USER'S GUIDE
to
TANKS

Storage Tank Emissions Calculation Software
Version 4.0

September 30, 1999

Emission Factor and Inventory Group
Emissions, Monitoring, and Analysis Division
Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency

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TABLE OF CONTENTS

Page

USER'S GUIDE
to
TANKS 4.0

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LIST OF FIGURES AND TABLES

List of Tables

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1.0 INTRODUCTION

The TANKS program is designed to estimate air emissions from organic liquids in storage tanks. The United States (U.S.) Environmental Protection Agency's (EPA) Office of Air Quality Planning and Standards (OAQPS) develops and maintains emissions estimating tools to support Federal, State, and local agencies, consultants, and industry with estimating air emissions from various sources. This user's manual provides installation and general use instructions for the TANKS software. It is not intended to document how to estimate air emissions from storage tanks. Documentation of emission factors and calculations used to estimate air emissions can be found in "Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources" (AP-42), Section 7.1, Organic Liquid Storage Tanks.

TANKS allows users to enter specific information about a storage tank (dimensions, construction, paint condition, etc.), the liquid contents (chemical components and liquid temperature), and the location of the tank (nearest city, ambient temperature, etc.), and generate an air emissions report. Report features include estimates of monthly, annual, or partial year emissions for each chemical or mixture of chemicals stored in the tank.

Version 4.0 of TANKS, hereafter referred to as TANKS 4.0, represents an upgrade to versions 3.1, 3.0, 2.0, and 1.0, and includes several new features and revisions to maintain consistency with EPA emissions calculation methodology and to respond to users' comments. These new features are described below. The program was written in Microsoft Visual Basic, and a runtime version of Visual Basic is distributed with the system. The program is intended for use on systems running Windows 95 or later, or Windows NT 3.51 or later. Additional information about system requirements is detailed in Section 2.1.

Please note that the emissions estimating equations that form the basis of the TANKS 4.0 software program were developed by the American Petroleum Institute (API). API retains the copyright to these equations. API has granted permission for the nonexclusive, noncommercial distribution of this material to governmental and regulatory agencies. However, API reserves its rights regarding all commercial duplication and distribution of its material. Therefore, the TANKS program is available for public use, but the program cannot be sold without written permission from the American Petroleum Institute, the U.S. Environmental Protection Agency, Midwest Research Institute, and The Pechan-Avanti Group (a unit of E.H. Pechan & Associates, Inc.).

1.1 TANKS User Assistance and Response

TANKS 4.0 may require revisions and modifications to ensure consistency with EPA emissions calculation methodologies. The EPA welcomes feedback on this program to identify limitations and suggest modifications to TANKS.

1.2 Obtaining TANKS Version 4.0

To obtain a copy of TANKS 4.0 please write or call EPA at the following address:

> Info CHIEF
> U.S. EPA
> MD-14
> Research Triangle Park, NC 27711
> (919) 541-5285
> E-mail: info.chief@epa.gov

In addition, both the TANKS 4.0 software and AP-42 documentation are available on the CHIEF web site at the Internet address http://www.epa.gov/ttn/chief/tanks.html. To obtain a copy of TANKS 4.0, download the TANKS installation file from the TTN to your computer. Refer to section 2.2 for detailed installation instructions.

1.3 What's New in TANKS 4.0

(1) TANKS 4.0 is a Windows-based application. It is a 32-bit program designed for users of Windows 95, Windows 98, or Windows NT 3.51 or later.

(2) The meteorological data were updated. The update includes the addition of site-specific atmospheric pressures.

(3) You may add deck seam loss factor records to the database.

(4) Generic speciation profiles are available and contain component information for select petroleum liquids. You may enter your own speciation profiles for any type of mixture.

(5) All data for TANKS 4.0 are stored in Access 2.0 databases. You should not modify these databases outside of the program. The chemical, meteorological, fitting, deck seam, rim seal, and speciation profile information is stored in one database with a default name "tankdata.mdb." The tank information is stored in a separate database with a default name "client1.mdb." You may create separate "Client Databases" for different companies, sites or tank categories.

(6) You can import data from TANKS 3.1 into TANKS 4.0. Creating a new "Client Database" or creating a backup copy of the "Client Database" before importing tank records is recommended. You also should create a backup of the "Tank Database" (tankdata.mdb) before importing ancillary data (e.g., chemicals or cities that you added to TANKS 3.1).

