User's Guide
Delisting Risk Assessment Software (DRAS)
Version 3.0

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1 Introduction

The U.S. Environmental Protection Agency (EPA) developed this User's Guide as part of the Hazardous Waste Delisting Program. The Region 6 Delisting Program originally developed The Delisting Risk Assessment Software (DRAS) to compute risks and hazards associated with individual waste streams for delisting petitions. Regions 5 and 6 updated DRAS and released version 3.0 in October 2008. DRAS is used by several EPA Regions, numerous delisting-authorized states and facilities interested in delisting waste.

DRAS was specifically designed to help determine whether a waste meets the conditions under Title 40 Code of Federal Regulations 40 CFR §261.11(a)(3) (*Criteria for Listing Hazardous Waste*), as well as other factors. These may include chemical constituents other than those for which the waste was listed that could cause the waste to be a hazardous waste. This guide will assist the user in applying DRAS to evaluate petitions to delist hazardous wastes submitted under (40 CFR) §260.22.

DRAS performs a multi-pathway and multi-chemical risk assessment to assess the acceptability of a petitioned waste to be disposed into a Subtitle D landfill or surface impoundment. DRAS executes both forward- and back calculations. The forward-calculation uses chemical concentrations and waste volume inputs to determine cumulative carcinogenic risks and hazard results. The back-calculation applies waste volume and acceptable risk and hazard values to calculate upper- limit allowable chemical concentrations in the waste.

1.1 Objectives

The objectives of the User's Guide are: (1) to provide general information about DRAS; (2) to provide step-by-step instructions on using the software and interpreting the results of the risk assessment; and (3) to troubleshoot difficulties commonly encountered in installation and operation of the software. This information is intended to assist regulatory authorities, petitioners, and decision makers in the hazardous waste delisting determination process.

Users are directed to the Delisting Technical Support Document (DTSD) for detailed background information about the algorithms, equations, and the dilution-attenuation factors (DAFs) used in the risk assessment. The DTSD is provided with the software and in most installations, can be accessed directly from within the program by selecting the *Documents* menu. In the event the link fails, the documents are located in the *Documents* subfolder within the folder in which the program was installed.

For additional information necessary to satisfy the information requirements of a complete delisting petition, Petitioners should consult their delisting regulatory authority. The Region 6 RCRA Delisting Program Guidance Manual for the Petitioner (U.S. EPA, 1996) is also available with additional information for the petitioner.

2 System Requirements and Installation

This section summarizes the operating system requirements for DRAS version 3.0.

- Pentium, or compatible processor-based personal computer (PC with 1GHz or greater is recommended).
- Windows 2000, or Windows XP, or later Windows versions.
- 256 MB of RAM.
- At least 100 MB of available hard disk space.
- Printer for generating hard-copy reports.

A CD-ROM drive, flash drive, or floppy drive is not necessary but can facilitate exporting of DRAS project files from one computer to another.

To install DRAS version 3.0, download setup.exe to your PC, double-click setup.exe, and follow instructions on the screen.

3 Quick User's Guide

1. Through *Start* and *Programs*, Open DRAS version 3.0.

2. Select **New Analysis** from among the *Analysis Operations* also along the left side of the screen.

3. In the DRAS window *Steps 1-3*, enter values into all required fields, choose single- or multi-batch waste generation, enter the annual or total volume in cubic yards (for landfills), set target risk and hazard according to your delisting regulatory authority. Click **Update**, then **To Steps 4&5**.

4. In the DRAS window *Steps 4&5*, use drop-down tables to add DRAS waste constituents to the project list and enter analytical data for total and leachate concentrations. Click **Update Site COCs**, then **Run DRAS**.

5. Check the *Pathways Exceeding the Delisting Limits* output table for any concentrations exceeding target risk, hazard, or SDWA MCLs.

6. Check the *Maximum Allowable TCLP Concentrations – Groundwater Exposure Pathway* and *Maximum Allowable Total Concentrations – Surface Exposure Pathway* output tables for allowable concentrations.

7. Check the *Aggregate Risk and Hazard Quotient Results* output table for aggregate risks or hazards that may exceed target levels.

8. Check the *Toxicity Characteristic, Soil Saturation, and Ecological Values* output table to confirm that none of these parameters are exceeded.

9. Click **Save Analysis** and **Print** output tables as needed.

4 Overview

DRAS assesses the carcinogenic risk and noncarcinogenic hazard associated with a petitioned waste's disposal to either of two types of waste management units (WMU). These are a landfill and a surface impoundment. The software prompts the user to enter waste information which should be available from a facility's delisting petition. Once all the general waste information and the chemical specific concentration data are entered, the program performs screening and cumulative risk and hazard calculations.

The screening risk evaluation provides the user with Toxicity Characteristic Leachate Procedure (TCLP) and total waste constituent concentrations associated with the target carcinogenic risk level and the target hazard quotient for the most sensitive exposure pathway. The target carcinogenic risk and noncarcinogenic hazard must be entered by the user. The targets are typically set by the delisting regulatory authority applicable to your delisting and may vary from one jurisdiction to another due to differences in local risk management objectives. TCLP and total constituent concentrations derived from target risk and hazard settings may be used as the maximum allowable waste constituent concentrations for a multi-year standard exclusion (delisting). If the waste constituent concentration exceeds these risk-based levels, the waste may not qualify for a multi-year exclusion under 40 CFR §§260.20 and 260.22.

The cumulative risk assessment provides the user with an overall carcinogenic risk and noncarcinogenic hazard index (HI) for the petitioned waste as a whole, summing risks associated with each exposure pathway for a given constituent and then summing risks for all waste constituents. The assessment also provides the user with the cumulative carcinogenic and noncarcinogenic risks associated with a specific waste constituent. If the waste constituent concentrations exceed the risk-based levels calculated from DRAS, the waste may not qualify for exclusion under 40 CFR §§260.20 and 260.22. The methods and data used in the determination of media waste concentrations at the point of exposure and the risk assessment algorithms are outlined and referenced in the DTSD.

The results are presented in a series of tables documenting the constituents evaluated, any modifications to default chemical, physical, or toxicological parameters, forward estimation of risks by pathway and constituent, back-calculated estimation of allowable concentrations by pathway and constituent, estimates of aggregate risk and hazard, and a screening of concentrations exceeding the allowable concentrations, soil saturation, toxicity characteristic concentrations, or ecological screening values.

