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**USER'S GUIDE FOR THE U.S. EPA REGION 6
DELISTING RISK ASSESSMENT SOFTWARE
(DRAS)**



Office of Solid Waste

Prepared by

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August 31, 2000

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(DRAS)**

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1.0 INTRODUCTION

This *User's Guide* has been developed as part of the U.S. Environmental Protection Agency (EPA) Region 6 Hazardous Waste Delisting Program. It has been prepared to assist the user in applying the Region 6 Delisting Risk Assessment Software (**DRAS**) to determine whether a waste qualifies as not characteristically toxic for the purposes of delisting (in accordance with Title 40 Code of Federal Regulations (CFR) Parts 260.20 and 260.22 and the Region 6 Delisting Program).

The Region 6 Delisting Program developed this software to compute the risks and hazards associated with a specific waste stream for which a delisting petition has been submitted. The Region 6 **DRAS** will assess the toxicity of a petitioned waste by calculating: (1) chemical and waste volume-specific screening exit values, and (2) cumulative carcinogenic risks and hazard indices (for non-carcinogens).

1.1 OBJECTIVES

The objectives of the *User's Guide* are: (1) to provide general information about the Region 6 **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 available as a WordPerfect 6.1 file on the compact disc (CD).

Petitioners are directed to the *Region 6 RCRA Delisting Program Guidance Manual for the Petitioner* (U.S. EPA, 1996) for additional information necessary to satisfy the information requirements of a complete delisting petition.

1.2 BRIEF OVERVIEW OF THE SOFTWARE

This software will assess the carcinogenic risk and noncarcinogenic hazard associated with a petitioned waste's disposal to either of two types of waste management units (**WMU**): 1) landfills and 2) surface impoundments. The software prompts the user to enter waste information which should be available in the delisting petition. Once all the general waste information and the chemical specific constituent concentration data have been entered, the program will perform screening and cumulative risk and hazard calculations.

The screening risk evaluation will provide the user with Toxicity Characteristic Leachate Procedure (**TCLP**) and total waste constituent concentrations associated with a 1×10^{-5} carcinogenic risk level and a hazard quotient of 0.1 for the most sensitive exposure pathway. These **TCLP** and total values 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 will provide 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 risk for all waste constituents. The assessment will also provide the user with the cumulative carcinogenic and noncarcinogenic risks associated with a specific waste constituent. If the waste exceeds the risk-based levels outlined in the **DTSD**, the waste may not qualify for exclusion under 40 CFR §§260.20 and 260.22. The methods and data used in: 1) the determination of media waste concentrations at the point of exposure; 2) the risk assessment algorithms is outlined and referenced

in the **DTSD**.

To obtain a copy of the **DTSD**, please contact:

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To avoid misinterpretation, the results of the screening analyses and the cumulative risk analyses are displayed to the user on separate screens. The screening results display each waste constituent that exceeds the screening risk levels, along with the exposure pathway for which the exceedance was determined and the waste concentration (**TCLP** and total) that would allow the constituent to pass the screening levels (i.e., 1×10^{-5} for carcinogens and 0.1 hazard quotient for non-carcinogens).

The cumulative risk interface screens provide: 1) the carcinogenic risk and noncarcinogenic hazard quotient for each pathway for a given constituent; 2) the cumulative risk and HI for all exposure pathways of a specific waste constituent; 3) the cumulative risk and hazard index (HI) summed for all waste constituents; 4) identification of chemicals that exceed their soil saturation value; and 5) identification of chemicals that exceed Toxicity Characteristic (TC) Rule regulatory 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 0.5 (50% of the detection level). The program will track waste constituent risks associated with actual measured concentrations and those risks associated with **DL** values.

1.3 USING THE DRAS SOFTWARE IN SEVEN EASY STEPS

- **Step 1: Installation (Windows 95).** To install the **DRAS** software, insert the installation CD into the drive. If your machine has AUTORUN enabled, a **DRAS** installation screen will be displayed. Click on the “Install Delisting Risk Assessment Software” button to install the **DRAS**, then follow the on-screen instructions. If AUTORUN is not enabled, then, from the start menu, select RUN. Enter the drive letter for your CD drive followed by SETUP.EXE in the dialog box or click “Browse” and click on the file SETUP.EXE on the CD drive. Then follow the instructions. (For more information, see Section 3.0).
- **Step 2: Open DRAS (Windows 95).** To open the **DRAS** software select “Programs” from the Start menu and then select “Delisting Risk Assessment Software” (see Section 5.1). On initial start-up the **DRAS** presents a series of introductory screens describing the program. Click “Next” until reaching the last screen, then click “Finish” to enter the analysis input part of the program. The introductory screens can be turned off by checking the box at the bottom of the analysis input screen.
- **Step 3: Enter information for record keeping.** To enter information for record keeping purposes, click the “Facility Information” tab located at the top of the data entry screen (see Section 5.3.1).
- **Step 4: Enter facility-specific information about the WMU.** To enter information about the **WMU**, click on the “Waste Management Unit” tab. Then select the **WMU** type (“Landfill” or “Surface Impoundment”) and enter the **WMU** properties (“Waste Volume” and “Active Life”) (see Section 5.3.2).

- **Step 5: Enter chemical-specific information about a waste petitioned for delisting.** To enter chemical-specific information about a waste, click on the “Chemical Input” tab. Then select the desired chemicals from the chemical list. After selecting the chemicals enter the maximum **TCLP** concentration (mg/L), maximum total concentration (mg/kg), and, if necessary, its **DL** (see Section 5.3.3).
- **Step 6: Run analysis.** To obtain detailed risk assessment results, click on the “Run Analysis” tab at the bottom of the screen. Clicking on the “Run Analysis” button generates the **Analysis Results** screen comprised of four tabs: **Delisting Results**, **Chemical-Specific Results**, **Cumulative Results**, and **Summary of Results** (see Section 5.4).
- **Step 7: Print and/or save results.** To print the risk assessment results, click on the “Print Results” button at the bottom of the **Analysis Results** screen, and then select the desired reports to print. To save the analysis results, click on the “Save Analysis” button at the bottom of the **Analysis Results** screen, and then choose the desired location and filename (see Section 5.5).

