What’s New in Tier 2-SMR, Version 2.51
The following changes have been made in the Tier 2-SMR software from version 2.40 to version 2.51. The majority of the additions are for the SMR portion of the software.

Bug Fix - Surface Water Bodies
In version 2.40 if a user failed visual inspection and selected the type of surface water body (Other, Pond or Lake) the software did not retain the selection and showed CNE (can not evaluate) for the preliminary pathway evaluation. This has been fixed. The software retains the user’s choice of surface water body type and shows the proper results for preliminary pathway evaluation.

Bug Fix - E Wells at SMR
In version 2.40 a problem could occur when generating the SMR groundwater monitoring plan if the number of E-wells changed from Tier 2 to SMR. This could also lead to some e-wells being lost from the monitoring plan. The source of this error has been identified and the error has been fixed.

Vapor receptors: lower limits for groundwater target levels
In prior versions it was possible for a groundwater target level less than the Tier 1 level to be assigned to vapor receptors if the user assigned a volume to area less than the default. This had occurred in some instances. In version 2.51 if the computed groundwater target level for a vapor receptor is less than the Tier 1 level, the software uses the Tier 1 level.

Actual Sanitary Sewers: Default Volume to Area
Prior to version 2.51 a user could enter a volume to area for an actual sanitary sewer receptor. Unlike confined space, no procedure or method exists for defining this measurement. It has been decided to always use the default volume to area for actual sanitary sewer receptors. The user option for entering a volume to area for sanitary sewers has been removed.

Non-Detect Groundwater and Soil Data
An inconsistency has existed in the user of non-detect soil and groundwater data. The actual values are used to determine the source concentrations and risk classification, while in some situations ½ the detection limit was used for contouring. This could occasionally create situations where the user is required to generate a receptor identification plume due to the source concentration, but no plume can be contoured. To provide consistency between receptor identification and risk classification, all soil and groundwater concentrations are now assigned the detection limit for contouring when a detention limit is entered.

Risk Classification for Soil Vapor, Soil to Plastic Water Line
In a situation where the contoured plume is very small there have been cases where the software assigned a risk classification of N to a receptor that was clearly H, based on a visual inspection of the receptor identification plume. The algorithm for determining the risk classification in this situation has been improved, and this is much less likely to happen.

Soil Gas Data Analysis
In the assignment of a soil gas concentration to a location, starting with version 2.51 the 14-day, 6-month rules are being applied. The rules require at least 14 days between soil gas samples at a location, and a waiting period of at least 6 months after a sample exceeds soil gas target levels. At Tier 2 this could affect the selection of the soil gas source location and concentration, and the data used for soil gas contouring. The rules are also applied to soil gas data analysis at the SMR stage. See Section 5.8, page 23.

Additional Corrective Action Legends
Two items have been added to the list of corrective actions: 12. Zoning, and 13. For actual PWL, GW > 3 feet. The new items are displayed as part of the corrective action grid in the pathway receptor summaries at Tier 2 and SMR.

Groundwater and Soil Plume Contouring
Previously, if all sample data was ignored for a location, the data was not used for contouring, but the most recent concentration was shown on the plot (even if ignored). Now, if there is no concentration assigned to a location for
SMR- the remaining changes all relate to the SMR portion of the software

SMR: Groundwater Plume Contouring
Groundwater Plume contouring is now done as part of the SMR. The contouring is based on the most recent valid sample at each location from among all groundwater sample data (Tier 2 and SMR). See Section 28.0, page 116.

SMR: Corrective Action Taken Column
A column has been added for “Corrective Actions Completed” in the pathway summaries for SMR, where the user can enter actions using the legend (i.e. 3,9). The information is stored and printed as part of receptor summary page. See Section 23.2, page 105, Section 24.2, page 109 and Section 25.2, page 112.

SMR: Consistency Check
With “corrective action taken” and “correction action(s) completed” columns the user is warned if “Corrective Action Taken” is “Y” but no information is provided in the “Corrective Actions(s) Completed” column, or if information is given in the “Corrective Action(s) Completed” column, but the “Corrective Action Taken” column is not set to “Y”. If such inconsistencies are present when a summary is printed the printout includes the line “INCONSISTENT INFORMATION FOR CORRECTIVE ACTION TAKEN OR CORRECTIVE ACTION(S) COMPLETED.” See Section 23.2, page 105, Section 24.2, page 109 and Section 25.2, page 112.

SMR: Addition to check list
The following item has been added to the SMR checklist:
☐ Corrections to Tier 2 Deficiencies Included

This is to remind groundwater professionals that if Tier 2 deficiencies were noted, a detailed response should be included in the next SMR report.

SMR: GW Monitoring Plan, Minimum Frequency Column
A minimum sampling frequency column has been added to the SMR GW Monitoring Plan, similar to Tier 2. The column is automatically set by the software to annual for all wells, except for E-wells (set to once). See Section 26.0, page 113.

SMR: GW Monitoring Results for NFA Receptors
When generating the groundwater monitoring plan for SMR, the software generates a summary of groundwater monitoring results for receptors that are NFA. The format is the same as the groundwater monitoring plan, both on screen and in the print-out. See Section 26.0, page 128.

SMR: Soil gas methods
A button has been added to access the soil gas methods form from the SMR portion of the software. This is where the user enters “Soil Gas Sampling Methods” and “Soil Gas Sampling Location Justification”. The user can now enter this information from Tier 2 and/or SMR. This information is now printed from SMR when the soil gas data is printed. Previously this information could not be printed from SMR. When printed from the SMR the soil gas data, Soil Gas Sampling Methods, and Soil Gas Sampling Location Justification are printed as page 10 and shows “SMR” on the title line. When printed from Tier 2 the soil gas data, Soil Gas Sampling Methods, Soil Gas Sampling Location Justification are printed as page 12 and shows “T2” on the title line. See Section 20.5, page 99.

SMR: Passing Soil Gas at a Source during SMR, User Identified
Questions have been added to the SMR for a user to identify soil gas sampling results at soil or groundwater sources during the SMR stage. These questions would apply if a user has done soil gas sampling after the completion of a Tier 2, and affects only risk classification for the SMR. See Sections 21.0, 21.1 and 21.2, page 101. Also, Section 23.2, page 105, Section 24.2, page 109, and Section 25.2, page 112.
SMR: Passing Soil Gas during SMR at Tier 2 Sources, Software Evaluation of Soil Gas Data
At SMR the software evaluates the soil gas data at the Tier 2 soil and groundwater sources and determines whether soil gas has been passed, failed or is incomplete. The results are shown in the receptor summaries for Groundwater, Soil Leaching and Soil Vapor. The results are also shown in tables for: Soil Gas at Soil Sources, and Soil Gas at GW Sources. The evaluation incorporates the 14-day and 6-month rules. See Sections 21.3 and 21.4, pages 102-103. Also, Section 23.2, page 105, Section 24.2, page 109, and Section 25.2, page 112.

SMR: Soil Gas Sample Data Summary at Soil and Groundwater Sources
To assist with the evaluation of the results of soil gas sampling at Tier 2 sources, tables are now produced on-screen and printed that show the soil gas samples at each Tier 2 soil and groundwater source location. The tables lists all soil gas samples found within 5 feet of a soil or groundwater source, sorted from oldest to most recent. If a soil gas sample groundwater elevation is above a soil source sample elevation, this is shown in red on the screen and bold on the print-out. These tables are new items on the SMR report checklist and are printed from the software as page 15 and page 16. See Sections 21.3 and 21.4, pages 102-103.

SMR: Submerged Soil Source at SMR for Soil Leaching
The SMR portion now helps identify whether a submerged soil source may be present when soil gas sampling is being applied to the soil leaching pathway. The submerged soil source evaluation is shown in the receptor summaries for Soil Leaching and Soil Vapor. See Section 21.3, page 102. Also, Section 24.2, page 109 and Section 25.2, page 112.

SMR: Steady and Declining
When steady and declining is a required criteria for risk classification at SMR, the evaluation has been modified to account for variability in the detection limit for non-detect values. Previously, a series of concentrations such as (from oldest to most recent), <1, <1, <2, would not be considered steady and declining because the detection limits are treated as concentrations and <1 to <2 is an increase of 100%.

Now the following is applied. For concentrations being considered to determine steady and declining, all non-detect values that do not exceed the target levels for drinking water wells are set equal to the highest non-detect value that does not exceed the drinking water well target level, for the purposes of determining steady and declining. For example, if you have 3 non-detect values for benzene and all 3 values have a detection limit of less than or equal to 5 µg/L, then the 3 samples would meet steady and declining criteria. Measurable concentrations (concentrations that are not non-detect) are still evaluated using the measured concentration.

A non-detect value that is greater than the drinking water well target level is still treated as a concentration. For example, for Benzene <6 would be evaluated as 6. See Section 23.8, page 107.
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1. INTRODUCTION

Welcome to Version 2.51 of the Iowa Risk-Based Corrective Action (RBCA) Tier-2/Site Monitoring Report (SMR) software. The Tier-2/SMR software will assist you with preparation of a Tier 2 Site Cleanup Report (Tier 2 SCR) or Site Monitoring Report (SMR). Tier-2/SMR version 2.51 is compatible with previous Tier 2 versions 2.00 or higher. Tier 2 version 1.0 is not compatible with this or other version 2.XX software and should no longer be used for completion of a Tier 2 SCR.

This User’s Manual covers how to use the software. This is best done in context. The manual covers some of the concepts, objectives, policies, and requirements of Iowa RBCA and the Tier 2 SCR. However, this Manual is not official Iowa Department of Natural Resources (DNR) policy or guidance. Throughout the User’s Manual you are referred to official DNR documentation.

Relevant DNR documentation for Tier 2 and SMR reports include:

- Chapter 135 of the Iowa Administrative Code
- Tier 1 Guidance, Version 1.0, November 1996


Bedrock

Note that if bedrock is encountered before groundwater for your site, you may have a “Bedrock” site. A “Bedrock” site has unique procedures, and you are required to use the “Bedrock” software. If bedrock is encountered before groundwater you need to check the rules and guidance to determine if you should be performing a “Bedrock” analysis. In the Rules, bedrock assessment is covered in detail under 135.10(3), Bedrock Assessment. In the Guidance, bedrock assessment is discussed in detail in Chapter 4, Bedrock Assessment, and in Section 6.6, Bedrock Pathway Assessment Attachments. If bedrock is encountered before groundwater and your site is not “exempt granular” (see the Guidance for definitions), you should not be using the Tier 2/SMR software described in this manual. You must use the Tier 2 Bedrock software to evaluate a “granular” or “nongranular” bedrock site. If your bedrock site does qualify as “exempt granular”, then you should be using the software described in this manual. The bedrock software can be downloaded from the Groundwater Professional Bulletin Board, referenced above.

If you have problems with or questions about the software, please contact our software representative:

LaDon Jones
Digital Control, Inc. 225 Hickory Drive
Ames, Iowa 50014-3428
Phone: 515-292-5300, Cell Phone: 515-460-1060, Fax: 515-292-0004
email: ladoncjones@qwest.net
For questions about the Tier 2 process in general, please contact the DNR LUST staff.

This manual is divided into two major sections: 1) the Tier 2 portion of the software; and 2) the SMR portion of the software. In order to use the SMR portion of the software you need to have completed data entry and analysis for the Tier 2 portion of the software.

1.1 Operating System (OS) Requirements

Tier 2/SMR version 2.51 is written in Visual Basic 6.0 for Windows. You do not need Visual Basic 6.0 to run the software. Version 2.51 will run under Microsoft® Windows 95, 98, NT, 2000 and XP, in short any version since Windows 95 or later.

1.2 Installing the Program

You will need to download the installation files and installation instructions for Tier 2 version 2.51 from the DNR Groundwater Professional Bulletin Board, http://www.iowadnr.gov/InsideDNR/RegulatoryLand/UndergroundStorage Tanks/GroundwaterProfessionals/GWPBulletinBoard, if you have not already done so. After installation your program menu will contain “Tier 2-SMR V2.51”. You should use version 2.51 in place of all previous versions 2.xx of the Tier 2 software. Version 2.51 is backwards compatible with files created using any previous versions numbered 2.xx. Before you open a file created in a previous version you might want to save a backup copy. You can open a file created in any version 2.xx in version 2.51 and all previous information is preserved. Even if you are continuing work on a file created with a previous version, you should open the file in version 2.51 and continuing your work using version 2.51.

1.3 The Origins of Iowa RBCA

The application of Risk-Based Correction Action (RBCA) to Iowa’s Leaking Underground Storage Tanks (LUSTs) was mandated by the Iowa legislature through Iowa House File 508, signed into law by the governor on May 25, 1995. You can download a copy of House File 508: www.legis.state.ia.us/GA/76GA/BillHistory/. This legislation called for a tiered assessment approach consistent with the “Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites”. This is an emergency standard, E538-94, published by the American Society of Testing and Materials (ASTM) in 1994. The final ASTM standard was published as E 1739-95.

The legislation said, in essence, that RBCA would be applied to LUST sites in Iowa. The legislation required the formation of a Technical Advisory Committee (TAC) fill in the details. The legislation required the TAC be made up of representatives from the: Iowa Environmental Council, Petroleum Marketers of Iowa, Iowa League of Cities, Iowa Groundwater Association, Iowa Petroleum Council, Consulting Engineers of Iowa, Iowa Association of Business and Industry and the Administrator of the Iowa Comprehensive Petroleum Underground Storage Tank Fund Board. The DNR was instructed to work jointly with the TAC to prepare draft rules for presentation to the Environmental Protection Commission. The RCBA program and rules were primarily developed by the TAC, with input from the DNR. The TAC began meeting in June 1995 and met on a regular basis for over a year. The RBCA rules developed by the TAC, and put into rule form by the DNR, became effective in January 1997. The TAC made final decisions by majority vote. NOTE: DNR was not a voting member of the committee. The TAC ceased to exist, as required by House File 508, when the Environmental Protection Commission adopted the final rules.

1.4 Overview of the Iowa DNR RBCA Program

RBCA considers the potential for chemical exposure by pathways from a source to a receptor, using a so-called Tiered approach. Tier 1 assumes a receptor could be exposed to a chemical-of-concern at the source location and has more stringent target levels based on the risk of exposure at the source. Tier 2 assumes exposure to a chemical-of-concern might occur at some distance from the source and allows for site-specific target levels (SSTLs) based on this distance. A Tier 3 approach may be used in instances where it is believed an alternative approach may better reflect site conditions. For more information on the tiered RBCA approach, please refer to Chapter 135 and the respective Tier 1 and 2 Guidance Documents.
2. OVERVIEW OF THE TIER 2 RBCA METHODOLOGY

The Tier 2 RBCA recognizes exposure to chemicals occurs through pathways. Chapter 135 defines a “Pathway” as a “transport mechanism by which chemicals of concern may reach a receptor(s) or the location(s) of a potential receptor”. A “Receptor” refers to “enclosed spaces, conduits, protected groundwater sources, drinking and non-drinking water wells, surface water bodies, and public water systems which when impacted by chemicals of concern may result in exposure to humans and aquatic life, explosive conditions or other adverse effects on health, safety and the environment as specified in these rules”. A receptor may be an “actual” receptor, one presently in existence, or could be “potential”, or not in existence at the time of assessment, but which could reasonably be expected in the future. Whether a pathway is “complete” or “incomplete” is determined by the source of contamination and the mechanisms of chemical migration. Complete pathways must be evaluated. Incomplete pathways do not require evaluation. The DNR generally classifies pathways into seven categories:

1. Groundwater Ingestion
2. Soil Leaching to Groundwater
3. Groundwater Vapor to Enclosed Space
4. Soil Vapor to Enclosed Space
5. Groundwater to Plastic Water Line
6. Soil to Plastic Water Line
7. Surface Water

In the Tier 2 software the pathways are grouped by media type: groundwater pathways, soil leaching pathways, and soil pathways.

Groundwater Pathways

The source of contamination for the groundwater pathways is existing groundwater contamination. The mechanism for chemical migration is groundwater transport. The risk-based target levels at the receptors (points of exposure) are groundwater concentrations.

The groundwater concentrations at a receptor, under existing conditions, are estimated by: 1) interpolation using measured concentrations and 2) simulation (modeling) of chemical transport in the groundwater. The groundwater simulation model assumes steady-state and uses site-specific data (source location, source concentration, source width and length, hydraulic conductivity, gradient, plume migration direction, and plume spread or range). The groundwater transport model is used to estimate the maximum groundwater concentrations that may occur in the future at a receptor, given the known conditions at the site. It is difficult to predict or forecast, with any level of confidence, the future evolution of a groundwater plume. Current plume measurements may not reflect the ultimate extent or magnitude. Yet, a no action required classification may be granted for a site based on modeling, without actual measurements to confirm the ultimate extent and magnitude of groundwater contamination (i.e., without actually measuring the groundwater concentration at a receptor ten years from now). Hence, one of the criteria for groundwater transport modeling at Tier 2 is to be reasonably confident actual groundwater concentrations at a receptor are not likely to exceed the target levels at any time in the future. That is, we would rather overestimate the maximum concentration that might occur at a receptor in the future, than underestimate.

If the simulated or measured concentrations at a receptor exceed the target levels, the groundwater model is then used to estimate the groundwater concentrations required to meet the target levels, and presumably protect the receptor. The groundwater concentrations required (according to the modeling) to meet the target levels at the receptor are called “site-specific target levels”, or SSTLs. These are site-specific, receptor-specific, and chemical-specific. If groundwater concentrations do not exceed the groundwater SSTLs, we are reasonably confident (according to the modeling) that groundwater concentrations at the receptor (now or in the future) will not exceed the target levels.

Soil Leaching Pathway
Existing soil contamination is the source for the soil leaching pathway. The mechanism of chemical migration is soil contamination leaching to the groundwater table, followed by groundwater transport. The risk-based target levels at the receptors (points of exposure) are groundwater concentrations.

Simulation modeling is used to estimate the future groundwater contamination that may result from current soil contamination. If a simulated groundwater concentration at a receptor exceeds a target level, the models are used to estimate the soil concentration required to be reasonably confident the groundwater target level at the receptor is not exceeded, now or in the future. The resulting soil concentration is called a soil source (or soil leaching) SSTL (site-specific target level). This SSTL is pathway-specific, chemical-specific, and receptor-specific. If a soil concentration does not exceed a soil leaching SSTL, we are reasonably confident the future groundwater concentration at a receptor (resulting from soil contamination) will not exceed the groundwater target level.

Here again, it is difficult to predict/forecast, with a reasonable level of confidence, groundwater concentrations that may occur in the future from current soil contamination. Current measurements may not reflect the ultimate extent or magnitude of the plume, or current groundwater concentrations may actually be below method detection levels, or “non-detect”. Yet, a no action required classification may be granted for a site based on modeling without, in many cases, confirming by actual measurements the ultimate extent and magnitude of groundwater contamination (i.e., without actually measuring the groundwater concentration at a receptor ten years from now). Hence, one of the criteria for the modeling of soil leaching at Tier 2 is to be reasonably confident actual future groundwater concentrations, resulting from current soil contamination, will not exceed a target level at a receptor. That is, we would rather overestimate the maximum potential concentration at a receptor in the future, than underestimate.

**Soil Pathways**

**Soil Vapor to Enclosed Space Pathway**

Existing soil contamination is the source of contamination for the soil vapor to enclosed space pathway. Migration of contaminated air/vapor in the vadose (unsaturated) zone is the transport mechanism of concern. The risk-based target levels are soil concentrations. The route of exposure is inhalation of vapors by humans in enclosed spaces. However, the TAC did not develop or select a model for vadose zone vapor transport. The modeling for this pathway does not include lateral (or horizontal) chemical vapor transport in the vadose zone. Hence, this pathway does not compute a soil SSTL, in the usual sense. That is, this pathway does not compute soil SSTLs for the soil concentrations that are simulated to meet the inhalation target levels at an enclosed space receptor, after accounting for lateral vapor transport in the vadose zone.

Vertical vapor transport modeling was used to convert the risk-based inhalation target level in an enclosed space to a soil concentration or soil target level for the soil immediately below or adjacent to an enclosed space (i.e., basement). These soil SSTLs are for the soil directly beneath or adjacent to an enclosed space. If soil concentrations beneath or in the immediate vicinity of an enclosed space do not exceed the soil SSTLs, we are reasonably confident (based on the modeling and assumptions) the concentrations in the air inhaled by a human in the enclosed space will not exceed the risk-based inhalation target levels. The TAC decided the soil target levels for the pathway would be the soil SSTLs for soil immediately adjacent to an enclosed space.

**Soil to Plastic Water Line Pathway**

Existing soil contamination is the source for the soil to plastic water line pathway. The receptor type is a plastic water line. A target level was set for groundwater in contact with a plastic water line. The soil leaching model was used to estimate the soil concentration that would result in the groundwater target level. This soil concentration is the soil target level for plastic water lines. The objective is to not exceed the soil target level in the vicinity of a plastic water line.

**Pathways and Media Type**

The following table shows the media for receptor target levels and for corrective action. For example, for groundwater
pathways, the target levels at the receptors are groundwater concentrations and the media for corrective action, if needed, is groundwater. For soil leaching, target levels at the receptors are groundwater concentrations, and the media for corrective action is soil.

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<td>Groundwater</td>
<td>Groundwater</td>
<td>Groundwater</td>
</tr>
<tr>
<td>Soil Leaching</td>
<td>Groundwater</td>
<td>Soil</td>
</tr>
<tr>
<td>Soil</td>
<td>Soil</td>
<td>Soil</td>
</tr>
</tbody>
</table>

### 2.1 An Overview of Receptor Types and Notation

A number of different receptor types are defined for Iowa RBCA. Their names and shorthand notations (as used in the software), grouped by route of exposure, are:

**Groundwater Ingestion Receptors (Groundwater Ingestion and Soil Leaching to Groundwater Ingestion Pathways)**
- **Actual**
  - DWW: Drinking Water Well
  - NDWW: Non-Drinking Water Well
- **Potential**
  - PGWS: Protected Groundwater Source

**Vapor Receptors (Groundwater Vapor to Enclosed Space, Soil Vapor to Enclosed Space, and Soil Leaching to Groundwater Vapor to Enclosed Space Pathways)**
- **Actual**
  - ACSR: Actual Confined Space Residential
  - ACSNR: Actual Confined Space Nonresidential
  - ASSR: Actual Sanitary Sewer Residential
  - ASSNR: Actual Sanitary Sewer Nonresidential
- **Potential**
  - PCSR: Potential Confined Space Residential
  - PCSNR: Potential Confined Space Nonresidential
  - PSSR: Potential Sanitary Sewer Residential
  - PSSNR: Potential Sanitary Sewer Nonresidential

- **Actual**
  - PWL: Plastic Water Line Potential
  - PPWL: Potential Plastic Water Line

**Surface Water Body (SWB) Receptors (Groundwater to Surface Water Body, Soil Leaching to Surface Water Body)**
- **Actual**
  - DU:B(CW): Designated Use, Cold Water
  - DU:B(WW): Designated Use, Warm Water
  - DU:B(LR): Designated Use, Limited Resources
  - DU:B(LW): Designated Use, Lakes and Wetlands
  - DU:C: Designated Use, Drinking Water
  - DU:SOL: Designated Use, State-Owned Lakes
  - GU:ASW: General Use, All Surface Water
  - GU:PL: General Use, Ponds and Lakes

### 2.2 Receptor Types
Groundwater Ingestion Receptors (Groundwater Ingestion and Soil Leaching to Groundwater Ingestion Pathways)

The concern is with ingestion (drinking) of contaminated groundwater.

**Drinking Water Well (DWW):**

An actual receptor. An existing groundwater well that supplies drinking water. This includes wells supplying water used primarily for the final production of food or medicine for human consumption in facilities routinely characterized with the Standard Industrial Codes (SIC) group 283 for drugs and 20 for foods, or North American Industry Classification System (NAICS) Codes of 3254 for drugs and 311 for food (Chapter 567-135.2(455B)).

**Non-Drinking Water Well (NDWW):**

An actual receptor. An existing groundwater well supplying water that is not defined as a drinking water well, including an abandoned groundwater well not properly plugged in accordance with department rules in 567 Chapters 39 and 49.

Groundwater wells that are not defined as drinking water or non-drinking water wells include groundwater monitoring wells and extraction wells for remediation systems, and wells used in a closed loop water system (i.e., a heat pump). However, if the well serves a consumptive use, such as evaporative cooling (e.g., a production well), it must be considered a non-drinking water well.

For additional information on definitions of drinking water wells and non-drinking water wells, see Chapter 567-135.2 (455B), the Tier 1 Guidance (Receptor Survey, page 43) and the Tier 2 Guidance (page 82, Section 6.4.2).

The risk-based target levels must be met at the water well receptor. The groundwater target levels at drinking and non-drinking water wells are shown in the Tier 1 Table (Tier 2 Guidance, Appendix A). The levels applicable to drinking water wells (DWWs) are under the Groundwater Ingestion Exposure Pathway, Actual Receptor. The levels applicable to non-drinking water wells (NDWWs) are under the Groundwater Ingestion Exposure Pathway, Potential Receptor. These target levels apply at all Tiers (Tier 1, Tier 2, and Tier 3).

**Protected Groundwater Source (PGWS):**

A potential receptor. Our concern is with the potential for ingestion of contaminated groundwater that is not currently used as a drinking water source.

A Protected Groundwater Source is defined in Subrule 567-135, p. 7, as “a saturated bed, formation, or group of formations which has a hydraulic conductivity of at least 0.44 meters per day (m/d) and a total dissolved solids of less than 2,500 milligrams per liter (mg/L) or a bedrock aquifer with total dissolved solids of less than 2,500 milligrams per liter (mg/L) if bedrock is encountered before groundwater.”

The protected groundwater source receptor exists when the first encountered groundwater meets the definition of a protected groundwater source (567-135.10(4)a),(Tier 2 Guidance, 3.1.1). If bedrock is encountered before groundwater, a protected groundwater source is assumed, regardless of the hydraulic conductivity measurements (i.e., even if the hydraulic conductivity is measured as less than 0.44 m/d) (Tier 1 Guidance, page 39) (Tier 2 Guidance, Section 4.2.2).

The groundwater target levels for a protected groundwater source are shown in the Tier 1 Table (Tier 2 Guidance, Appendix A). The levels applicable to a protected groundwater source are under the Groundwater Ingestion Exposure Pathway, Potential Receptor.

**Vapor Receptors (Groundwater Vapor to Enclosed Space, Soil Vapor to Enclosed Space, and Soil Leaching to Groundwater Vapor to Enclosed Space Pathways)**
Also called “Vapor to Enclosed Space” receptors. See 567-135.10(6), 156-135.10(7) (Tier 2 Guidance, Sections 3.3, 3.4).

The route of exposure for vapor receptors is the inhalation (breathing) of contaminated air by humans in an enclosed space. (However, vapors can also create explosive hazards for their receptors.) The risk-based inhalation target levels are limitations on the concentration of a chemical inhaled by a human. Vertical vapor transport models are used to compute the soil and groundwater concentrations beneath the receptor that will meet the inhalation target levels. These soil and groundwater concentrations are the target levels for the vapor receptors and apply to the soil and groundwater directly beneath and immediately adjacent to the receptor.

The vapor receptors also have vapor target levels. These target levels are the vapor concentrations immediately beneath or adjacent to an enclosed space that would result in indoor air concentrations that meet the inhalation target levels (according to the modeling). The vapor target levels are:

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Target Level (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>600,000</td>
</tr>
<tr>
<td>Toluene</td>
<td>9,250,000</td>
</tr>
</tbody>
</table>

The target levels are the same for all vapor receptor types and chemicals.

Vapor sampling, while not specifically required to address vapor pathways as part of the Tier 2, is recommended. This allows you to establish the risk of the vapor receptors without having to complete this step later in a Corrective Action Design Report (CADR) or Site Monitoring Report (SMR).

Vapor receptors are divided into two major categories: confined space receptors and sanitary sewer receptors.

**Confined Space Receptors (Actual and Potential)**

At Tier 2 a confined space is a basement in a building occupied by humans. Buildings constructed with a concrete slab on-grade, or buildings constructed without a concrete slab, but with a crawl space, are not considered confined spaces.

- Actual Confined Space Residential (ACSR) and Actual Confined Space Nonresidential (ACSNR):

  These are existing confined space receptors (basements in an existing building occupied by humans). The pattern of occupancy is used to determine if the receptor is residential or nonresidential. A residence or home that could be occupied by the same person on a 24-hour basis would be considered residential. For example, a nursing or rest home would be considered residential, even if the property is zoned non-residential. An office building or factory that is not continuously-occupied by the same person on a 24-hour basis would be considered nonresidential.

- Potential Confined Space Residential (PCSR) and Potential Confined Space Nonresidential (PCSNR):

  Potential confined space receptors are confined spaces that do not presently exist, but could exist in the future. Roads and public rights-of-way are not considered potential confined space receptors. Current zoning is used to determine whether a potential confined space receptor is residential or nonresidential. An area without zoning is assumed to be residential.

**Sanitary Sewer Receptors (Actual and Potential)**

Chapter 135 and the Tier 2 Guidance state, “sanitary sewers are considered confined space receptors...”. However, in the Tier 2 software a “confined space” refers only to a basement in a building occupied by humans. Sanitary sewers and confined spaces are treated as separate receptor types.

The route of exposure for a sanitary sewer receptor is inhalation of contaminated air. The concern is with sanitary sewers or their utility envelopes creating an inhalation hazard by acting as a route for vapors to migrate into a building.
occupied by humans. Vapors can also create an explosion hazard. However, because of the uncertainties with attempting to model vapor migration along or through a sanitary sewer or its envelope, the sanitary sewer itself is used as a surrogate receptor. That is, the sanitary sewer is treated as a receptor, and the groundwater target levels or soil concentrations apply to the groundwater beneath the sanitary sewer and the soil in the vicinity of the sanitary sewer. The objective is to limit the groundwater and soil concentrations adjacent to the sanitary sewer, in order to meet inhalation target levels in the building to which the sanitary sewer is connected.

**Actual Sanitary Residential (ASSR) and Actual Sanitary Sewer Nonresidential (ASSNR):**

An actual sanitary sewer is an existing sanitary sewer connected to an existing building. The zoning (residential or nonresidential) is based on the zoning (or occupancy) of the building the sanitary sewer connects to, not the zoning where the sanitary sewer is located.

**Potential Sanitary Sewer Residential (PSSR) and Potential Sanitary Sewer Nonresidential (PSSNR):**

Potential sanitary sewers are locations where sanitary sewers do not presently exist, but could exist in the future. Roadways are not potential sanitary sewer receptors. However, a public right-of-way is a possible location for a potential sanitary sewer. For potential sanitary sewers, the zoning of a public right-of-way is assumed to be the same as the zoning of the property directly adjacent to the right-of-way. An area without zoning is assumed to be residential exposure.

**Plastic Water Line (PWL) Receptors**

The plastic water line receptor is often incorrectly overlooked in Tier 2 SCRs. You should review the Tier 2 Guidance carefully with regard to plastic water line receptors (Sections 3.5, 3.6). The concern is the water inside the line becoming contaminated by external contact with contaminated soil or groundwater and diffusion of contamination into the plastic water line. As a surrogate for someone drinking contaminated water from a plastic water line, the plastic water line itself is treated as a receptor. There are actual (existing) and potential plastic water line receptors.

It should be assumed every property has a water service line unless the property is undeveloped or has no water usage. Water service lines can connect from the property to the main or to a water well providing water. Unless the material of construction of a water service line or main is known or unless the city/county has a specific ordinance banning the use of plastic water lines, then a plastic water line should be assumed.

**Surface Water Body Receptors**

The concern with contamination of surface water bodies is from infiltration of contaminated groundwater. Surface water bodies are actual receptors. There are no potential surface water body receptors. There are two categories of receptor types: designated use and general use. See the Tier 2 Guidance, Section 3.7.

Designated use segments are assigned or declared by the state, and have specific water target levels. General use segments do not have specific water target levels. However, both designated use and general use have a visual inspection requirement. If a general use segment fails visual inspection, then specific water target levels are applied.

### 2.3 Receptor Target Levels by Media

Each receptor type has groundwater and/or soil, risk-based target levels. The target levels apply at or near the receptor. In some cases, the target levels are based on direct exposure (groundwater target levels at drinking water wells). In other cases, the target levels are developed using vertical transport modeling (for a confined space, the concern is inhalation in an enclosed space). Groundwater and soil target levels were developed using vertical vapor transport models to relate the vapor concentration at a person’s nose in the enclosed space to the groundwater and soil concentrations beneath the enclosed space.
The following table shows the target level media for each receptor type:

**Target Levels by Media at the Receptor**

<table>
<thead>
<tr>
<th>Receptor Type</th>
<th>Route of Exposure</th>
<th>Groundwater Target Levels at the Receptor</th>
<th>Soil Target Levels at the Receptor</th>
<th>Soil Gas Target Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>DWW</td>
<td>Ingestion</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>NDWW</td>
<td>Ingestion</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>PGWS</td>
<td>Ingestion</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>PWL</td>
<td>Ingestion</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>PCSR</td>
<td>Inhalation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>ACSR</td>
<td>Inhalation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>PCSNR</td>
<td>Inhalation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>ACSNR</td>
<td>Inhalation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>PSSR</td>
<td>Inhalation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>ASSR</td>
<td>Inhalation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>PSSNR</td>
<td>Inhalation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>ASSNR</td>
<td>Inhalation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SWB</td>
<td>Ecological</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

2.4 Receptor Types and Pathways

For each receptor type, the following table lists applicable pathways. An “X” means the receptor type is applicable for the pathway. An “N/A” means the receptor type is not applicable for the pathway.

<table>
<thead>
<tr>
<th>Receptor Type</th>
<th>Groundwater Source</th>
<th>Soil Leaching</th>
<th>Soil Vapor to Enclosed Space</th>
<th>Soil to Plastic Water Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinking Water Well-DWW</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Nondrinking Water Well-NDWW</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Protected Groundwater Source-PGWS</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Plastic Water Line-PWL</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
<td>X</td>
</tr>
<tr>
<td>Potential Confined Space Residential-PCSR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
</tr>
<tr>
<td>Actual Confined Space Residential-ACSR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
</tr>
<tr>
<td>Potential Confined Space Nonresidential-PCSNR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
</tr>
<tr>
<td>Actual Confined Space Nonresidential-ACSNR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
</tr>
<tr>
<td>Potential Sanitary Sewer Residential-PSSR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
</tr>
<tr>
<td>Actual Sanitary Sewer Residential-ASSR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
</tr>
<tr>
<td>Potential Sanitary Sewer Nonresidential-PSSNR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
</tr>
<tr>
<td>Actual Sanitary Sewer Nonresidential-ASSNR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
</tr>
<tr>
<td>Surface Water Body (All Types)</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

3. SOFTWARE OVERVIEW

The following is an overview of the major sections of the Tier 2 portion of the software, listed in the typical order of completion. Each task is covered in more detail, later.

a) Site Identification:
   Enter the information identifying the site. The LUST number for the site is shown on the tables and plots printed by
b) Enter Data:
In general, you should enter all groundwater sample data, soil sample data, and vapor sample data for the site (Tier 2 Guidance, 2.1.1, 6.4.1). The software does extensive data management, analysis, and. The software, for example, automatically determines the concentrations assigned to each sampling location, and the groundwater and soil sources.

c) Data Adjustment:
Indicate the groundwater or soil data should be ignored (if any) by the software. You will need to provide justification why data can be ignored (Tier 2 Guidance, 6.4.1).

d) Hydrogeology:
Enter the hydrogeologic data. The software does not contour groundwater elevations or provide head gradient estimates. You will need to do this outside the software. The software does provide contouring of groundwater and soil concentrations.

e) Source Width and Length for Soil and Groundwater:
The software provides tools for estimating Source Width and Length from the soil and groundwater data.

f) Receptor Questions:
A series of questions are presented to help identify the receptor types and chemicals you need to evaluate for your site.

g) Receptor Type Evaluation Requirements (Preliminary Pathway Evaluation Requirements).
This is an important step in the Tier 2 process. The results indicate the receptor types you must evaluate at Tier 2 and the receptor types you do not need to evaluate. This information is pathway specific:

- Groundwater Ingestion
- Soil Leaching to Groundwater
- Groundwater Vapor to Enclosed Space
- Soil Vapor to Enclosed Space
- Groundwater to Plastic Water Line
- Soil to Plastic Water Line
- Surface Water

You need to complete tasks (a) through (f) before you produce the final receptor type evaluation requirements.

h) Receptor Identification:
You use receptor identification plumes generated by the software to identify the receptors present for each pathway.

All receptors of a type are entered in the same table. A receptor is only entered once, regardless of the number of pathways for which it needs evaluation. On the other hand, for a receptor to be entered, it only needs to be identified by one of the receptor identification plumes (groundwater ingestion, soil leaching, groundwater vapor to enclosed space, soil vapor to enclosed space, groundwater to plastic water line, soil to plastic water line, surface water).

In version 2.51, as well as any 2.xx version, you do not and should not enter potential receptors at the soil or groundwater sources. Version 2.50, as well as the previous 2.xx versions, will automatically assume and evaluate potential receptors at the soil and groundwater sources.

i) Entering Receptors:
Enter the receptors you have identified for your site.
Pathway Evaluations:
For organization, and because of procedural differences, the pathway evaluations are divided into three categories.

- Groundwater Pathways (Groundwater Ingestion, Groundwater Vapor to Enclosed Space)
- Soil Leaching to Groundwater
- Soil Pathways (Soil Vapor to Enclosed Space and Soil to Plastic Water Line)

Monitoring well identification, Site-Specific Target Level (SSTL) Tables, Receptor Summaries, and Corrective Action Maps are produced under each pathway, as appropriate.

Groundwater Monitoring Plan:
The software combines the results from the pathway evaluations for the groundwater pathways and soil leaching pathways into a Groundwater/Soil Leaching Monitoring Plan for your site. For the joint monitoring plan to be complete, you complete the pathway evaluations Groundwater and Soil Leaching prior to production of the final Groundwater/Soil Leaching Monitoring Plan.

General Plume Contouring:
The software provides tools for general contouring of the soil, vapor, and groundwater chemical concentration data.

4. GETTING STARTED WITH TIER 2; A TUTORIAL

If you have not already done so, start the Tier-2/SMR software. When the software is finished loading, you will see the startup form. We will call this form the “Main Form” throughout this manual. The “Main Form” is the base from which program features are accessed. The buttons shown on the form are used to access other forms: forms used to enter data, save and open files, display results, plot graphs, and print results.

The Tier 2 software is structured by the tasks you need to perform as part of a Tier 2 assessment. In most cases, the logical progression is to perform the tasks in a column of buttons (moving from top to bottom), and work through the columns, moving from left to right.

A Tier 2 example file has been included as part of the version 2.51 installation. The example problem is not a complete Tier 2 analysis. The example problem is used in this manual to demonstrate the Tier 2 software. I would strongly encourage you to open the example problem file and follow along. Click the “Open” button on the “Main Form”. Select and open the file t2v25umexp.tv2. The full path name for the currently active file is shown at the top of the “Main Form”.

If you cannot find your copy of the example problem file, e-mail me and I will e-mail you the file(s).

4.1 Site Identification (Site ID)

Click the “Site ID” button in the “Site Identification” frame to activate the “LUST SITE IDENTIFICATION” form. The information in this form is printed as part of the cover page of the Tier 2 SCR (Tier 2 Guidance, Section 6.1).

The information is used to identify the site, the responsible party, the certified groundwater professional responsible for the Tier 2, and the proposed site risk classification. When you start a new project file you should enter the “LUST No.” right away. The LUST number is printed on all graphs and tables produced by the Tier 2 software.

Normally the site “Classification” and whether you “Recommend” Tier 3 or Correction action is completed after you have completed your Tier 2 analysis.

Except for signatures, version 2.51 will print all the information required on the Tier 2 SCR cover page. To print the Tier 2 cover page, click the “Print” button on the “Main Form”.

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When you are done, click “OK/Back” to return to the “Main Form”. If you click “Cancel” you will be asked to confirm your cancellation. If you confirm the cancellation, you will be returned to the “Main Form”, but the “Site Identification” information will not be updated to reflect any changes or additions you have made.

4.2 Saving Your Tier 2/SMR Assessment Data and Results, the Data Files

You may save your data and results to a data file at any time. I strongly recommend you periodically save your data while you are working. If the Tier 2 software or the operating system crashes, when you restart the Tier 2 software, you can open the data file, and it will contain data up to the point of your last “Save”.

When you are entering data for a new site, you will get the “Save As” menu the first time you click the “Save” button. We need to select a new file name for our example problem so we do not overwrite the original example file (in case other users want to use the example file). Click “Save As”. For our example, enter myt2exp.tv2 as the new file name and click “OK”.

You are required by the DNR to use the LUST number as the file name(s) for the Tier 2 data file(s) you are required to submit as part of the Tier 2 SCR (Tier 2 Guidance, Section 6.9).

It is strongly recommended that you back-up your Tier 2 data files (copy the files to a back-up directory before you open an existing file). If you are updating a Tier 2 data file and a problem occurs when you are saving the file, the file may be corrupted or information may be lost. If you make back-up files, then you can recover the data using the back-up files.

Version 2.50, as well as previous 2.xx versions, uses a data file extension of “.tv2”. When you specify a file name, you should either specify the file name only (with no period and extension, i.e., 8LTX50) and the software will automatically add “.tv2” or include the entire name and extension (i.e., 8LTX50.tv2).

When you select “Open” under “File” to open an existing file, version 2.51 will automatically list files with extensions of .tv2 (*.tv2).

Once you have saved your data to a file, clicking the “Save” button will automatically update the active file (the active file path and name is shown at the top of the Main Form). If you wish to save the results under a new file name, use the “Save As” button.

Starting a “New” assessment will clear all existing data from the program. To protect against inadvertent data loss, whenever you select “New”, the program requires you confirm the “New” selection before clearing the existing data.

Use “Open” in the “File” frame to open a previously-saved Tier 2 assessment. Make sure you have saved any existing data before opening a new file. Opening a file will clear the existing data from the software and replace it with the data in the file.

4.3 Data File Structure for Version 2.51

When you save your data, version 2.51 (as well as previous 2.xx versions) actually creates two files. The sample data you enter (groundwater, soil, vapor) is saved in the file with the .t2d extension, while all other site data is saved in the file with the .tv2 extension. However, you work directly (Save, Open, etc.) ONLY with the file with the .tv2 extension. For example, assume the LUST Number is 8LTF45 and you have saved your data using 8LTF45 or 8LTF45.tv2 as the file name. The program will create a file named 8LTF45.tv2. The program will also create a file named 8LTF45.t2d. The t2d file will always use the name you selected for the tv2 file, except the extension is .t2d instead of .tv2. The file with the .t2d extension is created and handled automatically, and you should not use .t2d as an extension for saving or opening a Tier 2-version 2.51 data file. As far as your file interaction, you are saving data to a single file with an extension of .tv2 and opening a single file with an extension of .tv2. The software will automatically handle the .t2d file.

The purpose of having two files is for future portability of the data file, so sample data you enter for the Tier 2 report can
be used in other programs.

When you are sending your data files to the DNR as part of the Tier 2 SCR (Tier 2 Guidance, Section 6.9), you should include both files on the floppy disk: the file with the .tv2 extension and the file with the .t2d extension (i.e., LUSTNO.tv2 and LUSTNO.t2d). Also, if you are sending data files to LaDon Jones as attachments to an e-mail or on a floppy disk, please include both files.

**Important:**
The files created are ASCII files and can be opened and viewed with a word processor. However, I would strongly recommend against this. You should certainly not open the files in a word processor and then save the files from the word processor. Word processors have program-specific formats. If you modify or save the files from a word processor, the Tier 2 program may not be able to properly read the data.

If you feel the need to view the files, do not work with the original files. Copy both files, give new names to the copied files, and open the copied files, not the original files. If you want to make changes, make changes to the copied files and test them, not the original files. It is recommended you use Notepad® to look at the copied files. Notepad® is an ASCII editor and will save changes in an ASCII format.

Again, unless absolutely necessary, it is recommended you do not open or edit the files in a word processor. If you do, work with copies of the files, not the original files. Use Notepad®. Notepad® is included as part of Microsoft® Windows (Start/Programs/Accessories).

If you believe you have corrupted data files, LaDon Jones may be able to fix the problem. Send him the files as e-mail attachments (*.tv2, *.t2d) or on a floppy disk with a detailed note describing the problem.

### 4.4 Site Cartesian Coordinate System

To use the Tier 2 software, you must define a Cartesian coordinate system for your site. Figure 1 is an example showing the X and Y directions. X always increases from left to right, and Y always increases from bottom to top. It is recommended you select North as vertically upward (Positive Y). The location of the coordinate system origin (0,0) is up to you.

In the Tier 2/SMR software, the length unit is always feet. Do not enter the units, just the values for x and y, in units of feet.

The locations of all monitoring wells, soil samples, adjacent property boundaries, and receptors are specified using the Cartesian coordinate system for the site.

### 5. CONTAMINANT DATA, GROUNDWATER, SOIL, AND VAPOR

All soil, vapor, and groundwater contaminant data ever measured at the site or obtained during site investigations must be entered into the software (Tier 2 Guidance, Sections 2.1.1, 6.4.1). Soil and groundwater samples from releases of petroleum-regulated substances must always be analyzed for the presence of benzene, toluene, ethylbenzene, and xylenes (BTEX). Additionally, if the release is suspected to include any petroleum-regulated substance other than gasoline or gasoline blends, or if the source of the release is unknown, the soil and groundwater samples must also be tested for the presence of total extractable hydrocarbons (TEH) (Tier 2 Guidance, Section 1.5). Appendix F of the Tier 2 Guidance contains information on “Using Data Acquired Prior to August 15, 1996”.

Version 2.50 automatically manages and organizes the sample data. The software will assign chemical concentrations to each sampling location and determine the source concentrations. The criteria used for data selection and the procedure for modifying the data selection are discussed later.

**Important:**
You must not enter a quote (“”) anywhere in the Tier 2 software. The quote is used as a separator in saving the information to file, and entering a quote will cause problems when the software attempts to read a previously-saved data file. Version 2.51 will not allow you to directly type in a quote ("), but you could paste in a quote. Do not do so.

5.1 Tier 2 Groundwater Sample Data

Click the “GW Data” button on the “Enter Data” frame to activate the “Tier 2, Groundwater Sample Data” form. This form is used to enter your Tier 2 groundwater sample data, data used for the Tier 2 SCR analysis. If you have opened the example data file (t2v25umexp.tv2), groundwater sample data will already be present.

You should not enter groundwater data collected after the Tier 2 was submitted, unless you are re-doing a Tier 2 with additional data. Groundwater data collected after the Tier 2, as part of the SMR process, is entered into a form in the SMR portion of the software.

