



New Jersey Department of Environmental Protection
Site Remediation Program

TECHNICAL IMPRACTICABILITY Guidance for Ground Water

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Executive Summary

The scope of this guidance document is limited to the remediation of contaminated ground water.

Technical Impracticability (TI) is a condition where remediation of ground water to the applicable standards is not feasible from an engineering perspective because of the limitations in the currently available ground water remediation system engineering methods or technologies at the time the remedy is being designed. Although cost may be considered as an additional screening criterion in assessing the appropriateness of making a TI determination, cost is only considered as subordinate to that of ensuring protection of public health, safety and the environment.

A TI determination is not a permanent remedy for contaminated ground water. The TI determination should be reevaluated periodically to assess whether advances in engineering capabilities subsequently render the TI determination inapplicable and enable the responsible person to further remediate ground water to meet the applicable remediation standard. Approval of a TI determination application does not relieve the responsible person of the obligation to manage contaminant conditions in a manner that protects public health, safety and the environment.

Additionally, the responsible person is not relieved of his or her responsibility to remediate the site to the applicable standards if a TI determination is made. When subsequent advances in remedial system engineering or technologies or changes in site conditions make achievement of the applicable standards practicable, the Department retains the authority to modify the TI determination as appropriate and to require further remediation to meet the remediation standards.

To apply for a TI determination, the responsible person should provide the Department with sufficient evidence at an appropriate phase of the remedial process in support of their TI determination application.

TI does not equate to “no action.” When the Department agrees that a remedial action should be deemed technically impractical, the responsible person must implement measures to safeguard potential receptors in accordance with Technical Requirements for Site Remediation (Technical Rules) at N.J.A.C. 7:26E-5 and must apply for a classification exception area (CEA) and a ground water remedial action permit in accordance with the Administrative Requirements for the Remediation of Contaminated Sites (ARRCS) at N.J.A.C. 7:26C-7. The Department will include requirements for monitoring the ongoing protectiveness of the remedy in the ground water remedial action permit.

1 Introduction

This guidance document addresses Technical Impracticability (TI) as applied to the remediation of ground water. It does not address TI as applied to the remediation of other contaminated media such as soil, surface water or vapors. TI is a condition where remediation of ground water to the applicable standards is not feasible from an engineering perspective because of limitations in the ground water remediation system engineering methods or technologies available at the time the remedy is being designed. The TI concept may be applied to either an entire site or an area of concern (AOC).

This technical guidance document addresses the various components of the process for applying to the Department for a TI determination, including the appropriate timing to request a TI determination, and the type and scope of data necessary to support the request. This technical guidance also addresses the information needed from an investigator to document that an appropriate post-determination management program is, or will be, in place to ensure protectiveness of public health, safety and the environment; and the timeframe for re-evaluating the ongoing protectiveness of the TI from a technical and regulatory viewpoint. The primary issues covered by this guidance document are as follows:

- identifying when in the site remediation process it is appropriate to evaluate TI
- identifying when it is appropriate to propose a TI determination
- assessing whether an action or proposed action is technically impracticable
- documenting the assessment and determination of TI
- developing an appropriate post determination site management approach
- demonstrating post determination protectiveness
- identifying when to reevaluate the TI determination

The scope of this guidance is focused on ground water as the contaminated medium. Other media may be addressed in future updates to this document. However, the investigator could expect that future guidance may use the same process to evaluate whether a TI determination for other media is supported.

1.1 Intended Use of this Technical Guidance Document

This Technical Impracticability Guidance for Ground Water is designed to help the responsible person determine whether and when it is appropriate to seek a TI determination and to identify the steps that should be taken before applying for a TI determination from the Department. This technical guidance also helps the responsible person determine whether public health, safety and the environment remain protected during the time a TI determination remains in effect.

This guidance will be used by many different people involved in the remediation of a contaminated site, such as responsible persons, Licensed Site Remediation Professionals (LSRPs), non-LSRP environmental consultants and other environmental professionals. Therefore, the generic term “investigator” will be used to refer to any person that uses this guidance on behalf of a responsible person, including the responsible person.

The procedures for a person to vary from the technical requirements are outlined in the Technical Rules at N.J.A.C. 7:26E-1.7. The procedures for deviating from technical guidance are found in ARRCs at N.J.A.C. 7:26.C-1.2(a) 3. Variances from a technical requirement or deviation from guidance must be documented and adequately supported with data or other information. In applying technical guidance, the Department recognizes

that professional judgment may result in a range of interpretations on the application of the guidance to site conditions.

This document supersedes any previous Technical Impracticability Guidance for Ground Water issued by the Department.

1.2 Regulatory Obligations and Technical Impracticability Determinations

Responsible persons who conduct the remediation according to a TI determination that involves the use of an engineering control, such as a ground water pumping system, or an institutional control such as a classification exception area (CEA), are required to comply with the permit requirements at N.J.A.C. 7:26C-7, including but not limited to the following:

- obtaining a remedial action permit
- monitoring the effectiveness of the remedial action
- submitting a biennial certification of the continued protectiveness of a remedial action that includes an engineering or institutional control
- posting financial assurance when an engineering control is implemented

An application for a TI determination may be submitted at any time during the remediation process. However, N.J.A.C. 7:26C-3 requires the responsible person to comply with all applicable regulatory and mandatory timeframes that apply to the site. A TI determination proposal has no associated regulatory or mandatory timeframes for compliance purposes; conversely a TI determination, by itself, does not alter regulatory and mandatory timeframes. The responsible person should be sure to request a mandatory timeframe extension per N.J.A.C. 7:26C-3.5 or a regulatory timeframe extension per the applicable provisions of the Technical Rules if the time necessary to apply for a TI determination would cause the responsible person to miss a regulatory or mandatory timeframe. See the timeframes Quick Reference Guide located at

http://www.state.nj.us/dep/srp/srra/training/matrix/new_responsibilities/timeframe_req.pdf .