(7) You may only use the "Vapor Weight Speciation" option for Horizontal Fixed Roof Tanks and Vertical Fixed Roof Tanks. If you enter 100 percent of the vapor component information for a tank using this speciation option, individual compound emissions will be calculated using the vapor component information. You also may select the mixture from the chemical database and specify less than 100 percent of the components of the vapor. Individual compound emissions will be calculated using percent composition of the vapor for specified components.

(8) TANKS 4.0 uses the number of days in each month to calculate all standing losses. The previous versions of TANKS equally divided the loss between the months.

(9) You can perform monthly calculations for all tanks when the chemical or mixture is selected from the chemical database.

(10) The value given for the 8" diameter pipe option for the column diameter for Internal Floating Roof Tanks in previous versions of TANKS was inconsistent with AP-42, Section 7.1. The following table details the changes made to the software for version 4.0. If you import data from TANKS 3.1 to TANKS 4.0, and have an erroneous column diameter, you will have to manually change the diameter from 0.8 to 0.7.

Column Diameter Option Changes

Old	Diam. (ft)	New	Diam. (ft)
9" by 11" built up pipe	1.1	9" by 7" built-up column	1.1
8" diameter pipe	0.8	8" diameter pipe	0.7
Unknown	1.0	Unknown	1.0

(11) Methyl-tert-butyl ether (MTBE) was added to the chemical database.

(12) Gasoline (RVP 6), Gasoline (RVP 8), Gasoline (RVP 9), Gasoline (RVP 11), and Gasoline (RVP 12) were added to the chemical database.

1.4 Hints for Using TANKS 4.0

(1) If you have any previously installed versions of TANKS 4.0 on your computer, uninstall these versions before attempting to reinstall the program. Failure to do so may cause errors.

(2) Use [TAB] or the mouse to move between the data entry fields.

(3) For internal floating roof tanks, you can double-click the number of columns field to suggest the default number of columns at any time.

(4) If you encounter an incomplete chemical list (e.g., chemical name field list stops at chemicals that start with the letter C), try to type the first letter of the chemical you want (for example, M) several times while the menu is dropped down. You also may want to re-click on the chemical category field.

2.0 INSTALLATION AND SET-UP

2.1 Operational Requirements

The following hardware and software are required to use TANKS 4.0:

(1) Microsoft Windows NT 3.51 or later, or Microsoft Windows 95 or later
(2) 486 or higher processor
(3) VGA or higher-resolution screen supported by Microsoft Windows
(4) 8 MB of RAM
(5) Mouse or other pointing device
(6) About 10MB of free hard disk space. Additional hard disk space will be required to accommodate large databases or back-up databases.

2.2 Installation

To setup TANKS 4.0 on your personal computer, double-click on the downloaded file from Windows Explorer, or use Start Menu/Run to open the file. The installation utility will guide you through the setup process. Once the program is installed on your computer, you may start the program by selecting Start Menu/Programs/TANKS 4.0/TANKS40.

2.3 Protecting Your Data

Menu options are provided to make backup copies of the program's data. Also, upon exiting the program you will have an opportunity to make backup copies of the client and tank files. Backup copies of your data files should be made on a regular basis to a floppy disk or tape backup system. We recommend that successive generations of backup copies be made and preserved to ensure that copies of data are available in case of hard-disk failure or other data problems.

2.4 Troubleshooting

Data Contamination. Occasionally, hard-disk problems or other system malfunctions will create "contaminated" data files. Contaminated data files are characterized by random stray characters in the data or by data that has shifted from one field to another field throughout a record or a range of records.

These problems are not caused by software and may indicate an underlying hard-disk problem. They can be corrected either by replacing the data with back-up data or by deleting and reentering the contaminated records. Repeated data file contamination may indicate a memory conflict or the need for additional hard-disk maintenance procedures.

