STATE OF CONNECTICUT

DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION

[DRAFT]

Guidance for

Applying Technical Impracticability of Groundwater Remediation Variance

Pursuant to the Remediation Standard Regulations

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LIST OF ACRONYMS AND ABBREVIATIONS

AULs	Alternative Use Restrictions
CGS	Connecticut General Statutes
CSM	Conceptual Site Model
Department	Department of Energy and Environmental Protection
DNAPL	Dense Non-Aqueous Phase Liquid
ELUR	Environmental Land Use Restriction
EPA	United States Environmental Protection Agency
ITRC	Interstate Technology and Regulatory Council
LEP	Licensed Environmental Professional
LNAPL	Light Non-Aqueous Phase Liquid
MNA	Monitored Natural Attenuation
NAPL	Non-Aqueous Phase Liquid
PCBs	Polychlorinated Biphenyls
PMC	Pollutant Mobility Criteria
RAP	Remedial Action Plan
RCSA	Regulations of Connecticut State Agencies
RSRs	Connecticut Remediation Standard Regulations Sections 22a-133k-1 through 22a-133k-3
TI	Technical Impracticability
TI Zone	The geographic area where contaminants related to a TI Variance are known or anticipated to exceed applicable criteria in groundwater or soil vapor

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In developing this guidance document some concepts and terminology were utilized from a pre-publication draft of guidance prepared by the New Jersey Department of Environmental Protection, the Army Corps of Engineers Remedial System Evaluation Checklist, and various documents published by the Interstate Technology and Regulatory Council (ITRC).

1. Introduction

This guidance document titled "Guidance for Applying Technical Impracticability of Groundwater Remediation Variance Pursuant to the Remediation Standard Regulations" (Document) has been prepared to assist environmental professionals with understanding the conditions for which a Technical Impracticability (TI) Variance pursuant to Section 22a-133-3(e)(2) of the Regulations of Connecticut State Agencies (RCSA) are applicable and appropriate to achieve site closure. This Document expresses the Department of Energy and Environmental Protection's (Department) preferred approach for demonstrating the appropriateness of a TI Variance, to identify the steps that should be taken before applying for a TI Variance, and what a TI Variance would allow in terms of final site closure, including requirements for long-term responsibilities. The guidelines presented in this Document provide a consensus on the most expeditious approach for review and approval of a TI Variance Request.

The Department recognizes that professional judgment may differ on the application of the guidance offered in the Document to specific site conditions. In such cases, it is incumbent upon environmental professionals to provide justification to document that their decision is equally protective of human health and the environment. The Department may consider alternative approaches to requesting a TI Variance provided a thorough explanation is provided to demonstrate that the variance is consistent with Sections 22a-133k-1 through 22a-133k-3, inclusive, of the RCSA (Remediation Standard Regulations [RSRs]).

It should be noted that the term "Technical Impracticability" is also used in the RSRs in Section 22a-133k-3(e)(1) in reference to a self-implementing variance allowing the use of remedial criteria other than background concentrations, or analytical method detection limits for groundwater samples. The allowable remedial criteria being utilized in that provision are the health-based RSR criteria and thus no long-term controls are necessary. The provision allows the endpoint of an active groundwater remediation to be defined by risk-based default RSR criteria if further remediation to natural conditions is technically impracticable. The self-implementing TI Variance pursuant to Section 22a-133k-3(e)(1) of the RSRs is not included in this Document.

This Document provides guidance on the scope of investigation and type of data typically needed to support a request to the Department for a TI Variance. In addition, this Document identifies long-term obligations to document the continued effectiveness of the site management approach. The primary topics covered in this Document are:

- Applicability of a TI Variance for groundwater impacts which cannot be fully remediated, including circumstances where the groundwater impacts are the result of a residual source that cannot be fully remediated and where groundwater impacts will persist for an extended period of time following source remediation (Section 2);

- Extent of remediation that is required for the source and for the groundwater plume under a TI Variance (Section 3);

- Information necessary to develop and validate a Conceptual Site Model (CSM) to support a TI Variance Request (Section 4);

- Components of the review and approval process for a TI Variance Request (Section 5); and

- Long-term responsibilities associated with an approved TI Variance including, establishing restrictions on land use, land use monitoring, operation and maintenance of long-term control measures, groundwater monitoring, financial assurance, and reporting (Section 6).

Appendices to this Document include:

- A flow chart illustrating the sequence of components in the process for requesting a TI Variance (Appendix A);

- A suggested format for submittal of a TI Variance request (Appendix B);

- Factors to be considered in determining the need for and the boundaries of a Secondary TI Zone (Appendix C);

- A request for public input regarding the concept of creating a permitting process to manage the long-term responsibilities for ensuring the continued effectiveness of the TI Variance (Appendix D) (This appendix will not be included in the final version of this Document);

- A request for public input regarding the type of financial assurance that would be appropriate for supplemental measures identified in the site's contingency plan (Appendix E) (This appendix will not be included in the final version of this Document);

- Recommendations for changes to the TI Variance Provision from the February 7, 2013 "Draft Proposal for a Transformed Cleanup Program" (Appendix F);

- A description of the envisioned Class C Cleanup Exits from the February 7, 2013 "Draft Proposal for a Transformed Cleanup Program" (Appendix G).

2. Applicability

A TI Variance, under Section 22a-133-3(e)(2) of the RSRs, provides an alternative means of achieving compliance with applicable criteria for groundwater contamination which is not technically feasible to be remediated. A TI Variance is a mechanism to manage risks to human health and the environment in situations where there is no readily available technology to complete remediation and achieve compliance with the applicable RSR groundwater criteria within a reasonable timeframe. A TI Variance does not waive the requirements to delineate the nature and extent of the release of pollutants, to remediate continuing sources of groundwater pollution, or to address potential risks to groundwater receptors.

There are three options for TI Variances allowed under Section 22a-133k-3(e)(2) of the RSRs, titled "Variance Due to Technical Impracticability of Ground-water Remediation". This subsection states:

The Commissioner may grant a variance from any of the requirements of this section if he finds that:

- *non-aqueous phase liquids that cannot be contained or removed … are present;*
- *remediation to the extent technically practicable has reduced the concentration of pollutants in ground water to steady-state concentrations…; or*
- *… as determined using Directive No. 9234.2-25 issued September 1993 by the U.S. Environmental Protection Agency's Office of Solid Waste and Emergency Response.*

This Document discusses the first two technically distinct options in detail. The United States Environmental Protection Agency (EPA) document, referenced in the RSRs as a third approach for documenting the appropriateness of the TI Variance, ("Guidance for Evaluation of the Technical Impracticability of Ground-Water Restoration" Directive No. 9234.2-25) is essentially a variation on the first two concepts. EPA provides a more detailed framework under which a TI can be effective for "maintaining protectiveness at the sites where ground water cannot be restored within a reasonable timeframe."[1] The premise of the EPA guidance is that a TI determination involves a consideration of engineering feasibility and reliability of attaining media cleanup standards, as well as situations where remediation may be technically possible, but the scale of the operations required may be of such a magnitude and complexity that the (remedial) alternative would be impracticable. Although the EPA reference is separately identified in the RSRs, in the decades since the EPA guidance was developed, there have been significant advances in remedial technologies and the understanding of contaminant fate and transport in the environment. However, the RSRs specifically provide for use of the EPA guidance as a means for requesting a TI Variance, therefore, it remains a viable option. The Department will generally review a TI Variance submittal relying on the EPA guidance in a manner described in this Document for the first two options.

Please note that for non-aqueous phase liquid (NAPL), whether dense or light, containing polychlorinated biphenyls (PCBs), as well as any PCB source removal, the federal PCB regulations

[1] EPA Directive No. 9234.2-25, page 2

at 40CFR761 require EPA approval of remedial options. Also, a TI Variance Request including the presence of PCBs in groundwater may also be subject to the requirements of 40CFR761. Any such proposal would require EPA review and approval.

2.1 Technical Impracticability Variance Overview

A TI Variance is an optional remedial approach that can be protective of human health and the environment, even though remedial criteria in groundwater will not be fully achieved. The TI Variance applies only to the specific contaminants and the specific portion of the aquifer for which they are demonstrated to be impracticable to remediate. The TI Variance may apply to either an entire groundwater plume or just to a portion of the plume for which natural attenuation is not anticipated to result in the achievement of groundwater criteria (the portion of the plume could be upgradient of a treatment area or within a containment zone). Essentially, a TI Variance provides an alternative approach for closure at sites that have difficulty achieving compliance using a permanent remedy or another option under the RSRs. A TI Variance would be a viable remedial option when it has been demonstrated that appropriate remedial measures have been evaluated and implemented and it is not technically practicable to further reduce contaminant concentrations in groundwater to achieve applicable remedial criteria within a "reasonable timeframe"[2], and that downgradient receptors (e.g. private wells, surface water bodies, indoor air via volatilization, direct exposure to groundwater at seeps) are not likely to be exposed to concentrations above applicable established criteria.

Once it has been determined that it is not practicable to remediate or otherwise restore groundwater quality, the concept of "prudent" can be applied in evaluating the merits of remedial options available for those plumes that are impracticable to fully remediate.[3]

If compliance with the applicable criteria can be achieved within a reasonable timeframe, then Monitored Natural Attenuation (MNA) should be evaluated as a remedial approach. For the purpose of this Document, a "reasonable timeframe" generally refers to a period of 20 years from the date of the completion of source remediation. Alternative timeframes and approaches to compliance may be considered with appropriate justification and technical documentation.

A TI Variance requires the establishment of a "TI Zone" which is defined as the geographic area where contaminants related to the TI Variance are known or anticipated to exceed applicable criteria in groundwater or soil vapor. Compliance with RSR criteria is not required within the TI Zone for those specific contaminants. Within the TI Zone, the protection of human health and the environment is ensured by site-specific measures defined by the TI Variance rather than by achieving the RSR criteria for groundwater or soil vapor for the specific contaminants being addressed by the TI Variance. This might include site-specific alternative criteria that are based on certain receptor assumptions within the TI Zone. One of the long-term obligations under any TI Variance is to assure

[2] EPA Directive No. 9234.2-25, page 2
[3] This topic is discussed further in Section 3.2 of this Document.

that the receptor assumptions used in determining the remedial approach remain protective. The long-term obligations required to ensure that the TI Variance continues to be protective are the responsibility of the Party requesting the TI Variance. Those obligations are transferable from one Party to another and may run between Parties but not necessarily between property owners.

