5.4 Tier 1 Evaluation

The IWEM Tier 1 analysis automates the comparison of your expected leachate concentration(s) with the Tier 1 LCTV lookup table to produce waste management recommendations for your particular waste. The IWEM Tier 1 analysis consists of four main screen groups: Tier 1 Input, Tier 1 Output (Summary), Tier 1 Output (Details), and Tier 1 Evaluation Summary. Each of the first three of these groups contains several screens.

The Tier 1 Input screen group consists of three screens:

- WMU Type (6)
- Constituent List (7)
- Leachate Concentration (8)

The Tier 1 Output (Summary) screen group consists of two screens:

- MCL Summary (9)
- HBN Summary (10)

The Tier 1 Output (Details) screen group consists of three screens:

- Results for No Liner (11) [based on MCL and HBN]
- Results for Single Liner (12) [based on MCL and HBN]
- Results for Composite Liner (13) [based on MCL and HBN]

The overall Tier 1 result is then displayed on the Tier 1 Evaluation Summary (14) screen.

The available options and data displayed on each of these screens are explained in the following sections.

5.4.1 Tier 1 Input Screen Group

5.4.1.1 Tier I Input: WMU Type (6)

This is the first input screen for a Tier 1 evaluation; you can select the WMU type and enter facility identification information on this screen, as explained below.