Other Problems or Errors. If other types of problems occur, please note the following:

1. Some information regarding the PC you are using: the manufacturer, CPU type, and available RAM.

2. What operating system you are using and if the program is installed in a LAN environment.

3. Where you were in the program and what you were trying to do.

4.   The nature of the error and any error messages that might have appeared.

For technical support please call:

Info Chief
U.S. Environmental Protection Agency
MD-14
Research Triangle Park, NC 27711
(919) 541-1000
E-mail: info.chief@epa.gov

You also may refer to Appendix D: Frequently Asked Questions or the TANKS FAQ web page, located at the Internet address http://www.epa.gov/ttn/chief/faq/tanksfaq.html.

3.0 GETTING STARTED

To start TANKS 4.0, go to the Windows Start menu and select TANKS 4.0 to execute the program. Upon start-up, a screen will appear describing API's copyright to the emissions equations. Click "OK" to continue to the TANKS Main Menu.

3.1 Getting Around

The following keys and conventions will assist you in moving through the menus and records contained in TANKS 4.0:

[TAB]. Use the tab key to move between the fields on the screens.

Arrow Keys. The up and down arrows move the cursor up or down. The right and left arrow keys move the cursor to the left or right.

Use of a Mouse. Clicking the mouse pointer on any option will select that option. Windows may be moved around on screen by clicking on the title of a menu and holding the mouse button down while dragging to the desired position. During data entry, clicking on a field will move the cursor to that field.

[F1]. Use [F1] to access the help system.

3.2 Help System

You may access the Help screens from almost anywhere in the program by pressing [F1] or clicking on the "Help" button. Pressing [F1] brings up the Help screen that most directly relates to the current menu option, screen, or field. From any Help screen click "Search" to review the Help Screen Index.

3.3 TANKS Main Menu

There are five main options on the TANKS 4.0 main menu. These options are described below.

File. This menu allows you to create a new client database, or change the database locations. The client database contains information specific to your tanks. The tank database contains the chemical, meteorological, rim seal, fitting, deck seam, and speciation profile data.

Data. This menu contains all the major data functions including options to create, edit, delete, import, export, and print: tank records, chemical data, meteorological data, fittings data, rim seam data, deck seam data, and profile data.

Report. This menu allows you to select the level of detail, time basis, and tank records for an emissions report.

Backup. This menu allows you to backup and restore data. Backup both the client and tank databases.

Help. This menu allows you to access the online help, and view a brief description of the TANKS program.

3.4 Using a Previous Database

In getting started, TANKS 3.1 you may wish to import your TANKS data into the TANKS 4.0 program. Although this utility is described in Section 6 Database Utilities, it may be useful in getting started to follow a quick set of instructions. Importing data may be accomplished by following the steps below.

Step 1:   You may wish to create a new client database for your data. To accomplish this, use the menu option **File\New Client Database** from the main menu.

Step 2:   Choose the menu option **Data\Tanks\Import From Version 3.1.** Type the file location, or use the "Browse" buttons to identify each file location. You must provide locations for the tank, mixture, fittings, and storage databases. Providing locations for the chemical, cities, fit_tbl, and rim_seal databases is optional, but if you have used custom ancillary data for your tanks you will need to import these data along with the tank data.

Step 3:   Click "OK." The results of your import will be provided to you in an import report. You may view this report, print it, or export it to a file.

The program attempts to add imported tank records to the current "Client Database." If you have specified locations for the ancillary data, the program will attempt to add imported data to the current "Tank Database." The "Tank Database" contains the chemical, meteorological, fitting, rim seal, deck seam, and profile information. The "Client Database" stores the information used during data entry for each tank record. The current location of these files is shown at the bottom of the main TANKS screen.

Hints on Importing TANKS 3.1 Data:
1. When importing records from TANKS 3.1, make sure that none of the records have the same TANK ID. TANKS 4.0 will not import records with duplicate TANK ID's.
2. When importing chemical data from TANKS 3.1, make sure that the vapor molecular weight field is completed for each chemical. Early versions of TANKS 3.1 allowed the user to leave the vapor molecular weight field blank when adding a new chemical to the chemical database. TANKS 4.0 will not import an chemical record if the vapor molecular weight field is blank.

4.0 ENTERING TANK DATA

The TANKS 4.0 program requires certain information about a storage tank and the liquid it contains to calculate the tank's air emissions. This information is entered and stored in tank records. There are four categories of information in a tank record:

Tank Information. Identification information, construction type, and physical characteristics of the storage tank.