A TI Variance is a variance from the regulations and is associated with a Remedial Action Plan (RAP). A TI Variance is generally not filed on the land records, however, a groundwater or land use restriction in the form of an Environmental Land Use Restriction (ELUR) is typically a component of a TI Variance. The posting of financial assurance may be necessary for any continued inspection, monitoring, containment, treatment, reporting or contingency measures that may be needed. Periodic updates, in the form of five (5) year review reports, typically will be required to verify that a TI Variance continues to be protective.

Further remedial actions, beyond the approved RAP, such as the review and implementation of emerging technologies, will not be required unless conditions in the field change to cause the approved remedial approach to be ineffective in protecting groundwater receptors. Although not required, the Party assuming the long term obligations pursuant to a TI Variance may evaluate and implement emerging technologies to achieve groundwater conditions that preclude the continued need for the TI variance and its associated obligations. Additional information regarding long-term responsibilities and administrative mechanisms is provided in Section 6.

Based on the Department's experience, approvals of TI Variances will be infrequent due to the burden of proof necessary to support such requests. TI Variances for certain sites, such as those with sensitive receptors, may have an even higher burden of proof than those without a sensitive receptor in the vicinity.

2.2 Residual Source

A TI Variance may be appropriate for scenarios where groundwater impacts exceeding applicable criteria resulting from a release of NAPL, or pollution in the form of a smear or discontinuous residual NAPL in soil or bedrock that cannot be effectively removed or degraded (hereinafter referred to as a Residual Source). Generally, TI Variances are most commonly applied to releases of dense non-aqueous phase liquids (DNAPL) and light non-aqueous phase liquids (LNAPL) in environmental settings that pose significant technical difficulties for effective remediation. (Typically, LNAPL residuals naturally degrade in a much shorter time frame, but a TI Variance may be appropriate to address persistent exceedances of groundwater criteria.) The Residual Source scenario also applies to persistent contamination in a solid or sorbed form, rather than as a NAPL, causing a continuous impact to groundwater quality.

2.3 Persistent Plume

A TI Variance may also be appropriate for scenarios where groundwater impacts that demonstrate apparent steady state or slowly diminishing plumes persist at levels exceeding applicable criteria and cannot be fully contained or remediated (hereinafter referred to as a Persistent Plume). For the purposes of this Document, a Persistent Plume may include dissolved contamination in groundwater, exceeding applicable groundwater criteria, in which the mass of contaminants within the plume is not increasing over time and is naturally attenuating, but the concentrations of the contaminants and/or their breakdown products may increase at any location within the plume. The areal extent of the Persistent Plume may increase, as long as the assumptions applied to evaluate or control risks to potential receptors remain unchanged. Persistent Plumes may remain at unacceptable levels after the best technically practicable clean-up of impacted groundwater has been evaluated, and implemented as appropriate, including remediation of the plume source.

The Persistent Plume option applies to those sites where the sources (primary and secondary) have been remediated, but resulting groundwater impacts, whether contiguous to or detached from the former source, will remain for an unreasonably long time due to low groundwater velocity or other geologic conditions.

In some cases, both scenarios described above may apply at a site. It should be noted that in some cases, a Persistent Plume may reflect that an unidentified Residual Source is still present at the site, and the need for further site characterization should be evaluated. (See Section 4)

2.4 What a Technical Impracticability Variance is Not

A Technical Impracticability Variance is not:

- A waiver for the remediation of any unsaturated soil impacted above applicable Pollutant Mobility Criteria (PMC);
- A waiver from the requirements to complete remediation and monitoring of other release areas or other contaminants of concern at a Site;
- A determination that no further action is feasible, or that no other measures are necessary to manage pollution in a manner that is protective of human health and the environment;
- A reclassification of groundwater quality to GB; or
- A substitute for MNA when groundwater concentrations are projected to meet the applicable remedial criteria within a "reasonable timeframe."[4]

[4] Until a separate guidance document is issued or endorsed by the Department, the use of MNA at a site will be a site-specific evaluation. Use of concepts presented in various guidance documents published by EPA and ITRC may be beneficial in such an evaluation.

3. Extent of Remediation Required

This Section discusses the extent of remediation that is required for a TI Variance under either the Residual Source or Persistent Plume scenarios.

The goal of remediation is to prevent the degradation of environmental media and protect receptors. The RSRs allow a TI Variance where remediation "has reduced the concentration of pollutants in groundwater to steady state concentrations that exceed any applicable criteria."[5] This concept applies both to the remediation of residuals which are continuing to contribute contaminants to the environment and remediation of the impacted groundwater. The extent of the groundwater plume exceeding applicable criteria must also be "reduced to the extent technically practicable,"[6] or the impracticability of such reduction of plume area must be demonstrated.[7]

In order to limit the duration and extent of a plume subject to a TI Variance, it is expected that remediation of a contaminant source and plume will be implemented on those portions, and for those contaminants, which are able to be remediated with commonly used technologies capable of causing a meaningful reduction.

3.1 Source Remediation

Contaminant source removal and contaminant source control must be evaluated and implemented to the extent "technically practicable," which the RSRs define as "the greatest degree of remediation that can be achieved using sound engineering and hydrogeologic practices."[8] Note that this definition includes the use of "sound … practices" which will generally be interpreted as including commonly accepted and proven technologies. This definition does not allow for the consideration of cost, except in the case of removal of dense non-aqueous phase liquids under Section 22a-133k-(2)(g) of the RSRs which requires containment or removal to the maximum extent prudent.

Remediation of the contaminant source applies to the "primary release area(s)" where the activities occurred at the site as part of operational releases of contaminants. It also applies to "secondary release areas" where undissolved contaminants are present as a result of migration from the primary release area and are serving as an ongoing source of contamination impacting water, soil vapor and/or seeps of free-phase product and where sorbed contaminants continue to pollute groundwater.

[5] §22a-133k-3(e)(2) of the RSRs
[6] §22a-133k-3(e)(2)(A)(ii)(aa) of the RSRs
[7] §22a-133k-3(e)(2)(A)(ii)(bb) of the RSRs
[8] §22a-133k-1(a)(71) of the RSRs

In order to show that remediation of a source area has been completed to the extent technically practicable or maximum extent prudent, as applicable, the following should be documented:

- DNAPL has been "contained or removed from soil and groundwater to the maximum extent prudent."[9]

- LNAPL has been remediated to the extent technically practicable in accordance with Section 22a-133k-2(g) of the RSRs.

Note that source area remediation may entail remediation of NAPL or non-NAPL sources of groundwater pollution that are below the water table and thus not specifically subject to the PMC section of the RSRs. To support the use of a TI Variance, which is a variance to groundwater quality criteria, implementation of supplemental measures beyond what is required under Section 22a-133k-2(c) for PMC and Section 22a-133k-2(g) for NAPL will typically be necessary to address the impact that residual contamination present below the water table has on groundwater quality. In the context of a request for a TI Variance, the concept of remediation to the "maximum extent prudent" could be applied to all releases which are not otherwise limited by the reference to "extent technically practicable" under Section 22a-133k-2(g) of the RSRs (for example, non-NAPL sources).

As part of the requirement to evaluate source removal and source control options, it will be necessary to demonstrate whether supplemental treatment for mass removal would achieve significant environmental benefit by reducing the size or duration of the plume and the potential risk to receptors. However, the adequacy of such a determination is not subject to further evaluation during the 5 year review reporting that will typically be part of the TI Variance long-term responsibilities.

The continuation of a remedial system to reduce a plume's extent by reducing the mass flux from a source area, or a short-term containment system such as one used for removal of NAPL, is inconsistent with the use of a TI Variance as a final remedy. When reduction of mass flux has been accomplished as a permanent remedy rather than as an actively maintained remedy, a TI may be appropriate. Until that time, the Department may provide a "Concurrence Letter" indicating that a TI Variance would be appropriate following completion of such active remedies. Concurrence Letters typically include conditions necessary for the TI Variance to become final, such as successful implementation of the approved RAP and the achievement of any site-specific remedial criteria.

3.2 Groundwater Remediation

Separate from addressing the contaminant source, the RSRs require that "the extent of the ground-water plume which exceeds such ground-water protection criterion has been reduced to the extent technically practicable"[10] or "is not technically practicable to reduce the extent of the ground-water

[9] §22a-133k-2(g) of the RSRs
[10] §22a-133k-3(e)(2)(A)(ii)(aa) of the RSRs

plume."[11] The Department expects that groundwater remedial measures will be evaluated and implemented, as appropriate, and that supplemental actions will be implemented to maximize and/or enhance the initially implemented measures prior to the issuance of a TI Variance. Such groundwater remedial measures are necessary in combination with, rather than in place of, addressing the source of the contamination.

An evaluation of the merits of active remediation of the groundwater impacts should be made in relation to whether the success of such an action would be "practicable in a reasonable timeframe."[12] Infrequently, there may be situations where it is determined that although it is technically possible to achieve the applicable criteria, that goal is impracticable due to the scale of the remediation project, the amount of time that the remediation system would need to operate to meet those criteria, costs associated with construction of the remedy or its long-term operation, the potential for unacceptable impacts to the community from the remedial approach, or other site-specific factors.

Once it has been determined that it is impracticable to remediate a plume, the concept of "prudent" should be applied in evaluating the merits of remedial options available for those plumes that are impracticable to fully remediate. It will be expected that in many cases active limited groundwater plume remediation, or other methods of enhanced attenuation, will be used to minimize the mass of contaminants in the core of the plume and minimize the extent of groundwater that exceeds applicable remedial criteria. These remedial measures, focused on source and plume reduction, would not be appropriate to be part of the long-term obligations under the TI Variance; rather they are measures necessary to demonstrate that the remediation of the plume has been performed to the maximum extent prudent, prior to the issuance of a TI Variance.

However, to the extent that an active system is serving to provide long-term hydraulic containment of the groundwater plume to reduce the long-term costs for a TI Variance, to address risks to receptors related to the groundwater plume, or to reduce the number of off-site properties that may have restrictions on their use, the ongoing operation of that system could be considered part of the implementation of the TI Variance.

[11] §22a-133k-3(e)(2)(A)(ii)(bb) of the RSRs
[12] This topic is further discussed in Section 2.1 of this Document.

4. Conceptual Site Model to Support TI Variance Request

The RSRs allow a TI Variance where remediation "has reduced the concentration of pollutants in ground water to steady-state concentrations that exceed any applicable criteria."[13] However, the extent of the plume exceeding criteria must be "reduced to the extent technically practicable,"[14] or the impracticability of such reduction of plume area must be demonstrated.[15]

A TI Variance may be an appropriate remedial option for groundwater impacts where it is not technically feasible to remove a source area (Residual Source), or monitoring has shown that, although the source area has been addressed, groundwater will not achieve remedial criteria within a "reasonable timeframe" due to low groundwater velocity or other geologic conditions (Persistent Plume).