Important:
Groundwater sample data collected as part of post-RBCA Site Monitoring Report (SMR) sampling is entered in a different form accessed in the SMR portion of the software. Pre-RBCA SMR sampling may be entered in the main data form. Again, do not enter groundwater concentration data collected as part of post-RBCA SMR sampling in the “Tier 2, Groundwater Sample Data” form, unless you are redoing the Tier 2 analysis. The Tier 2 portion of the software is “live” with respect to groundwater and soil data. If you enter groundwater sample data collected as part of SMR sampling in the “Tier 2, Groundwater Sample Data” form, the software will re-compute the Tier 2 results using the new data as soon as you leave the “Tier 2, Groundwater Sample Data” form (Tier 2 sources, modeling results, SSTLs, contouring, risk classification, etc., could change).

Please see the Tier 2 Guidance, Section 6.4.1, for additional information on entering groundwater, soil, and vapor analytical data.

The sample data input is by row. Each groundwater analytical sample occupies one row. To start, click on the cell under “Well/BH Label” and type in the well label. To move to the next column, press the enter key, use the arrow keys, press the Tab key, or place the mouse cursor on the cell you want to move to and click the left mouse button.

No Data: For samples, or any column for which a value is not available, enter n or N, to indicate no information. You must have an entry in every column for a sample, but you can enter N for any column, except for the first four columns; you must have a Well/BH Label, a sample date, and an (x,y) location for each sample.

We will now discuss the individual columns:

Well/BH Label: Enter the label for the well or borehole (BH) sampled. The column will accept any text or numeric inputs, including commas. However, you should not enter a quote (“”) anywhere in the program. When the data is saved or read from the file, the quote (”) is used as a separator between text strings. Using a (”) will result in the data not being read correctly from the data file. Version 2.30 and later prohibit the entry of quotes directly but you can paste text with a quote from the clipboard. Do not do this, or if you do, make sure the quote has been deleted before you save the file.

You will save yourself time if you enter the data in the order you want it to be displayed or printed. For example; MW1, BH-1, MW2, MW3, etc. You can, however, use cut and paste (discussed later) to rearrange the data.

The text does not need to fit within the column space shown. You can change the width of any column by placing the mouse cursor on the vertical column separator in the top row (the row with the column labels), click and hold the left mouse button and drag left or right.

Sample Date: Enter the date the sample was collected. The format is month/day/year. You can use a variety of formats to enter the date, but when you return to the Groundwater Data form, or print the date, the date is always shown by mm/dd/yyyy.
For example, you can enter March 4, 1998, in the “Sample Date” column as:

March 4, 1998
3-4-1998

You should use all four digits for the year, but it is not required. If you do not use four digits for the year, after you leave the groundwater data form you should return to the form to make sure the software has converted the two-digit year to the correct four-digit year.

**X,Y Location:** Enter the (x,y) location of the well or borehole, based on the Cartesian coordinate system you have chosen for the site. The units are feet. Do not enter the units, just the location in feet.

**Chemical Concentration Columns:** Benzene, toluene, ethylbenzene, xylenes, total extractable hydrocarbons as diesel (TEH-D), total extractable hydrocarbons as waste oil (TEH-WO), naphthalene (Naph.). The units for groundwater concentrations are micrograms per liter, or $\mu$g/L. Do not enter the units, only the concentration in $\mu$g/L.

Check the units reported on the original laboratory data sheets to ensure the correct unit conversion is applied. For example, TEH in groundwater is often reported in milligrams per liter, or mg/L, on the laboratory sheet and must be converted to $\mu$g/L for the Tier 1 and Tier 2 evaluations (Tier 2 Guidance, Section 6.4.1). The Tier 2 Guidance, Section 6.4.1, discusses when TEH must be sampled at your site.

If you do not have data for a chemical, enter n or N in the column.

**Samples Below Detection Limits:** For samples with concentrations below the method detection limit, or laboratory reporting limit (e.g., “non-detect”), you must enter “<” followed by the detection limit. For example, if the sample is less than the method detection limit for a chemical and the detection limit is 10 µg/L, enter <10.

**Free Product:** The free product column is used to indicate whether free product is present. Valid entries are:

- G or g: Gasoline
- D or d: Diesel
- W or w: Waste Oil
- U or u: Free product is present, but type is unknown.
- N or n: Free product is not present.

**Use FP Defaults:** If free product (FP) is present (any entry other than N in “Free Product”), one of two cases could occur:

Case 1: The groundwater beneath the free product has been sampled for BTEX and/or TEH. Place the measured groundwater concentrations for the chemicals in the appropriate columns and set “Use FP Defaults” to N. **You are required to sample groundwater beneath free product for samples collected as part of the RBCA process.**

Case 2: The groundwater beneath the free product has not been sampled for BTEX and/or TEH. Set “Use FP Defaults” to “Y”. When you type “Y” or “y” in the “Use FP Defaults” column, and a free product type has been specified in the “Free Product” column, the software will confirm you want to use free product defaults for chemical concentrations. If you answer “Yes” to the message box, free product defaults will be inserted for BTEX and/or TEH concentrations. If you change “Y” to “N” in the Use FP Defaults column, any previously-inserted defaults are left in the chemical concentration columns. If you need to change previously-inserted free product defaults, you will need to type in the values in the chemical concentrations columns.

Note: Using “Free Product Defaults” generally only applies to using data from a pre-RBCA report (Tier 2 Guidance, Section 6.4.1).
Groundwater Surface Elevation, Top-of-Casing Elevation, Top-of-Screen Elevation, Static Groundwater Elevation: Enter the values requested in feet above mean sea level. Enter only the value, not the units. If the information is not available, enter n or N.

Hydraulic Conductivity: You are required to estimate the hydraulic conductivity for your site. Generally, this is done by slug testing a minimum of three monitoring wells. The analysis of slug test data must be done using the Bouwer-Rice method (Bouwer, H., 1989, The Bouwer and Rice Slug Test – An Update, Groundwater, Vol. 27, No. 3, pg. 304-309). For additional information on hydraulic conductivity estimation (and the slug test information you are required to send to the DNR), see the Tank Memo dated March 29, 1999 (Volume 3, Issue 1), and the Tier 1 Guidance (pages 24 and 34, Hydraulic Conductivity Well Diagram). You may obtain a copy of a DNR paper titled, “Recommended Method for the Determination of Hydraulic Conductivity”, by contacting Bonnie Garrison at 515-281-6010.

If slug testing was performed, enter the estimated hydraulic conductivity in meters per day (m/d). A hydraulic conductivity value (K) of 5 m/d may be used when the recharge rate of the well is too rapid to be accurately measured (Tier 2 Guidance, 2.4). Enter n or N if there is no data.

TDS: If any of the hydraulic conductivity measurements exceed 0.44 m/d, groundwater samples must be collected from the wells used for slug testing, and analyzed for total dissolved solids (TDS) (Tier 1 Guidance, page 24). If TDS were measured, enter the concentration in milligrams per liter (mg/L). Enter n or N if there is no data.

Automatic Number Formatting: One of the changes after version 2.2 was automatic number formatting. For example, if you type in a concentration of 20000 the number is automatically formatted as 20,000.

Versions 2.30 and later automatically format new groundwater data. Versions 2.30 and later do not automatically format groundwater data entered using an earlier version (v2.2 or earlier). (However, the data is read into version 2.51 and works fine.) For example, if you open a data file generated by version 2.2 or earlier, the existing groundwater data will be read and saved in version 2.51 and will work fine. However, the concentrations will not be automatically formatted. This does not cause a problem with data analysis. It is not required the data be formatted. (All data is automatically formatted when it is printed, regardless of whether it is formatted in the groundwater data grid).

There is a reason existing groundwater data read into version 2.30 or later from version 2.2 or earlier is not automatically formatted. The reason is to avoid the loss of information for groundwater samples the user selected to ignore in version 2.2 or earlier. The identification of which samples to ignore is based on an identification string for each sample which includes the text representation of the chemical concentrations. If the previously-existing groundwater samples were automatically formatted when a version 2.2 or earlier file was read into version 2.30 or later, it is likely information on groundwater samples ignored in version 2.2 or earlier would be lost when read into version 2.30 or later.

If you have ignored groundwater samples in version 2.2 or earlier and read the file into version 2.51, your ignore selections should be retained. However, you should not re-type the concentrations for samples you have entered and ignored in version 2.2 or earlier. For new sample data entered into version 2.51, the automatic formatting will not cause a problem with ignoring samples entered in version 2.51.

Fix Cols/Unfix Cols Button: Clicking the “Fix Cols” button will fix the first two columns. As you scroll the grid to the right, the Well/BH label and Sample Date Column will remain in place to assist with entering the proper values in the far right columns. When the columns are fixed, however, you cannot type in new data in the first two columns. If the columns have been fixed, the button will show “Unfix Cols”. Click the button to unfix the first two columns.

Editing values in the grid: To edit a value in the table, click on the cell and press the F2 key. Edit the value in the text box above the grid. Press enter to update the table with the edited value. Press Esc to return to the grid without editing the value.

EDIT menu: Copy/Paste/Cut
The “EDIT” menu at the top left of the form is a drop down menu with editing commands. You can also display the
“Edit” menu by clicking the right mouse button when the mouse cursor is over the grid.

The program has spreadsheet-type Copy and Paste capability. You can also Copy and Paste to and from other Windows programs (the Windows Clipboard is used). To select an area for copy/paste/cut, you click and hold down the left mouse button and drag the mouse, or hold down the shift key and use the arrow keys.

**INSERT ROWS**

To insert rows, click the row where you want to insert. Click “EDIT” (or the right mouse button when the mouse is over the grid), then “INSERT ROWS”. Type in the number of rows you wish to insert and whether you want the insertion above or below the current row, then click OK.

**DELETE ROWS**

To delete rows, select the rows you want to delete. One method of selection is to click the first row you want to delete with the left mouse button, hold down the left mouse button, and drag to select the rows you want. You can also hold down the Shift key and use the arrow keys to select rows. Click “EDIT” (or the right mouse button when the mouse is over the grid), then “DELETE ROWS” to delete the selected rows. The software will confirm you want to delete the selected rows if they are not empty. Once rows are deleted the information is lost.

**SORT**

The sort button will sort the data, first by location (x,y), then by date at a location. Starting with the first sample, the software will find all other samples within a 5-foot radial distance and group the samples together. The software then moves to the next sample not assigned a location, and finds all following samples within 5 feet. This continues until all groundwater samples have been assigned a location. All samples assigned to the same x-y location are then sorted by date, from the oldest to the most recent sample.

To sort the data, click the “Sort” button. You are not required to sort samples. The software maintains an internal copy of the sorted data for computational purposes.

**OK/Back**: When you are done entering, or modifying data, click “OK/BACK” to update the stored groundwater sample information with the information in the grid. When you click “OK/Back”, the data is checked for formatting errors. If errors are present, a message box will inform you of the error. “OK/Back” will not update the data and leave the form until all errors are cleared.

**Identical Sample Check**: As part of error checking, the software will check for identical samples (added at version 2.30). Possible identical samples are flagged if two groundwater samples have the same well label, sample date, (x,y) location, and chemical concentrations for BTEX, TEH-D, TEH-WO, and naphthalene. Identical samples can create problems with retaining your selections for groundwater sample data to ignore (discussed later).

If the samples are identical samples entered twice by mistake (the most likely case), one of the samples should be deleted. If they are not truly identical samples, the best approach is to modify the label of one of the samples slightly.

**Cancel**: If you click “Cancel” on the menu, you will first need to confirm the cancel. If you confirm the cancel selection, any changes you have made since entering the Groundwater Sample Data form will be ignored, and you will be returned to the Main Form.

**Printing Groundwater Sample Data**: To print the groundwater sample data, use the “Print” button on the “Main Form”.

### 5.2 How Tier 2 Organizes Groundwater Sample Data

The Tier 2 program organizes and analyzes the groundwater sample data. This is done automatically, but we will discuss
The groundwater data is first grouped by (x,y) location. Samples within 5 feet radial distance are treated as representing the same location. The samples at the same location are sorted by date, from the oldest to the most recent. For each chemical, a single concentration is assigned to each location. The chemical concentrations are used for contouring, determination of source location/concentration, and risk classification.

The location a groundwater sample is assigned can be affected by the order in which the data is listed in the table. The software looks at the location of the first groundwater sample in the grid. It then searches the following groundwater data in the grid, in the order shown in the grid. Any sample within 5 feet radial distance is considered to be at the same location, and the sample is not considered again. The software then moves down in the grid to the next sample not assigned a location. All following samples are checked against this location. Samples with 5 feet are assigned to the location. This continues until all samples have been assigned a location. If a number of samples are close together (i.e., four samples on a line, each spaced 4 feet apart), the order of the samples in the grid can affect their location assignment.

Consider the following example. Assume the following three samples are available from two wells. For purposes of illustration, we will look at benzene and toluene. Assume monitoring well MW-3 was no longer usable after 1994 and MW-8 was installed as a replacement:

<table>
<thead>
<tr>
<th>Well</th>
<th>Sample Date</th>
<th>X (ft)</th>
<th>Y (ft)</th>
<th>Benzene (µg/L)</th>
<th>Toluene (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW-3</td>
<td>04/05/1992</td>
<td>100</td>
<td>100</td>
<td>2,000</td>
<td>4,000</td>
</tr>
<tr>
<td>MW-3</td>
<td>04/09/1994</td>
<td>100</td>
<td>100</td>
<td>1,000</td>
<td>5,000</td>
</tr>
<tr>
<td>MW-8</td>
<td>04/12/1997</td>
<td>101</td>
<td>103</td>
<td>800</td>
<td>4,700</td>
</tr>
</tbody>
</table>

Regardless of where the three samples are entered in the Groundwater Sample Data form, the software will organize the samples as shown. MW-8 is treated as a sample from the same location as MW-3, because it is within 5 feet (radial distance) of MW-3.

The software will assign a benzene and toluene concentration to the location, based on all the groundwater samples assigned to the location. For each chemical, the criteria for assigning a concentration to a location are either the maximum of the two most recent samples or the most recent sample if steady and declining criteria are met. Steady and declining criteria state: three samples at least six months apart, cannot have concentrations increasing more than 20% from one sample to the next, and concentrations cannot increase more than 20% from the third (oldest) to the most recent sample.

In the example above, the benzene concentrations meet steady and declining criteria, so the benzene concentration used for the location is the most recent sample, 800 µg/L. Toluene does not meet steady and declining criteria, so the maximum of the two most recent samples is assigned. For toluene, the second sample concentration is assigned to the location (5,000 µg/L). So the chemical concentrations assigned to a location may be from different sampling dates and/or wells. This approach is applied to all chemicals.

If you are still in the “Groundwater Sample Data” form, click “OK/Back” to return to the “Main Form”.

5.3 Tier 2 Soil Sample Data

The grid for entering Tier 2 soil analytical data and groundwater data are similar. We will only discuss the differences. Click the “Soil Data” button in the “Enter Data” frame on the “Main Form” to activate the “Tier 2, Soil Sample Data” form.

Important: Soil sample data collected as part of a post-RBCA Site Monitoring Report (SMR) is entered in a different form, accessed from the SMR portion of the software. Information in pre-RBCA SMRs may be used. Do not enter soil data
collected as a part of post-RBCA SMR sampling in the “Tier 2, Soil Sample Data” form, unless you are redoing the Tier 2 analysis. The Tier 2 portion of the software is “live” with respect to groundwater and soil analytical data. If you enter soil data collected as part of SMR sampling in the “Tier 2, Soil Sample Data” form, the software will re-compute the Tier 2 results using the new data as soon as you leave the “Tier 2, Soil Sample Data” form.

One row of the grid (table) is used for the results from one soil sample analysis. See the Tier 2 Guidance, Section 6.4.1 and Appendix F, for additional information on soil analytical data.

Use TPH/TEH Defaults: RBCA is based on individual chemical concentrations. Be sure to look at the lab data sheets to see if individual concentrations are available. If only total petroleum hydrocarbon (TPH) and/or total extractable hydrocarbon (TEH) concentrations are available, the “Use TPH/TEH Defaults” column will compute default BTEX values, using the assumptions listed in the Tier 2 Guidance (Appendix F), and insert the computed values in the BTEX chemical concentration columns.

If you have the individual chemical concentrations, enter the actual measured values for the individual concentrations. Actual data may be much less restrictive than the default values. If you also have a TPH and/or TEH value for the sample, you should enter it, but you should not “Use TPH/TEH Defaults” if you have the actual concentrations for the individual chemicals. Place an n or N in the column for this situation.

To use the default conversions for BTEX if you only have TPH and/or TEH concentrations for the sample, type a Y for Yes in the “Use TPH/TEH Defaults” column. The software will ask you to confirm your choice.

If you wish to change from Y to N, type an “N” in the column. If you change from Y to N, the software does not remove the previously-inserted defaults. You must replace the default concentrations in the chemical concentration columns by manually typing in the actual measured concentrations for the chemicals.

Automatic Number Formatting: One of the changes from version 2.2 to version 2.30 was automatic number formatting. For example, if you type in a concentration of 1000 the number is automatically formatted as 1,000. Version 2.30 and later automatically formats new soil data. Version 2.30 and later do not automatically format soil data entered in version 2.2 or earlier. (However, the data will be read into version 2.51 and works fine.) If you open a data file generated by version 2.2 or earlier, the existing soil data will be read and saved in version 2.51 and will work fine. However, the concentrations will not be automatically formatted. This does not cause a problem with data analysis. It is not required the data be formatted. All printed data is formatted, regardless of whether it is formatted in the soil data grid.

There is a reason existing soil data read into version 2.51 from a version 2.2 or earlier data file is not automatically formatted. The reason is to avoid losing the ignore selections for soil data the user selected to ignore in version 2.20 or earlier. The identification of which samples to ignore is based on an identification string for each sample which includes the text representation of the chemical concentrations. If the previously-existing soil samples were automatically formatted when a version 2.2 or earlier file is read into version 2.51, it is likely information on which soil samples to ignore would be lost when read into version 2.51.

If you have ignored soil samples in version 2.2 or earlier and read the file into version 2.51, your ignore selections will be retained. However, you should not re-type the concentrations for samples you have entered and ignored in version 2.2 or earlier.

For new sample data entered into version 2.51, the automatic formatting will not cause a problem with ignoring samples for data first entered in version 2.51.

Identical Sample Check: As part of error checking, the software will check for identical soil samples (added at version 2.30). Possible identical samples are flagged if two soil samples have the same well label, sample date, (x,y) location, sample elevation, and chemical concentrations for BTEX, TEH-D, TEH-WO, and naphthalene. Identical samples can create problems with data analysis and retaining user selections of which soil samples to ignore. If the samples are truly identical samples and entered twice by mistake (the most likely situation), one of the samples should be deleted. If they
are not truly identical samples, the best approach is to modify the label of one of the samples slightly so the software does not see the samples as identical.

**Printing Soil Sample Data:** To print the soil sample data, use the “Print” button on the “Main Form”.

### 5.4 How Tier 2 Evaluates Soil Sample Data

The evaluation process for soil and groundwater data is similar, but not exactly the same. Soil samples are grouped by location, then sorted by date at each location (oldest to most recent). Samples within a 5-foot radial distance are considered to represent the location and the data is lumped together.

In contrast to groundwater data, steady and declining or the maximum of the two most recent samples is not used for soil data. For soil data, the concentration from the most recent sample for a chemical is assigned to the location. If there are multiple samples from different depths on the most recent date, the maximum concentration is used.

The software groups soil samples by location, based on the order the data is encountered in the grid. For example, the software looks at the location of the first soil sample in the grid. It then searches the following soil sample locations in the grid. Any sample within 5 feet radial distance is considered to be at the same location, and the sample is not considered again. The software then moves down in the grid to the next sample not assigned a location. All following samples are checked against this location. This continues until all samples have been assigned a location. If a number of samples are near to each other (four samples on a line, each spaced 4 feet apart), the order of the samples in the grid can affect the location assignment.

When selecting the (x,y) locations for soil samples taken on the same date (e.g., tank closure, over-excavation), selecting locations at least 5 feet apart will assure such samples are treated independently. Samples lumped together because they are less than 5 feet apart may adversely affect the size of the contoured plumes.

If you are in the “Tier 2, Soil Sample Data” form, click “OK/Back” to return to the “Main Form”.

### 5.5 Groundwater and Soil Data Adjustment

Generally speaking, you should enter all groundwater and soil analytical data available for the site (Tier 2 Guidance, Sections 2.1.1, 6.4.1). The software will reduce the data using the specified. The data reduction is done automatically using all the data, except for samples you specifically exclude. If you exclude a sample, you will need to provide a justification. There may be situations where not using a sample as part of a Tier2 analysis can be justified. For example, perhaps the location of a soil sample has since been excavated. To exclude a sample from the evaluation process, you must tell the software which samples to ignore.

**Important:**  
You do no need to ignore samples to have the software assign the correct concentration to a location. This is done automatically.

**Groundwater Data Adjustment**

To see how this is done for groundwater data; click the “GW” button under the “Data Adjustment” label in the “Enter Data” frame to activate the “Tier 2, Groundwater Sample Data, Data Adjustment” form. The form displays all Tier 2 groundwater sample data, identified by Well/BH label and sample date. The data is sorted by location, then by date at a location.

By default, the column for each chemical will show “Use”. This means the software will consider the sample when assigning concentrations to a location. To toggle between Use/Ignore, first select the cell for the sample and chemical. Press the SPACE BAR to toggle the selected cell. You can select multiple cells by clicking and holding down the left mouse button and dragging the mouse, or by pressing and holding the shift key down and using the arrow keys. You can select
an entire row by clicking any of the fixed columns (columns with gray shading) in the row.

If “Ignore” is shown for a cell, the software will ignore the concentration for the sample when the groundwater data is evaluated. The sample concentration will be maintained as part of the sample. For our example, we will use all the samples. Click “Cancel” to return to the “Main Form”. Using “Cancel” will ignore any changes you have made.

**Soil Data Adjustment**

The procedure is similar for soil sample data adjustment. Click the “Soil” button under the “Data Adjustment” label in the “Enter Data” frame to activate the “Tier 2, Soil Sample Data, Data Adjustment” form. The table includes a soil sample elevation column, “Elev.(ft)”, in order to distinguish between soil samples taken from different elevations in the same borehole on the same date.

For purposes of our example, we will assume the soil sample at BH-1 was collected prior to soil excavation. After the excavation, the samples at BH-3 and BH-5 were collected. Hence, we will instruct the software to ignore the soil sample at BH-1. Set the chemical column entries to “Ignore” for BH-1. The easiest way to do this is to first select the entire row by clicking one of the gray columns in the first row, then press the SPACE BAR.

When you are done, click “OK/Back” to accept the changes and return to the “Main Form”.

**How Ignores Can Be Lost**

When you “ignore” a sample, the software uses a text string to identify the sample. The text string is made up of the sample label, data, (x,y) location, concentrations, etc. In short, most of the sample data.

If you set a sample to be “Ignore”, but then go back and change the sample data, there is a good chance the ignore selection will be lost. This is because the text string identifying the sample changes when you change the sample data. For example, if you set a groundwater sample to “Ignore”, but then change the data for the sample, such as changing the label or date or a concentration, the “Ignore” selection will be lost.

If you change the sample data for an ignored sample, you should go back and see if you need to reset the ignore selection.

**5.6 Viewing Groundwater and Soil Sources**

The software automatically identifies the groundwater and soil sources, based on the sample data entered, the Tier 2 procedures for evaluating multiple soil and groundwater samples from a location, and user selection, if any, for samples to ignore. The source location and concentration for a chemical is the location with the maximum concentration.

To view the groundwater and soil sources selected by the software, on the “Main Form”, click the “Sources” button in the “Enter Data” frame to activate the “Groundwater and Soil Sources” form. The sources are displayed for your information. You cannot select or modify a source location or concentration from this form.

**Water Supply Notification**

The source concentrations can be used to determine if you need to do water supply notification:

If groundwater source concentrations exceed the Tier 1 level for drinking water wells and the groundwater is a protected groundwater source, you need to provide notification of the site conditions on the Water Supply Notification Form to the DNR Water Supply Section. If a county has delegated authority, send the form to the designated county authority for issuing well construction permits as listed in Appendix K of the Tier 2 Guidance. Notification does NOT clear the groundwater ingestion pathway if the Tier 1 levels for potential groundwater ingestion are exceeded (Tier 2 Guidance, Section 3.1.9, Water Supply Notification).
The Tier 1 levels for drinking water wells are:

<table>
<thead>
<tr>
<th>Substance</th>
<th>Tier 1 Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>5 µg/L</td>
</tr>
<tr>
<td>Toluene</td>
<td>1,000 µg/L</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>700 µg/L</td>
</tr>
<tr>
<td>Xylenes</td>
<td>10,000 µg/L</td>
</tr>
<tr>
<td>TEH-Diesel</td>
<td>1,200 µg/L</td>
</tr>
<tr>
<td>TEH-Waste Oil</td>
<td>400 µg/L</td>
</tr>
</tbody>
</table>

Click “OK/Back” to return to the “Main Form”.

5.7 Vapor (Soil Gas) Data


Vapor sampling is optional at Tier 2. That is, you are not required to sample vapor at Tier 2. If you do sample vapor, the results are applicable to vapor receptors (confined space and sanitary sewer). For vapor receptors that are low or high risk based on soil or groundwater data, vapor sampling is not strictly required, but is strongly recommended. If you pass the Tier 2 evaluation based on groundwater or soil data, but fail the evaluation due to vapor sampling, you must still address the vapor concentrations at the site before receiving no further action classification.

To pass using vapor sampling at a location requires two samples, collected at least two weeks apart, both of which must meet the vapor target levels.

If you pass vapor sampling at a source location (groundwater, soil), this clears (no action required) all the vapor receptor types (confined space and sanitary sewer, actual and potential) for the appropriate pathway. You may also, under defined conditions, clear an actual receptor by passing vapor sampling at an appropriate location between the source and the actual receptor, a so-called alternative point of compliance (see above references). The following table shows the applicable source location for doing vapor sampling at the source for each pathway.

<table>
<thead>
<tr>
<th>Pathway</th>
<th>Vapor Source Measurement Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundwater Source</td>
<td>Groundwater Sources</td>
</tr>
<tr>
<td>Soil Leaching</td>
<td>Soil Sources</td>
</tr>
<tr>
<td>Soil Vapor to Enclosed Space</td>
<td>Soil Sources</td>
</tr>
</tbody>
</table>

Click “Soil Gas Data” in the “Soil Gas” frame to activate the “Soil Gas Data” form. Use this form to enter the vapor data you have collected. The vapor data shown in the grid for the example problem is for illustrating the use of the vapor grid only, and is not used further for our example.

The column “Receptor(s) Evaluated” is used to indicate the receptors or sources the vapor sample point is being used to evaluate. You can type multiple entries in this column, but by default only the text that fits in the column width and one row is shown. For example, for entry six (row 6, sg3-b) there are six receptors listed. To see all the text, you can change the row height for row 6. To do this, put the mouse cursor on the line immediately below the number 6 in the first column (“Count”). Click and hold down the left mouse button, then drag the mouse downward. Release the left mouse button. You can also change the width of columns by using the vertical lines in the first row (the row with the column labels).

If you wish to add or edit entries in the “Receptor(s) Evaluated” column, the easiest method is to use the edit box (F2). Click on the row in the “Receptor(s) Evaluated” column you want to add entries to, then press the F2 key. After you are done using the edit text box, press enter to accept the changes and update the grid.

The Tier 2/SMR software does not do risk classification analysis of the vapor data. Under Questions (discussed later), you
can specify whether vapor data sampling criteria has been met at soil or groundwater sources, and the software will account for this when doing Risk Classification for vapor receptors. But, it is up to you to correctly determine vapor sampling has passed. The Tier 2 portion of the software does not automatically determine whether vapor sampling has passed at the sources or for specific receptors.

The “Sort” button will sort the vapor data by location and date.

To print the vapor data, use the “Print” button on the “Main Form”. One of the options is “Soil Gas” data. This will print page 12 of the Tier 2 report. The vapor data is printed out sorted by location and date, regardless of whether the data is sorted in the grid. If you have multiple entries for “Receptor(s) Evaluated”, the software will automatically adjust the row height of the printout to show all the entries, even if they are not all visible in the “Soil Gas Data” form.

When you are done click “OK/Back” to return to the “Main Form”.

**Soil Gas Sampling Methods**

Click the “S.G. Methods” button in the “Soil Gas” frame to activate the “Soil Gas Sampling: Methods/Location (page 12)” form.

The two text boxes are used to enter information on “Soil Gas Sampling Methods” and “Soil Gas Sampling Location Justification”. The information you entered is stored in the Tier 2/SMR data file, and printed as part of page 12 of the Tier 2 report. The information is automatically printed when you printout the vapor data from the Tier 2 portion of the software.

### 5.8 14-day, 6-month rules for Soil Gas Data Evaluation

Starting with version 2.51 additional analysis of the soil gas data is performed by the software to assign concentrations to locations. A measured soil gas concentration is assigned to each location for Benzene and Toluene. Soil gas sample locations within 5 feet (radial distance) are treated as representing the same location. Like groundwater and soil, the location of the first soil gas sample in the grid is checked against all following samples. Any samples within 5 feet are assigned to the same location and the samples are no longer considered. Then the next sample is found that has not been assigned a location and all following samples not already assigned a location are checked against this sample. This continues until all samples have been assigned a location. If a number of samples are less than 5 feet apart on a line, the order in which the samples are listed in the soil gas data grid could affect the locations the samples are assigned to.

In assigning a soil gas concentration to a location, the samples considered to represent the same location are first sorted from oldest to most recent. For each chemical the maximum of the two most recent samples is assigned as the chemical concentration for a location, subject to the 14-day, 6-month rules. Rules require that soil gas samples from a location be separated by at least 14 days, and that a waiting period of 6 months is required after a soil gas sample exceeds a target level, before re-sampling.

At a location the concentration used is the maximum concentration for all samples between Date A and Date B, inclusive, where:

- **Date A** is the date of the most recent soil gas sample.
- **Date B** is the date of the first prior sample that is at least 14 days earlier than Date A. However, if a failing soil gas sample exists less than 6 months (≤180 days) prior to Date B, then Date B is the date of the failing soil gas sample.

To make this more concrete, consider the following examples. The examples are for benzene, but the same process is applied for toluene.

