: Discovery of Historical Releases [Subcommittee 1], Reporting of Historical Releases [Subcommittee 2], Characterization of a Discovered Release [Subcommittee 3], Immediate Removal Actions [Subcommittee 4], and Tiers [Subcommittee 5]. These subcommittees provided summary concept papers in June 2021 known as the first-phase topics. Currently, three additional subcommittees were formed (second-phase topics) and include Modification of Clean-up Standards for Lower-Risk Releases [Subcommittee 6], LEP-implemented, Risk-Based Alternative Cleanup Standards [Subcommittee 7], and Clean-up Completion Documentation, Verifications, and Audit Frequency and Timeframes [Subcommittee 8].

The Working Group will consider the information provided in this concept paper, as well as the other concept papers prepared by all the first-phase and second-phase topical subcommittees. 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 7 during weekly meetings over a period of over four months beginning in December 2021. During the course of the Subcommittee meetings, numerous topics or issues related to LEP-implemented, risk-based alternatives 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 7 consider and provide opinions on several risk-based alternative questions and issues. The specific questions and topics the Working Group requested that Subcommittee 7 address are presented in Section 2 of this concept paper. In addition to the specific concerns identified by the Working Group, Subcommittee 7 also discussed a number of risk-based methods and factors that they believed were important to include in the concept paper to provide a more comprehensive view of the concept of LEP-implemented risk-based alternatives 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 7 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 requirements and goals that the Subcommittee considered and followed in creating this concept document are presented in Section 3.

## 1.2 Document Organization

This concept paper is organized to provide an overview of the primary considerations related to LEP-implemented, risk-based alternatives that were identified during the weekly Subcommittee 7 meetings, with additional information on specific topics is intended to illustrate the various elements in the risk-based process that would be relevant to an LEP-implemented risk assessment under a release-based program. The concept paper prepared by Subcommittee 7 is divided into the following sections.

- Section 2 – Subcommittee 7 Discussion Items
- Section 3 – Requirements and Goals
- Section 4 – Approach to Developing Alternative Risk-Based Cleanup Standards
- Section 5 – Factors for Development of Risk-Based Alternative Cleanup Standards
- Section 6 – Summary

**Attachments** to the concept paper provide greater detail and additional comments on topics related to LEP-implemented, risk-based alternatives. Specific topics addressed in each attachment are:

- Attachment 1: Existing Alternatives in the RSRs that Could Be Considered for Increased LEP Implementation
- Attachment 2: MassDEP User Guide for the Method 3 Shortforms and Example of a Completed Shortform for Residential Exposure to a Petroleum Release.

## 2. Discussion Items

In creating the second-phase topical subcommittees that began meeting in December 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 concerns related to LEP implemented, risk-based alternatives were posed by the Release-Based Working Group for Subcommittee 7's evaluation. DEEP's charge and questions for Subcommittee 7 are identified below. The sections of the document that reference that charge and associated questions are indicated in parentheses, wherever applicable.

- How do the statutory factors (site use, exposure assumptions, geologic and hydrogeologic conditions and physical and chemical properties of each substance that comprise a release) control applicability of risk-based approach? (Section 5)
- Should there be threshold factors (i.e., site conditions, proximity to receptors, depth to groundwater, soil type) that will permit or exclude use of certain calculated alternative standards? (Section 5.3)
- Which inputs for calculating alternative standards can be modified, using what information, and in what instances? (Section 5.3)
- What are contaminant thresholds that cannot be exceeded (ceiling values) (Section 5.4)
- Will alternative standards be allowed for all contaminants? Are any off-limits (polychlorinated biphenyls [PCBs], per and poly-fluoroalkyl substances [PFAS] and other emerging contaminants)? (Section 5.4)
- Are there instances where LEPs cannot independently implement such alternatives? Is this specialized group with particular qualifications? (Section 5.5)
- What are scenarios and thresholds where alternate cleanup levels can be developed as part of site closure? Are any contaminants off limits (e.g., PCBs, emergent contaminants)? (Section 5)

Upon initiation of the release-based program, the DEEP will be required to focus its resources on releases that pose the greatest risk to human health and the environment. As such, the release-based regulations will need to accommodate additional methods and scenarios for use of alternate standards that would be implemented by LEPs. Therefore, the primary objective of Subcommittee 7 was to evaluate under what circumstances, and with what justification, LEP-implemented alternative criteria can be used. The above primary questions and concerns have been evaluated and addressed in subsequent sections of this concept paper.

### 3. Requirements and Goals

In preparing this concept paper, Subcommittee 7 considered many issues and factors that would need to be addressed in order to allow LEPs to develop site-specific, risk-based alternative cleanup standards. The listed goals, or in some cases, general statements, are presented below in no particular order of importance. Specifically, alternative cleanup standards should be:

- Implementable
- Scientifically valid
- Trusted by the Public, the DEEP, and the regulated community
- Protective of current and future risk scenarios
- Consistent with “CT Antidegradation Standards and Policies (§ 22a-426-8)”

These overall goals and general statements served as a context for Subcommittee 7 discussions and were used to evaluate the questions and concerns and qualify the conclusions and recommendations presented in this concept paper. Also acknowledged in developing the above goals is that, in some cases, an LEP would be required to rely on another individual with risk assessment expertise or a specialty subcontractor to develop alternative risk-based cleanup standards. This is further supported by the LEP regulations regarding professional competency (22a-133v-6(c)(2)) which allow LEPs to rely on other qualified professionals if they are addressing topics outside their area of expertise.

Subcommittee 7 also considered the January 11, 2022 memo from the Department entitled, *Second Phase Subcommittees and Massachusetts Method 3 Risk Characterization*, that discussed DEEP’s reservations about adopting an approach similar to that of the Massachusetts Method 3 risk characterization. The Department’s specific concerns related to Method 3 risk assessment are that 1) a Method 3-like approach would require an entirely new class of professionals (i.e., risk assessors) in addition to LEPs, 2) assessment of toxicology and cancer risk are not allowed under the enabling statutes, 3) the approval of release-specific cleanup criteria derived from a risk assessment must be performed by the Connecticut Department of Public Health (DPH) and therefore cannot be delegated to an LEP by DEEP, and 4) a Method 3-like approach is not necessary for the success of a release-based program. With limited exceptions, the recommendations presented in this concept paper are within the boundaries of the January 11, 2022 memo. The subcommittee had mixed views on whether a Method 3-type risk assessment should be included in the new release-based program, with some supportive of allowing a Method 3 approach, while others were not comfortable with allowing that additional flexibility.



#### **4. Approach to Developing Alternative Risk-Based Cleanup Standards**

This section provides a summary of the current risk assessment process in Connecticut and by comparison, what is allowed in select other states. The purpose is to provide the Working Group with an awareness of what alternative methods have been approved and currently exist in other states and should be evaluated when deciding on specific risk assessment approaches that could be used in the future in Connecticut.

The following subsections provide a summary of human health risk assessment processes and ecological risk assessment considerations.

##### **4.1. Summary of Current Connecticut Risk Assessment Process**

Connecticut allows LEPs to verify that the remediation of certain releases conforms to the Connecticut Remediation Standard Regulations (RSRs), which contain default remediation standards that are implemented directly by the LEP without requiring prior approval by the State. For simple releases with common constituents of concern, this process has historically worked well. The RSRs also establish clear lines demarcating LEP vs. DEEP approval authority.

Pre-set exposure scenarios established in the RSRs include drinking water consumption, vapor inhalation in residential and commercial settings, dermal exposure in residential and commercial settings, and ecological exposure via plume discharge to surface water bodies. Each exposure scenario (and default risk-based remediation criteria) includes implicit and explicit exposure assumptions, few of which are open for re-evaluation by the LEP. This allows for a relatively straight-forward application of the remediation standards for most simple releases of common substances. When they are allowed, LEP-implemented alternatives in the RSRs are generally clear and easy to apply but are relatively restrictive in scope.

The result of having a small number of pre-set exposure scenarios is that the scenarios tend to be overly protective by limiting future use scenarios and the suite of variables that can be adjusted without allowing LEPs to consider site-specific variables. For example, all sites must use residential or commercial exposure scenarios that are based on the most conservative scenarios for these two categories.

In addition, the RSRs are administratively burdensome by requiring Commissioner approval for too many low-risk, highly prescriptive options and are not responsive to technological and toxicological advances.

In Connecticut, the DPH is responsible for the completion of “*risk assessment*” as codified in Connecticut General Statutes Title § 22a-1i. Specifically, the statute states:

“(b) The Department of Public Health shall be the lead agency responsible for the risk assessment of human health regarding toxic substances identified in all environmental media, including, but not limited to, food, drinking water, soil and air.

(c) Risk assessments shall be conducted or reviewed by the Department of Public Health after the need for such risk assessments has been established by the state agency responsible for regulation of the given contamination. Such decisions on the need for risk assessments shall be made in consultation with the Department of Public Health. Nothing contained in this section

shall hinder or dictate the authority of any state agency to decide when a risk assessment is required.”

This Statute defines risk assessment as:

“the use of various databases to estimate the human health effects of exposure of individuals or populations to various hazardous substances and situations. The risk assessment process includes, but is not limited to, hazard identification, dose response assessment, exposure assessment and risk characterization. Risk assessment shall not include normal day-to-day activities conducted by state agencies mandated under federal or state laws or regulations. Specifically, activities such as environmental permitting shall not be considered to constitute a risk assessment activity, unless otherwise defined as such in state or federal regulation.”

Based on this statutory obligation, the DEEP has worked with the DPH on many aspects of risk assessment associated with the investigation and remediation of releases of pollutants. Examples of some of these items include:

- Development of baseline (i.e., method 1) cleanup criteria as part of the original RSRs promulgated in 1996.
- Development of draft proposed volatilization criteria in 2003.
- Review and approval of additional polluting substance requests submitted to the DEEP commissioner since the effective date of the RSRs in 1996.
- Development of the “fast track” form process for additional polluting substances.
- Development of Technical Guidance on trichloroethylene and its potential for developmental risks in 2015.
- Development of preliminary drinking water action levels for Per- and Polyfluoroalkyl Substances (PFAS) in 2016.
- Review and assistance with the Wave II RSR revisions that became effective in 2021.

Regarding release-specific risk assessment, the RSRs do permit the regulated community to submit a request for a release-specific risk assessment for Commissioner approval as an alternative to complying with the baseline direct exposure criteria (DEC). This alternative is found at Section 22a-133k-2(d)(2) of the RSRs which states:

(2) Commissioner Approval of Alternative Release-Specific Direct Exposure Criteria

With respect to a substance, except PCBs, for which direct exposure criteria are specified in Appendix A of the RSRs or approved in writing by the commissioner pursuant to subsection (b)(7) of this section, the commissioner may approve or deny in writing a request for an alternative release-specific direct exposure criteria or an alternative method for determining compliance with such criteria.

(A) For substances in soil at a release area, no request shall be approved unless it is demonstrated to the commissioner's satisfaction that:

(i) The application of such alternative direct exposure criteria or method of compliance will protect human health and the environment from the risks associated with direct exposure to polluted soil;

(ii) The concentration of each carcinogenic substance in such soil is equal to or less than a  $1 \times 10^{-6}$  excess lifetime cancer risk level and the concentration of each non-carcinogenic substance in such soil does not exceed a hazard index of 1;

(iii) For a release area polluted with ten (10) or more carcinogenic substances, the cumulative excess lifetime cancer risk for all carcinogenic substances in such soil with the same target organ is equal to or less than  $1 \times 10^{-5}$ ; and

(iv) For a release area polluted with ten (10) or more non-carcinogenic substances, the cumulative hazard index is equal to or less than 1 for non-carcinogenic substances in such soil with the same target organ.