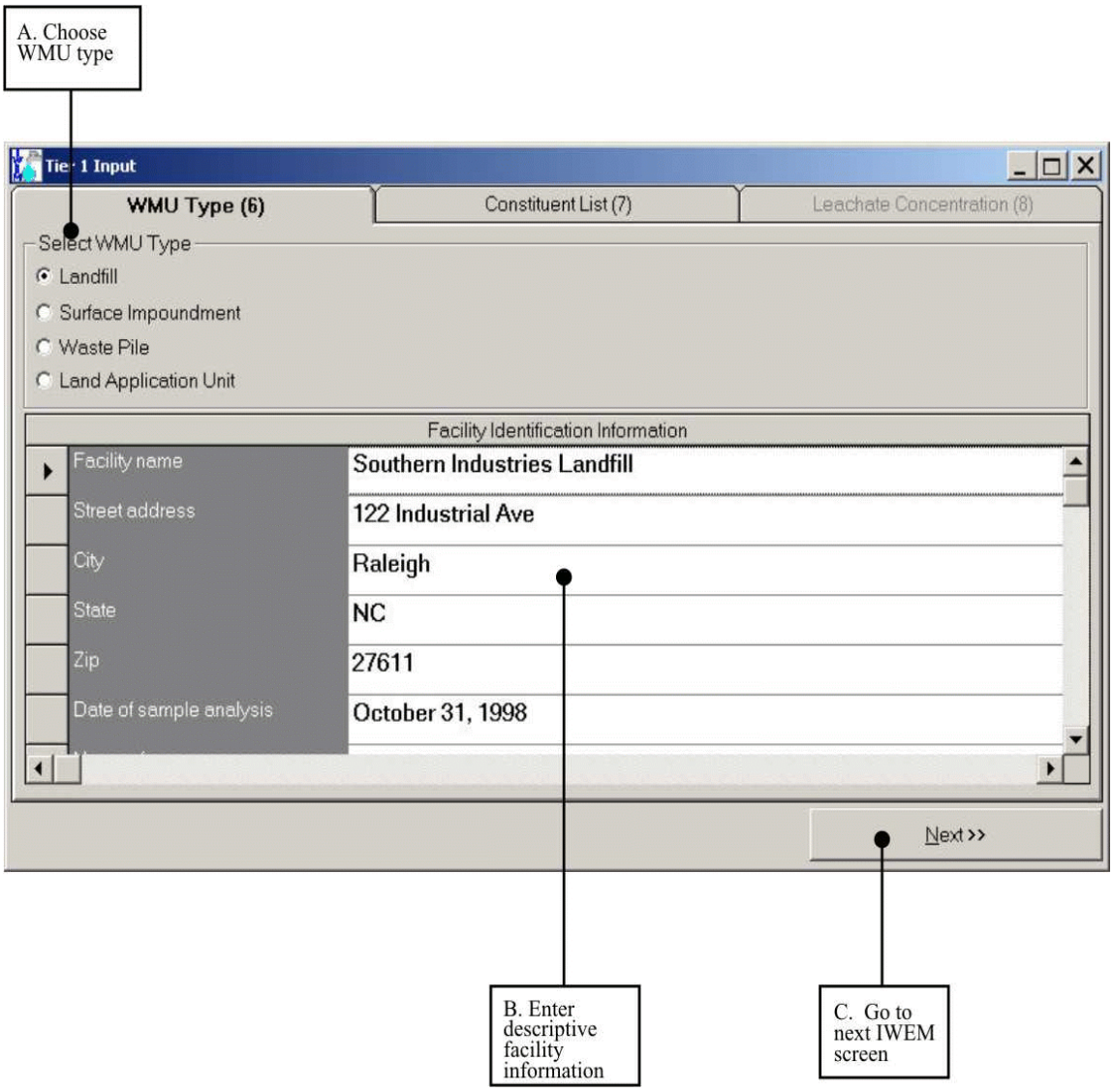


Figure 5.14 Tier 1 Input: WMU Type (6).

The features identified in Figure 5.14 are explained in more detail in the following paragraphs.

A. Choose WMU Type

First, select one of the following choices from the |SELECT WMU TYPE| option list by clicking on the appropriate option button:

- Landfill
- Surface Impoundment
- Waste Pile
- Land Application Unit

B. Enter Descriptive Facility Identification Information

Then, in the text boxes located in the lower half of the screen, enter the following information about the WMU being evaluated:

- Facility name
- Address of the WMU (street, city, state, zip)
- Date of waste constituent sample analysis
- User name (name of the person performing the liner evaluation)
- Any additional identifying information that you would like to include

All facility identification information will be included on the printed Tier 1, and if performed, Tier 2 Evaluation Reports.

C. Go to Next IWEM screen

After entering your site information, click the |NEXT| button at the bottom right of the screen to proceed to the next screen.

5.4.1.2 Tier I Input: Constituent List (7)

On this screen you can, select constituents expected in leachate by searching for the name or CAS number or by scrolling through the displayed list of IWEM constituents, as explained below.

What waste constituents can I enter in the IWEM software?

On the Constituent List (7) screen, you will find the list of waste constituents that are included in the IWEM database. This list of constituents includes 206 organics and 20 metals. These constituents are presented in Appendix A.

