**STATE OF TENNESSEE**

**DEPARTMENT OF ENVIRONMENT AND CONSERVATION**

**DIVISION OF UNDERGROUND STORAGE TANKS**

**TECHNICAL GUIDANCE DOCUMENT - 017**

**EFFECTIVE DATE – DECEMBER 1, 2004**
**REVISION DATES – DECEMBER 1, 2005; SEPTEMBER 1, 2006**

**RE: RISK-BASED PROCEDURE TO DETERMINE CLEAN-UP LEVELS – EXPOSURE ASSESSMENT REPORT PREPARATION**

## I. General Guidance

A. Purpose

The purpose of this Technical Guidance Document (TGD) is to provide owners and/or operators the minimum requirements to determine clean-up levels at petroleum underground storage tank sites that have, at a minimum, completed an Initial Site Characterization Report (ISCR) in accordance with Rule 1200-1-15-.06(5)(b). These clean-up levels will be determined for specific Chemicals of Concern (COCs) to provide adequate protection of human health and/or the environment.

B. Applicability

This document provides one risk-based process for petroleum contaminated sites and supercedes all previously issued TGDs (i.e. TGD-008 and TGD-015), regulatory interpretive memorandums (RIMS), and policies addressing risk-based determinations.

If either of the following conditions is present, then contact the Division of Underground Storage Tanks (Division) immediately. Attempt to abate these conditions but do not complete the Exposure Assessment Report (ExAR) until directed by the Division:

Vapor/Explosion Hazards - Vapors and/or explosion hazards are defined, for the purpose of this document, as the presence of any detectable levels of petroleum vapors in a confined or enclosed space.

Impact to Surface Water - Any surface water on or near the petroleum site is visibly impacted by petroleum product including, but not limited, to: free product/sheen on water, free product/sheen on stream bank/sediment, and/or release of product droplets from sediment when disturbed.

C. Required Information and Report Format

The ExAR shall be prepared as a stand-alone document consisting of Part A, Part B, and a cover page.

Part A shall provide the general site background and investigation information. Each section of Part A shall be prepared and assembled in the order presented within these guidelines and each page, including all appendices, shall be numbered. Text shall be provided explaining the associated tables, figures, and maps. All tables, figures, and maps shall be in the appropriate sections, not in appendices. All maps shall be drawn on 8.5 x 11 or 11 x 17 inch paper and contain at a minimum, the UST Facility Identification Number, the date the map was drawn, a north arrow, a legend, a scale bar, a vertical scale, if applicable, and a figure number. The information shall be assembled in each section to provide a comprehensive final document. Each section and subsection heading shall be clearly printed in the report. A table of contents shall be provided listing the location of all sections, maps, figures, and appendices.

Part B shall consist of a printout of the completed TGD-017 Risk Analysis Report (RAR). The RAR shall contain the results of risk-based calculations performed in accordance with this document. The RAR shall be generated using an Excel based spreadsheet developed by the Division. In order to maintain the proper formatting for report submittal, print each sheet of the RAR utilizing the print button provided in the spreadsheet.

The cover page (see Part A, Section VIII) shall be in the format of a letter addressed to the Division director and shall contain the proposed site specific standard request (SSSR).

A notarized signature page as provided shall be attached to the ExAR.

## II. Definitions

For the purposes of this TGD only, the following definitions apply:

**Chemicals of Concern (COCs) -** Specific constituents of petroleum product(s) and/or additives that have been identified by the Division (see Reference 1).

**Ground Water/Soil Concentration -** The detection of a COC above the minimum laboratory detection limit.

**Off-site -** Any location outside the area of known petroleum contaminated soil and/or ground water. This location may be either inside or outside the facility property boundary.

**Off-site Site Specific Clean-up Level (Off-site SSCL) -** The risk-based clean-up level, calculated with site specific data, for an individual COC that will provide adequate protection of human health and/or the environment at an off-site receptor. The clean-up levels are determined using the Domenico (ground water flow) Fate and Transport model.

**On-site -** Any location within the area of known petroleum contaminated soil and/or ground water. This location may be either inside or outside the facility property boundary. **As the contaminant plume shrinks, a receptor that was once on-site may become off-site. If this situation occurs before clean-up levels are reached, then notify the Division case manager. The case manager may require an updated exposure assessment by requesting a revised Risk Analysis Report (RAR).**

**On-site Contamination -** Any on-site area where COCs have been detected, in the subsurface soil and/or ground water, above the minimum laboratory detection limit.