(B) A request for approval of direct exposure criteria or method of compliance shall include a risk assessment prepared in accordance with the most recent EPA Risk Assessment Guidance for Superfund, or other risk assessment method approved by the commissioner.

(C) Any approval of the commissioner under this subdivision may require that an EUR is or will be in effect for the subject area, which restriction shall require compliance with any conditions specified by the commissioner when issuing such approval.

Although this section has been present in the RSRs since they were first promulgated in 1996, we understand that it has only been used sparingly, if at all, with the primary obstacle being long and costly reviews.

In summary, the DPH and DEEP have a long track record of working together on risk assessment for the development of state-wide default, numeric (method 1-style) cleanup criteria and in more limited instances for site-specific additional polluting substance requests. To date, wider spread implementation of a cumulative, release- or site-specific-based risk assessment program has not been implemented.

#### **4.2. Summary of Pennsylvania Act 2 Toxicological-Based Criteria**

In 1995, Pennsylvania passed the Land Recycling and Environmental Remediation Standards Act (known as Act 2) that established guidelines for remediation or cleanup standards. The standards allow three possible cleanup levels: (1) background, (2) statewide health standards, and (3) site-specific standards. The standards apply to most voluntary and all mandatory cleanups in Pennsylvania.

The Background Standard allows developers to clean a property to the concentration of a contaminant present at the site but not related to a release of that contaminant from the site (i.e. the background level). Pennsylvania does not require a deed notice or restriction when developers clean to this reduced standard.

The Statewide Health standard is a risk-based standard. Pennsylvania, like Connecticut, requires developers that remediate to industrial levels to file a deed restriction.

Pennsylvania allows developers to request cleanup to a Site-Specific Standard for a proposed site; these standards must be based on a site-specific risk assessment and must satisfy a health risk criterion for all carcinogenic contaminants. The risk is somewhat lower than the general risk standard used by the federal EPA and by DEEP.

On November 20, 2021, revisions to the regulations found at 25 Pa. Code Chapter 250, Administration of the Land Recycling Program (Act 2 cleanup standards), became effective. The Medium Specific Concentrations (MSC) have been updated to incorporate new toxicological information on about 400 chemical substances. The following tables have been established:

- Table 1 - Medium Specific Concentrations (MSCs) for Organic Regulated Substances in Groundwater
- Table 2 - MSCs for Inorganic Substances in Groundwater
- Table 3a - MSCs for Organic Regulated Substances in Soil: Direct Contact Values
- Table 3b - MSCs for Organic Regulated Substances in Soil: Soil-to-Groundwater Values
- Table 4a - MSCs for Inorganic Regulated Substances in Soil: Direct Contact Values
- Table 4b - MSCs for Inorganic Regulated Substances in Soil: Soil-to-Groundwater Values
- Table 5a - Physical and Toxicological Properties: Organic Regulated Substances
- Table 5b - Physical and Toxicological Properties: Inorganic Regulated Substances
- Table 6 - Threshold of Regulation Compounds
- Table 7 - Default Values for Calculating Medium-Specific Concentrations for Lead
- Table 8 - Constituents of Potential Ecological Concern

To select a standard to use on a site, a site assessment is needed to determine site conditions that may require remediation of a release. Characterization of a release includes the identification of specific contaminant concentrations throughout soil and groundwater media, discharges to surface water and air, and any other conditions that may pose a risk to human health and the environment associated with the release.

These regulations were established to facilitate clean-up of “Brownfields” sites, but have been broadly applied to address other locations. In some cases, it has not been necessary to remediate to background conditions, which may allow degradation of groundwater quality. In other cases, concentrations of compounds that are not constituents of concern may be detected and result in unanticipated remediation activities.

#### 4.3. Massachusetts Risk-Based Process

The Massachusetts approach to evaluating risks posed to human health, public welfare and the environment posed by residual impact in the environment is accomplished through one of three risk characterization methods included in the Massachusetts Contingency Plan (MCP). The most used method, referred to as Method 1 Risk Characterization, consists of comparing concentrations in soil and groundwater to published values in the MCP. This approach is similar to the RSR process without the use of alternatives. According to information provided by staff at the Massachusetts Department of Environmental Protection (MassDEP) Method 1 risk assessments are used for approximately 75% of the releases for which a risk characterization is required. The other two methods, Method 2 and Method 3 are used on approximately 3% and 22% of the releases requiring a risk characterization, respectively. The Method 2 risk characterization, which includes using site-specific data to develop alternative criteria similar to Method 1 criteria and to develop criteria for compounds that do not have a Method 1 criteria and is most similar to the alternatives allowed and contemplated for the RSRs. The Method 3 process includes an evaluation of cumulative risks to human health via the exposure scenarios identified to currently exist and are anticipated to exist in the future. The Method 3 process also includes an evaluation of potential risks to the environment and to public welfare.

Overall, Massachusetts provides more opportunity to evaluate and characterize risk to human health and the environment in comparison to the RSRs. More methods are available to characterize risk, and potential exposure to human receptors is evaluated via more scenarios than are available under the RSRs. Some challenges associated with the Massachusetts program include:

- Several of the Upper Concentration Limits (UCLs) used to evaluate the potential risk to public welfare are arbitrary and not tied to risk or non-risk factors;
- The comprehensive risk characterization method does not require the evaluation of the potential for contamination in soil to migrate into groundwater under future site conditions.

#### 4.4. USEPA/CERCLA Risk Assessment Process

For federal remediation projects, a risk assessor is often called upon to help plan a remedial action at a site. The goal of all such actions is to ensure that the residual risks that remain at the site after cleanup will be within some specified limit of acceptability. Thus, the first step in the process is for the risk manager to specify the maximum level of residual risk that will be considered acceptable. Based on this, the risk assessor can then solve the basic risk equations to find the concentration of a chemical that corresponds to the specified "target risk." Concentration values derived in this way are thus referred to as preliminary remediation goal (PRGs).

The PRG is the average concentration of a chemical in an exposure area that will yield the specified target risk in an individual who is exposed at random within the exposure area.

A key concept is that a PRG is the *average* concentration of a chemical in an exposure area that will yield the specified target risk in an individual who is exposed at random within the exposure area. Thus, if an exposure area has an average concentration above the PRG, some level of remediation is needed.

However, it is *not* necessary that all concentration values above the PRG be remediated. Rather, all that is required is that the average concentration be reduced to the PRG or below. Thus, some concentrations may remain that are above the PRG. The concentration value that is to be removed in order to reduce the mean to the PRG or below is often referred to as the remedial action level (RAL). It is important not to confuse the nature and purpose of PRG and RAL values.

#### **4.5. Human Health Risk Assessment**

A human health risk assessment is the process to estimate the nature and probability of adverse health effects in humans who may be exposed to chemicals in contaminated environmental media, now or in the future. A human health risk assessment includes four steps after the planning step:

- **Planning - Planning and Scoping Process**

EPA begins a human health risk assessment by planning the overall approach with dialogue between the risk manager(s), risk assessor(s), and other interested parties or stakeholders. Members of the team:

- identify risk management goals and options;
- identify the natural resources of concern;
- reach agreement on scope and complexity of the assessment; and
- decide on team member roles.

- **Step 1 - Hazard Identification**

The risk assessor(s) examine whether a stressor has the potential to cause harm to humans and/or ecological systems, and if so, under what circumstances.

- **Step 2 - Dose-Response Assessment**

The risk assessor(s) gather information to determine the numerical relationship between exposure and effects (generally identifying toxicity factors and cancer slope factors that will be used in risk calculations).

- **Step 3 - Exposure Assessment**

Once steps 1 & 2 are identified, the risk assessor(s) examine what is known about the frequency, timing, and levels of contact with the stressor. Exposure assessment is the process of measuring or estimating the magnitude, frequency, and duration of human exposure to an agent in the environment, or estimating future exposures (i.e., developing exposure assumptions).

- **Step 4 - Risk Characterization**

Risk characterization includes two major components—risk estimation and risk description. This step is calculation of cancer and non-cancer risk and documentation of the risk assessment process.

"Risk estimation" compares:

- the estimated or measured exposure level for each stressor and plant or animal population, community, or ecosystem of concern; and
- the data on expected effects for that group for the exposure level.

"Risk description" provides information important for interpreting the risk results. This includes:

- whether harmful effects are expected on the plants and animals of concern;
- relevant qualitative comparisons; and
- how uncertainties (data gaps and natural variation) might affect the assessment.

#### **4.6. Ecological Risk Assessment Considerations**

An ecological risk assessment is the process for evaluating how likely it is that the environmental receptors (non-human) might be impacted as a result of exposure to one or more environmental stressors, such as chemicals, land-use change, disease, and invasive species. An ecological risk assessment includes three phases, but begins with planning:

- **Planning** - EPA begins an ecological risk assessment by planning the overall approach with dialogue between the risk manager(s), risk assessor(s), and other interested parties or stakeholders. Members of the team:
  - identify risk management goals and options;
  - identify the natural resources of concern;
  - reach agreement on scope and complexity of the assessment; and
  - decide on team member roles.
- **Phase 1 - Problem Formulation**

The risk assessor(s) gathers information to determine which plants and animals are or might be at risk and in need of protection. Based on the Planning results, they specify:

- the scope of the assessment in time and space;
- the environmental stressors of concern;
- the endpoints to be evaluated (e.g., continued existence of a fishery population, fish species diversity in lakes, sustainable forest habitat); and
- which measures, models, and type of data will be used to assess risks to those endpoints.

Problem formulation concludes with an Analysis Plan.

- **Phase 2 - Analysis**

Two components of the analysis phase are exposure and effects assessments. In the exposure assessment, the risk assessor determines which plants and animals are or are likely to be exposed to each environmental stressor and to what degree. In the effects assessment, the risk assessor reviews available research on the relationship between exposure level and possible adverse effects on plants and animals. They may also review evidence of existing harmful ecological effects.

- **Phase 3 - Risk Characterization**

Risk characterization includes two major components—risk estimation and risk description.

"Risk estimation" compares:

- the estimated or measured exposure level for each stressor and plant or animal population, community, or ecosystem of concern; and
- the data on expected effects for that group for the exposure level.

"Risk description" provides information important for interpreting the risk results. This includes:

- whether harmful effects are expected on the plants and animals of concern;
- relevant qualitative comparisons; and
- how uncertainties (data gaps and natural variation) might affect the assessment.

In Connecticut, the oversight and review of ecological risk assessment is not specifically specified by Statute and falls under the purview of the DEEP as one of their main objectives to protect human health and the environment. Connecticut's RSRs address the potential for ecological risk in two ways. First, the default, numeric Surface Water Protection Criteria (SWPC) for groundwater were established to protect aquatic organisms in surface water bodies and/or the consumption of organisms by humans. Second, the RSRs provide a requirement which addresses ecological risk in the *Additional Remediation of Polluted Soil* section of the RSRs (Section 22a-133k-2(i)(1)). Specifically, this section states:

"At any location at which, despite remediation in accordance with the RSRs, the commissioner determines that there is a potential ecological risk, the commissioner may require that an ecological risk assessment be conducted and that additional remediation be conducted to mitigate any risks identified in such assessment."