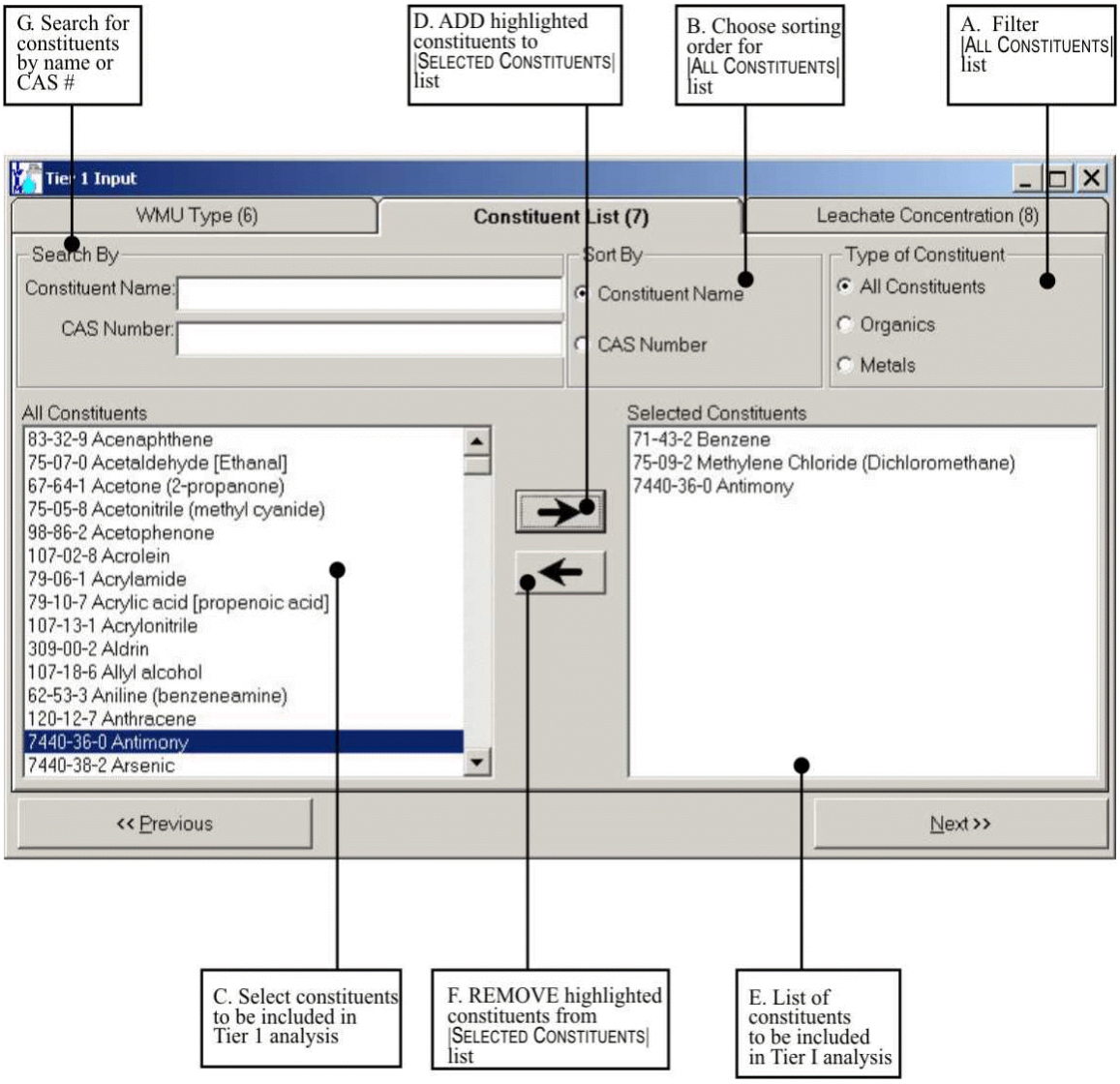


Figure 5.15 Tier 1 Input: Constituent List (7).

The features identified in Figure 5.15 are explained in more detail in the following paragraphs.

A. Filter |ALL CONSTITUENTS| *List*

You can choose to display only organics, only metals, or all constituents by clicking one of the radio buttons within the frame titled |TYPE OF CONSTITUENT|.

B. Choose Sorting Order for │ALL CONSTITUENTS│ List

You can determine whether the constituents are sorted by name or by CAS number by clicking one of the radio buttons within the frame titled │SORT BY│.

C. Select Constituents to be Included in Tier 1 Analysis

The following keyboard functions simplify the selection of more than one waste constituent:

- To add a group of constituents that are displayed sequentially in the list (that is, one after another without any non-selected constituents in the middle), click on the first desired waste constituent, press down the │SHIFT│ key, and then click on the last desired waste constituent. All waste constituents listed between the first and last chosen constituents should now be highlighted.

- To add a number of constituents that not are displayed sequentially, click on the first waste constituent, and then hold down the │CONTROL│ (Ctrl) key while selecting additional constituents using the mouse.

Once your selection is complete, use the │ADD│ button (described below) to transfer all the highlighted constituents to your list.