**Example 1:**

```
<table>
<thead>
<tr>
<th>Date</th>
<th>Concentration (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/01/2001</td>
<td>520,000</td>
</tr>
<tr>
<td>2/02/2002</td>
<td>467,000</td>
</tr>
<tr>
<td>2/20/2002</td>
<td>346,000</td>
</tr>
</tbody>
</table>

The concentration assigned in example 1 is 467,000, the maximum of the 2 most recent samples, because the last two samples are 14 or more days apart, and there is not a failing sample in the 6 months prior to 2/02/2002. That is Date A = 2/20/2002 and Date B = 2/02/2002 and the maximum of all samples between Date A and Date B, inclusive, is used.

Example 2:

<table>
<thead>
<tr>
<th>Date</th>
<th>Concentration (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/01/2001</td>
<td>620,000</td>
</tr>
<tr>
<td>2/02/2002</td>
<td>467,000</td>
</tr>
<tr>
<td>2/20/2002</td>
<td>346,000</td>
</tr>
</tbody>
</table>

The concentration assigned in example 2 is 620,000. Although the 2 most recent samples meet the 14-day rule, there is a failing sample within 6 months of the 2nd of the 2 most recent. All three samples will be evaluated for the location. In this case Date A = 2/20/2002 and Date B = 12/01/2001, and the maximum concentration between Date A and Date B, inclusive, is used.

Example 3:

<table>
<thead>
<tr>
<th>Date</th>
<th>Concentration (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/01/2001</td>
<td>578,000</td>
</tr>
<tr>
<td>2/02/2002</td>
<td>467,000</td>
</tr>
<tr>
<td>2/20/2002</td>
<td>346,000</td>
</tr>
</tbody>
</table>

The concentration assigned in example 3 is 578,000. The 2 most recent samples are not at least 14 days apart. The sample from 12/01/2001 is the first sample that is at least 14 days earlier than the most recent. The maximum concentration from the 3 samples will be assigned to the location.

If you have a single sample at a location, the concentration from the single sample will be assigned to the location. The maximum soil gas concentration for each chemical is the maximum from among the concentrations assigned to each location.

At Tier 2 the concentrations assigned to a location are used for contouring only. During SMR the concentrations assigned to a location are used to check whether soil gas sampling has passed or failed at Tier 2 soil and groundwater source locations.

6. **HYDROGEOLOGY**

Click the “Hydro-Geo” button in the “Hydrogeology” frame to activate the “Site Hydrogeology Data” form. In this form you enter some of the basic information required for Tier 2 modeling of steady-state soil leaching to groundwater and groundwater contaminant transport. The equations and assumptions used are specified in the Iowa RBCA rules and Tier 2 Guidance.

6.1 **Flow/Migration Parameters**

**Head Gradient**
The head gradient is the average overall slope of the groundwater table representative of where the plume has migrated, or is likely to migrate. The head gradient can be estimated from contouring measured water level elevations. The Tier 2 software does not contour water level elevations or estimate the head gradient. You must estimate the head gradient outside of the Tier 2 software. In the Tier 2 software, you enter the value you have determined (Tier 2 Guidance, Section 2.9).

Mathematically, the head gradient can have a negative sign, depending on the direction of flow. However, for the Tier 2 program the direction of flow is accounted for with the plume flow direction, and the head gradient should always be entered as a positive number. For our example, we will use 0.008 as the head gradient.

### Hydraulic Conductivity

Hydraulic conductivity is usually estimated from slug testing a number of wells at the site. For a slug test where the recharge rate is too rapid for accurate measurement, use a hydraulic conductivity value of 5 m/d (Tier 2 Guidance, Section 2.4, Model Parameters). For Tier 2, you must use the highest hydraulic conductivity, unless justification is provided for using a different value. Keep in mind, in Version 2.50 you must enter the results of your hydraulic conductivity testing as part of the “Tier 2, Groundwater Sample Data”. You should have already entered such data before you enter the “Site Hydrogeology Data” form.

Click the “Select K from GW Data” button to activate the “Hydraulic Conductivity Selection” form. This form searches the Groundwater Sample Data and lists the hydraulic conductivity values found, sorted from largest to smallest. Clicking the “Auto Select” button will select the maximum hydraulic conductivity value. The currently selected value is shown in the boxes to the left of the “Insert K” button.

Clicking the “Insert K” button inserts the currently selected hydraulic conductivity value into the hydrogeology form. If you are following along using the example data file, this will be 0.6 m/d. You can change the selected hydraulic conductivity value by clicking any row in the “Site K (Yes)” column. If you select a value other than the maximum, you will need to provide justification.

Click “OK/Back” at the upper left corner of the “Hydraulic Conductivity Selection” form to close the form and return to the “Site Hydrogeology Data” form.

Note: If you used the “Insert K” button on the “Hydraulic Conductivity Selection” form, the selected hydraulic conductivity value was inserted as the hydraulic conductivity value on the hydrogeology form. You can also directly type in or edit the hydraulic conductivity value.

### Total Dissolved Solids

The total dissolved solids (TDS) entry works similarly to hydraulic conductivity. Click “Select TDS from GW Data” to activate the “Total Dissolved Solids (TDS) Selection” form. The TDS data entered as part of the groundwater data is sorted from lowest to highest. Generally, the default is to use the smallest measured value from TDS.

Click “Insert TDS” to use the selected value, and “OK/Back” to return to the “Site Hydrogeology Data” form.

### Main Plume/Flow Direction

This is the primary direction the plume is migrating or is expected to migrate. The direction is measured clockwise in degrees from the Y (due north, vertically upward) direction. For main plume/flow direction the vertically upward direction is 0 degrees. The main plume/flow direction should be the mid-line of the plume in the direction of migration. See Figure 1 for an example.

The Tier 2 software does not estimate the main plume/flow direction. You must estimate the value outside the program.
and enter the number. Some judgment is required, usually involving contours of the measured groundwater concentrations and water table elevations.

After the flow direction is determined, measure the angle, in degrees, of the migration direction from the vertical (north), with positive being clockwise. If you measure counter-clockwise from vertical upward, the degrees should be input as negative.

For our example, as illustrated in Figure 1, use a main plume/flow direction of 156 degrees.

**Range of Plume/Flow**

Iowa RBCA Tier 2 uses a solution to a steady-state groundwater transport model which only predicts the concentrations on a line directly downgradient from the source (in the main plume/flow direction). In order to account for potential lateral spread in a plume as it migrates, locations not directly downgradient are given concentrations that are a fraction of the directly downgradient concentrations. The range of plume flow is used to account for the current spread of the plume in the downgradient direction, as illustrated in Figure 2. The range entered is added to each side of the main plume/flow direction. By default, 30 degrees is automatically added to the range of plume flow to account for possible future spreading of the plume. Locations to each side of the main plume/flow direction within the range plus 30 degree cone are assigned 100% of the downgradient concentration. If a location is 100 feet from the source and in the range plus 30 degree cone, the concentration is calculated as if the location is 100 feet directly downgradient.

For our example, shown in Figure 2, enter a range of 37 degrees. This means locations within 67 degrees (37 degree range + 30 degree default) of either side of the main plume/flow direction will be modeled to have a concentration equivalent to the directly downgradient concentration.

Under some circumstances, you must consider the concentrations in all directions to be 100% of the downgradient concentration. The Tier 2 Guidance, Section 2.9, states; “If the groundwater gradient is less than 0.005 or the groundwater contaminant plume shows no definitive direction or shows direction reversals, values will be assumed to be 100 percent of the modeled [simulated] values in all directions from the source.” To implement this situation you must set the range of plume/flow to 150 degrees. This will result in treating all directions as equivalent to 100% of downgradient (150+30=180 for each side), and the modeled plume for a chemical will be a circle with the center at the source location.

When the range is less than 150 degrees, an upgradient fraction is computed internally and used for concentrations directly upgradient. The maximum value is 0.2 (20%). The upgradient fraction is decreased as the groundwater velocity increases (as estimated by the hydraulic conductivity times the head gradient).

Locations between the 100% direction and directly upgradient are given percentages between 100% and the upgradient %, based on a linear interpolation of the angle of the point between the 100% direction and the upgradient direction.

Modeled (simulated) concentrations are based on an adjusted distance. For example, if a location has a radial distance of 100 feet from the source, and is 54% of downgradient, the concentration for the location is computed as if the point is 185 feet directly downgradient (100 feet/0.54).

### 6.2 Soil Parameters

The soil parameters shown in “Site Hydrogeology Data” form are default values. You are not required to measure the soil parameters. If default values are replaced with field measurements, field measurements must be obtained and used for all three of the parameters (fraction organic carbon, total porosity, and soil bulk density). See Tier 2 Guidance, Section 3.4. The analytical model for Tier 2 are homogenous and isotropic; therefore, a single value must be used for each parameter. Clicking the “Insert Defaults” button for soil parameters inserts the default values for all three parameters. For our example, we will use the defaults.
Click “OK/Back” to accept the hydrogeology values you have input and return to the Main Form. Click “Save” in the “File” frame to update the active file with the data you have added.

6.3 Hydrogeology Justification

From the “Main Form” click the “Justification” button in the “Hydrogeology” frame to activate the “Site Hydrogeology Justification Sections (page 5)” form. The form provides two text boxes where you enter the information required for “Tier 2 Data Before Modeling Justification” and “Site Hydrogeology Justification Section”. The information you type into the text boxes is stored in the data file and printed as part of page 5, the “Site Hydrogeology” page of the Tier 2 SCR.

For “Tier 2 Data Before Modeling Justification”, the Tier 2 Guidance (6.3.2) says, “If diesel and/or waste oil were stored on site, but samples were not analyzed using Method OA-2, provide a justification for not testing for TEH (i.e., if the questions “TEH-diesel required?” and/or “TEH-waste oil required?” were answered “No”). If “Groundwater encountered?” was answered “No”, explain why. Additional justification may be provided for responses given in “Tier 2 Data Before Modeling”, if necessary for clarification.”

For “Site Hydrogeology Justification”, the Tier 2 Guidance (6.3.2) says, “Explain which points or contours were used to determine the gradient at the site. If the main plume migration and groundwater flow are not in the same direction, or if they are multidirectional, explain how the MAIN PLUME/FLOW was determined. Explain how the RANGE of PLUME/FLOW was determined. If source dimensions other than those determined by software were used, explain why.”

When you are done with this form, click “OK/Back” to return to the “Main Form”.

7. SOURCE WIDTH (Sw) AND SOURCE LENGTH (W) CONTOURING

The analytical mass transport models used for soil leaching to groundwater and groundwater contaminant transport require values for size of source of contamination: a source width (Sw) and a source length (W) for groundwater and soil contamination. The Tier 2 estimation method involves contouring the soil and groundwater concentrations. Source width and length estimation is discussed in Sections 2.5 and 2.6 of the Tier 2 Guidance. The software provides tools for estimating source width and length.

7.1 Groundwater Source Width and Length Estimation

We will use an example to illustrate the estimation of groundwater source width and length. Click the “GW” button in the “Sw-W Contour” frame to activate the “Groundwater: Source Width (Sw) and Source Length (W) Contouring” form.

The software automatically sums the BTEX concentrations for the groundwater data and applies a criteria (maximum of two most recent or steady and declining) to assign a Sum BTEX value to each location. In essence, Sum BTEX is treated like another chemical.

The chemical to be contoured is selected using the drop-down list box beneath the “Chemical” label. The options are Sum BTEX, TEH-D, TEH-WO, or FP (for free product). Select “Sum BTEX” as the chemical.

Interpolation Range

Click “Interpolation Range” to show the “Contour Information: Sum BTEX” frame. The top frame shows a summary of the groundwater sample data, the range of sample locations (Minimum X, Maximum X, Minimum Y, Maximum Y), the maximum Sum BTEX, and the concentration to be contoured. The concentration contoured for Sw-W estimation is specified by rule to be 50% of the maximum. Also shown is the minimum radial distance between sample locations, “Minimum distance between data”. The interpolation range is used to tell the software the range and resolution to use when interpolating concentrations between the measured chemical concentrations in groundwater. It is up to you, the user, to input interpolation range information, and to modify the range as needed to achieve an acceptable plot.
Figure 3 is an example of an interpolation grid for the following settings:

<table>
<thead>
<tr>
<th>Minimum X (ft)</th>
<th>Maximum X (ft)</th>
<th>X Grid Spacing (ft)</th>
<th>Minimum Y (ft)</th>
<th>Maximum Y (ft)</th>
<th>Y Grid Spacing (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>90</td>
<td>10</td>
<td>-30</td>
<td>100</td>
<td>10</td>
</tr>
</tbody>
</table>

Using the measured groundwater concentrations and their locations, an interpolation method (by Roland Hardy) is used to fit a function to the data that matches the measured concentrations at their locations (honors the data). This function is used to estimate (interpolate/extrapolate) concentrations at every grid point (the points where the grid lines intersect). It is analogous to generating additional concentration data at grid points consistent with the actual measured concentrations (as measured by a defined, but selected, mathematical function). In addition to the grid intersection points, interpolated values are also generated at the center point of each cell, shown by the grid detail in Figure 3.

The finer the grid (i.e., smaller grid spacing), the more points interpolated and the smoother the contoured curve. The trade-off is computational effort. Interpolation of each point requires a certain amount of computational time (the time increases with the number of actual data points). If you double the number of interpolation points, the computer time required for interpolation will double. Also, the problem is two-dimensional (x,y). If the x and y grid spacing are both decreased by half, the number of grid points (and associated computational time) will increase by four times.

As a first estimate for interpolation range data, I would suggest you subtract 50 feet from the minimum values for X and Y and add 50 feet to the maximum values for X and Y, then round off to the nearest 10 feet. Try using the same X and Y grid spacing and try 10 feet as the initial spacing. The software will modify the grid spacing, if necessary, to generate an integer number of steps between the minimum and maximum X and Y.

For our example problem, enter the following values for “Interpolation Range”:

<table>
<thead>
<tr>
<th>Minimum X (ft)</th>
<th>Maximum X (ft)</th>
<th>X Grid Spacing (ft)</th>
<th>Minimum Y (ft)</th>
<th>Maximum Y (ft)</th>
<th>Y Grid Spacing (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-50</td>
<td>150</td>
<td>10</td>
<td>-100</td>
<td>150</td>
<td>10</td>
</tr>
</tbody>
</table>

It is not necessary to match the X or Y range of the data exactly. For example, if the Minimum X is –32, entering –40, -50, -100, etc. will work fine. For the interpolation range shown above, chemical concentrations are interpolated at 946 points. The software uses the interpolated concentrations at the grid points to track, or trace out, lines of equal concentration (contour lines).

To continue with our example, click “Plot”. The software will perform the interpolation calculations and track the contour lines, then show the plot on the screen.

Note: There is a text box at the upper right of the plot area that tracks the (x,y) location in feet of the mouse cursor when the mouse cursor is over the plot. The (x,y) location is the (x,y) location based on the site Cartesian coordinate system.

The software plots a contour for 50% (25,500) of the maximum Sum BTEX (51,000). The software draws a rectangle around the contour, with one of the axes oriented parallel to the direction of groundwater flow. Shown at the top of the form is Sw (44 feet), which is the width of the contour perpendicular to the groundwater flow direction (width of the box perpendicular to the groundwater flow direction). Also shown is W (45 feet), which is the length of the contour parallel to the groundwater flow direction (width of the box parallel to the groundwater flow direction).

The software, based on the data range and interpolation range, automatically selects the range of (x,y) data to plot. For most of the plots, you can “zoom in”. To see this, place the mouse cursor on the plot, click and hold down the left mouse button, and drag the mouse. The box being drawn is the zoom area. Release the left mouse button to set the zoom area. If you want to change the zoom area, repeat the procedure. After selecting a zoom area, click the “Zoom” button. You
can continue to zoom in if you like. Click the “Full Screen” button to return to the full size plot.

**Printing a Plot:**

Click the “Print” button. This brings up a frame for sending the plot to the printer. You must specify a print scale. You can select to “Center Contour Plot on Page”, and the software will automatically center the plot.

You can also “Select a Map Coordinate” and specify exactly where you want the printout placed. Each printer has a certain amount of “dead space” at the edges of the paper and you may have to experiment with “Printer Shift” to place the print exactly where you want it.

“Print Preview” is used to preview your print. The font sizes of the text are not correct (text will usually be smaller when printed), but the locations of wells and contours lines are accurate.

Click “Close”.

We are done estimating Sw and W for Sum BTEX. Click “OK/Back” to return to the first panel.

Click “TEH-D” as the chemical, then click “Plot”. The TEH-D data is plotted, and Sw and W are estimated using the same. Click “OK/Back” to return to the chemical selection panel. The computed Sw-W values are automatically saved.

Click “TEH-WO” and click “Plot”. No contour is generated because there are less than three data points (there are, in fact, no data points as shown by the N symbols at the sampling locations). At least three data points are required for two-dimensional contouring.

Return to the chemical and click “FP” for free product. Click “Plot”. Again, there are less than three locations with free product identified, and contouring cannot be done.

**Summary**

Return to the chemical selection panel (click “OK/Back”). Click the “Summary” button. This brings up a summary table of the results. The software stores the information displayed.

We are finished with estimation of groundwater Sw and W. Click “OK/Back” to return to the “Main Form”.

### 7.2 Soil Source Width and Length Estimation

Source width and length estimation for soil source is similar to groundwater. Click the “Soil” button in the “Sw-W Contour” frame to activate the “Soil Sw-W Contouring” form. Select “Sum BTEX” as the chemical. Click the “Interpolation Range” button and enter the following values for Interpolation Range:

<table>
<thead>
<tr>
<th>Minimum X (ft)</th>
<th>Maximum X (ft)</th>
<th>X Grid Spacing (ft)</th>
<th>Minimum Y (ft)</th>
<th>Maximum Y (ft)</th>
<th>Y Grid Spacing (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10</td>
<td>70</td>
<td>10</td>
<td>40</td>
<td>100</td>
<td>10</td>
</tr>
</tbody>
</table>

Click “Plot”. For the soil data, Sw = 36 feet and W = 32 feet for Sum BTEX.

Let us examine the effect of grid spacing on interpolation. Click “OK/Back”, then “Interpolation Range”. Set the X grid spacing to 5 and the Y grid spacing to 5. Click “Plot”. The contour line is somewhat smoother, but Sw and W are the same. In some situations a smaller grid spacing may result in small changes in the Sw and W values.

Now, on your own, do Soil Sw and W contouring for TEH-D and TEH-WO (using X and Y grid spacing of 5 feet). For TEH-D, you should get Sw = 23 feet and W = 26 feet, and for TEH-WO there are no data points to contour. Click the “Summary”
button to see a summary of the results for each chemical, and the results for soil as a whole. For soil, the Sw is the maximum of the Sw’s for each chemical, and the W is the maximum of the Ws for each chemical.

When you are done, click “OK/Back” until you reach the “Main Form”.

7.3 Setting Soil and Groundwater Source Width and Length

The software does not automatically use the values generated by groundwater source width and length estimation and soil source width and length estimation. You must specify the Sw and W values the software will use for Tier 2 and SMR analysis. In most cases, you will use the values generated by the software, but to allow for exceptions you must input the Sw and W values.

Click the “Sw-W” button in the “Sw-W Contour” frame to activate the “Source Width and Length Selection” form. The two tables on the right of the form summarize the results from contouring Sw and W for groundwater and soil in the Tier 2 software. The table on the lower left, “Sw and W: Contoured Results”, shows the maximum Sw and W for groundwater and soil found via the software (i.e., the maximum in each column for the tables on the right side of the form).

In most situations, the values shown in the lower left table will be the appropriate ones to use for the Tier 2 analysis. To use these values, click the “Insert Contoured Results” button, and the values in the lower left table will be inserted as the Sw and W values in the upper left table. For our example, click “Insert Contoured Results”.

If necessary, you can directly type Sw and W values into the upper left table. The values in the upper left table will be used for modeling. You must enter values into the table, either by using the “Insert Contoured Results” button or by typing in values. The program does not automatically update the values. If, for example, you later entered some TEH-WO data and needed to use the data as part of Sw-W contouring, you would need to do the Sw-W contouring and return to this form to update, if necessary, the site Sw-W values.

Click “OK/Back” to return to the “Main Form”. Click “Save” to save the results to the file.

7.4 Adjustments to Sw-W Contouring Results

There are situations where you may need to modify the Sw-W values determined by the software. Two situations which might occur are: 1) there is no definitive flow direction (the range of plume flow is 150 degrees) or 2) there are multiple contour lines. We will examine these situations.

No Definitive Flow Direction

You are required to enter a main plume/flow direction, even if the range of plume flow is 150 degrees. The main plume/flow direction is used by the software to estimate Sw-W in Sw-W contouring (sets the orientation of the rectangular box). However, in this situation, the Sw-W estimated by the software may not be appropriate. Figure 4 shows an example for this situation. In this example, the range is 150 degrees, and you need to use the maximum length of the plume for both Sw and W (see Sections 2.5 and 2.6 in the Tier 2 Guidance), not the dimensions estimated by the software based on the main plume/flow direction. You will need to manually determine the Sw-W values from a print out of the plot, rather than using the software determined values. The maximum length (Figure 4) looks to be about 94 feet, and Sw = W = 94 feet for TEH-D for this situation.

In this situation, you would apply the same procedures for each chemical and manually determine the maximum Sw and W for groundwater and soil. You would then directly input your manually-determined Sw and W values for groundwater and for soil into the software (“Sw-W” button in the “Sw-W Contouring” frame).

Multiple Contour Lines
When the software contours 50% of the maximum for Sw-W, in some situations more than one closed contour line may result. In this situation, the software estimates Sw-W from the total spread, which may not be appropriate (there are cases where the result is appropriate if the plumes overlap).

Figure 5 is an example for this situation. This example has produced two separate plumes. It is assumed there is a definite groundwater flow direction. Sw can be viewed as the width of plume(s) perpendicular to the groundwater flow direction, and W as the width of plume(s) parallel to the groundwater flow direction. The application of this approach for estimating Sw and W is shown in Figure 5. Sw is estimated as 59 feet and W is estimated as 58 feet, instead of 89 and 90 feet, respectively, as estimated by the software.

For the chemicals where such a situation occurs, you need to calculate Sw and W from the plots as needed, and manually enter the maximum Sw and W values for groundwater and for soil (“Sw-W” button in the “Sw-W Contour” frame).

For the case of multiple plumes and no definite flow direction, determine the maximum length for each plume, add the lengths together, and use the resulting value for Sw and W.

8. RECEPTOR TYPE EVALUATION REQUIREMENTS

The RBCA process and rules developed by the TAC, and implemented by DNR, are fairly complex. It can be difficult to determine the receptor types you need to evaluate. For example, even if you have a no action required classification for a pathway at Tier 1, you may still need to evaluate the pathway at Tier 2. The Tier 2/SMR software (versions 2.xx) determines the receptor types you need to evaluate for your site, based on your answers to some questions, soil and groundwater data, policy, and modeling. The results are output as page 6 of the Tier 2 SCR, the “Preliminary Pathway Evaluation Requirements”.

You need to complete the “Receptor Type Evaluation Requirements” before you generate “Receptor Identification Plumes” and identify receptors. The “Receptor Evaluation Requirements” will help to ensure you evaluate the receptor types you need to for your site, and do not spend time on receptor types you are not required to evaluate.

8.1 Questions

The buttons in the “Questions” frame on the “Main Form” access the questions used to determine the receptor types you need to evaluate. You must answer all the questions to ensure you get the correct results. Your responses are displayed on page 4 of the Tier 2 report, the “Tier 2 Data Before Modeling” printout. Use the “Print” button on the “Main Form” to print page 4. For our example problem, the questions have already been answered.

General

Click the “General” button in the “Questions” frame to activate the “General Tier 2 Data Before Modeling Questions” form. For our example, the following answers have been selected:

- SCR Conversion: Yes
- Free Product Present: No
- Groundwater Encountered: Yes
- Was bedrock encountered before Groundwater: No
- TEH-Diesel required: Yes
- TEH-Waste Oil required: No

Bedrock

Note that if you answer YES to “Was bedrock encountered before Groundwater” for your site, you may have a “Bedrock” site. A “Bedrock” site has different procedures and software. If bedrock is encountered before groundwater
you need to check the rules and guidance to determine if you should be performing a “Bedrock” analysis. In the Rules, bedrock assessment is covered in detail under 135.10(3), Bedrock Assessment. In the Guidance, bedrock assessment is discussed in detail in Chapter 4, Bedrock Assessment, and in Section 6.6, Bedrock Pathway Assessment Attachments. If bedrock is encountered before groundwater and your site is not “exempt granular” (see the Guidance for definitions), you should not be using this software to evaluate this site. There is “Tier 2 Bedrock” software for evaluating “granular” and “nongranular” bedrock sites. If your bedrock site does qualify as “exempt granular”, then you should use the (Tier 2/SMR) to evaluate the site.

You can click “OK/Back” to return to the “Main Form”, or “Next” to move directly to the next set of questions. Click “Next”.

**Groundwater Ingestion**

If you have returned to the “Main Form”, click the “GW Ingestion” button in the “Questions” frame to activate the “Groundwater Ingestion Pathway Questions” form. Your responses in this form are used, along with source concentrations and modeling results, to determine whether the drinking water well type, non-drinking water well type, or protected groundwater source type need to be evaluated for groundwater or soil leaching.

For our example, the questions are answered as shown below:

**Well Survey: Yes**  **Drinking Water Wells: No**  **Non-Drinking Water Wells: Yes**  **Protected Groundwater Source: Yes**  **Institutional Control: No**

**Important:**

*You must answer the question for protected groundwater source, even if you have entered the hydraulic conductivity and total dissolved solids in the Hydrogeology form. The software does not automatically determine whether the first encountered groundwater is a protected groundwater source. The software uses your Yes or No answer to the Protected Groundwater Source question to determine whether a protected groundwater source is present.*

If you have entered a hydraulic conductivity and total dissolved solids value, it is shown in blue beneath the protected groundwater question. The software indicates in blue whether the parameters meet (Yes) or do not meet (No) the usual criteria for a protected groundwater source, as defined by $K \geq 0.44 \text{ m/day}$ and $TDS < 2,500 \text{ mg/L}$. Regardless of this, you need to answer the question. There are cases, “exempt granular” bedrock for example, where the first encountered groundwater is a protected groundwater source, even if $K$ is $< 0.44 \text{ m/day}$.

**Vapor to Enclosed Space**

Click “Next” to move to the “VES: Vapor to Enclosed Space Questions” form. Or, from the “Main Form”, click the “VES Receptors” button in the “Questions” frame to activate the “VES: Vapor to Enclosed Space Questions” form.

**Explosive Vapor Survey (See the Tier 2 Guidance, 3.3.2 Explosive Vapor Survey)**

As stated in the Tier 2 Guidance: “An explosive vapor survey should be conducted, at a minimum, in the nearest subsurface enclosed spaces in all directions from the source and in any places with a history of vapor problems. Enclosed spaces for the purpose of the explosive vapor survey include buildings with basements, storm and sanitary sewers, and underground utility vaults.”

For our example the questions have been answered as shown:

**Explosive Vapor Survey: True**  **Explosive Vapors Identified: False**  **Institutional Control, Groundwater Vapor: False**  **Institutional Control, Soil Vapor and Soil Leaching: False**
Soil: Soil Gas

Click “Next” or the “Soil: Soil Gas” button in the “Questions” frame on the “Main Form” to activate the “Soil Vapor/Soil Leaching Soil Gas Questions” form. Your answers are used to determine whether or not you will need to evaluate vapor receptors for soil vapor or soil leaching to groundwater at Tier 2. That is, you are indicating whether or not you have passed vapor sampling criteria at a soil source at Tier 2. Note that the text at the top of the form reminds you that these questions are for, “Soil gas sampling at Soil sources at Tier 2”. If you perform soil gas sampling at soil sources after you have completed and submitted your Tier 2, you should identify the results in the SMR portion of the software, not here.

The software does not determine, based on your vapor samples, the answers to these questions, nor does it check your answers against the vapor data you have entered. See the Tier 2 Guidance, Sections 1.8, 3.3, and 3.4 for information on vapor sampling and the required criteria for passing. You have to determine whether you have passed vapor sampling criteria at a soil source.

If you have passed vapor sampling criteria at a soil source at Tier 2 you must answer both questions to have the software recognize you have passed. For example, you must answer “True” to, “Soil Gas sampling has been completed at the soil source location for Benzene”, and “True” to “Soil Gas target levels are not exceeded”, to receive credit for passing vapor at the benzene soil source. If you answer “False” to “Soil Gas sampling has been completed at the soil source location for …” and “True” to “Soil Gas target levels are not exceeded”, the software will assume you have not passed vapor sampling at the soil source for that chemical.

For our example, the answer to all questions is “False”.

GW: Soil Gas

Click “Next” or the “GW: Soil Gas” button in the “Questions” frame on the “Main Form” to activate the “GW Soil Gas Questions” form. Again, note that the text at the top of the form reminds you that these questions are for, “Soil gas sampling at GW sources at Tier 2”. If you perform soil gas sampling at groundwater sources after you have completed and submitted your Tier 2, you should identify the results in the SMR portion of the software, not here.

As with soil vapor for soil sources, the software does not determine from your soil gas data the answers to these questions, nor does it check your answers against the vapor data you have entered. You have to determine if you have passed vapor (soil gas) sampling criteria at a groundwater source. If you have passed groundwater vapor sampling criteria at a groundwater source, you must answer “TRUE” to both questions for that chemical to have the software recognize you have passed vapor sampling at the groundwater source for a particular chemical.

For our example, the answer to all questions is “False”.

Plastic Water Line

Click “Next” or the “Plastic Water Line” button in the “Questions” frame on the “Main Form” to activate the “Plastic Water Line: Initial Receptor Evaluation” form.

The software searches through the groundwater sample data you have entered to determine the shallowest measured depth to groundwater below the ground surface, and displays the result as “The shallowest depth to groundwater in the groundwater sample data is...”. You need to enter the shallowest measured depth to groundwater (from the ground surface) over the LUST site. If you have other data not entered as part of the groundwater data showing a shallower depth to groundwater, you should enter such information as the shallowest depth. If you have such data, you could also enter the data as groundwater sample data, even if no chemical concentrations were measured (use N), and the data will be used in calculating the shallowest depth to groundwater. In any case, you must enter a shallowest measured depth to groundwater (measured from the ground surface). The software uses the entered value to evaluate the potential plastic water line receptors.
For our example, we have used the shallowest depth to groundwater found in the groundwater data, 14.22 feet. Also for our example, the response to the statement, “A plastic water line is present within 200 feet of the soil or groundwater sources,” is “False”.

**Surface Water Bodies, Designated Use**

Click “Next” or the “SW: Designated” button in the “Questions” frame on the “Main Form” active the “Surface Water Pathway: Designated Use Receptor Questions” form. For more information on Surface Water Bodies, refer to Sections 3.7 and 6.4.7 of the Tier 2 Guidance.

A survey is required to identify any designated use surface water bodies within 500 feet of the sources. If designated use receptors are present within 500 feet, you should identify the types of designated uses surface water bodies present.

For our example the answers are as shown below:

- A survey has been done ...: Yes
- Designated use surface water bodies are present: Yes
- Type Present: B(CW)

**Surface Water Bodies, General Use**

Click “Next” or the “SW: General” button in the “Questions” frame on the “Main Form” to activate the “Surface Water Visual Inspection: General and Designated Use” form. This form contains a series of questions used to determine if you have passed or failed visual inspection requirements for general use streams. For more information regarding visual inspection requirements for surface water bodies, refer to Sections 3.7 and 6.4.7 of the Tier 2 Guidance.

For the purposes of visual inspection, a designated use stream must also meet general use criteria. That is, a visual inspection is required of both general use and designated use streams.

For our example the questions are answered as shown:

- Surface water bodies (general or designated use) are present within 200 feet ...: Yes
- A visual inspection has been completed of all surface water bodies ...: Yes
- The visual inspection shows evidence of a possible petroleum sheen ...: No

With these answers, you will note the bottom box on the screen shows visual inspection has passed. If visual inspection has failed, you will need to identify the type of surface water body for which visual inspection has failed. As you answer the questions in this form, if addition responses are required, the option boxes will be activated.

Clicking the “Justification” buttons will activate text boxes where you can enter justifications, if required. If you enter “Justifications”, they are printed when you print page 4 of the Tier 2 SCR, “Tier 2 Data Before Modeling”. If justifications are entered, they are printed as page 4a. If no justifications have been entered, page 4a will not be printed.

We have now completed the required questions. You may complete the questions in any order, but all questions should be answered, particularly before you proceed to “Preliminary Pathway Evaluation Requirements”.

Click “OK/Back” to return to the “Main Form”.

### 8.2 Preliminary Pathway Evaluation Requirements

The “Preliminary Pathway Evaluation Requirements” or “Receptor Type Evaluation Requirements” are an integral part of the Tier 2 software. They identify the “Receptor Types” you must evaluate for your site. It is important you complete the “Preliminary Pathway Evaluation Requirements” before you generate “Receptor Identification Plumes” and identify
The results are valid only if you have input the required information. In order for the results to be valid, you need to have:

- Entered all groundwater, soil and vapor data.
- Specified groundwater and soil data adjustment, if needed.
- Completed the data in the hydrogeology form.
- Determined and entered Sw-W values for groundwater and soil.
- Correctly answered all questions contained in the “Questions” frame.

In terms of the frames on the “Main Form”, you need to have completed the information required in the following frames:

- “Enter Data”.
- “Data Adjustment”.
- “Hydrogeology”, except for Justification.
- “Sw-W Contour”, in particular the “Sw-W” button.
- “Questions”.

These tasks have been completed for the example problem.

Click the “All Sources” button in the “Receptor Type Evaluation Requirements” frame (beneath the “Questions” frame on the “Main Form”) to activate the “Preliminary Pathway Evaluation Requirements” form. The results are organized by “GROUNDWATER”, “SOIL LEACHING” and “OTHER SOIL PATHWAYS”.

If there is an “X” for any chemical for a receptor type, the receptor type needs to be evaluated for that source. That is, you need to generate a receptor identification plume for that source type and receptor type, and determine if any receptors are present at your site.

If a chemical does not need to be evaluated (symbol other than an X), a reason the chemical does not need to be evaluated is indicated. A symbol legend is shown in the bottom grid and on the printout.

For example, for GROUNDWATER, Groundwater Vapor to Enclosed Space, the Confined Space Residential-CSR receptor type does not need to be evaluated for toluene (T), because the groundwater source concentration (15,000 µg/L) is less than the minimum default target level for the receptor type (20,190 µg/L).

The “NSC” (No Source Concentration) is based on whether sample data (groundwater or soil) has been entered for a chemical. The software does not check whether sample data should have been entered for a chemical. For example, if you answered TEH-D data is required, but have not entered TEH-D data, NSC will still be shown. It is up to you to ensure you have entered the required soil or groundwater data.

The results in the “Preliminary Pathway Evaluation Requirements” table are based in part on:

- Comparing source concentrations to the minimum default target levels for a receptor type.
- Computing vertical soil leaching and comparing the modeled groundwater concentrations at the soil sources to the minimum default groundwater target levels.
- For vapor receptors, if you indicated you passed vapor sampling at a source.
- DNR policy considerations.

For our example, the results indicate we need to evaluate the following receptor types: Groundwater:
- Non-Drinking Water Wells
- Protected Groundwater Source
- Confined Space Residential
- Confined Space Nonresidential
- Sanitary Sewer Residential
- Sanitary Sewer Nonresidential
- Plastic Water Line
- Surface Water, B(CW)

Soil Leaching:
- Non-drinking Water Wells
- Protected Groundwater Source
- Confined Space Residential
- Confined Space Nonresidential
- Sanitary Sewer Residential
- Sanitary Sewer Nonresidential
- Plastic Water Line
- Surface Water, B(CW)

Soil:
- Confined Space Residential
- Confined Space Nonresidential
- Sanitary Sewer Residential
- Sanitary Sewer Nonresidential
- Plastic Water Line

Having to evaluate a receptor type does not mean you will have receptors of that type. It means you must follow procedures to determine whether you have receptors of that type.

The “Preliminary Pathway Evaluation Requirements” table is printed using the “Print” button on the “Main Form”, and is page 6 of the Tier 2 SCR. An example of the printout for our example problem is shown as Table 1.

9. **RECEPTOR IDENTIFICATION**

After you determine the receptor types you need to evaluate, the “Receptor Identification Plumes” (RIDs) are used to identify the receptors of that type, if any, for your site. You enter the identified receptors into the software. The buttons to reach the receptor identification plumes are grouped together in the “Receptor ID” frame on the “Main Form”.

We will illustrate receptor identification for:
- Non-Drinking Water Wells
- Protected Groundwater Source
- Confined Space, Residential and Nonresidential
- Sanitary Sewer, Residential and Nonresidential
- Plastic Water Line
- Surface Water Body

For the following source pathway types,

Groundwater
The sequence you use for receptor identification does not matter. For example, you could decide to do receptor identification for soil leaching first.

Keep in mind a receptor should only be entered once, even if it falls in the receptor identification plume for more than one pathway. On the other hand, a receptor identified by any receptor identification plume must be entered.

Use unique receptor labels:

The short label you assign to each receptor should be unique. No two receptors should have the same short label. If you have duplicate short labels, this can cause problems in saving the “current risk” settings you assign to receptors in the Soil Vapor/Soil to Plastic Water Line Receptor Summary.

The software generates a receptor identification plume based on groundwater or soil data, not based on whether you have to evaluate the receptor type according to the “Preliminary Pathway Evaluation Requirements”. For example, the software may generate a receptor identification plume for protected groundwater source, even if the first encountered groundwater is not a protected groundwater source. Or, the software may generate a receptor identification plume for confined space residential receptors, regardless of whether or not you have passed vapor sampling.

Whether you need to identify receptors of a type (need to generate a Receptor Identification Plume) for a pathway should be based on the “Preliminary Pathway Evaluation Requirements” for the pathway, not on whether the software will plot a “Receptor Identification Plume” for the receptor type.

9.1 Groundwater Pathways, Receptor Identification Plumes

The receptor types you need to evaluate for groundwater pathways are shown under “Groundwater Pathways” in the “Preliminary Pathway Evaluation Requirements” printout, page 6 of the Tier 2 SCR.

Click “GW” in the “Receptor ID” frame, to activate the “GW Receptor Identification” form. This form is used to generate a “Receptor Identification Plume” for each “Receptor Type” you need to evaluate under “Groundwater Source”.

The receptor identification plumes for groundwater plot simulated and interpolated groundwater concentrations, contoured to the target levels for the receptor type. If you are required to evaluate a receptor type for the pathway, you need to overlay the receptor identification plume on your site map. If a receptor of that type is present and in the receptor identification plume, it is a receptor for your site and needs to be entered into the software. If a receptor of the type is present, but does not fall within the receptor identification plume, it is not a receptor for the site and does not need to be entered into the software.

Use the drop-down list box under “Receptor Type” to select a receptor type. Non-Drinking Water Wells: NDWW
Select “NDWW” (Non-drinking water wells) as the “Receptor Type”. Click “Interpolation Range” and enter the following values:

<table>
<thead>
<tr>
<th>Minimum X (ft)</th>
<th>Maximum X (ft)</th>
<th>X Grid Spacing (ft)</th>
<th>Minimum Y (ft)</th>
<th>Maximum Y (ft)</th>
<th>Y Grid Spacing (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-50</td>
<td>150</td>
<td>10</td>
<td>-100</td>
<td>130</td>
<td>10</td>
</tr>
</tbody>
</table>

Click “Plot”. The software will plot, if possible, the simulated and contoured target levels for all the chemicals of concern, using the default or Tier 1 target levels for the receptor type. For non-drinking water wells the groundwater target levels are,

Groundwater Target Levels for Non-Drinking Water Well Receptors (µg/L)

37
Benzene  Toluene  Ethylbenzene  Xylenes  TEH-D  TEH-WO  Naphthalene
290    7,300    3,700    73,000   75,000   40,000   150

If a chemical cannot be contoured or simulated, a reason is indicated in the upper left-hand corner of the plot. The reasons for not contouring a chemical are given in red, followed by the reasons for not simulating a chemical in black. For example, ethylbenzene (E: TL>=SC) is not contoured or simulated because the target level (3,700) is greater than the source concentration (3,600).

The contours simulated by the Tier 2 groundwater contaminant transport model are shown in black. The contours from interpolation of the actual groundwater sample data are shown in red.

You can click the option buttons in the “Plot MW/BH Labels” frame to toggle the display of monitoring well labels. The receptors for the example problem have been input to save time (i.e., NDWW-1 is shown on the plot). For a new site, no receptors would be shown. You can select “No” for “Plot Act. Recept.” (Plot Actual Receptors) to remove the non-drinking water well from the plot. After you have identified and entered receptors, you can return to the receptor identification plumes to check their location.

The contour line for 290 µg/L benzene is not complete (the red contour does not close at the top, but ends abruptly). We need to expand the interpolation range to the north (Maximum Y). Click “OK/Back”, then click “Interpolation Range” and input the following values:

<table>
<thead>
<tr>
<th>Minimum X (ft)</th>
<th>Maximum X (ft)</th>
<th>X Grid Spacing (ft)</th>
<th>Minimum Y (ft)</th>
<th>Maximum Y (ft)</th>
<th>Y Grid Spacing (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-50</td>
<td>150</td>
<td>10</td>
<td>-50</td>
<td>180</td>
<td>10</td>
</tr>
</tbody>
</table>

Click “Plot”. The contour for 290 µg/L benzene now closes. The interpolation range is sufficient. If a contour line does not close, this means you need to expand the interpolation range.

The “Receptor Identification Plume” is used to identify receptors. Any non-drinking water well (NDWW) on or within the simulated or contoured plumes is a non-drinking water well receptor. You will need to overlay the receptor identification plumes on your site map to identify the appropriate receptors.

Click the “Print” button to activate the Print Form. You can send the “Receptor Identification Plume” directly to your printer. You can also save the plot to an AutoCAD® compatible DXF file and then import the DXF file into your CAD software to overlay on your site map.

You must specify a “Print Scale”. You have two options for placement of the plot when printing directly to the printer. You can select “Center Plot on Page”, and the software will automatically center the plot based on the modeled and contoured plumes. You can also “Select a Map Coordinate”, and specify where a location (Map Coordinate) will print on the page (Paper Location). All printers have some dead space, and you may have to experiment to determine the “Printer Shift” needed to precisely place the map coordinate at the paper location.

For DXF files, the plume contours and wells locations are always output as actual (x,y) locations in feet. The “Print Scale” selected does not affect this, but is used to estimate the size to use for the text sent to the DXF file. Of course, you can change the text size after you import the file into your CAD software.

You use the “Printer Setup” button to specify the printer, printer orientation, and size of paper. This is the only information in “Printer Setup” used by the Tier 2 software. Setting number of copies, print to file, etc. has no effect.

The “Print Preview” button can be used to preview plume placement prior to printing. The plume and well placement shown in “Print Preview” are accurate, but font sizes are not. The text shown on the print preview is generally larger.
than the text will be when the plot is printed. “Print Preview” is particularly useful to check the result of your “Print Scale” if you are sending the plot directly to the printer. It is preferable to select an even scale (such as 1:20, 1:30, 1:50, 1:100), which can be used with an engineering scale.

To continue our example, Figure 6 shows the groundwater source receptor identification plume for non-drinking water wells overlain on our example site. All the plumes in this User’s Manual, shown overlain on the example site, were generated by saving the receptor identification plume as a DXF file, then merging the DXF file with a CAD drawing for the example site.

We will assume we have checked for all non-drinking water wells, using a plot at a smaller scale, and the only non-drinking water well found within the plume is shown on Figure 6. The non-drinking water well receptor located at (40, -45).

We will go ahead and input this receptor into the program, although when working with your site you may wish to identify all the receptors first, and then enter them into the software. Click “OK/Back” until you reach the “Main Form”.

All receptors are entered into the software using the buttons in the “Receptors” frame. Click the “GW Ingestion” button in the “Receptors” frame to activate the “Groundwater Ingestion Receptors” form. The form is used to enter drinking water well (DWW), non-drinking water well (NDWW), and protected groundwater source (PGWS) receptors.

The “Receptor Type” is selected from the drop list box at the top of the form. Select “NDWW: Non-Drinking Water Wells” in the list box, and the grid appears for non-drinking water well receptors. The information for our non-drinking water well receptor has already been entered.

The short label is used on plots and in tables. The short label for each receptor should be unique. The difference in short labels can be minor (i.e., NDWW-1, NDWW-2, NDWW-a, etc.), but no two receptors should have the same short label. This applies both to receptors of the same type and to different receptor types. The short label for every receptor entered into the program should be unique.

The long label should be descriptive and does not have to be unique. **Recall you should not use a quote (") in any information you enter in the Tier 2 program.**

Click “OK/Back” to return to the “Main Form”. Click “Save” to update the example data file.

**Protected Groundwater Source: PGWS**

Click the “GW” button in the “Receptor ID” frame to activate the “GW Receptor Identification” form. Select “PGWS” as the “Receptor Type”. Click “Plot” to generate the “Groundwater Source Receptor Identification” Map for “Protected Groundwater Source”. “Protected Groundwater Source” has the same target levels as non-drinking water well, so the receptor identification plumes are the same. Figure 7 shows the receptor identification plume for groundwater ingestion to protected groundwater source (PGWS) overlain on the site.

A PGWS is a potential receptor. All areas within the receptor identification plume not subject to an institutional control prohibiting use of the PGWS are points of exposure. The source is a potential area of exposure, unless an institutional control is in-place.

Source locations (version 2.30 and later) are automatically evaluated by the software as points of exposure for potential receptors. You **should not** input the source locations (as shown using the “Sources” button in the Main Form) as the location for a potential receptor (i.e., you should not input a PGWS receptor at a source location).

The Tier 2 software (versions 2.30 and later) automatically evaluates the protected groundwater source receptor type for two situations:
1. No institutional control is in-place, and the source locations for each chemical are potential points of exposure. This will happen regardless whether or not you enter any PGWS receptors into the software.

2. An institutional control is in-place between the source location for each chemical and the PGWS receptors you have input.

In practice, this means in Case 2 PGWS is evaluated using only the PGWS receptors you have entered into the software (source locations are assumed to be covered by an institutional control).

For our example, we will input the adjacent property boundaries as PGWS receptors, as shown in Figure 7. There are no institutional controls in place off-site. So, we will select our PGWS receptors to represent the nearest adjacent properties lying within the receptor identification plume. The locations selected take into account the streets and a 10-foot public right-of-way for the adjacent properties. If at a later date, for example, an institutional control were put in place on-site and on an adjacent property, you would need to adjust the adjacent receptor locations to reflect the off-site institutional control.

In most cases, you should place potential PGWS receptor(s) at the closest adjacent property boundaries lying within the receptor identification plume. Even if you know an institutional control is not feasible at the sources, no harm will be done if you put potential receptors at the adjacent property boundaries lying within the receptor identification plume.

To view the PGWS receptors input for our example problem, click “OK/Back” until you return to the “Main Form”. Click “GW Ingestion” in the “Receptors” frame. Select “PGWS: Protected Groundwater Source” in the list box.

**With the exception of drinking water and non-drinking water wells (DWW, NDWW), all receptors in the Tier 2 software are represented as line receptors.** The location of a line receptor is specified by entering the (x,y) locations of the two end points of the line. You may use as many line receptors as needed to describe receptors. Remember to use a unique short label for every receptor entered into the Tier 2 software (even if two lines make up one receptor, use a unique label for each line).

After you are done viewing the PGWS receptors, click “OK/Back” to return to the Main Form.

**Confined Space Receptors**

At Tier 2 a confined space is a basement in a building occupied by humans. Buildings constructed with a concrete slab on grade, or buildings constructed without a concrete slab but with a crawl space, are not considered confined spaces (Tier 2 Guidance, Section 3.3.3).

Actual confined space receptors are actual existing confined spaces. Potential confined space receptors exist where the construction of confined spaces is not prohibited and could occur in the future. The existing zoning is used to define residential or nonresidential for potential confined space receptors. For actual confined space receptors, both the zoning and the occupancy pattern should be considered when determining whether the actual confined space is residential or nonresidential. If the confined space can be occupied by a person on a 24-hour basis, it should be treated as residential. For example, a nursing or retirement home should be considered residential (for purposes of exposure), even if the property on which it rests is zoned nonresidential.

**Confined Space Residential: CSR**

We will now generate the “Groundwater Source, Receptor Identification Plume” for confined space residential (CSR) receptors. The plume is used to identify both actual and potential confined space residential receptors. If you are not already there, from the “Main Form” click the “GW” button in the “Receptor ID” frame to activate the ‘GW Receptor Identification” form.

Select “CSR” as the Receptor Type. Click “Plot”. The receptors for our example problem have already been entered.
Select No for “Plot Potent. Recept” (Plot Potential Receptors) and “Plot Act. Recept” (Plot Actual Receptors) to see the plot without the receptors. Figure 8 shows the Receptor Identification Plume for the Groundwater Vapor to Confined Space Residential Pathway overlain on our example site map.

The actual confined space receptors (acsr-) identified are shown on Figure 8. These are residential confined spaces within the receptor identification plume.

Also shown on Figure 8 are the line receptors used to represent potential confined space residential receptors (pcsr-) on adjacent properties. The source locations are automatically assumed to be points of exposure for potential confined space receptors, and should not be entered as potential receptors. You should enter the closest adjacent properties as potential confined space residential receptors, if they are zoned residential or have no zoning, fall within the receptor identification plume, and do not have an institutional control in-place prohibiting confined spaces. Roads and public rights-of-way are not considered possible locations for potential confined space receptors.

Note: Even if your site is nonresidential, you can have off-site potential confined space receptors.

Click “OK/Back” until you return to the “Main Form”. Click the “Vapor” button in the “Receptors” frame to activate the “Vapor to Enclosed Space Receptors” form. Select “ACSR: Actual Confined Space Residential” in the drop-down list box to see the receptors entered for the example problem.