A decision regarding the appropriateness of a TI Variance cannot be made until characterization of the plume and its source(s) is sufficient for decision-making purposes with no significant data gaps, consistent with the Site Characterization Guidance Document. In some cases, a specific remedy would be suitable for either Residual Source or Persistent Plume scenarios, so there can be flexibility in the level of characterization and certainty needed to develop a Conceptual Site Model (CSM) to distinguish between either of these scenarios. Supplemental characterization may be necessary as part of the TI Variance approval process to support the technical evaluation of possible remedial technologies, the feasibility of these technologies, and the evaluation of potential future risks. In the case of a Persistent Plume, the Department expects that contaminant sources that may be causing the persistent groundwater impacts will be investigated in accordance with prevailing standards and guidelines.

When a TI Variance is part of a long-term solution, it will not be considered as an alternative to, at a minimum, addressing the source of the pollution to the maximum extent prudent, or practicable as appropriate, and implementing other appropriate remediation techniques for the groundwater plume. It is expected that remediation of a contaminant source and plume will be implemented with commonly used technologies capable of meaningfully reducing the duration and extent over which a TI Variance would be necessary in order to limit the extent of a plume subject to a TI Variance. The focus of the source remediation would be on those portions of a release area and for those contaminants that are able to be remediated.

A TI Variance deals with groundwater contamination and compliance with the applicable groundwater criteria. The specific contaminants and the applicable criteria, or site-specific criteria, for which the TI Variance is being sought, must be specified, along with how compliance with those criteria will be monitored.

[13] §22a-133k-3(e)(2) of the RSRs
[14] §22a-133k-3(e)(2)(A)(ii)(aa) of the RSRs
[15] §22a-133k-3(e)(2)(A)(ii)(bb) of the RSRs

4.1 Evaluating Appropriateness of a TI Variance for Groundwater Remediation

Evaluation of remediation potential should be undertaken in a phased approach by using both site characterization and remedial performance data. Any assessment of a TI Variance Request should be viewed as a collaborative process between the Department and the environmental professional. Thus, the use of a TI Variance in establishing the site remediation and management approach should be planned in conjunction with this Document and in consultation with the Department. Data should be collected, analyzed and presented using multiple lines of evidence so that the engineering feasibility and reliability of groundwater remediation is fully addressed.

The evaluation of the appropriateness of a TI Variance should be based on an assessment that any ongoing sources of contamination (residuals which are continuing to contribute contaminants to the environment) have been, at a minimum, remediated to the maximum extent prudent and would not be subject to further remedial requirements.

Prior to attributing a chronic groundwater problem to untreatable residuals or geologic conditions, assessment of whether groundwater remediation is technically impracticable should be based on a validated CSM that describes contaminant releases, remedial activities completed, contaminant migration, and environmental receptor exposure to contaminants. Note that when evaluating the appropriateness of the TI Variance approach, care should be taken to review the thoroughness of the site investigation. The Department has frequently found that when a plume fails to attenuate following source remediation, the problem is actually the result of an inadequately defined source area that has not been properly remediated. Also, in some cases, an apparent Persistent Plume may be the result of an incompletely characterized or remediated secondary source associated with sorption which is not easily delineated or remediated, but is discernable by review of monitoring data or remedial system performance.

In validating the CSM and evaluating the thoroughness of the remedial activities completed, the environmental professional should consider the following data objectives when considering if a TI Variance is appropriate:

- Groundwater monitoring adequately characterizes the nature and three-dimensional extent of the plume[16] and any potential changes in contaminant concentrations will not pose a risk to human health and the environment;

- Potential exposure pathways threatening human health and the environment from polluted groundwater have been identified and addressed;[17]

- Data gaps have been identified and evaluated for significance (a significant data gap would be one that limits the ability to formulate a single scientifically defensible interpretation of environmental conditions or potential risks, or that may affect the choice of remedial approach);

[16] §22a-133k-3(e)(2)(A)(i) & (ii) of the RSRs
[17] §22a-133k-3(e)(2)(A)(iii) & (iv) of the RSRs

- An evaluation of natural attenuation, based on monitoring subsequent to source remediation, has shown that groundwater will not achieve remedial criteria within a "reasonable timeframe;"[18]

- Removal or containment of NAPL has been achieved to the maximum extent practicable, or prudent, as applicable (for Residual Source scenario);

- Remediation of the source area(s) has been completed and there is no soil contamination within the source area causing impairment to groundwater above applicable criteria as shown through soil and groundwater monitoring (for Persistent Plume scenario); and

- Remediation and/or containment of the groundwater plume have been conducted to limit the extent of the groundwater plume.

In evaluating the appropriateness of a TI Variance, the environmental professional will need to consider alternative remedial technologies (conventional or innovative). This evaluation should include an assessment of the feasibility, effectiveness, and relative costs of the alternative remedial technologies for both achieving compliance with the RSRs in a reasonable timeframe and full restoration of the aquifer.

In some cases it may not be feasible to attain the applicable criteria, but it may be feasible to substantially reduce contaminant concentrations or control contaminant migration. For sites where remedial systems have been in operation for a period of time, operational data can be used to demonstrate that contaminant mass removal is negligible for the time and resources being expended. In those cases, once it is shown that an appropriate remedial system has been selected, properly operated and optimized to reduce contaminant concentrations or control migration, a TI Variance may be an appropriate alternative.

4.2 Establishing the TI Zone

As stated earlier, the TI Zone is the area where the contaminants specific to the TI Variance exceed applicable groundwater criteria in groundwater or soil vapor. Delineation of the TI Zone based on a stable or diminishing plume is an essential element in obtaining a TI Variance.[19] For the purpose of a TI Variance, the evaluation of whether a stable or diminishing plume exists may include items such as:

- The plume is not increasing in size or concentration in a manner which would alter the risk assumptions associated with the TI Variance Request or the extent of the TI Zone;

- The mass flux of the plume is not increasing at an appropriate measuring point(s) within the TI Zone boundary; and

[18] This topic is further discussed in Section 2.1 of this Document.
[19] See concept as discussed in ITRC EACO-1 "Enhanced Attenuation: Chlorinated Organics"

- Natural attenuation mechanisms associated with the current conditions have been reasonably shown to be sustainable.

In most cases, the vertical extent of the TI Zone will extend through the entire groundwater column and will not differentiate between overburden and bedrock aquifers, or between stratified overburden aquifers. Horizontally, the TI Zone can be limited to an area within an actively maintained groundwater containment or treatment zone, rather than an entire plume. This would apply to cases where the portion of the aquifer outside the TI Zone would be restored to the applicable criteria through natural attenuation. Groundwater monitoring will be necessary to confirm continued compliance at this boundary. The continued operation and maintenance of any containment or treatment process maintaining the TI Zone boundary will also be a necessary part of the TI Variance.[20]

In some cases, groundwater analytical or numerical modeling may be utilized to predict the current and future extent of the plume exceeding criteria and the resulting boundaries for the TI Zone.

Depending on the nature of administrative controls being proposed and the hydrogeologic setting, a Secondary TI Zone may be required as a buffer beyond the TI Zone, with a limited set of land use restrictions. The Secondary TI Zone is the geographic area where there is potential for future activities to alter the groundwater or soil vapor dynamics within the TI Zone, resulting in concentrations of contaminants exceeding applicable criteria migrating beyond the TI Zone boundary. These potential future activities may include, but are not limited to:

- New groundwater withdrawals;
- Ceasing of significant existing groundwater withdrawals;
- Alterations that impact groundwater recharge, such as the addition of storm water infiltration basins or significant regrading for development;
- Land use or topographic changes that introduce volatilization risks; and/or
- Any activity that could otherwise influence the nature of the risk evaluation.

Where possible, Secondary TI Zone boundaries would be situated along property boundaries and roads.

Appendix C provides further guidance on establishing the Secondary TI Zone.

[20] See Section 6.3 of this Document

4.3 Receptor Assessment

The CSM supporting a TI Variance Request should also include a groundwater receptor assessment that evaluates existing risks and potential risks to human health[21] and the environment[22] posed by the groundwater plume, and should also consider the following:

- Sensitive land uses in the vicinity of the site;
- A receptor survey(s) for potable wells, or non-potable wells, such as those used for process water or irrigation, including the identification of any "at risk" wells and measures incorporated into the TI Variance to address exposure pathways;
- A vapor intrusion receptor survey which identifies all buildings overlying the groundwater plume and measures taken to assess and mitigate any impacts to indoor air quality, if volatilization is an issue; and
- Summary of an ecological risk assessment, including the identification of any exposure pathways.

The receptor assessment should also include an evaluation on how potential changes in land use might affect the groundwater plume and potential receptors, along with proposed measures to prevent future changes which could alter the hydrologic conditions which form the basis for the risk assessment assumptions for those receptors.

If risks or potential risks are identified, a plan to address the risks must be provided as part of the information in support of the TI Variance Request.[23]

4.4 Application for Reclassification of Groundwater to GB

The RSRs require a request for a TI Variance to include an application for a groundwater reclassification to Class GB in accordance with Sections 22a-426-1 through 22a-426-9 RCSA, inclusive.[24, 25] However, there is no connection between the ability for a GB reclassification to be obtained and the ability to issue a TI Variance. Often, the applicant for the TI Variance has already explored the potential for reclassification and found that the criteria cannot be met. In such case, the application for reclassification of groundwater can be abbreviated. The GB reclassification application should be discussed with Department's Water Protection and Land Reuse Bureau, Planning & Standards Division staff prior to submittal.

[21] §22a-133k-3(e)(2)(A)(iv) of the RSRs
[22] §22a-133k-3(e)(2)(B) of the RSRs
[23] §22a-133k-3(e)(2)(A)(iii), (A)(iv) & (B)(ii) of the RSRs
[24] §22a-133k-(3)(e)(2)(A)(v) of the RSRs
[25] See "Revised Guidance for the Submission of Applications to Lower Ground Water Quality Classifications to Class GB" dated November, 2013.

Typically, applications for a change of groundwater class are submitted early in the process and prior to the submittal of a formal TI Variance Request, since in many cases the removal of Groundwater Protection Criteria as the remedial goal will eliminate the need for a TI Variance. Previously submitted applications may be sufficient to satisfy this requirement.

4.5 Natural Resource Assessment

Regardless of whether the application for groundwater reclassification is approved, a natural resources assessment is a necessary component of a TI Variance Request.