In practice, LEPs have the duty to, at all times, hold paramount the health, safety and welfare of the public and the environment, pursuant to their authorizing regulations (Section 22a-133v-6. Rules of Professional Conduct) and this duty has been interpreted to require that ecological risk be considered at all sites where a verification by an LEP is required. This interpretation has resulted in the DEEP requesting information pertaining to the completion of ecological risk assessments on all LEP verification forms. In addition, facilities subject to Resource Conservation and Recovery Act (RCRA) Corrective Action have federal obligations to address ecological risk and, in these scenarios, reviews and approvals of Ecological Risk Assessments are typically completed by USEPA or DEEP technical staff. At all other sites,



LEPs rely on ecological risk assessments performed by themselves, or others when determined to be necessary, to support the completion of a verification form, and DEEP has the authority to question the logic and conclusions of ecological risk assessment as part of the LEP verification audit process. Therefore, in practice, the completion of ecological risk assessment is LEP self-implemented and does not require regulatory approval unless a Site is subject to RCRA Corrective Action.

## **5. Factors for Development of Risk-Based Alternative Cleanup Standards**

Subcommittee 7 identified several issues or factors that they considered to be relevant with respect to developing a process by which LEPs could implement alternative cleanup standards while being protective of human health and the environment and demonstrating site closure. Each of these factors was the subject of considerable discussion during the Subcommittee meetings and provided a context for the Subcommittee recommendations for an LEP-implemented, risk-based process and alternative standards development under a release-based program.

### **5.1. Current Areas of RSRs Allowing LEP Self-Implementing Approval**

The Subcommittee's first step in considering factors for the development of risk-based LEP-implemented alternative cleanup standards was to review what LEP self-implementing approval options are currently available in the RSRs. While reviewing the LEP self-implementing approval methods are currently available in the RSRs, Subcommittee 7 observed that while there are various options throughout the RSRs, most of the self-implementing alternatives are associated with the Pollutant Mobility Criteria (PMC). The Subcommittee further noted that the LEP self-implementing options were often quite limited with respect to circumstances when the self-implementing alternatives could be applied and also limited with respect to the extent to which alternative values could be calculated. In most cases, the Subcommittee believes that these limitations could be removed or at least be much less restrictive, allowing greater latitude for LEP-implementability.

The following includes a brief summary of the sections in the RSRs where LEP self-implementing alternatives are identified in the RSRs and the types of circumstances for which an LEP can use allowable alternatives to determine compliance with the RSRs, without the need for Commissioner approval. Additional details on alternatives already included in the RSRs for compliance with the PMC are presented in Attachment 1. Existing alternatives available for compliance with the PMC are provided as examples in that attachment because, as noted above, the greatest number of LEP self-implementing alternatives apply to PMC.

#### **Pollutant Mobility Criteria [22a-133k-2(c) and 2(d)]**

The following categories of self-implementing options require notification from an LEP, but not approval by the Commissioner.

- Optional Criteria for Polluted Soil in any GA Area
- Optional Criteria for Polluted Soil in a GB Area
- LEP Calculation and Use of Alternative Release-Specific Pollutant Mobility Criteria

#### **Soil Criteria Variances [22a-133k-2(f)(1)(B)]**

- LEP Certification of a Widespread Polluted Fill Variance

#### **Use of Polluted Soil and Reuse of Treated Soil [22a-133k-2(h)]**

- Polluted Soil

#### **Alternative Surface Water Protection Criteria [22a-133k-3(b)(1) and 3(b)(2)]**

- Groundwater Plume Discharge to a Watercourse
- Aquifer Dilution

#### **Groundwater Protection Criteria [22a-133k-3(d)(3)]**

- LEP Calculation of Alternative GWPC
- LEP Calculation and Use of Alternative Release-specific PMC

Subcommittee 7 discussed the importance of expanding the existing self-implementing options and that the expansion of alternatives would be expected to take into consideration such factors as complexity of the hydrogeological setting, mobility and toxicity of contaminants, proximity of potential receptors, and the completeness of exposure pathways. An important additional factor that should be taken into account when evaluating the expansion of LEP-implementable options for both existing self-implementing options, as well as for those alternatives that currently require Commissioner approval (addressed in Section 5.2), would be the level of characterization that has been conducted, and on which, decision-making was based. With better understanding of subsurface conditions and scientifically defensible approaches and documentation, a higher level of confidence in the decisions being made by the LEP should allow for increased options for LEP self-implementing alternatives.

#### **5.2. Increasing LEP Implementability for Current Alternatives Provided of the RSRs**

As indicated in Section 5.1, the RSRs already provide a number of opportunities for LEPs to use alternative approaches or alternative criteria for compliance with the various provisions of the RSRs rather than requiring strict compliance with the default, numeric criteria identified in Appendices A through E of the RSRs. The Subcommittee recognized early on in the discussion process that the while numerous options exist for alternative means of demonstrating compliance with various provisions of the RSRs, there were usually restrictions associated with those provisions with respect to when or in what circumstances the alternatives could be implemented solely by the LEP, without the requirement for obtaining approval from the DEEP Commissioner. In some cases, the alternatives themselves were limited to specific circumstances or site-specific conditions. The Subcommittee believes that a number of these Commissioner-approval scenarios could be 1) modified for LEP implementability, 2) reconsidered for LEP implementability under additional scenarios, or 3) expanded to include some options that are currently only Commissioner-approved alternatives.

The Subcommittee further recognized that many of the limits on LEP implementability or on the alternatives themselves could arguably be considered somewhat arbitrary in nature, and presumably based on the Department's level of comfort with relinquishing some degree of control with respect to their decision-making role and their legitimate responsibility for protection of public health, welfare, and the environment. However, because of the auditing process, that control is never completely relinquished. This would mean that the risk of a particular approach taken by an LEP not being found acceptable to the Department, as might be determined through the audit process (or during review of the required annual status reports), is more likely to affect the Responsible Party for the remediation, rather than the possibility of the public being put at risk, because the incorrect or unacceptable implementation of an alternative would need to be corrected.

One option to perhaps allow more options for LEP-implementable alternatives would be to include check boxes to readily indicate use of LEP-implemented options on whatever form accompanies the transmission of a verification or some new form of closure document that might be used for the release-based program. This would allow the Department to identify those sites where they might want to take a closer look at how an LEP chose to implement and support the use of one or more of the alternative options that are available. The “submission without Commissioner approval” approach would be similar to the situation in Massachusetts, where the approach for licensed site professionals (LSPs) to achieve compliance with the MCP is still subject to the scrutiny of the regulators, and LSPs must demonstrate to the regulators that their approach is based on sound scientific principles and in accordance with applicable statutes, regulations, guidance, and policy. If not, they must provide technical justification for how their approach is still sufficiently protective of human health, welfare, and the environment to meet statutory and regulatory requirements. Those requirements are specifically stated in the MCP and provide overarching protection for the public and other stakeholders, without the need to obtain pre-approval before submission of documents required for closure of a site.

To provide an understanding of some of the opportunities already in the RSRs for LEP-implementable alternatives, the Subcommittee has included in Attachment 1 examples of potential sections of the regulations that could be adapted to allow more flexibility for LEPs without the need for Commissioner approval. Information provided in that attachment focused on the possible alternatives related to PMC because it became evident that most of the flexibility for alternatives seemed to be related to those sections of the RSRs.

The Subcommittee also discussed the rationale behind allowing additional flexibility and scope of LEP-implementable alternatives in the RSRs. Through the LEP licensing process, LEPs are deemed qualified to make decisions and draw conclusions with respect to all elements of the conceptual site modeling (CSM) process. These elements include 1) recognizing releases and the potential for releases and release mechanisms, 2) understanding contaminant fate in the subsurface and the migration pathways and transport processes, and 3) identifying potential receptors to contamination, the pathways to those potential receptors, and the concentrations of contaminants to which receptors could be exposed.

For example, the RSRs at §22a-133k-2(d)(2)(iii) provide an opportunity to comply with the DEC via the calculation of potential risk using a risk assessment prepared in accordance with the EPA Risk Assessment Guidance for Superfund or “another method approved by the commissioner.” The regulations establish a excess lifetime cancer risk limit of equal to or less than  $1 \times 10^{-6}$  for each substance when 10 or fewer carcinogenic compounds are present at the site and a cumulative risk of equal to or less than  $1 \times 10^{-5}$  when 10 or more carcinogens are present at the site. The regulations also establish a hazard index (non-cancer risk value) of equal to or less than 1, with the caveat that when 10 or more non-carcinogenic substances are present, the cumulative hazard index must be equal to or less than 1 for non-carcinogenic substances with the same target organ.

The calculation of these values similar to what was described previously is common in the industry and may be reasonably calculated by LEPs themselves or via the use of other professionals that an LEP may be reasonably rely upon or via the use of a risk calculator as described in subsequent sections of this concept paper.

Therefore, it is reasonable that LEPs would be qualified to use and understand the rationale behind any alternatives related to those elements that are included in the RSRs. Restrictions on implementation of alternatives unless approved by the Commissioner before submission of a verification or closure

documents should consider whether such a restriction could be eliminated by the submission of more detailed documentation by the LEP for why the approach met the objectives of the RSRs and was scientifically defensible.

As is evident in the current alternatives to various RSR provisions that make a distinction between those that can be implemented by an LEP and those that require Commissioner approval, potential risk to public health and the environment is a fundamental factor in determining LEP-implementability vs. required Commissioner approval. The Subcommittee recognizes the very legitimate concern that there are some situations for which Commissioner approval would be required to provide the requisite level of confidence to all stakeholders that public health and the environment, as well as other interests of the State, are adequately protected. However, the Subcommittee believes that there are lower-risk release situations where the risk of being wrong (should that be the case) would be low enough that Commissioner approval prior to verification might not be necessary for some alternatives. Examples would be:

- 1) releases of limited volume or mobility,
- 2) limited hydrogeologic complexity or contaminant transformation possibilities, or particularly,
- 3) lack of receptors or pathways to receptors (including a demonstration that a potential pathway is not complete).

Situations that would be more likely to require Commissioner approval would be for those releases involving emerging or particularly hazardous contaminants, sensitive receptors, complex receptor exposure scenarios, or complex contaminant migration potential and distribution.

Overall, the Subcommittee believes that many of the alternative approaches to demonstrating compliance or using alternative criteria currently in the RSRs could be expanded or modified to increase the number of LEP-implementable alternatives, and that new alternatives could be added to 1) improve the efficiency in achieving compliance for sites in the future and 2) to reduce the number of documents that must be reviewed by DEEP staff, leaving more staff time for those projects that represent the highest risk to the public and the environment.

### **5.3. Future RSRs – Additional LEP/Commissioner Approval Options**

In addition to the alternatives reviewed in the preceding sections, Subcommittee 7 also reviewed additional methods for evaluating risks associated with releases in Connecticut. Subcommittee 7 members support the evaluation of the additional alternatives presented in this section and support their inclusion in future regulations to provide LEPs and the regulated community with additional methods to evaluate risk at release sites. A discussion of the alternatives/methods reviewed and recommended for additional evaluation is presented below.