D. Add Highlighted Constituents to │SELECTED CONSTITUENTS│ List

Once the appropriate constituents are highlighted in the list (on the left of the screen), you can click the │ADD│ button  in the center of the screen to transfer it to your list of constituents present in the leachate (on the right side of the screen). Note that a waste constituent can also be added quickly to your list by double-clicking on it in the list on the left. Likewise, multiple selections can be added using the same technique: double-clicking on your highlighted list of constituents once you have created it using the │SHIFT│ or │CONTROL│ keys, as described above.

E. List of Constituents to be Included in Tier 1 Analysis

After adding a constituent to your analysis, that constituent's name and CAS number will appear in the │SELECTED CONSTITUENT│ listbox on the right side of the screen.

F. Remove Highlighted Constituents from* |SELECTED CONSTITUENTS| *List

Similarly, you can click the |REMOVE| button  to remove highlighted constituent(s) from your list of selected constituents. You may also use the short-cut techniques previously described in item D above (|SHIFT| and |CONTROL| keys, double-clicking) to delete constituents.

G. Search for Constituents by Name or CAS Number

As an alternative to selecting constituents by scrolling through the display list, you can search for constituents by entering their name or CAS number in the |SEARCH BY| box at the top-left of the screen. IWEM will match the name or CAS number to its database while you type and as soon as you have typed in enough information to identify one of the listed constituents, that waste constituent will be highlighted in the list. You can use the |ARROW| keys on the keyboard to move up or down the list if the highlighted constituent is not exactly the one you intended to select.

You can move through the constituent display list to select a particular constituent by using any of these methods:

To move through the list of waste constituents:

1) Use the scroll bar at the right of the displayed list

2) Use the |ARROW| keys on the keyboard (once one constituent in the list is selected)

3) Type in the constituent name or CAS number in the |SEARCH BY| text box

Once your list of waste constituents is complete, you can proceed with the Tier 1 evaluation by clicking on either the screen titled |LEACHATE CONCENTRATION| or the |NEXT| button at the bottom of the screen.

5.4.1.3 Tier I Input: Leachate Concentration (8)

On this screen, you can enter the expected leachate concentration (in milligrams per liter [mg/L]) for each selected waste constituent, as explained below. Please see Chapter 2 - Waste Characterization of the ***Guide*** for analytical procedures that can be used to determine leachate concentrations for waste constituents.

The Tier 1 Evaluation cannot be performed until an expected leachate concentration is entered for each selected waste constituent.