2.0 SYSTEM REQUIREMENTS

This section summarizes the minimum and recommended installation and operating requirements.

2.1 MINIMUM SYSTEM REQUIREMENTS

The minimum system requirements for installing and running this software are as follows:

- PC: 486 CPU
- Operating System: Windows 3.11
- System Memory: 16 Mb RAM
- Disk Storage Space: 6 Mb hard-disk space
- Other: CD-ROM

2.2 RECOMMENDED SYSTEM REQUIREMENTS

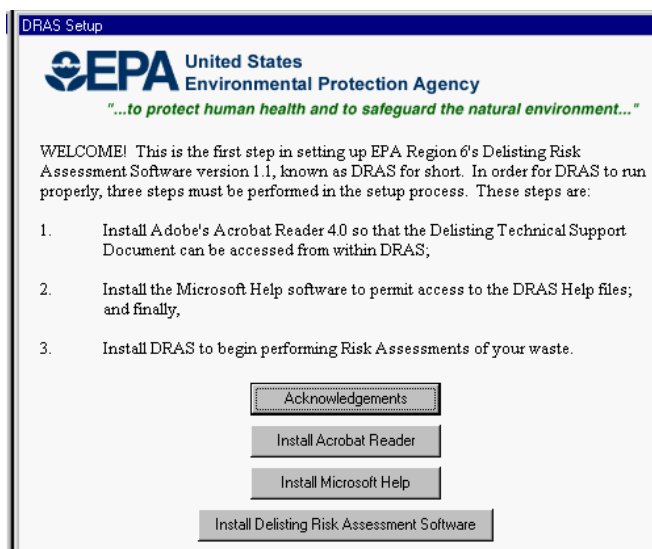
The recommended system requirements for installing and running this software are as follows:

- PC: Pentium 133 MHZ
- Operating System: Windows 95
- System Memory: 32 Mb RAM
- Disk Storage Space: 30 Mb hard-disk space
- Other: CD-ROM

3.0 INSTALLATION

The U.S. EPA Region 6 **DRAS** is installed from a CD installation disk. To install the software, the user should perform the following steps:

- Close all other applications.
- Insert disk into the CD drive.
- If your machine has AUTORUN enabled, an installation screen will load automatically from the CD. Click the “Install Delisting Risk Assessment Software” button to install the **DRAS**. If your machine does not have AUTORUN installed, then, to begin the installation process:
 - For Windows 3.11 users: from the “File” menu, select “Run.”
 - For Windows 95 and NT users: from the “Start” menu, select “Run.”
- Click the “Browse” button and navigate to the CD drive. Click on the setup.exe file and then click the “OK” Button.
- On the “Welcome” screen, click “OK.”
- Select the destination directory on your hard-drive where this software is to be installed and click on the “Installation” button.
- When the installation is complete, click on the “OK” button to exit the installation process.



For Windows 3.11 users, the program can be started by double-clicking on the Delisting program group, and then double-clicking on the Drasv1.exe file.

For Windows 95 users, the program can be started by selecting “Programs” from the “Start” menu (on the Windows tool bar at the base of your screen). Then select “Dras” from the list of available programs.

If you are experiencing difficulties installing the **DRAS** and are linked to a network version of Windows, it may be necessary to use your local version of windows. Check with your local network administrator to determine the best option for installation.

If you are running virus scan software, it may be necessary to close the virus scan software prior to installing the **DRAS**.

4.0 BRIEF OVERVIEW OF RUNNING THE SOFTWARE

The Region 6 Delisting Program has developed this Windows-based **DRAS** to calculate delisting levels and to perform a cumulative assessment of the total carcinogenic risk and noncarcinogenic hazard associated with the disposal of the petitioned waste.

4.1 DELISTING LEVEL ANALYSIS VERSUS RISK AND HAZARD ANALYSIS

The **DRAS** performs two types of analyses: (1) a delisting level analysis and (2) a cumulative risk and hazard analysis. The results of these analyses may be viewed on screen, imported into word processing documents, or printed in document-ready form. The results of the delisting level analyses are used in the evaluation of multi-year delisting petitions, whereas the results of the risk and hazard analyses are used in the evaluation of one-time delisting petitions.

4.2 DELISTING LEVEL ANALYSIS

The delisting level analysis computes chemical-specific delisting levels or “exit values” for multi-year delistings. These delisting levels are the maximum allowable total constituent concentration in the waste and the maximum allowable waste leachate concentration. Delisting levels are calculated using default values for the target risk and hazard quotient of 10^{-5} and 0.1, respectively. The default target risk and hazard quotient values can be changed by the user, but this will impact the magnitude of the resulting delisting levels. EPA Region 6 requires use of the default values in delisting petitions.

Because toxicity is only one of the waste characteristics which are examined in a delisting petition, a waste which does not exceed its delisting levels is not automatically delisted. A waste that contains constituents at concentrations that exceed their delisting levels may not qualify for delisting.

4.3 RISK AND HAZARD ANALYSIS

The cumulative risk and hazard analysis computes the cumulative carcinogenic risk and noncarcinogenic HI of a waste petitioned for a one-time delisting to determine if the risk exceeds a 10^{-4} risk and/or if the hazard exceeds a 1.0 HI.

4.4 REQUIRED INPUT

To calculate the delisting levels and the potential risks associated with a particular waste stream petitioned for delisting, specific information about the petitioned waste is required. EPA Region 6 requires the petitioner to input the following waste-specific information into the **DRAS** to estimate risks associated with potential exposure to the petitioned waste stream:

- The maximum annual volume of the petitioned waste for a multi-batch delisting petition or the maximum total waste volume for a one-time delisting,
- The rate at which leachate flows from a surface impoundment into the subsurface,
- The maximum total concentration of each chemical constituent in the petitioned waste,
- The maximum **TCLP** concentration (estimated leachate concentration) of each chemical constituent in the petitioned waste, and
- The number of years the petitioned waste is projected to be generated.