#### ***Allow Use of a Toxicity Hierarchy***

Factors for risk assessment that may be modified in Connecticut and other jurisdictions include exposure scenarios and toxicity. Other states use a hierarchy of sources for determining acceptable cancer risk thresholds and hazard indices that includes:

1. State-specific/calculated toxicity and cancer slope factors

2. EPA-calculated toxicity and cancer slope factors
3. Toxicity and cancer slope factors established by other states
4. Literature-based toxicity and cancer slope factors

The Subcommittee was in consensus that the new Connecticut regulations should allow consideration of a wider range of site-specific factors in risk assessment, such as exposure assumptions/scenarios, and that toxicity and cancer slope factors should be more responsive to changing industry standards and technological and toxicological advances than is currently allowed in the RSRs. The Subcommittee also believed that pre-approval of specific databases (e.g., IRIS) for reference to toxicity values was appropriate and should be included in the new regulations. The Subcommittee was divided on whether the new regulations should allow LEP implementation of the full hierarchy or to require Commissioner approval to implement steps 3 and 4.

### ***Create a Spreadsheet-style Risk Calculator***

The Subcommittee reviewed spreadsheet-style risk calculators developed by the MassDEP and the North Carolina Department of Environmental Quality.

The North Carolina Brownfields program uses a risk calculator that allows the environmental professional to calculate risk to human health. However, the calculator was developed for use only at Brownfields sites, and since North Carolina does not have a unified system for addressing contamination at other sites, the risk calculator was quite limited in scope. Therefore, the Subcommittee's evaluation of how assessing risk is addressed in North Carolina was also limited.

The MassDEP Method 3 Shortform was evaluated in depth since the scenarios presented are most similar to conditions present in Connecticut. Massachusetts developed the Shortform risk calculators to evaluate cumulative risk to receptors through several exposure scenarios such as: direct contact exposure to soil and exposure to contaminant vapors in indoor air. The calculators use pre-programmed equations and, for the purposes of the Method 3 Shortform Risk Characterization, the only variables that can be input by the user are:

- The contaminants detected in the media applicable to the risk scenario for the specific calculator; and
- The concentrations of the contaminants that are being evaluated.

The Massachusetts program has developed a calculator for several common exposure scenarios present at contaminated properties. When site-specific data is entered into the calculator, the calculator then produces a value for the Excess Lifetime Cancer Risk (ELCR) and a Hazard Index (HI) value for non-cancer risks. The cumulative risk is then calculated by summing the ELCR and HI for each exposure scenario applicable to each receptor at the disposal. Cumulative ELCR values in excess of  $1 \times 10^{-5}$  and/or HI values in excess of 1 indicate that a condition of unacceptable risk exists at the disposal site.

A caveat to the Massachusetts system is that a Method 3 Shortform Risk Characterization is limited to using the calculator without any modifications to the risk calculations or toxicity values. If any changes are made to the default calculations, the changes must be identified in writing in the risk characterization text, and the reason for the changes must be scientifically valid. The MassDEP User

Guide for the Method 3 Shortforms and an example of a completed Shortform for a residential exposure to a petroleum release are provided as Attachment 2.

### ***How to Pay for a Site-specific Risk-based Review?***

Obtaining funding and maintaining a staff to review site-specific risk assessments that include a hazard index calculation, exposure assessment, and/or toxicological evaluation will be a challenge in Connecticut. This is not an uncommon challenge for regulators of all types. For example, it is common for large-scale real estate developers of new facilities to pay for a third-party reviewer that the local municipality hires to review the details of the development application. Four models that could be considered:

- 1) Retain third-party reviewer and require applicant to pay for their services. Rhode Island requires a fee for risk assessment review to allow for the hiring of third-party consultants.
- 2) Charge a fee for the risk assessment review to pay for the hiring of staff to conduct the reviews. This is analogous to the DEEP adding a fee for the Environmental Use Restriction (EUR) application process.
- 3) Use funding from other related programs or obtain funding from DECD or federal sources to hire staff to conduct the reviews. For example, the Brownfield Remediation and Revitalization Program (BRRP) collects fees for entering that program. Since comprehensive risk assessment with assist in the closure of most Brownfield sites, using money obtained from this program to hire staff could be considered. Similarly, DECD awards brownfield funding twice a year. A small portion of this funding could be allotted to developing a more robust risk assessment staff.
- 4) Request that the Governor provide additional funding in the budget supporting additional risk assessment staff.

### ***Use Site-specific Boundary Conditions and Additional Self-implementing Compliance Alternatives for Groundwater Provisions in the RSRs***

Groundwater compliance provisions under the RSRs already provide for various options for LEPs to calculate various SWPC dilution factors or ratios and alternative GWPC limits under §22a-133k-3(d)(2) that may be used to facilitate a compliance demonstration for groundwater plumes emanating from a release. However, the DEEP should consider the following as potential future revisions to the RSRs or as modifying provisions in the proposed release-based regulations that would allow additional opportunities for LEPs to demonstrate compliance for groundwater using alternative compliance applications on a self-implementing basis:

- Add language to allow self-implementing use of “fast-track” criteria for demonstrating RSR compliance, and as the numerical basis for applying self-implementing dilution factor/ratio calculations, without formal DEEP approval for substances not already having promulgated criteria. Given that these criteria have already been vetted by DEEP and DPH, there is no practical need for Commissioner approval. Use of such criteria would be equivalent to allowing self-implementing calculation of criteria using RSR-specified formulas and risk factors taken from published lists according to a DEEP/DPH-approved hierarchy, as proposed elsewhere in this document.

- Provide additional quantitative limits under §22a-133k-3(b)(3)(C) that may allow additional self-implementing application of alternative SWPC provisions by LEPs.
- Eliminate restrictions on self-implementing use of alternative GWPC, since criteria for Commissioner approval of alternative GWPC under §22a-133k-3(d)(4) and (5) are already specific, and self-implementing use would be subject to audit.
- Allow for release-specific exemption from SWPC and GWPC under specified conditions. For example, GWPC compliance could be demonstrated at the downgradient property boundary in areas where public water is available (including confirmation of no existing wells) and/or hydraulic barriers or controls are present, and the release is such that the source area is steady-state or has been removed.
- The calculation of potential risk to human health via exposure to impacts in indoor air, either by using direct measurements of indoor air or through extrapolation via soil gas data, in a manner similar to the EPA Superfund Risk Assessment process.
- Under the current RSRs, the responsible party must receive Commissioner approval for additional polluting substance (APS) criteria using the equations in Appendix G of the RSRs, which rely on a Target Cancer Risk Level of  $10^{-6}$  for carcinogenic substances or HI of 1.0 for non-carcinogenic substances to calculate new criteria. In addition to these risk-based toxicity benchmarks, taste, odor, and color thresholds should also be considered in developing APS criteria.

The above recommendations would be best implemented by specifying the methodology in the regulations so if the criteria changes later, the approved process is fixed. The Subcommittee recommends structuring the RSRs so that they can provide direction without including specific numbers and stay in LEP implemented scenario. Exposure assumptions could be in the regulations if you don't have specific values. If DPH has concerns regarding the critical values for a site specific scenario, then LEPs can implement an approved procedure.

#### **5.4. Threshold Factors and Exemptions to Developing Risk-Based Alternative Cleanup Standards**

Threshold factors that may preclude the use of risk-based alternative cleanup standards are likely to involve releases in areas of sensitive receptors such as a drinking water supply contribution zone (GAA Area), endangered, threatened, special concern species, and significant natural communities. Other factors, such as site use, exposure assumptions, geologic and hydrogeologic conditions and physical and chemical properties of each substance may also preclude the use of alternative risk-based alternative cleanup standards.

Ceiling concentrations for soil and groundwater could be developed for application in Connecticut much like UCLs have been promulgated in Massachusetts to minimize potential risks associated with uncontrolled environmental contamination, and the costs associated with cumulative anthropogenic contributions to "background". In Massachusetts, the UCLs in soil and groundwater are applicable when a detailed risk characterization (Method 3) is used to evaluate the potential risk of harm to health, public welfare and the environment. The UCLs identify contamination which may pose a significant risk of harm to public welfare and the environment in the future and are established to minimize the



incremental contributions to anthropogenic background. Similar to Connecticut, the MassDEP does not endorse the general degradation of groundwater or soil.

In Massachusetts, a disposal site may qualify for a “Temporary Solution” even if the concentrations of oil or hazardous material remaining at the disposal site exceed the UCLs. An exceedance of these standards is interpreted to indicate significant risk of harm to public welfare and/or environmental resources in the future, and thus a Temporary Solution may be appropriate if, for current conditions, a condition of no significant risk of harm to health, safety, public welfare and the environment has been achieved. A detailed risk characterization performed in Connecticut could be conducted with a similar temporary end point, which is not dissimilar in concept to using a Technical Impracticability Variance, but without the need for financial assurance.

Massachusetts UCLs are simply 10-fold multiples of the highest Method 1 (default, numeric) exposure-related standard, capped at a maximum concentration. For soil, the UCL is capped at 10,000 micrograms per gram ( $\mu\text{g/g}$ ), or 1 %. For groundwater, the UCL is capped at 100,000 micrograms per liter ( $\mu\text{g/L}$ ), or 0.01 %. Connecticut could consider applying similar ceiling concentrations from DEC for soil and GWPC for groundwater established in the RSRs should detailed numeric risk assessments be included as an alternative under the release-based program.

Secondary Maximum Contaminant Levels (SMCLs) are guidance values issued by the US EPA representing levels of chemicals or parameters above which the aesthetic properties of the water can be affected (e.g., taste, odor, color) or cosmetic effects may occur (e.g., skin or tooth discoloration). Connecticut should evaluate whether SMCLs can be considered when calculating Ceiling Concentrations for these constituents. However, non-health-based risk criteria may be problematic in some cases, and an LEP-implemented alternative should be available to address such situations.

In some cases, use of risk-based alternative criteria on a release-specific basis may be straightforward. Examples include federal programs, such as RCRA Corrective Action and Superfund, and Brownfields programs, which are subject to other statutes and regulations. Such sites are generally evaluated on a site-wide basis, and were designed with a broader focus to identify whether a release petroleum hydrocarbons and hazardous materials has occurred, not just address identified releases. Closure of such facilities must typically address Areas of Concern (AOCs) on a site-wide basis and must meet closure criteria specific to the specific regulatory program, although there may still be cases for which use of release-specific alternatives may be possible for certain AOCs.

It is important to note that the discussion regarding calculation of alternative criteria presented in this document does not apply to PCBs. Alternative standards developed for PCBs must comply with 40 Code of Federal Regulations (CFR) 761.

## **5.5. Qualifications for Developing Alternative Risk-Based Cleanup Standards**

The concept of risk characterization and risk-based alternatives seems to conjure up different images of the tasks involved, and therefore, expected qualifications for different individuals who might be involved in the performance of those tasks. Therefore, it is important to distinguish among the types of tasks that are involved in the implementation of any risk-based alternative or risk characterization that would be included under the release-based program.

The process of characterizing risk is inherent in development of the RSRs, as risk is a consideration in the development of default, numeric standards for soil, groundwater, and soil vapor, and in the creation of alternative approaches for demonstrating compliance with RSR criteria. The purpose of this section is to present the issues associated with qualifications of individuals who can be relied on by stakeholders to perform that part of a full risk characterization that relies on numerical risk assessments which involve the selection and calculation of toxicological data to assess risk for a site-specific scenario.