A natural resource assessment typically includes the following:

- Demonstrating the value of the natural resource system, including the aquifer as a present and future resource based on its potential yield and natural quality;
- Determining the feasibility to restore the aquifer as a natural resource system;
- Determining the availability of alternative sources for water supply;
- Assessing the value of the habitat supported by the aquifer; and
- Assessing the vulnerability of the resource to further impairment.

In addition, a Use Attainability Analysis, as provided under the Connecticut Water Quality Standards, is required if the TI Variance will result in a permanent surface water impairment. [26, 27]

4.6 Contingencies to Manage Potential Future Risks

Depending on site conditions and the ability to implement land use restrictions to prevent future changes to the risk assessment assumptions, a Contingency Plan for addressing future changes to the contaminant plume may be required as part of the TI Variance Request. The future corrective measures included in a Contingency Plan would be dependent on the level of certainty in the CSM, the nature of land use control measures to be used, and the level of risk associated with the CSM being inaccurate.

The Contingency Plan may be activated in the event that land use restrictions instituted within the TI Zone or Secondary TI Zone are not sufficient to prevent changes to conditions which could result in human and environmental receptors ceasing to be adequately protected by the remedial approach.

[26] CTDEP Water Quality Standards Effective Feb. 25, 2011" pages 1 and 39
[27] §22a-133k-3(e)(2)(B) & (D) of the RSRs

The Contingency Plan may also be activated in the event long-term monitoring results indicate increases in contaminant concentrations, which will therefore require a re-evaluation of the CSM to identify the reason for such changes to the groundwater plume.

Triggers to activating a Contingency Plan include, but may not be limited to, changes to receptor assumptions, changes in the geochemical stability of the groundwater plume, or failure to achieve or maintain site-specific milestones at monitoring points associated with the approved remedial approach.

Threshold concentrations for key constituents at specified monitoring points may be used to define triggers for the implementation of various enhanced monitoring, evaluation, or protective measures under the site's Contingency Plan. For example, the Contingency Plan could include things such as supplemental testing to explain changes to water quality or flow direction or implementation of predetermined additional remedial measures to avert impacts to receptors. The posting of financial assurance may be required to ensure implementation of supplemental corrective measures if changes in site conditions warrant such a response.

One example of a situation that would require a Contingency Plan would be for a downgradient property where a land use restriction cannot be secured, or the future use of groundwater on that property cannot otherwise be restricted. In this example, the Contingency Plan ensures the protection of future potential receptors in the event contamination migrates beyond the defined TI Zone. The Contingency Plan could also include measures to contain or treat groundwater, or provide an alternate supply of drinking water.

Another example would be where a downgradient property owner does not allow installation of a sub-slab venting system and subsequent long-term monitoring shows the groundwater plume has migrated beyond the containment system or the previously anticipated limits of the groundwater plume.

As previously mentioned, remedial actions beyond those conducted under the approved RAP, are not required to be taken unless conditions in the field change regarding groundwater receptors causing the approved approach and contingency options to be ineffective in protecting those receptors. However, the Department does not prohibit any Party implementing a TI Variance from undertaking supplemental voluntary remedial actions, should a new technology arise that has the ability to achieve the default cleanup objectives or reduce long-term operation and maintenance obligations.

5. Approval Process

This Section describes the steps and components of application request for a TI Variance. Appendix A provides a Process Flow Chart to illustrate the steps and components.

5.1 Initial Meeting

Parties interested in assessing whether a TI Variance is appropriate as a remedial component for a specific site are encouraged to contact Department staff to discuss the process for submitting and evaluating a formal request. Typically, an initial meeting with the Department will be appropriate. In order for such initial meeting to be productive, it is generally necessary for the environmental professional to have a fairly thorough understanding of the source areas and a CSM relating those releases to the groundwater impacts that would be subject to the TI Variance. The following information should be brought to the initial meeting:

1. Summary of why the TI Variance is being sought;
2. Applicant's relationship to property owner;
3. Brief site history, description of all Areas of Concern, and summary of the investigations completed;
4. Discussion of hydrogeology including appropriate groundwater flow maps;
5. Discussion of the vertical and horizontal delineation of contaminants and media that are the subject of the TI Variance;
6. Discussion of the stability of the plume;
7. A regional location map showing source area(s), estimated lateral limits of the plume and presumed discharge location(s) of plume;
8. A basic understanding of nearby receptors including discussion of potential on-site and off-site groundwater users, vapor intrusion risks and ecological receptors;
9. Efforts to address residual sources and source media subject to the TI Variance; and
10. Discussion of feasibility of more permanent remedies.

Any information available related to the following would also be useful to contribute to the discussion during the initial meeting:

11. A statement that all Areas of Concern relevant to the TI Variance have been investigated and the nature and extent of releases are understood (no unaddressed sources contributing to the TI issue remain);

12. Maps and relevant cross sections showing vertical and horizontal delineation of contaminants and media that are the subject of the TI Variance;

13. A conceptual TI Zone boundary, showing the projected long-term extent of exceedances of groundwater criteria;

14. Discussion and tabulation of all available groundwater data including duration and frequency;

15. Discussion of steady state nature and fate and transport evaluation in support of TI Variance Request; and

16. Discussion of the viability of MNA as an alternative remedial approach.

Based on the data gaps in the CSM, the suitability of the remedial approach and other items identified as a result of the initial meeting with the Department, revisions would typically need to be made to the CSM and potentially the remedial approach. These other items might include supplemental investigation, remedial actions, feasibility studies, monitoring, receptor surveys and/or risk assessments.

5.2 Review Process

Revisions to the CSM in response to comments from Department staff may be an iterative process to address various complex issues such as: those related to contaminant fate and transport; a determination of what site-specific level of remediation would be necessary to achieve the "maximum extent prudent" threshold; the geographic boundaries of the area to be subject to the TI Variance; land use restriction options; and long-term obligations.

In most cases, initial contact with appropriate local officials should occur at this stage of the process.

As a result of this iterative process, either the Department will concur that the CSM and remedial approach support a TI Variance, or determine that it is not an appropriate alternative for the site. Once concurrence is received, a formal TI Variance Request would be submitted and formal public notice distributed.

5.3 Formal TI Variance Request

The submission of a formal TI Variance Request typically follows the Department's concurrence with the CSM and Remedial Approach for a site or portion of a site. The TI Variance Request provides a public record of the current CSM, the assumptions included in the risk evaluation, the delineation of the TI Zone and Secondary TI Zone, if applicable, and the long-term obligations of the party requesting the variance. A suggested format for presenting this information is provided in Appendix B.

The TI Variance Request must be public noticed as part of the Remedial Action Plan prior to the Department's approval. If public comments on the TI Variance Request are received, then the request may need to be revised in response to those comments. The Department's evaluation of the TI Variance Request will take into account the public comments received and any revisions required in response to the public comments.

5.4 Public Participation

The framework for public notice of actions being implemented in accordance with the RSRs is specified in Section 22a-133k-1(d). Essentially, this provision requires that for each site where remediation is to occur, a general public notice be published, posted or mailed. However, in many cases the decision to seek a TI Variance may be made after the close of the relevant regulatory comment period, precluding a specific opportunity for the public to comment on the proposed variance. Since sites where a TI Variance is being requested have resulted in groundwater impacts that will remain for a long period of time, there is a greater need for the public to specifically review the concept of a TI Variance as a remedial approach for the site.

To ensure the public has sufficient opportunity to review and comment on a pending TI Variance Request, the Department recommends the following approach to public noticing.

- Since a request for a TI Variance seeks a waiver from complying with prescribed remedial criteria in the RSRs for groundwater, the public should have an opportunity to review and comment on the request prior to the Department's approval. However, varying levels of public notice and public participation would be expected for various situations and settings.

- If there are long-term implications to water supplies or other natural resources, all interested and affected property owners should be allowed the opportunity to review and comment. This may require an expanded public notice beyond what is typically required.

- The language in the public notice for a TI Variance should be clear in describing that the proposed remedial approach will not remove the full extent of contamination present in the environment.

- The local health director and other town officials would be involved, at varying levels, depending on the complexity of the site. As noted above in Section 5.2, in most cases, contact with local officials would occur during the initial technical review and prior to Department's concurrence with the CSM and the remedial approach.

- It may be beneficial to initiate the public notice process following the Department's concurrence with the CSM and the remedial approach, and the subsequent submittal of the formal TI Variance Request (as shown in the Process Flow Chart provided in Appendix A).

- The public notice associated with the formal TI Variance Request should include:

    - The geographic area (including streets) affected;

    - A description of how both the presence of the contamination and the approval of a TI Variance will affect natural resources and properties within the TI Zone and Secondary TI Zone, if applicable. (For example, this might include the inability to use groundwater for potable purposes or the need to install vapor barriers for new construction.);

    - Locations where the site reports can be reviewed;

    - Direct notification to the individual property owners within the TI Zone;

    - A 45 day public comment period, possibly longer, if necessary; and

    - An informational meeting, if necessary.

- To the extent possible, public notices associated with other components of the site remediation (i.e., RAP, engineered control, and/or ELUR) should be combined to streamline the process and provide the public with a complete picture of the remediation proposed for the site.

- To the extent possible, public information meetings for the TI Variance Request should be held in combination with any public meetings or hearings required under other applicable programs, such as RCRA or the groundwater quality reclassification process.

- The need for an additional public notice may be triggered if significant changes to the long-term responsibilities are proposed in a 5 year reporting event.

The applicant may propose another approach to public noticing, as long as it is consistent with the RSR objectives and other relevant statutes and regulations.

5.5 Actions Required Following Approval

As specified in Section 22a-133k-3(e)(2)(C) of the RSRs, within 30 days of the approval of a TI Variance, the person receiving the variance shall submit to the Commissioner:

> *(i) "certification that written notice of the extent and degree of such pollution has been provided to each owner of property overlying the subject ground-water plume at which it is not technically practicable to remediate a substance to a concentration equal to or less than the ground-water protection criterion;*
>
> *(ii) certification that written notice of the presence of pollution on each such parcel and a description of the extent and degree of such pollution has been sent to the Director of Health of the municipality or municipalities in which the ground-water plume is located; and*
>
> *(iii) certification that best efforts have been made to ensure that each owner of property overlying the subject ground-water plume records an environmental land use restriction which ensures that the subject ground-water plume is not used for drinking or other domestic purposes."*[28]

While it is expected that each of the parties cited in the section referenced above would have been involved in the process leading up to the granting of the TI Variance, the RSRs specifically require issuance of those notifications following the formal approval.