Depth to groundwater is the estimated shallowest depth to groundwater below the ground surface at the receptor. Two other values need to be entered for actual confined space receptors: depth of the foundation below the ground surface (Depth to Found.) and ratio of enclosed space volume to infiltration area (Volume to Area, i.e., the volume of the enclosed space below ground divided by the surface area of the walls and floor below ground). At your option, you can measure these values for an actual receptor or you can use the defaults. We will use the defaults. To have the software insert the defaults, select the last two columns for receptors you have entered. Click and hold down the left mouse button and drag over the area, then release the left mouse button, or hold down the shift key and use the arrow keys. After selecting the area, click the “Insert Defaults” button.

As mentioned, for actual confined space receptors (residential or nonresidential), you have the option of measuring the ratio of enclosed space volume to infiltration area (Volume to Area) for any existing building receptor. The enclosed space volume is a measure of only the subsurface interior portion of the building. The infiltration area is the area of the exterior subsurface portion of the building including the base and all sidewalls (see Tier 2 Guidance, Section 3.3.5, Target Levels for Groundwater).

To view the potential receptors entered, select “PCSR: Potential Confined Space Residential” in the list box at the top of the form. The grid shows the PCSR receptors identified on Figure 8. In locating the receptors to represent the adjacent properties, we have neglected the streets and assumed there is a 10-foot public right-of-way. Depth to groundwater is your best estimate of the shallowest depth to groundwater along the line receptor.

When you are done, click “OK/Back” to return to the “Main Form”.

**Confined Space Nonresidential: CSNR**

Click the “GW” button in the “Receptor ID” frame to activate the “GW Receptor Identification” form. We will now view the Receptor Identification Plume (Groundwater Source) for “Confined Space Nonresidential” receptors. Select “CSNR” in the Receptor Type list box. Click the “Plot” button. Two receptors are shown because we have already entered them as part of our example problem.

Figure 9 shows the plume overlain on the site. There are no actual confined space nonresidential receptors, but there might be a potential receptor on the west adjacent property. The plume is very close to being beyond the 10-foot public right-of-way. To be on the safe side, we have entered the property as a potential confined space nonresidential receptor (pcsnr-1).
Click “OK/Back” until you reach the “Main Form”. Click the “Vapor” button in the “Receptors” frame. Select “PCSNR: Potential Confined Space Non-Residential” in the list box to view the receptor entered.

When you are done, click “OK/Back” to return to the “Main Form”

**Sanitary Sewer Receptors**

The route of exposure for sanitary sewer receptors is inhalation (breathing) of contaminated air in an enclosed space. Our concern is a sanitary sewer acting as a conduit for vapor migration into an enclosed space. Explosive hazards from vapor are also of concern. Because of the difficulty of attempting to model vapor migration in or along a sanitary sewer, the sanitary sewer itself is treated as a receptor. Our objective in limiting the modeled or measured groundwater concentrations in the vicinity of a sanitary sewer is to protect against possible vapor migration into an enclosed space and subsequent inhalation of vapors at unacceptable concentrations by humans in an enclosed space.

A sanitary sewer, then, is treated as a vapor receptor. To account for some degree of possible dilution as vapors migrate along the sanitary sewer to the enclosed space, the TAC decided to use a hazard quotient of 2 and a target risk of 2x10^-4 (for confined space receptors the hazard quotient is 1 and the target risk is 1x10^-4). The TAC also specified a criterion on the maximum distance between where a sewer enters an enclosed space and where target limits are exceeded along the sanitary sewer, beyond which the sanitary sewer is no longer a receptor. Addition information on sanitary sewer receptors can be found in Chapter 135 (135.10(6) and 135.10(7)) and Tier 2 Guidance (Sections 3.3, 3.4, and 5.4.5).

It can occur that the same section of a sanitary sewer line or property boundary (the same line) serves as both a residential and nonresidential receptor. In this case, make sure you use unique labels (i.e., ASSR-1, ASSNR-1) for the receptors, even though they represent the same physical location.

**Actual Sanitary Sewer Receptors**

There are actual sanitary sewer residential receptors and actual sanitary sewer nonresidential receptors. Whether the receptor is residential or nonresidential is determined by the exposure for the enclosed space the sanitary sewer enters, not the zoning where the sanitary sewer receptor itself is located.

The Tier 2 Guidance (Section 3.3.3) notes, “Sanitary sewers are considered confined space receptors and preferential pathways if an occupied building exists within 200 feet of where the sewer line crosses over or through actual or modeled groundwater contamination which exceeds the target levels calculated for sewers. The 200-foot distance should be a direct measurement from the point(s) of intersection to the occupied building rather than the measure of sewer line length to the building. Sanitary sewer lines associated with septic systems must be evaluated the same as those leading to public treatment plants. Additionally, if it is known a storm sewer is connected to a building, the storm sewer must be included in the evaluation and treated the same as a sanitary sewer. The point of exposure is the receptor, and points of compliance include locations from the source to the receptor where actual contamination levels are measured and compared with modeled data for comparison and corrective action evaluation purposes.”

Keep in mind although Chapter 135 and the Tier 2 guidance refer to a sanitary sewer as a confined space receptor, in the software confined spaces and sanitary sewers are treated as separate receptor types. In the software, confined space refers only to a basement in a building occupied by humans, and sanitary sewer is used to refer to sanitary sewer receptors. The sanitary sewer receptor type is also used for septic tank systems and storm sewers. Keep in mind, even if a building is not a confined space (i.e., is slab-on-grade or has a crawl space) the sanitary sewer connected to the building could be a sanitary sewer receptor.

**Potential Sanitary Sewer Receptors**

There are “Potential Sanitary Sewer Residential” and “Potential Sanitary Sewer Nonresidential” receptors. Potential sanitary sewer receptors are sanitary sewer receptors not presently in existence, but which could exist in the future. A
public right-of-way is a possible area of exposure for potential sanitary sewers. The zoning of a public right-of-way should be considered the same as the zoning of the property directly adjacent to the right-of-way. Roads are not considered points of exposure for potential sanitary sewers.

**Sanitary Sewer Residential Receptors, Receptor Identification**

To generate the Receptor Identification Plume for Groundwater Vapor to Sanitary Sewer Residential (SSR), click the “GW” button in the “Receptor ID” frame. Select “SSR” as the “Receptor Type”. Click “Plot”. The receptor identification plume is computed and displayed. Some actual and potential sanitary sewer residential receptors have already been entered and are displayed on the plot.

Figure 10 shows the receptor identification plume overlain on the site. Receptors for our example problem are also identified. We have not necessarily identified all the receptors, but have selected some receptors to illustrate the process.

**Actual Sanitary Sewer Residential: ASSR**

The first actual sanitary sewer is assr-1. The sanitary sewer passes through the receptor identification plume within 200 feet of where the sanitary sewer enters a residential enclosed space. Note: The enclosed space itself does not have to be within the receptor identification plume for the sanitary sewer to be an actual receptor. For example, even if the residence directly east of the site did not exist, assr-1 would still be an actual sanitary sewer receptor because of the residence to the southeast of the site.

The sanitary sewer itself is input as a line receptor. The line receptor representing a sanitary sewer receptor is placed where the receptor identification plume intercepts the sanitary sewer. The sanitary sewer is a receptor if it enters an enclosed space within 200 feet of where the receptor identification plume intercepts the sanitary sewer.

The second actual sanitary sewer is labeled, assr-2. It is an actual sanitary sewer receptor because of the residential enclosed spaces (houses) to the south and southwest of the site.

**Potential Sanitary Sewer Residential: PSSR**

The Receptor Identification Plume for Groundwater Vapor to Sanitary Sewer Residential (SSR) is also used to identify potential sanitary sewer residential receptors (pssr). For the example problem, we have entered two potential sanitary sewer residential (PSSR) receptors, with labels pssr-1 and pssr-2. If you look at Figure 10, you will see they are the closest adjacent properties zoned residential where the receptor identification plume intercepts the properties. The public right-of-way is a possible area of exposure for potential sanitary sewers (since sanitary sewer main lines are often placed in the public right-of-way). The potential sanitary sewer receptors are placed at the edge of the public right-of-way closest to the source.

The software will automatically consider the source locations as potential receptor points of exposure. You do not need to, and should not, enter the source locations as potential receptors.

**Sanitary Sewer Nonresidential (SSNR) Receptors, Receptor Identification**

To generate the Receptor Identification Plume for Groundwater Vapor to Sanitary Sewer Nonresidential (SSNR) receptors, click the “GW” button in the “Receptor ID” frame. Select “SSNR” as the “Receptor Type”. Click “Plot”. The receptor identification plume is computed and displayed. Some actual and potential sanitary sewer nonresidential receptors have been entered and are displayed on the plot.

Figure 11 shows the receptor identification plume overlain on the site. Example receptors for our example problem have been identified. We have not necessarily identified all the receptors, but have selected some receptors to illustrate the process.
Actual Sanitary Sewer Nonresidential: ASSNR

Actual sanitary sewer nonresidential receptors are existing sanitary sewers entering a nonresidential enclosed space within 200 feet of where they fall within the receptor identification plume.

The actual sanitary sewer nonresidential receptor assnr-1 is selected because it lies within the receptor identification plume within 200 feet of where it enters a nonresidential enclosed space. The same is true for assnr-2. The lines chosen to represent the receptors should be placed and sized to cover where the sanitary sewer intercepts the receptor identification plume. Note: You do not need to determine exactly where the sewer intercepts the edge of the receptor identification. The receptor (the line representing the receptor) can extend beyond edge of the plume, if this is more convenient for picking \((x,y)\) locations for end point(s). The software will find the most restrictive point on the receptor and use this point for determining risk and site-specific target levels. The most restrictive point will be some point on the receptor inside the receptor identification plume. Extending a line receptor beyond the edge of the receptor identification plume will not affect the evaluation of the receptor.

Potential Sanitary Sewer Nonresidential: PSSNR

The LUST site for our example is nonresidential. The closest nonresidential potential receptors (which are not the source locations) lying within the receptor identification plume are the public rights-of-way at the edge of the LUST site property. Note: This is the on-site right-of-way (we are assuming a 10 foot right-of-way), since the right-of-way is considered a potential receptor point of exposure for sanitary sewers. For our example, we could have omitted the public right-of-way to the south (pssnr-2) as a potential sanitary sewer nonresidential receptor since it does not fall within the receptor identification plume, but no harm would be done by including it.

**Entering/Viewing the Receptors**

Although the receptors have been entered for the example problem, we want to view where in the software they are entered. Return to the “Main Form”. Click the “Vapor” button in the “Receptors” frame.

Select “PSSR: Potential Sanitary Sewer Residential” as the receptor type. Shown are the two potential sanitary sewer residential receptors we entered into the software for the example problem. You must enter a depth to groundwater (from the ground surface). Estimate the shallowest depth to groundwater from the ground surface along the receptor.

Select “PSSNR: Potential Sanitary Sewer Non-Residential” as the receptor type. Shown are the four potential sanitary sewer nonresidential receptors we entered into the software for the example problem.

Select “ASSR: Actual Sanitary Sewer Residential” as the receptor type. Shown are the two actual sanitary sewer residential receptors we entered into the software for the example problem.

For actual receptors you have the option of actually measuring “Depth to Sewer Bottom (ft)” from the ground surface or you can use the default. To use the default, place the mouse in the “Depth to Sewer Bottom” column, click and hold down the left mouse button and drag down to select the rows for which you wish to use the default. Release the mouse button. Click the “Insert Defaults” button.

Select “ASSNR: Actual Sanitary Sewer Non-Residential” as the receptor type. Shown are the two actual sanitary sewer nonresidential receptors we entered into the software for the example problem.

Click OK back to return to the “Main Form”.

**Septic Systems**

Sanitary sewer lines associated with septic systems are treated the same as sanitary sewer lines leading to public
treatment plants.

**Storm Sewers**

If it is known a storm sewer is connected to a building, the storm sewer must be included in the evaluation and treated the same as a sanitary sewer.

**Plastic Water Line: PWL**

Please review the Tier 2 Guidance, Section 3.5.

From the “Main Form”, click the “GW” button in the “Receptor ID” frame. Select “PWL” as the “Receptor Type”. Click the “Plot” button. The Receptor Identification Plume for Groundwater to Plastic Water Line is shown, along with a plastic water line receptor already entered for the example problem. The receptor identification plume is used to identify actual plastic water line receptors and the area of concern for potential plastic water line receptors.

**Actual Plastic Water Line: APWL**

An actual plastic water line receptor for the groundwater pathway is: An existing plastic water line that falls on or within the receptor identification plume, where the highest groundwater elevation is within three feet of the bottom of the plastic water line. If the highest groundwater elevation is more than 3 feet below the bottom of an existing plastic water line, the plastic water line is not a receptor, even if it falls with the receptor identification plume. The highest groundwater elevation is the estimated average of the highest measured groundwater elevations for each year. Only actual plastic water lines are entered into the software as plastic water line receptors. Potential plastic water line receptors are **not** entered into the software.

Figure 12 shows the receptor identification plume overlain on the site. For illustration purposes, we have assumed the only plastic water line within the receptor identification plume is a line running along the public right-of-way on the north side of Fourth Street.

**Potential Plastic Water Line: PPWL**

The area of the receptor identification plume for plastic water line where the first encountered groundwater is less than 20 feet below the groundwater surface is the area of concern for the potential plastic water line receptor type. You do not enter potential plastic water line receptors into the software. Instead, you are required to provide utility company notification of the area of concern. The potential plastic water line receptor is then no action required (Tier 2 Guidance, Sections 3.5.5, 3.5.6). A form for Utility Company Notification (DNR FORM 542-1531) is included in the blank forms at the back of the Tier 2 Guidance. The receptor identification plume is part of the material making up the notification.

The potential plastic water line receptor is the only potential receptor where notification alone is necessary and sufficient for no action required.

By mistake, some users assume notification alone is all that is required for other potential receptors (protected groundwater source, potential confined space, and potential sanitary sewer) for no action required. Although notification may be required for other potential receptors, notification alone is not sufficient to receive no action required for other potential receptors.

Click “OK/Back” until you return to the “Main Form”. Click “Plastic Water Line” in the “Receptors” frame. This activates the form for entering plastic water line receptors. The software assumes all plastic water line receptors entered here are actual plastic water line receptors. Our example plastic water line receptor has been entered.

Click “OK/Back” to return to the “Main Form”.

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Surface Water Bodies: SWB

Surface water bodies are actual receptors only, either designated use, or general use if a general use fails visual inspection. Initially, you identify surface water bodies using the default target levels for the receptor type. The default target levels are in-stream concentrations. Once a receptor has been identified and input into the software, a procedure is followed to compute target levels for the groundwater adjacent to the surface water body needed to meet the in-stream target levels (after accounting for in-stream discharge and mixing). The surface water pathway is discussed in Section 3.7 of the Tier 2 Guidance.

We will use an example to illustrate a surface water body receptor. For our example, we have indicated under the “Questions” section for designated use streams a B(CW) designated use surface water body is present within 500 feet.

Click the “GW” button in the “Receptor ID” frame. Select “DU:B(CW)” as the “Receptor Type”. Click “Plot”. The DU:B(CW) receptor has been entered into the software (as two line segments) and is shown on the plot. Figure 13 shows the plot overlain on the site. Because of the stream shape where it lies in the receptor identification plume, the stream is defined by two line segments.

Click “OK/Back” until you return to “Main Form”. Click “Surface Water” button in the “Receptors” frame. The two line segments comprising the receptor have been entered. Click “OK/Back” to return to the “Main Form”.

After you have entered surface water receptors, the software will estimate the length (L) and discharge (Q) for contaminated groundwater entering the surface water body. Click the “SW: L and Q” button in the “Receptors” frame on the “Main Form” to activate the “Surface Water Body, Designated Use, L and Q” form. For the surface water bodies entered, the form will show the L and Q, for the groundwater source and soil leaching pathways. Note: The entry in the top table under the B (Benzene) column for the first receptor listed (dubcw-40/7.2e-05). The first value is the estimated length (in feet) along the receptor over which the default target level is exceeded for the chemical (based only on the modeled contour lines from the sources). This is the length over which the (modeled) default target level is equaled or exceeded along the line receptor(s) you have input representing the stream. You ought to be able to check whether L is approximately correct by looking at the receptor identification plume with the surface water body receptors you have entered displayed. If only contoured groundwater concentrations intercept the surface water body or intercept a longer length than the modeled contour lines, you will need to calculate your own L and Q. See section 3.7 of the Tier 2 Guidance. The second value is the estimated groundwater discharge into the stream along this length. The estimated discharge is 7.2x10-5 ft³/s (cfs). “ATL” in the table means there is no specific target level for the chemical for the receptor type, and the acute toxicity level will be used. This level is applied without dilution.

If the L and Q are showing 0’s in all the boxes and not ATL or NA, it may be a condition where only the contoured groundwater concentrations are intercepting the stream or only the secondary plumes. In this situation you may need to compute your own L and Q, using the groundwater receptor identification plumes with the surface water body receptor displayed. Again, L is the length over which the target levels are equaled or exceeded along the receptor. Section 3.7 of the Tier 2 Guidance describes how to calculate Q. If you have questions, contact LaDon Jones or Ralph Turkle in Water Resources.

Using the “Print” button on the “Main Form”, this information is printed using the “Surface Water DU L and Q results” selection. You must send this information, along with the Allowable Discharge Concentration form (see the Tier 2 Guidance Appendices) to the DNR Water Resources Section. The Department will calculate groundwater target levels (alternative target levels) for surface water receptors taking into account groundwater flow and in-stream dilution (see section 3.7 of the Tier 2 guidance). The calculations also consider stream-specific information, such as the 10-year, 7-day low flow. If the surface water body is a state-owned lake, there is no discharge allowed. The cleanup level is the criteria listed under state-owned lakes in the Surface Water Criteria for Designated Uses for LUST Sites (Tier 2 Guidance, page 42). You must still complete the Allowable Discharge Form; however, keep in mind, no discharge will be allowed for these sites.

When you receive alternative target levels for a surface water receptor from the DNR, you must enter them in the
software. Click OK/Back to return to the “Main Form”.

Click the “SW User TLs” in the “Receptors” frame on the “Main Form” to activate the “Surface Water, User Target Levels” form. If you have previously entered surface water receptors, they are listed here by type. Use the grid to enter the alternative target levels received from the DNR Water Resources Section. Groundwater source target levels go into the upper grid, and soil leaching alternative target levels go into the lower grid. The units are µg/L.

For our example problem, we have received alternate target levels from the DNR Water Resources Section, and they have been entered into the software. The numbers are for illustration purposes only.

Important:
You should only enter alternative target levels received from the DNR Water Resources Section in this form. The software will automatically use the default target levels for the surface water receptors (Tier 2 Guidance, Section 3.7) if a value is not entered in this form. If a target level is entered, the software will use it for the receptor in place of the default.

When you are done, click “OK/Back” to return to the “Main Form”.

9.2 Soil Leaching, Receptor Identification Plumes

We will now look at receptor identification for “Soil Leaching”. The procedures are the same as for the groundwater pathways, except for the method used to generate the simulated groundwater plume (the regulatory area of concern). The soil leaching receptor identification plumes are the result of combining two models. Using the measured soil concentration at the soil source the first model simulates the groundwater concentration beneath the soil source from leaching (soil leaching model). The simulated groundwater source concentration is used as the groundwater source concentration to simulate the groundwater plumes. The simulated groundwater concentrations are used to identify receptors, using the risk-based groundwater target levels for each receptor type.

Based receptor types you need to evaluate for Soil Leaching identified by the Preliminary Pathway Evaluation Requirements, you generate the required receptor identification plumes, overlay the plumes on your site map and identify receptors. Enter the identified receptors into the software, if they have not already been entered due to another pathway.

The receptor-specific criteria are the same for groundwater source and soil leaching. This is because both pathways are concerned with groundwater concentrations. The risk-based target levels for the receptors are groundwater concentrations for both pathways. For example, for both soil leaching and groundwater source, an actual sanitary sewer is a receptor if it enters an enclosed space occupied by humans within 200 feet of the where the sewer is within the receptor identification plume. An existing plastic water line is a plastic water receptor if it is within the receptor identification plume and the highest groundwater elevation is within 3.0 feet of the bottom of the plastic line at the measured or predicted points of exposure (Tier 2 Guidance, Section 3.5).

The “Preliminary Pathway Evaluation Requirements” table shows the receptor types to be evaluated for soil leaching (listed under the “Soil Leaching Pathways” heading). Because groundwater pathway results are based on groundwater sample data and soil leaching pathways are based on soil sample data, the receptor types to evaluate for the different sources (groundwater, soil leaching) may not be the same.

For our example, the “Preliminary Pathway Evaluation Requirements” Table (Table 1) shows that we need to evaluate the following receptor types for the “Soil Leaching Pathways”:

- Non-Drinking Water Wells-NDWW
- Protected Groundwater Source-PGWS
- Confined Space Residential-CSR
- Confined Space Nonresidential-CSNR
- Sanitary Sewer Residential-SSR
Click the “Soil Leaching” button in the “Receptor ID” frame to activate the “Soil Leaching: Receptor Identification Plumes” form. Select “NDWW” as the “Receptor Type”. Click the “Plot” button. The Receptor Identification Plume for Soil Leaching to Groundwater Ingestion to Non-Drinking Water Wells is generated. Figure 14 shows the plume overlain on the site.

The soil leaching receptor identification plume only plots the simulated groundwater plumes. It does not contour the measured groundwater concentrations (this is taken care of by the groundwater source receptor identification plume).

The non-drinking water well receptor identified by the groundwater receptor identification plume is shown on the screen plot. All receptors of a type entered into the software are shown on the receptor identification plumes.

For our example, the soil leaching plume is smaller than the groundwater plume, and no new receptors are identified. If the soil leaching plume were larger than the groundwater plume and additional non-drinking water well receptors were identified, we would add the additional non-drinking water well receptors to the existing NDWW receptors (“GW Ingestion” button in the “Receptors” frame).

For our example, the soil leaching receptor identification plumes do not identify new receptors. For example, Figure 15 is the Soil Leaching Receptor Identification Plume for Confined Space Residential, and you can compare it to Figure 8, the Receptor Identification Plume for Groundwater. No new receptors are identified.

For the sake of brevity, we will not discuss or show the soil leaching plumes for the other receptor types. But note that the method is the same as for groundwater source. Over the plumes on your site and identify any receptors of the appropriate type that fall within the receptor identification plume(s).

For our example, the soil leaching plumes are smaller than the groundwater source plumes. But, this will not always be the case, and may even vary by receptor type. In some cases, the soil leaching plumes will be larger than the groundwater plumes and may identify new receptors. Also, you may decide to identify soil leaching receptors before you identify groundwater source receptors.

### 9.3 Soil Pathways, Receptor Identification Plumes

The receptor identification plumes for soil vapor to enclosed space and soil to plastic water line are generated using the same form, since both involve the contouring of soil concentration data. Please review Sections 3.4 and 3.6 of the Tier 2 Guidance.

The receptor types to be evaluated are shown in the “Preliminary Pathway Evaluation Requirements” under “Other Soil Pathways”. For our example problem (Table 1), for Soil Vapor to Enclosed Space, we need to identify the following receptor types:

- Confined Space Residential-CSR
- Confined Space Nonresidential-CSNR
- Sanitary Sewer Residential-SSR
- Sanitary Sewer Nonresidential-SSNR

Table 1 also indicates we need to identify soil to plastic water line receptors, for which there is only one type, Plastic Water Lines (PWL).

**Confined Space Residential**
We will first identify soil vapor to confined space residential receptors. Click the “Soil Vapor/PWL” button in the “Receptor ID” frame to activate the “Soil Vapor and Soil to Plastic Water Line, Receptor Identification” form. Select “CSR” as the “Receptor Type”. Click the “Interpolation Range” button and set the following values:

<table>
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<tr>
<th>Minimum X (ft)</th>
<th>Maximum X (ft)</th>
<th>X Grid Spacing (ft)</th>
<th>Minimum Y (ft)</th>
<th>Maximum Y (ft)</th>
<th>Y Grid Spacing (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-25</td>
<td>75</td>
<td>5</td>
<td>20</td>
<td>130</td>
<td>5</td>
</tr>
</tbody>
</table>

Click the “Plot” button to plot the “Soil Vapor to Confined Space Receptor Identification Plume” for “Confined Space Residential Receptors”. Any previously entered potential confined space residential receptors and actual confined space residential receptors are shown on the plot.

Soil vapor receptor identification plumes for vapor receptors are not based on lateral modeling of vapor transport. The soil data are contoured to the target level for the receptor type (red line). The potential receptor area of concern is where soil concentrations exceed the target levels. The potential receptor area of concern is on or inside (the interior) of the red contour line, where soil concentrations are estimated to exceed the target levels. Keep in mind the soil source locations are automatically evaluated as points of exposure for potential receptors. You should not enter soil source locations as potential receptor locations. If an adjacent property is zoned residential and lies within the red contour line, it should be entered as a potential confined space residential receptor. Roads and public rights-of-way are not considered points of exposure for potential confined space receptors.

The area of concern for actual receptors is within 50 feet of where soil concentrations exceed the target levels. Existing residential confined spaces are actual receptors if soil concentrations are exceeded within 50 feet of the confined space. The area within 50 feet of where soil concentrations exceed the target levels is approximated using the green circles. Each green circle has a radius of 50 feet and is centered on the soil contour (red) line. The area interior to the outer edges of the green circles is the area of concern for actual confined space receptors. Any existing confined space residential receptor lying within the area is an actual confined space residential receptor, and should be entered into the software.

Figure 16 shows the plot overlain for our example site. There are no actual receptors. Keep in mind the influence of zoning. The receptor ID plume is for confined space residential. The building east of the site is a confined space and within 50 feet of the soil contour line, but it is a nonresidential confined space. There are no off-site potential receptors, because the area where the soil concentrations exceed the target level (the contour line, labeled “B, 1.16”) does not contact an off-site residential property. We can see from the plot the previously-entered receptors (entered due to groundwater source receptor identification) will be no action required. The potential receptors do not fall with the red contour, and the actual receptors do not fall within the outer edge of the green circles.

Confined Space Nonresidential

Click “OK/Back”. Select “CSNR” as the “Receptor Type”. Click “Plot” to plot the “Receptor Identification Plume” for “Confined Space Nonresidential” receptors. Figure 17 shows the plume overlain on the example site.

The plot on-screen shows the west adjacent property (pcsnr-1), but this receptor was entered because of groundwater source receptor identification. It is not a receptor for “Soil Vapor”. It is a potential receptor and does not fall within the soil target level contour (red line). When the pathway evaluations are done, the software will determine which receptors apply to which pathways.

Figure 17 shows the nonresidential building on the adjacent property to the west falls within the actual receptor area (within 50 feet of the soil target level contour). This is a new actual receptor (acsnr-1). That is, it was not a receptor for groundwater or soil leaching, but is a receptor for soil vapor. The receptor has already been entered into the software for convenience.

Sanitary Sewer Receptors
An existing sanitary sewer line is an actual sanitary sewer receptor for the soil vapor to enclosed space pathway, if the sanitary sewer enters an occupied building within 200 feet of where the sewer line crosses over, through, or within 50 feet of soil contamination which exceeds the target levels calculated for sewers. The 200-foot distance is a direct measurement from the point(s) of intersection to the occupied building rather than the measure of sewer line length to the building (Tier 2 Guidance, Section 3.4.4). The zoning for the sanitary sewer receptor is based on the zoning appropriate for the occupied building, not on the zoning where the sanitary sewer line receptor itself is located.

Potential sanitary sewer receptors are locations where sanitary sewers do not currently exist but could exist in the future. Areas within the soil plume defined to the target levels are considered potential receptor points of exposure. Roads are not considered possible points of exposure for potential sanitary sewers. Public rights- of-way are considered points of exposure for potential sanitary sewers. The zoning for a public right-of-way is assumed to be the zoning of the property immediately adjacent to the public right-of-way.

**Sanitary Sewer Residential Receptors**

Select “SSR” as the “Receptor Type”. Click “Plot”. The Receptor Identification Plume for Soil Leaching to Groundwater Vapor to Sanitary Sewer Residential is shown. For the purposes of our example problem, there are no new receptors. In fact, we can see the receptors already entered will be no action required for the pathway.

If an existing sanitary sewer passed through the plume (outside edge of the green circles, that is within 50 feet of a red contour line) and entered a residential-occupied building with 200 feet of the edge of the plume, you would need to enter the sewer line as a receptor (use a line receptor(s) where the sewer intercepts the plume).

If the soil plume itself (red contour) intercepted an off-site residential property, the residential property line should be entered as a potential sanitary sewer (don’t forget the right-of-way does count as a potential sanitary sewer receptor). Do not enter the source location as a potential sanitary sewer. The software will automatically evaluate the source location.

**Sanitary Sewer Nonresidential Receptors**

Click “OK/Back”. Select “SSNR” as the “Receptor Type”. Click “Plot”. Shown is the receptor identification plume for soil vapor for sanitary sewer nonresidential receptors, along with the receptors we have already entered. For our example site, there are no additional receptors. We can see the existing actual receptors (assnr-1, assnr-2) will be high risk for the pathway. They are within 50 feet of where soil concentrations are estimated to exceed the target level (they fall within the green circles). For the potential receptors, pssnr-1 and pssnr-4 will be low risk (soil target levels are exceeded, they fall within the red contour), while pssnr-2 and pssnr-3 will be no action required for soil vapor (they are outside the red contour, or are located where soil target levels are not exceeded).

If an existing sanitary sewer passes through the plume (outside edge of the green circles) and enters a nonresidential-occupied building with 200 feet of the edge of the plume, you need to enter the sewer line as a sanitary sewer nonresidential receptor (use a line receptor(s) where the sewer intercepts the plume).

If the site is nonresidential and the soil plume (red contour) intercepts the public right of way of the site, the edge of the public right of way closest to the source should be entered as a potential nonresidential sanitary sewer receptor. If the soil plume itself (red contour) intercepts an off-site nonresidential property, the nonresidential property line should be entered as a potential sanitary sewer nonresidential receptor (the right-of-way is a point of exposure for potential sanitary sewer). Do not enter the source location as a potential sanitary sewer receptor. The software will automatically evaluate the source location.

**Plastic Water Line**

Select “PWL” as the “Receptor Type”. Click “Plot” to plot the “Soil to Plastic Water Line Receptor Identification Plume”. 
The Tier 2 Guidance (Section 3.6) states, “Actual receptors include all existing plastic water lines within the receptor ID plume (measured soil contaminant plume plus 10 feet beyond the edge of the measured plume).” The red contour line(s) shows the show data contoured to the target level for the receptor. The green circles are centered on the contour line, and have a radius of 10 feet. Any existing plastic water line within 10 feet of where soil concentrations exceed the soil target levels (within 10 feet of the red contour or within the outer edge of the green circles) should be entered as a plastic water line receptor. The line receptor should cover where the plastic water line intercepts the plume (including the green circles). See Section 3.6 of the Tier 2 Guidance for a figure illustrating plastic water line receptor identification. Keep in mind, only actual plastic water line receptors should be entered into the software as plastic water line receptors.

Potential plastic water line receptors exist where soil concentrations exceed the target levels (inside the red contour line). For potential plastic water lines receptors for the soil to plastic water line pathway, utility company notification of the potential area of concern is required. After notification, the pathway becomes no action required (Tier 2 Guidance, Section 3.6). Do not enter potential plastic water line receptors into the software. The potential plastic water line receptor is the only potential receptor type at Tier 2 for which notification alone is necessary and sufficient for no action required.

For our example problem, there are no additional existing plastic water line receptors within the receptor identification plume.

When you are done, click “OK/Back” to return to the “Main Form”. Click “Save” to update the example data file.

9.4 Summary: Receptor Types, Receptor Identification, and Receptors

We have now completed receptor identification and entered the receptors for our example.

To summarize; the “Preliminary Pathway Evaluation Requirements” identify the receptor types you need to evaluate. For the receptor types you are required to evaluate, overlay the appropriate receptor identification plumes over your site map and identify potential and actual receptors. The identified receptors are entered into the Tier 2 software using the buttons in the “Receptors” frame. Each receptor should have a unique short label.

A receptor should only be entered once, even if multiple receptor identification plumes identify it. On the other hand, a receptor identified by any receptor identification plume for that type (groundwater source, soil leaching, soil vapor or soil to plastic water line) needs to be entered.

Once you have entered all the receptors identified for your site, you are ready to move on to evaluation and risk classification for the pathways.

10. PATHWAY EVALUATION

The results of a pathway evaluation are risk classifications for each applicable receptor. The possible risk classifications for a receptor are H (high), L (low), or N (no action required).

There are seven pathways (source of contamination and mechanism of contaminate migration) recognized by the Iowa RBCA program. The seven pathways are:

- Groundwater Ingestion
- Soil Leaching to Groundwater
- Groundwater Vapor to Enclosed Space
- Soil Vapor to Enclosed Space
- Groundwater to Plastic Water Line
- Soil to Plastic Water Line
- Surface Water
For data management purposes, these pathways are grouped into the following categories under the “Pathway Evaluation” portion of the Tier 2 program:

- Groundwater Source (Groundwater Ingestion, Groundwater Vapor to Enclosed Space, Groundwater to Plastic Water Line, Surface Water)
- Soil Leaching (Groundwater Ingestion, Groundwater Vapor to Enclosed Space, Groundwater to Plastic Water Line, Surface Water)
- Soil Vapor to Enclosed Space/Soil to Plastic Water Line

Although soil vapor to enclosed space and soil to plastic water line are separate pathways, the evaluation results are combined in the software as the soil vapor and soil to plastic water line pathway. Both pathways involve soil concentrations and soil target levels.

Keep in mind, the risk classification for the same receptor may vary between the pathways. For example, a non-drinking water well may be high risk under groundwater and no action required under soil leaching. An actual vapor receptor will have three risk classifications: one for groundwater source, one for soil leaching, and one for soil vapor.

The buttons in the “Pathway Evaluation” frame on the “Main Form” lead to the risk classification sections for each pathway. Prior to entering pathway evaluations, you should have completed the following:

1. Entered all groundwater, soil and vapor data.
2. If appropriate, set data adjustment (ignore) for selected groundwater or soil data.
3. Determined and entered Sw-W values for groundwater and soil.
4. Entered hydrogeology data.
5. Answered all questions.
6. Determined the receptor types to be evaluated.
7. Generated required receptor identification plumes.
8. Recognized and entered into the software all receptors identified by the receptor identification plumes. If you have not completed these steps, the “Pathway Evaluation” results may be incorrect.

10.1 Include Preliminary Pathway Evaluation Results in Analysis

In the pathway evaluation sections (Groundwater Source, Soil Leaching, and Soil Vapor to Enclosed Space/Soil to Plastic Water Line), the first question on the form is “Include Preliminary Pathway Evaluation Results in analysis”, to which you answer “Yes” or “No”. You should select “Yes” as the answer to this question for all the pathways.

If you answer “Yes” the results of the “Preliminary Pathway Evaluation Requirements” (Table 1) will be incorporated into the risk classification requirements and results for the pathway. If, according to the “Preliminary Pathway Evaluation Requirements”, a chemical does not have to be evaluated for a receptor type or a receptor type does not need to be evaluated, this will be reflected in the Risk Classification.

If you select “No” the software will ignore the “Preliminary Pathway Evaluation Requirements” and evaluate the receptors based only on the analytical data and modeling. For example, suppose the first encountered groundwater is not a protected groundwater (and you have told the software this is the case by answering No for the protected groundwater question: “GW Ingestion” button in the “Questions” frame). But, you answered “No” for “Include Preliminary Pathway Evaluation Results in the analysis”. The software will assume a protected groundwater source exists and perform the risk evaluation based on source concentrations and modeling results. If you answer “Yes” for “Include Preliminary Pathway Evaluation Results in the analysis”, the risk classification will reflect there is not a protected groundwater source receptor (the risk classification for PGWS will be N). Or, for example, suppose you have passed vapor sampling at the soil source for benzene. If you answered the questions in the “Soil: Soil Gas” to this effect, the “Preliminary Pathway Evaluation Requirements” will indicate you do not need to evaluate the vapor receptors under soil leaching and soil vapor for benzene. If you answer “Yes” for “Include Preliminary Pathway Evaluation results in analysis”, then the risk classification for the vapor receptors will reflect you have passed vapor sampling at the benzene source for
soil (i.e., the risk classification will be N). If you answer “No”, then the risk classification will be based only on the soil concentrations or soil leaching modeling, and the risk classification for a vapor receptor could be low or high risk for benzene.

11. GROUNDWATER SOURCE PATHWAY EVALUATION

On the “Main Form”, click the “GW Source” button in the “Pathway Evaluation” frame to activate the “Groundwater Source” form. The software does preliminary calculations for the pathway and it may take moment for the form to appear. This form is the “Groundwater Source Pathway” evaluation form for Tier 2. Make sure “Include Preliminary Pathway Evaluation Results in analysis” is “Yes”.

The steps for evaluating actual receptors and potential receptors differ.

11.1 Groundwater Source, Actual Receptors

The actual receptor types applicable for this pathway are:

- **Groundwater Ingestion**
  - Drinking Water Well: DWW
  - Nondrinking Water Well: NDWW
  - Plastic Water Line: PWL

- **Vapor Receptors**
  - Actual Confined Space Residential: ACSR
  - Actual Confined Space Nonresidential: ACSNR
  - Actual Sanitary Sewer Residential: ASSR
  - Actual Sanitary Sewer Nonresidential: ASSNR

**Surface Water Body (All 8 Types)**

**Actual Receptors: Evaluation Requirements**

Click the “Evaluation Requirements” button in the “Actual Receptors” frame to activate the “GW Source, Actual Receptors, Evaluation Requirements” form. The top small table contains a legend for the main table.

The main table lists all the actual receptors. For each actual receptor, the software has determined the receptor-chemical combinations that you are required to evaluate. The key result in the table is “Eval”, short for evaluate: Eval(1), Eval(2), or Eval (3). An “Eval” means you need to evaluate the receptor-chemical combination. That is, you need to do monitoring well selection for the receptor-chemical.

Any result besides “Eval” means no additional work is necessary for the actual receptor-chemical combination under Groundwater Source; you should not do monitoring well selection. If monitoring well selection is not required (any result other than “Eval”), the symbol used indicates the reason.

To determine the evaluation requirements the software calculates the simulated and contoured groundwater concentrations at each actual receptor. If the simulated or interpolated concentration at the receptor exceeds the target level for a chemical (“Eval”), you need to do additional work (monitoring well selection) to properly complete risk classification.

For some receptor types, the groundwater target level is fixed (i.e., DWW, NDWW, and PWL). For such receptor types, “Eval” will result when the receptor falls within the groundwater receptor identification plume (simulated or contoured) for a chemical. “Eval” will not result if the receptor falls outside of the groundwater receptor identification plumes for a chemical.
For actual vapor receptors, it is possible an actual vapor receptor can be in the groundwater receptor identification plumes for a chemical, yet “Eval” does not result. That is, it is possible for an actual vapor receptor to fall within the groundwater source receptor identification plume for a chemical, yet be no action required (N) for the chemical. The groundwater (and soil leaching) receptor identification plumes use the minimum default groundwater concentrations for a vapor receptor type (i.e., 1,540 µg/L benzene for confined space residential). When you enter an actual confined space or sanitary sewer receptor into the software, a receptor-specific target level is computed (based on depth to groundwater, depth to foundation, and volume to area). The receptor-specific target level for a vapor receptor will be equal to or greater than the minimum default target level. For example, the receptor-specific target level for an actual confined space residential receptor could be 2,740 µg/L benzene. Thus, in some situations, an actual vapor receptor may fall within the groundwater (or soil leaching) receptor identification plume for a chemical, yet when the simulated and contoured concentrations at the receptor are compared to the receptor-specific target level, it may no longer be a receptor for the chemical: the simulated and contoured concentrations at the receptor may be less than the receptor-specific target levels.

The “Evaluation Requirements” are important for two reasons: 1) they indicate the actual receptor-chemical combinations for which you are required to do “monitoring well selection”. 2) Just as important, they indicate the actual receptor-chemical combinations for which you should not do “monitoring well selection”.

The results are receptor- and chemical-dependent. If a receptor-chemical combination has “Eval”, you are required to do monitoring well selection for that receptor-chemical combination.

If a receptor-chemical combination does not have “Eval”, you should not do monitoring well selection for that receptor-chemical combination. If you do monitoring well selection for a receptor-chemical combination which does not have “Eval”, the receptor-chemical can end up having a risk classification of Low or High, whereas the risk classification would have been N (no action required) if you had not done monitoring well selection.

A common mistake for users is to do monitoring well selection for actual receptor-chemical combinations which do not have “Eval”.

You should print the “Evaluation Requirements” immediately to use as a reference when you are doing monitoring well selection for actual receptors. The table can be printed using “Print” at the top of the form or from the Groundwater Source print menu (“Print” button on Groundwater Source form). Table 2 shows the printout for our example. The printout is required as part of the Tier 2 SCR.

Click “OK/Back” at the top of the form to return to the “Groundwater Source” form.

**Actual Receptors: Monitoring Well Selection**

Click the “MW Selection” button in the “Actual Receptors” frame to activate the “GW: Selection of MW locations for Receptors” form. This form is used to do monitoring well selection for the actual receptor-chemical combinations you are required to evaluate ("Eval" for Evaluation Requirements). You need to specify the receptor type, the receptor, and the chemical. To illustrate the process, we will work through the some of the required receptor-chemical combinations for our example problem, shown in Table 2.

Select “NDWW” as the receptor type. When you select a receptor type, the small grid to the right lists all the receptors of that type. Click the row under the “Selection” column until “Yes” is shown. The chemical is already set as benzene. If there are multiple receptors of a type, only one receptor can be selected at a time.

Click “Interpolation Range” and set the following ranges:

<table>
<thead>
<tr>
<th>Minimum X (ft)</th>
<th>Maximum X (ft)</th>
<th>X Grid Spacing (ft)</th>
<th>Minimum Y (ft)</th>
<th>Maximum Y (ft)</th>
<th>Y Grid Spacing (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>90</td>
<td>5</td>
<td>-30</td>
<td>160</td>
<td>5</td>
</tr>
</tbody>
</table>
Click “Plot”. The receptor type, receptor, and chemical for the plot are shown in the frame above the plot area.

Shown on the plot are the receptor, a line between the source and the receptor critical point (blue), the primary area, the secondary area, the SSTL line area, and the source line (see the Tier 2 Guidance, Section 6.5.3, for a more detailed description).

The software determines the site-specific target level (SSTL) at the groundwater source for the receptor and contours the groundwater data to that value (red contour line). This is the primary area. The secondary (trapezoid shape) area originates from where the contoured SSTL value crosses the source line (a line perpendicular to the receptor passing through the source location). If this results in a width on a side less than the ½ the source width, ½ the source width is used.

Plotted on the screen are the locations of groundwater samples, with labels. Your first task is to select candidate monitoring wells (possible monitoring wells) for the receptor. Generally, these are all the wells in the secondary area (including the source) and “P” wells. “P” wells are wells not in the secondary area, but which have measured concentrations above the groundwater source SSTL for the receptor (a concentration above the contoured concentration shown on the plot). Selected wells are shown on the screen with a red label and in the grid to the right of the plot with a “Y” in the “Select” column.

To toggle the selection of a well you can click on the label for the well. To test this, click the label “MW-7” on the plot. As you click the label, it will toggle from red to black. You can also click the row for MW-7 in the grid in the select column. If labels overlap, you can select an area on the plot, and use the “Zoom” button to zoom in.

**Auto Select**

You can use the “Auto Select” button to have the software select the candidate monitoring wells. When you click “Auto Select”, the software will clear the previous selections and select all wells in the secondary area, the SSTL line area, the source well, and all “P” wells.

The wells used to monitor the actual receptor-chemical are chosen from the “candidate” monitoring wells. In some cases, this will include all the “candidate” monitoring wells, in other cases, a subset of the “candidate” monitoring wells. After using “Auto Select”, you can adjust the well selection, if necessary, by clicking individual well labels or the grid.

For our example, click “Auto Select”. Now click the “Risk” button on the right side of the form. The software does calculations and evaluation for the receptor-chemical, using the selected wells, and shows the results in a grid at the bottom of the form. The “Risk Classification” is shown above the table or grid.

For each selected well, a row in the grid shows the simulated (modeled) concentration (Sim. Conc.), the SSTL concentration (SSTL Conc., the concentration which needs to be met at the well, according to the modeling, in order to meet the risk-based target level at the receptor), the measured concentration (Meas. Conc.), and the monitoring criteria for the well (Criteria).

**Depending on your screen size and resolution, you may need to scroll the grid to the right to see all the columns.**

**Well Criteria**

Monitoring wells are assigned a monitoring type depending on the criteria they meet. The criteria are discussed in the Tier 2 Guidance (Section 5.4).

The symbols and criteria applicable for actual receptors are:
- S: Source well for the chemical
- X: Not the source well. Measured concentrations above the SSTL.
T: Above the method detection limit, or above “non-detect”.
G: Measured concentration less than the SSTL.
P: In the primary area. Not in the secondary area. Concentration greater than the groundwater source SSTL.
L: For low risk receptor classification only. Measured concentration greater than the simulated concentration.

You Select T and G Wells

Your only actual task here is to select a transition (T) and guard well (G) for the receptor. If appropriate, one well may serve as both a T and G well. The wells meeting transition well criteria show a “T” in the “Criteria” column, and wells meeting guard well criteria show a “G” in the “Criteria” column. You select a transition well by clicking the row for the well in the “T Well(s)” column. For example, to select MW-10 as a T well click the row for MW-10 in the “T Well(s)” column. The entry will change from “NO” to “YES”, and a T will be shown in the “Monitor” column.

You select a G well(s) by clicking on the “G Well(s)” column, until YES is shown. If a well does not meet G well criteria, NA (not applicable) is shown in the “G Wells(s)” column. The monitor column (Monitor) will always reflect the current selections for T and G wells.

The Tier 2 Guidance, Section 5.4.1, notes, “If any required monitoring wells are not included in the monitoring plan, justification must be provided. For example, if the guard well is less than 50 feet from the source well, no transition well is required. If the receptor is less than 50 feet from the transition well, no guard well is required. If the receptor is less than 50 feet from the source well, neither a transition well or guard well is required.”

For our example, select MW-10 as both the transition (T) and guard (G) well. Click the row for MW-10 to set “YES” in the “T Well(s)” column and “YES” in the “G Well(s)” column. The “Monitor” column will show a “T” and “G” for MW-10.

We could pick separate wells for transition and guard. For this example, we could pick MW-3 as the transition well and MW-10 as a guard well.

If possible, you should try to pick transition and guard wells as close to being on-line between the source and receptor as possible. There are situations where wells will meet T and G well criteria, but may not be good choices, because they do not represent good locations for measuring groundwater concentrations between the source and receptor.

It is possible wells meeting T and/or G well criteria do not exist in the trapezoid area.

The wells selected for monitoring the receptor are shown in the “Monitor” column, along with their monitoring criteria (S, X, P, L, T, G). Except for T and G wells, the software automatically selects the monitoring wells in the “Monitor” column from the candidate monitoring wells.

It may be that not all the wells selected by the “Auto Select” end up included in the groundwater monitoring plan for the receptor (“Monitor” column). The “Auto Select” chooses “candidate” monitoring wells. For our example problem MW-3, although a candidate monitoring well because it falls in the secondary area, is not included in the monitoring plan (Monitor column).

The “P” well, MW-12, shows a –1 for the simulated concentration (Sim. Conc.). Because of the way groundwater transport modeling is done at Tier 2, no simulated concentrations are computed for P wells, so the value is shown as –1. This does not affect the risk classification. The SSTL for a “P” well is the groundwater source SSTL.

Your only task in this grid is to select T and G wells. You must select T and G wells. The software does not automatically select T or G wells, even if there are candidate monitoring wells meeting T and G well criteria. A common error for users is to not select T and G wells. You may need to scroll the grid to the right to display the appropriate columns. Also, if after selecting T and G wells, you return to a receptor-chemical combination and click “Auto Select”, your previous selections are cleared. If you click “Auto Select” for a receptor-chemical combination after you have previously selected T and G wells, you will need to do T and G well selection again for that receptor-
chemical combination. If you want to confirm your T and G well selection, click the “Risk” button without clicking the “Auto Select” button.

Again, if you want to check monitoring well selection, click the “Risk” button only; do not click the “Auto-Select” button.

If you wish to change the T or G well for an actual receptor-chemical at some later time, you will have to return to this grid.

Having selected MW-10 as the T and G well for this actual receptor-chemical, click the “Done” button. Then click “OK/Back”.

Select “ACSR” as the “Receptor Type”. Click the first row in the “Selection” column to select the first receptor listed (YES), which for our example has a short label of “acsr-1”.