The user may also enter the detection limit (DL) value associated with a given waste constituent and the program will determine the risk and hazard associated with a fraction of the waste constituent DL value. The default fraction used in the risk assessment is one-half of the detection level. The program tracks waste constituent risks associated with actual measured concentrations with and without out non-detects valuated at one-half of the DL.

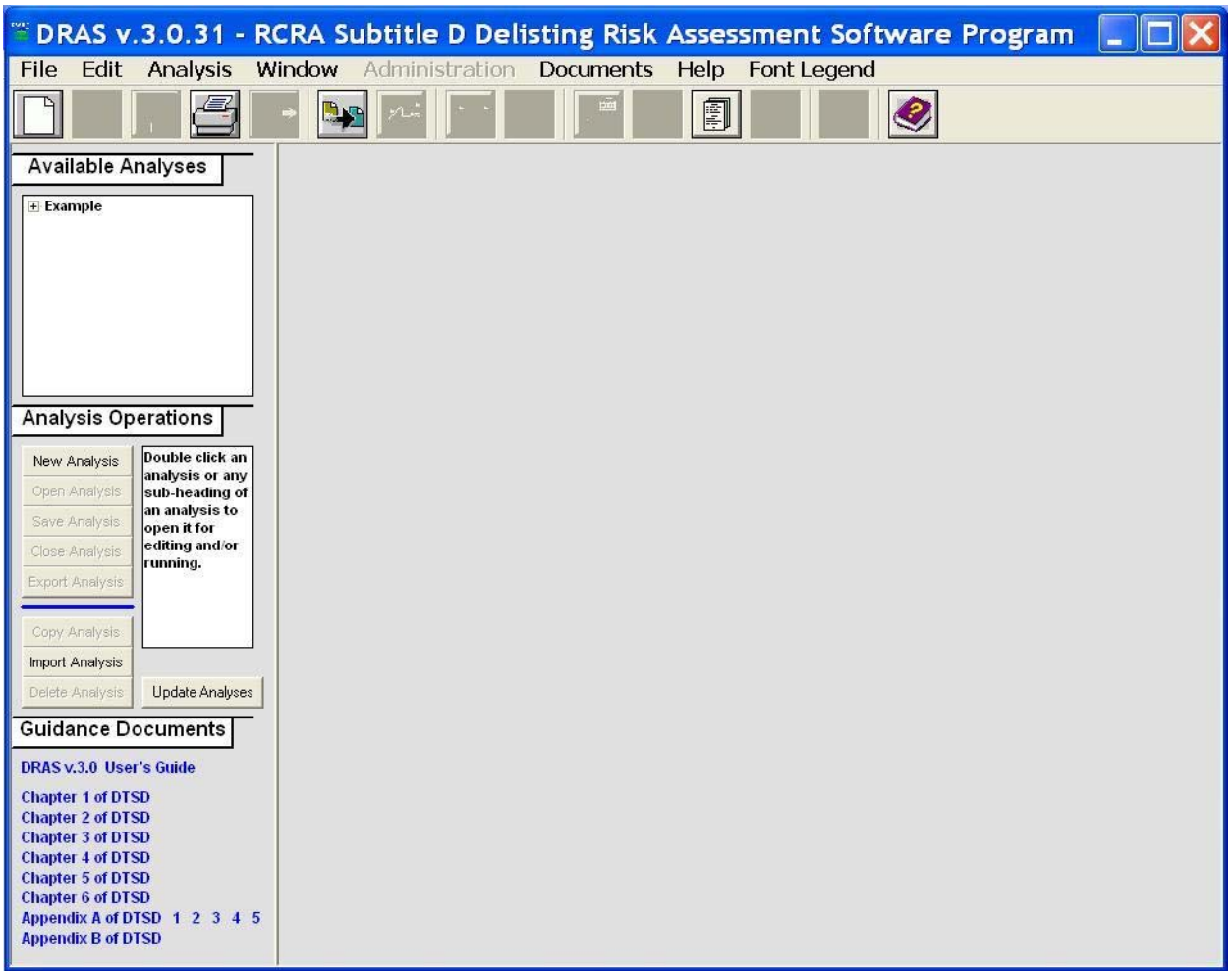
5 Detailed Description

5.1 Start-Up

Upon opening DRAS 3.0, a small window box appears with a reminder that a number of changes have been made to the program. A link is provided to a more detailed summary of the modifications. Click **No, go to program** to bypass the message and open the main menu.

5.2 Main Menu

The Main Menu appears as follows:



Existing projects are listed in a window on the left side of the screen labeled *Available Analyses*. To start a new project, select **New Analysis** from among the *Analysis Operations* also along the left side of the screen. You can also click on the **Begin a New Analysis** button located in the tool bar or by selecting **New Analysis** from the *File* Menu at the top of the page. This will open a window where you can enter facility information (see section 5.3). Note that project data entry and results screens will appear in the empty window to the right

within the Main Menu and the commands listed both above and to the left of the project window will remain during all subsequent DRAS operations.

The other options available under *Analysis Operations* are:

Open Analysis – This will open any project listed above. The user must have that project selected in the *Available Analyses* window by clicking on it once until highlighted.

Save Analysis – This will save the project. Note: this option is only available if a project is open. Also, the projects are automatically saved within the DRAS database. In order to archive a project or move it to another computer you must use the **Export Analysis** command.

Close Analysis – This will close the project. Note: this option is only available if a project is open.

Export Analysis – This will export the project as a file in a format specific to the DRAS software (with the extension *.drs*). Note: this option is only available if a project is open or is selected in the *Available Analyses* window by clicking on it once until highlighted.

Copy Analysis – This will create a duplicate copy of a project. You can run variations of the same project without having to reenter data by copying the analysis and renaming it and saving it in the *Steps 1-3* window (see Section 5.3.).

Import Analysis – This will allow you to import a project from an archive or another computer by opening an existing DRAS formatted "Export" file (with the extension **.drs*).

Delete Analysis – This will delete the project file.

Update Analysis – This function is used to update existing projects in the event a newer version of DRAS is issued. A duplicate of all projects imported into the *Available Analyses* window will be created using physical and chemical parameters from the new version. The user should rename them or otherwise note they may have different results. This function will not update DRAS version 1.0 and 2.0 files since the version 3.0 database has been restructured.