There was general consensus among the Subcommittee members that LEPs should be considered qualified to develop and support those elements of a site-specific risk assessment up to and including identifying exposure point concentrations. Specifically, an LEP's scientific background, as evidenced by qualifying for and passing the LEP exam, qualifies an LEP to evaluate those elements of the risk characterization process that are included in the CSM process – identifying constituents of concern, determining pathways of contaminant migration and contaminant changes in the subsurface environment, and identifying potential receptors and the concentrations to which those receptors would be exposed. None of that process requires knowledge of toxicology and toxicological risk assessment. Therefore, the discussion below focuses on qualifications for those professionals who would be called on by LEPs to assist with any aspect of the risk characterization process that requires a toxicological assessment outside the realm of those aspects of that process that have been pre-approved by the DEEP and the DPH.

### ***Qualification Concepts***

In general, the Subcommittee believes it is essential that individuals involved with the use of risk-based alternatives 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 these activities in a scientifically defensible manner. It may be appropriate to establish or allow for different levels of qualifications for developing appropriate alternative criteria. In other words, more qualified individuals could be allowed to directly develop alternative criteria using a variety of publicly accepted or proprietary risk-based equations requiring background and knowledge of toxicological factors, whereas other environmental professionals might only be allowed to use approved DEEP equations and only allowed to change limited input values based on site-specific information. LEPs are allowed under the LEP Rules of Professional Conduct to rely on the work of others if the subject requiring input is outside the LEP's area of expertise. However, the LEP must have some knowledge of the toxicological aspects of the risk characterization if they are to be able to identify those individuals on whose opinions it would be appropriate to rely.

It was the general opinion of Subcommittee 7 that while LEPs should be allowed to direct risk-based alternatives 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, they would almost always be assisted by a competent risk assessment professional having the experience and education to develop alternative risk-based cleanup endpoints for such situations. For lower risk situations or simple releases, the DEEP would need to approve standard equations and training requirements necessary for LEPs involved with the development of alternative cleanup values for simple releases or lower-risk settings. Such requirements could vary based on the risk level associated with the release.

### ***Licensed Environmental Professionals***

Subcommittee 7 generally believes that LEPs are certainly qualified to direct the development of risk-based alternative cleanup criteria in certain situations. The qualifications necessary to obtain an LEP license, as well as the continuing education training requirements and experience of most LEPs, certainly qualify LEPs to recognize higher vs. lower risk situations, and the LEP regulations require that LEPs hold paramount human health and the environment during the performance of their duties. 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. Many of the Subcommittee members believe that the regulations should allow for an individual who holds a valid LEP license to direct the evaluation and development of risk-based alternative cleanup standards. Some members of the Subcommittee believe that DEEP, in consultation with DPH, should establish appropriate minimum qualifications with respect to the experience and training of risk assessors, so LEPs would be able to properly vet their qualifications and provide an additional level of confidence in the results of the risk assessment.

### ***Continuing Education Requirements***

Subcommittee 7 recommends that sufficient continuing education on topics related to risk characterization be expected of LEPs who intend to submit verifications or other closure documents that rely on a risk-based alternative that involves those risk characterization elements that are addressed following identification of receptors and exposure point concentrations. Specifically, continuing education topics should include hazard identification, exposure assessment, and toxicological evaluation in accordance with associated regulations and guidance. The LEP Program already requires specific continuing education obligations for LEPs, but the appropriate regulatory agency (DEEP and/or DPH, depending on the specific topic) DEEP should consider developing a course(s) specifically on risk-based alternative closure criteria and important risk assessment considerations prior to allowing LEPs being permitted to direct a risk-based alternative evaluation.

### ***Oversight and Sanctioning***

The Subcommittee believes there must be an appropriate level of accountability for any LEP that develops alternative risk-based cleanup criteria under the Release-Based Cleanup Program. If the representations by the LEP and the performance of such an individual do not meet prevailing standards and guidelines or the regulations, a mechanism (i.e., the LEP Board of Examiners) provides that oversight, and accountability is in place to hold the LEP accountable for inappropriate risk assessment evaluations.

## 6. Summary

Upon initiation of a release-based program and the anticipated volume of additional release reports that will result, the DEEP will be required to focus its resources on those releases that pose the greatest risk to human health and the environment and increasingly rely on LEPs to provide closure for releases. With the anticipated expansion of LEP responsibilities, it is anticipated that DEEP will need to cede some of its authority when it comes to prior review and approval of alternative methods of demonstrating compliance with the RSRs and with using risk-based, alternative numerical criteria.

In addition to 1) expanding existing provisions of the RSRs to include greater opportunity for LEP-implemented alternative options for demonstrating compliance or calculating alternative criteria and 2) reducing the number of circumstances for which Commissioner approval is required for implementation of various alternatives, Subcommittee 7 generally believed that additional alternative methods suitable for self-implementation by LEPs without prior Commissioner approval could include a range of risk characterization approaches, such as DEEP-prescribed, site-specific numerical risk assessment procedures that involve the use of a range of acceptable input parameters. Developing site-specific risk-based alternative cleanup standards using scientifically valid risk-based assumptions and prescribed input parameters is a widely used and valid approach to demonstrating site closure, and risk-based calculations are a fundamental aspect of the RSRs. A wider range of scenarios and input parameters should be allowed for the LEP self-implementing process, and previously approved approaches and numerical criteria should be available for self-implementation by LEPs, as long as the use of such alternatives or values were prescribed by DEEP or, in certain other instances, identified on submitted release-closure documentation.

In general, Subcommittee 7 members believed that site-specific, numerical and toxicological risk assessment alternatives could be LEP-implemented with the use of a spreadsheet-type risk calculator, while some members also believed that full-scale cumulative risk assessment could be implemented by LEPs with or without the assistance of trained and experienced risk assessment professionals using generally accepted risk assessment practices, similar to the remediation program in Massachusetts and the Federal Superfund Program. The need for additional professional assistance would be dependent on the LEP's background and training, and the LEP regulations provide accountability for an LEP's decisions. LEPs routinely rely on ecological risk assessors, groundwater modelers, professional engineers, chemists, geotechnical engineers, remediation specialists, wetland scientists, surveyors, and legal counsel when investigating and remediating sites, so reliance on other professionals is precedented and common.

The Subcommittee recognized that Department of Public Health is responsible for overseeing human health risk assessment in Connecticut by statute, and that the DPH is not represented on the current Release-Based Working Group or its subcommittees. As proposed by DEEP, the Subcommittee members encourage and look forward to the development of future workgroups with a wider array of stakeholders, including DPH representatives, to evaluate the use of more-detailed, site-specific numerical and toxicological risk assessment by LEPs. Some, but not all Subcommittee members, agreed that such procedures would benefit the more complicated legacy sites in Connecticut that are often located in environmental justice zones, such as Brownfield sites. Use of detailed numerical risk assessment has been demonstrated to help bring these more complicated sites back to the tax rolls and productive use when used in other states.

As the development of such procedures will take time, some Subcommittee 7 members did believe that having an expanded number of pre-approved risk scenarios and input parameters or ranges would be appropriate for LEP-implementation without requiring Commissioner approval each time such options

might be used. This approach would be appropriate until such time that a program for site-specific numerical and toxicological risk assessment can be developed, and would be subsequently useful for many risk-assessment scenarios that would not need a more-detail toxicological risk assessment.

Under either scenario, Subcommittee 7 recognized that safeguards would still need to be in place to ensure the protection of human health, public welfare, and the environment. LEPs would be responsible for providing the Department, as well as the public, with a level of confidence in their decisions by implementing technically sound and generally accepted methodologies to achieve compliance with the RSRs or other regulatory closure regulations and documenting their rationale and decision-making for any LEP-implemented alternative. The DEEP would be responsible for 1) developing an auditing program that focused Department resources on those sites representing the greatest potential risk to human health, safety, welfare, and the environment and 2) providing guidance that makes the Department's expectations clear to LEPs when using LEP-implemented alternative approaches for demonstrating compliance. Ideally, such guidance would result in better communication and transparency between both LEPs and the DEEP.

## **ATTACHMENTS**

**ATTACHMENT 1**

***Existing Alternatives in the RSRs that Could Be Considered for Increased LEP Implementation***

## Attachment 1

### Existing Alternatives in the RSRs that Could Be Considered for Increased LEP Implementation

#### Attachment 1a

##### Examples of Existing LEP-implementable Alternatives in the RSRs with Details on Specific Requirements or Limitations

The Subcommittee's first step in considering factors for the development of risk-based LEP-implemented alternative cleanup standards was to review what LEP self-implementing alternatives are currently available in the RSRs. Subcommittee 7 noticed that while there are various options throughout the RSRs, most of the self-implementing alternatives are associated with the Pollutant Mobility Criteria (PMC). The following examples require notification from an LEP, but not approval by the commissioner.

The list is not intended to be comprehensive and does not include all relevant information related to the individual topic, but is presented to provide a general understanding of the types of alternatives that the RSRs currently allow for implementation by an LEP without Commissioner approval, as well as some of the restrictions, limitations, or qualifications associated with use of the respective alternative.

#### ***Pollutant Mobility Criteria [22a-133k-2(c) and 2(d)]***

- Optional Criteria for Polluted Soil in any GA Area
  - TCLP or SPLP analysis is equal to or less than 10 times the GWPC
  - Mass analysis is equal to or less than 10 times the applicable PMC multiplied by ten
  - Does not apply to PCBs or ETPH
  - NAPL is not present
  - Water table is 15 feet above bedrock
  - Downward vertical flow is less than horizontal flow velocity
  - Public water supply is available
  - Groundwater not used for drinking water
  - No public or private wells
  - Groundwater is not a potential public water supply or in an aquifer protection area
  - Diminishing state groundwater plume
- Optional Criteria for Polluted Soil in a GB Area
  - Mass analysis is equal to or less than 10 times the applicable PMC multiplied by ten
  - TCLP or SPLP analysis is equal to or less than the GWPC multiplied by a release-specific dilution factor
  - NAPL is not present
  - Public water supply is available
  - Groundwater no used for drinking water



- No public or private wells
- Groundwater is not a potential public water supply or in an aquifer protection area
- LEP Calculation and Use of Alternative Release-Specific Pollutant Mobility Criteria
  - Uses appendix H of RSRs
  - Calculated alternative PMC does not exceed 1,000 mg/kg in GA area or 10,000 mg/kg in a GB area
  - Groundwater in area must be below the GWPC if in a GA area, and aquifer protection area, or an area where groundwater is used as source for drinking water
  - Groundwater must also be below the SWPC or the water quality criteria
  - Groundwater does not exceed the volatilization criteria

**Soil Criteria Variances [22a-133k-2(f)(1)(B)]**

- LEP Certification of a Widespread Polluted Fill Variance
  - Does not include volatile organics above PMC
  - Will not affect quality of any water supply
  - Direct exposure compliance achieved
  - Any spill into the polluted fill will be remediated to previous levels
  - Fill will stay on parcel
  - Owner of property agrees to EUR
  - Fill extends over 10 acres
  - Fill must be located within a coastal boundary
  - Within a GB area
  - Not located within the drainage footprint of a Class A stream
  - Groundwater compliance has been achieved
  - Fill is not hazardous waste

**Use of Polluted Soil and Reuse of Treated Soil [22a-133k-2(h)]**

- Polluted Soil
  - Polluted soil may be reused on the same property of its origin if it is below applicable RSR criteria
  - Does not contain PCBs
  - Is not placed under a building if containing VOCs