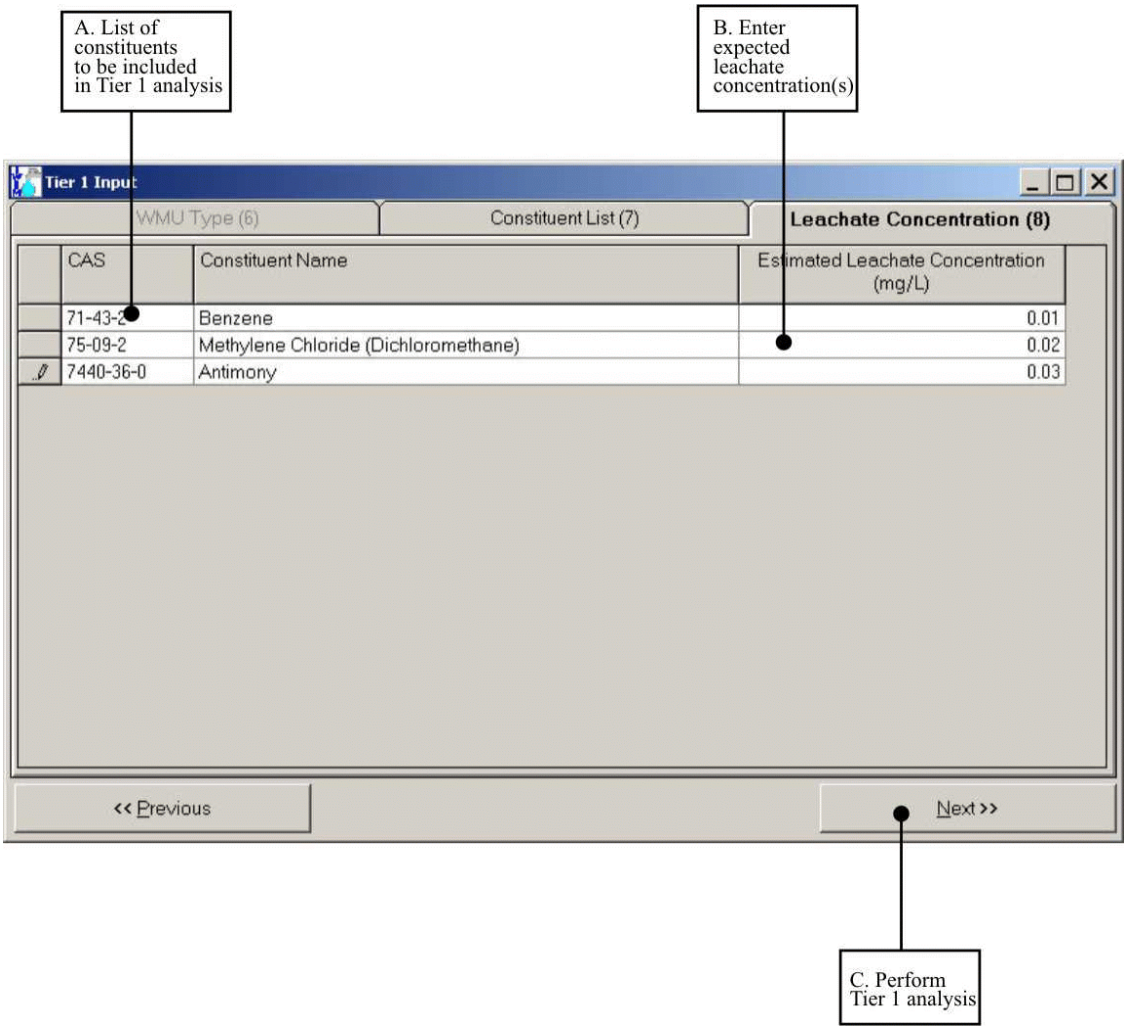


Figure 5.16 Tier 1 Input: Leachate Concentration (8).

The features identified in Figure 5.16 are explained in more detail in the following paragraphs.

A. List of Constituents to be Included in Tier 1 Analysis

The constituent names and CAS numbers for all selected waste constituents will appear in the table on this screen.

B. Enter Expected Leachate Concentration(s)

This table is similar to a spreadsheet. Using the mouse, click on the first empty cell in the |ESTIMATED LEACHATE CONCENTRATION| column, and type in your expected leachate concentration. The concentration must be entered in units of mg/L, and cannot exceed 1,000 mg/L.[1] The IWEM software will display a warning message similar to the one shown below (after the description of item C) if you enter an expected leachate concentration that exceeds the solubility of that constituent, as cited in the IWEM database. If you accidentally entered the wrong value, click the |YES| button and correct the expected leachate concentration on the Leachate Concentration (8) screen. If you want to proceed with the evaluation using your entered value, click the |NO| button. In this case, a similar warning message about your input leachate concentration will be included in the printed report.

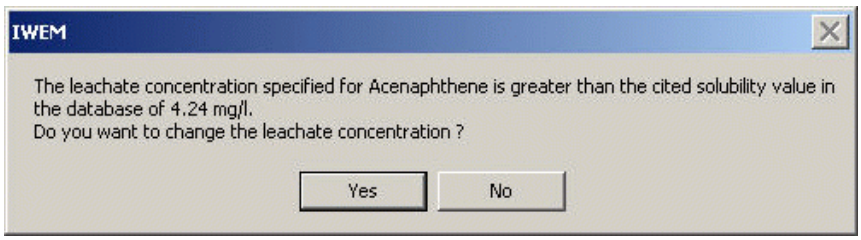
After entering the expected leachate concentration for the first selected constituent, then click on the cell below, press the |TAB| key, or press the |ARROW-DOWN| key to move to the next cell and enter the next concentration. Repeat this process until you have entered expected leachate concentrations for all waste constituents. You can move up and down through the list of leachate concentration values and edit them by using the |ARROW-UP| and |ARROW-DOWN| keys on your keyboard or by using the mouse to click on the value that you want to change and entering a new concentration value.