Delisting Technical Support Document (DTSD)

A link to the Delisting Technical Support Documents is provided down the left side of the screen below the *Analysis Operations*. Clicking on these will open the documents in portable document format in the project window to the right. The same documents are also available under the *Documents* sub-menu at the top of the page. In the event the links fail, which can happen depending how your portable document format viewer is installed, you can access these files from the *Documents* sub folder located in the folder in which you installed the DRAS.

Tool Bar and Menu

A number of these same commands repeat as buttons in the tool bar or as menu options at the top of the page. Additional commands available in the tool bar and menu include:

Print – This allows the selection of various reports and results tables for hard-copy printing. Note: many of the tables are wide and print better in landscape mode.

Export to Table – This allows whichever table is displayed in the project box to exported as either a *Table Export* in **.html* format or a comma and space delimited text file suitable for importing into a spreadsheet program such as Microsoft Excel™. The export to the comma delimited export is very useful in the event you wish to sort, compare, or process the results in ways beyond those available within DRAS.

Edit Customer COCs and DAFs – This allows the creation of and management of a database of chemicals or elements not preloaded in DRAS (See Section 5.4). Table entries can be made for the same physical, chemical, biological, and toxicological parameters entered for the DRAS default elements and chemicals. Dilution-Attenuation Factors (DAFs), a parameter relating leachate concentrations in the landfill or surface impoundment to groundwater concentrations at a nearby residential supply well, can be entered on a separate line. DRAS can only evaluate one constant DAF for a constituent entered in the customer database. This DAF will be used for all entered concentrations. To avoid run-time errors, please enter estimated DAFs for both landfill and surface impoundments for each unique constituent added. **Note**: this function is not operational in all installations at this time. In the event this function does not work on your computer, try installing DRAS on a different computer or choose a surrogate element or chemical (one you were not planning on including in your analysis) and modifying the physical, chemical, biological, and toxicological parameters in the table in DRAS window *Steps 4 & 5* while noting your change.

Analysis – This option lets you switch views between facility information, chemical data entry, and results screens. Note: the links to the **Chemical Properties Database** and the **Show Delisting Level Analysis** are not operational at this time. **Show Delisting Level Analysis** is meant to allow the calculation of delisting levels using only facility and target risk information for the purposes of conveying target data quality objectives at the outset of a project. EPA will attempt to restore these functions in the future. All chemical properties entered in the default database can be viewed in DRAS window *Steps 4 & 5* once that element or chemical has been added to the project-specific list. All of these values can also be viewed along with references in Appendix A1 of the DTSD. Target data quality concentrations must be generated by selecting all of the elements and chemicals of concern and running DRAS to obtain maximum allowable total and TCLP concentrations.

Window - This option lets you switch views between facility information, chemical data entry, and results screens but includes links to more of the individual results screens. Note: the link to the **Chemical Properties Database** is not operational at this time. All chemical properties entered in the default database can be viewed in DRAS window *Steps 4 & 5* once

that element or chemical has been added to the project-specific list. All of these values can also be viewed along with references in Appendix A1 of the DTSD.

DRAS v.3.1 Help – This command is reserved for a help, topics, index, and search-style help function which is not currently operational. Please refer to this guide, the DTSD, or the Agency's contact for DRAS for assistance. The current Agency contact for DRAS is Todd Ramaly, EPA Region 5, and can be reached at 312-353-9317 or ramaly.todd@epa.gov.

5.3 Steps 1-3 – Entering Facility Information

The following screenshot shows the first data entry window. *Step 1* includes fields for entering the project filename, petitioner, location, EPA Region, waste code, waste description, and pertinent dates. There is also a User Comment box where detailed comments about the run can be entered. This is helpful if the user wishes to run the project multiple times with varying inputs and differentiate one run from another.

Step 2 – Waste Management Unit and Risk/HQ Information – is where the user specifies the following input:

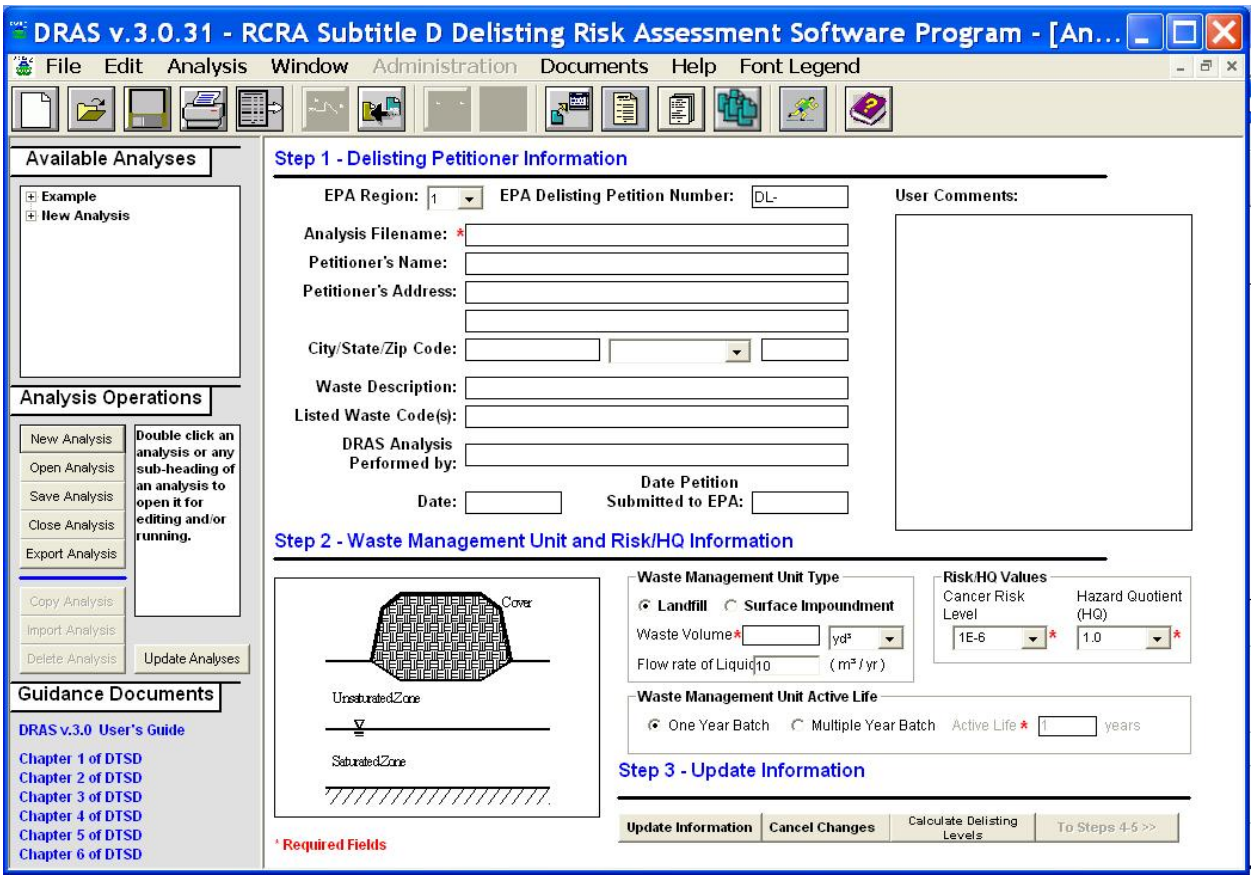
Waste Management Unit Type - **Landfill** for non-liquid wastes or **Surface Impoundment** for liquid wastes;