**On-site Site Specific Clean-up Level (On-site SSCL) -** The risk-based clean-up level**,** calculated with site specific data, for an individual COC that will provide adequate protection of human health and/or the environment to an on-site receptor. These clean-up levels are determined by entering site specific data into the ASTM Designation: 1739-95 (Reapproved 2002) intake equations.

**PAHs -** Polycyclic Aromatic Hydrocarbons. See Reference 2 for a list of PAHs that Tennessee will use to evaluate risk to human health and/or the environment.

**Pathway -** The course a COC takes from the source area to an exposed organism. Each exposure pathway includes a source, a point of exposure, and an exposure route.

**Point of Exposure -** The point(s) at which an individual or population may or have come in contact with a COC originating from the petroleum release. The distance from the on-site contamination to the off-site receptor will be measured during Fate and Transport modeling. For example, a resident child lives in a house outside the area of known contamination (off-site) and this receptor is identified as having the lowest applicable Risk Based Clean-up Levels (RBCLs) for indoor air volatilization. The Point of Exposure is the house where the child lives.

**Receptor -** Persons, structures, utilities, surface waters, and/or water supplies that are or may be adversely affected by a petroleum release. A receptor may be on-site or off-site.

**Risk Based Clean-up Level (RBCL) -** Generic risk-based clean-up level established for an individual COC that provides adequate protection of human health and/or the environment. The RBCL represents a conservative approach for potential exposure and risk. These clean-up levels have been established by the Division, based in part, on the ASTM Designation: 1739-95 (Reapproved 2002) and cannot be changed.

## Table of Contents for Part A (Report Format)



## Table of Contents for Part B (Risk Analysis Report – Spreadsheet Completion)

### RBCL Report



### On-site SSCL Report



### Off-site SSCL Report



### Summary Page

# PART A – REPORT FORMAT

## I. Executive Summary

Provide a brief history of the site, including date of discovery, how the release was discovered, product(s) released, conclusions, and recommendations. Describe any initial abatement activities performed to date.

## II. Site Description and Location

A. Provide a brief description of the site, including but not limited to, current zoning, current land use, and site ownership at the time of the release. If zoning changes have been proposed and/or are pending for the site, then provide all relevant information. Provide a brief description of reasonably expected future use(s) for the site.

B. Provide a scaled site map depicting the location of tank(s), product and vent line(s), dispenser(s), buildings, subsurface structures, underground and overhead utilities (including all vaults), closure sampling locations (if applicable), soil borings, and monitoring wells. Indicate former tank systems with dashed lines.

C. Provide a vicinity map of the area depicting the location of all streets, buildings, subsurface structures, underground utilities (including all vaults), and surface water bodies within one-tenth (0.1) mile of the site. The map shall also depict the site location.

D. Provide a scaled receptor map of the area depicting the nearest current off-site receptors for each applicable pathway. Draw an arrow to each receptor from the monitoring well with the highest benzene concentration. The distance shall be provided in feet. If benzene concentrations are below laboratory analytical detection limits, then draw the arrow from the monitoring well with the highest COC concentration based on the following order: toluene, ethylbenzene, xylenes, MtBE, naphthalene, PAHs.

## III. Release and Investigation Summary

A. Provide a discussion of past releases and/or potential source areas, including tanks, lines, and dispensers.

B. Provide a brief discussion of the current and completed site activities, and any corrective actions implemented to date, including the construction of any new structures.

C. If free product is/has been present, then provide an explanation of all recovery efforts that have been made to date **(Note: Non-aqueous phase contamination, i.e. free product, shall be removed to the maximum extent practicable as determined by the Division before a risk-based closure can be approved. RBCL and/or SSCL determinations may be established during the interim period of free product removal. A detailed free product removal plan and cost proposal shall be submitted in accordance with TGD-004 to the Division for review prior to implementation.).**

D. Provide a brief discussion of the predominant soil type in both the vadose zone and capillary fringe zone (that will be input into the RAR ).

## IV. Hydrogeologic Characteristics of the Site and Surrounding Area

A. Provide a description of the site-specific hydrogeologic conditions including ground water flow direction, gradient, hydrologic boundaries (if any), and the occurrence of main aquifers or water bearing zones as discussed in the ISCR and/or Environmental Assessment Report (EAR).