C. Perform Tier 1 Analysis

Simply click on the |NEXT| button at the bottom right of the screen to perform the Tier 1 evaluation and view your results. Before allowing you to proceed, IWEM will check to make sure that you have entered a leachate concentration for all constituents, and will compare the leachate concentration(s) to the corresponding solubility limits in the

[1] EPA does not expect leachate concentrations from units covered by this guidance to exceed 1,000 mg/L for a single constituent. Additionally, the fate and transport assumptions in IWEM may not be valid at high concentrations. Therefore, the EPA has designed IWEM so that the input expected leachate concentrations are not allowed to exceed 1,000 mg/L.

constituent database. If any leachate concentration(s) exceed the solubility limit, the following warning message will be displayed to alert you and to ask if you want to change the concentration value. If you select |No|, the analysis will proceed.



5.4.2 Tier I Output (Summary) Screen Group: MCL Summary and HBN Summary (9 and 10)

The IWEM Tier 1 analysis is essentially a query to an existing database of modeling results. The results of this database query are immediately presented in summary form on screens 9 and 10, as shown below in Figures 5.17 and 5.18.

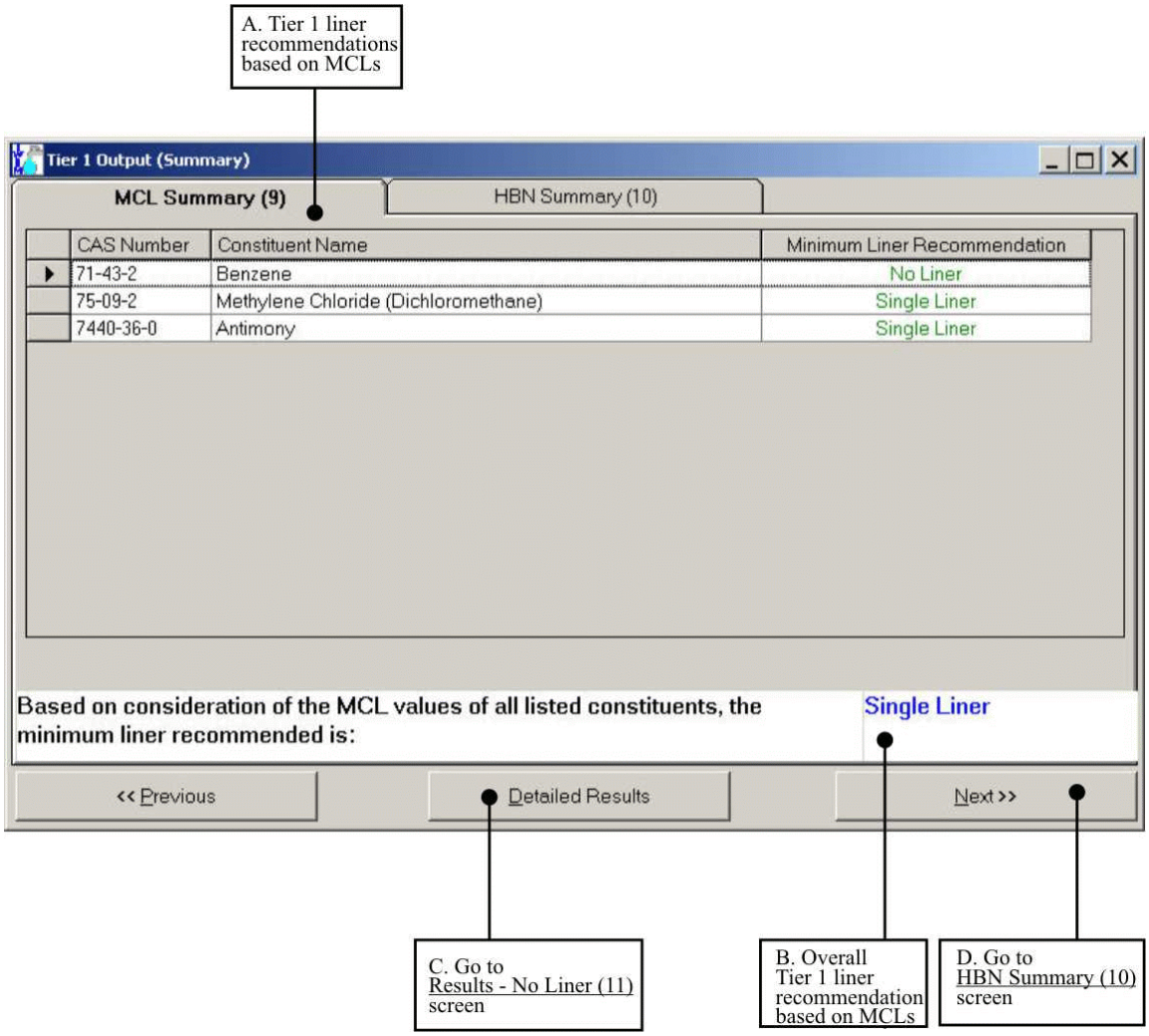


Figure 5.17 Tier 1 Output (Summary): MCL Summary (9).