1.3 Examples of Conditions when a Technical Impracticability Determination May be Appropriate

Some of the conditions that may prompt a responsible party to consider applying to the Department for a TI determination include the following:

- hydrogeologic conditions
 - complex (e.g., highly heterogeneous) sedimentary deposits
 - low permeability strata
 - fractured bedrock
- contaminant conditions
 - non-aqueous phase liquids (NAPLs) (particularly dense non-aqueous phase liquids {DNAPLs})
- remedial technology limitations

In some cases, it may not be feasible to attain the applicable standards, but it may be feasible to conduct remedial activities to approach those standards. The ability to achieve or approach applicable standards depends on the type and concentration and/or quantities of contamination present at the site, the volume of affected media, the available remediation technologies, and the associated cost of treatment to reduce the presence of contamination beyond an asymptotic concentration level. This may be particularly true for remedial systems

that have been in operation for a period of time, and data are available that demonstrate that contaminant mass removed is not commensurate to time and resource expenditure.

In some cases it may be possible to improve system performance by using Remediation Process Optimization (RPO) techniques. However, there may be cases where it is not possible to improve system performance. Provided that this is not the result of a poorly conceived Conceptual Site Model (CSM) or poor engineering, but rather is the result of the properties of the contaminants and the media, an argument for a TI determination can be made. While attaining the applicable standards may be impracticable under those conditions, substantially reducing contaminant concentrations or controlling migration may be reasonable alternatives for ground water contamination management.

Additionally, the selection of a remedy may depend upon the impact of the remedy on the site, surrounding properties and existing infrastructure. For example, contamination under a major highway may impact ground water, but closing the highway to address the source material may not be the preferred alternative. In this circumstance, an applicant for a TI determination should demonstrate that it is not necessary to demolish the permanent structure or cause unwarranted interruption of a public service in order to implement a remedy that is protective of public health, safety and the environment.

A TI determination may also be appropriate for cases in which, for example, a deep bedrock formation is affected by DNAPL. In this example, the investigator may determine that it is impracticable to remediate to the applicable remediation standards. As part of the TI determination application, the investigator would propose alternative measures to protect receptors from potential exposure to contaminants; for example, hydraulic control of the source area plume and monitored natural attenuation (MNA) for the remaining plume. However, the mere presence of DNAPL should not be the sole basis for seeking a TI determination. Rather, the investigator should provide a sufficient science-based justification for seeking a TI determination (see USEPA, OSWER #9355.5-32, 9/19/2011). Conversely, where a moderately large volume of shallow petroleum contaminated ground water must be treated but no special engineering construction measures are required, the remediation may be costly, but implementation of the remedial action is not technically impracticable. See section 2.1.2 for further discussion on cost.

TI determinations are not applicable when the site conditions have been altered post-discharge in such a way that the investigator has created a TI condition. For example, where a structure is knowingly placed on an impacted area that would interfere with the remedial effort, an argument that the structure is precluding implementation of a remedial action cannot be supported.

2 Technical Impracticability Determination Evidence

The 1993 United States Environmental Protection Agency (USEPA) guidance document, USEPA Office of Solid Waste and Emergency Response (OSWER) Directive 9234.2-25, provides the following summary of factors to be considered in making a TI determination:

“...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.”

The threshold criteria for consideration for a TI determination are whether the responsible person conducts the following:

- appropriately manage the site so that remaining contaminants do not pose a threat to public health, safety and the environment
- prepare a CSM that accurately characterizes and integrates site-specific chemical, physical, migration pathway and receptor information

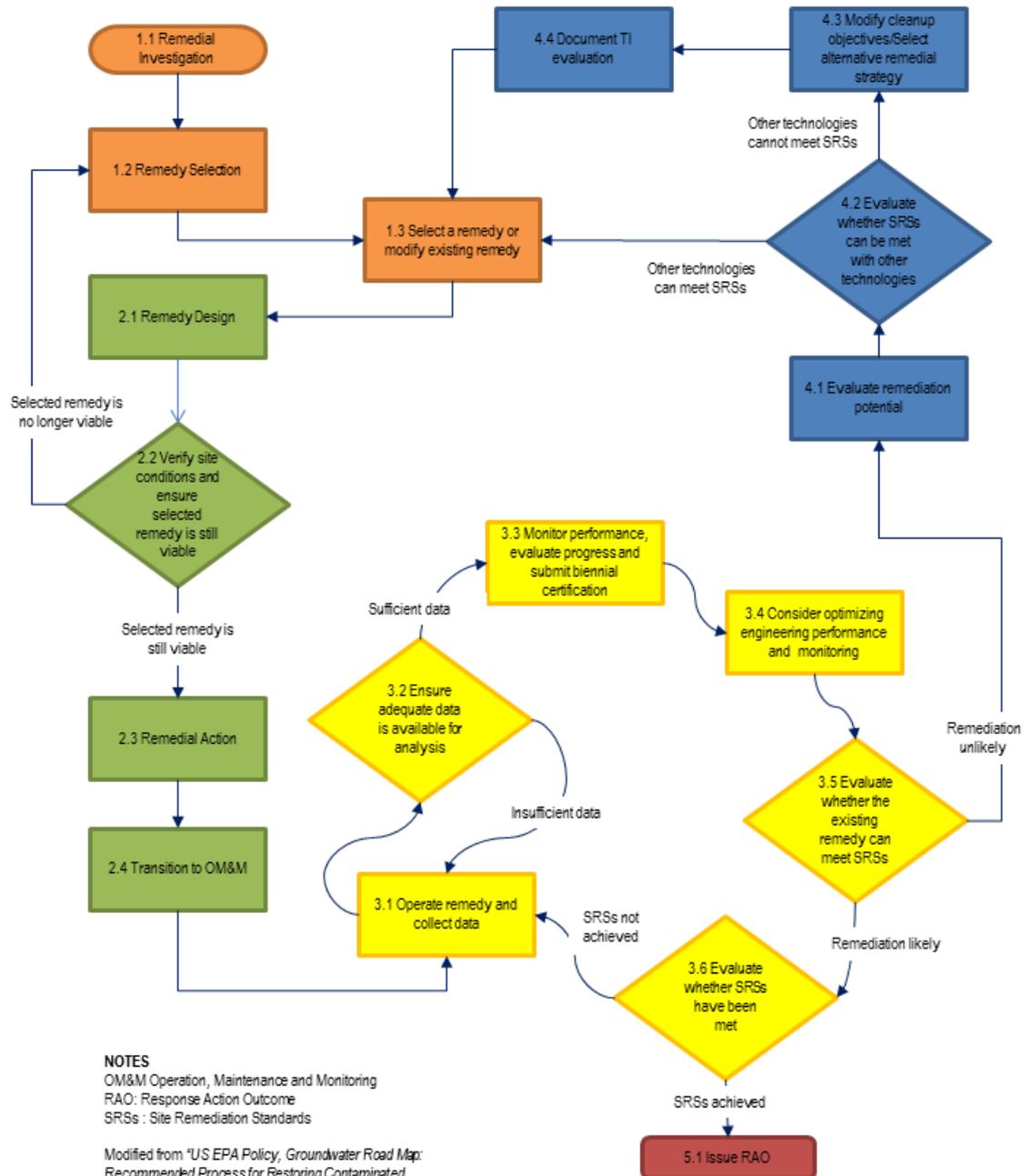
A TI determination may require multiple lines of evidence (MLE). Evaluation of remedial alternatives should be undertaken in a phased approach by using both site characterization and remedy performance data. The investigator should evaluate if the information already gathered for the remedial investigation or existing system performance data is sufficient to make the TI determination. If additional data needs to be gathered to support the TI determination, the investigator can then tailor the data collection needed to support the TI determination. The types of data collection and analysis that an investigator could perform are given in this guidance and the prior referenced 1993 TI guidance by USEPA. Also, any assessment of TI should be viewed as a collaborative process between the Department and the investigator. Thus, the use of a TI determination in establishing the site remediation and management strategy should be planned in conjunction with this guidance.