5.6 Natural Resource Damages

The Department reserves the right to seek a Natural Resource Damage claim as part of the granting of a TI Variance, as allowed by Section 22a-6a of the Connecticut General Statutes, or other related statutory authority delegated to the Commissioner.

5.7 Final Approval/Verification Status

In situations where the only issue preventing a site from achieving a final closure is the inability to comply with groundwater criteria, the granting of a TI Variance for the area exceeding those criteria would allow the issuance of a final verification or Department final approval for a site. A site with a TI Variance approval can be completely closed and the remedy accepted as a permanent and final solution, as long as any applicable Engineered Controls, ELURs, other land use or municipal restrictions, and other long-term responsibilities remain in place for the site and all potentially

[28] The Department's expectations for alternative measures when ELURs are not achievable are discussed in Section 6.1 of this Document.

impacted parcels. The long-term responsibilities under an approved TI Variance are discussed in Section 6 of this Document.

6. Long-Term Responsibilities

Most TI Variances will include long-term monitoring and reporting obligations. Frequently, approved TI Variances also include containment systems and other protective measures to address risks to receptors. These systems and measures require long-term operation, maintenance, monitoring, financial assurance, and reporting. The obligation to conduct these continuing long-term actions must be clearly identified in a legally binding document.

Presently, long-term responsibilities required under the TI Variance can be specified and obligated through an existing enforcement action, a new Consent Order or in the case of RCRA Corrective Action sites, a Stewardship Permit. However, many sites are not performing remediation under these enforcement mechanisms, but rather are conducted under Voluntary Remediation and Property Transfer programs. Most obligations under those programs cease upon the final sign-off for the site and so do not provide viable options for administering the necessary long-term obligations under a TI Variance. To address this, the Department is evaluating the applicability of a long-term permit or a similar vehicle as part of the Transformation of cleanup programs in Connecticut. As part of the February 2014 draft version of this Document, concepts for how this may be implemented in the future are presented in Appendix D.

In most cases, the desired goal of these TI Variances is to allow the final verification or Department final approval of a site, and, as appropriate, a subsequent Form II filing pursuant to the Property Transfer Program, under Section 22a-134a Connecticut General Statutes (CGS). However, the use of enforcement actions would be inconsistent with this goal.

The Department expects that a Licensed Environmental Professional (LEP) will be retained to oversee performance of the long-term obligations. In addition, five (5) year reports and other submissions to the Department that interpret monitoring results, inspection results or otherwise address the protectiveness of the TI Variance shall be submitted under the review of the LEP. Notification to the Department is needed should the LEP of record change.

6.1 Restrictions on Alterations to Land Use Assumptions

As part of the evaluation of potential risks related to the plume migration, certain assumptions are made regarding land uses and potential exposure to polluted groundwater within the TI Zone. In order for these assumptions to remain valid, restrictions will typically be put in place to prevent exposure to contaminated groundwater, changes in the flow direction or velocity of the groundwater plume, or changes to vapor migration pathways.

For some sites, restrictions may need to extend beyond the TI Zone to prohibit new groundwater extractions to the extent that it might intercept or otherwise divert polluted groundwater. Similar restrictions may be necessary to limit significant changes to surface or subsurface drainage features which have the potential to influence the flow direction of polluted groundwater. As discussed in

Section 4.2, the Secondary TI Zone is the area where additional restrictions are needed to prevent future activities that may alter the groundwater or soil vapor dynamics within the TI Zone. This area is not part of the TI Zone itself because the groundwater beneath the Secondary TI Zone does not exceed applicable criteria and is not within an at-risk area at the time the TI Variance is granted.

There are several options available to enact restrictions within the TI Zone and Secondary TI Zone:

6.1.1 Option 1: Recording of Environmental Land Use Restrictions

The preferred approach to enacting restrictions is by recording an ELUR to prohibit certain activities on those portions of the site, and as applicable, other affected properties within the TI Zone and Secondary TI Zone. ELURs are effective tools to apply restrictions such as prohibiting the installation of potable wells and construction of buildings without vapor control measures.

The RSRs require *best efforts* be made "to ensure that each owner of property overlying the subject ground-water plume records an environmental land use restriction which ensures that the subject ground-water plume is not used for drinking or other domestic purposes".[29] For situations where such a filing on the land records is not attainable, alternative options are suggested below.

Use of Alternative Use Restrictions (AULs), as provided in 22a-133o(c) CGS, may also be applicable; however, regulations governing the implementation of AULs are currently not in place.

6.1.2 Option 2: Municipal Restrictions

The Department may consider alternative mechanisms to ensure adequate control of potential exposure when, despite best efforts, ELURs cannot be obtained for all parcels within the TI Zone (and Secondary TI Zone when necessary). The Department may forgo the requirement for an ELUR if a municipal ordinance covering the area of the impacted properties is implemented. These municipal ordinances might include zoning restrictions, parcel-specific well installation prohibitions due to presence of water main, or conditions for various local permits to pre-screen land use changes within the TI Zone (and Secondary TI Zone when necessary). It may be necessary to include a provision to involve the Department if any request for a variance to the municipal ordinance is made, or if the ordinance is proposed to be modified or eliminated by the municipality. Periodic monitoring and reporting would be required to ensure that the initial land use assumptions regarding receptors or exposure issues are maintained as discussed below in Section 6.2.

6.1.3 Option 3: Long-Term Monitoring of Land Use Assumptions

If ELURs or municipal ordinances are not feasible or adequate to provide assurance of the protectiveness of the remedial approach, an additional long-term post-remediation care plan may be required to verify that the initial land use assumptions regarding receptors or exposure issues inherent to the TI Variance are maintained. The post-remediation care plan may include periodic monitoring

[29] §22a-133k-3(e)(2)(C)(iii) of the RSRs

and reporting of the status of the potentially impacted properties (possibly at a frequency different than the typical 5 year review) to assure the initial land use assumptions regarding receptors or exposure issues are maintained. The post-remediation care plan would be part of the long-term obligations for the site. If in the future it is determined that such a plan is not adequately protective, predetermined contingency measures may need to be implemented.[30]

Under Option 3, since administrative controls in place would be insufficient to limit changes to the receptor assumptions that have a reasonable potential to occur, the remedial approach approved would not be viewed by the Department as a final remedy. Therefore, TI Variances utilizing this option would not be suitable to support a final verification or a final approval for the site by the Department.

6.2 Land Use Monitoring

For most TI Variances, periodic re-confirmation of land use risk management assumptions will be necessary. Varying degrees of land use monitoring will be required to identify and address changes to the initial land use assumptions regarding receptors or exposure issues that form the basis for determining adequacy of long-term controls. In most cases, long-term monitoring requirements will consist of 5 year status updates to evaluate whether the TI Variance remains protective and whether changes to downgradient receptors have occurred. Depending on the nature of the groundwater impacts and the potential for changes within the TI Zone or the Secondary TI Zone, a monitoring program specifically designed for the site could also include inspections within the TI Zone and/or Secondary TI Zone to identify land use changes that might affect groundwater flow patterns, groundwater use, or contaminant mobility. Land use changes that might be of concern include things such as the introduction of new receptors within the TI Zone (buildings subject to vapor intrusion, pumping sources, surface water expressions), creating or increasing a groundwater withdrawal near the TI Zone (either through active pumping or passive dewatering measures), the construction of structures which could disrupt the existing groundwater flow pattern (deep footings or other barriers) or significant changes to drainage patterns (such as the installation of infiltration basins).

As part of a land use review, an LEP certification indicating whether the approved remedial approach remains effective at protecting human health and the environment will be necessary. In the event that a 5 year review or some interim review identifies conditions suggesting the existing remedy is no longer effective at protecting human health and the environment, a plan and schedule for further investigation and, if necessary, for the implementation of the site's Contingency Plan, would be submitted to the Department. The Department may also take, or require, appropriate actions.

[30] This concept is further discussed in Section 4.6 of this Document.

6.3 Ongoing Controls and Measures

The approved TI Variance may include active containment systems and venting systems, conventional (passive) engineered controls, other protective measures and other alternative approaches which will be necessary for achieving compliance with the applicable criteria outside of the TI Zone. To ensure that the groundwater plume does not migrate beyond the boundaries of the TI Zone, the following items may be necessary:

- An operation and maintenance plan for the required active and/or passive controls and measures associated with the remedial strategy;
- Performance criteria for each system, including but not limited to, design objectives, maximum contaminant concentrations, minimum pumping rates, draw downs, and operating pressures;
- A monitoring program to gauge the effectiveness of each system, to be included with the submittal of monitoring reports to the Department on an annual basis;
- A program for assessing monitoring data and site conditions with the submittal of monitoring reports to the Department on an annual basis; and
- A program for implementing contingency measures if a system becomes ineffective, including triggers for implementing various changes to the operation, maintenance and monitoring.

It is important that the purpose and goals of each system are clear so that there can be a process for proposing modifications to the systems and ultimately decommissioning the systems and associated long-term obligations when that system is no longer necessary for the protection of receptors under the TI Variance.[31]

The long-term responsibilities for ensuring the continued effectiveness of these systems in support of the TI Variance will need to be enforceable through an administrative action or permit process. Concepts for how this may be implemented in the future are presented for public discussion in Appendix D.

6.4 Groundwater Monitoring

In most cases, a long-term groundwater monitoring program will be required and will vary from annually to every 5 years, depending on risk factors such as migration rates, proximity to receptors, the potential for changes in receptors, contaminant mass flux, and toxicity of the contaminants.

[31] This concept is further discussed in Section 6.6 of this Document.

The primary objectives of such a program are to demonstrate the long-term effectiveness of any control methods and to provide periodic revalidation of the hydrogeologic and hydrogeochemical data upon which the TI Variance was based. The design of such a monitoring program will vary, depending on site specific conditions and the nature of the necessary controls. The monitoring program should be designed to analyze plume migration and/or the effectiveness of containment and identify concentration trends within the delineated groundwater plume. Depending on the site setting, the inclusion of upgradient monitoring wells as part of a long-term program should be considered.

When the limits of a TI Zone are based on observed natural attenuation processes, the long-term monitoring program could require periodic documentation that the attenuation processes are continuing to perform as anticipated.

Under some circumstances, it may be beneficial for the Party responsible for implementing the requirements of the TI Variance to obtain long-term access agreements for parcels within the TI Zone and Secondary TI Zone, if applicable.

Groundwater monitoring necessary to achieve compliance under the RSRs for releases or contaminants not covered by the TI Variance will still be required.