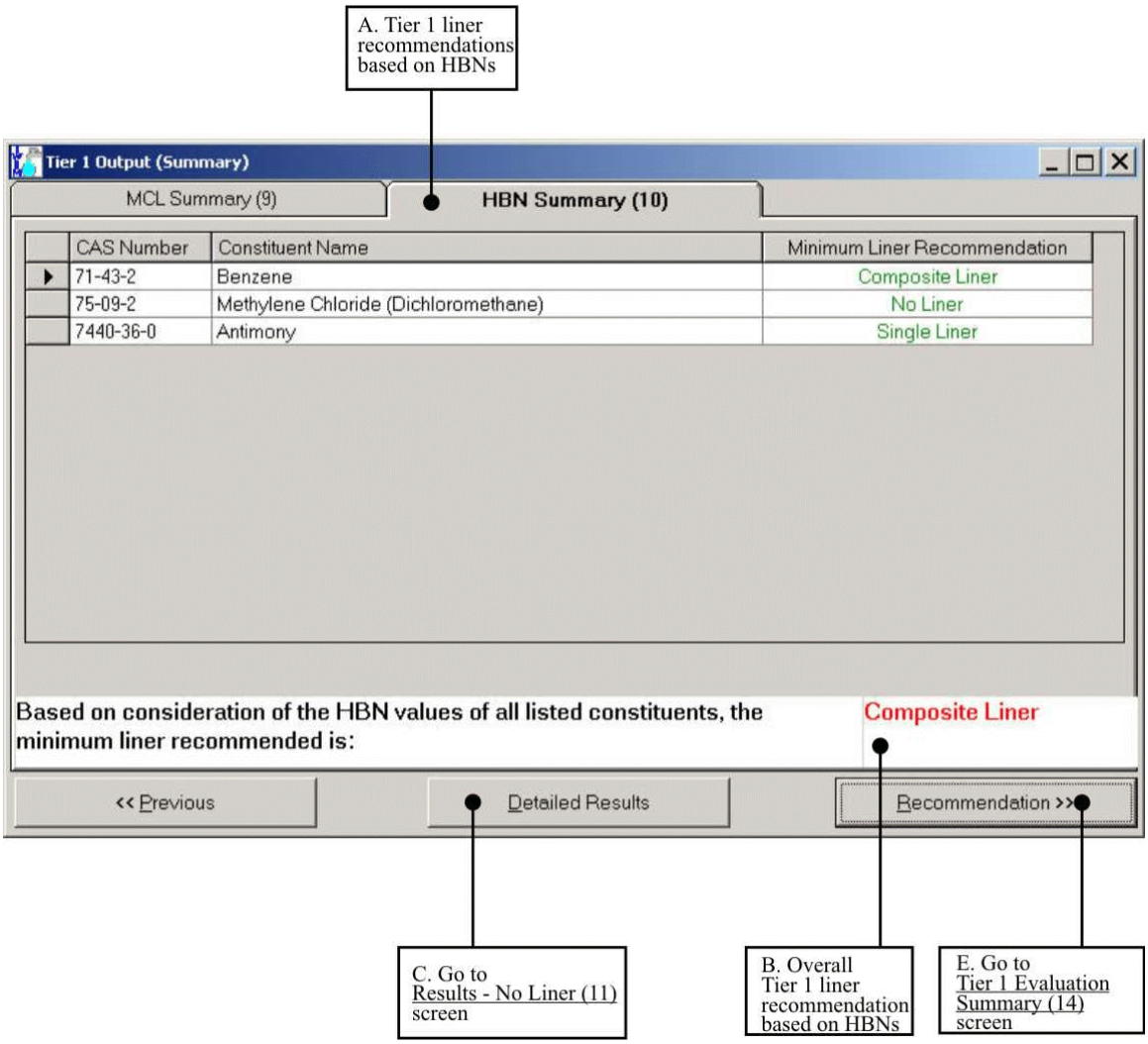


Figure 5.18 Tier 1 Output (Summary): HBN Summary (10).

The features identified in Figures 5.17 and 5.18 are explained in more detail in the following paragraphs.

A. Tier 1 Liner Recommendations Based on MCLs/HBNs

The results of the Tier 1 Evaluation are first presented on-screen in summary form. The summary results are divided into two screens: one, for LCTVs calculated based on MCLs; and one, for LCTVs calculated based on HBNs.

Not all waste constituents have both an MCL and an HBN. The MCL summary screen provides a minimum liner recommendation for each of the selected constituents that have an MCL. Likewise, the HBN screen presents a minimum liner recommendation for each of the selected constituents that have an HBN. These recommendations are based on a comparison of the expected leachate concentration for that constituent to the calculated LCTV using the constituent-specific MCL or HBN. For those constituents that have more than one HBN, the LCTV is calculated for each HBN, and the HBN that produces the lowest LCTV is used to determine the Tier 1 liner recommendation. The value and type (pathway and effect) of the controlling HBN are shown on the Detailed Results screens (11 through 13).

For each constituent in an IWEM Tier 1 evaluation, a liner recommendation that is protective is presented in green text. If the composite liner scenario is not protective, this message is presented in red text. If a constituent does not have a liner recommendation on the MCL Summary (9) screen because it does not have an MCL, this message is presented in black text.

B. Overall Tier 1 Liner Recommendation Based on MCLs/HBNs

This text box displays an overall minimum liner recommendation which is based on consideration of all waste constituents.

The overall liner recommendation may be different based upon whether HBNs or MCLs are being used. Depending upon the waste constituents being evaluated and the appropriate RGC for each, you may have to create for yourself a final list of LCTV values and minimum liner recommendations, some based on MCLs and some based on HBNs. You should obtain direction from your state regulatory authority regarding which RGC should be used for the Tier 1 evaluation of a particular waste.

C. Go to Results - No Liner (11) screen

Clicking on this button will take you to a detailed listing of the Tier 1 results, including the constituent-specific LCTVs for all evaluated liner scenarios.

D. Go to HBN Summary (10) screen

Clicking on this button will take you to minimum liner recommendations based on a comparison of expected leachate concentrations to calculated LCTVs.