Click the “Plot” button. Shown on the plot are the receptor, a line between the source and the receptor critical point (blue), the primary area, and secondary area SSTL line area. The SSTL at the groundwater source which must be met (according to the groundwater transport simulation) is contoured against the measured groundwater concentrations (red line, value of 17,753 µg/L Benzene).

Click “Auto Select”. The source well and the wells in the trapezoid area are automatically selected as candidate monitoring wells. Click the “Risk” button.

The risk classification is high risk. Again, there are multiple wells which could be used for T and G wells. Select MW-10 as the T and G well (TG will show for MW-10 in the Monitor column). Note: Out of the four candidate monitoring wells, only two wells will be monitored for this receptor: MW-1, because it is the source well for Benzene, and MW-10, because we have selected it as the T and G well for the receptor-chemical.

Click “Done”. Remember, if you want to review the monitoring well criteria or selection for a receptor-chemical, click the “Risk” button. If you click “Auto Select” at this time, the T and G well selections just made will be cleared.

Click “OK/Back”.

We will now select the monitoring wells for the second ACSR receptor, acsr-2. Select the second receptor, with short label acsr-2, in the “Receptors” grid (click the row for the receptor in the selection column until YES is shown). If there are multiple receptors of a type, only one receptor can be selected at a time.

Click the “Plot” button. Shown on the plot is the receptor, a line between the source and the receptor critical point (blue), the primary, secondary, and SSTL line area. The SSTL at the groundwater source which must be met (according to the groundwater transport simulation) is contoured against the measured groundwater concentrations (red line, value of 13,278 µg/L benzene).

Click the “Auto Select” button. The source well, MW-1, and the one well in the secondary area, MW-6, are selected. The wells selected are shown with red labels.

Click the “Risk” button. The receptor is high risk. An actual receptor is high risk if a measured concentration (Meas. Conc.) exceeds the site-specific target level (SSTL Conc.) for any candidate monitoring well. For this receptor, select MW-6 as the T well and G well (in the T Well(s) column, click the row for MW-6 until YES is shown, T will be shown in the Monitor column for MW-6. In the G Well(s) column, click the row for MW-6 until YES is shown, G will be shown in the Monitor column for MW-6).

Keep in mind; you must select the T and G well for the receptor. The software determines the candidate monitoring wells, if any, meeting T and G well criteria, but the software does not select the T or G wells to include in the monitoring
Click the “Done” button, and then click the “OK/Back” button.

According to the “Evaluation Requirements”, we need to also do monitoring well selection for benzene for the following receptors:

- assr-1
- assnr-1
- assnr-2
- pwl-1
- dubcw-a
- dubcw-c

For the sake of brevity, the monitoring well selections for these receptors have already been done. You may wish to review the selections. However, don’t forget if you are reviewing or checking previous selections, click the “Risk” button, do not click the “Auto Select” button. Clicking “Auto Select” erases any previous selections (including T and G well selections), and then selects candidate monitoring wells (this can happen so fast on screen you may not see the labels change colors and may not realize you have cleared the T and G well selection).

We are done selecting monitoring wells for the actual receptors-chemicals for our example. Monitoring wells have been selected only for the actual receptor-chemical combinations having “Eval” in the “Evaluation Requirements”.

For your site, you should do monitoring well selection (including T and G well selection) for all actual receptor-chemical combination with “Eval” in the “GW Source, Actual Receptors, Evaluation Requirements” print out (“Evaluation Requirements” button). **If an actual receptor-chemical combination does not have “Eval” for “Evaluation Requirements”, you should not do monitoring well selection.**

Click “OK/Back” to return to the “GW Source” form.

At this point, you might wish to return to the “Main Form” to “Save” the data, and then return to the “GW Source” form under “Pathway Evaluation”.

**Groundwater Source, Actual Receptors, SSTL Tables**

After you have completed “Monitoring Well Selection” for actual receptor-chemical combinations having “Eval” under “Evaluation Requirements, you can print the SSTL Tables for the Groundwater Source, Actual Receptors.

From the “Groundwater Source” form, click the “SSTL Tables” button in the “Actual Receptors” frame to activate the “GW Source, Actual Receptors, SSTL Tables” form. The form is a print menu you use to print the SSTL Tables for actual receptors to include in the Tier 2 SCR. An SSTL Table also contains detailed information on risk classification and monitoring for an actual receptor. Monitoring well criteria and risk classification criteria are covered in detail in Chapter 5 of the Tier 2 Guidance.

The grid lists all actual receptors and has a column for each chemical. By default, the actual receptor-chemical combinations to be evaluated, as identified by “Evaluation Requirements”, are shown with a “*” and “YES”. Actual receptor-chemical combinations with a “YES” will be printed when you print the pathway for the receptor type. To toggle the actual receptor-chemical combination from YES to NO, click the grid with the left mouse button.

The YES selections are printed by “Pathway”. The receptor types printed for each “Pathway” selection are:

- Ingestion
  - Drinking Water Wells (DWW)
To print the selected SSTL tables for a “Pathway”, select the pathway (click the option button), then click the “Print” button.

The printouts for Ingestion and Confined Space are Tables 3 and 4. Let’s discuss the information in a printed SSTL Table for Groundwater Source, Actual Receptors (see Table 3 and Table 4 as examples).

The first row shows the receptor type, the receptor short label and description, the chemical, and the groundwater source SSTL. The groundwater source SSTL is the groundwater concentration required at the source in order to meet the risk-based target level at the receptor (according to the simulation model).

The second row shows the risk (H for High, L for Low, N for No Action Required). The software determines the risk classification, based on the criteria in Chapter 135 and the Tier 2 Guidance. The second row also shows the target level (TL) at the receptor, the simulated (modeled) concentration at the receptor (Simulated), and the interpolated concentration at the receptor based on the measured groundwater concentrations (Interpolated).

The remaining rows show information for each of the candidate monitoring wells selected for the actual receptor-chemical combination (“MW Selection” in the “Actual Receptors” frame).

The information for each candidate monitoring well includes the following:

- The “Location” column - The well label for the monitoring well.
- The “Distance from Source” column - The “projected” distance of the monitoring well from the source. The monitoring well location is “projected” onto a line between the source and the receptor, and this is the distance shown, not the radial distance between the source and the monitoring well. Figure 18 illustrates the “Distance from Source” measurement.
- The “Simulation Value” column - The simulated groundwater concentration at the monitoring well. This is the groundwater concentration at the monitoring well, estimated using the Tier 2 groundwater transport model and site-specific parameters (i.e., source width, hydraulic conductivity, head gradient, main plume flow direction, range of plume flow, source concentration and location, monitoring well distance, and direction from the source). This is the concentration the groundwater model estimates could occur at the monitoring well location under current conditions.
- The “Actual Data” column - The groundwater concentration for the well location. This concentration is the maximum of the last two samples (six-month separation) or the last sample if steady and declining is met.
- The “SSTL Value” column - The concentration to be met at the monitoring well (according to the groundwater transport model) in order to meet the target level at the receptor.

The risk classification for the receptor is determined from a comparison of the values in the “Simulation Value”,...
“Actual Data”, and “SSTL Value” columns. For an actual receptor, if an “Actual Data” value is greater than an “SSTL Value” for any monitoring well, the receptor is high risk. If the receptor is not high risk, but the “Actual Data” is greater than the “Simulation Value” for a monitoring well, the receptor is low risk.

- The “Criteria” column - The monitoring criteria the candidate monitoring well meets (determined by the software).
- The “Monitor” column - The wells to be monitored for the actual receptor-chemical. All wells in the “Monitor” column are automatically selected by the software from the wells in the “Criteria” column, except for T and G wells. The T and G wells in the “Monitor” column are those selected by you (by selection of T and G wells in “MW Selection”). The only entries in the Monitor row you can directly affect are T and G wells (by selecting T and G wells in “MW Selection”). If there are T and/or G wells in the “Criteria” column, but a T and/or G well is not shown in the “Monitor” column, you probably need to do T and G well selection for the actual receptor-chemical in “MW Selection (if the actual receptor-chemical shows “Eval” in “Evaluation Requirements”).

For our example problem, we can see the non-drinking water well, NDWW-1, is high risk. Four wells will be monitored for the receptor: mw-12, mw-1, mw-2, and mw-10. The target levels the monitoring wells will need to meet in order to reclassify the receptor to no action required during site monitoring are shown in the “SSTL Value” column.

**Actual Vapor Receptors and Vapor Sampling**

Table 4 shows the SSTL tables for confined space vapor receptors. They are both high risk for benzene based on groundwater concentrations. Because they are vapor receptors, one of the options you have is vapor sampling. If you performed vapor sampling (Tier 2 Guidance, Sections 1.6, 1.8, 3.3.6, and 3.3.7) at the benzene groundwater source and passed, all vapor receptors under groundwater source would be no action required.

You also have an option of completing vapor sampling between the groundwater source and an actual vapor receptor (confined space or sanitary sewer). This is called an alternative point of compliance. There are restrictions on where the vapor sampling can be done (Tier 2 Guidance, Section 3.3.7; Groundwater Professional Bulletin Board-Soil Gas Sampling Guidance). The SSTL table contains important information relating to the restriction. If you do soil gas sampling between the source and the receptor, it must be done where current groundwater concentrations meet or exceed the simulated groundwater concentration at the receptor. The SSTL table shows the simulated groundwater concentration at the receptor. It is the “Simulated” value in the second row of the SSTL table.

For our example, Table 4 shows the simulated benzene concentration at acsr-1 is 1,881 µg/L, and the simulated benzene concentration at acsr-2 is 2,515 µg/L. If soil gas sampling were to be done between the source and acsr-1 to attempt to clear the receptor, it would need to be done where current groundwater concentrations are ≥1,881 µg/L. If soil gas sampling were to be done between the source and acsr-2 to attempt to clear the receptor, it would need to be done where current groundwater concentrations are ≥2,515 µg/L. The reasoning of the TAC was; we are concerned with what soil gas concentrations could be if the groundwater concentration at the receptor reaches the simulated concentration.

The vapor sampling option is only applicable for vapor receptors (confined space and sanitary sewer).

**11.2 Groundwater Source, Potential Receptors**

The process for selecting monitoring wells to monitor “Potential Receptors” under Groundwater Source is not the same as the process for “Actual Receptors”. In versions 2.30 and later of the software, a single set of monitoring wells are selected to monitor all potential receptors of the same type (i.e., protected groundwater source, potential confined space, and potential sanitary sewer).

For example, for protected groundwater source, a set of monitoring wells is selected to monitor the source location and all the protected groundwater source receptors you entered into the software (to represent adjacent property boundaries).
In addition, residential and nonresidential potential confined space receptors are evaluated as a group, with one monitoring plan and risk classification. The same is true for potential sanitary sewer receptors.

11.3 Groundwater Source, Protected Groundwater Source

We will now discuss the selection of monitoring wells for Protected Groundwater Source, under Groundwater Source. The chemicals you need to do monitoring well selection for are shown in the “Preliminary Pathway Evaluation Requirements” printout. You should select monitoring wells for each chemical with an X for “Protected Groundwater Source-PGWS” under “Groundwater Pathways”. For our example (see Table 1), we need to select monitoring wells for benzene (B), toluene (T), and TEH-Diesel (TEHd).

If you are not required to evaluate the Protected Groundwater Source receptor type for Groundwater Source, then, of course, you would not do monitoring well selection.

Click the “MW Selection” button in the “Protected GW Source” frame to activate the “GW Source: Protected Groundwater Source” form.

Interior Wells

Click the “Interior” button in the “Wells” frame. You will see a plot showing the protected groundwater source receptors you have entered, along with the locations and labels of the monitoring wells. You need to identify the “Interior” wells.

Interior wells are wells lying between the source locations and the protected groundwater source receptors you have entered into the software (generally, the closest adjacent property boundaries). When the software does risk classification, it first does risk classification assuming there is no institutional control and all wells must meet Tier 1 levels. The software also automatically does risk classification under the assumption of an institutional control being in-place and assumes the interior wells are subject to the institutional control. Even if you know you will not be considering an institutional control on-site, you should still select interior wells, based on an assumed institutional control covering from the sources to the adjacent PGWS receptors you have input. If you have not entered any off-site PGWS receptors (the receptor identification plume is entirely on-site), then you should select all on-site wells as “Interior” wells.

An interior well has a red label. You must tell the software which wells are “Interior”. To toggle the selection from “Not-Interior” (black label) to “Interior” (red label), click the well label on the plot. If the labels overlap or are difficult to read, you can zoom in to any area of the plot.

Interior wells are based on spatial location only (i.e., they are not chemical-specific). You only need to do interior well selection once for protected groundwater source.

For our example, the only non-interior well is MW-5. Set the label of MW-5 to black, and the labels of all the other wells to red.

Click “Done”.

Down-Gradient Transition, and Guard Wells

We need to select a down-gradient transition (T) and guard (G) well(s) for benzene. This is a well (or wells) meeting transition (T) and guard (G) well criteria that is down-gradient from the source location in the estimated travel direction of the plume. The selection is chemical-specific, although it may end up being the same well(s) for different chemicals. You need to do the selection for each chemical you need to evaluate for protected groundwater source.

Select “Benzene” as the “Chemical”. Click the “T,G Wells” button in the “Down Gradient” frame. The plot shows the monitoring wells. The monitoring well label shows if a well meets transition well (T) criteria and/or guard well (G) criteria. A well may meet both criteria. The source well is shown with an S (mw-1,S).
You select the down-gradient T and G well(s) by clicking the well label. A selected well is shown with a red label. A well not selected is shown with a black label. To toggle between selected (red) and not-selected (black), click the well label using the left mouse button.

For our example, there are several wells which meet transition or guard well criteria, but some are not down-gradient. For example, MW-8 meets T and G criteria, but it is not down-gradient from the source. The well(s) selected should be down-gradient from the source in the direction the plume appears to be migrating. On-site wells are preferable. It is best to review a plot of the groundwater concentration contours overlain on the site to assist in the selection of a suitable down-gradient T and G well(s). It is possible several T or G wells may need to be selected if the plume does not have a definite direction of migration or is migrating in more than one direction.

For our example, MW-5 and MW-10 could serve as the down-gradient T and G wells. You might also select MW-4 as the T well (because it is on-site) and MW-5 as the G well.

We will select both MW-4 and MW-5: MW-4 to serve as the T well (it is on-site) and MW-5 to serve as the guard well. Looking at a plot of the groundwater contamination contours for benzene (Figure 19), MW-4 and MW-5 appear to be down-gradient of the apparent plume migration direction, while MW-10 seems a bit off-center. Select both MW-4 and MW-5. Click the label for MW-4 and MW-5 so they are red. The labels for all other wells should be black. Click “Done”.

**Transition Well-Most Limiting Receptor**

For any chemical for which monitoring well selection is required, you also need to select a transition well(s) for the most limiting receptor (T-ML). Click the “T Well” button in the “Most Limiting” frame.

The software computes the groundwater source SSTLs for all the protected groundwater source receptors you have entered. A red line is drawn from the source to the most limiting receptor (the receptor with the lowest groundwater source SSTL or most restrictive groundwater cleanup requirement), and the label for the most limiting receptor is shown in red. The T well for the most limiting receptor is intended to monitor groundwater contamination in the direction of the most limiting receptor.

All wells meeting T or G criteria are shown with a T or G appended to the well label. You should first attempt to select a well between the source and the most limiting receptor meeting T well criteria. If a suitable T well is not available, you can select a G well.

For our example, MW-2 and MW-7 look like possibilities. We will select MW-7, since MW-2 is so close to the source and MW-7 is also a guard well. Also, looking at the contoured groundwater data (Figure 19), MW-7 would appear to be more representative of potential contaminant migration in the direction of the most limiting receptor (although, it is a judgment call).

Click “MW-7,T,G” to red and leave all other well labels as black. Click the “Done” button.

We will now select a down-gradient T and G well(s) for toluene. Set the “Chemical” to “Toluene”. Click the “T, G Wells” button in the “Down Gradient” frame. For toluene, MW-3, MW-4, MW-5, or MW-10 would seem suitable as a down-gradient transition and guard well. Looking at a plot of the toluene groundwater concentrations (Figure 20), MW-4 looks to be a suitable choice. Select MW-4 as the down-gradient transition and guard well. Click on the label for “MW-4,T,G” so it is red; all other labels should be black. Click “Done”.

Click the “T Well” button in the “Most Limiting” frame. Based on Figure 20, MW-7 would appear to be a suitable well for monitoring the most limiting receptor. Select MW-7 as the T well in the direction of the most limiting receptor for toluene. Click the “MW-7,T,G” label so it is red; all other labels should be black. Click “Done”.

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We will now select a down-gradient T and G well(s) for TEH-Diesel. Set the “Chemical” to “TEH-D”. Click the “T, G Wells” button in the “Down Gradient” frame. Looking at the TEH-Diesel concentrations (Figure 21) and the on-screen plot, MW-3, MW-4, MW-5, or MW-10 would appear suitable as a down-gradient transition and guard well. For our example problem, select MW-4 as the down-gradient transition and guard wells. Click on the label for “MW-4,T,G” so it is red; all other labels should be black. Click “Done”.

Click the “T Well” button in the “Most Limiting” frame. Looking at the TEH-Diesel contours (Figure 21) and the on-screen plot, MW-7 appears suitable as the T well in the direction of the most limiting receptor. For our example, select MW-7 as the T well in the direction of the most limiting receptor for TEH-Diesel. Click the “MW-7,T,G” label so it is red; all other labels should be black. Click “Done”.

Keep in mind, you should select a down-gradient T and G well(s), and T well(s) in the direction of the most limiting receptor for each chemical for which you need to do monitoring well selection. Your selections are chemical-specific. For example, if you select a down-gradient T and G well for benzene, the software does not assume the benzene down-gradient T and G well applies for other chemicals (and in some cases, it may not meet down-gradient T and G well criteria for other chemicals). It is recommended you take into account the measured groundwater concentrations, groundwater concentration contour plots and apparent direction of plume migration when you make your monitoring well selections.

Click “OK/Back”. This will save your monitoring well selections and return you to the “Groundwater Source” form.

**Monitoring Map (Receptor Evaluation Map)**

The “Receptor Evaluation Map” was added at version 2.30. The Receptor Evaluation Maps for potential receptors, if applicable, should be included in your Tier 2 SCR (Tier 2 Guidance, Section 6.5.3). This section of the guidance discusses the Receptor Evaluation Map for actual receptors, but not for potential receptors. However, the Receptor Evaluation Maps for potential receptors should be included in this section of your Tier 2 SCR.

Click the “Monitoring Map” button in the “Protected GW Source” frame to activate the “Groundwater, Protected Groundwater Source, Monitoring Map” form. Click the “Plot” button. The plot shows the protected groundwater source receptors you have entered and the monitoring wells. The monitoring wells that are part of the monitoring plan for the “Protected Groundwater Source” receptor are shown in red. For each monitoring well in the monitoring plan, the well label is shown, followed by the monitoring criteria, then the concentration. For each well not in the monitoring plan (black), the well label is shown, followed by the concentration. Also shown is a red line drawn from the source well to the most limiting receptor.

Besides the wells you selected for monitoring the receptor, the software may have automatically selected additional wells for the monitoring plan. For example, MW-1 is the source well for benzene and is automatically included in the monitoring plan (MW-1:S:20,000). MW-6 was automatically selected as an “Interior E” well (MW-6:IE:300). An interior E well (IE) is an interior well having a concentration above the target level for the receptor type. The target level for benzene for PGWS is 290 µg/L, while the concentration at MW-6 is 300 µg/L. Although not shown, you can have exterior E wells (EE). These are wells which are not-interior and have a concentration above the target level for the receptor type.

Of course the wells you have selected for monitoring are also shown. If you have been following along with the example, you will see MW-4 is listed as a down-gradient transition (T-DG) well, an interior E (IE) well, and has a concentration of 300 µg/L benzene. (MW-4:T-DG:IE:300). MW-5 is listed as a down-gradient transition and guard (DG-TG) well with a concentration of 30 µg/L (MW-5:DG-TG:30). MW-7 is listed as a transition well for the most limiting receptor (T-ML) with a concentration of 5 µg/L (MW-7:T-ML:5).

You can use the “Print” button to print the map. The map can also be exported as a DXF file. Click “Done”, then “OK/Back” to return to the “Groundwater Source” form.
Risk Classification and SSTL Table

We will now look at the “Risk Classification” results for Groundwater Source-Protected Groundwater Source. Click the “Risk/SSTL” button in the “Protected GW Source” frame to activate the “GW Source, PGWS, Risk Classification and Monitoring Plan” form.

For each chemical, the results are shown for two situations: the result with No Institutional Control (NIC) and the result assuming an institutional control (IC).

For the case of no institutional control (NIC), all wells must meet the target levels.

In practice, the institutional control case (IC) works like this: groundwater SSTLs are computed for the monitoring wells using only the receptors you have entered into the software. Note: You will still get SSTLs for the wells on-site, but they are based on meeting the target levels for the off-site receptors you have input.

The risk classification for benzene for a case with no institutional control is shown at the top of the form. The risk is L for Low Risk. The SSTLs to be met at each monitoring well for this situation are shown in the grid in the “NIC-SSTL” column. The target levels are all 290 µg/L benzene.

The risk classification for benzene, assuming an institutional control, is shown at the top of the form. The risk is L for low risk. The SSTLs to be met at each monitoring well for this situation are shown in the grid in the “IC-SSTL” column. Generally, these SSTLs will be higher than the target level at the receptor, since they are based on meeting the target level at the receptors you have input and not at the monitoring well itself.

As discussed previously, besides the wells you selected (DG-TG, T-ML), the software automatically identifies E wells: wells with concentrations greater than the Tier 1 levels for protected groundwater source. An interior E well is an interior well meeting E well criteria. An exterior E wells is a well which is not- interior, but which meets E well criteria.

A well may have more than one classification (i.e., the same well can be a T-ML well and an interior E well).

To determine the IC-SSTL for interior E wells the software checks the well as a monitoring well for all the PGWS receptors you have input and uses the lowest SSTL. The receptor with the lowest SSTL is shown in the “Receptor” column.

Table 5 is a printout of the SSTL Table. We will examine Table 5 in more detail. The top table is a summary risk classification for all chemicals for the case of no institutional control (NIC) and the case of an institutional control (IC). The results are valid for a chemical only if you have previously selected monitoring wells, if required, for the chemical.

The second table gives the chemical-specific results. For the case of no institutional control, all wells must meet the Tier 1 values. For the case of an institutional control, the SSTLs are determined from the PGWS receptors you have input (e.g., the source locations are not the point of exposure). For this example, the PGWS receptor type is low risk both without an institutional control and with an institutional control. However, as expected, the SSTLs are higher with an assumed institutional control on-site preventing exposure at the groundwater source locations.

You can see for the case of toluene and TEH-D an institutional control on-site would result in no further action required. Set the chemical to “Toluene”, then “TEH-D” to see the results for those chemicals.

You can print the results currently displayed by clicking the “Print” button. The printout is the SSTL Table for the chemical for Groundwater Source, Protected Groundwater Source. You can also print the SSTL Tables for any potential receptor and chemical using the “Print” button on the “Groundwater Source” form.

Return to the “Groundwater Source” form.
11.4 Groundwater Source, Potential Vapor Receptors

To help simplify the evaluation process for potential vapor receptors, the residential and non-residential potential confined space (PCS) receptors are monitored and evaluated as a group, and the residential and non-residential potential sanitary sewer (PSS) receptors are monitored and evaluated as a group. In order to combine residential and non-residential receptors, the software needs to know the zoning at each monitoring well.

You should specify “Monitoring Well Zoning” if you need to evaluate any of the vapor receptors for the “Groundwater Pathways” in the “Preliminary Pathway Evaluation Requirements”. Check the receptor types under “Groundwater Vapor to Enclosed Space” (Table 1). The relevant receptor types are confined space residential (CSR), confined space nonresidential (CSNR), sanitary sewer residential (SSR), and sanitary sewer nonresidential (SSNR). If you need to evaluate a chemical (X) for any of these receptor types (CSR, CSNR, SSR, SSNR), you need to do monitoring well zoning. If you are not sure whether you need to do monitoring well zoning, you should do it. No harm will be done if you do monitoring well zoning and it was not necessary.

Monitoring Well Zoning

Monitoring well zoning is used as part of evaluating potential confined space (PCS) receptors and potential sanitary sewer (PSS) receptors. Click the “MW Zoning” button in the “Potential Vapor Receptors” frame to activate the “Potential Vapor Receptors, MW Zoning” form.

The form shows a plot of the well locations, and labels. You set the zoning by clicking the labels on the plot or the “Zoning” column in the grid. A black label (blank cell in the Zoning column) identifies no-zoning. If there is no-zoning, the zoning is treated as residential for the purposes of risk classification. A red label with NR (“Non-Res.” in the grid) is nonresidential zoning. A blue label with R (“Res.” in the grid) is residential zoning.

Your task is to tell the software the zoning at each well. The zoning is the zoning for the property where the well is located. That is, specify the zoning for the well based on the zoning at the well location. For our example, set MW-5 to residential (blue) and all other wells to nonresidential (red).

Click “OK/Back”.

11.5 Groundwater Source, Potential Confined Space

You can determine whether you need to evaluate potential confined space by checking the results for confined space residential (CSR) and confined space nonresidential (CSNR) under “Groundwater Pathways” in the “Preliminary Pathway Evaluation Requirements”. If any chemical has an X for either receptor type (CSR or CSNR), you need to evaluate potential confined space. If you need to evaluate potential confined space, you need to complete the following: 1) identify interior wells, and 2) for each chemical with an X (CSR or CSNR), you need to select a down-gradient T and G well(s) and a T well(s) for the most limiting receptor. If you need to evaluate the potential confined space receptor, you should do “Monitoring Well Zoning” beforehand.

For our example problem (Table 1), we need to evaluate potential confined space. In particular, we need to select monitoring wells for benzene.

In the “Groundwater Source” form click the “MW Selection” button in the “Potential Confined Space” frame to activate the “GW, Potential Confined Space, MW Selection” form.

Interior Wells

Click the “Interior” button in the “Wells” frame. You will see a plot showing the potential confined space receptors you have entered (both residential and nonresidential), along with the well locations and their labels. You need to identify
the “Interior” wells.

Interior wells are wells lying between the source locations and adjacent off-site property boundaries you have input as potential confined space receptors (residential or nonresidential). When the software does risk classification, it first does risk classification assuming there is no institutional control. All wells must meet Tier 1 levels, based on the well zoning.

The software also automatically does risk classification under the assumption of an institutional control and assumes the interior wells are subject to the institutional control. Even if you know you will not be considering an institutional control on-site, you should still select interior wells, based on an assumed institutional control covering from the sources to the potential confined space receptors you have input.

If you have not entered any off-site potential confined space receptors (the receptor identification plumes for potential confined space residential and potential confined space nonresidential are entirely on-site), then you should select those wells on-site as “Interior” wells.

The software does not assume the interior wells are the same for protected groundwater source, potential confined space, and potential sanitary sewer. Even if you have selected interior wells for protected groundwater source or potential sanitary sewer, you will need to select interior wells for potential confined space, if you need to evaluate potential confined space.

A red label indicates an interior well. You must tell the software which wells are “Interior”. To toggle the selection from “Not-Interior” (black label) to “Interior” (red label), click the well label on the plot. If the labels overlap or are difficult to read, you can zoom in to any area of the plot. Interior wells are based on spatial location. They are not chemical-specific. You only need to do interior well selection once for potential confined space.

For our example, the only non-interior well is MW-5. Click on the well labels on the plot (or the interior column in the grid) to set all wells, except MW-5, to on-site (red/YES). The label for MW-5 should be black.

Click “Done”.

**Down-Gradient Transition and Guard Wells**

We will now select a down-gradient transition and guard well(s) for benzene. Set the “Chemical” to “Benzene”. Click the “T, G Wells” button in the “Down Gradient” frame. Looking at the benzene concentrations (Figure 19) and the on-screen plot, MW-4 would appear to be a suitable down-gradient T and G well. For our example, select MW-4 as the down-gradient T and G well (red/YES) for benzene.

MW-4 is not a G well for protected groundwater source, but it is a G well for potential confined space. For potential receptors, the criterion for a G well is the measured concentration must not exceed the receptor target level. The concentration at MW-4 (300 µg/L) is less than the Tier 1 level for potential confined space (1,540 µg/L), making it a G well for potential confined space, but is greater than the Tier 1 level for protected groundwater source (290 µg/L) and the well is not a G well for protected groundwater source.

Click “Done”.

**Transition Well-Most Limiting Receptor**

To determine the most limiting receptor, the software calculates the groundwater source SSTL for all the potential confined space residential (PCSR) and nonresidential (PCSNR) receptors you have input. The receptor with the lowest groundwater source SSTL is the most limiting receptor.

Click the “T Well” button in the “Most Limiting” frame. The most limiting receptor is to the east. Looking at the groundwater concentrations (Figure 19) and the on-screen plot, MW-6 appears to be the best choice for monitoring the
most limiting receptor. Select MW-6 (red/YES) as the T well in the direction of the most limiting receptor for benzene.

The most limiting receptor for protected groundwater source was to the west. However, for potential confined space, the receptor to the east is residential (default target level = 1,540 µg/L), while the receptor to the west is nonresidential (default target level = 4,780 µg/L). Since residential and nonresidential receptors are combined, the most limiting receptor will depend on the target level at the receptor and the direction and distance of the receptor from the source.

Click “Done”.

We are done selecting groundwater monitoring wells for the potential confined space receptor for our example problem.

Click “OK/Back” to return to the “Groundwater Source” form.

**Monitoring Map (Receptor Evaluation Map)**

The “Receptor Evaluation Map” was added at version 2.30. Earlier versions did not generate Receptor Evaluation Maps for potential receptors. Section 6.5.3 of the Tier 2 Guidance discusses Receptor Evaluation Maps for actual receptors, but not for potential receptors. However, the Receptor Evaluation Maps for potential receptors should be included in this section of your Tier 2 SCR, if applicable for your site.

Click the “Monitoring Map” button in the “Potential Confined Space” frame to the “Groundwater, Potential Confined Space, Monitoring Map” form. Click “Plot”. The plot shows the potential confined space receptors you have entered (residential and nonresidential), the monitoring wells, and a red line from the source well for benzene to the most limiting receptor. The monitoring wells that are part of the monitoring plan for benzene are shown in red. For each well in the monitoring plan (red), the well label is shown, followed by the monitoring criteria, then the concentration. For each well not in the monitoring plan (black), the well label is shown, followed by the concentration.

Besides the monitoring wells you selected, the software may have automatically selected additional wells for the monitoring plan. For example, MW-1 is the source well for benzene and is automatically included in the monitoring plan (MW-1:S:20,000). MW-2 was automatically selected as an “Interior E” well (MW-2:I:E:8,400). An E well has a concentration above the target level for the receptor type. The default target level for E wells for potential confined space is based on the zoning at the well location. The target level for benzene for PCSNR is 4,780 µg/L, while the concentration at MW-2 is 8,400 µg/L (MW-2 is zoned nonresidential). An interior E well (IE) is an E well which is also an interior well. Although not shown, you can have exterior E wells (EE). These are wells which are not interior and which have a concentration above the target level for the receptor type.

Of course, the monitoring wells you selected are also shown. If you have been following along with the example, you will see MW-4 is a listed as a down-gradient transition and guard (TG-DG) well and has a concentration of 300 µg/L benzene (MW-4:TG-DG: 300). MW-6 is listed as a transition well for the most limiting receptor (T-ML) with a concentration of 300 µg/L (MW-6:T-ML:300).

Click “Done”, then “OK/Back” to return to the “Groundwater Source” form.

**Risk Classification and SSTL Table**

Click the “Risk/SSTL” button in the “Potential Confined Space” frame to activate the “GW Source, Potential Confined Space, Risk Classification and Monitoring Plan” form. A print out of the information, the SSTL Table for GW Source, Potential Confined Space, is shown as Table 6.

The top table in Table 6 is a risk classification summary for each chemical, for the case of no institutional control (NIC) and the case of an assumed institutional control (IC). The receptor type is low risk (L) for benzene and no action required for the other chemicals. “N(PE)” means no action required as determined by the “Preliminary Pathway Evaluation Requirements” (Table 1). The on-screen form shows the risk classification for the selected chemical.
The second table in Table 6 has detailed results for a specific chemical. Results are shown for each monitoring well in the monitoring plan. The same chemical specific results are shown on the screen. The “well” column shows the well label. The “Actual” column shows the Tier 2 concentration at the well (maximum of two most recent samples at the location, or most recent sample if steady and declining). The “Criteria” column shows the monitoring criteria for the well. “S” is the source well. “TG-Down Gradient” is the down-gradient transition and guard well. “T-ML” is the transition well in the direction of the most limiting receptor. “Interior E” is an interior E well. You may also have “Exterior E” wells.

The “NIC-SSTL” column shows the SSTLs, the target levels the wells need to meet, for the case of no institutional control. Since we are combining residential and nonresidential receptor types, the SSTL shown for a well is the minimum of the following: 1) the SSTL for exposure at the well based on the zoning at the well and 2) the SSTL at the well based on the most limiting receptor. The most limiting receptor is shown in the “Receptor” column. For example, if a well is zoned nonresidential and there are residential receptors off-site, the most limiting SSTL for the well may result from meeting the target level for the off-site residential receptor, rather than from exposure at the well.

The “IC-SSTL” column shows the SSTLs for the case of an assumed institutional control. In practice, this is implemented by determining the minimum SSTL for each well, using only the potential confined space receptors you have entered into the software. For example, with an institutional control, the SSTL at the source well is 8,346 µg/L, which is the source concentration required to meet the target level at PCSR-6, an off-site potential confined space residential receptor. In contrast, if an institutional control is not in-place at the source well, the SSTL is 5,195 µg/L, based on exposure at the source well location. Of course, only one situation (NIC or IC) will end up applying to your site. The results show the effect an institutional control would have on monitoring well target levels.

Set the “Chemical” to “Toluene”. We have not selected monitoring wells for toluene (it is not required for our example), so only the source well is shown. The source well is always a monitoring well. The risk classification is “N(PE)”: the source concentration is lower than the SSTL concentrations at the source.

Click “OK/Back” to return to the “Groundwater Source” form.

11.6 Groundwater Source, Potential Sanitary Sewer

The procedures for evaluating the potential sanitary sewers receptor type for groundwater are quite similar to potential confined space. The residential and non-residential potential sanitary sewer (PSS) receptors are monitored and evaluated as a group.

You can determine whether you need to evaluate potential sanitary sewer by checking the results for sanitary sewer residential –(SSR) and sanitary sewer nonresidential (SSNR) under “Groundwater Pathways” in the “Preliminary Pathway Evaluation Requirements”. If any chemical has an X for either receptor type (SSR or SSNR), you need to evaluate potential sanitary sewer. You need to evaluate potential sanitary sewer, you need to complete the following: 1) identify interior wells, and 2) for each chemical with an X (SSR or SSNR), you need to select a down-gradient T and G well(s) and a T well(s) for the most limiting receptor. If you need to evaluate the potential sanitary sewer receptor type, you should have completed “Monitoring Well Zoning” beforehand.

For our example problem (Table 1), we need to evaluate potential sanitary sewer. In particular, we need to select monitoring wells for benzene. In the “Groundwater Source” form, click the “MW Selection” button in the “Potential Sanitary Sewer” frame to activate the “GW, Potential Sanitary Sewer, MW Selection” form.

Interior Wells

Click the “Interior” button in the “Wells” frame. You will see a plot showing the potential sanitary receptors you have entered (both residential and nonresidential), along with the locations and labels of the monitoring wells. Your task here is to indicate the wells which are “Interior”.
Interior wells are wells lying between the source locations and first adjacent on-site or off-site property boundaries or locations you have input as potential sanitary sewer receptors (residential or nonresidential). Keep in mind, public rights-of-way, if any, at the edge of the LUST site are points of exposure for potential sanitary sewer receptors. In fact, for our example, some wells that are interior for protected groundwater source and potential confined space are not interior for potential sanitary sewer. This is because we had to input potential sanitary sewer receptors at the on-site public right-of-way (the public right-of-way is not considered a point of exposure for protected groundwater source and potential confined space).

When the software does risk classification, it first does risk classification assuming there is no institutional control. All wells must meet Tier 1 levels based on the zoning at the well.

The software also automatically does risk classification under the assumption of an institutional control being in place and assumes the interior wells are subject to the institutional control. Even if you know you will not be considering an institutional control on-site, you should still select interior wells, based on an assumed institutional control covering from the sources to the potential sanitary sewer receptors you have input. If you have not identified any on-site or off-site potential sanitary sewer receptors (the receptor identification plumes for potential sanitary sewer residential and nonresidential are entirely on-site and do not impact any public right-of-way at the edge of the property), then you should select wells on-site (not including the public right-of-way) as “Interior” wells.

The software does not assume interior wells are the same for protected groundwater source, potential confined space, and potential sanitary sewer. Even if you have selected interior wells for protected groundwater source or potential confined space, if you need to evaluate potential sanitary sewer for groundwater source, you need to select interior wells.

A red label is used to identify an interior well. You must tell the software which wells are “Interior”. To toggle the selection from “Not-Interior” (black label) to “Interior” (red label), click the well label on the plot. If the labels overlap or are difficult to read, you can zoom in to any area of the plot.

Interior wells are based on spatial location. They are not chemical-specific for a receptor type. You only need to do interior well selection once for potential sanitary sewer.

For our example, there are four interior wells; MW-1, MW-2, MW-3, and MW-6. Click on the well labels on the plot (or the Interior column in the grid) to set the labels for these wells to red. The labels for all the other wells should be black. Click “Done”.

**Down-Gradient Transition and Guard Wells**

Set the “Chemical” to “Benzene”. Click the “T, G Wells” button in the “Down Gradient” frame. MW-3, MW-4, MW-5, and MW-10 would appear to be likely candidates. Looking at the benzene concentrations (Figure 19) and the on-screen plot, MW-4 would appear to be the most suitable down-gradient T and G well. It appears to be more or less down-gradient in the apparent direction of plume migration, meets T and G criteria, and is on-site (in fact, in the public right-of-way). For our example, select MW-4 as the down-gradient T and G well (red/YES) for benzene. Click “Done”.

**Transition Well-Most Limiting Receptor**

To determine the most limiting receptor, the software calculates the groundwater source SSTLs for all the potential sanitary sewer residential and nonresidential receptors (PSSR, PSSNR). The receptor with the lowest groundwater source SSTL is the most limiting receptor.

Click the “T Well” button in the “Most Limiting” frame. The most limiting receptor (PSSNR-4) is to the north. There is no T well between the source and the receptor. Looking at locations and concentrations (Figure 19), we will select MW-12 as the T well because it has the highest concentration to the north. Select MW-12 (red/YES) as the T well in the direction of the most limiting receptor for benzene. Given the proximity of the source to the most limiting receptor and a fairly
high concentration at MW-12, if this were an actual site, we might need to install a new well between the source and PSSNR-4 to use as the T well for the most limiting receptor.

Click “Done”. We are done selecting groundwater monitoring wells for the potential sanitary sewer receptor type.

Click “OK/Back” to return to the “Groundwater Source” form.

**Monitoring Map (Receptor Evaluation Map)**

The “Receptor Evaluation Map” for potential receptors was added at version 2.30. Version 2.20 and earlier did not generate Receptor Evaluation Maps for potential receptors. Section 6.5.3 of the Tier 2 Guidance discusses the Receptor Evaluation Map for actual receptors, but not for potential receptors. However, the Receptor Evaluation Maps for potential receptors, if applicable, should be included in this section of your Tier 2 SCR.

Click the “Monitoring Map” button in the “Potential Sanitary Sewer” frame to activate the “Groundwater, Potential Sanitary Sewer, Monitoring Map” form. Click the “Plot” button. The plot shows: the potential sanitary sewer receptors you have entered (residential and nonresidential), the monitoring wells, and a red line from the source well for benzene to the most limiting receptor. The monitoring wells that are in the monitoring plan for benzene are shown in red. For each monitoring well in the monitoring plan (red), the well label is shown, followed by the monitoring well criteria, then the concentration. For each well not in the monitoring plan (black), the well label is shown, followed by the concentration.

Besides the monitoring wells you have selected, the software may have automatically selected additional wells for the monitoring plan. For example, MW-1 is the source well for benzene and is automatically included in the monitoring plan (MW-1:S:20,000). For a particular site, you may have E wells, interior (IE) or exterior (EE). An interior E well (IE) is an interior well (defined by you) having a concentration above the target level for the receptor type. The default target level for potential sanitary sewer is based on the zoning at the well. If the zoning at the well is residential, the default target level at the well for benzene is 3,080 µg/L; and, if the zoning is nonresidential, the default target level at the well for benzene is 9,550 µg/L.

Of course, the monitoring wells you selected are also shown. If you have been following along with the example, you will see MW-4 is a listed as a down-gradient transition and guard (TG-DG) well with a benzene concentration of 300 µg/L (MW-4:TG-DG:300). MW-12 is listed as a transition well for the most limiting receptor (T-ML), with a concentration of 2,700 µg/L (MW-12:T-ML:2,700).

Click “Done”. Click “OK/Back” to return to the “Groundwater Source” form.

**Risk Classification and SSTL Table**

Click the “Risk/SSTL” button in the “Potential Sanitary Sewer” frame to activate the “GW Source, Potential Sanitary Sewer, Risk Classification and Monitoring Plan” form. The information in this form is printed as the SSTL Tables for “GW Source, Potential Sanitary Sewer”. Table 7 is the SSTL Table for potential sanitary sewer for benzene. You can print the information using the “Print” button on this form or the “Print” button on the “GW Source” form.

The top table in Table 7 is a risk classification summary for all the chemicals, for no institutional control (NIC) and with an institutional control (IC). Potential sanitary sewer is low risk (L) for benzene and no action required for the other chemicals. “N(PE)” means no action required, as determined by the “Preliminary Pathway Evaluation Requirements” (Table 1). The on-screen form shows the risk classification for the selected chemical.

The second table in Table 7 and the grid on the screen show the results for a specific chemical. Results are shown for each monitoring well in the monitoring plan. The “well” column shows the well label. The “Actual” column shows the Tier 2 concentration at the well (maximum of two most recent samples at the location, or most recent sample if steady and declining). The “Criteria” column shows the monitoring criteria for the well. “S” is the source well. “TG-Down
Gradient” is the down-gradient transition and guard well. “T- ML” is the transition well in the direction of the most limiting receptor. For an actual site, you might also have “Interior E” or “Exterior E” wells.

The “NIC-SSTL” column shows the SSTLs (the target levels the wells need to meet) for the case of no institutional controls. Since we are combining residential and nonresidential receptor types, the SSTLs shown are the minimum of: 1) the SSTL at the well based on the zoning at the well or 2) the SSTL at the well from the most limiting receptor (residential and nonresidential). The most limiting receptor is shown in the “Receptor” column. For example, if a well is zoned nonresidential and there are residential receptors off-site, the most limiting SSTL for the well may result from meeting the target level for the off-site residential receptor.

The “IC-SSTL” column shows the SSTLs for the case of an assumed institutional control. In practice, this is implemented by determining the minimum SSTL for each well, using only the potential sanitary sewer receptors you have entered into the software. For example, with an institutional control, the source well SSTL is 11,465 µg/L, based on meeting the target level at potential sanitary sewer nonresidential receptor PSSNR-4. If an institutional control is not in-place at the source well, the SSTL is 10,390 µg/L: the smallest SSTL from 1) assuming exposure at the well or 2) the SSTL required to meet the target levels at the receptors you have entered. In this example, the lowest SSTL is for exposure at the well (10,390 µg/L). We can tell this because the lowest SSTL for the receptors we have entered is shown in the IC-SSTL column (11,465 µg/L).

Note: For MW-12 for “IC-SSTL”, “Out of Range” is shown. This is because MW-12 does not qualify as a T well for the most limiting receptor. It is a T well, but it is not between the source and the most limiting receptor. This is another indication we may need to install a new well to serve as the T well between the source and the most limiting receptor.

Of course, only one situation (NIC or IC) will end up applying to your site. The results show what the effect of an institutional control would be for your site.

Set the “Chemical” to “Toluene”. We have not selected monitoring wells for toluene (it is not required for our example), so only the source well is shown. The source well is always a monitoring well. The risk classification is “N(PE)”. The source concentration of 15,000 µg/L is lower than the SSTL concentrations of 113,752 µg/L and 124,345 µg/L.

Click “OK/Back” to return to the “Groundwater Source” form.

11.7  **Groundwater Source, Receptor Summary**

We now turn to the “Receptor Summary” for “Groundwater Source”. For the receptor summary to be accurate, you need to have completed any required monitoring well selections for the actual and potential receptors. In practical terms, you need to have completed, if appropriate, the following:

- **Actual Receptors frame**
  - MW Selection
- **Protected GW Source frame**
  - MW Selection
- **Potential Vapor Receptors frame**
  - MW Zoning
- **Potential Confined Space frame**
  - MW Selection
- **Potential Sanitary Sewer**
  - MW Selection

For actual receptors, use the “Evaluation Requirements” button to determine the actual receptor-chemical combinations requiring monitoring well selection. For potential receptors, use the “Preliminary Pathway Evaluation Requirements” to determine the receptor types-chemicals requiring monitoring well selection.
Click “Receptor Summary” in the “Actual and Potential” frame to activate the “Groundwater Source, Tier 2 Receptor Summary” form. The form lists the risk classifications for “Groundwater Source” for the actual and potential receptors. The risk classifications are N/A (chemical is not applicable), N (No action required), L (Low Risk), and H (High Risk). The small top grid is a legend of the risk classifications.

The second grid has the risk classification for each receptor-chemical. The software determines and displays the risk classifications shown in the chemical columns (i.e., Benzene). The actual receptors are listed first, always followed by the potential receptors (always the last six rows). Two rows are shown for each potential receptor: one row for no institutional control (No-IC) and one row for institutional control (IC). PGWS is protected groundwater source, PCS is potential confined space, and PSS is potential sanitary sewer.

The column with a heading of “C” is for whether confirmation sampling has been completed. You can toggle the answer from NO to YES by selecting a cell in the column and pressing the Space Bar, or by typing “N” or “Y”. Select “YES” if confirmation sampling was successfully completed.

Confirmation sampling for groundwater is a second sample confirming the no action required criteria. Confirmation sampling is required for groundwater pathways with an initial no action required classification (with the exception of vapor pathways which are successfully cleared using vapor and vapor confirmation sampling) (Tier 2 Guidance, Sections 5.1.4, 6.3.4). Additional information on confirmation sampling is posted on the Groundwater Professional Bulletin Board (http://www.iowadnr.gov/InsideDNR/RegulatoryLand/UndergroundStorageTanks/MWG/GroundwaterProfessionals/GWPBulletinBoard Posted 07/21/99 Confirmation Sampling Update). Please check this reference.

The “Corrective Action(s) Completed” column is where you input numbers to indicate completed corrective actions. The numbers to use for various corrective actions are shown in the grid at the bottom of the screen. For example, you would put a 1 in the column if you plugged a drinking water well. Simply type in the numbers as needed. If you have completed more than one corrective action for a receptor, separate the entries with a comma (i.e., 3,4). List the numbers only for corrective actions completed prior to submittal of the Tier 2 SCR (Tier 2 Guidance, Section 6.3.4).

The column for “Current Risk” is used to indicate the overall current risk for the receptor. The software does not set the “Current Risk” column. You must set the “Current Risk” column. The information in the Current Risk column affects the receptors included in the groundwater monitoring plan, the receptors included in the groundwater corrective action map, and the receptors carried over to the site monitoring report (SMR) portion of the software.

Select a cell in the “Current Risk” column and press the Space Bar to toggle between blank, N, L and H. You can also type an N, L, or H to set the selection. You can use the delete (Del or Delete) key to reset the cell to blank.

If you have not completed corrective actions affecting the risk classification for a receptor, the “Current Risk” you specify should be based on the risk classifications shown for the chemicals. If the risk is high (H) for any chemical, the risk is high (H) for the receptor. If there are no high risk chemicals, but one or more low (L) risk chemicals, the risk is low (L) for the receptor. If there are no high or low risk chemicals, the risk is no action required (N).

You also use Current Risk to reflect changes in risk classification resulting from corrective actions. That is, when the chemical risk classifications no longer are applicable you use the “Current Risk” column to specify the new risk classification.

For our example problem, the non-drinking water well (NDWW-1) is currently high risk (H). If no corrective action were completed, we would set the “Current Risk” to “H”. However, suppose we properly plugged the well, thereby eliminating the receptor. In that case, we would enter a “Corrective Action(s) Completed” of 2 (plugged non-drinking water wells) and set the “Current Risk” to N.

As another example, consider the receptor ACSR-1, an actual confined space residential receptor which is high risk (H) for benzene. In the absence of corrective action, we would set the “Current Risk” to H. However, suppose we clear the receptor using vapor sampling. In that case, we would enter a “Corrective Action(s) Completed” of 11 (cleared with
vapor), and set the “Current Risk” to N.