B. Provide a description of the regional hydrogeologic conditions.

C. Provide scaled potentiometric maps from the two (2) most recent water level measuring events. These maps shall be derived from data at least thirty (30) days apart. If multiple aquifers were investigated due to the presence of contamination in a deeper aquifer, and if sufficient data is available, then potentiometric maps for each aquifer shall be included. These maps shall include an arrow depicting the predominant direction of ground water flow.

D. Provide a current water level data table for all sampling events as required in the current ISCR Guidelines.

## V. Location and Current Use of Ground Water

A. State the current ground water usage of the impacted ground water (i.e., drinking water supply or non-drinking water supply) at the time of the ExAR preparation. If the water use survey is more than five (5) years old, then the Division may require an updated water use survey.

B. Provide a color topographic map depicting the location of all drinking water supplies (i.e., wells, springs, and/or surface water bodies) within a one-half (0.5) mile radius of the site. The topographic map shall depict the site location and the one-quarter (0.25) and one-half (0.5) mile radii from the UST site. If drinking water supplies are adjacent to the UST site, then provide a vicinity map showing the locations. A legend shall be provided detailing the water supply user name.

C. Discuss the reasonably expected future use of ground water at this site (Note: If the impacted ground water at the site is not currently used as a drinking water supply, then it **is not reasonable** to expect that the ground water at the site will be used as a drinking water supply in the future).

## VI. Location and Current Use of Surface Waters

A. Discuss any current use(s) of the surface waters within a one-half (0.5) mile radius of the site (i.e., drinking water supply, recreational, etc.).

B. Provide a color topographic map depicting the location of any surface waters within a one-half (0.5) mile radius of the site (These may be depicted on the same map as the drinking water supplies).

C. Discuss the reasonably expected future use(s) of surface waters near the site (Note: If the impacted surface waters at the site are not currently used as a drinking water supply, then it **is not reasonable** to expect that the surface waters at the site will be used as a drinking water supply in the future).

## VII. Physical Characteristics of the Contaminants

A. Provide a contoured, scaled plan view map for each COC depicting the horizontal extent of soil concentration based on the most current soil sampling event, unless directed to do otherwise by the Division. Contour each map to the appropriate RBCL of the COC (as provided in Reference 3) except xylenes, which shall be contoured to either the residential or commercial RBCL, whichever is applicable. The COC soil source width parallel to ground water flow direction shall be indicated by an arrow and the width shall be provided in feet. Include the location of tanks, product and vent lines, dispensers, buildings, subsurface structures, underground utilities (including all vaults), closure sampling locations (if applicable), soil borings and monitoring wells. Indicate former tank systems with dashed lines. The horizontal extent of any free product shall be depicted. Plume maps are not required for any COC which does not have laboratory analytical results above the laboratory detection limit. No more than three COCs can be included on any one plan view map and a different color shall be used for each COC contoured.

B. Provide a contoured, scaled plan view map for each COC depicting the horizontal extent of ground water concentration based on the most current ground water sampling event, unless directed to do otherwise by the Division. Contour each map to the appropriate Maximum Contaminant Level (MCL) or RBCL of the COC (as provided in Reference 3). The COC ground water source width perpendicular to ground water flow direction shall be indicated by an arrow and the width shall be provided in feet. Include the location of tanks, product and vent lines, dispensers, buildings, subsurface structures, underground utilities (including all vaults), closure sampling locations (if applicable), soil borings and monitoring wells. Indicate former tank systems with dashed lines. The horizontal extent of any free product shall be depicted. Plume maps are not required for any COC which does not have laboratory analytical results above the laboratory detection limit. No more than three COCs can be included on any one plan view map and a different color shall be used for each COC contoured.

   If two (2) different aquifers have been impacted, then provide a separate plan view map for each aquifer.

C. Provide a current soil analytical table as required in the current ISCR Guidelines.

D. Provide a current ground water analytical table as required in the current ISCR Guidelines.

## VIII. Site Specific Standard Request

**The Site Specific Standard Request (SSSR) shall be submitted as the cover page to the ExAR.** The SSSR shall be in the format of a letter addressed to the Division director and submitted to the local environmental field office as an attachment to the ExAR. The letter shall contain the following information:

1. The facility name, facility identification number, the tank owner of record at the time of the release, and the date of the report, and

2. A summary statement containing the proposed clean-up levels (either RBCLs and/or SSCLs)

**A copy of the ExAR and SSSR shall also be submitted to the Division Central Office Technical File.**

## PART B - RISK ANALYSIS REPORT - SPREADSHEET COMPLETION

Due to the complexity of the calculations (in particular the Domenico Fate and Transport equations used in the Off-site SSCL Report), two "Add-Ins" must be activated in the spreadsheet: Analysis ToolPak and Analysis ToolPak - VBA options. To activate these options, select the "Tools" option from the menu bar and click on "Add-ins". Check both Analysis ToolPak buttons. For recent versions of Excel, the security level for the spreadsheet must be set at "Medium". To activate this option, select the "Tools" option from the menu bar and click on "Options". Next, click on the "Security" tab and click the "Macro Security" button. Select the "Medium" category button and click "Ok". Then click "Ok" on the "Security" page.