Waste Volume – This is the value for waste generated annually for continually generated wastes or one total volume for one-time projects like remediation. For landfills, please enter the annual volume in cubic yards. For surface impoundments, please enter the total volume of liquid in the surface impoundment in cubic meters (typical operating capacity).

Flow Rate of Liquid – This applies to evaluations of surface impoundments only and must be set to the expected flowrate of liquid into the surface impoundment in cubic meters per year.

Waste Management Unit Active Life – The default values are 20 years for landfills and 50 years for surface impoundments.

Target risk and target hazard quotient – The target risks and hazards are obtained from your delisting regulatory authority.



This Step also allows you to choose between a **One Year Batch** delisting, typical for a remediation waste scenario or a **Multiple Year Batch** where the facility plans on generating the waste indefinitely.

On some systems, you may not be able to see the entire screen, including important commands at the bottom of the window. By selecting the Windows button that allows multiple window pane display (between the "minimize" button and the "close" "x" button on the menu bar above) the *Steps 1-3* window refreshes with a scroll bar on the right. Use the scroll bar to move to the bottom of the window where you can now choose from the *Step 3* options. The following screen shows the bottom of the *Steps 1-3* window.

Step 3 – The following four commands are presented under *Step 3 – Update Information*:

Update Information – This locks in all entries or modifications made in steps 1 & 2.

Cancel Changes – This clears all modifications to steps 1 & 2.

Calculate Delisting Levels – This feature generates a concise list of maximum allowable concentrations for both total concentrations and leachate concentrations so that "practical quantitation limits" (PQLs – the concentrations at which selected laboratory methods are sensitive to the tested constituents) could be confirmed as adequate for comparison to the

DRAS maximum allowable concentrations. **This feature is not currently working as intended**. EPA recommends that waste constituents be entered in steps 4&5 and that the DRAS analysis be fully run to generate maximum allowable concentrations. The existing DRAS project named *example.drs* can be used to prepare provisional delisting levels for use as PQLs. The project *example.drs* has all chemicals in the DRAS database already selected so the user need only reenter the facility name, annual volume, and target risk and target hazard in order to quickly run the project. "Dummy" values for TCLP and total concentrations are also pre-loaded into *example.drs*. Even though the concentrations are not needed in determining maximum allowable delisting levels (for use as PQLs in this case) DRAS will not run without concentrations entered. *Example.drs* can be renamed to match your project.

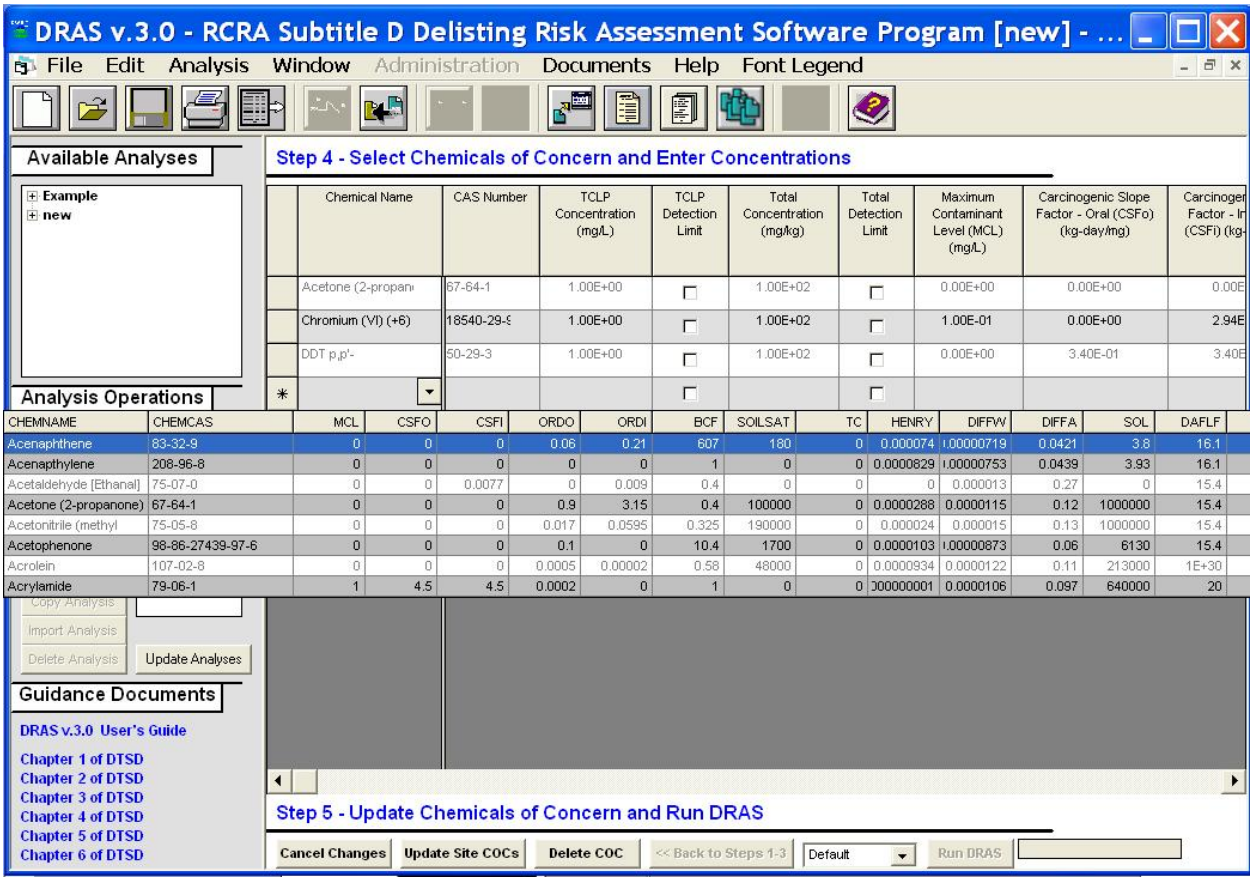
To Steps 4&5 – This option moves data entry to the *Steps 4&5* window where individual waste constituents are selected and concentrations are entered. Note: This command will not be available unless all mandatory fields, marked with a red asterisk, are completed.