Once the technical factors above and the process factors depicted in Figure 1 “Recommended Process for Restoring Contaminated Groundwater at Superfund Sites”, below, are evaluated, implementation costs may be included as a supplemental consideration. Cost considerations are discussed further in Section 2.1.2.

Figure 1 includes a decision tree that USEPA uses and the Department recommends investigators use to help evaluate the TI of a proposed ground water remedial action. As at step 4.4 in Figure 1 below, TI is usually evaluated after an effort to deploy the currently available technology has been attempted, evaluated, optimized, and then reevaluated. TI prior to deployment of a technological solution is exceptional.

Figure 1

Recommended Process for Restoring Contaminated Groundwater at Superfund Sites USEPA Policy, *Groundwater Road Map: Recommended Process for Restoring Contaminated Groundwater at Superfund Sites*, July 20, 2011



2.1 How to Assess Whether an Action or Proposed Action is Technically Impracticable

The responsible person should base their TI determination application on site-specific data and, where appropriate, data concerning the performance of an implemented remedy. These data should be collected, analyzed and presented so that the engineering feasibility and reliability of ground water remedy is fully addressed in a concise and logical manner. The investigator should consider the following information in support of a TI determination:

- Ground Water Quality Standards (GWQS) and/or screening levels applicable to the site
- spatial extent over which the TI determination will apply
- CSM that describes site geology, hydrogeology, ground water contamination sources, the fate and transport of the contaminants, receptors and any site features that may be impacted by the remedial action
- evaluation of the remediation potential of the site, including data and analyses that support the assertion that attainment of the applicable GWQS are technically impracticable from an engineering perspective. This evaluation should include the following:
 - demonstration that contamination sources have been identified and have been, or will be, treated, removed and/or contained to the extent practicable and as necessary to mitigate risks to public health, safety, and the environment
 - analysis of the performance of any ongoing or completed remedial actions
 - predictive analyses of the timeframes to attain the applicable standards using available technologies
 - demonstration that no other remedial technologies (conventional or innovative) could attain the applicable standards at the site within a reasonable timeframe
 - bench and pilot scale testing
- estimates of the cost of the existing or proposed remedy options, including construction, operation and maintenance costs
- any additional information or analyses deemed necessary to support the TI evaluation

2.1.1 Remedial Process Optimization

In cases where a remedial system is already in place and the investigator is considering applying to the Department for a TI determination, the investigator should ascertain if the appropriate remedial system has been selected and whether it is being operated correctly. RPO is one method the investigator can use to ensure that remediation is effective and efficient. The purpose of an RPO is to evaluate whether the protectiveness of public health, safety and the environment is maximized at existing installations. Depending on site-specific conditions, an extensive RPO review may be needed; the more complex a site, e.g., multiple AOCs, the more complex the RPO may need to be to support an application for a TI determination.

If the results of the RPO evaluation show that there is no reasonable or appropriate technological or administrative means by which to achieve the applicable ground water remediation standards, the investigator may apply to the Department for a TI determination. The following discussion of RPO provides some guidance for those activities. A thorough discussion of the RPO process can be found at <http://www.itrcweb.org/Documents/RPO-1.pdf>.

RPO is the periodic systematic evaluation and enhancement of site remediation processes to ensure that public health, safety and the environment are being protected over the long term at minimal risk and cost. Remediations at both large and small sites have benefited from RPO reviews. The investigator is not required to conduct an RPO review as a part of conducting a remediation or seeking a TI determination. However, as stated

above, the strongest application for a TI determination will include MLE, and an RPO is an appropriate line of evidence available to an investigator.

When conducting an RPO, the investigator should consider whether the plan for the ongoing remediation includes the following:

- a clear objective
- a means of reducing costs and optimizing the system performance considering current conditions and new technologies
- adequate maintenance and performance of the remedial equipment and system
- periodic evaluation of the protectiveness of the system in accordance with this guidance (the recommended frequency is at least once every five years)

The key steps in the RPO process are outlined below:

1. Select an independent, multidisciplinary RPO review team to collect data on and review the following:
 - CSM
 - applicable rules and regulations
 - technology selection
 - monitoring data
 - system effectiveness
2. Optimize by:
 - minimizing risks
 - evaluating costs
 - evaluating the time to complete
 - maximizing efficiency
 - evaluating green remediation alternatives
3. Develop:
 - remedial processes optimization implementation strategy
 - exit strategy
 - RPO recommendations
4. Track the answers to the following questions:
 - Is optimization continuing? Are the RPO recommendations being tracked?
 - Has progress towards closure been made? Will the cleanup goals be achieved?
 - Is periodic review needed, and if so, how often and at what level of effort?
 - Were the RPO goals achieved?