The Risk Analysis Report spreadsheet contains five separate spreadsheets: (a) Main, (b) RBCL Report, (c) On-Site SSCL Report, (d) Off-Site SSCL Report, and (e) Summary.

The Main page briefly describes the purpose of the Risk Analysis Report spreadsheet.

The RBCL Report will be used to compare the current COC site concentrations to the Division established RBCLs.

The On-site SSCL Report will be used to determine the on-site SSCLs for all COCs that failed the RBCL comparison.

The Off-site SSCL Report will be used to determine whether the RBCLs or SSCLs generated in the previous two reports are protective of any applicable off-site receptor(s).

The Summary Report displays, for both soil and ground water, the RBCL, the final calculated on-site SSCL (if any), and the SSCL that is protective of the off-site receptor(s).

The RBCL Report contains a reset button ("Reset Entire Workbook") at the top of report. The Reset button should be used to clear any entries made in the RBCL Report, On-site SSCL Report, and Off-site SSCL report. **If data has been previously entered on any of the referenced reports, then the "Reset Entire Workbook" button must be clicked prior to performing a new data analysis. (Note that area labeled "Sample Data Temporary Storage Area" will not be deleted when the "Reset Entire Workbook" button is clicked).**

### RBCL Report

The general site information and current COC concentrations that are inputted into the RBCL Report will be used in the comparison to Division established RBCLs and are based in part on ASTM Designation: 1739-95 (Reapproved 2002). The results of the comparison represent the first step toward determining the site-specific clean-up levels for the site.

#### I. General Facility Information

For number 1, the facility name and facility identification number shall be entered.

#### II. Ground Water Usage

For number 2, click the applicable button for the current ground water usage at the site. The selection of the ground water usage will aid in the generation of COC input tables (see Reference 1 "Chemicals of Concern Table" for the applicable COCs) in numbers 5 and 6. Non-drinking water sites and gasoline sites will evaluate naphthalene as the surrogate for Gasoline Range Organics (GRO) and/or Extractable Petroleum Hydrocarbons (EPH). All drinking water sites (except gasoline) will evaluate the sixteen identified PAHs on the Tennessee

PAH List (see Reference 2 "Tennessee PAH List").

## III. Type of Petroleum Released

For number 3, click on the applicable boxes for the petroleum product(s) released at the site. If gasoline, in combination with diesel, kerosene, or jet fuel has been released, then check the "Gasoline/Diesel/Kerosene/Jet Fuel" box **only**. If the product(s) released at the site are unknown, or are a combination of any known and unknown substances, then click the "Unknown" box **only**. These check boxes, along with the ground water usage, will be used to generate COC concentration input tables in numbers 5 and 6. **Note: If a release has been identified from more than one tank pit/area of the site, then a separate Risk Analysis Report (RAR) spreadsheet shall be completed and submitted for each tank pit/area.**

## IV. Pathway and Receptor Evaluation

A. Determining Pathways and Receptors

1. Click all applicable pathway(s) boxes.

**The on-site volatilization to indoor air box shall be clicked for all evaluations since a building could be constructed within the area of known petroleum contamination** (i.e., if a property is currently vacant, then **it is reasonable** to expect that a building will be constructed in the future). The off-site volatilization to indoor air box shall be clicked if residential off-site structures are within one-tenth mile radius of known petroleum contaminated soil and/or ground water (It is not necessary to run the off-site volatilization to indoor air scenario if all structures within one-tenth mile are commercial).

The on-site ingestion of ground water box shall be clicked **only** if the drinking water supply is within the area of known petroleum contaminated soil and/or ground water. The off-site ground water ingestion box shall be clicked if a drinking water supply within one-half mile radius of the site is currently in use at the time of the ExAR preparation, unless justification has been provided to the Division and/or a determination has been made that no drinking water supplies are in use within a one-half mile radius of the site.