**Alternative Surface Water Protection Criteria [22a-133k-3(b)(1) and 3(b)(2)]**

- Groundwater Plume Discharge to a Watercourse
  - Dilution factor to be calculated for flow of water into a AA, A, or B inland surface watercourse
  - Dilution factor to be calculated for flow of water into a SA or SB coastal surface watercourse
  - Cannot be more than a multiple of 100 based on distance from compliance point to downgradient surface water
- Aquifer Dilution
  - Plume is at least 500 feet from nearest downgradient surface water
  - Dilution ratio calculated is equal to or greater than 5

- Final dilution factor used based on distance to nearest surface water in table

**Groundwater Protection Criteria [22a-133k-3(d)(3)]**

- LEP Calculation of Alternative Groundwater Protection Criteria
  - In this scenario the LEP can calculate a new GWPC for areas within the “Potential Alternative Groundwater Protection Criteria Map” in Appendix 1.
  - They must include a well receptor survey showing no well within the plume
  - The concentration calculated cannot exceed 100x the GWPC specified in Appendix C
  - There can be no exceedance of the residential volatilization criteria
  - A public water supply must be within 200 feet or 500 feet downgradient.
  - Release source has been remediated
  - No alternative PMC is used for the substance the GWPC is being used
  - The groundwater plume must be in a diminishing state
  - Alternate GWPC cannot be for portion of plume in bedrock

## **Attachment 1b**

### **Pollutant Mobility Criteria Sections of the RSRs Indicating the Potential for LEP-implemented Risk-Based Alternate Cleanup Standards**

This attachment to the Subcommittee 7 Concept Paper identifies those sections of the RSRs that currently provide alternative approaches to demonstrating compliance with sections of the RSRs that relate to the Pollutant Mobility Criteria (PMC). The attachment focuses on the PMC to provide examples of sections within the existing regulations where flexibility already exists for LEP self-implementation of alternatives or where alternatives exist, but the regulations currently require Commissioner approval, because the majority of the alternatives for demonstrating compliance with the regulations are within the sections of the RSRs that apply to the PMC.

The information provided in this attachment is not intended to be a comprehensive review of all the alternatives presented in the RSRs for PMC or PMC-related topics, but is intended to indicate the range of alternatives that currently exist and present these for consideration as to how the existing alternatives, with or without requiring Commissioner approval could be expanded to allow greater flexibility in their applicability and to allow greater LEP self-implementation, without Commissioner approval, particularly if the alternatives were supported with adequate characterization and documentation that followed sound scientific, and technically justified, commonly accepted principles. For example, the subcommittee identified language related to NAPL that may be considered for more universal applicability – “Such proposed alternative methods may be based upon emerging technologies and approaches for which guidance, a standard, or an industrial code has been published by a regulatory agency, governmental advisory group, or other recognized professional organization.”

#### **Definition:**

[(48)] (62) "Pollutant mobility criteria" or "PMC" means the criteria identified in Appendix B of the RSRs, alternative pollutant mobility criteria calculated by an LEP or approved by the commissioner pursuant to section 22a-133k-2(d) of the RSRs, or pollutant mobility criteria approved by the commissioner pursuant to section 22a-133k-2(c)(6) of the RSRs.

#### **PMC-related Sections of the RSRs Indicating the Potential for LEP-implemented Alternate Cleanup Standards.**

The following subsections of Sections 22a-133k-2(c), 22a-133k-2(d), 22a-133k-2(e), and Appendices G and H of the RSRs provide language that indicates flexibility in demonstrating compliance with the PMC beyond a straightforward comparison to the default, numeric criteria.

**22a-133k-2(c) Pollutant Mobility Criteria**

(1) Pollutant Mobility Criteria

(B) In GA areas, if it is determined that remediation to the seasonal low water table is technically impracticable or would not result in the permanent elimination of a source of pollution, this subsection shall apply to polluted soil above the seasonal high water table.

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(2) Optional Criteria for Polluted Soil in a GA Area

(B) Polluted Soil, Except for PCBs or ETPH, in Certain GA Areas

(i) Substances, except for either PCBs or ETPH, in polluted soil in a GA area may be remediated to a concentration at which the analytical laboratory results of:

(I) TCLP or SPLP analysis for such substance in soil is equal to or less than ten (10) times the groundwater protection criteria;

(II) TCLP or SPLP analysis for such substance in soil is equal to or less than the groundwater protection criteria multiplied by an alternative dilution or dilution and attenuation factor, approved in writing by the commissioner in accordance with subsection (d)(3)(B) of this section;

(III) Mass analysis for such substance in soil is equal to or less than ten (10) times the applicable pollutant mobility multiplied by ten or criteria in Appendix B of the RSRs or approved in writing by the commissioner in accordance with subsection (c)(6) of this section; or

(IV) Mass analysis for such substance in soil is equal to or less than the applicable pollutant mobility criteria multiplied by an alternative dilution or dilution and attenuation factor approved in writing by the commissioner in accordance with subsection (d)(3)(B) of this section.

(ii) The remediation standards specified in clause (i) of this subparagraph may be used only if conditions at a release area satisfy the requirements of subparagraphs (C) and (D) of this subdivision and the notice requirements of subparagraph (E) of this subdivision are satisfied.

(C) Conditions at the release area shall comply with the following requirements:

(i) NAPL is not present as determined in accordance with subdivision (4) of this subsection;

(ii) The water table is at least fifteen (15) feet above the surface of the bedrock; and

(iii) The downward vertical flow velocity of groundwater is equal to or less than the horizontal flow velocity.

(D) Conditions at the release area shall satisfy clause (i) or (ii) of this subparagraph.

(i) (I) A public water supply distribution system is available within two hundred (200) feet of the parcel on which the release area is located, within two hundred (200) feet of all adjacent parcels, and within two hundred (200) feet of any parcel within the areal extent of the groundwater plume from the subject release area;

(II) The groundwater within the areal extent of the groundwater plume from the subject release area is not used for drinking water;

(III) No public or private water supply wells exist within five hundred (500) feet of the subject release area; and

(IV) The groundwater affected by the subject release area is not a potential public water supply resource or in an aquifer protection area; or

(ii) The groundwater plume resulting from the subject release is a diminishing state groundwater plume and either:

(I) The concentration of any substance in the groundwater plume from the subject release area and within seventy-five (75) feet of the nearest downgradient parcel boundary is equal to or less than the groundwater protection criteria; or

(II) The concentration of any substance within the groundwater plume from the subject release area is equal to or less than the groundwater protection criteria for such substance at a location downgradient of the subject release area, on the subject parcel, and within twenty-five (25) feet of such release area.

(E) Written notice of the use of optional criteria calculated by an LEP under this subparagraph shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs.

\*\*\*\*\*

### (3) Optional Criteria for Polluted Soil in a GB Area

(A) Polluted Soil in a GB Area Provided that NAPL is not present in the release area above the seasonal high water table, as determined in accordance with subdivision (4) of this subsection, substances in soil in a GB area may be remediated to a concentration at which the results of a TCLP or SPLP analysis of each substance is equal to or less than the groundwater protection criteria:

(i) Multiplied by ten (10);

(ii) Multiplied by the ratio of the summation of the downgradient area and upgradient area compared to the release area, provided that such ratio is equal to or less than five hundred (500); or

(iii) Multiplied by an alternative dilution or dilution and attenuation factor approved in writing by the commissioner in accordance with subsection (d)(3) of this section.

(B) Optional Criteria Based Upon Release-Specific Dilution in a GB Area

(i) The criteria in this clause may only be used if the requirements in clauses (ii) and (iii) of this subparagraph are satisfied. Except for soil polluted with PCBs, substances in soil in a GB area may be remediated to a concentration at which the results of either:

(I) Mass analysis for each substance is equal to or less than the pollutant mobility criteria applicable to such substance in a GA area multiplied by a release-specific dilution factor calculated in accordance with clause (iv) of this subparagraph; or

(II) TCLP or SPLP analysis for each substance is equal to or less than the groundwater protection criterion for such substance multiplied by a release-specific dilution factor calculated in accordance with clause (iv) of this subparagraph.

(ii) Conditions at the subject release area comply with the following requirements:

(I) NAPL is not present above the seasonal high water table as determined in accordance with subdivision (4) of this subsection;

(II) The water table is at least fifteen (15) feet above the surface of the bedrock;

(III) The downward vertical flow velocity of groundwater is equal to or less than the horizontal flow velocity; and

(IV) For each substance in groundwater, the background concentration is equal to or less than the groundwater protection criteria.

(iii) Written notice of the use of optional criteria calculated by an LEP under this subparagraph shall be submitted to the commissioner in accordance with section 22a-133k1(g) of the RSRs and shall also include the calculation in clause (iv) of this subparagraph, value and basis of terms, and the till infiltration rate and dilution factor from the following table, based on the geologic material and infiltration rate.

<b>Geologic Material</b>	<b>Infiltration Rate (feet/year)</b>
Stratified Drift	2.0
Till	0.5 - 1.0
Lacustrine Deposits	0.4

(iv) The release-specific dilution factor referred to in clause (i) of this subparagraph, shall be calculated using the following formula, and the value of terms referred to in clause (i) of this subparagraph shall be calculated using the following formula:

$$DF = \left(1 + \left(\frac{Kd}{IL}\right)\right)(1 - F_{adj})$$

<u>Term</u>	<u>Description</u>	<u>Value</u>	<u>Units</u>
<u>DF</u>	<u>Release-specific dilution factor</u>	<u>substance-specific</u>	<u>unitless</u>
<u>K</u>	<u>Hydraulic conductivity of the unconsolidated aquifer underlying the release area</u>	<u>calculated</u>	<u>ft/year</u>
<u>i</u>	<u>Horizontal hydraulic gradient</u>	<u>calculated</u>	<u>ft/ft</u>
<u>d</u>	<u>Aquifer mixing zone default value of 3 feet or a release-specific value calculated using:</u>  $d = (0.0112L^2)^{0.5} + d_{\alpha} \left[1 - e^{\left(-\frac{LI}{Kd_{\alpha}}\right)}\right]$	<u>3, or as otherwise calculated</u>	<u>ft</u>
<u>d<sub>α</sub></u>	<u>Aquifer thickness</u>	<u>as determined from boring logs</u>	<u>ft</u>
<u>I</u>	<u>Infiltration rate, as identified in section 22a-133k-2(c)(3)(B)(iii)(IV) of the RSRs</u>	<u>calculated</u>	<u>ft/year</u>
<u>L</u>	<u>Length of the release area parallel to the direction of groundwater flow</u>	<u>as measured</u>	<u>ft</u>

<u>F<sub>adj</sub></u>	<u>Background concentration for groundwater divided by the groundwater protection criteria for the subject substance or, where the background concentration for groundwater cannot be quantified, one half the laboratory reporting limit for the subject substance divided by the groundwater protection criteria for the subject substance</u>	<u>calculated</u>	<u>ug/L</u>
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#### (5) Conditional Exemptions to Pollutant Mobility Criteria

(A) Environmentally Isolated Soil Polluted soil at a release area above the seasonal high water table is not required to be remediated to the pollutant mobility criteria, provided that:

- (i) Such soil does not contain substances that are a continuing source of pollution;
- (ii) Regardless of groundwater classification, if such soil contains volatile organic substances in excess of GA area pollutant mobility criteria, the concentrations of such substances have been reduced or immobilized to the maximum extent prudent;
- (iii) An EUR is in effect for the subject area, which restriction shall:
  - (I) Prohibit infiltration of liquid into such soil; and
  - (II) Require compliance with clause (i) and, if applicable, clause (ii) of this subparagraph; and
- (iv) The EUR specified in clause (iii) of this subparagraph shall also:

(I) Require that any building that renders soil environmentally isolated consists of a roof and structural walls that prevent infiltration of liquid into the soil beneath the building footprint, and prohibit removal of such building; or

(II) Require that the use of a permanent structure that renders soil environmentally isolated and prevents infiltration of liquid into the soil beneath the structure's footprint has been approved in writing by the commissioner and prohibit the removal of such structure.