5.4 Steps 4&5 – Selecting Chemicals of Concern

Step 4 includes a table where individual waste constituents are selected for evaluation. By clicking in the *Chemical Name* or *CAS Number* fields, a drop-down table can be opened revealing all of the chemicals or elements available in the DRAS default database arranged in alphabetical order. Waste constituents are added to the project-specific Step 4 table by scrolling down and clicking on a particular constituent. The user can also begin typing a constituent name or CAS number and if a default constituent matches the entry, the drop-down table will advance to the matching constituent.

Once added to the project-specific analysis table, the user must enter a concentration or detection level (in the case of non-detects) for both the total concentration and the leachate concentration. Leachate concentrations are typically obtained from the Toxicity Characteristic Leachate Procedure (TCLP) although other tests may apply depending upon the delisting regulatory authority's requirements. A non-zero concentration must be entered for both types. If you wish to run the analysis with incomplete data, for example to see if a waste will pass based on existing data, EPA recommends that you enter a dummy value so that the program will run. The dummy value can be an extremely low detection level so that the estimated risk or hazard doesn't skew the results.

To record a non-detected result, enter the detection limit and select the "detection limit" box. Risks will be aggregated in two ways. One includes risks generated only from detected concentrations and another includes risks generated from both detected concentrations and a fraction (50%) of the detection limits from non-detected constituents.



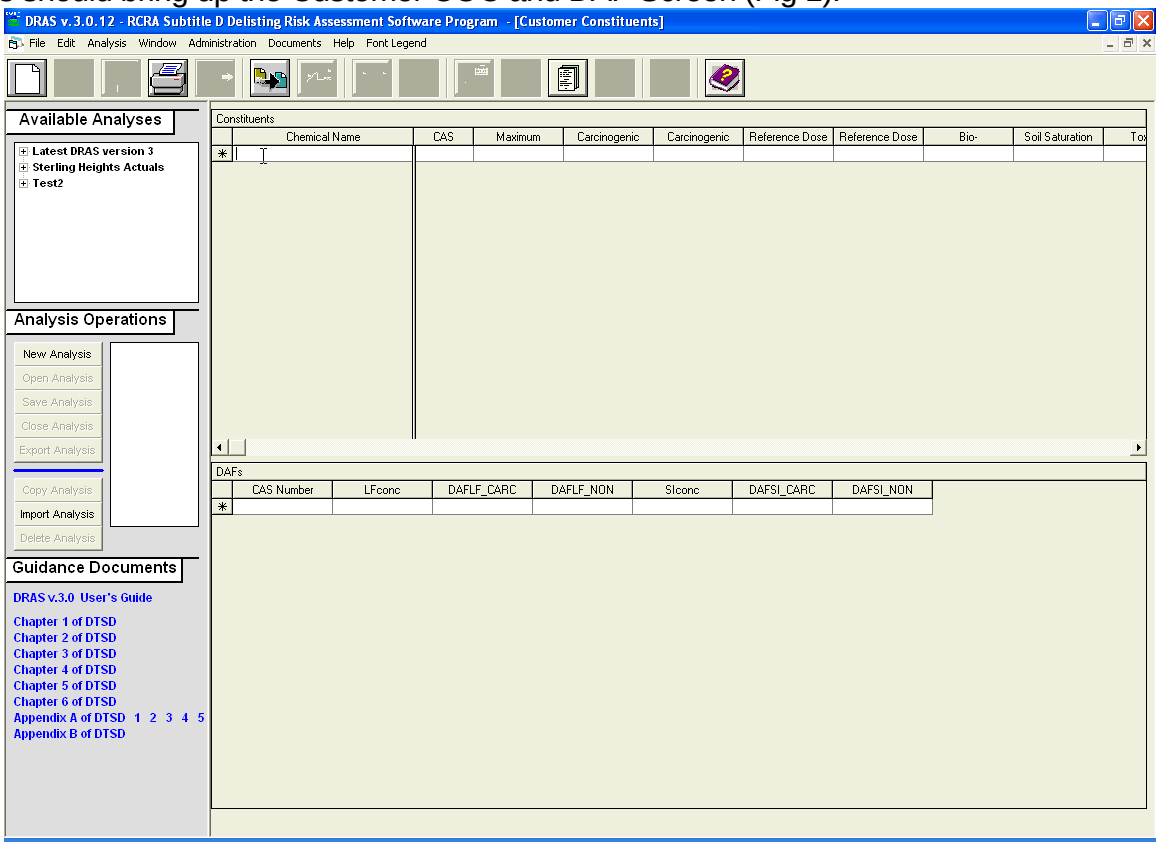
Modifying physical, chemical, biological, and toxicological parameters: To modify any parameter (for example, to incorporate an updated cancer slope factor), the user can scroll across the line for a constituent by using the left and right cursor keys and typing in the new value. Any modifications to the default database will be documented in a particular output table.

Evaluating waste constituents not available in the default database: In the event that the user wishes to evaluate a waste constituent that is not among those pre-loaded in the DRAS database, there are two ways to perform this evaluation.