2. Click all applicable receptor(s) boxes.

Consider both the current use and **reasonably expected** future use of the property when determining on-site and off-site receptors. Current use should represent site conditions at the time the ExAR is prepared. Off-site receptors shall be determined in the downgradient direction based on the predominant ground water flow direction. (Note: If the ground water flow direction varies, then determine all receptors in each direction of ground water flow and click on all applicable boxes).

**The on-site commercial/industrial worker box shall be clicked for all evaluations since it is reasonable to expect that a commercial building either is or could be built on-site.** If the property is currently zoned commercial and no one resides at the property, then it **is not reasonable** to expect that the property will be re-zoned residential in the future, therefore only the commercial/industrial worker box would apply.

If a residential receptor is present, either on-site or off-site, then the resident child box **must always** be clicked.

If the area is metropolitan and revitalization projects are currently underway, then it **is reasonable** to expect that the property **may be** re-zoned residential. In this case, click both the resident adult and child boxes in addition to the commercial/industrial worker box. (Note: Details of any proposed zoning changes and the revitalization project should be discussed in Part A, Section II.A.).

The surface water (Domestic Water Supply Use) box shall be clicked if a surface water body near the site is used for a drinking water supply and the distance to the surface water intake is within one-half mile of the site. If the surface water intake is upgradient of the site, then surface water should not be considered to be a drinking water supply for the purpose of this evaluation. The surface water (Water and Organisms Use) box shall be clicked if a surface water resource within a one-tenth mile radius of the site is currently utilized for fish that may be eaten or recreational purposes. {Note: The Division of Water Pollution Control regulates surface water under General Water Quality Criteria in Rule 1200-4-3-.03 (revised January 2004)}.

B. Creating COC Tables

After selecting the applicable pathways and receptors, click on the "Create COC and RBCL Table" box to create two tables for COC concentration entry: one for soil concentrations and one for ground water concentrations.

## V. Soil Analytical and Depth to Contamination

In number 5, enter the soil sample concentrations and depths for up to six (6) samples into the Soil Data Table.

The data shall be for samples from the most current sampling event with the maximum contaminant concentrations across the site. The samples shall be selected based on benzene concentration. If benzene concentrations are not present, then enter data from the samples with the highest MtBE concentration (and so forth in this order – toluene, total xylenes, ethyl benzene, naphthalene, PAHs). All depths entered in the spreadsheet shall be between three (3) feet and thirty (30) feet. For spreadsheet data entry, enter the shallowest sample depth for the specified sampling interval. For example, if a soil sample was collected between four (4) and six (6) feet, enter a depth of 4 feet into the spreadsheet. If applicable, enter at least one soil sample analytical result from a depth between three (3) and ten (10) feet. All sample concentrations shall be entered as reported on the laboratory data sheets. **If the sample result for any COC is reported to be below the laboratory detection limit (i.e., "ND", "BDL", "<number", etc.), then enter a less than (<) symbol followed by the actual reported detection limit that appears on the laboratory analytical sheet. For example, if the sample results are below the reported laboratory analytical detection limit and the referenced limit is "<0.005 mg/kg", then enter "<0.005" in the spreadsheet.**

In Part B of this section, enter the original report name in which the sampling data can be verified. Include the date of the report and the page number or table name where the information appears.

## VI. Ground Water Analytical Contamination

In number 6, enter the sample date, sample location (i.e. monitoring well number), and COC concentration (in ppm) for the most recent ground water sampling event. A maximum of six (6) ground water samples can be entered. The sample results shall be obtained from the monitoring wells containing the highest benzene concentrations. If benzene is not present, then the samples shall be selected based on the following order of maximum concentration: MtBE, toluene, total xylenes, ethyl benzene, naphthalene, PAHs. **If the sample result for any COC is reported to be below the laboratory detection limit (i.e., "ND", "BDL", "<number", etc.), then enter a less than (<) symbol followed by the actual reported detection limit that appears on the laboratory analytical sheet. For example, if the sample results are below the reported laboratory analytical detection limit and referenced limit is "<0.005 mg/l", then enter "<0.005" in the spreadsheet.**

If two (2) different aquifers have been impacted, then provided a separate RAR for each aquifer.

In Part B of this section, enter the original report name in which the sampling data can be verified. Include the date of the report and the page number or table name where the information appears.