4.5 OUTPUT

Delisting levels are presented on the tab entitled **Delisting Results**. These delisting levels are the maximum allowable concentrations which can be present in the waste without exceeding the defined risk level (10^{-5}) or HI (0.1). If the concentration in the petitioned waste exceeds the delisting level for a given waste constituent, the delisting level is reported in the table on the **Delisting Results** tab; otherwise, "N/A" is reported in the table. Further, instances of a chemical's total waste concentration exceeding the 10,000 mg/kg delisting ceiling are indicated in the results. Also, when a chemical's **TCLP** concentration exceeds its TC Rule regulatory value (see CFR §261.24(a), Table 1), this is indicated in the results. Finally, when an organic chemical's calculated delisting level is greater than its soil saturation value (given in the Appendices of the **DTSD**), this is indicated in the results.

The complete results from the risk/hazard analysis are presented on the **Chemical-Specific Results** tab and the **Cumulative Results** tab and are summarized on the **Summary of Results** tab. In the risk and hazard analysis, first the potential risk and hazard posed by disposal of the petitioned waste is calculated. Then the calculated total risk level for the petitioned waste is compared to the standard risk level of 10^{-4} and the calculated total HI for the petitioned waste is compared to the standard HI of 1.0.

4.6 APPLICATION OF RESULTS TO EVALUATION OF DELISTING PETITION

If any of the delisting levels are exceeded, the waste may not qualify for delisting. However, because toxicity is only one of the waste characteristics which are examined in a delisting petition, a waste which does not exceed the delisting levels is not automatically delisted.

A petitioned waste whose cumulative carcinogenic risk (as calculated in **DRAS** risk and hazard analysis) exceeds the value of 10^{-4} may not be a candidate for delisting.

Exceeding a hazard quotient of 1.0 (as calculated in **DRAS** risk and hazard analysis) does not necessarily indicate that the petitioned waste should not be delisted. Not all noncarcinogenic hazards are additive (U.S. EPA, 1989). If the HI for a petitioned waste exceeds 1.0, the compounds should be segregated by the type of effect induced and the mechanism of action. Separate hazard indices could then be derived for each target organ(s) or mechanism of action. This analysis is not a simple process and should only be performed by a qualified toxicologist. The user is referred to the Region 6 **DTSD** for additional information.

5.0 GETTING STARTED: WALK-THRU WITH SCREENS

5.1 HOW DO I START THE DRAS SOFTWARE?

To use the program for the first time, you must install the software from the CD to the hard-drive (see Section 3.0).

For Windows 3.11 users, the program can be started by double-clicking on the **DRAS** group, and then double-clicking on the Dras1.exe file.

For Windows 95 users, the program can be started by selecting “Programs” from the Start menu (on the Windows tool bar at the base of your screen). Then select the “Dras” program from the list of available programs.

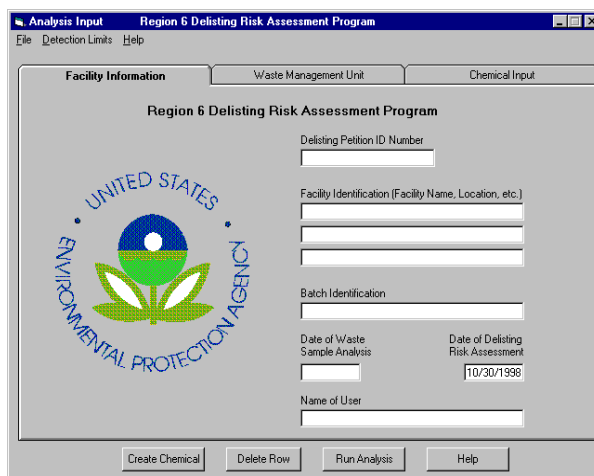
5.2 WHAT ARE THE FEATURES OF THE DRAS USER-INTERFACE?

This software is optimized to work with the Windows 95 operating system, but is also backward compatible with Windows 3.11. The software is likely to be compatible with the Windows 98 operating system, but has not been tested in this setting. The DRAS user interface is designed to operate similar to other Windows-based programs. At the very top of the screen is a title bar which displays the software title. Directly below the title bar is the main program menu. The user can select among the following menu items: “File,” “Detection Limits,” and “Help.” General file operations such as open and save can be accessed by clicking on the “File” menu. The user can display the list of **DLs** for all constituents by clicking on the “Detection Limits” menu (note: close the “Detection Limits” menu to bring back the user-interface screen). The user can access the *User’s Guide*, get information about the software, or re-display the introductory screens by clicking on the “Help” menu.

How do I navigate through the **DRAS** software?

The user interface is set up as a series of Windows-based screens and tabs through which the user navigates to enter data and view results. The user can page through the program using two different methods: 1) by clicking on the command buttons at the bottom of the screen, or 2) by clicking on one of the labeled tabs located at the top of the data entry and results screens. These tabs allow the user to:

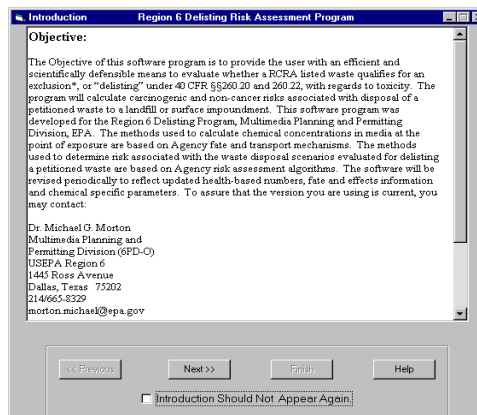
- Enter descriptive information about the waste being evaluated for delisting
- Select the waste management scenario and waste volume
- Select waste constituents and enter leachate and total waste concentrations
- Print reports and save, open, and edit delisting files



How do I get HELP if I have a problem or a question?