Remediation System Evaluation Checklists

Remediation System Evaluation Checklists or RSEs were developed by the U.S. Army Corps of Engineers. RSEs can be technology specific or apply to broader processes depending on the needs of the investigator. RSEs can be used by the investigator as part of the RPO.

In general, RSEs consist of an evaluation of design, operational and cost data by the investigator assigned to the project. RSEs include a site visit and interviews with the responsible person, their system operator, and possibly the regulator(s) and the public. Example checklists and reports for conducting and documenting an RSE can be found at:

http://www.environmental.usace.army.mil/rse_checklist.htm

The investigator should begin the RPO review by reviewing the remedial goals. Sometimes, due to advances in technologies or techniques, there is a clear need to revise remedial goals, and the investigator can address this important aspect of the remedial process by conducting an RPO review. The investigator can also use the RPO review to determine whether active remediation should be abandoned and natural attenuation should be implemented because it is not possible to attain the original goals, even after several years of operating the active remediation system. Although an RPO review can be done as early as at the beginning of the remedial action, it is typically done between two and five years after the initiation of the remedial action.

2.1.2 Cost Considerations

When evaluating a remedy for TI, the investigator may factor into the analysis the cost of the remedial action. However, cost should be a supplemental consideration, and not the primary reason for seeking a TI determination. Depending on the nature of the contamination, the hydrogeologic conditions, potential receptors and the current and potential future uses of the site, a remedial action with which are associated higher implementation costs may be the most appropriate when compared with lower cost alternatives because the higher cost alternative will more likely achieve the remedial goal than the lower cost alternatives.

When an investigator chooses to include the cost of the remediation in a TI analysis, the costs should be calculated at net present value and should be determined for all proposed remedial alternatives. The cost should be calculated based on an estimate of how long the site or portion of the site will be subject to the TI determination. The cost of maintaining any engineering/institutional controls (i.e., pump and treat system or CEA), and those costs needed to manage the site during the time that the TI determination is in effect should also be included. If the engineering/institutional control duration is indeterminate, the investigator should use 30 years as the time variable in the net present value equation.

The investigator should include all costs associated with capital, labor, subcontractors, consumable supplies, and yearly operation and maintenance associated with the remediation system and regulatory requirements (i.e., permitting, oversight, etc.). USEPA states that certain costs may not be included, such as the costs of sampling and analysis for delineation purposes, system engineering and bid specification preparation because these costs would be required for all remedial actions, other agencies allow these costs to be included. The Department has no preference as to the method but the investigator should clearly state what costs and time frames are included in the estimate and the details on how they performed the cost calculations. The cost should be calculated based on the anticipated duration of the TI determination; including any engineering/institutional control costs (e.g. inspection, permitting, biennial certification, etc.). If the engineering/institutional control duration is indeterminate, a 30-year duration should be used. One way to present cost data is to present the cost per unit of contaminant reduced (for example, dollars spent per gallon of DNAPL recovered). A resource for how to evaluate costs is USEPA Guidance: A Cost Comparison Framework for Use in Optimizing Ground Water Pump and Treat Systems, EPA 542-R-07-005, May 2007.

The investigator may either use commercially available software or may develop cost data using other methods chosen by the investigator. The following software is commercially available:

- Cost Pro, available from the USEPA at <http://www.epa.gov/osw/hazard/tsd/td/ldu/financial/costpro.htm>
- Remedial Action Cost Engineering and Requirements (RACER), available from the Federal Remediation Technologies Roundtable at, <http://www.frtr.gov/ec2/ecracersystem.htm>
- Crystal Ball, information available at <http://www.oracle.com/us/products/applications/crystalball/index.html>

The following programs are available, should the investigator choose to add green and/or sustainability issues to the calculations. They are of particular value in comparing different remedial alternatives or when making decisions about potential changes in treatment technology:

- SiteWise, available for free from the US Navy, found under tools and resources at, https://portal.navfac.navy.mil/portal/page/portal/NAVFAC/NAVFAC_WW_PP/NAVFAC_NFESC_PP/ENVIRONMENTAL/ERB/ERT2

- Sustainable Remediation Tool (SRT), available for free from the US Air Force, updated public web link to be published at <http://www.afcec.af.mil/environment/>

If the investigator chooses to use a method that is not included in any of the above-listed resources, the investigator should include a detailed description of how the investigator used the methodology as a part of the application for the TI determination.

The following references may be helpful in determining costs:

- The Instructions for the Remediation Cost Review/Estimate Form, New Jersey Department of Environmental Protection http://www.nj.gov/dep/srp/srra/forms/remediation_cost_review_est_ins.pdf.
- Cost Estimating Tools and Resources for Addressing Sites Under the Brownfields Initiative (USEPA/65/R-99/001, April 1999), United States Environmental Protection Agency.
- Ground water and Soil Remediation, Process Design and Cost Estimating of Proven Technologies, Marv Hyman and R. Robert Dupont, The American Society of Civil Engineers, 2001.

2.2 When is it Appropriate to Apply for a Technical Impracticability Determination?

An investigator should not apply to the Department for a TI determination until after the investigator has collected sufficient information and data to support the TI determination. The investigator may have sufficient supporting data at any one of the following points in time during the remediation process, depending on the complexity of the remediation being conducted:

- prior to issuance of a Remedial Action Workplan (RAW) or restricted or limited restricted Response Action Outcome (RAO) based on the site investigation data
- at the time the restricted or limited restricted RAO is issued, based in part on the remedial action (RA) selection and pilot test performance evaluation
- during the remedial action selection process when the feasibility, implementation and cost of available remedial technologies are evaluated
- after the restricted or limited restricted RAO is issued based on remedial action performance evaluations
- after the reevaluation of a selected remedial action, where contaminant, hydrogeologic or other limiting factors, such as land use changes, are determined to adversely affect the ability of the RA to achieve cleanup objectives

Before applying to the Department for a TI determination, the investigator should first develop and validate a CSM in accordance with the Department's Conceptual Site Model Technical Guidance. A well-supported CSM is crucial to assessing TI, as the CSM provides a basis for assessing risk and evaluating methods to manage those risks. The CSM is a written and/or graphical representation of the physical, chemical and biological processes that control the transport, migration and interaction of chemicals of concern through site-specific environmental media. The investigator should incorporate their understanding of the contaminants of concern and specific exposure pathway information and should include a description of the basic components of the remedial system in the development of an overall CSM as described in the Technical Guidance for Preparation and Submission of a Conceptual Site Model: http://www.nj.gov/dep/srp/guidance/srra/csm_tech_guidance.pdf. The Technical Guidance for Preparation and Submission of a Conceptual Site Model provides a description of the basic components that should be considered in developing a CSM.