## VII. Applicable RBCLs and COCs

Click the "Compare RBCLs to COC Concentrations" button to generate two tables that compare the maximum soil/ground water contaminant concentration to the applicable RBCL.

The "Below RBCLs Y/N" column of each table displays the results of the comparison between the applicable RBCL and Maximum Soil/Ground water concentration data. "Yes" indicates that the COC concentration is lower than the applicable RBCL. "No" indicates that the COC concentration is at or above the applicable RBCL.

## VIII. Comparison of COC Concentrations to RBCLs

If all rows in both the soil and ground water tables provide an evaluation answer of "Yes" **and** the off-site receptors are the same as the on-site receptors **or** no off-site receptors exist, then the site is eligible for a risk-based closure. The RBCL Report will display "Yes, this site is eligible for a risk-based closure at this time! Please check the summary page for site specific standards". The completed RBCL Report shall be attached to Part A (text portion) of the ExAR, along with the SSSR cover page and signature page, and submitted to the Division for review. If a residential receptor exists or a commercial/industrial worker is using an off-site drinking water supply, then it is necessary to complete the On-Site SSCL Report and Off-Site SSCL Report to determine the SSCLs.

If all rows in the soil and ground water tables provide an evaluation answer of "Yes" **and** off-site receptors exist, then the RBCL Report will display "This site has passed the initial RBCL comparison, you must now select the soil type(s) and enter depth to ground water on the On-site SSCL Report page (do not select the Calculate On-Site SSCLs Button), then perform the Off-site SSCL calculation(s)".

If any row for any COC from either table indicates "No", then the site is not eligible for a risk-based closure based on the RBCL comparison. The RBCL Report will display "This site is not eligible for a risk-based closure as determined by the RBCL comparison. It is necessary to calculate the On-site SSCLs". It will be necessary to calculate the on-site and off-site SSCLs by completing the On-Site SSCL Report and Off-Site SSCL Report.

**In the case of some Polycyclic Aromatic Hydrocarbons (PAHs)**, the applicable RBCL may be less than the current chemical technological capabilities for laboratory analytical equipment (when employing the correct method). In these instances, the spreadsheet may display a "No". If a value of "<Detection Limit Concentration" was entered in the spreadsheet for any PAH and "No" is displayed, then the COC **did not fail** and the requested SSSR level for the PAH shall be the SSCL displayed on the summary page.

**On-site SSCL Report**

The site-specific data inputted into the On-Site SSCL Report will be used to determine the on-site SSCLs for all COCs that failed the RBCL comparison in the RBCL Report. The calculations to determine the SSCLs are based in part on the intake equations in ASTM Designation: 1739-95 (Reapproved 2002). Once the SSCLs have been determined, the values will be compared to the current COC concentrations.

**I. Soil Type**

In number 1, for the "On-site" box, click the appropriate boxes for all subsurface material encountered during site investigation. If no overburden exists at the site, then click the bedrock box.

In number 1, for the "Vadose Zone" and "Capillary Fringe" boxes, click on the boxes that best describes the **predominant** subsurface material type within each interval as determined during subsurface investigation. The predominant subsurface material type is defined as the material type that has the greatest percentage in the specified interval, and is not based on any modifiers that may have been used to describe the material. For example, if the vadose zone material consists of 40% sandy silt and 60% silty clay, then the **predominant** vadose zone material type is clay. Since the soil type is not based on any modifiers, the "clay" box would be clicked for the vadose zone material type.

The vadose zone material type will be used to determine the default values for bulk density, fractional organic carbon, and the volumetric air and water content in the vadose zone. The vadose zone material will also be used to determine hydraulic conductivity and effective porosity values that will be used in the Off-site SSCL Report.

The capillary fringe material type will be used to determine the default capillary fringe thickness ($h_{cap}$) in the SSCL calculations. If the capillary fringe is located at the boundary between two major material types, then click on the material type that will result in more conservative risk calculations (conservative selection order is bedrock, sand, clay, then silt). For example, if the capillary fringe is at the soil/bedrock interface, then click the "bedrock" box. For the purpose of these calculations, the selection of bedrock material type includes gravel and fractured chert.

For the "Source for Soil Types" box, enter the date and boring log number where the vadose zone and capillary fringe soil type data can be verified.

**II. Site Specific Parameters (Input parameters)**

In number 2, enter the original report name in which the site-specific data can be verified. Include the date of the report, monitoring well number used to determine the ground water depth, and the page number or table name where the information appears.