6.5 Financial Assurance

On a case-by-case basis, the Department may require financial assurance for any long-term obligations for measures which may be needed to ensure that human health and the environment continue to be protected. The need for financial assurance deals with both the known ongoing obligations for the site and the additional contingency measures which may need to be implemented in the event that the long-term monitoring data suggests that changes have occurred and the plume is no longer under control.

Posting of financial assurance to cover the cost of long-term obligations for the TI Variance will typically include the continuation of:

- Operation, maintenance and monitoring for the active and/or passive controls and systems associated with the remedial strategy. This may also include costs associated with energy needed to operate the systems and costs associated with the discharge or disposal of water or waste generated by such systems;

- Long-term groundwater and land use monitoring;

- Inspection, review, and reporting on the effectiveness of the TI Variance to protect human health and the environment;

- Receptor updates on the Secondary TI Zone, as appropriate; and

- Future contingency measures or controls that can reasonably be anticipated to be necessary to address changes in the field that cause the selected remedial approach to cease being protective of human health and the environment.

The process for calculating, approving, and implementing the financial assurance should generally be consistent with the financial assurance process for Engineered Controls under Section 22a-133k-2(f)(2)(B)(vii) of the RSRs. Consistent with the Engineered Control section of the RSRs, payment of the Party's expenses for conducting long-terms obligations under the TI Variance is not derived from the financial assurance mechanism. The financial assurance serves as a guarantee that if that Party who has the ongoing long-term obligations under the TI Variance defaults on their obligations, there are funds available for the State or another party to continue performing the necessary long-term operation, maintenance, and monitoring obligations

It is envisioned that as the process for requesting and approving TI Variances matures, there will be the need for two separate types of financial assurance. Further discussion on this concept is presented in Appendix E of this February 2014 Draft version of this Document.

6.6 Five Year Status Review Reporting

In most cases, five (5) year status updates will be included as a key component of the long-term responsibilities. The 5 Year Status Review Report should demonstrate whether the groundwater monitoring program is of sufficient quality and quantity to fully evaluate the performance of the selected remedial approach. If this review indicates that the TI Variance is no longer protective of human health and the environment, then the Party must take appropriate actions.

The 5 year status review will include a review of the necessary data to confirm the assumptions used to support the TI Variance, including but not limited to, groundwater monitoring data, contaminant migration, land use and systems operations. Interim reviews or more frequent reviews may be necessary if required by the approved plan or if the LEP becomes aware of significant changes in monitoring results, system operations, receptor assumptions, or other factors.

The 5 Year Review Report should include the following:

- An evaluation of groundwater monitoring results to assess contaminant trends, compare results with the predicted groundwater conditions, validate the CSM, and verify the plume remains consistent with the TI Zone boundaries. This evaluation should consider factors such as whether the contaminant plume continues to be contained; whether the areal extent of the plume is being reduced and the rates of decline of contaminant concentration and whether dilution or other natural attenuation processes are responsible for the observed trends; and contaminant mass removal. Considerations should be given to whether the observed trends

suggest contaminant sources, other than the residuals identified in the TI Variance, may be acting as an additional source of groundwater contamination;

- An evaluation of the effectiveness of the containment systems, engineered controls, or other measures implemented to achieve the stated objectives and protection of human health and the environment. This evaluation should consider factors such as the performance, operation, maintenance and modifications of systems, and the effectiveness of any modifications previously made to the systems (whether variations in operation, physical changes, or augmentations to the system);

- A description of any changes to land use or receptor assumptions and an assessment of the implications of those changes;

- An assessment of the adequacy of the contingency plan based on the results of the 5 year status review;

- An assessment of the adequacy of the amount of financial assurance including a review of the operational and performance costs for the ongoing requirements, along with the effects of any other findings or recommendations;

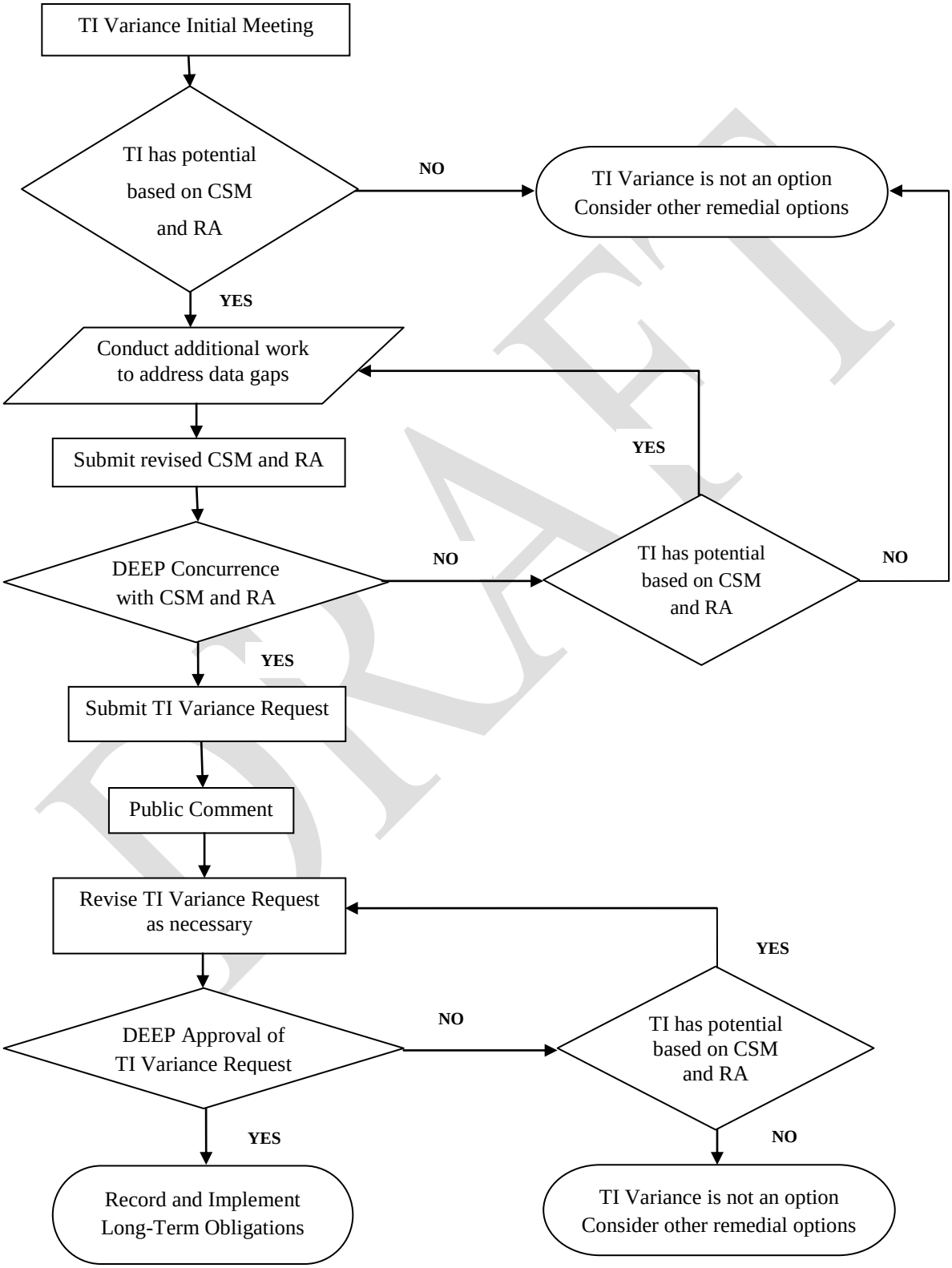
- A recommendation for any modifications to the long-term obligations that ensure the TI Variance continues to be protective of human health and the environment. This includes things such as: changes to technologies; system components; operating parameters; performance data; monitoring; operation and maintenance programs; requests for regulatory changes or actions; and recommendations for changes to land use controls; and

- A certification that the approved TI Variance continues to be protective, or a plan for the identification and implementation of any contingency measures necessary to restore such protectiveness.

As previously noted, these 5 year reviews are not intended to require a re-evaluation of the adequacy of a determination regarding remediation to the maximum extent prudent, or the extent technically practicable, as applicable, or to require the consideration of new remedial technologies as alternatives to an already implemented remedy that continues to be protective.

APPENDIX A - PROCESS FLOW CHART

The following flow chart is provided to illustrate the sequence of components in the process for requesting a TI Variance. CSM = Conceptual Site Model; RA = Remedial Approach.



APPENDIX B - TI VARIANCE REQUEST SUGGESTED FORMAT

The submission of a formal TI Variance Request typically follows the Department's concurrence with the Conceptual Site Model (CSM) and Remedial Approach for a site or portion of a site. The TI Variance Request provides a public record of the current CSM, the assumptions included in the risk evaluation, the delineation of the TI Zone and Secondary TI Zone, if applicable, and the long-term obligations of the party requesting the variance. The TI Variance Request must be public noticed as part of the Remedial Action Plan prior to the Department's approval.

This appendix describes the type of information that is necessary to support a TI Variance Request and suggests a format for presenting the information. In reviewing the TI Variance Request, the Department will further assess the applicability of the site for a TI Variance, the adequacy of the characterization and remedial efforts evaluated and implemented, the nature and extent of the groundwater plume subject to the TI Variance, and the proposed long-term obligations. The Department recommends that the environmental professional include all pertinent information to support the request in the submittal and not reference previously submitted reports. In addition, the Department's transmittal form must accompany the submittal of a TI Variance Request.

The TI Variance Request should include the following topics: Introduction; Conceptual Site Model; Receptor Assessment; Remedial Action Summary; TI Zone and Secondary TI Zone; Land Use Management; and Long-Term Obligations. Details on each topic are provided below.

1. Introduction

The introductory information should include the following:

- A description of the TI Variance, including the contaminants of concern, the RSR criteria subject to the variance and the extent of the groundwater plume;
- Identification of the applicant (e.g., certifying party, responsible party, property owner, potential developer) and their relationship with the property owner;
- Identification of the regulatory program under which the investigation and remediation is being completed, and the regulatory compliance history for the site; and
- An inventory of existing and available documentation that supports the investigation and remediation of the site with a brief description of pertinent information, such as site development and operational history, dates of reports and activities documented therein. Information regarding the condition and status of releases at the site which are unrelated to the TI Variance should also be included. Supporting information from previous reports should be referenced and summarized. If supporting reports have not been previously submitted to the Department, these should be attached as addenda.

2. Conceptual Site Model

The CSM must be presented with sufficient detail to document the environmental professional's complete understanding of the environmental conditions of the site, the nature and extent of the subject groundwater plume, the findings and rationale to support the TI Variance Request, and the completion of the investigation in accordance with prevailing standards and guidelines, including the Department's Site Characterization Guidance Document.