First, a customer-generated separate database for unique chemical entries can be prepared by the user. The menu item *Edit Customer COCs and DAFs* from the *Edit* menu. Table entries can be made for all of the same physical, chemical, biological, and toxicological parameters entered for the DRAS default elements and chemicals. DAFs, a parameter relating leachate concentrations in the landfill or surface impoundment to groundwater concentrations at a nearby residential supply well, can be entered on a separate line. The DRAS can only evaluate one constant DAF for a constituent entered in the customer database. This DAF will be used for all entered concentrations. To avoid run-time errors, please enter estimated DAFs for both landfill and surface impoundments for each unique constituent added.

Instructions for adding a new COC:

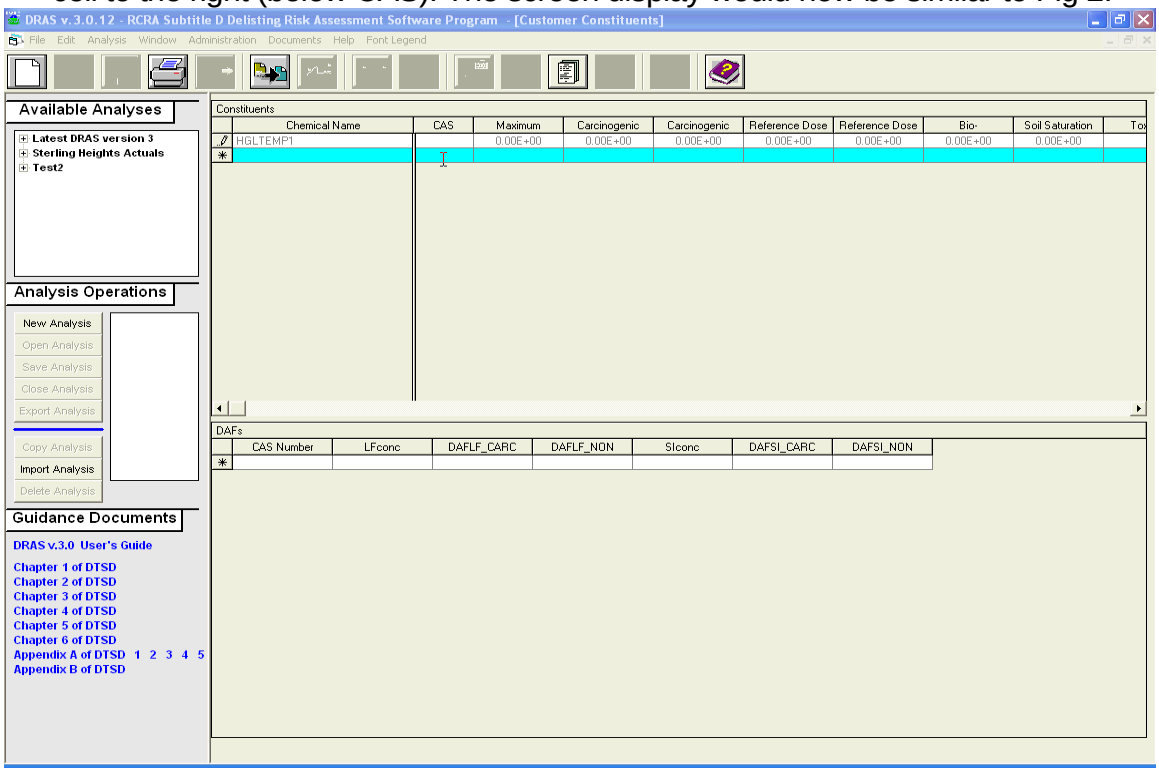
1. From the Main Screen, Click on **Customer COCs and DAF** under the *Edit* menu. This should bring up the Customer COC and DAF Screen (Fig 1).



- Figure 1

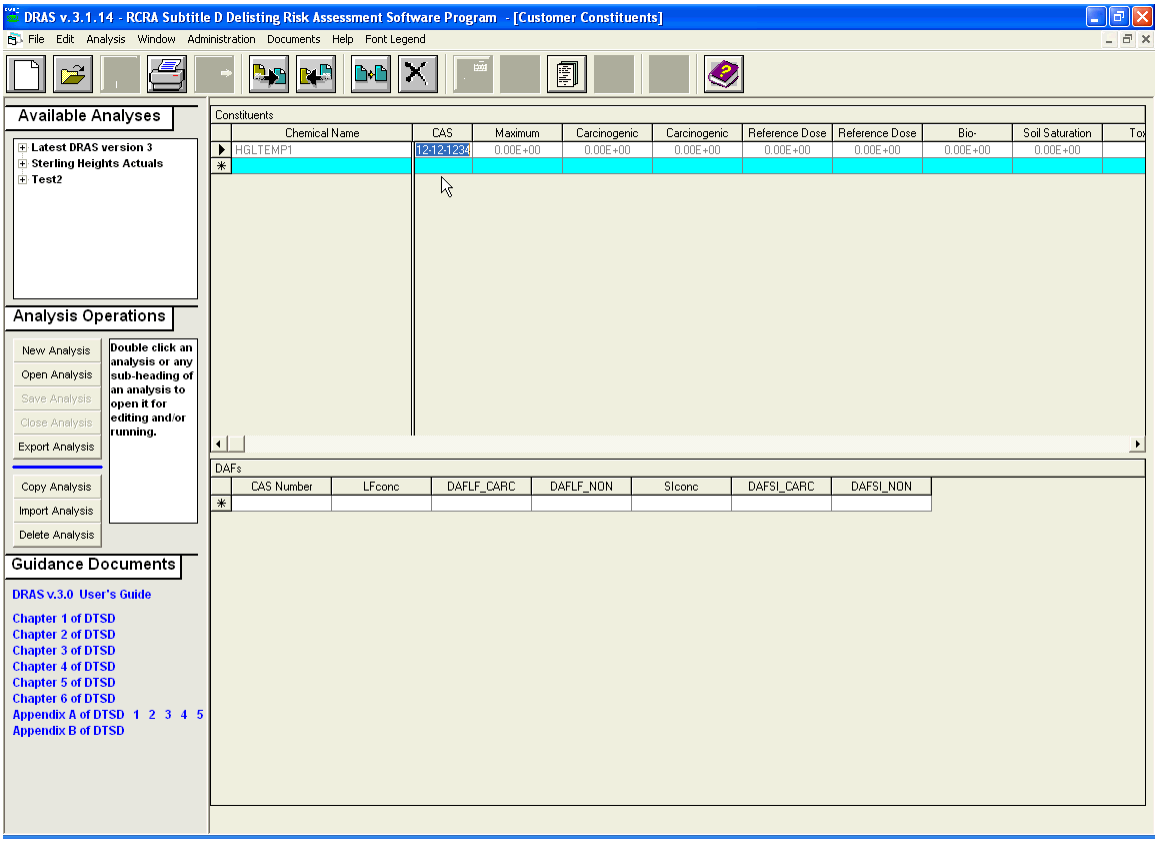
2. COC properties are entered in the top half of this window and DAF information is entered in the bottom half.