Or for example, if we established an institutional control on-site prohibiting use of the protected groundwater source, for the “PGWS-No IC” receptor we would enter a “Corrective Action(s) Completed” of 9 (Established institutional controls) and set the “Current Risk” to N.

You may also have completed corrective actions not affecting the risk classification. For example, you may have notified the utility company supplying water to the area of potential plastic water line impacts (6). This notification is required, but the notification alone would not clear an actual high risk plastic water line receptor. The correct current risk is the highest chemical risk, unless you have performed corrective actions and the corrective actions affect the risk classification for the receptor.

**It is important you properly set the “Current Risk” column.** When the software generates the groundwater/soil leaching monitoring plan, if a receptor has a software-computed chemical risk of L or H it will be included in the monitoring plan, **unless the “Current Risk” column is N.** If you clear a receptor by corrective action but do not put an N in the “Current Risk” column, the receptor may be included in the groundwater/soil leaching monitoring plan (it will be included if any chemical has an L or H).

For our example problem, we will assume we have not completed any corrective actions. The “Current Risk” column, based on the chemical risk, has already been set.

The column for “To Tier 3” is to indicate whether a Tier 3 evaluation is being proposed for the receptor. Click a cell in the column and press the Space Bar to toggle NO/YES. You can also type “N” or “Y”.

Click “OK/Back” to return to the “Groundwater Source” form.

To print the Receptor Summary, click the “Print” button. Click the check box for “Tier 2 Receptor Summary”, then click “Print”. Click “Close” to return to the “Groundwater Source” form.

### 11.8 Groundwater Source, Groundwater Monitoring Plan

Click the “Monitoring Plan” button in the “Actual and Potential” frame to activate the “GW Source, Combined Monitoring Plan, Actual and Potential Receptors” form. Select a chemical (choose benzene for now), then click “Display” to show the results for the selected chemical.

The groundwater monitoring plan shown here only includes the wells required to monitor receptors for “Groundwater Source”. You do not print the monitoring plan shown here. This is because the monitoring plan required for the Tier 2 SCR combines the groundwater monitoring required for groundwater source and soil leaching. The combined groundwater source/soil leaching monitoring plan contains all the information in the groundwater source monitoring plan, along with any groundwater monitoring required for soil leaching. Accessing the combined plan is discussed later.

To create the groundwater monitoring plan, the software assembles the monitoring well information for all low and high risk receptors. A receptor having L or H for a chemical in the “Receptor Summary” is included in the groundwater monitoring plan, unless the “Current Risk” has been set to N.

The monitoring plan is organized by well location, with the source well listed first, followed by the other wells, listed in order of increasing radial distance from the source. The wells included in the monitoring plan are those selected by the user (i.e., T, G wells) or the software (i.e., S, P, X, E, or L) as part of evaluating a receptor. If a monitoring well is not being used to monitor a low or high risk receptor, it will not be included in the monitoring plan. For our example, MW-8 is not part of the monitoring plan.

For each well, the following is shown:
• “Monitoring Well” column - The well label.

• “Actual µg/L” column - The Tier 2 measured groundwater concentration: maximum of two most recent or most recent if steady and declining.

• “SSTL (µg/L)” column - The groundwater site-specific target level (SSTL) at the well for the receptor. The groundwater target level the well needs to meet as part of meeting the target level at the receptor (according to the groundwater modeling). The concentration the well must meet as part of the no action required criteria for the receptor.

• “Institutional Control” column - Applies to potential receptors only (protected groundwater source, potential confined space or potential sanitary sewer). Indicates the situation the SSTL is applicable to: no institutional control (No) or an institutional control (IC).

• “Receptor” column - The short label you assigned to actual receptors. For potential receptor types (protected groundwater source, potential confined space, potential sanitary sewer), this column shows the label of the most limiting receptor, except for down-gradient T and G wells. For down-gradient T and G wells, this column shows the receptor type (i.e., PGWS, PCS, PSS).

• “Description” column - The description you input for the receptor. For potential receptors, if there is no most limiting receptor, the “Description” will show PGWS for protected groundwater source, PCS for potential confined space, and PSS for potential sanitary sewer.

• “Type” column - The criteria the monitoring well meets for the receptor. “S” is source well. The well criteria have been covered elsewhere in this User’s Manual and are also covered in the Tier 2 Guidance, Section 5.4.

• “Risk” column - The risk classification for the receptor. This “Risk” is the chemical specific risk determined by the software (shown in the “Receptor Summary”). This column does not show the “Current Risk” assigned by the user in the “Receptor Summary”. However, if the Current Risk for a receptor is N, the receptor is not included in the monitoring plan.

• “Frequency” column - The frequency of sampling required. Determined from the risk classification for the receptor and the well “Type”. E wells do not need to be sampled annually. A minimum of one sample is required for E wells, and the most recent sample must meet the SSTL.

The “Groundwater Source Monitoring Plan” information is used to construct the “Groundwater Corrective Action Map”. For each monitoring well in the monitoring plan, the Groundwater Corrective Action Map displays the concentration (“Actual”) and the lowest SSTL from among the high risk receptors. For example, at the source well for benzene, the lowest SSTL for a high risk receptor is 2,595 µg/L (non-drinking water well, NDWW-1). If the non-drinking water well was plugged and the “Current Risk” was set to “N” for the receptor in the “Receptor Summary”, the lowest high risk corrective action SSTL at the benzene source would then be 7,706 µg/L (PWL-1).

There may be cases (i.e., MW-10) where the lowest SSTL for high risk receptors is higher than the current actual concentration at the well. MW-10 is being monitored as a guard well, and the actual concentration should be lower than the SSTL. If a well does not have a high risk receptor (i.e., MW-4), no corrective action concentration will be shown for the Corrective Action Map (however, as part of the monitoring plan, the well still needs to be monitored).

Depending on your site you may also have a monitoring plan for other chemicals. If you set the chemical to “TEH-D” and click the “Display” button, you will see the wells in the groundwater monitoring plan for TEH-Diesel. For our example, the only receptor type is protected groundwater source, and the receptors are all low risk. You can confirm this in the “Receptor Summary”. For TEH-Diesel, the only receptor not N is PGWS (No-IC), with a risk of L. However, the wells still need to be monitored as part of the groundwater monitoring plan.
When you are done, click the “OK/Back” button to return to the “Groundwater Source” form.

11.9 Groundwater Source, Corrective Action Map

The Groundwater Corrective Action Map displays the lowest SSTL for the high risk receptors associated with a well. The “Corrective Action Map” is a really a “High Risk” corrective action map. The Tier 2 Guidance calls this map the “Groundwater Summary Corrective Action Map”.

Click the “Corrective Action Map” button in the “Actual and Potential” frame to activate the “Groundwater, High Risk Corrective Action Map” form.

Select “Benzene” as the chemical. Set the “Interpolation Range” to:

<table>
<thead>
<tr>
<th>Minimum X (ft)</th>
<th>Maximum X (ft)</th>
<th>X Grid Spacing (ft)</th>
<th>Minimum Y (ft)</th>
<th>Maximum Y (ft)</th>
<th>Y Grid Spacing (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100</td>
<td>5</td>
<td>-50</td>
<td>150</td>
<td>5</td>
</tr>
</tbody>
</table>

Click “Plot”.

Each groundwater sample location is shown on the map with a well label, the measured concentration at the well, and the lowest SSTL for the high risk receptors assigned to the well. An SSTL concentration is not shown if there are no high risk receptors assigned to the well. Keep in mind, a well may have SSTL concentrations for low risk receptors that must be met, even if no SSTLs are shown on the [High Risk] Corrective Action Map.

The lowest SSTL at the source well is contoured (red line) and forms the “Primary Area”. For our example, this is 2,595 µg/L benzene for the non-drinking water well receptor, NDWW-1. Keep in mind, corrective action must reduce the maximum groundwater concentration to the lowest source SSTL: the maximum groundwater concentration must be reduced to 2,595 µg/L benzene. The contour is an estimate of where concentrations currently exceed 2,595 µg/L. All wells need to meet the primary area SSTL, even if a specific high risk SSTL is not shown for a well.

In addition to all wells meeting the primary source SSTL for a chemical, some wells will have high risk SSTLs specific to the well (i.e., MW-1, MW-2, MW-3, MW-6, MW-9, MW-10, MW-12). All wells need to meet the lower of the well-specific SSTL or the primary area SSTL (the SSTL for the source well). For example, MW-10 has a well-specific SSTL of 836 µg/L for benzene (MW-10 is a G well for a number of receptors).

If the measured concentration at a well is greater than the well-specific SSTL, the SSTL concentration is underlined on the plot (i.e., MW-1, MW-2).

To print the “Groundwater High Risk Corrective Action Map” use the “Print” button. The map can be sent directly to a printer or exported as a DXF file.

Click “OK/Back”. Set the “Chemical” to “Toluene”. Click the “Plot” button. The wells are shown with their measured concentrations, but there are no SSTL values shown and no primary area contoured. This is because no receptors are high risk for toluene (“Receptor Summary”). However, there are low risk receptors for toluene and wells that need to be monitored, as shown in the “Groundwater Source Groundwater Monitoring Plan”.

Click “OK/Back” until you return to the “Main Form”. Click the “Save” button on the “Main Form” to update the example problem data file.

12. SOIL LEACHING PATHWAY EVALUATION

Soil leaching is concerned with the potential for existing soil contamination to produce future groundwater contamination problems. The modeling involves two steps: 1) the soil leaching model uses existing soil contamination to
simulate (model) the potential future groundwater concentration beneath a soil source. 2) The simulated groundwater concentration beneath the soil source is used as the groundwater source concentration in the groundwater transport model. The simulations are an estimation of the groundwater concentrations which could occur in the future, as a result of current soil contamination. Soil source site- specific target levels or soil source SSTLs are soil source concentrations we are reasonably confident will not result in groundwater concentrations exceeding groundwater target levels at a receptor in the future (according to the modeling). The soil source SSTLs are the soil target levels for the “Soil Leaching” pathway.

The “Groundwater Source” and “Soil Leaching” pathways are both concerned with meeting groundwater target levels at receptors. The “Groundwater Source” pathway is concerned with existing groundwater contamination and produces groundwater cleanup levels (groundwater SSTLs). The “Soil Leaching” pathway is concerned with existing soil contamination becoming groundwater contamination in the future and produces soil cleanup levels (soil SSTLs or soil leaching SSTLs). Hence, a receptor can have groundwater SSTLs that measured groundwater concentrations need to meet, and soil SSTLs that measured soil concentrations need to meet. Both are based on meeting the same groundwater target levels at a receptor.

Prior to doing “Soil Leaching Pathway Evaluation”, you need to have identified and entered all receptors. The “Receptor Types” you need to evaluate for the soil leaching pathway are shown in the “Preliminary Pathway Evaluation Requirements” under “Soil Leaching Pathways”. The “Soil Leaching: Receptor Identification Plumes” are generated using the “Soil Leaching” button in the “Receptor ID” frame on the “Main Form”.

Click the “Soil Leaching” button in the “Pathway Evaluation” frame to activate the “Soil Leaching Pathway Evaluation” form. Some time may be required for the software to do background calculations before the form is shown. Select “Yes” for “Include Preliminary Pathway Evaluation results in analysis” (see Section 10.1 for more information).

### 12.1 Soil Leaching, Monitoring Well Selection

The “groundwater concentration in the vicinity of the soil source” is a factor in risk classification and reclassification during site monitoring of potential receptors for the soil leaching pathway (Chapter 135, Subrules 135.12(2)c and 135.12(4)c; Tier 2 Guidance, Sections 3.2, 3.2.5, 5.4.6, and 5.4.7).

You must first determine whether you need to do “monitoring well selection in the vicinity of the soil source(s)”. A common error in Tier 2 SCRs is neglecting to do monitoring well selection, when it is required.

Use the “Preliminary Pathway Evaluation Requirements” (Table 1) for the “Soil Leaching Pathways” to determine the chemicals for which you need to do monitoring well selection. Check the “Protected Groundwater Source-PGWS”, “Confined Space Residential-CSR”, “Confined Space Nonresidential-CSNR”, “Sanitary Sewer Residential-SSR” and “Sanitary Sewer Nonresidential-SSNR” receptor types under “Soil Leaching Pathways”. If a chemical has an “X” for any of these receptor types, you need to do monitoring well selection for that chemical. For our example problem, we need to do monitoring well selection for benzene and ethylbenzene.

Click the “MW Selection” button on the “Soil Leaching Pathway Evaluation” form to activate the “Soil Leaching, Monitoring Well Selection in Vicinity of Soil Source(s)” form.

Select “Benzene” as the “Chemical”. Click the “Interpolation Range” button. The ranges for both the soil and groundwater data are shown. Set the interpolation range to:

<table>
<thead>
<tr>
<th>Minimum X (ft)</th>
<th>Maximum X (ft)</th>
<th>X Grid Spacing (ft)</th>
<th>Minimum Y (ft)</th>
<th>Maximum Y (ft)</th>
<th>Y Grid Spacing (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-50</td>
<td>100</td>
<td>5</td>
<td>0</td>
<td>200</td>
<td>5</td>
</tr>
</tbody>
</table>

Click “Plot”.
The software contours the soil data to the Tier 1 levels for soil leaching to groundwater (red contour, 0.54 mg/kg for benzene) and this defines the vicinity of the soil source for benzene. The software also plots the groundwater data to the Tier 1 levels for protected groundwater source (blue contour, 290 µg/L for benzene). The location of a monitoring well is shown with a black circle. The location of a soil sample is shown with a blue circle. The soil source location for the chemical is shown with an “S”. You can select “Yes” for “Plot BH Labels” to show the soil sample labels. The soil sample labels are blue.

You are required to identify the groundwater monitoring well locations lying on or within the soil contour (red contour). The blue groundwater data contour is for information only, but is not used to define the area of concern. Only the red soil data contour is used to determine groundwater monitoring wells in the vicinity of the soil source.

To make it easier to select the groundwater monitoring well locations, set “Plot BH Labels” to “No”. The labels for soil sample locations will be cleared, leaving only the labels for groundwater monitoring well locations. Select the monitoring wells on or within the red contour (click on the well label with the left mouse button). A selected well has a red label. A non-selected well has a black label. Clicking the well label will toggle black/red.

For our example problem, select MW-1, MW-2, MW-3, and MW-7 (all fall in or on the red soil contour). Click MW-1, MW-2, MW-3 and MW-7 to red (already done for the example problem). All other monitoring well labels should be black.

Click “OK/Back”.

Select “Ethylbenzene” as the “Chemical”. Click “Plot”. The soil contour concentration is the Tier 1 level for soil leaching to groundwater (15 mg/kg). MW-1 and MW-2 fall on or within the red contour line. Click the labels for MW-1 and MW-2 to red. The labels for all other groundwater monitoring wells should be black.

Click “OK/Back”.

Select “Toluene” as the “Chemical”. Click “Plot”. No contour is plotted. In the upper left corner of the plot, you see “Soil:S<=TL”. This means the soil source concentration is less than the Tier 1 target level for soil leaching to groundwater. This also means you are not required to evaluate this chemical for soil leaching, as indicated in the “Preliminary Pathway Evaluation Requirements” for “Soil Leaching Pathways” and you do not need to do monitoring well selection for the chemical.

We are done with groundwater monitoring well selection for our example problem. Click “OK/Back” until you return to the “Soil Leaching Pathway Evaluation” form.

### 12.2 Soil Sample (BH) Zoning

To help simplify the monitoring and risk classification process for potential receptors, residential and nonresidential receptors are combined. Potential confined space residential and nonresidential receptors are monitored and evaluated as a group. Potential sanitary sewer residential and nonresidential receptors are monitored and evaluated as a group. To combine residential and nonresidential receptors the software needs to know the zoning at soil sample locations.

Use the “Preliminary Pathway Evaluation Requirements” to determine if soil sample zoning is required. Examine the vapor receptors under “Soil Leaching Pathways”: “Confined Space Residential-CSR”, “Confined Space Nonresidential-CSNR”, “Sanitary Sewer Residential-SSR” and “Sanitary Sewer Nonresidential-SSNR”. You should do soil sample zoning if any chemical has an “X” for any of these receptor types. Soil sample zoning is not chemical-specific. If you do soil sample zoning and it is not required for your site, no harm will be done.

We need to do soil sample zoning for our example problem. Click the “BH Zoning” button in the “Potential Vapor Receptors” frame to the “Soil Leaching, Potential Vapor Receptors, Soil Source Zoning” form.
You need to tell the software the zoning at each soil sample location. You set the zoning at a location by clicking the label for the location. Black is no zoning (treated as residential for risk classification), red is nonresidential (an NR is added to the label), and blue is residential (an R is added to the label). As you click a label (using the left mouse button), the label will toggle from black to red to blue.

Note: The label for the sample location at the bottom of the screen is “B7 B8”. That is because these samples are within 5 feet of each other and are assigned to represent one location.

The zoning to use is the zoning at the physical location of the soil sample.

For our example, the soil sample locations are all on land zoned nonresidential. Set all the labels to red. Click “OK/Back” when you are done.

12.3 Soil Leaching, SSTL Tables for Actual Receptors

To view the risk classification and SSTL results for actual receptors click the “Actual Receptors” button in the “SSTL Tables” frame to activate the “Soil Leaching, Actual Receptors, SSTL Tables” form. The results are displayed by “Receptor Type”.

The first four rows of the grid are the same for all receptor types:

- **Soil Source (mg/kg)** - The soil source, or maximum soil concentration for a chemical. Determined by the software from the Tier 2 soil sample data. Additional information for the soil source can be viewed using the “Sources” button on the “Main Form”.

- **Simulated GW at Soil Source (µg/L)** - The simulated groundwater concentration beneath the soil source. Computed using the soil source concentration and the soil leaching model. The source width (Sw) used for the soil leaching model is the larger of the groundwater and soil source width. The source length (W) is the larger of the groundwater and soil source length. For benzene, the soil leaching model estimates a soil concentration of 25 mg/kg will produce a groundwater concentration of 12,361 µg/L.

- **SL Monitoring Well** - Used to monitor soil leaching in the vicinity of the soil source. Selected by the software from the monitoring well locations you identified as being in the vicinity of the soil source. The software selects the well with the highest measured concentration for the chemical. It is possible different wells could be used to monitor different chemicals. For our example, we only needed to select monitoring wells for benzene and ethylbenzene, so no monitoring well is shown for the other chemicals.

- **Monitoring Well Conc. (µg/L)** - The groundwater concentration for the soil leaching monitoring well (maximum of two most recent or most recent if steady and declining).

For the receptor type selected, the grid shows information for each of the receptors of that type you have entered into the software.

Select “NDWW” to view the results for non-drinking water wells. For our example, there is one non-drinking water well receptor.

For each receptor of a type, the grid shows:

- The short label and description you entered to identify the receptor.
- **Risk** - The risk classification for each chemical. If the risk classification is N, a reason is identified. The top grid in the form contains a legend for the risk classification symbols.
• **Soil SSTL at Soil Source (mg/kg)** - This is the soil concentration needed at the soil source (according to the simulation models) in order to meet the groundwater target level at the receptor: This is the soil remediation target level. The value is determined by solving the simulation models “backwards”. The groundwater transport model is used to determine the groundwater concentration at the soil source needed to meet the groundwater target level at the receptor (GW SSTL at Soil Source). The soil leaching model is used to calculate the soil source concentration that would produce the groundwater concentration at the soil source.

• **GW SSTL at Soil Source (µg/L)** - The groundwater concentration beneath the soil source the software has determined is needed to meet the groundwater target level at the receptor. This value is not used for evaluating actual receptors. This value is compared to the monitoring well concentration in the vicinity of the soil source to determine the risk classification for protected groundwater source, and for monitoring of low risk potential receptors at the SMR stage.

• **GW TL at Receptor (µg/L)** - The risk-based groundwater target level at the receptor. This is set or determined by the software. For example, for actual vapor receptors, a receptor-specific target level is computed that incorporates the depth to groundwater entered for the receptor.

• **Simulated GW at Receptor (µg/L)** - The simulated groundwater concentration at the receptor, using the soil leaching and groundwater transport models. This is the concentration the models predict might occur at the receptor in the future; based on the current soil source concentration, source width, source length, hydraulic conductivity, etc.

In some situations, values are not shown for “Soil SSTL at Soil Source”, “GW SSTL as Soil Source”, or “Simulate GW at Receptor”. This occurs when the values are not needed for risk classification. For example, consider the ethylbenzene (E) result for NDWW-1. The simulated groundwater concentration at the receptor under current conditions (Simulated GW at Receptor) of 1,197 µg/L is less than target level at the receptor (3,700 µg/L). No SSTL levels are computed. For toluene (T), the simulated groundwater concentration beneath the soil source (5,533 µg/L) is less than the target level at the receptor (7,300 µg/L).

Let us examine in more detail the benzene (B) results for “NDWW-1, Bib Villa”. The soil source concentration is 25 mg/kg (Soil Source). The soil leaching model estimates a groundwater concentration beneath the source location of 12,361 µg/L (Simulated GW at Soil Source). Using this as the source concentration, the groundwater transport model predicts a concentration at the receptor of 1,771 µg/L (Simulated GW at Receptor). The risk-based target level (the level we do not want to exceed) at the receptor is 290 µg/L (GW TL at Receptor). If the predicted groundwater concentration at the receptor (Simulated GW at Receptor) is greater than the target level at the receptor (GW TL at Receptor), the risk classification (Risk) for an actual receptor is high (H). The non-drinking water well, NDWW-1, is high risk for benzene. If a receptor is high risk, the site-specific target levels (SSTLs) need to be computed. These are the concentrations, according to the modeling, required to meet the target level at the receptor. As mentioned above, the SSTLs are found by essentially solving the models in reverse. To meet 290 µg/L at the receptor, the groundwater transport model finds a groundwater concentration of 2,024 µg/L is needed at the soil source (GW SSTL at Soil Source). To meet this groundwater concentration, the soil leaching model estimates a soil source concentration of 4.09 mg/kg is required (Soil SSTL at Soil Source). An actual receptor is high risk if the soil source concentration (Soil Source) is higher than the soil source SSTL for the receptor (Soil SSTL at Soil Source). The Soil SSTL at Soil Source is the action level for the receptor-chemical. To clear this receptor (NDWW-1) by soil corrective action (achieve a reclassification of no action required), the maximum soil concentration for benzene must be reduced to 4.09 mg/kg.

To print the “SSTL” Tables for soil leaching, use the “Print” button on the “Soil Leaching Pathway Evaluation” form.

If you wish, you can view the results for other actual receptors by changing the “Receptor Type” selection. **Vapor**

**Sampling and Actual Vapor Receptors**

For soil leaching, vapor receptors can be cleared by passing vapor sampling at the soil source. Actual vapor receptors for soil leaching can be cleared by vapor at an alternative point of compliance, if steady and declining conditions for
groundwater can be demonstrated. See the Tier 2 Guidance and Groundwater Professional Bulletin Board (http://www.iowadnr.gov/InsideDNR/RegulatoryLand/UndergroundStorage Tanks/GroundwaterProfessionals/GWP Bulletin) for more information on the use of soil gas sampling to evaluate vapor receptors for soil leaching.

Click “OK/Back” to return to the “Soil Leaching Pathway Evaluation” form.

12.4 Soil Leaching, Protected Groundwater Source, Risk Classification and SSTL Table

To view the risk classification and SSTL Table for protected groundwater source, click the “PGWS” button in the “SSTL Tables” frame to activate the “Soil Leaching, Protected Groundwater Source, Risk Classification and SSTL Table” form.

Protected groundwater source is a potential receptor. The only situation in which a potential receptor can be high risk is the protected groundwater source receptor under soil leaching. In all other situations, potential receptors can only be low risk or no action required. For example, protected groundwater source cannot be high risk under “Groundwater Source”. Potential confined space and potential sanitary sewer receptors are never high risk (although actual confined space and actual sanitary sewer receptors can be high risk).

The first four rows are a summary of the soil source data (the same as the actual receptor SSTL Tables, see the previous section for a detailed discussion).

The results for two cases are shown:

- First case - The case of no institutional control (NO I.C.). The soil source SSTLs are based on having to meet the receptor groundwater target levels at all locations. They are also computed assuming the groundwater target levels must be met directly below the soil sources.

- Second case - The case of an institutional control (I.C.). In practice, this is implemented by computing the SSTLs using only the protected groundwater source receptors you have entered into the software. That is, you do not need to meet the groundwater target level directly beneath the soil source, but only at the receptors you entered.

The major results are summarized under two headers in the grid, “SUMMARY-NO I.C.” and “SUMMARY- I.C., ML Receptor”.

SUMMARY-NO I.C.: The case of no institutional control. You need to meet the groundwater target levels everywhere. The soil SSTLs are computed assuming you must meet the groundwater target levels directly beneath the soil sources.

The three rows directly beneath “SUMMARY-NO I.C.” give the detailed results:

- “GW SSTL at Soil Source (µg/L)” - The groundwater target level for the receptor type. For the case of no institutional control, the target level for the receptor type.

- “Soil SSTL at Soil Source (mg/kg)” - The soil concentration (according to the soil leaching model) that would result in the groundwater concentration shown by “GW SSTL at Soil Source”.

- Risk Classification - The risk classification for the chemical. The grid at the top of the form has a legend for the risk classification symbols.

For our example problem, for benzene, the target level 290 µg/L must the met directly beneath the soil source (GW SSTL at Soil Source). With a soil concentration of 25 mg/kg, the soil leaching model predicts a groundwater concentration directly beneath the soil source of 12,361 µg/L (Simulated GW at Soil Source).

According to the soil leaching model, a soil concentration of 0.59 mg/kg (Soil SSTL at Soil Source) will result in a groundwater concentration of 290 µg/L. When the “Soil SSTL at Soil Source” is less than the “Soil Source” concentration,
the risk classification is either low or high (the conditions for high risk are discussed shortly).

The soil SSTL can be computed by multiplying the soil source concentration by the ratio of the groundwater target level to the simulated groundwater concentration beneath the soil source (25*(290/12,361)).

For our example problem, for toluene, for a soil source concentration of 35 mg/kg the simulated groundwater concentration beneath the soil source is 5,533 µg/L (Simulated GW at Soil Source). This concentration is less than the target level for the receptor (7,300 µg/L). The receptor is no action required (N), and no further computations are done. The soil SSTL at the soil source is not computed. If it were computed for this situation, the soil SSTL would be higher than the soil source concentration.

For our example problem, for ethylbenzene, the target level of 3,700 µg/L must be met directly beneath the soil source location (GW SSTL at Soil Source). With a soil source concentration of 30 mg/kg, the soil leaching model predicts a groundwater concentration directly beneath the soil source of 6,504 µg/L (Simulated GW at Soil Source). According to the soil leaching model, a soil concentration of 17 mg/kg (Soil SSTL at Soil Source) is required to meet the groundwater target level of 3,700 µg/L. The soil SSTL is less than the soil source concentration. The receptor is low or high risk for the chemical (the reason it is low risk is discussed shortly).

SUMMARY-IC, ML Receptor: The case of an assumed institutional control covering the soil source. The soil SSTLs needed to meet the groundwater target levels are computed using only the receptors you have entered into the software. The software then finds the most restrictive receptor for each chemical: the receptor having the lowest SSTL at the soil source. The results for the most limiting receptor (ML Receptor) are shown in the four rows beneath “SUMMARY-IC, ML Receptor”.

- ML Receptor - The most limiting receptor. Of the receptors you entered, the receptor with the lowest soil SSTL at the soil source. The computations and results for each receptor are shown following “RESULTS FOR PGWS RECEPTORS”.

- GW SSTL at Soil Source (µg/L) - This is the groundwater concentration beneath the soil source required to meet the groundwater target level at the most limiting receptor, according to the groundwater transport model.

- Soil SSTL at Soil Source (mg/kg) - The soil concentration that would produce the “GW SSTL at Soil Source”, according to the soil leaching transport model. The soil concentration at the soil source that would produce the groundwater target level at the most limiting receptor (according to the modeling). If the current “Soil Source” concentration is greater than the “Soil SSTL at Soil Source”, then the receptor is low or high risk.

- Risk Classification - The risk classification for the chemical. The grid at the top of the form has a legend for the risk classification symbols.

High Risk Classification Criteria

The protected groundwater source receptor (PWGS) for the “Soil Leaching” pathway is the only situation where a potential receptor can be high risk (H). The risk classification is a two-step process. If the “Soil SSTL at Soil Source” concentration is less than the “Soil Source” concentration, the receptor is either low (L) or high (H) risk for the chemical. If the receptor is either low or high risk for a chemical, the receptor is high risk if: The measured groundwater concentration in the vicinity of the soil source (Monitoring Well Conc.) is greater than the groundwater site-specific target level at the soil source (GW SSTL at Soil Source). If the receptor is not high risk, it is low risk. Or, if the measured groundwater concentration in the vicinity of the soil source (Monitoring Well Conc.) does not exceed (≤) the groundwater site-specific target level at the soil source (GW SSTL at Soil Source), the receptor is low risk.

At Tier 2, the purpose of selecting groundwater wells in the vicinity of the soil source (“MW Selection” in the “Soil Leaching Pathway Evaluation” form) is to determine the risk classification for protected groundwater source under soil leaching. The monitoring well in the vicinity of the soil source may also be used after completion of the Tier 2 SCR, as
part of reclassification of potential receptors during site monitoring.

If for “Risk Classification” you see “L or H”, this means the soil SSTL at the soil source is less than the soil source concentration, but you either have not selected groundwater monitoring wells in the vicinity of the soil source or do not have any. In this situation, you will see there is no “SL Monitoring Well” or “Monitoring Well Conc.” shown for the chemical. Without a “SL Monitoring Well”, the software cannot determine if the risk classification is L or H. If you see “L or H” listed as the risk classification for a chemical, you need to do monitoring well selection in the vicinity of the soil source.

For our example problem, the most limiting receptor is PGWS-4. Scroll down in the grid until you see the specific results for this receptor, “Receptor: pgws-4”.

For benzene, the groundwater target level at receptor pgws-4 is 290 µg/L (GW TL at Receptor). With the current soil source concentration of 25 mg/kg, the modeled groundwater concentration at the receptor is 3,875 µg/L (Simulated GW at Receptor). This is higher than the target level at the receptor, so the receptor will be low or high risk. To meet the target level of 290 µg/L at the receptor, the groundwater concentration beneath the soil source needs to be 925 µg/L (GW SSTL at Soil Source). To achieve 925 µg/L in the groundwater beneath the soil source requires a soil source concentration of 1.87 mg/kg (Soil SSTL at Soil Source). In short, the modeling predicts a soil source concentration of 1.87 mg/kg will result in a concentration of 290 µg/L at the receptor. If the soil SSTL at the soil source is less than the current soil source concentration, the receptor is low or high risk. The receptor is high risk because the groundwater concentration for the monitoring well in the vicinity of the soil source (Monitoring Well Conc.: 20,000 µg/L) exceeds the groundwater SSTL concentration beneath the soil source (GW SSTL at Soil Source: 925 µg/L).

Scroll up in the grid to “SUMMARY- NO I.C.”. Consider the results for ethylbenzene (E). The risk is low (L) because the groundwater concentration for the monitoring well in the vicinity of the soil source (Monitoring Well Conc.: 3,600 µg/L) does not exceed the groundwater SSTL concentration beneath the soil source (GW SSTL at Soil Source: 3,700 µg/L).

The soil SSTL Tables can be printed using the “Print” button on the “Soil Leaching Pathway Evaluation” form.

Click “OK/Back” to return to the “Soil Leaching Pathway Evaluation” form.

12.5 Soil Leaching, Potential Confined Space, Risk Classification and SSTL Table

To view the risk classification and SSTL table for potential confined space, click the “PCS” button in the “SSTL Tables” frame. This will activate the “Soil Leaching, Potential Confined Space, Risk Classification and SSTL Table” form. This form displays the results for potential confined space under soil leaching. The residential and nonresidential Potential confined space receptors you have entered are combined and evaluated as a group. The risk classification for potential confined space is never high risk (H).

The first four rows summarize the soil source information. The details have been covered under actual receptors and protected groundwater source. See Sections 12.3 and 12.4 for details. The monitoring well in the vicinity of the soil source is (SL monitoring well) not used for risk classification for potential confined space at Tier 2. However, it is used for reclassification of risk in the site monitoring report (SMR) phase.

The results are presented for two situations: the results with no institutional control (SUMMARY-NO I.C.) and the results with an assumed institutional control (SUMMARY-I.C., ML Receptor). The major difference from protected groundwater source is while the target levels are fixed for protected groundwater source, the target levels for potential confined space are variable because they are computed using a receptor-specific depth to groundwater and because we are combining residential and nonresidential receptors.

SOIL SOURCE AS RECEPTOR: The results under this heading assume the point of exposure is the soil source, and reflect the zoning for the source location. The software, based on the zoning and the shallowest depth to groundwater, computes the groundwater target level at the soil source. The deeper it is to groundwater the higher the target level will
be. The shallowest depth to groundwater used for the calculation can be viewed using the “Plastic Water Line” button in the “Questions” frame on the “Main Form”. It is the depth to groundwater determined by the software from the groundwater sample data. For our example problem the depth is 14.22 feet. This is why the target level (5,195 µg/L) is slightly higher than the default minimum target level for confined space nonresidential (4,780 µg/L). The zoning specified for the soil source location is shown in the third row of the grid (Zoning). If the zoning at the benzene soil source for our example were residential, the groundwater target level would be 1,676 µg/L.

To meet the groundwater target level beneath the soil source (GW TL at Soil Source), the soil leaching model estimates the soil source concentration should be 11 mg/kg (Soil SSTL at Soil Source). In order words, according to the soil leaching model a soil source concentration of 11 mg/kg would result in a groundwater concentration of 5,195 µg/L directly beneath the soil source. If the soil SSTL at the soil source (11 mg/kg) is less than the current soil source concentration (25 mg/kg), the risk classification is low (L).

If the soil SSTL is greater the soil source concentration, the risk classification is no action required (N). In this case the soil SSTL is not shown. For example, consider the result for toluene (T) for “SOIL SOURCE AS RECEPTOR”. The groundwater target level beneath the soil source is 56,876 µg/L. With a soil source concentration of 35 mg/kg for toluene, the simulated groundwater concentration beneath the soil source is 5,533 µg/L (Simulated GW at Soil Source, second row). This is less than the groundwater target level of 56,876 µg/L, the risk classification is N, and the soil source SSTL is not computed.

RESULTS FOR PCS RECEPTORS: Following this heading are the results for each of the potential confined space residential (PCSR) and potential confined space nonresidential (PCSNR) receptors you have entered. The same type of information is shown for each receptor.

We will examine the results for benzene for the first receptor shown, PCSR-1, a potential confined space residential receptor. The groundwater target level at the receptor is 1,670 µg/L (GW TL at Receptor). The software, using the groundwater vapor to enclosed space model and the zoning and depth to groundwater for the receptor, computes the groundwater target level. The minimum possible target level is 1,540 µg/L (the Tier 1 level). Using the current source concentration of 25 mg/kg, the modeling predicts the groundwater concentration at the receptor could be 2,423 µg/L (Simulated GW at Receptor). If the simulated groundwater concentration at the receptor is greater than the groundwater target level at the receptor, the risk classification is low risk. The next step is to compute the soil source concentration which will meet the groundwater target level at the receptor. For our example, this is 17 mg/kg (Soil SSTL at Soil Source). The model predicts this will result in a groundwater concentration of 8,518 µg/L beneath the soil source (GW SSTL at Soil Source), and a simulated groundwater concentration of 1,670 µg/L at the receptor (GW TL at Receptor). If the soil SSTL at the soil source is less than the current soil source concentration (which will be the case if the simulated groundwater concentration at the receptor is greater than the groundwater target level at the receptor), the receptor is low risk for the chemical.

SUMMARY-I.C., ML Receptor: The results under this header represent the effect of an assumed institutional control. In practice, this is accomplished by computing the SSTLs using only the potential confined space receptors (residential and nonresidential) you have entered into the software. It is equivalent to assuming all the area between (and including) the sources and the receptors you have input is either covered by an institutional control, does not fall into the receptor identification plumes (residential or nonresidential), or is not a possible location for a receptor (i.e., road or public right-of-way).

After computing the results for all the potential confined receptors, the software finds the most-limiting (ML) receptor, defined as the receptor having the lowest soil source SSTL. The results for the most limiting receptor are summarized in the four rows following “SUMMARY-I.C., ML Receptor”. Detailed results for the most limiting receptor are shown under “RESULTS FOR PCS RECEPTORS”.

- “ML Receptor” - For our example, the most limiting receptor (the receptor with the lowest soil SSTL) for benzene is PCSR-1. If no receptors have been entered or all the risk classifications are N for a chemical, there is no most limiting receptor and “None” is shown.
“Soil SSTL at Soil Source” - For all potential confined space receptors you have entered which are low risk, the lowest soil SSTL at the soil source. For our example, the lowest soil SSTL for benzene is 17 mg/kg. If the soil SSTL at the soil source is less than the current soil concentration, the risk classification is low.

“GW SSTL at Soil Source” - From among the potential confined space receptors you have entered which are low risk, the lowest groundwater concentration beneath the soil source. This concentration is not used as part of the risk classification for potential confined space for Tier 2.

“Risk Classification” - The risk classification for the most limiting receptor.

SUMMARY-NO I.C.: The three rows following this header represent the results with no institutional control. That is, it assumes you have to meet the groundwater target levels directly beneath the soil source locations and at all potential confined space receptors you have entered into the software.

The results shown here are actually simply a copy of the most restrictive of the results shown under “SOIL SOURCE AS RECEPTOR” and “SUMMARY-I.C., ML Receptor”. Because we are combining residential and nonresidential zoning, the lowest soil SSTL may not always result from exposure at the soil source. For example, if the source location is zoned nonresidential, the lowest soil SSTL at the soil source could be from an off-site residential receptor.

To print the SSTL Table for soil leaching for potential confined space, click the “Print” button on the “Soil Leaching Pathway Evaluation” form.

Click “OK/Back” to return to the “Soil Leaching Pathway Evaluation” form.

12.6 Soil Leaching, Potential Sanitary Sewer, Risk Classification and SSTL Table

The potential sanitary sewer receptors (residential and nonresidential) you have entered into the software are monitored and evaluated together. Click the “PSS” in the “SSTL Tables” frame on the “Soil Leaching Pathway Evaluation” form. This will activate the “Soil Leaching, Potential Sanitary Sewer, Risk Classification and SSTL Table” form. The risk classification for a potential sanitary sewer is never high (H).

The first four rows summarize the soil source information. The details have been covered under actual receptors and protected groundwater source. See Sections 12.3 and 12.4 for details. The monitoring well in the vicinity of the soil source (SL monitoring well) is not used for risk classification for potential sanitary sewer at Tier 2. It is used for risk reclassification in the site monitoring report (SMR) phase.

The results for two cases are presented: the results with no institutional control (SUMMARY-NO I.C.) and the results with an assumed institutional control (SUMMARY-I.C., ML Receptor). The major difference from protected groundwater source is the target levels are fixed for protected groundwater source, while the target levels for potential sanitary sewer receptors are variable. They are computed by the software using a receptor-specific depth to groundwater and zoning (residential or nonresidential).

SOIL SOURCE AS RECEPTOR: The results under this heading assume the point of exposure is the only the soil source. The target level at the soil source is computed, based on the zoning and on the shallowest depth to groundwater. The shallowest depth to groundwater used for the calculation can be viewed using the “Plastic Water Line” button in the “Questions” frame on the “Main Form”. For our example problem, the depth is 14.22 feet. This is why the target level (10,390 µg/L) is slightly higher than the default minimum target level for sanitary sewer nonresidential (9,550 µg/L). The greater the depth to groundwater, the higher the target level. The zoning for the soil source is shown in the third row of the grid (Zoning). If the zoning at the benzene soil source were residential, the groundwater target level for our example would be 3,353 µg/L.

The soil leaching model estimates a soil source concentration of 21 mg/kg (Soil SSTL at Source Source) would result in
the groundwater target level beneath the soil source (GW TL at Soil Source) of 10,390 µg/L. If the soil SSTL at the soil source (21 mg/kg) is less than the current soil source concentration (25 mg/kg), the risk classification is low (L).

If the soil SSTL is greater than the soil source concentration, the risk classification is no action required (N). If this occurs, the soil SSTL is not shown. For example, consider toluene (T). The groundwater target level beneath the soil source is 113,752 µg/L. With a concentration of 35 mg/kg toluene, the simulated groundwater concentration beneath the soil source is 5,533 µg/L (Simulated GW at Soil Source, second row). This is less than the groundwater target level of 113,752 µg/L, the risk classification is N, and the soil source SSTL is not computed.

RESULTS FOR PSS RECEPTORS: The rows following this header contain the results for each of the potential sanitary sewer receptors (residential and nonresidential) you have entered into the software. The same type of information is shown for each receptor.

We will examine the results for benzene for the third receptor shown, PSSNR-1, a potential sanitary sewer nonresidential receptor. The groundwater target level at the receptor is 10,347 µg/L (GW TL at Receptor). This was computed determined using the groundwater vapor to enclosed space model, the zoning and depth to groundwater for the receptor. The minimum possible target level is 9,550 µg/L. Using the current source concentration of 25 mg/kg, the modeling predicts the groundwater concentration at the receptor would be 11,531 µg/L (Simulated GW at Receptor). If the simulated groundwater concentration at the receptor is greater than the groundwater target level at the receptor, the risk classification is low. The next step is to compute the soil source concentration required to meet the groundwater target level at the receptor. For our example, this is 22 mg/kg (Soil SSTL at Soil Source). The model predicts this will result in a groundwater concentration of 11,092 µg/L beneath the soil source (GW SSTL at Soil Source), and a simulated groundwater concentration of 10,347 µg/L at the receptor (GW TL at Receptor). If the soil SSTL at soil source is less than the soil source concentration for a chemical (which will be the case if the simulated groundwater concentration at the receptor is greater than the groundwater target level at the receptor), the receptor is low risk.

SUMMARY-I.C., ML Receptor: The results represent the effect of an assumed institutional control. In practice, the soil SSTLs are computed using only the potential sanitary sewer receptors (residential and nonresidential) you have entered into the software. It is equivalent to assuming the areas between (and including) the sources and the receptors you have input are either covered by an institutional control, do not fall into the receptor identification plumes (residential or nonresidential), or are not possible locations for potential sanitary sewers (i.e., roads).

The software finds the most-limiting (ML) receptor, as defined by the receptor with the lowest soil source SSTL. The results for the most limiting receptor are shown in the four rows following the “SUMMARY-I.C., ML Receptor” heading. The detailed results for the most limiting receptor are shown under “RESULTS FOR PSS RECEPTORS”.

• “ML Receptor” - The label for the most limiting receptor. For our example, the most limiting receptor for benzene is PSSNR-1. If no receptors have been entered or all the risk classifications are N for a chemical, there is no most limiting receptor and “None” is shown.

• “Soil SSTL at Soil Source” - For the potential sanitary sewer receptors entered into the software, the lowest soil SSTL at the soil source. For our example, the lowest soil SSTL for benzene is 22 mg/kg. If the soil SSTL at the soil source is less than the soil source concentration, the risk classification is low.

• “GW SSTL at Soil Source” - From among the potential sanitary sewer receptors you have entered that are low risk, the lowest computed groundwater concentration beneath the soil source. This concentration is not used as part of the risk classification for potential sanitary sewers at Tier 2.

• “Risk Classification” - The risk classification for the most limiting receptor.

SUMMARY-NO I.C.: The three rows beneath this header are the results with no institutional control. It is assumed you have to meet the groundwater target levels directly beneath the soil source locations and at all the potential sanitary sewer receptors you have entered into the software. The results shown here are actually simply copies of the most
restrictive of the results shown under “SOIL SOURCE AS RECEPTOR” and “SUMMARY-I.C., ML Receptor”. Because we are combining residential and nonresidential zoning, the lowest soil SSTL may not always result from exposure at the soil source. For example, if the source location is zoned nonresidential, the lowest soil SSTL could be from an off-site residential sanitary sewer receptor.

To print the Risk Classification and SSTL Table for soil leaching for potential sanitary sewer, use the “Print” button on the “Soil Leaching Pathway Evaluation” form.

Click “OK/Back” to return to the “Soil Leaching Pathway Evaluation” form.

12.7 Soil Leaching, Receptor Summary

The Tier 2 Soil Leaching Receptor Summary is a summary of the receptor risk classifications. Click the “Receptor Summary” button in the “Actual and Potential” frame. This will activate the “Soil Leaching, Tier 2 Receptor Summary” form. There are three grids on this form. The top grid shows a legend for the risk classification symbols. The second grid is the receptor risk classification summary. The third, or bottom grid, is a legend of corrective actions.

The software determines the risk classification results shown in the chemical columns. The results take into account the “Preliminary Pathway Evaluation Results” (assuming you answered Yes for “Include Preliminary Pathway Evaluation Results in analysis) and the modeling done to evaluate risk (i.e., comparing soil SSTLs at the soil sources to the current soil concentrations at the soil sources). The results are valid if you have correctly completed the previous steps (generated soil leaching receptor identification plumes, identified and entered receptors, selected monitoring well in the vicinity of the soil source for each chemical, if required, specified the zoning for soil sampling location, etc.).

The risk classifications are the same as those shown in the SSTL Tables. The SSTL Tables show detailed results and calculations. The Receptor Summary simply lists the risk classifications.

The results for the actual receptors (types DWW, NDWW, PWL, ACSR, ACSNR, ASSR, ASSNR, and SWB) you have entered into the software are listed first, with one row for each actual receptor.

The last six rows of the table are always the potential receptor types. The potential receptor types are protected groundwater source (PGWS), potential confined space (PCS), and potential sanitary sewer (PSS). Two rows are shown for each potential receptor type, the case with no institutional control (No-IC in the Receptor column) and the case with an assumed institutional control (IC in the Receptor column). The individual potential receptors you entered into the software are not listed in the Receptor Summary Table, although they are listed and printed as part of the SSTL Table for the receptor type.

Your task in this form is to set, as needed, the last four columns in the form: “C”, “Corrective Action(s) Completed”, “Current Risk”, and “To Tier 3”:

- **“C” column** - The confirmation sampling completed column. If confirmation sampling has been completed for a receptor or receptor type, set the value to “YES”. The column has only two settings: “YES” or “NO”. To change the setting, select a row in the column (you can click on it with the left mouse button), then press the space bar. This will toggle the setting between “YES” and “NO”. You can also press “Y” or “N”.


- **“Corrective Action(s) Completed” column** - You use this column to specify the corrective action(s) you have completed for a receptor. This column simply accepts text input. The third, or bottom grid, in the form is a legend for corrective actions (you can scroll the grid). You identify a corrective action by a number. For example, if you have
plugged a non-drinking water well, you would enter a 2. It is possible you may have performed multiple corrective actions. In that case, separate the corrective actions with a comma (i.e., 6,7).

- “Current Risk” column - This is an important column. The values affect the Soil Leaching High Risk Corrective Action Map, the Groundwater/Soil Leaching Monitoring Plan, and the receptors carried over from Tier 2 when you move to Site Monitoring Report (SMR). The column reflects the “Current Risk” for the receptor as a whole. **The software does not set the current risk column. You must set the current risk column.** The current risk column has already been set for the example problem.

The column can have four values: empty (blank), N, L, or H. N is no action required, L is low risk, and H is high risk. There are two methods for setting the value. Click on a row in the column. Pressing the space bar toggles the setting through empty, N, L, H, then repeats. You can also press the N, L, or H key on your keyboard. You can use the “Delete” key to reset the column to empty.

How do you determine the current risk?

If you have not performed any corrective action, the current risk is the highest chemical risk. If one or more of the chemicals are high risk (H), the current risk for the receptor as a whole is high (H). If none of the chemicals are high risk (H) but one or more of the chemicals are low risk (L), the current risk for the receptor as a whole is low (L). If none of the chemicals are low (L) or high (H) risk, the current risk for the receptor as a whole is no action required (N).

If the chemical risks computed by the software are no longer valid due to corrective action, you use the Current Risk column to tell the software the risk for the receptor as affected by your corrective action. For example, suppose a drinking water well is high risk (H) for one or more chemicals. Without corrective action, the current risk should be set to H. However, suppose you are able to properly plug the drinking water well. In that case, you should input a 1 into the “Corrective Action(s) Completed” column and set the “Current Risk” to N. Or, for example, suppose an actual confined space receptor is high risk for benzene only. Without additional action, the current risk for the receptor is H. However, suppose you are able to clear this receptor using soil gas sampling. In that case, you should input an 11 into the “Corrective Action(s) Completed” column and set the “Current Risk” to N.

So in short, if no corrective actions are taken, the “Current Risk” should reflect the highest chemical risk. If corrective actions have been taken and they affect the risk classification (for example, 5. Notified sanitary sewer authority, does not, by itself, clear the potential sanitary sewer receptor type), you should set the current risk to reflect the new risk status for the receptor.

- “To Tier 3” column: You set this column to “YES” for a receptor if you are proposing to develop a Tier 3 Work Plan for the receptor and do a Tier 3 analysis. The column has only two settings, “YES” or “NO”. To change the setting, select a row in the column (you can click on it with the left mouse button), then press the space bar. This will toggle the setting between “YES” and “NO”. You can also press “Y” or “N”.

**Receptor Summary Settings**

If you view the “Groundwater Source” and “Soil Leaching” Receptor Summaries, you will see they look essentially the same. The same receptors are shown in both. However, keep in mind the risk classification can be different for the same receptor. For example, for our example problem the actual confined space residential receptor, ACSR-1, is high risk (H) for groundwater source and no action required (N) for soil leaching. The software stores the “Current Risk” settings for “Groundwater Source” and the “Current Risk” setting for “Soil Leaching” separately.

In short, you have to complete the “Receptor Summary” table for each pathway. In some cases, this may mean you have to repeat information, particularly for corrective actions. For example, suppose you properly plugged a drinking water well. You will need to enter a “Corrective Action(s) Completed” of “1” and a “Current Risk” of N in both the
“Groundwater Source Receptor Summary” and the “Soil Leaching Receptor Summary” for that receptor.

To print the Soil Leaching Receptor Summary, use the “Print” button on the “Soil Leaching Pathway Evaluation” form.

Click “OK/Back” to return to the “Soil Leaching Pathway Evaluation” form.

12.8 Soil Leaching, Corrective Action Map