Help can be accessed by clicking on the pull-down “Help” menu screen and then selecting “Help Definitions” or by clicking on the “Help Definitions” button on the lower right of the screen. The “Help Definitions” selection presents the user with a screen containing links to help topics, a searchable index, and an option to print the “Help” topic text.

The first time the *DRAS* is run, a series of screens with introductory information is displayed. After reading this information, the user can click in the check-box at the bottom of the screen to prevent these introductory screens from being displayed the next time the program is run. This introductory information can be viewed at any time by choosing “Show Introduction Screens” from the pull-down “Help” menu. Also, the *User’s Guide* can be viewed from the pull-down “Help” menu. Finally, the pull-down “Help” menu includes an option for enabling the *DL* check screen when entering chemical concentrations.



5.3 ANALYSIS INPUT

This section of the *DRAS* is designated for the input of pertinent facility information, waste-specific information, and chemical-specific information about a petitioned waste. There are three interface screens in this section of the *DRAS*: 1) *Facility Information*; 2) *Waste Management Unit*; and 3) *Chemical Input*

5.3.1 Facility Information Tab

Are the inputs on the Facility Information screen necessary?

The *Facility Information* screen allows the user to enter information about a delisting petition analysis. While the inputs on this screen are not required to perform an analysis, this screen allows the user to enter information that is necessary for record-keeping. In addition, this information entered by the user is printed on all *DRAS* reports. The user should enter the following information in the appropriate text box:

Delisting Petition ID Number — Internal tracking number for the delisting petition which is being analyzed in the *DRAS*. To facilitate record keeping, each waste petitioned for a RCRA exclusion (delisting) should be assigned a unique number. We recommend that the ID number incorporate the EPA region number and year of the petition. For instance, ID# R6-98-001 could be the ID number for the first delisting petition received in Region 6 during 1998.

Facility Identification — The name and address of the facility petitioning for the delisting.

Batch Identification — Descriptive information about the batch of waste being analyzed. This information is useful for distinguishing between several waste streams at the same facility.

Date of Waste Sample Analysis — Date the petition analysis was performed. This information is useful for internal record keeping.

Name of User — Person who is performing the delisting risk assessment. Again, this information is useful for internal record keeping.

Throughout the *DRAS* program, the facility name and petition identification number are displayed on-screen

for the user's convenience and so that a printed copy of an individual screen will include identification of the waste being evaluated.

5.3.2 Waste Management Unit Tab

A waste petitioned for a RCRA hazardous waste exclusion (delisting) is expected to be disposed of in a *WMU*. The *Waste Management Unit* screen allows the user to enter facility-specific information about the *WMU* where the waste is disposed. The *DRAS* uses waste information entered on this screen to perform the risk assessment. The information that can be entered is explained below.

What types of *WMUs* can I select?

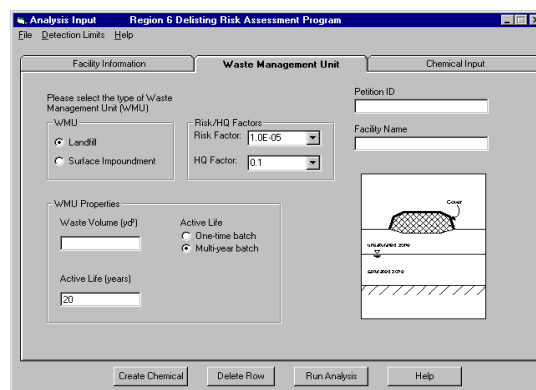
WMU — The *DRAS* predicts risks associated with the disposal of petitioned wastes for two types of *WMUs*: *Landfill* and *Surface Impoundment*. A *Landfill* scenario should be selected to assess the potential risks associated with the disposal of solid wastes petitioned for a RCRA exclusion (delisting). The *Surface Impoundment* scenario should be selected to assess the potential risks associated with the disposal of non-solid wastes petitioned for delisting. If the user selects a landfill as the *WMU*, only the annual waste volume must be entered. If the user selects a surface impoundment as the *WMU*, both the annual waste volume and flow rate must be entered.

WMU Properties — Includes waste volume, facility active life, and type of delisting petition.

Waste Volume — The annual volume of waste to be petitioned for a RCRA exclusion (delisting).

Type of Delisting Petition — The choice of *One-time batch* or *Multiple-year batch* determines whether or not a value for the active life of the delisting must be entered. If the delisting petition is for a one-time batch delisting, the user should select the *One-time batch* option button. For a *One-time batch*, the default value of *Active Life* is one year, and the *Active Life* input box will be grayed out. If the waste to be delisted will be disposed of in multiple batches over more than one year, the user should select the *Multi-year batch* option button. Selecting this option button will activate the *Active Life* input box where the user should input the number of years that the *WMU* is expected to accept the petitioned waste.

Active Life — Refers to the active life of the delisting petition with regard to the waste entering the *WMU*. The default value for a multi-year delisting is 20 years and the default value for a one-time delisting is one year, however, the user may input another value, as appropriate. For a multi-batch delisting, a facility is expected to have multiple batches of waste delisted over an extended period of time. Therefore, 20 years is selected as a reasonable maximum value for the facility operational life. The default value for a one-time delisting is one year since the waste to be delisted will be disposed into the *WMU* as a one-time batch.



Flow Rate — The rate at which leachate flows from the bottom of the surface impoundment (including any liner) into the unsaturated zone. This value is determined by the depth of the surface impoundment, the hydraulic characteristics of the liner or sludge at the base of the impoundment, and the depth and hydrogeological characteristics of the sediments comprising the unsaturated zone.

Petition ID and Facility Name — The *Petition ID* and *Facility Name* are displayed here as a reference for the user. These data can only be changed on the *Facility Information* screen, as described above.