The CSM presented in the TI Variance Request should also include information regarding other groundwater impacts in the vicinity of the plume and a detailed summary of the natural resource assessment performed.

Refer to Section 4 of this Document for more details regarding the CSM.

The data to support a TI Variance Request must be of sufficient quantity and quality to support the remedial approach and risk assessment. This may require more data than would be necessary to fully characterize a site. In addition to understanding the degree and extent of pollution, it is important to fully understand the fate and transport mechanisms that apply to the site scenario. The CSM discussion should be supported by maps, figures, tables and any other visual tools that assist to convey the findings and support the conclusions made by the environmental professional.

3. Receptor Assessment

The TI Variance Request must include the assumptions and results of the risk assessments completed including:

- Identification of both current and potential future receptors, including but not limited to water supply wells (both drinking water wells and wells for other uses), ecological receptors, and buildings overlying the subject groundwater plume;
- Details on the proposed measures to mitigate any existing and/or potential future exposure pathways; and
- Evaluation of how potential changes in land uses might affect the subject groundwater plume and the measures to be implemented to prevent such changes.

4. Remedial Action Summary

A description of remedial actions for the relevant source areas and groundwater plume is required. Refer to Section 4 of this Document for more information on the details necessary to demonstrate that remediation was completed to the maximum extent prudent or technically practicable, as applicable. The remedial action summary to support a TI Variance Request should including the following:

- A discussion of the COCs and the applicable RSR criteria that are considered technically impracticable to achieve;

- Details on the source area remediation completed, including type and duration of each remediation, monitoring results for each relevant release area both before and after remedial measures have been completed to demonstrate effectiveness of those measures in relation to achieving compliance with the RSRs; and why remediation of the source(s) was considered complete, either as having achieved compliance with the applicable RSR criteria, or as having been remediated to the maximum extent prudent or extent technically practicable, as applicable;

- A description of remedial options evaluated for the groundwater plume and, the pros and cons of each option evaluated but not implemented. For those remedial options implemented, include a summary of the remediation effort and groundwater monitoring results. Include a summary and evaluation of all monitoring results to demonstrate that groundwater concentrations will not achieve compliance with the RSRs within a "reasonable timeframe" for each relevant groundwater plume;

- A discussion of mass-removal calculations, total mass removal, remedial performance metrics, and justification for shut-down of applicable remedial systems, including light non-aqueous phase liquid (LNAPL) removed to maximum extent practicable and any other non-aqueous phase liquid (NAPL) removed to maximum extent prudent; and

- A description of the proposed components of any environmental land use restrictions (ELUR), engineered controls or long-term active control measures necessary to achieve compliance with the RSRs.

5. TI Zone and Secondary TI Zone

A description of the TI Zone and the Secondary TI Zone, if necessary, must be included. The descriptions must include the delineation of the Zones and should be supported by scaled figures and geological cross sections. Refer to Appendix C of this Guidance Document for more information.

6. Land Use Management

The TI Variance Request must include a description of the nature and purpose of any land use restrictions, municipal ordinances or other land use management tools which would be utilized to prevent exposure to the groundwater contamination that is subject to the TI Variance or to prevent changes to the groundwater flow assumptions used in determining the limits of the TI Zone. In addition, it must include a description of the potential effects the long-term presence of the groundwater plume would have on the natural resources and properties within the TI Zone and Secondary TI Zone, if applicable.

7. Long-Term Obligations

A plan is required for implementing the long-term obligations associated with the approval of a TI Variance to ensure that assumptions regarding the land uses and receptor assessment remain valid in the future. The long-term obligations include, but may not be limited to: operation and maintenance of remedial systems; restrictions on land use; periodic land use and groundwater monitoring and associated reporting; contingency responses to changes detected in such monitoring; financial assurance to cover the cost of the long-term operation, monitoring, maintenance and contingencies; and submittal of five (5) year status review reports.

The long-term obligations plan must identify specific activities and describe their purpose and objective to ensure the containment of pollution, and the protection of human health and the environment. The plan must also: define the frequency with which each activity must be conducted; describe in detail the process to implement each activity; identify the costs associated with each activity; and, describe how the completion of the activity will be documented and reported to the Department. For contingent response actions, the plan should identify the conditions which will trigger the implementation of the contingency.

APPENDIX C - ESTABLISHING THE SECONDARY TI ZONE

INTRODUCTION

Depending on the need for, and nature of, administrative and engineered controls being proposed and the hydrogeologic setting of the TI Zone, a Secondary TI Zone may be required as a buffer beyond the TI Zone. A Secondary TI Zone is the geographic area where there is the potential for future activities to alter the groundwater or soil vapor dynamics with the TI Zone, resulting in contaminant concentrations to exceed applicable criteria beyond the boundary of the TI Zone.

IS A SECONDARY TI ZONE WARRANTED?

Any decision regarding the need for a Secondary TI Zone should include an evaluation of potential changes in land use that might occur in the area surrounding the proposed TI Zone. The Secondary TI Zone would have a limited set of land use restrictions applied to the area to prevent potential future changes which would result in unacceptable changes to the stability of the plume within the TI Zone.

In assessing whether a Secondary TI Zone is warranted, the applicant should consider pertinent factors that evaluate the potential for impacted groundwater to affect existing or potential receptors, including both human and ecological exposures (e.g. surface water). Factors to consider include, but may not be limited to: the conceptual site model of groundwater flow and contaminant transport; hydrogeology; presence and type of receptors; the cultural setting; the potential for administrative and/or engineered controls to prevent exposure; and the potential for land use changes that may alter the groundwater flow regime, aquifer quality, and potential production capacity.

The potential land use changes which could alter the groundwater or soil vapor dynamics within the TI Zone would include activities such as new groundwater withdrawals, ceasing of significant existing withdrawals, alterations of groundwater recharge, such as the addition of storm water infiltration basins or significant regrading for development, land use or topographic changes that introduce volatilization risks, and activities that could otherwise influence the nature of the risk evaluation.

For example, it may be necessary to restrict certain types of development methods associated with the construction in areas where activities could alter the TI Zone. These restrictions could range from prohibitions of new developments, to the Department or LEP involvement in determining if a proposed development plan has the potential to adversely impact the conditions of a TI Variance.

Inspections are required as part of the 5 year review, or on an alternative approved schedule as appropriate, to determine whether any such land use changes have occurred within the Secondary TI Zone.

If a Secondary TI Zone is not proposed, it is the responsibility of the applicant to include a technical discussion to support that conclusion. In some cases, some type of analytical or numerical groundwater modeling may be needed to support the conclusion that a Secondary TI Zone is not warranted to protect human health and the environment.

EVALUATING THE EXTENT OF THE SECONDARY TI ZONE

The geographic extent of the Secondary TI Zone may be evaluated utilizing existing data or analytical and/or numerical groundwater modeling of contaminant migration both laterally and vertically under current conditions and various potential future conditions. The level of detail required for any groundwater modeling effort will depend primarily on the complexity and sensitivity of the hydrogeologic setting, as well as the nature of, and risk to, potential receptors. Numerical groundwater modeling might be more appropriate in situations where the complexity of the hydrogeologic or cultural setting would have a higher probability of affecting the predictability or reliability of an analytical model, or in situations that pose a higher level of risk to potential receptors.

The following provides a few examples of geographic or hydrogeologic settings where numerical groundwater modeling may be appropriate:

- Future development of the aquifer may result in new withdrawals or increases in withdrawals that could cause the contaminant plume to migrate beyond the defined TI Zone. This would include significant municipal, domestic, industrial, agricultural or remedial use of the aquifer in locations likely to be in hydraulic connection to the defined TI Zone.

- The plume is within a confined or semi-confined aquifer where the area of influence of a pumping well could intercept the plume from several thousand feet away.

- Well registrations or diversion permits exist, but the owners of such permits may not currently be fully exercising their rights to extract groundwater/surface water. Modeling the effects of such withdrawals may be necessary to establish an appropriate Secondary TI Zone, since the permitted withdrawal of water from the aquifer is still possible under those registrations/permits.

Items that should be considered when developing a numerical groundwater model to determine the extent of the Secondary TI Zone include the following:

- Three-dimensional extent of the contaminant plume and its fate and transport characteristics;

- Hypothetical groundwater withdrawals, such as production wells, and realistic as well as legally permissible withdrawal rates for such wells; and

- Shape of the Secondary TI Zone, which does not need to be consistent on all sides and in all directions.

In all cases where modeling is conducted, a sensitivity analysis should be performed for the entire modeling effort, and decisions regarding the size and shape of the Secondary TI Zone should take into account inaccuracies in the model. It is also important to consider possible changes in future use of the area under consideration and that the model is developed, or additional configurations of the model be constructed, to account for such changes in use.

In other scenarios where modeling is deemed necessary, qualitative hydrogeologic evaluation alone may be sufficient to determine the boundaries of the Secondary TI Zone. Examples of such situations might include relatively simple hydrogeologic settings in which the plume is migrating:

- Within a GB groundwater quality classification area;

- Into a major river;

- Towards a major highway; or

- Into an area where ordinances exist that prohibit future development and the drilling of water supply wells.

The above examples are provided as settings where analytical modeling or qualitative evaluations may be appropriate. It is the responsibility of the applicant to justify the type of model or evaluation that is used.

Where possible, the Secondary TI Zone boundaries should be situated on property boundaries, roads or topographic features.

The extent of the Secondary TI Zone may need to be reevaluated as part of the 5 year review based on the results of the long-term groundwater monitoring program and assumptions used in defining the limits of the Secondary TI Zone.

APPENDIX D - CONCEPTS FOR LONG-TERM OBLIGATION PERMITS

The Department is seeking public input in evaluating how to manage the long-term responsibilities for ensuring the continued effectiveness of the TI Variance.

Presently, the long-term responsibilities can be specified and obligated through an existing enforcement action, a new Consent Order or in the case of RCRA Corrective Action sites, a Stewardship Permit. However, since in most cases, the desired goal of a TI Variance is to allow a final verification or Department final approval of a site, the use of enforcement actions would be inconsistent with this goal. Since most obligations under Voluntary Remediation Programs and the Property Transfer Program cease upon the final closure for the site, these are not viable options for administering long-term obligations.

Most TI Variances will include long-term monitoring and reporting obligations. Frequently, the approved TI Variance will also include containment systems and other protective measures to address risks to receptors related to the groundwater pollution subject to the TI Variance. These systems and measures will require long-term obligations associated with operation, maintenance, monitoring, financial assurance, and reporting. The Department requires a formal mechanism, such as an administrative action or permit, to ensure long-term obligations associated with a TI Variance are performed.