CSM components include the following:

- nature and extent of contaminant(s) (including source types and affected media, as well as contaminant variability)
- contaminant fate and transport through the environment
- site geology and hydrogeology
- biological conditions (e.g. existing microbial communities, available nutrients, etc.)
- geochemical conditions
- number and distribution of monitoring points
- actual and potential receptors under current and reasonably expected future exposure scenarios
- past remedial actions and locations of remedial components and monitoring points
- historical, current, and expected future land and water use
- other factors relevant to the understanding of contamination at the site, including:
 - presence of sensitive receptors or designated protection areas (e.g., Pinelands)
 - site specific regulatory constraints
 - data gathering limitations

The investigator should update the CSM on pace with the work being performed to define the limits of contamination. Information gathered during the site investigation and the remedial investigation may help the investigator to characterize site-specific physical, biological and chemical systems that affect the fate and transport of the contaminants of concern. How to determine contaminant releases, contaminant migration, and environmental receptor exposure to contaminants are described and integrated into the CSM and the investigator can use the data collected in each of these processes to identify data gaps and identify whether additional information is needed. A CSM should be considered to be an iterative and dynamic process; the investigator should modify and expand it as site-specific data and information are collected and evaluated. The investigator should scale the scope of the CSM to match the level of site-related risk and complexity and the remedial goals. Many articles have been written on CSMs; however, DEP CSM technical guidance; ASTM 2007; USEPA 2005; and Interstate Technology Regulatory Council (ITRC) 2009 may be particularly useful.

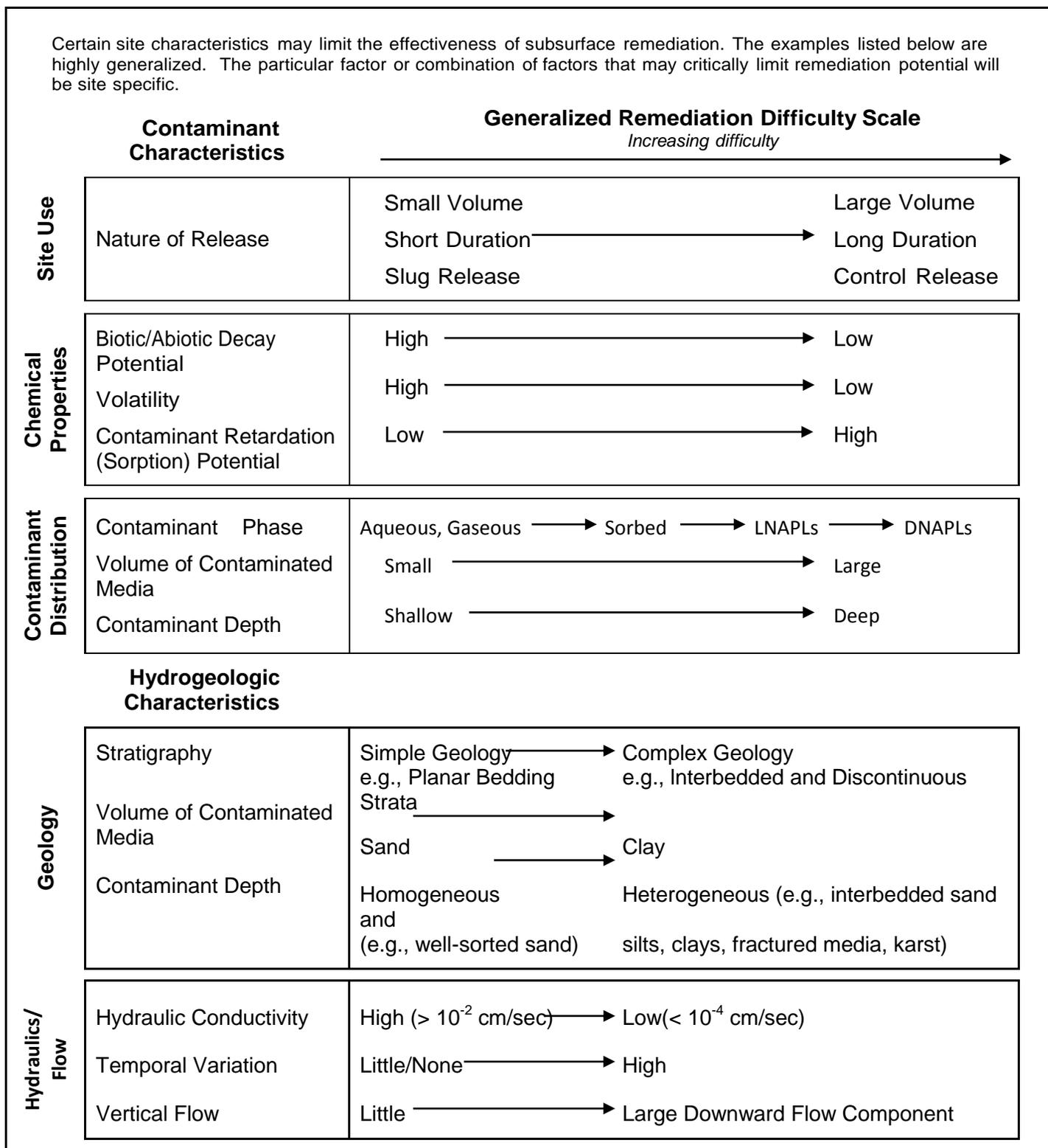
In the application for a TI determination, the investigator should describe the CSM development process and conclusions, including the extent of contamination, direction and gradient of ground water flow, evaluation of natural and anthropogenic preferential pathways, bedrock structure and identification of water bearing and confining stratigraphic intervals and the presence and location of sensitive receptors.