The Soil Leaching Corrective Action Map contours the lowest soil source SSTL concentration (high risk receptors only). Perhaps a more appropriate name would be the Soil Leaching [High Risk] Corrective Action Map. A receptor for which you have set the current risk to N in the Receptor Summary is ignored, even if the risk shown for a chemical is H. You should produce a Corrective Action Map for each chemical in the Receptor Summary with a high risk receptor (ignore receptors having a current risk of N).

For our example, the Receptor Summary shows we should produce a Corrective Action Map for benzene. Click the “Corrective Action Map” button in the “Actual and Potential” frame. Select benzene as the Chemical. Click the “Interpolation Range” button and set the range as the following:

<table>
<thead>
<tr>
<th>Minimum X (ft)</th>
<th>Maximum X (ft)</th>
<th>X Grid Spacing (ft)</th>
<th>Minimum Y (ft)</th>
<th>Maximum Y (ft)</th>
<th>Y Grid Spacing (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-20</td>
<td>80</td>
<td>2</td>
<td>10</td>
<td>130</td>
<td>2</td>
</tr>
</tbody>
</table>

Click “Plot”. If a high risk receptor exists for the chemical, the software uses the soil sample data to contour the most restrictive soil source SSTL. The label for the most restrictive receptor is shown at the top of the plot. The most restrictive receptor is also shown on the plot.

The most restrictive high risk receptor for our example is protected groundwater source with no institutional control. Since the most restrictive receptor is protected groundwater source with no institutional control, the label is plotted at the location of the soil source. The most restrictive receptor has a soil source SSTL of 0.59 mg/kg. For soil leaching, the maximum benzene soil concentrations at the site need to be reduced to 0.59 mg/kg. The contour line (red) is an estimate of where soil concentrations are equal to 0.59 mg/kg. Soil concentrations are estimated to exceed 0.59 mg/kg inside the contour line.

Use the “Print” button to send the plot directly to the printer or save it as a DXF file.

The Soil Corrective Action Map for Soil Leaching is part of the Tier 2 SCR report (Tier 2 Guidance, Section 6.7; Other Maps, Section 13).

Click “OK/Back” until you return to the “Soil Leaching Pathway Evaluation” form.

12.9 Printing from the Soil Leaching Form

Click the “Print” button on the “Soil Leaching Pathway Evaluation” form. This will activate the “Soil Leaching Print Menu”. All items the software can print for “Soil Leaching Pathway Evaluation” are printed from the “Soil Leaching Print Menu”, except for two.

The two items which cannot be printed from the print menu are:

1. Soil Leaching Monitoring Well Selection Map(s) - You print these directly from the map form itself. The map is reached by the “MW Selection” button.

2. Soil Leaching Soil Corrective Action Map(s) - You print these directly from the map form itself. The map is reached by the “Corrective Action Map” button.
The main reason maps and plots need to be printed directly from the forms is you need to set a number of variables to create the plot and printout you want (interpolation range, print scale, DXF file name, etc.).

You select the item(s) you want to print by clicking the check box to the left of the label. A check (✓) means the item is selected for printing. You toggle the check selection by clicking the checkbox. All items with a check (✓) will be sent to the printer when you click the “Print” button. The “Print Menu” does not automatically close after it is done sending items to the printer (in case you want to send addition items).

Click the “Close” button to close the “Print Menu”.

We are done with “Soil Leaching Pathway Evaluation”. Close the print menu. Click “OK/Back” to return to the “Main Form”. Click “Save” to update the data file for the example problem.

13. SOIL VAPOR TO CONFINED SPACE/SOIL TO PLASTIC WATER LINE, RISK CLASSIFICATION AND RECEPTOR SUMMARY

We will now turn to the final set of pathways for Tier 2: soil vapor to confined space and soil to plastic water line. These pathways are evaluated using soil concentrations. The receptors for these pathways are defined by contouring soil data to the target level for the receptor type.

Potential vapor receptors are low risk receptors for the pathway if current soil data at the receptor exceeds the target level (i.e., if some part of the receptor is on or inside the contour). Otherwise, they are no action required. Actual vapor receptors are high risk receptors for the pathway if they are within 50 feet of where current soil concentrations exceed the target level (some part of the receptor is within 50 feet of the soil target level contour). Otherwise, they are no action required.

Plastic water line (actual) receptors are high risk if they are within 10 feet of where current soil concentrations exceed the target level (within 10 feet of the soil target level contour). Otherwise, they are no action required. The receptor identification plots for the pathway are generated using the “Soil Vapor/PWL” button in the “Receptor ID” frame on the “Main Form”.

Risk classification procedures for these pathways are not the same as the procedures for groundwater and soil leaching. For groundwater and soil leaching, simulation modeling is used to produce SSTLs: Concentrations that must be met at groundwater wells or the soil source in order (according to the modeling) to meet the groundwater target levels at the receptors.

For soil vapor to confined space and soil to plastic water line, soil SSTLs, as such, are not computed, because lateral vapor transport models are not used. For example, for an actual confined space residential receptor for soil vapor to confined space, the software does not generate a soil source cleanup level. Instead, to clear the receptor by soil remediation, you would reduce soil concentrations such that soil concentrations within 50 feet of the receptor do not exceed the soil target level for the receptor type (1.16 mg/kg for benzene for confined space residential).

The software determines the risk classification for soil vapor for all the confined space, sanitary sewer and plastic water line receptors you have entered into the software. For each actual confined space receptor and actual sanitary sewer receptor, soil concentrations are interpolated within 50 feet of the receptor. If the interpolated concentrations exceed the soil target level for the receptor, the receptor is high risk (in other words, the receptor is within 50 feet of where soil concentrations exceed the soil target level for the receptor). Otherwise, the receptor is no action required. You can verify the risk calculation by checking the “Soil Vapor” receptor identification plume. If an actual vapor receptor (confined space or sanitary sewer) falls within the outer edge of the green circles on the soil vapor receptor identification plume, it should be high risk (H). Otherwise, it should be no action required (N). The same procedure is used for plastic water line receptors, except the distance is 10 feet.

For all potential vapor receptors soil concentrations are interpolated along the receptor. If any soil concentration along
(at) the receptor exceeds the soil target level, the receptor is low risk (L). Otherwise, the receptor is no action required (N). You can verify the risk calculation by checking the “Soil Vapor” receptor identification plume. If a potential vapor receptor falls within the soil target level contour (the red line), it should be low risk, otherwise it should be no action required.

Click the “SV/PWL” button in the “Pathway Evaluation” frame on the “Main Form”. This will activate the “Soil Vapor/Soil to Plastic Water Line Risk Classification” form. This form is the “Tier 2 Receptor Summary” form for the “Soil Vapor” pathway and the “Soil to Plastic Water Line” pathway. The receptor types evaluated in this form are:

- Plastic Water Line
- Actual and Potential Confined Space, residential and nonresidential
- Actual and Potential Sanitary Sewer, residential and nonresidential

Set the “Include Preliminary Pathway Evaluation results in analysis” to “Yes”. For more information on the effect of your selection, see section 10.0. Click the “Go” button. The “Go” button tells the software to display the risk classification results using the current setting for “Include Preliminary Pathway Evaluation results in analysis” question.

### Potential Receptors at Soil Sources

The “Receptor Type” and “Receptor” for the first five rows of the grid are generated automatically by the software. It is assumed a potential receptor of each type is located at the soil source for each chemical. Note: The “Receptor” for all five rows is “Source”. The chemical risk is determined by a simple comparison of the soil source concentration to the soil target level for the receptor type. If the soil source concentration is greater than the soil target level for the receptor type the risk is low (L), otherwise the risk is no action required (N).

The first four rows are the results for all the potential vapor receptor types (PCSR, PCSNR, PSSR, PSSNR). Depending on the zoning at the soil sources for your site, some of the receptor types may not be. For example, if the soil source locations at your site are all zoned nonresidential, then the potential confined space residential (PCSR) and potential sanitary sewer residential (PSSR) results will not apply. In that case, you should enter N/A for “Corrective Action(s) Completed” and N for “Current Risk”.

The fifth row (PPWL) shows the risk classification for “Soil to Plastic Water Line”. “PPWL” stands for “Potential Plastic Water Line”. If the risk for a chemical is low (L), this is a reminder you need to do notification for potential plastic water line for the “Soil to Plastic Water Line” pathway. After notification, the potential plastic water line receptor is no action required (N). Potential plastic water line is the only potential receptor type for which notification is necessary and sufficient for no action required (Tier 2 Guidance, Section 3.6). For all other potential receptor types, notification alone does not clear the receptor if the risk classification is L or H.

Following the first five rows are the results for receptors you entered into the software. Shown are the results for all the confined space (actual and potential), sanitary sewer (actual and potential), and plastic water line receptors.

Your task in this form is to set, as needed, the last four columns in the form: “C”, “Corrective Action(s) Completed”, “Current Risk” and “To Tier 3”:

- **“C” column** - The confirmation sampling completed column. If confirmation sampling has been completed for a receptor or receptor type, set the value to “YES”. The column has only two settings: “YES” or “NO”. To change the setting, select a row in the column (you can click on it with the left mouse button), then press the space bar. This will toggle the setting between “YES” and “NO”. You can also press “Y” or “N”. The Confirmation Sampling Update, posted 7/21/99 on the Groundwater Professional Bulletin Board ([http://www.iowadnr.gov/InsideDNR/RegulatoryLand/UndergroundStorageTanks/GroundwaterProfessionals/GWPBulletinBoard](http://www.iowadnr.gov/InsideDNR/RegulatoryLand/UndergroundStorageTanks/GroundwaterProfessionals/GWPBulletinBoard)) says “Soil - no confirmation sampling required.” Please check this reference. You may need confirmation sampling for the groundwater well in the vicinity of the soil source.
- **“Corrective Action(s) Completed” column** - You use this column to specify the corrective action(s) you have completed for a receptor. This column simply accepts text input. The third, or bottom, grid in the form is a legend for corrective actions (you can scroll the grid). You identify a corrective action by number. For example, if you cleared a receptor using vapor sampling you would enter an 11. It is possible you may have performed multiple corrective actions. In that case, separate the corrective actions with a comma (i.e., 6,7).

- **“Current Risk” column** - This is an important column. The values affect the receptors carried over from Tier 2 when you move on to the Site Monitoring Report (SMR) phase. The column reflects the “Current Risk” for the receptor as a whole. **The software does not set the current risk column. You must set the current risk column.** The current risk column has already been set for the example problem.

  The column can have four values: empty (blank), N, L, or H. N is no action required, L is low risk, and H is high risk. There are two methods for setting the value. Click on a row in the column. Pressing the space bar toggles the setting through empty, N, L, H, then repeats. You can also press the N, L, or H key on your keyboard. You can use the “Delete” key to reset the column to empty.

  How do you determine the current risk?

  If you have not done any corrective actions, the current risk is the highest chemical risk. If one or more of the chemicals are high risk (H), the current risk for the receptor as a whole is high (H). If none of the chemicals are high risk (H), but one or more of the chemicals are low risk (L), the current risk for the receptor as a whole is low (L). If none of the chemicals are low (L) or high (H) risk, the current risk for the receptor as a whole is no action required (N).

  If the chemical risks computed by the software are no longer valid due to corrective action, you use the current risk column to tell the software the risk for the receptor as affected by your corrective action. For example, suppose an actual confined space receptor is high risk for benzene only. Without additional action, the current risk for the receptor is H. However, suppose you are able to clear this receptor using vapor sampling. In that case, you should input an 11 into the “Corrective Action(s) Completed” column and set the “Current Risk” to N.

  So in short, if no corrective actions are taken, the “Current Risk” should reflect the highest chemical risk. If corrective actions have been taken and they actually affect the risk classification (for example, 5. Notified sanitary sewer authority, does not, by itself, clear the potential sanitary sewer receptor type), you should set the current risk to reflect the new risk status for the receptor.

  **If you have not used unique short labels for all your receptors, then some of your settings for “current risk” may be lost when you use leave this form.**

- **“To Tier 3” column** - You set this column to “YES” for a receptor if you are proposing to develop a Tier 3 Work Plan for the receptor and do a Tier 3 analysis. The column has only two settings: “YES” or “NO”. To change the setting, select a row in the column (you can click on it with the left mouse button), then press the space bar. This will toggle the setting between “YES” and “NO”. You can also press “Y” or “N”.

**Receptor Summary Settings**

If you view the “Groundwater Source” and “Soil Leaching” and “Soil Vapor-Soil to Plastic Water Line” Receptor Summaries you will see they look essentially the same. Some receptors are shown in all three. However, keep in mind the risk classification can be different for the same receptor. For example, for our example problem, the actual confined space residential receptor, ACSR-1, is high risk (H) for groundwater, no action required (N) for soil leaching, and no action required for soil vapor. The software stores the “Current Risk” separately for “Groundwater Source”, “Soil Leaching” and Soil Vapor-Soil to Plastic Water Line. You have to complete the “Receptor Summary” table for each pathway, including Corrective Action(s) Completed, even if it is the same corrective action.
You print the table by clicking the “Print” button on the form.

**Vapor Sampling for Soil Vapor to Enclosed Space for Actual Receptors**

You can clear an actual receptor, even if you fail vapor sampling at the soil source, by passing vapor sampling between the soil source and the receptor (see Tier 2 Guidance, Section 3.4.7, and the Groundwater Professional Bulletin Board).

Click “OK/Back” to return to the Main Form.

**14. TIER 2 GROUNDWATER MONITORING PLAN, GROUNDWATER SOURCE AND SOIL LEACHING**

The software generates a Groundwater/Soil Leaching Monitoring Plan for Tier 2. This is a list of the wells you need to continue sampling in the future in order to monitor the low and high risk receptors from the groundwater and soil leaching pathways. Prior to generating the Groundwater/Soil Leaching Monitoring Plan, you need to have completed the pathway evaluations for groundwater source and soil leaching. The monitoring plan for a chemical combines the monitoring wells from all receptors which are low or high risk for the chemical in the groundwater or soil leaching pathways. A receptor having a current risk of N in the receptor summary for a pathway is ignored. This is one reason it is important to correctly set the current risk column in the Groundwater Source and Soil Leaching Receptor Summaries. Soil leaching contributes to the Groundwater Monitoring Plan if you need to monitor groundwater in the vicinity of a soil source.

To view the Groundwater Monitoring Plan, click the “Monitoring Plan” button in the “GW Monitoring” frame on the “Main Form”. This will activate the “Tier 2 Groundwater Monitoring Plan: Groundwater Source and Soil Leaching” form.

**Justification**

Click the “Justification” button. This will activate the “Tier 2, Groundwater Monitoring Plan Comments/Justification” form. This was added at version 2.30. This form is simply a text box you use to enter any comments or justification required for your Tier 2 Groundwater Monitoring Plan. This information is saved in the site data file and can be printed for inclusion in your Tier 2 SCR. Click “Close” to close the justification form.

Set the answer for “Include Preliminary Pathway Evaluation results in analysis” to “Yes”. See 10.1 for more information.

Click the “Go” button. When you click the “Go” button, the software first gets your answer to “Include Preliminary Pathway Evaluation results in analysis”, and then assembles the monitoring plan.

In the pathway evaluations, you select monitoring wells to evaluate receptors. A monitoring well may be used to monitor several receptors. The monitoring plan might be thought of as the “inverse” of that information. The monitoring plan is organized by monitoring well, and the monitoring well is listed once. For each monitoring well, all the receptors (low or high risk) the monitoring well monitors are listed.

The results are chemical-specific. Select the chemical using the drop-down list box under the “Chemical” label:

- “Monitoring Well” column - The well label for the monitoring well. The first monitoring well shown is the source well for the selected chemical. Then, wells are listed by increasing radial distance from the source.

- “Actual (µg/L)” column - The Tier 2 measured groundwater concentration for the well (maximum of two most recent samples, or the most recent sample if steady and declining).

- The remaining columns show the receptor information for each receptor (low or high risk) the monitoring well monitors:

- “SSTL (µg/L)” column - The groundwater site-specific target level (SSTL) for the well applicable to the receptor. For
each well, the receptors are sorted by increasing SSTL. The groundwater SSTL (SSTL) is the groundwater concentration the well must meet as part of the no further action criteria for the receptor. The SSTLs are receptor- and chemical-specific.

- **“Institutional Control” column** - Applies to potential receptors only (protected groundwater source, potential confined space, or potential sanitary sewer). Indicates whether the SSTL is applicable for no institutional control (No) or for an assumed institutional control (IC).

- **“Receptor” column** - For actual receptors, the short label you assigned to the receptor. For potential receptor types (protected groundwater source, potential confined space, potential sanitary sewer), the label for the most limiting (most restrictive) receptor is shown, with the exception of down-gradient T and G wells. For down-gradient T and G wells, the receptor type label is shown (PGWS, PCS, PSS).

- **“Description” column** - The description you input for the receptor. If there is no most limiting receptor for a potential receptor, PGWS is shown for protected groundwater source, PCS for potential confined space and PSS for potential sanitary sewer. For down-gradient T and G wells, the receptor type label is shown (PGWS, PCS, PSS).

- **“Type” column** - The monitoring well criteria for the receptor. “S” is source well. “SL” is the soil leaching monitoring well in the vicinity of the soil source. The remaining criteria have been covered in this User’s Manual and are also covered in the Tier 2 Guidance (Section 5.4).

- **“Risk” column** - The risk classification for the receptor. This is the “Risk” determined by the software for the chemical (shown in the “Receptor Summary”), not the “Current Risk” assigned by the user. However, if the current risk for a receptor is “N”, the receptor is not included in the monitoring plan.

- **“Frequency” column** - The frequency of sampling, based on the receptor risk classification and the “Type” of well. E wells do not need to be sampled annually, but at least one sample must be collected and the most recent sample must meet the SSTL concentration prior to reclassification to no action required (Tier 2 Guidance, Section 5.4).

The Groundwater/Soil Leaching Monitoring Plan is exactly the same as shown under “Groundwater Source Pathway Evaluation”, except for the addition of receptors with an “SL” in the “Type” column. An “SL” in the “Type” column indicates monitoring for the “Soil Leaching” pathway. The “SL” will only be present for a single well for a chemical: the well used to assess groundwater concentrations in the vicinity of the soil source. In some cases, the soil leaching monitoring well (SL) may not be the same as the groundwater source well (S).

Let’s make a few observations using our example problem and benzene. For active corrective action purposes, the most restrictive SSTL for each monitoring will be from the high risk receptor with the lowest SSTL. For MW-1, the most restrictive high risk receptor is the protected groundwater source (no institutional control) for soil leaching. The receptor is high risk and the SSTL is 290 µg/L. The next most restrictive high risk receptor is protected groundwater source for soil leaching, with an institutional control. The SSTL is 925 µg/L. If you were able to eliminate protected groundwater source as a receptor (say with an institutional control exceeding the receptor identification plumes), the most restrictive receptor for the source location would then be the non-drinking water well, NDWW-1 (soil leaching) with an SSTL of 2,024 µg/L. If you were able to plug the non-drinking water well, NDWW-1, the next most restrictive SSTL for a high risk receptor would be 6,364 µg/L for the plastic water line receptor, PWL-1. And so on.

Now look at well MW-2. There are three high risk receptors: NDWW-1, PWL-1, and ASSNR-1. The well is an X well for NDWW-1 (the well is not the source well and the measured concentration of 8,400 µg/L is greater than the SSTL of 2,565 µg/L). The well is also an “Interior E” for protected groundwater source (PGWS-4) and for potential confined space residential (PCSR-1). Two rows are shown for each potential receptor type, one for no institutional control (No) and one for an institutional control (IC). The well is also a downgradient transition and guard well (TG) for ASSNR-1.

**Printing the Groundwater Monitoring Plan**
To print the Tier 2 Groundwater Monitoring plan, click the “Print” button to the right of the selected chemical. This will activate the “Print Selection” frame. For each chemical, the number of monitoring wells in the monitoring plan is shown to the right of the chemical name. For the example problem, there are 10 wells in the monitoring plan for benzene, “Benzene (10 wells)”. Select the items you want to print by clicking the check boxes to the left of the items. Click the “Send to Printer” button to send all the selected items to the printer. Click the “Close” button to close the “Print Selection” frame.

Normally you would select all chemicals having one or more wells and the “Monitoring Plan” justification.

Click “OK/Back” to return to the “Main Form”.

15. GENERAL CONTOURING, GROUNDWATER, SOIL, VAPOR

15.1 General Groundwater Contouring

The software provides tools for general contouring of the groundwater concentration data. Click the “GW” button in the “General Contouring” frame on the “Main Form”. This will activate the “Groundwater Plume Contouring” form. Select Benzene as the “Chemical”.

Target Levels

Click the “Target Levels” button. The software does not automatically set the target levels for general contouring. You select the target levels you want to contour. The default target levels (“Defaults”) are the default groundwater target levels for all the Tier 2 receptor types. Click the check box for each target level you would like to contour. The columns on the right allow you to enter other target levels you wish to contour. Enter a value you would like to contour and set the check box to checked.

There is a box at the top of the frame showing the “Maximum Concentration” for the chemical. Generally, there is no reason to select a target level greater than the maximum concentration. If you select target levels greater than the maximum concentration, it will not cause a problem, but it may increase the time required for the contouring.

For our example, check all the default contour levels, and put in and check user-specified values of 12,000; 15,000; and 30,000. This has already been done for the example problem. The software (beginning at version 2.30) will save your target level selections.

Click “Interpolation Range” and enter the following information:

<table>
<thead>
<tr>
<th>Minimum X (ft)</th>
<th>Maximum X (ft)</th>
<th>X Grid Spacing (ft)</th>
<th>Minimum Y (ft)</th>
<th>Maximum Y (ft)</th>
<th>Y Grid Spacing (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40</td>
<td>150</td>
<td>5</td>
<td>-60</td>
<td>170</td>
<td>5</td>
</tr>
</tbody>
</table>

Click “Plot”. The software does interpolation calculations, and then displays the results. The contour lines for the specified target levels are shown in red. If a target level cannot be contoured, the reason is shown in the upper right-hand corner of the plot. For our example, 30,000 µg/L could not be plotted because it is greater than the maximum interpolated value over the range of interpolation. This is not surprising since the maximum groundwater value is 20,000 µg/L.

The plot also displays the location and label of each groundwater sample location. The concentration shown is the concentration that has been assigned to the location by the software, and used for contouring. If no concentration has been assigned to a location, due to samples being ignored or no measured concentration, then only the well label is shown (no concentration is shown).

Use the “Print” button to print the results directly to a printer or save them to a DXF file.
The process is essentially the same for the other chemicals. However, you have to select what target levels you want to contour for each chemical, since the target levels for the receptor types are chemical-specific.

When you are done, click “OK/Back” until you return to the “Main Form”.

15.2 General Soil Contouring

Click the “Soil” button in the “General Contouring” frame on the “Main Form”. This will activate the “Soil Plume Contouring” form. Select Benzene as the “Chemical”.

Target Levels

Click the “Target Levels” button. The software does not automatically set the target levels for general contouring. You select the target levels you want to contour. The default target levels are the default soil target levels for all the Tier 2 receptor types (soil leaching, soil vapor to enclosed space, and soil to plastic water line). Click the check box for each target level you want to contour. The columns on the right allow you to enter additional target levels. Enter a value you want to contour and set the check box to checked.

There is a box at the top of the frame showing the “Maximum Concentration” for the chemical. Generally, there is no reason to select a target level greater than the maximum concentration. If you select target levels greater than the maximum concentration, it will not cause a problem, but it may increase the time required for contouring.

For our example, check all the default contour levels, and enter and check user-specified values of 10 mg/kg and 20 mg/kg. This has already been done for the example problem. The software (beginning at version 2.30) will save your target level selections.

Click “Interpolation Range” and enter the following information:

<table>
<thead>
<tr>
<th>Minimum X (ft)</th>
<th>Maximum X (ft)</th>
<th>X Grid Spacing (ft)</th>
<th>Minimum Y (ft)</th>
<th>Maximum Y (ft)</th>
<th>Y Grid Spacing (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-50</td>
<td>150</td>
<td>2</td>
<td>20</td>
<td>130</td>
<td>2</td>
</tr>
</tbody>
</table>

Click “Plot”. The software does interpolation calculations, and then displays the results. The contour lines for the specified target levels are shown in red. If a target level cannot be contoured the reason is shown in the upper right-hand corner of the plot.

The plot also displays the location and label of each soil sample location. The concentration shown is the concentration that has been assigned to the location by the software, and used for contouring. If no concentration has been assigned to a location, due to samples being ignored or no measured concentration, then only the well/borehole label is shown (no concentration is shown).

Use the “Print” button to send the plot directly to a printer or save it to a DXF file.

The process is essentially the same for the other chemicals. However, you have to select what target levels you want to contour for each chemical, since the target levels for the receptor types are chemical specific.

When you are done, click “OK/Back” until you return to the “Main Form”.

15.3 Vapor Contouring

Vapor contouring was added at version 2.30. Click the “Soil Gas” button in the “General Contouring” frame. This will bring up the “Soil Gas Contouring” form.
Click “Interpolation Range” and enter the following information:

<table>
<thead>
<tr>
<th>Minimum X (ft)</th>
<th>Maximum X (ft)</th>
<th>X Grid Spacing (ft)</th>
<th>Minimum Y (ft)</th>
<th>Maximum Y (ft)</th>
<th>Y Grid Spacing (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-50</td>
<td>200</td>
<td>5</td>
<td>-100</td>
<td>150</td>
<td>5</td>
</tr>
</tbody>
</table>

Sources

Click “Source”. The source locations you select will be displayed on the plot. This is useful for displaying vapor sampling in relation to source locations.

Click “Plot”. The software automatically contours the chemical target level: 600,000 µg/m³ for benzene; 9,250,000 µg/m³ for toluene. At a location the software displays the maximum of the two most recent samples at the location (subject to the 14-day, 6-month rules, see Section 5.8).

For vapor, linear interpolation is not used to define the edge of the plume (Tier 2 Guidance, Section 4.4.1). Only concentrations less than the target level are used to define the edge of the plume. To approximate this, if a location has a benzene concentration of less than 600,000 µg/m³, it is assigned a concentration of 599,000 µg/m³ for contouring (however, the measured concentration is shown on the plot). If a location has a toluene concentration of less than 9,250,000 µg/m³, it is assigned a concentration of 9,249,000 µg/m³ for contouring. This has the effect of pushing the contour line out to the first soil gas concentration that is less than the target level.

Use the “Print” button to send the plot to the printer or save it as a DXF file.

16. EXITING THE PROGRAM

This completes our example problem for the Tier 2 portion of the software. Coverage of the SMR portion of the software follows next. If you want to exit the software, click the “Exit” button on the “Main Form”. The “Save & Exit” button will save the data to the current file, then exit. The “Exit” button will exit the program without saving, so make sure you have already saved your data to a file before using “Exit”. The “Cancel” button will cancel the exit.

SITE MONITORING REPORT (SMR)

17. SMR INTRODUCTION

The Site Monitoring Report (SMR) tools are part of the Tier 2/SMR software. The SMR functions were first added at version 2.20. New features have been added for version 2.30 and version 2.51. When we refer to SMR software, we are referring to the SMR portion of the Tier 2/SMR software version 2.51. When we refer to Tier 2 software, we are referring to the Tier 2 portion of the Tier 2/SMR software version 2.51.

The Tier 2 and SMR information you enter for a site are stored together in the site data files (*.t2d, *.tv2).

The objective of the SMR software is to assist you with preparation of the “Site Monitoring Report for Leaking Underground Storage Tank Sites”. After a Tier 2 analysis has classified a site high or low risk, the site must be monitored annually. One objective of monitoring is to determine whether a receptor meets the criteria for risk reclassification. For example, as a result of annual monitoring a receptor having a low risk classification after a Tier 2 analysis may achieve a risk reclassification of no action required. In many cases, the criteria that must be met for reclassification during post Tier 2 site monitoring are different from the criteria applied to determine the initial Tier 2 classification. Where appropriate, and feasible, the SMR software determines the risk classification, based on data collected during site monitoring, that is subsequent to the Tier 2 analysis. Hence, a major task of the SMR software is the use of groundwater data collected during site monitoring to determine the updated risk classification for groundwater and soil leaching receptors.
The other major objective of the software is to provide data handling and produce output needed for the SMR. This includes inputting and printing soil, vapor, and groundwater monitoring data collected after the Tier 2 analysis; and the production of some of the tables and plots required for the Site Monitoring report.

18. GETTING STARTED WITH THE SMR SOFTWARE

We will use an example problem as we describe the SMR software functions. The example file (t2v25smrexp.tv2) is included as part of the Tier 2/SMR version 2.51 installation. This is not the same example file as the one used for the Tier 2 portion of the software. I would recommend you start the Tier 2, version 2.51 software at this time and open the SMR example file.

The SMR functions are integrated with the Tier 2 software and Tier 2 site data. Generally, you will need to have a complete Tier 2 analysis and associated data file in order to access and use the SMR functions. To do an SMR analysis, you open the Tier 2 data file, do your SMR work and save the SMR information to the same file. The Tier 2 data is also maintained in the file, and you can open the file and review or change the Tier 2 analysis, if needed.

It is assumed you are familiar with the Tier 2 RBCA process, particularly the Tier 2 portion of the software.

If you haven’t already done so, start up the Tier 2/SMR software (version 2.51) and open the example data file (t2v25smrexp.tv2).

18.1 Getting to the SMR Portion

There is an “SMR” button at the lower right of the Tier 2 startup form. This takes you to the SMR functions. Click the “SMR” button. You will see an hourglass mouse cursor, and may have to wait awhile as the SMR is initialized. The SMR uses Tier 2 information (receptors, SSTLs, risk classification) and must do Tier 2 calculations before proceeding. When the calculations are done, the “Site Monitoring Report (SMR)” form is shown. You can think of this as the “Main” form for the SMR portion of the Tier 2/SMR software. All SMR functions are reached from this form.

For safety reasons, you may wish to return to the Tier 2 main form periodically during your work on the SMR to save your data. This way, if a computer problem occurs you will be less likely to lose a significant amount of data. It is recommended you return to the Tier 2 main form after you have entered your SMR groundwater sample data, and save the data, then return to the SMR portion of the software.

19. SMR DATES

You need to enter dates as part of the SMR information. The software uses the dates primarily to keep track of how receptor risk classifications change over time. Each risk classification for a receptor is associated with a particular date. For example, if you have submitted three SMRs, the risk classifications you have assigned receptors for each SMR report are stored in the data file by date.

19.1 Entering Dates

Click the “Enter Dates” button in the “SMR Dates” frame. The “SMR Dates” form is where you enter the appropriate dates. Initially, you will need to enter two dates: the date for the Tier 2 analysis and the date for your first SMR. You might use the date the Tier 2 was submitted or approved and the date the SMR might be submitted (end of the third quarter). For the example problem, some dates are already entered. The dates do not have to be precise, just approximate and different so the risk classifications, Tier 2 and SMRs reports are associated with distinct dates.

The dates entered are shown in the list box on the left side of the form (sorted from oldest to most recent). If you wish to “Edit” or “Delete” a date, first select a date by clicking it in the list box.

In the future, as you prepare the next annual SMR for the site, you would come here first and add the date for the new
SMR (approximate submittal date) you are working on.

If you “Delete” a date, any risk classification information associated with that date will be lost. Click “OK/Back” to return to the SMR main form.

19.2 Selecting Dates

Click the “Select Dates” button in the “SMR Dates” frame to activate the “SMR Date Selection” form. You need to select two (2) dates here: a last risk date and a current risk date.

The last risk date might be viewed as the date of your previous report for the site. You select the date from the list box on the left side of the form by clicking a date in the list box (the dates you entered in Enter Dates) and then clicking the “Select Date” button. Initially, for your first SMR, the last risk date would probably be the date you selected to represent the Tier 2 report date. In the future, the last risk date is the date of your previous SMR submittal.

The current risk date represents the date of the current SMR report you are working on.

The next time you prepare an SMR for the site, you would select the current risk date you have right now as the last risk date (previous report date), and then select the date of the new report you are currently working on (entered in “Enter Dates”) as the current risk date. That is, as you step forward in time, you add a new date which is the current risk date, and the previous current risk date becomes the last risk date.

Dates have already been selected in the example file. The current risk date must be more recent than the last risk date.

You can only select dates in this form, you cannot enter dates. To enter dates, use the “Enter Dates” button on the SMR form.

Click “OK/Back” to return to the SMR main form.

20. SMR SAMPLE DATA

You can enter groundwater sample data and soil sample data in the SMR subprogram. This is data collected since the Tier 2 SCR. SMR data is entered and kept separate from data entered as part of the Tier 2 analysis, although both sets of data are stored in the same data file. The data entered for Tier 2 (in the Tier 2 portion of the software) is used to determine the Tier 2 site-specific target levels (SSTLs) for receptors. The SMR data, collected as part of site monitoring after the Tier 2 analysis, is used to determine whether the Tier 2 SSTLs have been met during site monitoring, which is subsequent to the Tier 2 analysis.

In general, groundwater and soil data collected as part of post Tier 2 site monitoring should not be entered in the Tier 2 portion of the software. It should be entered in the SMR portion of the software. If you enter SMR data into the Tier 2 portion of the software, you will essentially be redoing the Tier 2 analysis, since the Tier 2 portion of the software is “live” with the respect to Tier 2 data. There may be some cases where site re-evaluation is needed, where you need to redo the Tier 2 analysis and data entry in the Tier 2 portion is appropriate (SMR Guidance, page 6). Also, groundwater and soil data collected and used as part of the Tier 2 analysis should not be entered into the SMR portion of the software.

Generally, SMR groundwater data is obtained during annual or semi-annual sampling, following the Tier 2 analysis. Usually, data collected quarterly for remediation monitoring would not be used as part of SMR groundwater data. See the SMR Guidance for further information.

20.1 SMR Groundwater Data

Click the “Groundwater” button in the “SMR Sample Data” frame to activate the “SMR, Groundwater Sample Data”
This form functions the same as the form for entering groundwater data in the Tier 2 portion of the software. See Section 5.1 of this manual for more information on data entry and editing. Some data has already been entered for the example problem.

When you first enter here, no data will be present. The form does not show the groundwater data you entered in the Tier 2 portion of the software. This form is used to enter and save groundwater data collected after the Tier 2. The groundwater data entered into the Tier 2 portion of the software and the groundwater data entered into SMR portion of the software are entered and viewed separately.

Click “OK/Back” to return to the SMR main form.

### 20.2 SMR Soil Data

Click the “Soil” button in the “SMR, Soil Sample Data” frame. This form functions the same as the form for entering soil data in the Tier 2 portion of the software. See Sections 5.1 and 5.3 of this manual for more information on data entry and editing. Some data has already been entered for the example problem.

This form is used to enter soil data collected after the Tier 2 analysis. The form does not show the soil data you entered in the Tier 2 portion of the software. This form is used to enter and save soil data collected since Tier 2. The soil data entered into the Tier 2 portion of the software and the soil data entered into SMR portion of the software are entered and viewed separately.

You may not have any soil sample data for the SMR. Click “OK/Back” to return to the SMR main form.

### 20.3 Data Adjustment

The “Data Adjustment” frame contains the buttons to reach the data adjustment forms for groundwater and soil data. These forms function the same as the data adjustment forms for the Tier 2 portion of the software (see the data adjustment section, Section 5.5, in the Tier 2 portion of this manual for more information as how to use the data adjustment forms). In the SMR portion of the software, only groundwater and soil data entered in the SMR are displayed.

### 20.4 Vapor (Soil Gas) Data

Click the “Soil Gas Data” button in the “Soil Gas” frame to activate the “Soil Gas Data” form. This form functions the same as in Tier 2, and in fact, is the same form as the Tier 2 form. Unlike groundwater and soil data, which are kept separate for Tier 2 and SMR, there is one form for the vapor data. The Tier- and SMR vapor data are entered in the same form, and this form is accessed from both the Tier 2 and SMR portions of the software.

For additional information on the vapor data form, see the vapor data section, Section 5.7, in the Tier 2 portion of this manual.

Click “OK/Back” to return to the SMR main form.

### 20.5 Soil Gas Sampling Methods and Location Justification

Click the “S. G. Methods” button in the “Soil Gas” frame to activate the “SMR, Soil Gas Sampling: Methods/Location (page 10)” form. This was added at version 2.51. This form is shared for Tier 2 and SMR, and is the same form. Enter any information you need to add during SMR. The “Soil Gas Sampling Methods” and “Soil Gas Sampling Location Justification” tables will be printed when you print the “Soil Gas Data”, page 10 of the SMR report. Prior to version 2.51, these tables were not printed from the SMR portion of the software.

### 20.6 Save Your Groundwater, Soil and Soil Gas Data
After you have entered new groundwater, soil, or vapor data into the SMR portion of the software, it is strongly recommended you return to the Tier 2 “Main Form” and update the data file. Unfortunately, you cannot save the data file from the SMR portion of the software; you must return to the Tier 2 Main Form. This is because some data updating and conversion is done when you leave the SMR portion of the software. From the Site Monitoring Report main form, click “Done” at the top left of the form to return to the Tier 2 main form. Click “Save” to update the data file. Click “SMR” to return to the SMR portion of the software.

20.7 Printing Groundwater Data

From the SMR main form, click the “GW Data” button in the “Print Data” frame to activate the “SMR: Groundwater Data Print” form. You use this form to select the groundwater sample data you want to print. You also use this form to indicate the groundwater data to display on the monitoring results map.

For printing purposes, the Tier 2 and SMR groundwater data are combined. The grid displays the combined data by location. For example, the first row in the example shows MW-1 is located at (44, 92.5) and there are eight groundwater samples (# of samples) at that location.

An “X” in the “Tier 2 Monitor Plan” column means the location is part of the Tier 2 Groundwater/Soil Leaching Monitoring Plan. An “X” in the “SMR Monitor Plan” column means the location is part of the SMR Monitoring Plan. Methods for changing monitoring wells in the SMR Monitoring Plan are discussed later. If you make changes in the Groundwater Monitoring Plan, you should print the groundwater data after you have completed the changes.

You tell the software you want to print the groundwater data at a location by a “Y” in the “Print” column. Only locations with a “Y” are printed. To set Y, you can type a Y or use the space bar to toggle from Y to blank. You can also use the Delete key to set the column to blank.

You should specify the order in which you want the groundwater locations printed by typing the order in the “Print Order”. The data is printed in order starting with 1, followed by 2, etc. The print order does not have to start at 1 or be sequential. The locations with a “Y” for “Print” are printed by “Print Order”, sorted from the smallest to largest print order value. Locations with a “Y” for “Print”, but no “Print Order” value, will be printed after the samples with a print order, in their order in the grid, from top to bottom.

At a minimum, all monitoring wells in the “SMR Monitor Plan” should be selected for printing: “Y” in “Print”. The selections in the “Print” column are linked to the “Monitoring Results” map. If a well has “Y” in the “Print” column, the most recent concentration is shown on the Monitoring Results Map, otherwise no concentration is shown on the Monitoring Results Map.

When the software prints the groundwater data for a location, it prints all the data at the location, sorted from the oldest to the most recent sample. Your selections for the sample locations to print and the print order are stored in the data file.

After making your print selection, you print the groundwater sample data by clicking the “Print GW Data” button.

Use the “Print This Form” button to print a copy of the information on the form, including (x,y) locations, number of samples, SMR Monitoring Plan, etc. This feature was added at version 2.30.

Click “Done” to return to the SMR main form.

20.8 Printing Soil Data

From the SMR main form, click the “Soil Data” button in the “Print Data” frame to activate the “Soil Data Print Selection” form. You use this form to select the soil data you want to print.
For printing purposes, the Tier 2 and SMR soil data are combined. The grid displays the data combined by location. For example, the first row in the example shows SB-6 is located at (-79, 27) and there are two soil samples at that location.

You tell the software you want to print the soil data at a location by a “Y” in the “Print” column. Only locations with a “Y” are printed. To set “Y”, you can type a Y or use the space bar to toggle from Y to blank. You can also use the Delete key to set the column to blank.

You specify the printing order for soil locations by typing the order in the “Print Order” column. The data is printed in order starting with 1, followed by 2, etc. The print order does not have to start at 1 or be sequential. The locations with a “Y” for “Print” are printed by “Print Order”, sorted from the smallest to largest print order value. Locations with a “Y” for “Print”, but no “Print Order”, will be printed after the samples with a print order, in their order in the grid, from top to bottom.

When the software prints the soil data for a location, it prints all the data at the location, sorted from the oldest to the most recent sample. Your selections for the sample locations to print and the print order are stored in the data file.

After making your print selections, you print the soil sample data by clicking the “Send To Printer” button. Click “Done” to return to the main SMR form.

20.9 Printing Vapor Data

To print the vapor data, you simply need to click the “Soil Gas” button in the “Print Data” frame. This does not bring up a form, but sends the vapor data directly to the printer. Printing the vapor data from either Tier 2 or SMR results in the same printout, although the page numbering is different for the SMR and Tier 2.

21. SOIL GAS AT SOURCES

New for version 2.51 is “Soil Gas at Sources”. This allows you to tell the software if you have passed soil gas sampling at soil or groundwater sources during Site Monitoring. Your results will be incorporated in risk classification during SMR. Prior to version 2.51 there was no method for directly indicating that you passed or failed soil gas sampling during SMR.

21.1 Soil Gas Sampling at Soil Sources

Click the “Soil” button in the “Soil Gas at Sources” frame, to activate the “Soil Vapor/Soil Leaching Soil Gas Questions” form. This form is the same as the form at Tier 2, except you will note the label in red indicates this form is for “Soil gas sampling at Soil Sources at the SMR stage”. You use this form to input your soil gas sampling results during the SMR stage, that is results obtained after Tier 2.

The software does not determine, based on your vapor samples, the answers to these questions. However, at SMR the software does provide an analysis of your soil gas data at the Tier 2 soil sources for confirmation. See the Tier 2 Guidance, Sections 1.8, 3.3, and 3.4 for information on vapor sampling and the required criteria for passing.

The software uses your answers to these questions to incorporate the results in the SMR risk classification. Even if the software indicates you have passed or failed soil gas at Tier 2 soil sources, you must still correctly answer these questions to have the results incorporated in the SMR risk classification.

Note: that the location of concern during SMR is still the Tier 2 soil sources. If you have passed vapor sampling criteria during SMR at a Tier 2 soil source you must answer both questions to have the software recognize you have passed. For example, you must answer “True” to, “Soil Gas sampling has been completed at the soil source location for Benzene”, and “True” to “Soil Gas target levels are not exceeded”, to receive credit for passing vapor at the benzene soil source. If you answer “False” to “Soil Gas sampling has been completed at the soil source location for …” and “True” to “Soil Gas target levels are not exceeded”, the software will assume you have not passed vapor sampling at the soil source for that
chemical.

For our example, we have indicated that we have passed soil gas sampling at the Tier 2 soil source for toluene and failed soil gas sampling at the Tier 2 source for ethylbenzene.

Click “OK/Back” to return to the “Site Monitoring Report (SMR)” form.

21.2 Soil Gas Sampling at Groundwater Sources

Click the “Groundwater” button in the “Soil Gas at Sources” frame, to activate the “GW Soil Gas Questions” form. This form is the same as the form at Tier 2, except you will note the label in red indicates this form is for “Soil gas sampling at GW Sources at the SMR stage”. You use this form to input your soil gas sampling results during the SMR stage, that is results obtained after Tier 2. This for soil gas sampling during SMR at the Tier 2 Groundwater Sources. Note that the location of interest during SMR is still the Tier 2 groundwater sources.

The software does not determine, based on your vapor samples, the answers to these questions. However, during SMR the software does provide an analysis of your soil gas data at the Tier 2 groundwater sources for confirmation. See the Tier 2 Guidance, Sections 1.8, 3.3, and 3.4 for information on vapor sampling and the required criteria for passing.

The software uses your answers to these questions to incorporate the results in the SMR risk classification. Even if the software indicates you have passed or failed soil gas at Tier 2 groundwater sources, you must still correctly answer these questions to have the results incorporated in the SMR risk classification.

If you have passed vapor sampling criteria during SMR at a Tier 2 groundwater source you must answer both questions to have the software recognize you have passed. For example, you must answer “True” to, “Soil Gas sampling has been completed at the groundwater source location for Benzene”, and “True” to “Soil Gas target levels are not exceeded”, to receive credit for passing vapor at the benzene groundwater source. If you answer “False” to “Soil Gas sampling has been completed at the groundwater source location for …” and “True” to “Soil Gas target levels are not exceeded”, the software will assume you have not passed vapor sampling at the groundwater source for that chemical.

For our example, we have told the software we have passed soil gas at the Tier 2 groundwater source for toluene and failed soil gas at the Tier 2 groundwater source for ethylbenzene.

21.3 Soil Gas at Tier 2 Soil Sources

Click the “SG at Soil Sources” button in the “Soil Gas at Sources” frame to active the “SMR, Soil Gas Data at Tier 2 Soil Sources” form. This form was added at version 2.51. This form reflects your input for soil gas results at soil sources, the software’s evaluation of soil gas samples at the Tier 2 soil sources, and whether the Tier 2 soil source is submerged at a soil gas sample location.

The first row in the top grid (“SMR, SOIL GAS AT SOIL SOURCE, USER”) reflects the results of the answers you have given in the “Soil Vapor/Soil Leaching Soil Gas Questions” form during SMR, indicating whether, according to you, you have passed or failed soil gas at a Tier 2 soil source during SMR (see Section 21.1). We can see in our example that we told the software we passed soil gas at the Tier 2 toluene soil source and failed soil gas at the ethylbenzene Tier 2 soil source.

The second row in the top grid (“SOIL GAS AT SOIL SOURCE, DATA”) is an evaluation of your soil gas data against the Tier 2 soil source locations. This automatically completed by the software, and is an evaluation of whether you have passed or failed soil gas at a Tier 2 soil source based, on the soil gas data you have entered into the software. The possible entries are: “N/A”; Not Applicable, “INC.”; Incomplete data (i.e. less than 2 samples), “PASS”; soil gas has passed, “FAIL”; soil gas has failed, “NS”; no soil gas samples found for the soil source.

The data used for the evaluation is shown in the second or lower table (grid). For each chemical, the Tier 2 soil source data is shown, followed by the all the soil gas data found to be within 5 feet (radial distance) of the Tier 2 soil source.
Note that this is based on the \((x,y)\) location of the Tier 2 soil source and the \((x,y)\) locations of the soil gas samples. Hence, you need to have soil gas samples within 5 feet of a Tier 2 soil gas source, and have input the correct \((x,y)\) locations.

The PASS/FAIL criteria is based on the two most recent soil gas samples at a soil source, subject to the 14-day, 6-month rules (see Section 5.8). The soil gas target levels are:

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Target Level ((\mu g/m^3))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>600,000</td>
</tr>
<tr>
<td>Toluene</td>
<td>9,250,000</td>
</tr>
</tbody>
</table>

PASS: Two most recent samples for both Benzene and Toluene do not exceed the soil gas target levels.

FAIL: One or more of the two most recent samples exceeds a soil gas target level.

The third row in the top grid (“SUBMERGED SOIL SOURCE”) is an evaluation by the software of whether a submerged soil source existed at the time of a soil gas sample. All the soil gas data found within 5 feet of a Tier 2 soil source (shown in the second table) is examined. If the groundwater elevation for any soil gas sample exceeds the soil sample elevation, “YES” is shown and the groundwater elevation (“GW Elev.”) is shown in red.

If all the required data is present (a groundwater elevation for each soil gas sample and a sample elevation for the soil source) and no groundwater elevation exceeds the soil gas elevation, “NO” is shown for the chemical. Note that in order to receive a “NO” there must be a groundwater elevation for all soil gas samples found within 5 feet of the soil source.

If the result is not “YES” or “NO”, then “???” is shown. This means no data is present (which may be appropriate) or data required for evaluation is missing (i.e. A groundwater elevation is missing for a soil gas sample).

Keep in mind that the risk reclassification is based on your answers for soil gas results during SMR, not on the software analysis of the data. However, if there is an apparent inconsistency, some explanation will be required.

You can print the table, “SMR, Soil Gas Samples at Tier 2 Soil Sources” using the “Send to Printer” button or from the SMR print menu (“Print All Pages” button on the SMR Main Form).

Click “OK/Back” to return to the “Site Monitoring Report (SMR)” form.

### 21.4 Soil Gas at Tier 2 Groundwater Sources

Click the “SG at GW Sources” button in the “Soil Gas at Sources” frame to activate the “SMR, Soil Gas Data at Tier 2 Groundwater Sources” form. This form was added at version 2.51. This form reflects your input for soil gas results at Tier 2 groundwater sources during SMR and the software’s evaluation of soil gas samples at the Tier 2 groundwater sources.

The first row in the top grid (“SMR, SOIL GAS AT GW SOURCE, USER”) reflects the results of the answers you have given in the “GW Soil Gas Questions” form during SMR, indicating whether, according to you, you have passed or failed soil gas at a Tier 2 groundwater source during SMR (see Section 21.X). We can see in our example that we told the software we passed soil gas at the Tier 2 toluene groundwater source and failed soil gas at the ethylbenzene Tier 2 groundwater source.

The second row in the top grid (“SOIL GAS AT GW SOURCE, DATA”) is an evaluation of your soil gas data against the Tier 2 groundwater source locations. This automatically completed by the software, and is an evaluation of whether you have passed or failed soil gas at a Tier 2 groundwater source based on the soil gas data you have entered into the software. The possible entries are: “N/A”; Not Applicable, “INC.”; Incomplete data (i.e. less than 2 samples), “PASS”; soil gas has passed, “FAIL”; soil gas has failed, “NS”; no soil gas samples found for the Tier 2 groundwater source.

The data used for the evaluation is shown in the second or lower table (grid). For each chemical, the Tier 2 groundwater
source data is shown, followed by the all the soil gas data found within 5 feet (radial distance) of the Tier 2 groundwater source. Note that this is based on the (x,y) location of the Tier 2 groundwater source and the (x,y) locations of the soil gas samples. Hence, you need to have soil gas samples within 5 feet of a Tier 2 groundwater source, and have input the correct (x,y) locations.

The PASS/FAIL criteria is based on the two most recent soil gas samples at a groundwater source, subject to the 14-day, 6-month rules (see Section 5.8). The soil gas target levels are:

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Target Level (g/m3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>600,000</td>
</tr>
<tr>
<td>Toluene</td>
<td>9,250,000</td>
</tr>
</tbody>
</table>

PASS: Two most recent samples for both Benzene and Toluene do not exceed the soil gas target levels. FAIL: One or more of the two most recent samples exceeds a soil gas target level.

Keep in mind that the risk reclassification is based on your answers for soil gas results at Tier 2 groundwater sources during SMR, not on the software analysis of the data. However, if there is an apparent inconsistency, some explanation will be required.

You can print the table, “SMR, Soil Gas Samples at Tier 2 Groundwater Sources” using the “Send to Printer” button or from the SMR print menu (“Print All Pages” button on the SMR Main Form).

Click “OK/Back” to return to the “Site Monitoring Report (SMR)” form.

22. PATHWAY EVALUATION

We are now ready to move to Pathway Evaluations under SMR. This is similar to pathway evaluations under Tier 2, except the software compares the SMR groundwater data to the Tier 2 SSTLs to determine whether exit monitoring criteria have been met (calculates the current risk classification).

23. GROUNDWATER SOURCE PATHWAY EVALUATION

Click the “Groundwater Source” button in the “Pathway Evaluations” frame to activate the “SMR Groundwater Source” form.

23.1 Last Risk

Click the “Last Risk” button in the “Receptor Summary” frame to activate the “SMR, GW Source, Last Risk” form.

One of the tasks you need to complete as part of a Tier 2 analysis is to set the “Current Risk” for each receptor in the Receptor Summary for Groundwater Source. Under SMR, the software automatically evaluates any receptor not having a current risk set to N in the Tier 2 Receptor Summary. If a receptor has the current risk set to N in the Tier 2 Receptor Summary for Groundwater Source, then the receptor will not be evaluated under SMR. Hence, it is important you correctly set the Current Risk for the Receptor Summaries in the Tier 2 portion of the software.

Your job here is to specify the last risk (risk at the previous evaluation) for the receptors. Note: The Tier 2 Risk is shown. If this is your first SMR for a site, you would generally set the Last Risk Column to the Tier 2 Risk. The last risk information you enter will be stored with the date shown at the top of the form. At your next SMR for the site, the current risk you set for your previous SMR report will automatically show up as the last risk (assuming for your new SMR you have set the last risk date to the current risk date for your previous SMR report) and would not normally need to be set by you.

For the example problem, we have already set the last risk.
You set the risk in the “Last Risk” column by clicking a row in the column and pressing the space bar to cycle through the selections, or by typing N, L, H, or Ne (for New). The “New” selection is for a receptor that has been added since the Tier 2 analysis, and has not undergone risk evaluation.

Click “OK/Back” to return to the “SMR Groundwater Source” form.

### 23.2 Receptor Summary

Click the “View/Print Receptor Summary” button in the “Receptor Summary” frame to activate the “SMR, GW Source, Receptor Summary and Current Risk” form.

The table at top of the form shows the soil gas results for groundwater sources for SMR. The first row shows the soil gas results you have identified (SMR, SOIL GAS AT GW SOURCE, USER). See Section 21.1 for more information. These are the results used as part of risk classification. The second row shows the software determination of soil gas results at Tier 2 groundwater sources (see Section 21.4). If the calculated risk for a receptor is not N or N* and you have indicated you have passed soil gas at a Tier 2 groundwater source during SMR, then N(SG) will be shown in the receptor summary for the chemical, to indicated you have passed soil gas during SMR.

If you have indicated you have failed soil gas, this is not reflected in the receptor summary. The risks in the receptor summary are based on groundwater concentrations, unless you have passed soil gas. However, if you have failed soil gas at a groundwater source you will still need to address this issue, even if the vapor receptors are no further action based on groundwater concentrations.

The Receptor Summary lists all receptors that do not a current risk of N for Groundwater Source Receptor Summary in the Tier 2 portion of the software. The “Tier2 Risk” risk column shows the current risk that was assigned at Tier 2. The “Last Risk” column shows the previous SMR risk classification for the receptor.

The columns for the chemicals (B,T,E,X, D,W) show the “computed” risk. The computed risks are based on the groundwater concentrations. If the SMR groundwater sampling to date is not sufficient to determine a new risk (e.g., not enough sampling events have occurred), the Tier 2 computed risk for the chemical is shown (an asterisk, “*” is used to indicate when this is the case). For example, L* means the SMR data is not sufficient for reclassification, and the Tier 2 chemical risk is L. If the SMR groundwater sampling is sufficient to result in a reclassification of risk for the chemical this is shown by an N, L, or H, without an asterisk, “*”. If the computed risk for a chemical for a vapor receptor is L, L*, H or H*, but you have indicated you have passed soil gas at the Tier 2 groundwater source during SMR, then N(SG) is shown.

For example, consider the receptor type “ASSNR” with receptor label “ASSNR-1”. You will note the risk classifications are all “N”, “N*”, “NA”, or do not need to be evaluated based on the Tier 2 preliminary evaluation, “N(P)”. This means based on the groundwater sampling data collected as part of SMR, the risk classification for this receptor is now No Action Required (N). Hence, the “Current Risk” column for this receptor should be set to “N”.

Your task in this form is to set three columns; “Corr. Action Taken?”, “Corrective Action(s) Completed” and “Current Risk”. The Corrective Action Taken column should be set to Y (Yes) or N (No) depending on whether corrective action has been taken. You set the column by clicking the column and pressing the space bar to toggle the selection, or by typing Y or N. When corrective action is conducted which results in receptor reclassification, a narrative description of the corrective actions may be input under “Status/Reclassification” (Discussed later, Section 30.0.)

If a “Corrective Action Taken” is “Y”, then you should identify the “Corrective Action(s) Completed”. The grid at the bottom of the form has a legend for corrective actions. For example, if you plugged a non-drinking water well you should set “Correct Action Taken” to Y and enter a 2 (for Plugged non-drinking water wells) in the “Corrective Action(s) Completed” column. If you need to enter multiple corrective actions separate them with a comma (i.e. 6,7).

The software checks for inconsistencies in the “Corrective Action Taken: and “Corrective Action(s) Completed” columns. You are warned if “Corrective Action Taken” is Y but no information is provided in the “Corrective Action(s) Completed”
column, or if information is entered in the “Corrective Action(s) Completed” column, but the “Corrective Action Taken” column is not set to “Y”. If such inconsistencies are present when the pathway summary is printed, the printout includes the line “INCONSISTENT INFORMATION FOR CORRECTIVE ACTION TAKEN OR CORRECTIVE ACTION(S) COMPLETED”. You are warned of inconsistencies, but you are not required to fix them.

You also need to set the “Current Risk” column. In some cases, the current risk may be the same as the last (previous) risk. If there is not an “L”, “L*”, “H” or “H*” in one or more of the chemical columns, then the software has determined, based on SMR groundwater samples or the soil gas sampling results you have identified, that the receptor is now No Action Required, and the “Current Risk” column should be set to N for the receptor. Otherwise, the current risk should be set to the highest chemical risk (i.e., if one chemical is L (or L*) and another is H (or H*), the receptor risk is H).

There may be situations where the current risk is N regardless of the computed risk for the chemicals. For example, if a drinking water well or non-drinking water well receptor has been properly plugged, then the current risk should be set to N for the receptor. Or, if vapor sampling has been used to clear a vapor receptor, then the current risk should be set to N, regardless of the computed risk for the chemicals.

After you have set the two right-hand columns, you can generate the Receptor Summary Table for the SMR for Groundwater Source by clicking the “Send To Printer” button.

Click “OK/Back” to return to the “SMR Groundwater Source” form.

In many cases, this will be all you need to do under SMR Groundwater Source.

23.3 Changing the Monitoring Plan

You will note there are a number of buttons in the frame “Changing the Monitoring Plan”. You only need to use the buttons in this frame if you need to make a change in the wells assigned to monitor a receptor or receptor type.

By default, the SMR software continues to use the wells you selected for monitoring a receptor at Tier 2 (i.e., X, T, G). If you need to make a change in the monitoring plan (add or delete a well, perhaps a new receptor), you use the appropriate button in the “Changing the Monitoring Plan” frame.

23.4 Actual Receptors, Monitoring Plan

Click the “MWs” button in the “Actual Receptors” frame to activate the “SMR, GW, Actual Receptors, Monitoring Well Selection” form.

Use the drop-down list boxes at the upper left to select the chemical and receptor. The “Interpolation Range” button works the same as under Tier 2 for specifying the interpolation range.

For our example, we will use benzene and the first receptor, “DWW, CW-1, City Well 1”. Click the “Plot” button. The results here will look very similar to the results for monitoring well selection in Tier 2. In fact, the contouring and groundwater source SSTL are based on the Tier 2 data. The groundwater sampling locations are shown as black circles, along with the label for the location (including any new locations if new wells where added at the SMR stage).

Wells currently selected for the receptor are shown with red labels, while wells not selected are shown with black labels. To select/deselect a well, click on the well label. You can zoom in to an area, as needed.

The grid on the right shows information for each well. Shown for each sampling location are the well label, the most recent sample concentration for the chemical (Most Recent), and the SSTL concentration at the well for the receptor-chemical (SSTL). Also shown is the Tier 2 criteria for the well (Tier 2 Criteria), if the well was selected as a candidate monitoring well for the receptor-chemical at Tier 2.
The only column which accepts user input is the User Criteria (User Crit.) column. This column is for you to specify a criterion if you add a well to the monitoring plan for a receptor-chemical during SMR. For example, if you were adding a G well to the monitoring plan during SMR, you would select the well (click to have a red label) and put a G in the “User Crit.” column for the well.

Unlike Tier 2, the SMR software does not specify the criteria. There are some reasons for this. As you continue to sample, the criteria a well met at Tier 2 may no longer be applicable during SMR. You need to supply the criteria if you add a well to the monitoring plan.

Keep in mind, the selected wells are shown by the red label, and well selection/de-selection is done by clicking on the well labels in the plot.

To get back to the SMR Groundwater Source form, click the “Done” button, then the “OK/Back” button.

23.5 Protected Groundwater Source, Monitoring Wells

Click the “MWs” button in the “PGWS” frame to activate the “SMR, GW, PGWS Monitoring Well Selection” form. This form is used if you need to change the monitoring plan for protected groundwater source receptors during SMR.

You select the chemical and well type using the option boxes at the left of the form. As an example, select benzene as the chemical and “T, Most Limiting” as the “Well Type”. Click “Plot/Select”.

The well(s) selected are shown with a red label. Click the well label to toggle between selected (red) and not selected (black). Currently, MW-32 is selected as the monitoring well and appears to be appropriate.

The grid to the right shows information for the wells: the most recent sample concentration and which wells were selected at Tier 2 (Yes) for the chemical-well type is indicated. The grid is for information only, but can be useful for selecting new wells for the monitoring plan.

Click “Done”.

Click “OK/Back” to return to the “SMR Groundwater Source” form.

23.6 Potential Vapor Receptors, Monitoring Well Zoning

Click the “MW Zoning” button in the “Potential Vapor Receptors” frame to activate the “SMR, Monitoring Well Zoning” form. You use this form if you need to change or confirm the zoning specified for monitoring well locations at Tier 2. Any setting you made at Tier 2 is automatically carried over to the SMR.

If you added a new well during SMR, you need to come here and set the zoning for the well. You set the zoning by clicking on the well label on screen. A black label means no zoning, a red label means non-residential zoning, and a blue label means residential zoning. For risk classification purposes, no zoning will be treated as residential.

Click “OK” back to return to the “SMR Groundwater Source” form.

23.7 Potential Confined Space and Potential Sanitary Sewer Monitoring Plan

If you need to change the monitoring plan for potential confined space or potential sanitary sewer receptors, use the “MWs” button under the appropriate frame. These forms function in the same manner as protected groundwater source, discussed above in Section 23.5.

23.8 Actual Receptor SSTLs and SMR Receptor Evaluation
Click the “Receptor SSTLs” button in the “Actual Receptors” frame to activate the “SMR, GW, Actual Receptors, SSTLs” form. This form is for information only, but can be used to see how the SMR evaluates actual receptors for reclassification.

Select the chemical-receptor using the drop down list boxes at the top of the form. We will use the ones shown by default: benzene and DWW (CW-1, City Well 1). The computed risk is high. “TL at Receptor” is the target level for the chemical at the receptor.

The grid shows the wells in the monitoring plan. One column shows the Tier 2 simulated concentration at the well (Sim. Conc.), one column shows the SSTL value for the well (SSTL), one column shows the most recent sample concentration (Most Recent Sample), and one column shows whether the samples at the well meet steady or declining criteria (Steady & Decline). In order to receive No Action Required for the receptor (a risk of N), each well in the monitoring plan must meet steady and declining criteria, and the most recent sample must be less than or equal to the SSTL value. This is the SMR exit monitoring criteria and what the SMR software examines to determine reclassification under SMR.

Steady and declining means the three most recent samples (separated by at least six months) do not increase more than 20% from sample to sample and cannot increase more than 20% from the first (oldest) to the third (last or most recent) sample.

Generally, for non-detect samples (i.e. <50) the detection limit is used as the concentration for evaluating steady and declining. However, this can lead to a situation where, prior to version 2.51, a series of concentrations such as (from oldest to most recent), <1, <1, <2, would not be considered steady and declining because the detection limits are treated as concentrations and <1 to <2 is an increase of 100%. Starting at version 2.51 the following is applied. For concentrations being considered to determine steady and declining, all non-detect values that do not exceed the target levels for drinking water wells are set equal to the highest non-detect value that does not exceed the drinking water well target level, for the purposes of determining steady and declining. For example, if you have 3 non-detect values for benzene and all 3 values have a detection limit of less than or equal to 5 µg/L (for all receptor types, not just drinking water wells), then the 3 samples would meet steady and declining criteria. Measurable concentrations (concentrations that are not non-detect) are still evaluated using the measured concentration. A non-detect value that is greater than the drinking water well target level is still treated as a concentration. For example, for Benzene <6 would be evaluated as 6. The drinking water well target levels are used as the criteria for applying the method for all receptor types because the detection limit used should at least meet the target levels for the receptor with the most restrictive target levels (which is the drinking water well receptor).

The last column (T2 MW Criteria) shows the criteria for the monitoring wells. The criteria before the “/” is the Tier 2 criteria for the well (if the well was in the monitoring plan at Tier 2), and the criteria after the “/”, if any, shows the criteria for a well selected during SMR.

A “-1” in the “Sim. Conc.” column means a simulated concentration cannot be computed for the well. This is because the well is not between the source and receptor. Generally, this would be a P well. In this case, the SSTL for the P well is the groundwater source SSTL for the receptor-chemical.

Currently, the SMR does not show the details for potential receptors, although they can be recovered in the SMR Monitoring Plan, discussed later. For potential receptors, the main difference for risk reclassification is E wells do not need to meet steady and declining, and three samples are not required. For an E well, a minimum of one sample is required and the most recent sample must be less than or equal to the SSTL.

Click “OK/Back” to return to the “SMR Groundwater Source” form.

We are done discussing the groundwater source pathway evaluation under SMR. Again, in most cases you only need to address the last risk and receptor summary forms. You do not need to use the other forms unless you need to make a change in the monitoring plan, or have added a well during SMR and need to set the well zoning.
24. SMR SOIL LEACHING PATHWAY EVALUATION

Click the “Soil Leaching” button in the “Pathway Evaluations” frame to activate the “SMR, Soil Leaching” form. This is similar to groundwater source, in that the last risk and receptor summary need to be addressed.

24.1 Last Risk

Click the “Last Risk” button to activate the “SMR, Soil Leaching, Last Risk” form. The receptors included in the list are the receptors which have not had their current risk set to N in the Tier 2 Receptor Summary for the Soil Leaching Pathway.

Shown is the current risk you specified at Tier 2 (Tier 2 Risk). Again, you need to set the last risk for the first SMR done for the site. Generally, this would be the same as the Tier 2 risk. At your next SMR, the current risk you set at the previous SMR will automatically show up as the last risk (assuming when you start a new SMR report for the site you add a new date, set the previous current date as the last risk date and the new date as the current risk date).

If you need to set the last risk, click in the Last Risk column and press the Space Bar to cycle through the options, or type N, L, H, or Ne (New).

Click “OK/Back” to return to the “SMR, Soil Leaching” form.

24.2 Soil Leaching, Receptor Summary

Click the “View/Print Receptor Summary” button to activate the “SMR, Soil Leaching, Receptor Summary” form. This form is similar to groundwater source.

The top table shows the soil gas results for SMR. Section 21.3 covers the Soil Gas at Soil Source results in detail. Line 1 (“SMR, SOIL GAS AT SOIL SOURCE, USER”) is the results you have identified for soil gas sampling at Tier 2 soil sources during SMR. If you have indicated you passed soil gas sampling at a soil source, and the chemical risk is not N, the risk will be shown as N(SG) for vapor receptors, to indicate no further action due to soil gas during SMR.

If you have failed soil gas this does not directly affect the risk classification. The risk classification is based on soil and groundwater data, if you fail soil gas, but you will still need to address the failed soil gas.

The second line (“SOIL GAS AT SOIL SOURCE, DATA”) shows the software evaluation of soil gas data at Tier 2 soil sources. If an inconsistency is present between the information you provided (“USER”) and the “DATA” you will need to provide an explanation. Again, the risk classification is based on the results you have indicated (see Section 21.1), not on the results the software has determined. If you have a submerged soil source, as indicated by the third row, your soil gas results may not be applicable to the pathway. If you have incomplete data (“???”) for a chemical for which you have indicated soil gas has been passed, you will need to provide a justification or additional data. See the Tier 2 Guidance and Groundwater Professional Bulletin Board (http://www.iowadnr.gov/InsideDNR/RegulatoryLand/UndergroundStorageTanks/GroundwaterProfessionals/GWPBulletinBoard) for additional information on submerged soil sources and the soil leaching pathway.

The receptors that do not have their current risk set to N in the Tier 2 Receptor Summary for the Soil Leaching Pathway are listed in the second table, the receptor summary.

For each receptor, the Tier 2 risk and last risk are shown. The computed risk is shown for each chemical. If the computed risk was not N for a vapor receptor, but you have indicated soil gas was passed at the Tier 2 soil source during SMR, N(SG) is shown.

There is an important difference in the results for the actual and potential receptors.
For actual receptors, only the Tier 2 computed risk is shown (except for passing soil gas during SMR, where N(SG) is shown). At the SMR stage, the risk is not reclassified for actual receptors for soil leaching, except for passing soil gas at a soil source during SMR. This is because for actual soil leaching receptors, the risk is either high or no further action at Tier 2. If the risk is high, corrective action is indicated and there are no criteria for monitoring groundwater to clear a high-risk receptor for soil leaching at the SMR stage. Hence, the Receptor Summary Table will always show the risk computed based on Tier 2 criteria for soil leaching for actual receptors (unless, for actual vapor receptors, you have indicated you passed soil gas at a Tier 2 soil source during SMR).

For potential receptors (PGWS, PCS, PSS), the risk shown for the chemicals is based on evaluating the measured groundwater concentrations for the monitoring well in the vicinity of the soil source against the groundwater SSTL for the receptor and the exit monitoring criteria. Exit monitoring criteria for soil leaching is three years of sampling with the measured groundwater concentrations less than or equal to the groundwater SSTL at the soil source for all three years. Then the potential receptor(s) may be reclassified as no action required.

The chemical columns show the results of comparing the groundwater samples for potential receptors. If data is not sufficient for reclassification (e.g., only two years of sampling data), then the Tier 2 risk is shown and marked with an asterisk (*). If a potential receptor does not have an “L”, “L*”, “H”, or “H*” in one of the chemical columns, then the receptor has been reclassified as No Action Required based on groundwater sampling, and the Current Risk column should be set to N for the receptor. If an “L”, “L*”, “H”, or “H*” is shown for one or more of the chemicals, then the current risk, based on groundwater samples, should be set to the highest risk. If the chemical risk for a potential vapor receptor (PCS, PSS) is not N, and you have indicated you have passed soil gas at a Tier 2 soil source during SMR, then N(SG) will be shown to indicate the risk is now N for the chemical, based on soil gas. The software does not examine soil concentrations as part of risk reclassification for potential receptors during SMR.

Your job, again, is to fill out the Corrective Action Taken (Corr. Action Taken?) column, “Corrective Action(s) Completed” column and the Current Risk column. For the actual receptors, the risk shown for the chemicals for the actual receptors will not change (except for passing soil gas during SMR at a soil source). Hence, if the risk changes for some other reason (remediation, receptor eliminated), then you should set the Corrective Action Taken, Corrective Action(s) Completed and Current Risk columns appropriately. Otherwise, the current risk will generally be equal to the Tier 2 risk for actual receptors.

If you have taken corrective action, set the “Corrective Action Taken” column to “Y” and use the legend at the bottom of the form to set the “Corrective Action(s) Completed” column. For example, if you plugged a non-drinking water well you should enter a 2 in the “Corrective Action(s) Completed” column. If you completed multiple corrective actions use a comma to separate the entries (i.e. 6,7). A narrative description of the corrective actions may be input under “Status/Reclassification” (Discussed later, Section 30.0).

In any case, you should set the “Corrective Action Taken”, “Corrective Action(s) Completed” and “Current Risk” column before printing out the SMR Soil Leaching Receptor Summary Table for the SMR.

The software checks for inconsistencies in the “Corrective Action Taken: and “Corrective Action(s) Completed” columns. You are warned if “Corrective Action Taken” is Y but no information is provided in the “Corrective Action(s) Completed” column, or if information is entered in the “Corrective Action(s) Completed” column, but the “Corrective Action Taken” column is not set to “Y”. If such inconsistencies are present when the pathway summary is printed, the printout includes the line “INCONSISTENT INFORMATION FOR CORRECTIVE ACTION TAKEN OR CORRECTIVE ACTION(S) COMPLETED”. You are warned of inconsistencies, but you are not required to fix them.

To print the report, click the “Send To Printer” button at the top of the form. Click “OK/Back” to return to the “SMR Soil Leaching” form.

24.3 Soil Leaching, Soil SSTLs
Click the “View/Print Soil SSTLs” button to activate the “SMR, Soil Leaching, Soil SSTLs” form. This form simply lists the soil source SSTLs for the soil leaching receptors that are low or high risk. The table shows the soil SSTL (concentration) that be met if a receptor is going to be addressed by soil remediation.

To print the table, click the “Send To Printer” button.

Click “OK/Back” to return to the “SMR, Soil Leaching” form.

24.4 Soil Leaching, Changing Monitoring Wells

Click the “MW Selection” button in the “Change in GW Monitoring” frame to activate the “SMR, Soil Leaching, GW Monitoring in Vicinity of Soil Source(s)” form. You use this form to change or select the monitoring well used to evaluate groundwater concentrations in the vicinity of soil sources. The measured concentrations at the well are used for reclassification of potential receptors for soil leaching.

Any monitoring wells selected for this task at Tier 2 are automatically carried over to the SMR. If you had the appropriate wells selected at Tier 2, you will probably not need to use this form, unless you want to review the well selection. If you installed a new well for the purpose of monitoring soil leaching during SMR or need to change the soil leaching monitoring well, you would use this form to select the well.

To review or select a well, click “Plot”. The software will contour the Tier 2 soil data. Candidate monitoring wells are those within the red contour line.

At Tier 2, you selected all the monitoring wells within the red contour, and the software selected, from among those wells, the well with the maximum groundwater concentration. This well will be shown with a red label. To pick a well or change the well, click the well label. The selected well is shown with a red label. At the SMR stage, you directly select the well to be used for monitoring soil leaching. For a particular chemical, only one well can be selected. If no well has been selected at Tier 2, you should generally select the well inside the red contour with the highest groundwater concentration. The most recent groundwater sample concentration for the well is shown as part of the label. The well selection is chemical specific.

Click “Done”. Click “OK/Back” to return to the “SMR, Soil Leaching” form.

We are done with SMR Soil Leaching. Click “OK/Back” to return to the “Site Monitoring Report (SMR)” form.

25. Soil Vapor/Soil to Plastic Water Line Pathway Evaluation

Click the “Soil Vapor/Soil-PWL” button in the “Pathway Evaluations” frame to activate the “SMR, Soil Vapor, Soil to Plastic Water Line” form.

25.1 Last Risk

Click the “Last Risk” button to activate the “SMR, Soil Vapor-Soil to Plastic Water Line, Last Risk” form. The receptors listed are those that have not had their current risk set to N in the Tier 2 Receptor Summary for the Soil Vapor, Soil to Plastic Water Line pathways.

Shown is the current risk specified at Tier 2 (Tier 2 Risk). Again, you need to set the last risk for the first SMR done for the site. Generally, this would be the same as the Tier 2 risk. At your next SMR, the current risk you set at the previous SMR will automatically show up as the last risk (assuming when you start a new SMR report for the site you added a new date, set the previous current risk date as the last risk date and the new date as the current risk date).

If you need to set the last risk, click in the last risk column and press the Space Bar to cycle through the options, or type N, L, H, or Ne(New).
25.2 Receptor Summary

Click the “View/Print Receptor Summary” button to activate the “SMR, Soil Vapor, Soil to Plastic Water Line, Receptor Summary” form. This is similar to the Receptor Summary forms for Groundwater Source and Soil Leaching. It is different from the others, in that the software does not do risk reclassification for the chemicals, except for the case of passing soil gas at a Tier 2 soil source during SMR. This is because this pathway does not compute soil and groundwater SSTLs in the usual manner. In this form, if risk reclassification is appropriate, you need to realize this and enter the appropriate reclassification result yourself. If you reclassify the risk yourself you will need to provide justification for receptor reclassification under “Status/Reclassification” (Discussed later, Section 30.0).

The top table shows the soil gas results for SMR. See Sections 21.1 and 21.3 for more information. Line 1 ("SMR, SOIL GAS AT SOIL SOURCE, USER") is the results you have identified for soil gas sampling at Tier 2 soil sources during SMR. If you have indicated you passed soil gas sampling at a soil source, and the chemical risk is not N as a receptor, the risk will be shown as N(SG) for vapor receptors to indicate no further action. If you have failed soil gas during SMR, this will not be shown in the chemical risk classification columns for the receptors. However, you will need to address this situation.

The second line (“SOIL GAS AT SOIL SOURCE, DATA”) shows the software evaluation of soil gas data at Tier 2 soil sources. If an inconsistency is present between the information you provided (“USER”) and the “DATA”, you will need to provide an explanation. Again, the risk classification is based on the results you have indicated (see Section 21.1), not on the results the software has determined. If you have a submerged soil source, as indicated by the third row, your soil gas results may not be applicable to the pathway. If you have incomplete data (“???”) for a chemical for which you have indicated soil gas has been passed, you will need to provide a justification or additional data. See the Tier 2 Guidance and Groundwater Professional Bulletin Board (http://www.iowadnr.gov/InsideDNR/RegulatoryLand/UndergroundStorageTanks/GroundwaterProfessionals/GWPBulletin) for additional information on submerged soil sources and the soil vapor pathway.

The receptors included in the list are the receptors which have not had their current risk set to N in the Tier 2 Receptor Summary for the Soil Vapor, Soil to Plastic Water Line pathways.

When the option “Show Tier 2 Computed Chemical Risk” in the “Show” frame is selected, the chemical columns show the Tier 2 risk (unless the risk is not N and you have passed soil gas during SMR, then N(SG) will be shown). Except for passing soil gas a soil source during SMR, the Tier 2 risk is shown.

When the option “Show User Specified Chemical Risk” in the “Show” frame is selected, the chemical risk columns are blank. The risk classifications you enter here are stored.

Generally, for chemicals not showing an L or H for Tier 2 risk, you should enter N for user-specified chemical risk. For other chemicals, you should enter the risk as either the Tier 2 risk, or another risk as appropriate. For example, if you have indicated soil gas passed at the benzene soil source (reflected as N(SG) in the Chemical Risk Table, you would enter N as the user specified chemical risk for all the vapor receptors. Or, if you replaced or moved a plastic water line which was high risk, you would set the user-specified chemical risk to N, and the current risk for the receptor to N. Or perhaps, an actual receptor is high risk for benzene (N for all other chemicals) and you performed soil remediation such that the actual receptor is no longer within 50 feet of where soil concentrations exceed the soil target levels for the receptor. In that case, you would enter the current risk for the receptor for benzene as N. In short, the “Show User Specified Chemical Risk” is where you tell the SMR the risk reclassification for the receptors, as appropriate.

In addition to setting “User Specified Chemical Risk”, you need to fill out the “Corrective Action Taken”, “Corrective Action(s) Completed” and “Current Risk” columns. The risk you enter for current risk will be saved along with the date. When the current date becomes the last risk date, the current risk values you enter now will be shown as the last risk.
There is only one set of columns for “Correction Action Taken”, “Corrective Action(s) Completed” and “Current Risk”, that is the columns do not change if you change the option from Tier 2 risk to user-specified risk. Only the chemical columns change with a change in the “Show” option.

If you have taken corrective action, set the “Correction Action Taken” column to “Y” and use the legend at the bottom of the form to set the “Corrective Action(s) Completed” column. For example, if you plugged a non-drinking water well you should enter a 2 in the “Corrective Action(s) Completed” column. If you completed multiple corrective actions use a comma to separate the entries (i.e. 6,7).

The software checks for inconsistencies in the “Correction Action Taken: and “Corrective Action(s) Completed” columns. You are warned if “Correction Action Taken” is Y but no information is provided in the “Corrective Action(s) Completed” column, or if information is entered in the “Corrective Action(s) Completed” column, but the “Correction Action Taken” column is not set to “Y”. If such inconsistencies are present when the pathway summary is printed, the printout includes the line “INCONSISTENT INFORMATION FOR CORRECTIVE ACTION TAKEN OR CORRECTIVE ACTION(S) COMPLETED”. You are warned of inconsistencies, but you are not required to fix them.

To print the Receptor Summary form, click the “Send To Printer” button. Whatever is currently shown in the chemical columns (user-specified or Tier 2 risk) will be printed.

Click “OK/Back” to return to the “SMR, Soil Vapor, Soil to Plastic Water Line” form.

25.3 Soil Target Levels

Click the “View/Print Soil Target Levels” button to activate the “SMR, Soil Vapor, Soil to Plastic Water Line, Tier 2 Defaults” form. This form simply displays, and allows you to print, the soil target levels for receptors that are low or high risk. The units are in milligrams per kilogram (mg/kg). If soil remediation is undertaken as a corrective action, these are your soil target levels.

Click “OK/Back” to return to the “SMR, Soil Vapor, Soil to Plastic Water Line” form.

Click “OK/Back” to return to the “Site Monitoring Report (SMR)” form.

26. SMR GROUNDWATER/SOIL LEACHING MONITORING PLAN

Click the “GW/Soil Leaching” button in the “GW Monitoring Plan” frame to activate the “SMR, Groundwater/Soil Leaching Monitoring Plan” form. This form displays and prints the SMR Groundwater Monitoring Plan, similar to the Tier 2 Monitoring Plan. Recall the wells selected at Tier 2 are automatically carried over to the SMR, so a plan will be present even if no monitoring wells have been changed or added during SMR.

The plan for each chemical has two sections: “GW/SL Monitoring”, followed by “NFA Results” (added at version 2.51). Select “Benzene” as the Chemical.

“GW/SL Monitoring”

The first part of the table, under the heading “GW/SL Monitoring”, reflects the groundwater and soil leaching monitoring plan: The wells that need to be monitored for the SMR. The monitoring plan does not necessarily reflect all receptors. The monitoring plan is compiled by combining the wells for receptors which are high or low risk for groundwater source, and the receptors which are high or low risk for soil leaching. If a receptor has a current risk of N at Tier 2, it will not appear in the plan. If a receptor has a current risk of N in the SMR Receptor Summary, it will not appear in the plan. If the chemical risk for a receptor is N, the well will not appear in the plan for that chemical. As an example, if you had cleared a vapor receptor using vapor and set the current risk to N, the receptor will not appear in the monitoring plan, regardless of the computed chemical risk.
“NFA Results”

The “NFA Results” was added at version 2.51. Following the groundwater/soil leaching monitoring plan are the groundwater monitoring results for receptors that are no further action (N). For the example problem, you will need to scroll down in the grid to see the “NFA Results” for Benzene. The results for a receptor are shown in the “NFA Results” for a chemical if,

a) A receptor has a user assigned current risk of N and the chemical risk is N, L, L*, H or H*, or
b) A receptor does not have a current risk of N, none of the chemicals are L, L*, H or H*, and the chemical risk is N (i.e. Not shown in NFA results if receptor is still being monitored for a chemical).

Note that a receptor is not included for a chemical if the risk is N due to a reason other than a computed risk. For example, N* (N at Tier 2 and has not changed) or N(SG), the user has indicated soil gas passed at a source during SMR or N(PE), due to preliminary evaluation.

The “NFA Results” allow a review of results for receptors that have a computed chemical risk of N, or for which you, the user, has specified a current risk of N. Also, if all receptors are NFA, then this provides a final review of the data.

Note that the wells in the “NFA Results” are not part of the future monitoring plan of the SMR. However, note that a well could be in both the “GW/SL Monitoring” plan (needs additional monitoring) and in the “NFA Results”, because a well may be used to monitor more than one receptor.

Data Displayed

Table 8 is an example of a printout of an SMR Groundwater Monitoring Plan for toluene. The data does not reflect our example problem, but we will use it for discussion purposes. It will used to describe the printed results and the results shown on-screen.

The first column shows the monitoring well label. The second column shows the most recent measured concentration at the well.

S well flagged: You will note MW-3 has 60,000** in the column. The ** for the Tier 2 source well for the chemical (S in Monitor Type column), means the concentrations for the well have exceeded the Tier 2 source concentration for this well by more than 20% for each of the two most recent samples. In other words, the source concentration has increased since the Tier 2 was completed. You may need to perform a re-evaluation of the Tier 2 analysis. See the SMR Guidance for more information.

Other wells flagged: Also note well MW-10, which is not the source well, shows 60,000**/33,645. This means the concentration has increased more than 20% at the well since the Tier 2 was completed, and exceeds the Tier 2 modeled (simulated) concentration at the well. The number after the “/” is the Tier 2 simulated concentration at the well. This is an indicator the plume may be undergoing significant migration and a re-evaluation of the Tier 2 may be needed. Again, see the SMR Guidance for more information.

If neither of these indicators are present, there will be no ** in the “Most Recent Sample” column.

The SSTL column shows the SSTL value to be met for the well, for each receptor associated with the well. The “SSTL Met” column simply shows whether the most recent concentration at the well is greater than the SSTL value (No) or less than or equal to the SSTL value (Yes). The exception to this is the soil leaching monitoring well(s) (SL in Monitor Type). For “SSTL Met” to be Yes for the soil leaching monitoring well, the three most recent samples must all be less than or equal to the SSTL.

The “Steady Decline/3 year” shows whether the sampling at the well meets steady and declining criteria. “Yes” means the well has three samples and steady and declining criteria are met. If the well is a soil leaching well (SL in Monitor
Type), the three-year criteria is used and Yes means there are three years of sampling (i.e., steady and declining is not required). For E wells, the column shows “N/A” for not applicable. E wells do not need to meet steady and declining criteria, and three samples are not required. For an E well a minimum of one sample is required and the most recent sample must be below the SSTL.

The “Monitor Type (T2)” column shows the well monitoring criteria. The symbols before the “/” show the Tier 2 criteria, if the well was a well selected at Tier 2. The symbols after the “/”, if any, show the well criteria, input by the user, for a well selected during SMR.

**G well flagged**: If a well which was a G well at Tier 2 no longer meets G well criteria (exceeds the SSTL), this is indicated by “***” in the Monitor Type column. It means the most recent sample is above the SSTL for a Tier 2 G well.

The “Receptor” columns identify the receptors. For potential receptors, the “Type” column shows the receptor type, and the “Label” column shows whether the SSTL is applicable for no institutional control (No-IC) or for an institutional control (IC).

The “Chem. Risk” column shows the computed risk for the chemical for the receptor, based on groundwater monitoring. An asterisk “*” means the data is not sufficient for reclassification during SMR, and the risk shown is the Tier 2 risk for the receptor-chemical.

The “Recept Curr. Risk” column shows the Current Risk for the receptor, as set by you, the user, in the Receptor Summary for the Groundwater Source or Soil Leaching Pathway. This was added at version 2.51.

The “Min. Freq.” column is the minimum sampling frequency for the well-receptor. The frequency is always annual, except for E-wells, where the minimum required sampling is once (but the most recent sample must meet the SSTL).

Click the “Send To Printer” button to print the monitoring plan displayed. Click “OK/Back” to return to the “Site Monitoring Report (SMR)” form.

### 27. MONITORING RESULTS MAP

Click the “Groundwater” button in the “Monitoring Results Map” frame to activate the “SMR, Groundwater Monitoring Results Map” form. You must set the “Print” column in the “SMR: GW Data Print” form before you display or print the “Monitoring Results Map” in order to get the correct results. The print column must be set to print the monitoring wells in your monitoring plan (see Section 20.7). Groundwater concentrations will only be shown on this map for wells with “Print” selected as Y in “SMR: GW Data Print”.

You may plot any combination of receptor types on the map by selecting the appropriate check boxes. For our example, check the box next to “PGWS”, leave the chemical as benzene, and click the “Plot” button. The selected receptor types are plotted, along with the monitoring well labels. No contouring or modeling is done, because the concentrations shown may be from different sampling events/dates.

Monitoring Well Concentrations: The display of a concentration at a monitoring well is linked to “SMR: GW Data Print” form. If a monitoring well location has been selected to “Print” in the “SMR: GW Data Print” form, the concentration of the most recent sample will be shown following the well label. If a monitoring well location has not been selected to “Print” in the SMR GW Data Print” form, no concentration will be shown following the well label. The Monitoring Results Map should reflect the most recent measured concentrations for the wells in the SMR Groundwater Monitoring Plan. You must set the “Print” column in the “SMR: GW Data Print” form before you print the “Monitoring Results Map”.

If a measured concentration is displayed and the date for the most recent sample is more than six months prior to the current risk date, a “#” is shown as part of the well label, following the concentration. That is, older data are flagged on the map.
Use the “Print” button to print a Monitoring Map.

Click “Done”, then “OK/Back” to return to the “Site Monitoring Report (SMR)” form.

28. GENERAL CONTOURING – GROUNDWATER

Click the “Groundwater” button in the “General Contouring” frame to activate the “SMR Groundwater Concentration Contouring” form. This form was added at version 2.51 to provide a visual picture of the groundwater contamination at your site during site monitoring.

This form contours the most recent valid groundwater sample at each location. The Tier 2 and SMR groundwater data are combined, and the most recent valid sample is assigned to each location for plotting and contouring. This plot represents the groundwater contamination at your site, using the most recent data at each monitoring location, including wells that are not in the SMR monitoring plan. Note that this means, for example, if a location was last sampled 5 years ago, such data is used and plotted. If no concentration has been assigned to a location, due to samples being ignored or no measured concentrations, then the well/borehole label is shown, followed by “NVS” (No valid sample).

This form functions in the same manner as the groundwater contouring form for Tier 2. Click “Target Levels” to set the target levels. Generally you should select all the “Defaults” that are less than the “Maximum Concentration”. You can also enter and select target levels of you own (“User Specified”). For example, if your maximum concentration is high, i.e. 30,000, you might want to also contour 15,000, 20,000 and 25,000 to provide a more detailed presentation of your data.

Click the “Interpolation Range” button to set the interpolation range. As a starting point I would suggest:

Set the Minimum X to 50 feet less than the Minimum X of the GW Data, rounded to the nearest 10 feet. Set the Maximum X to 50 feet more than the Maximum X of the GW Data, rounded to the nearest 10 feet. Set the Minimum Y to 50 feet less than the Minimum Y of the GW Data, rounded to the nearest 10 feet. Set the Maximum Y to 50 feet more than the Maximum Y of the GW Data, rounded to the nearest 10 feet. Set the X and Y Grid Spacing both to 10 feet.

You may need to adjust your interpolation range, based on your contouring result.

Click the “Plot” button. The most recent valid groundwater sample at each location is plotted and contoured. As usual, you can print the results to a printer or to a DXF file. The map is part of the SMR. It is appendix “8. Groundwater contamination map”.

Click “OK/Back” until to return to the “Site Monitoring Report (SMR)” form.

29. VAPOR MONITORING PLAN

You can enter and print the information for the “Soil Gas Monitoring Plan Summary”, which is page 13 of the SMR. This was added at version 2.30. Prior to version 2.30, you had to generate page 13 of the SMR outside of the software. See the SMR Guidance for information on the requirements for the Soil Gas Monitoring Plan Summary.

The Soil Gas Monitoring Plan Summary information is entered and printed using the buttons in “Soil Gas Monitoring Plan” frame.

Summary Table:

Click the “Summary Table” button in the “Soil Gas Monitoring Plan” frame to activate the “Soil Gas Monitoring Plan Summary Table” form. You simply enter the required information. Whatever information you enter here is stored and
printed as part of page 13 of the SMR.

Click “OK/Back”.

**Comments/Justification**

Click the “Comments/Justification” button in the “Soil Gas Monitoring Plan” frame to activate the “Soil Gas Monitoring Plan Comments/Justification” form. This is simply a text box. Any information you enter here is saved and printed as part of page 13 of the SMR.

**Important:**

You must not enter a quote (“”) anywhere in the Tier 2 software. The quote is used as a separator in saving the information to file and entering a quote will cause problems when the software attempts to read a previously-saved data file. Version 2.3 or later will not allow you to directly type in a quote (“”), but you could paste in a quote. Do not do so.

Click “OK/Back”.

To print the “Soil Gas Monitoring Plan Summary”, page 13 of the SMR, click the “Send to Printer” button in the “Soil Gas Monitoring Plan” frame. You can also print the form using the “Print All Pages” button.

### 30. RECEPTOR STATUS CHANGE AND SITE RECLASSIFICATION

You can enter, save, and print information on changes in receptor status and site reclassification. This information is printed as page 7 of the SMR. This was added at version 2.30. Prior to version 2.30, you had to generate page 7 of the SMR outside of the software. See the SMR Guidance for additional information.

The information for receptor status change and site reclassification (page 7 of the SMR) is entered and printed using the buttons in the “Status/Reclassification” frame.

**Receptors: Status Change**

Click the “Receptor Status Change” button in the “Status/Reclassification” frame to activate the “SMR, Receptor: Status Change” form. The SMR Guidance, page 10, describes the information required.

Click “OK/Back”. **Site Reclassification:**

Click the “Site Reclassification” button in the “Status/Reclassification” frame to activate the “SMR, Site Reclassification” form.

If you answer “Yes” to “Should the site be reclassified?”, then an additional frame will appear where you select the proposed reclassification: high risk, low risk, no action required. Enter any required justification for site reclassification in the text box. Your answers to the questions and justification are printed as part of page 7 of the SMR.

Click “OK/Back”.

To print page 7 of the SMR, click the “Send to Printer” button in the “Status/Reclassification” frame or the “Print All Pages” button and select the appropriate item.

### 31. POTENTIAL RECEPTOR SUMMARY

You can enter, save, and print the “Potential receptor summary” information for the SMR. This is page 6 of the SMR. This was added at version 2.30. Prior to version 2.30, you had to generate this information outside of the software.

Click the “Potential Receptor Summary” button to activate the “SMR, Potential Receptor Summary” form. There is an
example of the printout of page 6 in the SMR Guidance. You will see you can enter the required information into this form. The list box is used to select the different receptor types under “Receptor questions”. For each receptor type you can enter up to 10 contacts (Contact #).

The “Copy” button copies the entries shown for Date, Contact Name, Company Name, Address, City, State, Zip, and Phone # to the clipboard. The “Paste” button pastes the most recently copied information. If you need to enter the same contact information for a number of receptor types, you can use “Copy/Paste” to save yourself some typing. The information you enter here is printed as page 6 of the SMR.

Click “OK/Back”.

To print the “Potential receptor summary”, page 6 of the SMR, use the “Send to Printer” button directly beneath the “Potential Receptor Summary” button or click the “Print All Pages” button and select “Potential Receptor Summary”.

32. COVER PAGE AND REPORT CHECKLIST PRINTING

To print the SMR Cover Page, click the “Cover Page” button in the “Print” frame on the SMR “Main Form. Information from the Tier 2 Site Identification form is included in the SMR Cover Page printout.

To print the SMR Report Checklist, page 2 of the SMR, click the “Report Checklist” button in the “Print” frame. The checklist cannot be completed in the software. Once printed, it should be completed manually.

33. SAVING THE SMR DATA

Click “Done” at the top of the “Site Monitoring Report (SMR)” form to return to the Tier 2 software main form. To save the SMR data to the Tier 2 software data file, click the “Save” or “Save As” button.

You cannot save your data directly from the SMR portion of the software. You must return to the Tier 2 Main Form to save your data. For safety reasons, you may wish to return to the Tier 2 main form periodically during your work on the SMR to save your data. This way, if a computer problem occurs, you will be less likely to lose a significant amount of data. It is recommended you return to the Tier 2 main form after you have entered your SMR groundwater sample data, and save the data, then return to the SMR portion of the software.

34. PRINT ALL PAGES

You can print all the necessary tables for the SMR from a central location in the SMR portion of the software. Click the “Print All Pages” button on the SMR main form. This will bring up the “SMR, Print All Form” form. This form was added at version 2.30.

It is strongly recommend you return to the Tier 2 main form and update (save) the data before using this form. The form works by essentially running the software the same way you would to reach a form and click the print button. For example, to print the SMR Groundwater Source Receptor Summary from this form, the software “clicks” the “Groundwater Source” button, “clicks” the “View/Print Receptor Summary” button, then “clicks” the “Send to Printer” button. In other words, this form does automatically what you would do manually to go to the individual forms to print the information. If the software or operating system crashes or the printer connection is lost during this process, you might lose unsaved data.

If you select “Print All” and click the “Send To Printer” button, all the items in the print menu will be printed. The reason you might not want to do this is a Groundwater Monitoring Plan is printed for every chemical.

To select the individual items you want to print, select the “Print Selections” option. This will enable the menu, and you can use the check boxes to select the items you want to print. Click “Send To Printer” to send your selected items to the printer.
The print menu will print all the tables which can be printed from the SMR. What the print menu does not print are plots or maps. A plot or map is defined here as plotting of well locations, receptors, items with a specific x-y location and you need to set a print scale. For example, the print menu does not print the Monitoring Results Map. You will need to go to the individual forms to print any required plots or maps (any output where you need to specify a print scale).

35. ADDING RECEPTORS AT THE SMR STAGE

If you need to add a receptor at the SMR stage, you add the receptor the same way you add a receptor at Tier 2. Use the buttons in the “Receptors” frame on the Tier 2 “Main Form”. There are no forms for adding receptors in the SMR portion of the software.
Figure 1. Cartesian Coordinate System and Main Plume Flow Direction
Figure 2. Range of Plume/Flow
Figure 3. Interpolation Grid Example
Figure 4. Sw-W estimation with a range of 150 degrees
Source: GW (ug/L)
Maximum Concentration: 100000
Contour Concentration: 50000
Source Width (Sw): 89. feet
Source Length (W): 90. feet

$\text{Sw} = \frac{2 \frac{5}{16}}{\text{inch}} + \frac{10}{\text{inch}} = 2 \frac{15}{16} \times \frac{20 \text{ feet}}{\text{inch}} = 58.75 \approx 59 \text{ feet}$

$\text{W} = \frac{3 \frac{5}{16}}{\text{inch}} + \frac{1}{\text{inch}} = 3 \frac{11}{16} \times \frac{20 \text{ feet}}{\text{inch}} = 57.5 \approx 58 \text{ feet}$

Figure 5. Sw-W estimation with multiple closed contours
Figure 6. Groundwater Source, Receptor Identification, Nondrinking Water Wells
Figure 7. Groundwater Source, Receptor Identification, Protected Groundwater Source
Figure 8. Groundwater Source, Receptor Identification, Confined Space Residential
Figure 9. Groundwater Source, Receptor Identification, Confined Space Nonresidential
Figure 10. Groundwater Source, Receptor Identification, Sanitary Sewer Residential
Figure 11. Groundwater Source, Receptor Identification, Sanitary Sewer
Figure 12. Groundwater Source, Receptor Identification, Plastic Water Line
Figure 13. Groundwater Source, Receptor Identification, Surface Water, B(CW)
Figure 15. Soil Leaching, Receptor Identification, Confined Space Residential
Figure 16. Soil Vapor, Receptor Identification, Confined Space Residential
Figure 17. Soil Vapor, Receptor Identification, Confined Space Nonresidential
Figure 18. Monitoring well distance from source, for receptor evaluation
Figure 19. Groundwater Concentrations, Benzene
Figure 20. Groundwater Concentrations, Toluene
Figure 21. Groundwater Concentrations, TEH-D
### Table 1. Preliminary Pathway Evaluation Requirements

X = Evaluation Required (A receptor identification plume must be generated.)

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<th>T</th>
<th>E</th>
<th>X</th>
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Version 2.50-Mat 2002
Table 2. Groundwater Source, Actual Receptors, Evaluation Requirements

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<th>TEH-WO</th>
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Table 3. Groundwater Source, Groundwater Ingestion, SSTL Tables, Actual Receptors

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<tr>
<th>Location</th>
<th>Distance from Source (ft)</th>
<th>Simulation Value</th>
<th>Actual Data</th>
<th>SSTL Value</th>
<th>Criteria</th>
<th>Monitor</th>
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<tr>
<td>mw-12</td>
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### Table 4. Groundwater Source, Groundwater Vapor to Enclosed Space, Confined Space, SSTL Tables, Actual Receptors

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<th>Benzene</th>
<th>GW Source SSTL: 17,753</th>
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<tr>
<td>Risk: H</td>
<td>At receptor: TL: 1,670</td>
<td>Simulated: 1,881</td>
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<table>
<thead>
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<th>Location</th>
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<th>Actual Data</th>
<th>SSTL Value</th>
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### Table 5. Groundwater Source, Protected Groundwater Source, Benzene

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### Monitoring Summary for Benzene

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### Table 6. Groundwater Source, Potential Confined Space, Benzene

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### Monitoring Summary for Benzene

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<td>11,257</td>
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### Table 7. Groundwater Source, Potential Sanitary Sewer, Benzene

**GW Source, Potential Sanitary Sewer, Benzene**

#### Risk Classification Summary

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#### Monitoring Summary for Benzene

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<th>IC-SSTL</th>
<th>Receptor</th>
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<td>10,390</td>
<td>Out of Range</td>
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### Table 8. SMR, Groundwater/Soil Leaching Monitoring Plan Summary, Toluene

**SMR, Groundwater/Soil Leaching Monitoring Plan Summary and NFA GW/SL Monitoring Results**  
Toluene, 8/23/2000, V-2.50, 7LTZB99

<table>
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<tr>
<th>MW</th>
<th>Most Recent Sample</th>
<th>SSTL</th>
<th>SSTL Met</th>
<th>Steady Decline/3 Year</th>
<th>Monitor Type (T2)</th>
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