In number 2 (parameter table), enter the depth to ground water from the monitoring well with the highest benzene concentration from the most current sampling event. The depth to ground water shall be entered (in feet) from the top of casing (installed at ground level). If benzene is not present, then enter the depth of ground water from the monitoring well with the highest MtBE concentration (and so forth in this order – toluene, total xylenes, ethyl benzene, naphthalene, PAHs).

### III. Comparison of COCs to SSCLs

Upon completion of numbers 1 and 2, click the "Calculate On-site SSCLs" button to generate a table of SSCLs for all soil and ground water COCs that failed the RBCL comparison in the RBCL Report. (Note: For any soil COC that fails the referenced comparison, a SSCL is generated at each sample depth for that particular COC, not just for the sample depth that failed the RBCL comparison.) The "Below SSCLs Y/N" column of each table displays the results of the comparison between the applicable SSCL and Maximum Soil/Ground water concentration data. "Yes" indicates that the COC concentration is lower than the applicable SSCL. "No" indicates that the COC concentration is at or above the applicable SSCL. The SSCLs will also be used for the comparison on the Summary page.

## Off-site SSCL Report

The site-specific data input into the On-Site SSCL Report and Off-Site SSCL Report will be used to determine whether the RBCLs and/or On-Site SSCLs are protective of any applicable off-site receptors. If the levels are not protective of the off-site receptors, then a back calculation will be performed to determine what concentration may be left on-site to be protective of human health and the environment for all applicable receptors. The calculations to determine the SSCLs are based in part on the Domenico Fate and Transport model.

To perform the calculations on the Off-site SSCL Report, the appropriate "Soil Type" (i.e. On-site, Vadose Zone, and Capillary Fringe) boxes shall be clicked on the "On-site SSCL Report". **If these tasks have not been performed, then complete the referenced portion of the On-site SSCL Report before proceeding to the Off-site SSCL Report page.**

### I. Domenico Model Input Parameters

A. Enter the hydraulic gradient. The hydraulic gradient shall be based on data collected during the most recent ground water gauging event.

B. Enter the Icover. Icover represents the percent of the soil contaminant plume that is covered by pavement, concrete, buildings, etc. The percent shall be entered as a decimal. For example, if the Icover is 80%, then enter 0.80. Note: 95% is the maximum allowable Icover.

C. Enter source width(s) and distance(s) to receptor(s).

1. Source width

   Soil and/or ground water plumes may not be fully delineated. In this case, extrapolation and/or estimation techniques shall be used to determine plume widths to laboratory detection limits.

Enter the ground water source width **perpendicular** to ground water flow (in centimeters). The source width shall be selected based on benzene concentration. If benzene is not present, then enter the width based on MtBE concentration (and so forth in this order – toluene, total xylenes, ethyl benzene, naphthalene, PAHs). If ground water concentrations are encountered in only one monitoring well, then a source width of half the distance between this well and the next downgradient well shall be used.

Enter the soil source width **parallel** to ground water flow direction (in centimeters). The source width shall be selected based on benzene concentration. If benzene is not present, then enter the samples with the highest MtBE concentration (and so forth in this order – toluene, total xylenes, ethyl benzene, naphthalene, PAHs). If soil concentrations are not encountered above laboratory detection limits or are encountered in only one soil boring, then a source width of five (5) feet shall be used.

2. Enter the distance from the monitoring well with the maximum concentration (see Part B, RBCL Report, Section VI) to each applicable receptor (in centimeters). Receptor evaluations are limited to the following distances:

    - Drinking water well – within one-half mile radius
    - Surface water (drinking supply) – within one-half mile radius
    - Surface water (organisms only) – within one-tenth mile radius
    - Residence – within one-tenth mile radius

3. Enter the original report name (i.e., source document), date and page number from which the hydraulic gradient (i), Icover, ground water source width (Sw) perpendicular to ground water flow direction, and soil source width (W) parallel to ground water flow direction can be verified.

## II. Comparison of Off-Site Concentrations to RBCLs

Upon completion of the data entry, click the "Calculate Off-site Concentrations" button to generate a table that provides:

- The modeled maximum ground water contaminant concentration at the receptor;
- The RBCL for the applicable receptor;
- The results of the comparison between the modeled concentration at the receptor and the applicable RBCL (displayed in the "Below RBCLs Y/N" column). "Yes" indicates that the modeled COC concentration at the receptor is lower than the applicable RBCL. "No" indicates that the modeled COC concentration at the receptor is at or above the applicable RBCL. If any modeled COC concentration fails the RBCL comparison, then "No" will be displayed; and
- The contaminant concentration level that may be left on-site to be protective of human health and the environment. This level was determined by performing a back calculation from the receptor back to the source. The results are displayed in the "Off-site SSCL" column.