(C) Soil Subject to Infiltration

Polluted soil at a release area polluted with substances, other than volatile organic substances, that exceed DEC or PMC is not required to be remediated to the pollutant mobility criteria, provided that at such release area:

(i) Eighty (80) percent or more of the mass of the substances remaining at the release area has been subject to infiltration;

(ii) Infiltration was not obstructed by anthropogenic features, for at least five (5) years;

(iii) Groundwater monitoring complies with the requirements of section 22a-133k-3(h)(1) of the RSRs; and

(iv) The laboratory analytical results for all groundwater sample events collected as specified in section 22a-133k-3(h)(3) of the RSRs are equal to or less than the following:

(I) For a GA area, an aquifer protection area, or groundwater area used as a source for either a private or public drinking water supply located in a GB area, the groundwater protection criteria and the surface water protection criteria or, if applicable, the water quality criteria; or

(II) For a GB area, other than a GB area specified in subclause (I) of this clause, the surface water protection criteria or, if applicable, the water quality criteria.

\*\*\*\*\*

(6) Pollutant Mobility Criteria for Additional Polluting Substances

(A) Substances at a release area for which pollutant mobility criteria are not specified in Appendix B of the RSRs shall be remediated to background concentration or to criteria obtained pursuant to this subdivision. A request under this subdivision shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, and shall also include:

(i) A proposed risk-based pollutant mobility criteria for each substance calculated in accordance with Appendix G of the RSRs, as applicable to the groundwater classification of the release area;

(ii) A method for determining compliance with each criteria;



- (iii) The laboratory reporting limit for each substance; and
- (iv) Any information demonstrating whether a proposed criteria will ensure that soil water at such release area does not exceed:

- (I) In a GA area, the groundwater protection criteria; or

- (II) In a GB area, the groundwater protection criteria multiplied by a dilution factor of ten (10).

(B) The commissioner may approve or deny in writing a request made under subparagraph (A) of this subdivision. No request shall be approved unless it is demonstrated to the commissioner's satisfaction that the requirements of this subdivision have been satisfied and that the proposed pollutant mobility criteria will be protective of human health and the environment.

(C) Unless prohibited in writing by the commissioner, criteria approved by the commissioner pursuant to subparagraph (A) of this subdivision, may be the subject of a request for alternative criteria under subsection (d)(3)(A) of this subsection.

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#### **22a-133k-2(d) Alternative Soil Criteria and Alternative Dilution or Dilution Attenuation Factor**

##### **(1) Information Required in a Request for Approval of Alternative Soil Criteria**

A request for approval of the alternative direct exposure criteria or alternative pollutant mobility criteria at a particular release area may be submitted to the commissioner under this subsection. Any such request shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, including any additional information specified in subdivisions (2) or (3) of this subsection, as applicable, and shall also include:

(A) A detailed description of any other release area located on the same parcel as the subject release area and whether such other release area is affected or potentially affected by the subject release area, or is affecting or may potentially affect the subject release area; and (B) When an EUR is required under this subsection, the acknowledgement and consent of the owner of the subject area to such alternative direct exposure criteria.

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##### **(3) Commissioner Approval of Alternative Release-Specific Pollutant Mobility Criteria**

###### **(A) Alternative Release-Specific Pollutant Mobility Criteria**

With respect to substances for which pollutant mobility criteria are specified in Appendix B of the RSRs or approved by the commissioner pursuant to subsection (c)(6) of this section, the commissioner may approve or deny in writing a request for an alternative releasespecific pollutant mobility criteria or an alternative method for determining compliance with such criteria. No request

shall be approved unless it is demonstrated to the commissioner's satisfaction that the application of such alternatives:

- (i) For a substance in soil located in a GA area, will ensure that soil water at such release area is equal to or less than the groundwater protection criteria for such substance; or
- (ii) For a substance in soil located in a GB area, will ensure that the groundwater plume, after dilution resulting from infiltration on the parcel, is equal to or less than the groundwater protection criteria for such substance.

(B) Alternative Release-Specific Dilution or Dilution Attenuation Factor

With respect to substances for which pollutant mobility criteria are specified in Appendix B of the RSRs or approved by the commissioner pursuant to subsection (c)(6) of this section, the commissioner may approve or deny in writing a request for an alternative releasespecific dilution or dilution attenuation factor. No request shall be approved unless it is demonstrated to the commissioner's satisfaction that the application of such dilution attenuation factor:

- (i) For a substance in soil located in a GA area, will ensure that the release area will not degrade groundwater quality and thereby prevent the achievement of the groundwater criteria or background concentration, in accordance with section 22a-133k-3 of the RSRs; or
- (ii) For a substance in soil located in a GB area, will ensure that the soil water at the release area will not cause the groundwater at the nearest downgradient parcel boundary to exceed the groundwater protection criteria for each substance.

(C) Condition for Approval

For any request for approval of alternative pollutant mobility criteria or alternative dilution or dilution attenuation factor specified in this subdivision, alternative groundwater criteria shall not be used for the same substance for which alternative soil criteria is requested.

\*\*\*\*\*

(4) LEP Calculation and Use of Alternative Release-Specific Pollutant Mobility Criteria

With respect to substances for which pollutant mobility criteria are specified in Appendix B of the RSRs, alternative release-specific pollutant mobility criteria for a particular release area may be calculated by an LEP in accordance with Appendix H of the RSRs and used at a release area, provided that:

- (A) The calculated alternative pollutant mobility criteria shall not exceed one thousand (1,000) mg/kg in a GA area or ten thousand (10,000) mg/kg in a GB area;
- (B) All representative laboratory analytical results of groundwater samples used to determine compliance with any such alternative criteria shall be conducted in accordance with section 22a-

133k-3(h) of the RSRs. Alternative criteria under this subdivision shall not be used if any groundwater sample results are equal to or greater than:

- (i) The groundwater protection criteria in Appendix C of the RSRs, if the subject release area is in a GA area, an aquifer protection area, or an area where groundwater is used as a source of either private or public drinking water supply;
- (ii) Either the surface water protection criteria in Appendix D of the RSRs or, if required under section 22a-133k-3(a)(3) of the RSRs, the water quality criteria; and
- (iii) The volatilization criteria in Appendix E of the RSRs; and

(C) Notice of the use and derivation of the calculated criteria is submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs.

\*\*\*\*\*

#### **22a-133k-2(e) Determining Compliance with the Soil Criteria**

##### **(2) Pollutant Mobility Criteria**

Unless an alternative method for determining compliance with pollutant mobility criteria has been approved in writing by the commissioner pursuant to subsection (d)(3) of this section, compliance with pollutant mobility criteria for each substance is achieved when either:

- (A) All laboratory analytical results of soil samples from a release area are equal to or less than the applicable pollutant mobility criteria; or
- (B) Except for PCBs, the ninety-five (95) percent upper confidence level of the arithmetic mean of a statistically representative sampling data set of all laboratory analytical results for such substance from a release area, consisting of ten (10) or more soil samples that are located above the water table, is equal to or less than the applicable pollutant mobility criteria.

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#### **Appendix G to the RSRs**

Equations, Terms, and Values for Calculating Release-Specific Direct Exposure Criteria, Pollutant Mobility Criteria, Groundwater Protection Criteria, Surface Water Protection Criteria, and Volatilization Criteria, for Additional Polluting Substances and Alternative Volatilization Criteria.

##### **(2) Pollutant Mobility Criteria for Additional Polluting Substances**

- (A) Pollutant Mobility Criteria for inorganic substances shall be calculated using the following equations: (i) For GA area groundwater classification:

$$PMC_{mg/L} = GWPC \times CF$$

(ii) For GB area groundwater classification:

$$PMC_{mg/L} = GWPC \times CF \times DF$$

(B) Pollutant Mobility Criteria for organic substances shall be calculated using the following equations:

(i) For GA area groundwater classification:

$$PMC_{mg/kg} = GWPC \times CF \times AAF$$

(ii) For GB area groundwater classification:

$$PMC_{mg/kg} = GWPC \times CF \times AAF \times DF$$

(C) The abbreviations in subparagraphs (A) and (B) of this subdivision shall be interpreted in accordance with the following table and shall be assigned the values specified therein:

Terms	Description	Value	Units
AAF	Analytical Adjustment Factors	20	unitless
CF	Conversion Factor	0.001	mg/μg
DF	Dilution Factor	10	unitless
GWPC	Groundwater Protection Criteria	Substance-specific	μg/L
PMC	Pollutant Mobility Criteria	calculated	mg/kg or mg/L

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## Appendix H to the RSRs

Equations, Terms, and Values for Calculating Release-Specific Alternative Pollutant Mobility Criteria (1) Release-Specific Pollutant Mobility Criteria shall be calculated using the following equation:

(1) Release-Specific Pollutant Mobility Criteria shall be calculated using the following equation:

$$Alt\ PMC = GWC \times DF \left( K_d + \frac{(\theta_w + \theta_a H')}{\rho_b} \right)$$

(2) The abbreviations in subdivision (1) of Appendix H of the RSRs, shall be interpreted in accordance with the following table and shall be assigned the values specified therein:

<u>Terms</u>	<u>Description</u>	<u>Value</u>	<u>Units</u>
<u>Alt PMC</u>	<u>Alternative Pollutant Mobility Criteria</u>	<u>calculated</u>	<u>mg/kg</u>
<u>GWC</u>	<u>Groundwater Criteria Goal</u>	<u>substance-specific (lowest of groundwater criteria applicable to release area)</u>	<u>mg/L</u>
<u>DF</u>	<u>Dilution Factor</u>	<u>20 or calculated in accordance with section 22a-133k-2(c)(2)(E)(ii) * of the RSRs with <math>F_{adj} = 0</math></u>	<u>unitless</u>
<u>K<sub>d</sub></u>	<u>Distribution Coefficient for Organic Contaminants may be approximated by: <math>K_{oc} * f_{oc}</math></u>	<u>substance-specific (see table below for inorganic substances)</u>	<u>L/kg</u>
<u>K<sub>oc</sub></u>	<u>Soil Organic Carbon-water Partition Coefficient</u>	<u>substance-specific (see table below for organic substances)</u>	<u>L/kg</u>
<u>f<sub>oc</sub></u>	<u>Soil Fraction of Organic Carbon</u>	<u>0.001 or tested for site-specific value (max value = 0.006)</u>	<u>kg/kg</u>
<u>θ<sub>w</sub></u>	<u>Water-filled Soil Porosity</u>	<u>0.28</u>	<u>L<sub>water</sub>/L<sub>soil</sub></u>
<u>θ<sub>a</sub></u>	<u>Air-filled Soil Porosity</u>	<u>0.15</u>	<u>L<sub>air</sub>/L<sub>soil</sub></u>
<u>H'</u>	<u>Henry's Law Constant</u>	<u>substance-specific (see tables below)</u>	<u>unitless</u>
<u>ρ<sub>b</sub></u>	<u>Dry Soil Bulk Density</u>	<u>1.5</u>	<u>kg/L</u>

\* The reference in the value for DF should be to "22a-133k-2(c)(3)(B)(iv)".