3. Click on the *Chemical Name* cell in the top window and enter the first COC: for example - HGLTEMP1 (Figure 2). After entering the Chemical Name, Click on the cell to the right (below CAS). The screen display would now be similar to Fig 2.

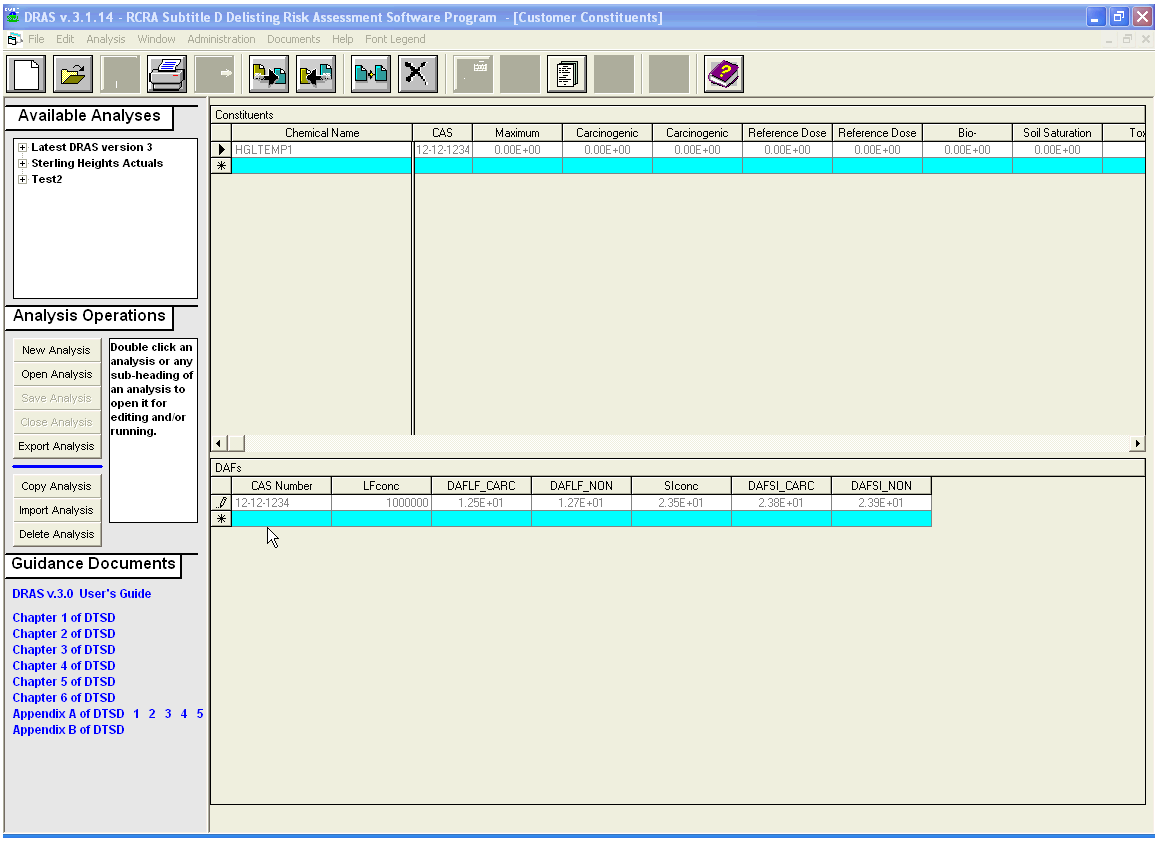


■ Figure 2

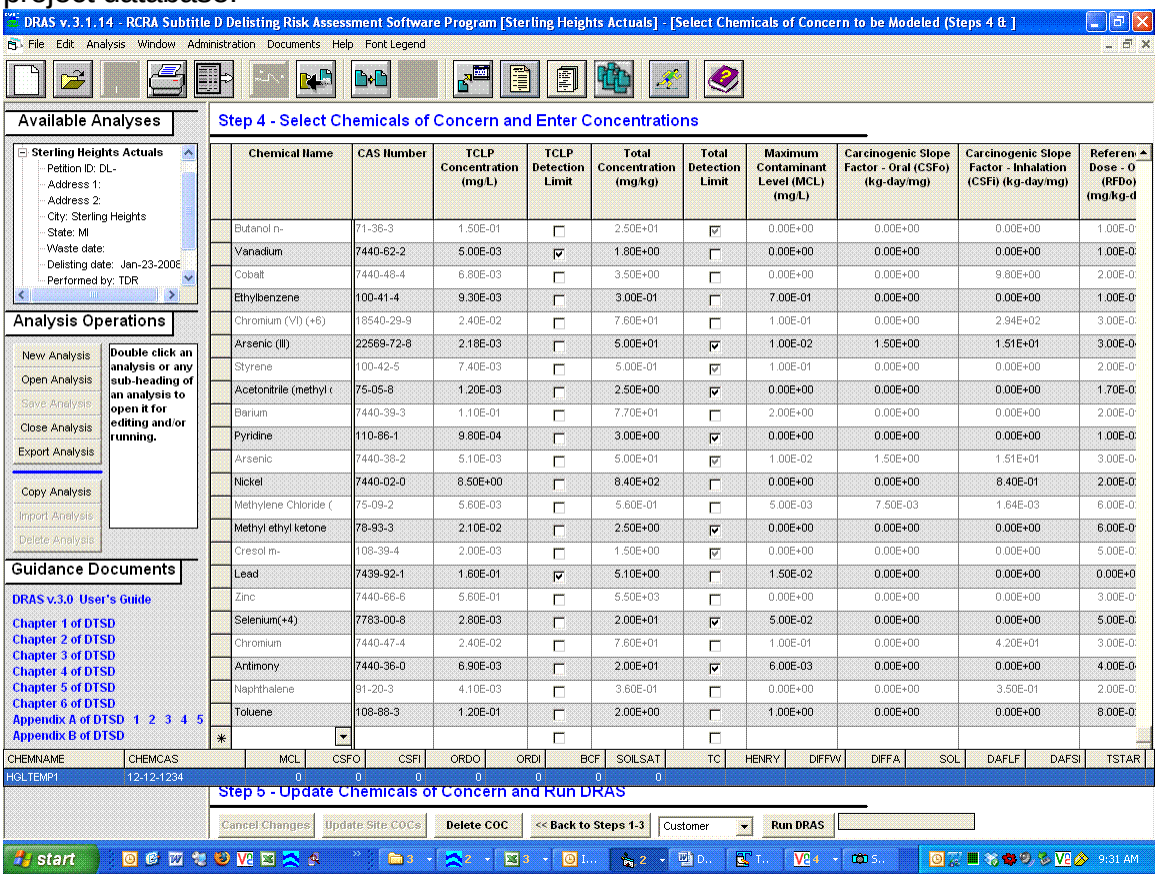
4. Enter the values for *CAS ID* and other properties. Once all values have been entered, click on the row below (Colored in blue). This should update the COC properties. Once the database is updated, the pencil icon will change to a black arrow.