The data and analyses needed to address each component of a TI evaluation should be determined on a site-specific basis. Where an investigator is preparing an application for a TI determination, the investigator should discuss the components of the application with the Department's technical consultation team prior to submitting the final application to the Department. Early discussions between the investigator and Department on the type, quantity and quality of data and analyses required for TI determinations will promote efficient review of TI applications.

Figure 2, below, "*Examples of Factors Affecting Ground-Water Remediation*", shows in a generalized manner how the interaction of a variety of factors can affect the potential to remediate ground water to the ground water remediation standards. The factors shown in the chart include site use, chemical properties and distribution of the contaminants, geology, and hydraulics or flow. The investigator should address each of these site attributes in the application for a TI determination.

Figure 2
Examples of Factors Affecting Ground-Water Remediation

Adapted from the USEPA, Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration, 1993



3 Components of an Application for a Technical Impracticability Determination

A TI Determination application includes the following three components: a discussion in an appropriate report, which should be submitted in the format suggested in this section; the appropriate form, discussed below; and an application for a Remedial Action Permit (RAP), the requirements of which are also discussed below. Although the investigator may begin the TI determination process early in the remedial process, e.g., at the completion of the remedial investigation, the Department will not document the conditions of the TI determination until the RAP is issued. For example: The Department will review the TI determination when the TI determination is submitted with either the Remedial Investigation Report or when the RAW is submitted to the Department. The Department typically establishes CEAs well before the RAP is issued but the RAP sets forth the full requirements for monitoring the ongoing protectiveness.

The Department recommends that the investigator make full use of the Technical Consultation process offered by the Department before applying for a TI determination. During a Technical Consultation, the investigator has the opportunity to informally explain to the Department why they are seeking the TI determination, what data they have or will gather to support the request, and to present a CSM that ultimately demonstrates the investigator's level of understanding of site conditions. As a result of the TI Technical Consultation, the investigator may conclude not to pursue a TI determination, and may be able to highlight data gaps and avoid performing activities that provide no added value to the TI determination application.

3.1 Document Transmittal Forms

When an investigator has determined that it would be appropriate to apply for a TI determination, the investigator should so indicate on the document transmittal form being submitted to the Department. The forms listed below have a line on which the investigator is to indicate that a TI determination is "Not Applicable", "Included in this Submittal", or "Previously Submitted," and as indicated on the form's instruction sheet, the date of submission, date of revision, and, if applicable, the date of document withdrawal are also to be indicated:

- Remedial Investigation Report Form
- Remedial Action Workplan Form
- Remedial Action Report Form
- Response Action Outcome Form

In addition, the investigator is required to complete the Case Inventory Document (CID) for all cases and include the CID with all remedial phase reports and all direct oversight documents. A TI determination application or final determination should be noted in the CID.

When submitting a Remedial Action Permit application make note of any TI determinations in Section K. "Other Information Provided".

The current version of these forms can be found at <http://www.nj.gov/dep/srp/srra/forms/>.

3.2 Technical Impracticability Determination Application and the Remedial Action Permit for Ground Water

The Department will use a Ground Water RAP as the oversight document to address TI determinations for ground water. The RAP Application for Ground Water form in the Monitoring, Maintenance and Evaluation Information section asks if a TI determination has already been submitted. If so, the investigator should include a summary of the TI determination and any additional monitoring requirements necessary to implement the TI determination in the Ground Water Monitoring Plan Spreadsheet that is included with the RAP application.

3.3 Suggested Technical Impracticability Application Report Format

An investigator seeking a TI determination should consider using the report outline set forth in Table 1, "Suggested Report Format", below or some logical variation thereof, as a starting point in presenting the information necessary to justify a TI determination. Table 1 should be considered as a minimum recommendation. TI determinations can be complex and the written TI determination should reflect the complexities presented by the site specific conditions.

Table 1
Suggested Report Format

Suggested TI Determination Report Format	
Suggested Section	Suggested Discussion
1. Applicable Standards	Identifies the applicable standards for which the TI decision is being sought. Generally, these should include only the standards or site specific criteria that are used to establish cleanup standards or levels.
2. TI Spatial Extent	Delineates the horizontal and vertical extent covered by the TI proposal, based on an appropriately documented data set.
3. Conceptual Site Model	Synthesizes and presents site description and history; geologic and hydrogeologic factors; contaminant sources and releases; and contaminant distribution, transport, and fate parameters. The discussion may be supplemented with interpretive graphics and site data, as necessary. See the Technical Guidance for Preparation and Submission of a Conceptual Site Model, http://www.nj.gov/dep/srp/guidance/srra/csm_tech_guidance.pdf
4. Evaluation of Remediation Potential	Demonstrates that source control measures have been or will be implemented to the extent practicable. Also offers an analysis of the suitability and performance of any ongoing or completed ground water remedial actions (including any enhancements), a predicted remediation time analysis which identifies assumptions and uncertainties, and a demonstration that no other conventional or innovative technologies can attain the applicable standards.
5. Cost Estimates	Estimates the present worth of construction, operation and maintenance costs of the remedial technologies that are deemed impracticable, as well as costs for the continued operation of existing remedies or alternative remedial strategies that are proposed as adjuncts to the TI.
6. Post TI Determination Monitoring	Monitoring of sufficient monitoring wells within the TI area, the boundaries of the TI area, and down gradient to protect potential receptors. Parameters, sampling frequency and methodologies should also be presented.