Soil Organic Carbon-Water Partition Coefficient (K<sub>oc</sub>) and Henry's Law Constant (H') Values for Organic Substances

<b>Substance</b>	<b>K<sub>oc</sub> (L/kg)</b>	<b>H' (Dimensionless)</b>
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Distribution Coefficient (K<sub>d</sub>) and Henry's Law Constant (H') Values for Inorganic Substances

<b>Substance</b>	<b>K<sub>d</sub> (L/kg)</b>	<b>H' (Dimensionless)</b>
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Note: The tables indicated provide values for individual substances for use in the associated equation.

**ATTACHMENT 2**

**MassDEP User Guide for the Method 3 Shortforms and  
Example of a Completed Shortform for Residential Exposure to a Petroleum Release**

# MassDEP Shortforms for Human Health Risk Assessment under the MCP

## USER'S GUIDE

### In this User's Guide

Shortform Applicability .....	1
Shortform Set-Up .....	1
Using the Shortforms .....	2
Adding Non-listed Chemicals to the Shortforms .....	2
Contact Information.....	3

### **Shortform Applicability**

The Shortforms are designed to streamline the Method 3 risk assessment and review process. While Method 3 risk assessments are site-specific, some exposure scenarios are sufficiently standardized for a template approach. MassDEP has assembled recommended exposure assumptions and toxicity information into the Shortform spreadsheets to calculate risk for each of these standard scenarios.

The Shortforms have important limitations. These include, but are not limited to:

1. Exposure Assumptions - It is the risk assessor's responsibility to verify that the exposure assumptions in each Shortform are appropriate for use at their site.
2. Exposure Pathways - The Shortforms may not cover all exposure pathways present at a site. For example, the Park Visitor Shortform for contaminated soil does not assess risks associated with inhalation of volatile compounds. At sites where this pathway might be of concern (e.g., athletic fields or parks established over former landfills), additional assessment would be needed.
3. EPC Development - Development of appropriate Exposure Point Concentrations (EPCs) for each exposure pathway is vital to ensuring that the results of the Method 3 Risk Assessment are valid. Regulations and guidance describing the development of EPCs can be found in 310 CMR 40.0900 and MassDEP's 1995 *Guidance for Disposal Site Risk Characterization*. If these requirements are not met, results from the Shortform are invalid.
4. Generic IH Calculations - The Shortforms use a generic approach to evaluating imminent hazards (IH). However, MassDEP's regulations at 310 CMR 40.0955(2)(c) call for chemical-specific approaches for certain hazardous materials. While some chemicals have reminders that pop up about a chemical-specific IH hazard quotient, it is the Shortform user's responsibility to identify contaminants that require a chemical-specific approach and evaluate them accordingly.
5. Non-Calculated Risks - Some risks are not included in the Shortforms. For instance, chromium(VI) in soils poses an imminent hazard due to contact dermatitis at a level of 200 mg/kg (rounded from 170 mg/kg), though the residential Shortform yields a hazard quotient of less than one for that concentration. All calculations should be reviewed to ensure that they comply with the MCP.

### **Shortform Set-Up**

The Shortforms are comprised of Excel workbooks, each of which addresses a specific receptor (e.g., resident, trespasser, construction worker, etc.) exposed to oil or hazardous materials (OHM) in soil, indoor air, drinking water, or surface water. Each Shortform workbook contains several worksheets, the first of which is an index with a short description of each of the subsequent worksheets. The following worksheets provide information on Exposure Point Concentration (EPCs), equations to calculate cancer and noncancer risk ("C Eq" and "N Eq"), exposure assumptions ("Exp"), and chemical-specific information ("Chem") drawn from the Vlookup workbook. Tables in the worksheets are designed to be self-explanatory and compliment a written risk assessment report.

All Shortforms are linked to the same Vlookup workbook that contains chemical-specific information such as dose-response values and physical constants. The Shortforms and the Vlookup file are intimately linked. To keep this relationship intact and the Shortforms functional, anytime a new file is available, it's best to download all of the files again.

## Using the Shortforms

The Shortforms and Vlookup files should be extracted to the same folder before being opened. In order to ensure that the workbooks link correctly, the Vlookup file should be opened first. Shortforms can then be opened subsequently.

Using each Shortform is a simple two-step process:

1. Select Contaminants of Concern (COCs) in the first column of the EPCs worksheet. COCs can be added using a drop-down menu that appears when a cell in that first column is selected.
2. Enter site-specific EPCs in the cell immediately to the right of each COC. Check to be sure the units of your data match those in the Shortform. Risks associated with each COC/EPC combination are calculated automatically and displayed in the cells to the right of the EPC. Risks are only displayed for pathways that might contribute significantly to overall risk.

The total site cancer (Excess Lifetime Cancer Risk, ELCR) and noncancer (Hazard Index, HI) risks for all of the COCs are summed at the top right of the EPC spreadsheet. If there is exposure to more than one medium (soil and groundwater, for example), the total risk must be calculated by adding the HIs and ELCRs from all of the applicable Shortform files.

Notes of caution: **Under no circumstances should columns or rows be deleted or inserted between existing ones in the Shortforms.** Doing so could disrupt the intra- and inter-worksheet links, thus compromising the validity of the risk calculations. Similarly, do not change the name of the Vlookup. The risk assessor is responsible for ensuring that the most recent versions of the Shortform and Vlookup files are downloaded from the MassDEP website when used to support a risk characterization report.

If the Shortform is submitted to fulfill a Method 3 Risk Assessment requirement, it must be submitted as a component of a report that includes a comprehensive site description, hazard identification, description of site activities and uses, identification of receptors and exposure points, discussion of the applicability of any Activity and Use Limitations (AULs), EPC estimation, risk characterization summary, and an uncertainty section. The Shortform is a risk calculation tool, intended for use by risk assessors in the context of a complete risk assessment.

## Adding Non-listed Chemicals to the Shortforms

Risk assessors comfortable with Excel can use the Shortforms to include additional chemicals of concern. Other than adding COCs and their respective properties and EPCs, the spreadsheets must not be modified in any way if they are to be submitted as Shortforms. If toxicity values or exposures factors for listed chemicals are altered, any **modifications should be highlighted** through the use of bold text, changed titles, and text description that clarifies that the workbooks are no longer the standard MassDEP Shortforms. The risk assessor should also describe and provide technical justification for the changes in the accompanying text.

Risk assessors may add chemicals to the COC list, provided they have the required physical and toxicological information for that chemical. The instructions below are for use with MS Excel version 2007.

1. Open the applicable Shortform and the VlookUp file.
2. Add the chemical to the COC dropdown in the Shortform:
  - a. Unhide Column A by dragging the column marker left of Column B to the right until chemical names show.



- b. Add the chemical to the *bottom* of the dropdown list, adding “zz” before the name to protect the Vlookup alphabetizing, eg “zzEthylMethylTop”.
  - c. Click in column B under Oil or Hazardous Material to select the dropdown.
  - d. Go to the Data tab, choose Data Validation
  - e. Under Settings, change Source to include the new row, ie \$A\$126 instead of \$A\$125. Add more if adding more chemical rows, ending with \$A\$127 or \$A\$128 as applicable.
  - f. Check the box “Apply these changes to all other cells with the same settings”
3. Add the zz chemical to the Vlookup: in the last row of column A in tabs v1, v2, v3, and v4.
4. Add the necessary data for each tab. Only chemical data that is required for the media and exposures used in the Shortform that is being modified must be added.
5. Change the Vlookup named ranges used in the equations to include the new chemical info:
  - a. In the Vlookup, select the Formulas Tab -> Name Manager.
  - b. Select named range “physical\_prop” -> edit.
  - c. Change the “refers to” box from “=V4!\$A\$2:\$F\$118” to “=V4!\$A\$2:\$F\$119”
    - This includes the new row. Add more if adding more chemical rows, ending with \$F\$120 or \$F\$121 as applicable.
  - d. Click “ok”
  - e. Repeat steps b. through d. to expand the “refers to” for these other named ranges:
    - RAFs
    - toxicity
    - V4Constants
    - WaterPUF
6. Hide column A in the Shortform again. Select column A, right click, and select Hide.
7. Add COCs and EPCs as usual.

## Contact Information

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**Resident - Soil: Table RS-1  
Exposure Point Concentration (EPC)  
Based on Resident Ages 1-31 (Cancer), 1-8 (Chronic Noncancer), and 1-2 (Subchronic Noncancer)**

ELCR (all chemicals) = 5.4E-07  
Chronic HI (all chemicals) = 2.5E-01  
Subchronic HI (all chemicals) = 5.6E-02

Do not insert or delete any rows

Click on empty cell below and select OHM using arrow.

Oil or Hazardous Material	EPC (mg/kg)	ELCR <sub>ingestion</sub>		ELCR <sub>dermal</sub>		Derm & Ing ELCR <sub>total</sub>		Chronic		Derm & Ing		Subchronic		Derm & Ing	
		ELCR <sub>ingestion</sub>	ELCR <sub>dermal</sub>	ELCR <sub>total</sub>	ELCR <sub>ingestion</sub>	ELCR <sub>dermal</sub>	ELCR <sub>total</sub>	HO <sub>ing</sub>	HO <sub>derm</sub>	HO <sub>total</sub>	HO <sub>ing</sub>	HO <sub>derm</sub>	HO <sub>total</sub>	HO <sub>ing</sub>	HO <sub>derm</sub>
ALIPHATICS C9 to C12	5.7E+02						1.4E-02	2.3E-02	3.7E-02	3.8E-03	4.4E-03	8.2E-03			
ALIPHATICS C5 to C8	2.8E+02						1.7E-02	2.9E-02	4.6E-02	4.7E-03	5.5E-03	1.0E-02			
AROMATICS C9 to C10	4.0E+02						3.2E-02	5.5E-02	8.7E-02	8.9E-03	1.0E-02	1.9E-02			
ALIPHATICS C9 to C18	1.2E+03						2.9E-02	4.9E-02	7.9E-02	8.0E-03	9.4E-03	1.7E-02			
BENZENE	5.0E-01	1.0E-08	3.2E-09	1.3E-08			3.0E-04	7.7E-05	3.8E-04	3.3E-04	5.9E-05	3.9E-04			
TOLUENE	7.4E-01						2.2E-05	5.7E-06	2.8E-05	6.2E-06	1.1E-06	7.3E-06			
PHENANTHRENE	3.0E+00						7.3E-05	2.1E-04	2.8E-04	2.0E-05	3.9E-05	5.9E-05			
FLUORANTHENE	4.0E+00						7.3E-05	2.1E-04	2.8E-04	8.0E-05	1.8E-04	2.4E-04			
BENZO(a)PYRENE	2.5E-01	2.0E-07	1.4E-07	3.5E-07			6.1E-06	3.4E-06	9.5E-06	1.7E-06	6.5E-07	2.3E-06			
BENZO(b)FLUORANTHENE	1.2E+00	9.8E-08	6.8E-08	1.7E-07			2.9E-05	1.6E-05	4.6E-05	8.0E-06	3.1E-06	1.1E-05			
BENZO(k)FLUORANTHENE	1.0E+00	8.2E-09	5.7E-09	1.4E-08			2.4E-05	1.4E-05	3.8E-05	6.7E-06	2.6E-06	9.3E-06			