5.3.3 Chemical Input Tab

The **Chemical Input** screen allows the user to enter chemical-specific information about a waste petitioned for delisting. The user first selects the chemicals that were detected in the petitioned waste and then inputs the **Maximum TCLP Concentration** and **Maximum Total Waste Concentration** for each selected chemical. The user may elect to enter concentrations below the **DL** in the petition data. The user indicates if a chemical is below the **DL** by clicking in the **DL** column for the specified chemical. The user also has the option to add a new chemical to the list if the desired chemical is not in the list or if the user does not think that the chemical properties are appropriate for the petitioned waste.

How do I select chemicals present in the petitioned waste?

List of Chemicals — There are four ways to choose chemicals to be analyzed:

- 1) Begin typing the chemical name in the “Enter Chemical Name” box and if the chemical is found, hit the “Enter” key;
- 2) Begin typing the chemical CAS (Chemical Abstracts Service) number in the “Enter Chemical CAS Number” box and if the chemical is found, hit the “Enter” key;
- 3) Scroll through the list of chemicals and click in the box of each chemical to be analyzed, then click the “Select Checked Chemicals” button;
- 4) Scroll through the list of chemicals and double click on each chemical to be analyzed.

If the user types in the chemical name or CAS number in the corresponding textbox, the program will then search the list of chemicals for the closest match to the typed value. Once the correct chemical is highlighted, the user can either double-click on the chemical or hit the “Enter” key to accept the chemical. The user should be aware that since some chemicals have more than one name, it is possible that the program may not find the correct chemical based on a search by chemical name. Therefore, if a name search is unsuccessful, the user should search by CAS number or scroll through the list of chemicals to find the desired chemical. Please note that the user also has the option to add a new chemical to the list with user-defined properties.

What if I suspect that a certain chemical is present in my waste, but at a concentration below the **DL**?

Often the delisting petition will contain waste sampling results that report non-detect values for a number of the chemicals analyzed. The non-detect concentration may be reported as the method detection limit (MDL) or as the estimated quantitation limit (EQL). For the purposes of this discussion, the concentration reported as non-detect will be the **DL**. Several variables influence the **DL** for a chemical, including the instruments used, the waste matrix, and the analytical test method. In some cases the reported **DL** for a chemical may exceed its delisting level at the target risk level. In such a case, the user may wish to discuss this issue with the lab to find out if there is another available analysis method with a lower **DL**.

Chemicals to be Analyzed	CAS Number	Maximum TCLP Concentration (mg/L)	DL	Maximum Total Concentration (mg/kg)	DL
Lead	7439921	Enter Concentration	No	Enter Concentration	No

To edit concentration, click on cell and enter new value.

Italics signify that the concentration for that constituent is a detection limit, not a measured concentration.

Buttons: Create Chemical, Delete Row, Run Analysis, Help

When a chemical is selected, and provided that the **DL** check screen option is turned on, the **DRAS** will present a screen that asks the user whether the concentration that will be entered for the chemical is to be treated as a **DL** or a measured value. Entering a **DL** will cause results for that chemical to be shown (on-screen and in printed reports) in italics throughout the rest of the **DRAS** analysis. Also, the **DRAS** determines the risk and hazard associated with a fraction of a chemical's **DL**. The default fraction used in the assessment is 0.50, so, in conducting the risk and hazard assessment for a chemical whose waste concentration (**TCLP** or total) has been entered as a **DL**, the **DRAS** first multiplies the waste concentration by 0.50, then evaluates the risk and hazard. Further, all risk assessments are conducted twice: once including those chemicals specified with concentrations that are **DLs** and once omitting them. This enables the user to know if these non-detects are driving the results of the risk assessment. Again, if the risk is impacted by the non-detects, the user may wish find out if there is another available analysis method with a lower **DL**.

The **DL** check screen option is accessed from the "Help" pull-down menu.

How do I enter the *TCLP* and total chemical concentrations for each chemical?

As the user selects chemicals and either hits the "Enter" key, double-clicks, or hits the "Select Checked Chemicals" button, a table is built at the bottom of the screen, each line of which specifies a selected chemical. The table cells below the column labeled **Maximum *TCLP* Concentration** are used to enter the waste **TCLP** concentration. To enter a value, click on the cell for a chemical and type in the concentration. Likewise, the cells below the column labeled **Maximum Total Concentration** are used to enter values for that parameter. If the laboratory analysis method reports a non-detect, the user should enter the **DL** as the concentration.

Can I edit the concentration values of a chemical?

Edit Constituent(s) — If the user accidentally enters an incorrect **TCLP** and/or **Total Waste Concentration**, these values can be edited. To edit these values, the user should click on the cell containing the incorrect value, then enter the new value. The user may also click on the "Delete Row" button to remove a chemical from the table.

How do I perform the risk assessment for the petitioned waste?

After entering all the waste- and chemical-specific values, the user should click on the "Run Analysis" button to perform the risk assessment for the petitioned waste.

5.4 ANALYSIS RESULTS

This section of the **DRAS** provides the user with detailed risk assessment results for the petitioned waste. The **Analysis Results** screen is comprised of four tabs: **Delisting Results**, **Chemical-Specific Results**, **Cumulative Results**, and **Summary of Results**. Each tab contains a different form of the results of the delisting analysis. The tabs and the information found on each of these tabs are explained below.

5.4.1 Delisting Results Tab

The **Delisting Results** tab is the first screen in the **Analysis Results** Section of the **DRAS**. This screen lists all chemicals whose **TCLP** and/or **Total Waste Concentration** exceed the delisting levels as computed by the risk equations. The first and second columns of the table show the **Chemical Names** and **CAS numbers**, respectively, for chemicals that exceed the delisting levels. The third column identifies the pathway and the fourth shows the resulting **Maximum Allowable TCLP Concentration** (i.e., the limiting **TCLP** concentration). The fifth column shows the **Actual TCLP Concentration** of the chemical. The sixth column shows the **Maximum Allowable Total Concentration** (i.e., the limiting **Total Waste Concentration**) of the chemical and the seventh column shows the **Actual Total Concentration** of the chemical.