4 Post Technical Impracticability Determination Management

4.1 General Considerations

Post TI determination management includes those actions taken by the investigator that are necessary to verify that the selected remedial action remains protective of public health, safety and the environment during the time that the TI determination remains in effect. Specific requirements for monitoring the area to which the TI determination put forth by the LSRP will be included in the RAP for the site. Since remaining contamination will prevent unrestricted use of the property, a post TI review of the remedial action should be conducted periodically. This review should be conducted at least every 5 years or as stipulated in the RAP. Circumstances under which the Department may request that the remedial action be re-evaluated include but are not limited to when the following occurs:

- permittee fails to comply with the terms and conditions of the RAP
- TI evaluation is determined to be incorrect through fraud, material misrepresentation, or failure to provide material information
- Changes in one or more components of the CSM that would indicate the potential for adverse impacts on one or more receptors, for example:
 - additional contamination is discovered that was not known at the time of the issuance of the RAP
 - unanticipated increasing concentrations or migration of contaminants

A decision to continue or terminate remedial controls and monitoring will be based on site-specific conditions supported by a body of evidence that justifies the decision. The investigator is obligated to demonstrate that any changes will not compromise the goal of ensuring protection of public health, safety and the environment. While TI may preclude complete remediation of the source or plume, it may be necessary to take other measures to protect receptors from potential exposure.

4.2 Post Technical Impracticability Determination Review

A Post TI determination review should include the following:

- Sufficient operation to evaluate performance. The investigator should demonstrate that the ground water monitoring program within and outside of the delineated TI area is of sufficient quality and detail to fully evaluate remedial performance. If a review of the remedial action indicates that a TI determination is no longer protective of public health, safety and the environment, then the investigator should take appropriate actions such as evaluating new technologies.
- A report on system performance. The Department recommends *A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems* (EPA 600-R-08-003; January 2008) as a resource for developing reports on system performance evaluation.
- A ground water monitoring program to demonstrate the long-term effectiveness of the control methods. The program could be modeled using the acceptable monitoring methods and criteria typically used to demonstrate remedy effectiveness. The monitoring program should be designed to analyze plume migration or containment migration and identify concentration trends within the delineated contaminant plume; lower intensity monitoring might be sufficient to provide assurance of remedy effectiveness over the long-term.

- An effective operation and maintenance program to demonstrate that the existing remedy has been effectively operated and adequately maintained.
- A plan to describe and evaluate the effectiveness of any modifications or enhancements to the remedial action including variations in the way the remediation system is operated and any physical changes or augmentations to the system that are designed to enhance its performance.
- A method of tracking trends in contaminant concentrations: consider such factors as whether the contaminant plume has been contained; whether the areal extent of the plume is being reduced and the rates of contaminant concentrations decline; and contaminant mass removal. Further considerations may include whether contaminant concentrations rebound when the selected remedial process is completed, whether dilution or other natural attenuation processes are responsible for the observed trends, and whether contaminated soil or back-diffusion from bedrock matrix may be a continuing source of ground water contamination.

4.3 Termination of Technical Impracticability Determination

TI determinations may be terminated under the following conditions:

- GWQSs have been met within the TI area
- new technology or other remedial actions has been identified that can address the contaminants
- site conditions now allow for implementation of a remedial action, including monitored natural attenuation

The process for terminating a TI determination is the termination or modification of the RAP as appropriate.

REFERENCES

Internet Resources

Connecticut Department of Energy & Environmental Protection (CT DEEP)

- Technical Impracticability Variance under CT DEEP rules
http://www.ct.gov/deep/cwp/view.asp?a=2715&Q=534920&deepNav_GID=1626

Federal Remediation Technologies Roundtable

- Case studies, conference materials and more, compiled by an inter-agency workgroup
<http://www.frtr.gov/optimization.htm>

U.S. Environmental Protection Agency – Guidance for Evaluating Technical Impracticability of Ground-Water Restoration

- <http://www.epa.gov/superfund/health/conmedia/gwdocs/techimp.htm>, Technical Impracticability: Guidance for Evaluating Technical Impracticability of Ground-Water Restoration, September, 1993. USEPA OSWER Directive 9234.2-25
- <http://www.epa.gov/superfund/health/conmedia/gwdocs/pdfs/642756.pdf>, Technical Impracticability: Clarification of OSWER's 1995 Technical Impracticability Waiver Policy, September, 2011. USEPA OSWER Directive 9355.5-32

Note: There is no link to the 1995 EPA document because the September 2011 clarification states, in part, "...the 1995 memorandum entitled, Superfund Groundwater RODs: Implementing Change This Fiscal Year, July 31, 1995 (OSWER Directive 9335.3-03P) should no longer be considered when making current site decisions." The EPA no longer posts the 1995 document on their website.

- http://www.epa.gov/superfund/health/conmedia/gwdocs/pdfs/TI_waiver_report%2009Aug2012.pdf, Summary of Technical Impracticability Waivers at National Priorities List Sites, USEPA OSWER Directive 9230.2-24, August, 2012

U.S. Environmental Protection Agency OSRTI, Post-Construction Program Area, Guidance for post-construction completion activities, with optimization project updates

- <http://www.epa.gov/superfund/cleanup/postconstruction/optimize.htm>

U.S. Environmental Protection Agency OSRTI, Hazardous Waste Clean-Up Information (CLU-IN) web site

- Site-specific RSE reports and recommendations
<http://www.clu-in.org/optimization>

U.S. Environmental Protection Agency

- <http://www.epa.gov/superfund/greenremediation/>

U.S. Environmental Protection Agency, Region 2

- http://www.epa.gov/region02/superfund/green_remediation/

U.S. Army Corps of Engineers, Hazardous, Toxic and Radioactive Waste Center of Expertise

- RSE checklists and scope of work, provided by developers of the RSE tool
http://www.environmental.usace.army.mil/ltm_rse.htm

U. S. Navy, Naval Facilities Engineering Command

- Guidance document for optimizing remedial actions, includes RPO, green and sustainability
https://portal.navfac.navy.mil/portal/page/portal/navfac/navfac_ww_pp/navfac_nfesc_pp/environmental/erb/resourceerb/ra-o_guide-final-13dec2012.pdf

Wyoming Voluntary Remediation Program

- Technical Impracticability Determinations
https://deq.state.wy.us/volremedi/downloads/Current%20Fact%20Sheets/FS_27.pdf