As part of the transformation of the Department's remediation programs, statutory changes are being considered to allow the issuance of Long-Term Obligation Permits. The Department envisions a long-term permit to be associated with the issuance of the TI Variance; however, this will require statutory changes. It is currently anticipated that such a permit would be issued by the Department in a manner similar to a simplified version of a RCRA Stewardship Permit.

A Long-Term Obligation Permit would provide an enforceable administrative mechanism for the long-term responsibilities associated with the TI Variance, without the connotation associated with an Order that the site is in violation of remedial requirements. Additionally, such a permit would be transferrable and would allow a site to be eligible for a final verification or Department final approval, and as appropriate, a subsequent Form II filing pursuant to the Property Transfer Program under Section 22a-134a of the CGS.

Presently, the Department has not initiated research to see how other States have addressed this issue and has not begun to list provisions or draft language which might be included. There are a variety of existing permit programs in Connecticut which could be used for the administrative review, approval, renewal and fees associated with such a permit. Also, the overlap between transferring the permit and transferring remedial liability under various statutes and regulations will need to be clarified.

Another approach which has been suggested, although not presently preferred by the Department, is the requirement that the obligation be tied to the land records and become the responsibility of each

subsequent land owner. In this situation, a contractual obligation between the property owner and the Responsible Party to perform the necessary work could be arranged.

The Department welcomes input regarding these and other options which could be made available to provide an administrative mechanism for these long-term obligations.

APPENDIX E - CONCEPTS FOR FINANCIAL ASSURANCE

To determine the appropriate amount of the financial assurance, it will be important to have a quantifiable cost for the long-term obligations associated with use of the TI Variance in a site's remedial approach.

It is envisioned that as the program for TI Variances matures, there may be a need for two separate types of financial assurance. The first type of financial assurance covers the cost for the State to hire a third party to continue monitoring, maintenance and reporting obligations of the TI Variance in the event that the Party fails to meet those obligations, similar to the financial assurance for engineered controls under the RSRs. A second type of financial assurance may be necessary to ensure implementation of supplemental measures identified in the site's Contingency Plan that may be triggered in the future to contain the groundwater plume or to protect receptors.

Depending on site conditions and the inability to implement land use restrictions to prevent future changes to the risk assessment assumptions, a Contingency Plan for addressing future changes to the contaminant plume may be required as part of the TI Variance Request for future corrective measures. The corrective measures included in a Contingency Plan would be typically dependent on the level of certainty in the Conceptual Site Model (CSM), the nature of land use control measures to be used, and the level of risk associated with the CSM being wrong.

Public input is invited regarding the options available to address this issue.

For example:

There is a need to have a balance between providing protection against certain potential changes to receptor assumptions and the reality that in some cases these scenarios have a very low likelihood of occurring.

Since many of the contingencies would be related to future events that are highly unlikely to occur, but would result in significant supplemental remedial costs, how would it be determined which of these contingencies will need to be covered with a surety, and how would the amount of the associated surety be calculated?

Since the portion of the financial assurance related to contingencies could be substantial, should funds designated specifically for contingencies be available for the implementation of those contingencies by the Party?

In the event that a Party fails to meet its obligations, under what circumstances should a prospective purchaser have access to the funds designated to cover the contingencies?

Under what circumstances might a fee be appropriate to pool funds exclusively for low probability contingencies to either supplement or replace the need for this second type of financial assurance, similar to the intent of fees collected under the Covenant-Not-to-Sue[32] or the Section 17 Program[33]?

[32] 22a-133aa CGS

[33] Section 17 of Public Act No. 11-141 "An Act Concerning Brownfield Remediation and Development as an Economic Driver"

APPENDIX F -TI VARIANCE RECOMMENDATIONS
FROM FEBRUARY 7, 2013
"DRAFT PROPOSAL FOR A TRANSFORMED CLEANUP PROGRAM"

Technical Impracticability

Current provisions in the RSRs allow for considering the remediation of groundwater to be technically impracticable. Obtaining such a variance can be a cumbersome, technically complicated, and expensive process. Efforts are being made to clarify and simplify this process in order to increase the ability for this option to be used. These efforts are two-fold:

(1) To identify criteria for determining the applicability, appropriateness, and protectiveness of a TI by demonstrating that a release subject to a TI variance does not and will not adversely impact human health or the environment; and

(2) To provide additional mechanisms for the use of a TI, including the use of Institutional Controls for groundwater and volatilization, a TI for impacts to groundwater from residual sources which have been remediated to the maximum extent prudent (or practicable), and a TI for groundwater plumes that can be shown to not be naturally attenuating in a reasonable time frame.

With regards to the first, it would be necessary to provide a better definition of what will be expected in remediating a release to the "maximum extent prudent", "reasonable timeframe," "extent practicable" and other technical concepts such as determining cost versus benefit to the environment, cost versus level of risk to receptors, and cost versus the ability to achieve compliance with criteria. The value of the current requirement to apply for a GB reclassification as part of the TI request should be revisited. It would also be useful to have the option to include prohibition of all groundwater pumping as part of an ELUR, rather than simply a prohibition to use water for potable or other domestic uses.

Two types of TIs are currently in use: the Residual Source TI and the Steady State TI. The Residual Source TI option applies to those sites where the primary release has ceased but a recalcitrant residual phase causes a continuing impact to the State's water quality. The Steady State TI option applies to those sites where the source (primary and residual) has been eliminated, but resulting groundwater impacts, whether contiguous or detached, will remain for an unreasonably long time due to low groundwater velocity or other geologic conditions.

Because of the associated long-term groundwater obligations, closure of a release for which a TI variance is obtained would be eligible for Class C Tiered Cleanup Exits (refer to Section XI). The TI provision in the RSRs (Section 22a-133k-3(e)(2)) does not mandate the posting of surety nor does it mandate long-term monitoring and maintenance. Since long-term obligations to maintain and monitor systems required for a TI variance would be comparable to those for Engineered Controls, this language would be updated in revisions to the RSRs. To make these long-term obligations

clearly enforceable, there would need to be a framework in place, such as a permitting process which can be transferrable from party to party and is long in duration. If the Responsible Party ceases to exist after the TI is in place, thereby abandoning its long-term obligations, the release would no longer be in compliance. Financial surety would be required to cover the cost of the State in taking over any short-term responsibility until obligations can be assumed by a new party. In such cases, it may be beneficial to allow some or all of the surety to be used as an incentive for a new owner to cover the cost of the long-term obligations that they would be assuming. TI variances would also be subject to registry for non-conforming groundwater quality so that such information will be readily available to interested parties.

Another expansion option may be the use of TI variances for containment of a plume exceeding volatilization criteria where containment is necessary to address volatilization issues that cannot be otherwise addressed by vapor barriers or negative pressure systems, such as when access is not granted to a neighboring property.

TI variances are often too rigorous and expensive to be used as a tool for addressing low level residual plumes, such as those commonly associated with gas stations. A less complex mechanism is needed to deal with those types of groundwater plumes, since they are typically smaller in area and the contaminants are less persistent. An alternative would be the use of a risk assessment variance that could show there is an acceptable level of risk. The risk assessment approach would allow some releases that would currently necessitate a TI to be addressed without DEEP approval and without the continuing obligation for periodic reviews under a TI.

APPENDIX G - PROPOSED CLASS C CLEANUP EXITS IN THE TRANSFORMED CLEANUP PROGRAM

The following text was taken from the February 7, 2013 "Draft Proposal for a Transformed Cleanup Program."

Class C Cleanup Exits

There are two Class C cleanup exits - Class C1 and Class C2. Similar to Class B cleanup exits, Class C exits permit the utilization of an institutional control; however, Class C exits also permit the use of engineered controls and long-term groundwater remediation and monitoring. Also similar to the two Class B cleanup exits, Class C2 differs from C1 in that C2 exits are reserved for cleanups that utilize alternative cleanup criteria or alternative cleanup assumptions.

CLASS C1 CLEANUP EXIT

Soil

Soil remediation has been completed and is in compliance with the applicable direct exposure criteria and the pollutant mobility criteria for the applicable groundwater classification.

Compliance with the direct exposure or pollutant mobility criteria may rely on an engineered control.

Groundwater

A groundwater remedy is operational; the remediation of groundwater has been completed and is in compliance with surface water protection criteria and applicable volatilization criteria; or groundwater remediation was not required.

For GA areas, any groundwater plume has been remediated to meet background or the Groundwater Protection Criteria, as appropriate.

A TI variance is in place for a groundwater plume.

Soil vapor is in compliance with the applicable soil vapor volatilization criteria, or an engineered control, institutional control, or both are being utilized to protect indoor air quality.

Long-Term Management

The remediation utilizes institutional controls and/or long-term obligations and any required financial surety mechanism(s) is in place.

If an institutional control is used, the remaining pollution from the release is being managed with an institutional control so that it will not pose an unacceptable risk to public health or the environment. This is inclusive of Imminent Hazards.

Any polluted materials have been remediated in accordance with the applicable standards and guidelines.

CLASS C2 CLEANUP EXIT

Soil

Soil remediation has been completed and is in compliance with the applicable direct exposure criteria or alternative criteria based on risk or site conditions.

Compliance with the direct exposure or pollutant mobility criteria may rely on an engineered control.

Soil remediation has been complete and is in compliance with the pollutant mobility criteria for the applicable groundwater classification or alternative criteria based on risk or site conditions.

Groundwater

A groundwater remedy is operational; the remediation of groundwater has been completed and is in compliance with surface water protection criteria and applicable volatilization criteria; or groundwater remediation was not required.

Groundwater remediation may also be completed in compliance with alternative surface water protection criteria and/or alternative volatilization criteria based on risk or site conditions.

A TI variance is in place for a groundwater plume.

For GA areas, any groundwater plume has been remediated to meet background or the groundwater protection criteria, as appropriate, or alternative groundwater protection criteria is being utilized.

Soil vapor is in compliance with the soil vapor volatilization criteria or an engineered control, institutional control, or both are being utilized to protect indoor air quality.

Long-Term Management

The remediation utilizes institutional controls and/or long-term obligations and any required financial surety mechanism(s) is in place.

If an institutional control is used, the remaining pollution from the release is being managed with an institutional control so that it will not pose an unacceptable risk to public health or the environment. This is inclusive of Imminent Hazards.

If alternative groundwater protection criteria are utilized, the groundwater plume has been registered.

Any polluted materials have been remediated in accordance with the applicable standards and guidelines.