**Summary**

The Summary sheet compiles the data generated by the RBCL, On-site SSCL, and Off-Site SSCL Reports, and provides the maximum SSSR that can be requested.

**I. Soil**

The summary page displays a table for soil that indicates the COC, the applicable RBCL, the final calculated on-site SSCL (if any), and the maximum soil SSSR concentration. A comparison of the concentrations is performed to determine which levels are protective of all on-site and off-site receptors, and displays the result in the "Maximum soil SSSR concentration" column. The COC concentration that appears on the RAR in the white shaded box represents **the maximum soil concentration that may be requested as the SSSR.**

**II. Ground Water**

The summary page displays a table for ground water that indicates the COC, the applicable RBCL, the final calculated on-site SSCL (if any), the final calculated off-site SSCL (if any), and the maximum ground water SSSR concentration. A comparison of the concentrations is performed to determine which levels are protective of all on-site and off-site receptors, and displays the result in the "Maximum ground water SSSR concentration" column. The COC concentration that appears on the RAR in the white shaded box represents **the maximum ground water concentration that may be requested as the SSSR.**

**III. Eligibility of Site for Risk-Based Closure**

If the site is eligible for a risk-based closure, then the Division will establish a closure-monitoring schedule. Some sites may proceed directly to monitoring well abandonment.

If the results of the comparison indicate that any COC concentration exceeds the on-site and/or off-site SSCLs, then the owner/operator has several options that may be pursued. These options shall not be pursued until directed by the Division. Upon receiving direction from the Division, the owner/operator shall submit a detailed plan and cost proposal for the chosen option. The Division may schedule a review meeting prior to approval. **Any work performed with the implementation of any option without prior Division approval will not be fund reimbursable.**

The following options may be considered to address the contamination that exceeds the on-site and/or off-site SSCLs:

- Option one consists of specific additional measures (i.e., soil gas survey) that will result in a more cost effective approach and/or faster contamination case closure.

- Option two consists of source removal (i.e., removal of free product, excavation of contaminated soil, etc.).

- Option three consists of risk reduction (i.e., supplying a permanent source of potable water to replace an impacted drinking water supply; re-routing utility lines or replacing vulnerable portions of utility lines; etc.).

- Option four consists of institutional controls (i.e., filing a Notice of Land Use Restrictions in the register of deeds office in the appropriate county).

- Option five consists of engineering controls (i.e., design and installation of a vapor barrier, ventilation system, etc.).

- Option six consists of the application of an advanced risk-based model which incorporates detailed site-specific data.

- Option seven consists of the preparation of a Corrective Action Plan (CAP). The CAP shall be prepared and submitted in accordance with the current CAP Guidelines. The CAP shall be submitted in accordance with a schedule established by the Division.

## SIGNATURE PAGE

A signature page as shown below shall be attached to the Site Specific Standard Request. The page shall be signed by the owner/operator (or authorized representative within the organization), and a registered professional geologist under the Tennessee Geologist Act (T.C.A. §62-36-101 et seq.) or a registered professional engineer under the Tennessee Architects, Engineers, Landscape Architects, and Interior Designers Law and Rules (T.C.A. §62-2-101 et seq.).

We, the undersigned, certify under penalty of law, including but not limited to penalties for perjury, that the information contained in this report form and on any attachments, is true, accurate and complete to the best of our knowledge, information, and belief. We are aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for intentional violations.

| _____ | _____ | _____ |
|---|---|---|
| Owner/Operator (Print name) | Signature | Date |
| _____ | | |
| Title (Print) | | |
| _____ | _____ | _____ |
| P.G. (Print name) | Signature | Date |
| | _____ | |
| | Tennessee Registration # | |
| _____ | _____ | _____ |
| P.E. (Print name) | Signature | Date |
| | _____ | |
| | Tennessee Registration # | |

Note: Each of the above signatures shall be notarized separately with the following statement.

STATE OF _____ COUNTY OF _____

Sworn to and subscribed before me by _____ on this date

_____. My commission expires _____.

| _____ | _____ | _____ |
|---|---|---|
| Notary Public (Print name) | Signature | Date |

Stamp/Seal