The delisting level is the maximum allowable concentration of a waste constituent in a petitioned waste that will not exceed the target risk level for that compound. For multi-year standard delistings, each waste constituent in a petitioned waste must not exceed its delisting level. The delisting level is generated for each **Exceeding Pathway** assessed by the **DRAS**. The **DRAS** selects a limiting delisting level for the total value and the **TCLP** value for each waste constituent. The delisting level for the total waste constituent value is called the **Maximum Allowable Total Concentration**. The delisting level for the **TCLP** waste constituent value is called the **Maximum Allowable TCLP Concentration**.

What are the various exposure pathways assessed in DRAS?

The **DRAS** assesses the potential adverse effects associated with the release and subsequent exposure of waste constituents in a petitioned waste from a **WMU**. Exposure may occur through contact with various contaminated media. The following exposure pathways (**Exceeding Pathways**) are assessed in the **DRAS**:

For releases to ground water:

- ingestion of contaminated ground water
- dermal absorption while bathing in contaminated ground water
- inhalation of volatile constituents emitted from contaminated ground water during showering

For releases to surface pathways:

- ingestion of contaminated surface water
- ingestion of contaminated fish
- ingestion of contaminated soil
- inhalation of contaminated air

How are the delisting levels calculated?

Chemical Name	CAS Number	Exceeding Pathway	Maximum Allowable TCLP Conc. (mg/L)	Actual TCLP Conc. (mg/L)	Maximum Allowable Total Conc. (mg/kg)	Actual Total Conc. (mg/kg)
Arsenic	7440382	GW Ingestion	4.13E-01	1.75E+00	N/A	5.00E+04
Arsenic	7440382	SW Acute Ecological	N/A	1.75E+00	3.40E-01	5.00E+04
Arsenic	7440382	SW Chronic Ecological	N/A	1.75E+00	1.50E-01	5.00E+04
Arsenic	7440382	Soil Ingestion	N/A	1.75E+00	1.40E-03	5.00E+04
Chloroform	67663	Air	N/A	1.94E-01	1.20E+07	1.21E+07

Italics signify that the concentration for that constituent is a detection limit, not a measured concentration. The values in the "Maximum Allowable TCLP Concentration" and the "Maximum Allowable Total Concentration" are the maximum waste concentrations which can be permitted without exceeding the defined cancer risk or hazard quotient levels set for the Delisting Level for a given waste constituent. See Help for additional information on the allowable risk level used to calculate a waste constituent's "Delisting Levels" (TCLP and Total).

For all standard multi-year delistings, the target risk level is used to calculate the delisting levels for a waste constituent. The target risk level for carcinogens is set at 10^{-5} and for noncarcinogens the target is set at a hazard quotient of 0.1. Additional technical information on risk levels is available in Chapter 4 of the *DTSD*.

What role does the 10,000 ppm delisting ceiling play in the delisting analysis?

Using standard chronic risk assessment algorithms, the *DRAS* generates delisting levels, which are protective of exposure to the receptor for the defined exposure pathways. However, the delisting levels generated in this manner for certain constituents can be extremely high in absolute concentrations (approaching that of a pure compound). Under certain circumstances, the generated delisting levels may not be the appropriate waste management concentration limits for the prescribed *WMU*. For these reasons, there is a need to assess the reasonableness of high concentration limits developed from the chronic risk models, particularly for liquid and volatile organics. The issue is a general policy concern for all chronic risk analyses, and resolution is beyond the scope of the *DRAS* or this user guide. However, the *DRAS* has been programmed to identify total waste constituents predicted at nominally high concentration levels (10,000 ppm or 1% by weight or greater). Delisting levels in excess of 10,000 ppm are highlighted in red text on the “Results” screen of the *DRAS*. When the *DRAS* computes a delisting level that exceeds 10,000 ppm, the petitioned waste containing constituents in excess of this value will be reviewed on a case-by-case basis. In the *DRAS*, the delisting levels (exit values) are not altered to reflect this ceiling review. The *DRAS* provides the user with the calculated delisting level, based on the waste constituent concentrations, the waste volume and the risk level selected by the user.

How are soil saturation values, Maximum Contaminant Level (MCL) values, and TC Rule regulatory values used?

Soil saturation values (see Appendix A of the *DTSD*) represent the contaminant concentration in soil at which the adsorptive limits of the soil particles and the solubility limits of the available soil moisture have been reached. Above this concentration, pure or free-phase compound is expected in the soil. If the soil saturation limit is exceeded, formation of a nonaqueous phase liquid (NAPL) plume is possible for the organic constituents. If NAPLs are present, significant contaminant migration may occur within this NAPL phase, which is not accounted for in the EPA Composite Model for Leachate Migration with Transformation Products (EPACMTP) fate and transport model. Hence, calculated delisting values may not be accurate.

The *DRAS* compares soil saturation values with calculated delisting levels and notifies the user when a waste constituent’s total delisting level exceeds its soil saturation value. When the *DRAS* calculates a delisting level greater than the calculated soil saturation, the delisting manager should consider setting the delisting level equal to the soil saturation.

In addition to calculating a waste constituent’s delisting level for the ingestion of ground water based on the pre-selected target risk level, the *DRAS* calculates the waste constituent’s delisting level for the ingestion of ground water where the ground water concentration is set at the constituent’s MCL. In some cases, the waste constituent’s ground water ingestion delisting level based on the MCL will be less conservative than that calculated according to the selected risk level. When the *DRAS* indicates that ground water ingestion is the limiting ground water pathway, the user has the option of considering either of the ground water ingestion pathway delisting levels: the risk-based *Maximum Allowable TCLP Concentration* or the *Maximum Allowable TCLP Based on MCL*.