Guidance and Fact Sheets

2004 Annual Progress Report for Ground Water Remedy Optimization (OSWER 9283.1-27; August 2005)

2005 Annual Progress Report for Ground Water Remedy Optimization (OSWER 9283.1-28; December 2006)

A Cost Comparison Framework for Use in Optimizing Ground Water Pump and Treat Systems
(EPA 542-R-07-005; May 2007)

Action Plan for Ground Water Remedy Optimization (OSWER 9283.1-25; August 25, 2004)

A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems
(EPA 600-R-08-003; January 2008)

Cost-Effective Design of Pump and Treat Systems (OSWER 9283.1-20FS / EPA 542-R-05-008; April 2005)

Effective Contracting Approaches for Operating Pump and Treat Systems (OSWER 9283.1- 21FS / EPA 542-R-05-009; April 2005)

Elements for Effective Management of Operating Pump and Treat Systems (OSWER 9355.4- 27FS-A; November 2002)

Groundwater Pump and Treat Systems: Summary of Selected Cost and Performance Information at Superfund-financed Sites (EPA 542-R-01-021a; December 2001)

Ground Water Remedy Optimization Progress Report: 2006-2007 (OSWER 9283.1-31; July 2008)

Groundwater Road Map: Recommended Process for Restoring Contaminated Groundwater at Superfund Site
(EPA Policy Memorandum, July 20, 2011)

Implementation of RSE Recommendations: Technical Assistance Resources Available to RPMs (EPA, January 2002)

Improving Environmental Site Remediation Through Performance-based Environmental Management (ITRC RPO-7, November 2007)

O&M Report Template for Ground Water Remedies (With Emphasis on Pump and Treat Systems) (OSWER 9283.1-22FS / EPA 542-R-05-010; April 2005)

Optimization Strategies for Long-Term Ground Water Remedies (with Particular Emphasis on Pump and Treat Systems) (EPA 542-R-07-007; May 2007)

Options for Discharging Treated Water from Pump and Treat Systems (EPA 542-R-07-006; May 2007)

Pilot Project to Optimize Superfund-financed Pump and Treat Systems: Summary Report and Lessons Learned (OSWER 9283.1-18; November 2002)

Project Risk Management for Site Remediation (ITRC RRM-1, March 2011)

Remediation Process Optimization: Identifying Opportunities for Enhanced and More Efficient Site Remediation (ITRC RPO-1, September 2004)

Superfund Reform Strategy, Implementation Memorandum: Optimization of Fund-lead Ground Water Pump and Treat (P&T) Systems (OSWER 9283.1-13; October 31, 2000)

Technical Impracticability: Summary of Technical Impracticability Waivers at National Priorities List Sites, August, 2012. USEPA OSWER Directive 9230.2-24

Using Remediation Risk Management to Address Groundwater Cleanup Challenges at Complex Site (ITRC RRM-2, January 2012)

Related NJDEP Site Remediation Program (SRP) Guidance:

<http://www.nj.gov/dep/srp/guidance/index.html#esm>

Conceptual Site Model (CSM) Technical Guidance

Ecological Evaluation Technical Guidance

Monitored Natural Attenuation Technical Guidance

Presumptive and Alternate Remedy Technical Guidance

Technical Guidance for the Attainment of Remediation Standards and Site-Specific Criteria

APPENDIX A

Glossary

Glossary

Building: Defined in the Technical Rules as “a permanent enclosed construction on land, having a roof, door(s) and usually window(s) that is or can be occupied by humans, and is utilized for activities such as residential, commercial, retail, or industrial activities.”

Conceptual Site Model (CSM): A written and/or illustrative representation of the physical, chemical and biological processes that control the transport, migration and potential impacts to receptors. Development and refinement of the CSM will help identify investigative data gaps in the characterization process and can ultimately support remedial decision making. The Department has prepared a “Technical Guidance for the Preparation and Submission of a Conceptual Site Model”, http://www.nj.gov/dep/srp/guidance/srra/csm_tech_guidance.pdf.

Department or the Department: New Jersey Department of Environmental Protection.

Engineering control: Defined in the Technical Rules as “any physical mechanism to contain or stabilize contamination or ensure the effectiveness of a remedial action. An engineering control may include, without limitation, a cap, cover, building, dike, trench, leachate collection system, fence, physical access control, and ground water containment system including, without limitation, a slurry wall and a ground water pumping system.

Licensed site remediation professional (LSRP): Defined in the Site Remediation Reform Act, N.J.S.A. 58:10C-1 et seq. as “an individual who is licensed by the Site Remediation Professional Licensing Board pursuant to N.J.S.A. 58:10C-7 or the Department pursuant to N.J.S.A. 58:10C-12.”

Responsible Person: The person responsible for conducting the remediation pursuant to N.J.A.C. 7:26C-1.

Technical Consultation: As excerpted from the SRP web site, “The Department has established a process to allow Licensed Site Remediation Professionals (LSRPs) and remediating parties to meet with experienced Department staff to ask site specific technical questions. Technical Consultation sessions will be held in face-to-face meetings to discuss technical issues related to the remediation of a site. These consultations will assist compliance with the Department’s applicable Site Remediation rule requirements and technical guidance.” More information on Technical Consultations can be found at: http://www.nj.gov/dep/srp/srra/technical_consultation/.

APPENDIX B

Acronyms

Acronyms

AOC	area of concern
ARRCS	Administrative Requirements for the Remediation of Contaminated Sites
CEA	Classification Exception Area
CID	Case Inventory Document
CSM	conceptual site model
DNAPL	Dense Non-aqueous Phase Liquid
GWQS	Ground Water Quality Standards
ITRC	Interstate Technology and Regulatory Council
LSRP	licensed site remediation professional
MLE	multiple lines of evidence
NAPL	non-aqueous phase liquid
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection or Department
N.J.S.A.	New Jersey Statutes Annotated
OSWER	USEPA's Office of Solid Waste and Emergency Response
RAO	Response Action Outcome
RAP	Remedial Action Permit
RAW	Remedial Action Workplan
RPO	Remediation Process Optimization
RSE	Remediation System Evaluation
SRP	Site Remediation Program
TI	technical impracticability
USEPA	United States Environmental Protection Agency