5. Now, click on the DAF window in the lower-half and enter CAS Number and respective DAFs. After entering all the data, click on the blue row below to update the database. Once the database is updated, the pencil icon will change to a black arrow.



6. To access this COC from the Site COCs screen, click on the drop down at the bottom and select the *Customer* option. Now, HGLTEMP1 can be added to the project database.



Note: The *Customer Database* function is not operational in all installations at this time. If it does not work on your installation, please try installing DRAS on a different system or use the second approach to evaluating a non-default waste constituent as described in the next paragraph.

A waste constituent not already included in the default DRAS database can also be added by selecting a DRAS constituent the user specifically does not need for the project to serve as a surrogate for analysis. Scroll to the right to enter all the physical, chemical, biological, and toxicological parameters to match the new chemical or element. Choose an organic chemical, or one for which the DAFs are not "TCLP dependent" for the surrogate. The user must keep a separate record documenting that the chemical selected is actually a surrogate for another.

The remaining commands under *Step 5 – Update Chemicals of Concern and Run DRAS* are:

Cancel Changes – This will remove any modifications made since the last update.

Update Site COCs – This will save all changes and entered data in Step 4. Users should update periodically while adding many waste constituents in order to minimize the loss of data if the program unexpectedly quits.

Delete COC – This will delete a selected waste constituent only if the line corresponding to it is highlighted by clicking on the box to the left of the *Chemical Name.*

Back to Steps 1-3 – This will return the user to *Steps 1-3, Delisting Petitioner Information, Waste Management Unit and Risk/HQ Information, and Update Information.*

Run DRAS – This will run the DRAS analysis, providing both a forward estimate of risk and hazard based on the concentrations of waste constituents entered and a list of maximum allowable concentrations back-calculated from the target risk and hazard settings

6 Results

The following tables will open upon a successful DRAS run with each available for viewing, printing, or export: To return to *Steps 1-3* or *Steps 4&5* from the results screens, click **Close Results Screens** under the *Windows* menu at the top of the page.

List of Customer COCs – This is a list of all customer COCs selected for analysis including all physical, chemical, biological, and toxicological data entered.

List of COCs with Altered Chemical Properties – This is a list of all default DRAS COCs selected for analysis where the user has altered any of the physical, chemical, biological, and toxicological data. This table will identify each parameter, units, the original value, and the new value.

Limiting Pathways – This table summarizes the most sensitive pathway for each constituent for both ground water pathways (evaluated as leachate) and surface pathways (evaluated as total concentrations).

Groundwater Pathway Hazard Quotient – This displays the estimated hazard quotient via ground water for each waste constituent by pathway and summed by constituent and pathway.

Groundwater Pathway Risk – This displays the estimated excess cancer risk via ground water posed by each waste constituent and summed by constituent and pathway.

Maximum Allowable TCLP Concentration – Groundwater Exposure Pathway – This table displays the maximum allowable receptor concentration for a number of ground water exposure pathways based on target risk and hazard settings. The minimum value of these concentrations and the Safe Drinking Water Act MCL is converted into a maximum allowable waste leachate concentration based on the DAFs that apply.

Surface Pathway Hazard Quotient – This displays the estimated hazard quotient via surface pathways for each waste constituent by pathway and summed by constituent and pathway.

Surface Pathway Risk – This displays the estimated excess cancer risk via surface pathways posed by each waste constituent and summed by constituent and pathway.

Maximum Allowable Total Concentrations – Surface Exposure Pathway – This table displays the maximum allowable total concentration for a number of surface exposure pathways based on the target risk and hazard settings. The least of these concentrations is selected as the overall maximum allowable concentration.

Aggregate Risk and Hazard Quotient Results – All excess carcinogenic risks for both detected values only and a combination of detected values and a fraction (50%) of the detection level for non-detected constituents are aggregated here. All hazard quotients for

both detected values only and a combination of detected values and a fraction (50%) of the detection level for non-detected constituents are aggregated here into a hazard index. Note: If the hazard index exceeds the target hazard set by the delisting regulatory authority, EPA recommends that the constituents may be evaluated and split by target organ (see DTSD Appendix A-4) before drawing a conclusion about exceeding the target hazard.

Toxicity Characteristic, Soil Saturation, and Ecological Values – This table identifies waste concentrations that exceed toxicity characteristic concentrations, waste concentrations that exceed soil saturation values (a condition that cannot be evaluated properly by the fate and transport models used in DRAS), and waste concentrations that result in surface water concentrations (from uncontrolled run-off at the waste management unit) that exceed surface water quality criteria.

Pathways Exceeding the Delisting Limits – This is a concise summary of only those evaluated constituents that exceed the maximum allowable concentrations based on target risk and hazard settings.