The TC Rule was promulgated in March, 1990 (55 FR 11798). This rule established regulatory levels for 40 nonhydrolyzing or mildly hydrolyzing constituents. A solid waste exhibits the toxicity characteristic if, using the *TCLP*, the extract from a representative sample contains any of the 40 TC Rule constituents at

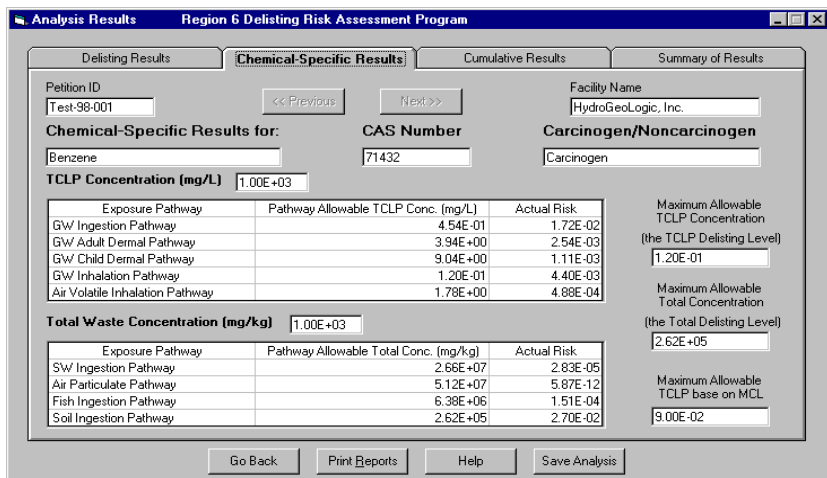
concentrations equal to or greater than the regulatory level (published at 40 CFR §261.24(a) and given in Table 4-1 of the *DTSD*). These regulatory levels are not to be exceeded. Because the *DRAS* generates exit levels using different modeling and exposure scenarios, delisting levels for these 40 constituents may be above or below the TC Rule regulatory levels. Therefore, the *DRAS* compares a waste constituent's delisting level for the *TCLP* waste constituent concentration, called the *Maximum Allowable TCLP Concentration*, with the waste constituent's TC Rule regulatory level. If the *Maximum Allowable TCLP Concentration* exceeds the TC Rule regulatory level, the *DRAS* notifies the user of the TC Rule exceedance.

How are dioxin congeners handled in the *DRAS*?

U.S. EPA Region 6 recommends that a risk assessment for all dioxin congeners be completed by calculating the Toxicity Equivalent Quotient (TEQ) for 2,3,7,8-tetrachlorodibenzo(p)dioxin (TCDD). The TEQ is calculated by converting the dioxin congener concentrations to a 2,3,7,8-TCDD dioxin concentration using Toxicity Equivalent Factors (TEF) for all 17 dioxin congeners. To assess the risk to a mixture of dioxin congeners reported in a delisting petition using the TEF procedure: 1) review the delisting petition for all polychlorinated dibenzo(p)dioxin (PCDD) and polychlorinated dibenzofuran (PCDF) analytical determinations from the sample; 2) multiply the congener concentrations in the sample by the TEFs listed in Section 4.2.5 of the *DTSD* to express the concentration in terms of 2,3,7,8-TCDD TEQs; 3) sum the products calculated in Step 2 to obtain the total TEQ for the delisting sample and; 4) use the delisting sample total TEQ as the sample concentration of 2,3,7,8-TCDD to be entered into the *DRAS* under the name *TCDDioxin*, 2,3,7,8- or CAS number 1746016.

5.4.2 Chemical-Specific Results Tab

Chemical-Specific Results is the second interface screen in the *Analysis Results* section of the *DRAS*. The user is provided with a chemical-by-chemical summary of the risk and hazard analysis of each waste constituent entered into the *DRAS*. The chemical-specific summary includes the *Allowable Total Concentration* and *Allowable TCLP Concentration* for each *Exposure Pathway* and the actual carcinogenic risk or noncarcinogenic hazard quotient predicted from exposure to each *Exposure Pathway*. The section also presents the *Maximum Allowable Total Concentration* and *Maximum Allowable TCLP Concentration* for a given waste constituent. The chemical name and *CAS number* are shown at the top along with information to tell the user if the risk assessment is based on carcinogenic effects or noncarcinogenic effects. The two tables show each *Exposure Pathway* in column 1, the maximum allowable concentration in column 2, and the actual risk or hazard quotient in column 3 for *TCLP* and *Total Waste Concentrations*.



How do I see the risk assessment for each chemical?

The user can click on the “Next” and “Previous” buttons to scroll through the list of chemicals and view the risk assessment that was conducted for each selected chemical.

5.4.3 Cumulative Results Tab

Cumulative Results is the third interface screen in the **Analysis Results** section of the **DRAS**. The **Cumulative Results** screen shows the cumulative **Groundwater Pathway** and **Surface Pathway** risk for each carcinogenic chemical and the cumulative HI for each noncarcinogenic chemical. If any of these calculations are based on **DL** values, the row containing that chemical is shown in italics. These values are then summed for each chemical to compute the **Chemical Cumulative Risk** or **Chemical Cumulative Hazard Index** found in the last column of the table. Directly below the “Carcinogen” results table, two total risk values are displayed. The first **Petitioned Waste Total Risk** value does not include any non-detects, whereas the second **Petitioned Waste Total Risk** value does include non-detects that were entered by the user. Likewise, directly below the “Non-carcinogen” results table is the **Petitioned Waste Total Hazard Index**, calculated both with and without the non-detect values.

How are the Risk and HI values calculated?

The **Chemical Cumulative Risk** value is a measure of the total risk associated with disposal of a carcinogenic waste constituent. This is computed by summing a waste constituent’s carcinogenic risk from each exposure pathway. Additional technical information on the generation of risk values is available in Chapter 4 of the **DTSD**.

The **Chemical Cumulative Hazard Index** value is a measure of the total hazard associated with disposal of a noncarcinogenic waste constituent. This is computed by summing a waste constituent’s noncarcinogenic HI for each exposure pathway. Additional technical information on the generation of hazard indices is available in Chapter 4 of the **DTSD**.

Petitioned Waste Total Risk (without DLs) is calculated by summing the petitioned waste’s carcinogenic risk from only those waste constituents whose input **TCLP** concentration and **Total Waste Concentration** were actual measured concentrations (not **DLs**).

Petitioned Waste Total Risk (including DLs) is calculated by summing the petitioned waste’s carcinogenic risk from all waste constituents. This includes constituents with a measured **TCLP** concentration and **Total Waste Concentration**, and constituents for which the **DL** was entered as the concentration.

Petitioned Waste Total Hazard Index (without DLs) is calculated by summing the petitioned waste’s noncarcinogenic hazard from only those waste constituents whose input **TCLP** concentration and **Total Waste Concentration** were actual measured concentrations (not **DLs**).

Petitioned Waste Total Hazard Index (including DLs) is calculated by summing the petitioned waste’s noncarcinogenic hazard from all waste constituents. This includes constituents with a measured **TCLP** concentration and **Total Waste Concentration**, and constituents for which the **DL** was entered as the

Carcinogens			
Chemical Name	Groundwater Pathway Cumulative Risk	Surface Pathway Cumulative Risk	Chemical Cumulative Risk
Arsenic	3.96E-05	3.17E+00	3.17E+00
Chloroform	1.66E-06	3.12E+00	3.12E+00
DDT, p,p'	1.04E-05	2.03E+01	2.03E+01
Trichloroethylene (1,1,2-) (TCE)	2.67E-06	7.53E+01	7.53E+01
Petitioned Waste (without Detection Limits) Total Risk =			7.85E+01
Petitioned Waste (including Detection Limits) Total Risk =			4.23E+02

Noncarcinogens			
Chemical Name	Groundwater Pathway Cumulative Hazard Index	Surface Pathway Cumulative Hazard Index	Chemical Cumulative Hazard Index
Cadmium	2.42E-05	2.11E+04	2.11E+04
Xylenes (total)	1.50E-02	2.64E+02	2.64E+02
Petitioned Waste (without Detection Limits) Total Hazard Index =			2.11E+04
Petitioned Waste (including Detection Limits) Total Hazard Index =			2.14E+04

concentration.

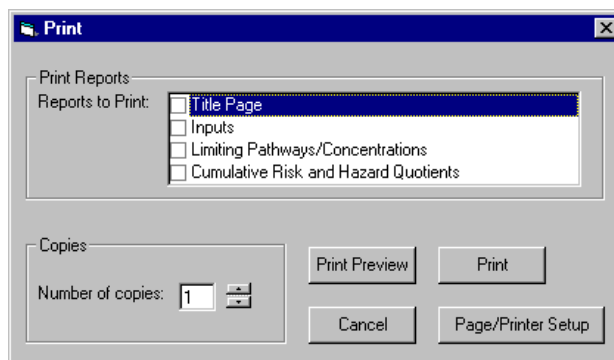
5.4.4 Summary of Results Tab

Summary of Results is the fourth screen in the **Analysis Results** section of the **DRAS**. This screen presents a summary of the risks and hazards associated with disposal of the petitioned waste. Also, this screen identifies those chemicals whose waste concentration exceeds their soil saturation value or TC Rule regulatory level. This screen repeats the facility and user information provided at the beginning of the analysis along with the total risks and hazard indices displayed in the **Cumulative Results** screen. The risk and HI values are calculated both with and without the non-detect values (**DLs**).

5.5 PRESENTATION OF RESULTS -- REPORTS

Can I print and save the results of the analysis?

The results of the analyses performed with the **DRAS** can be printed to hard copy or saved electronically as a file. The report form prints out all of the **WMU** parameters, chemical input values, and the results of the analysis. The user may click on the “Print Reports” button to print the reports in the **Analysis Results** section of the **DRAS**. The user also has the option to click on the “Print Preview” button to view the report before printing the reports. The user selects which reports to print or print preview by clicking on the boxes beside the various reports. The user may save a report as an electronic file by clicking the “Print Preview” button followed by the “Export” button (small envelope button). The user may choose which application to export the electronic file to under “Format” and if the file will be saved as a disk file, a Lotus Notes database file, or sent as an email file under “Destination.”



6.0 SUPPORTING INFORMATION

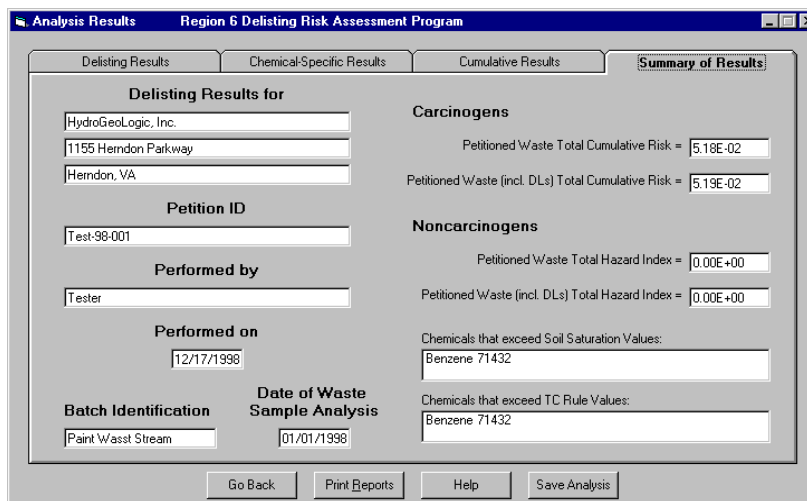
This section presents summary information that is required to perform U.S. EPA Region 6 Delisting risk assessments, or supporting information that can be accessed.

6.1 JUSTIFICATION AND DOCUMENTATION OF PARAMETER VALUES

All values input to the delisting risk assessment analyses must be backed up with supporting documentation including lab analysis results and other waste characterization data.

6.2 U.S. EPA REGION 6

Supporting information for EPA Region 6 Delisting includes this *User's Manual* and the **DTSD**. As



stated previously in this document, petitioners are directed to the *Region 6 RCRA Delisting Program Guidance Manual for the Petitioner* (U.S. EPA; 1996) for additional information necessary to satisfy the information and documentation requirements of a complete delisting petition.