Fitting Information. For floating roof tanks only, there is a separate data entry screen for deck and roof fitting information.

Site Information. The tank's nearest major city and state for which meteorological data are available is necessary to assign ambient temperature, atmospheric pressure, and wind speed variables to the tank information. You may add new cities to the database using the **DATA\ Meteorological\Edit Database** option from the main menu.

Liquid Information. Identification of chemical components and properties of the stored liquid is needed to determine the overall vapor pressure of the liquid and the vapor constituents present in any air emissions. Time periods for which each chemical or mixture is stored are also required. You may add new chemicals or mixtures to the database using the **DATA\Chemical\Edit Database** option from the TANKS main menu.

It is important to enter as much information as possible to ensure that each variable in the AP-42 calculations is available to the program. Insufficient information may prevent the program from generating an emissions report.

To add new tank records, select **DATA\TANKS\New Record** from the TANKS 4.0 main menu. The program will display a list of storage tank types. Choose the type of tank you wish to add. Or, you may select the appropriate acronym from the toolbar on the main screen.

4.1 Tank Types

TANKS 4.0 provides different data entry screens for five different types of tanks. Each of these types is described below.

Vertical Fixed Roof Tanks. These tanks consist of cylindrical shells with permanently affixed roofs; the tank axis is perpendicular to the foundation. The fixed roof may be dome-shaped or cone-shaped. Vertical fixed roof tank shells are usually constructed of steel. These tanks may be specified as "heated" in TANKS 4.0.

Horizontal Fixed Roof Tanks. These tanks are constructed for both above-ground and underground storage with the axis parallel to the foundation. Horizontal fixed roof shells may be steel, steel with a fiberglass overlay, or fiberglass-reinforced polyester. These tanks may be specified as "heated" in TANKS 4.0.

External Floating Roof Tank. This type of tank consists of a cylindrical steel shell equipped with a roof that floats on the surface of the stored liquid.

Internal Floating Roof Tank. This type of tank has both a permanent fixed roof and a floating deck.

Domed External Floating Roof. This type of tank is typically an external floating roof tank that has been retrofit with a domed fixed roof.

4.2 Tank Information

Regardless of the tank type chosen, each tank should be identified by five data fields: identification number, description, city, state, and company. These five fields have no effect on emissions calculations.

Identification Number. This field is the user-defined unique identifier for the record. The Tank Identification No. can be up to 50 characters long and can consist of any combination of letters, numbers, symbols, or spaces.

Description. This is an optional field where you may enter any information about a tank record.

City. This is an optional field used to identify the city in which the storage tank is located. The city name may be up to 50 characters long, using letters, numbers, and spaces in any combination. This may be different from the city chosen on the Site Selection menu. You may choose a city from the pull-down list or enter one that is not on the list.

State. This is an optional field used to identify the state in which the tank is located. Numbers, letters, and spaces are acceptable. This may be different from the State chosen on the Site Selection menu. You may choose a state from the pull-down list or enter one that is not on the list.

Company. This is an optional field used to identify the company which owns or uses the storage tank. The company name may be up to 50 characters, including letters, numbers, symbols, and spaces in any combination. You may choose a company from the pull-down list or enter one that is not on the list.

The remaining fields vary depending on the tank type chosen. Data entry for each type of tank is described below.

4.2.1 Vertical Fixed Roof Tank Information

There are 18 fields on the Vertical Fixed Roof Tank data entry screen, in addition to the identification information (see Figure 4-1). These fields are described below. You also may refer to the example tank records Tank 1 and Tank 2, provided with the program.

Shell Height. This is the actual height of the tank in feet. This must be between 5 and 65 feet inclusive; values outside this range will not be accepted by the program.

Diameter. This is the width in feet of a vertical, cylindrical shell. This must be at least 5 feet.

Maximum Liquid Height. This is the maximum height in feet of the liquid within the tank shell. This must be less than or equal to the shell height. The maximum liquid height is used to calculate the working volume for the tank and is used in the working loss equation.

Figure 4-1. Vertical Fixed Roof Tank Data Entry Screen

Average Liquid Height. This is the average height in feet of the liquid within the tank shell. This must be less than or equal to the maximum liquid height. The average liquid height is used in the standing storage loss calculations.

Working Volume. This is the working volume of the tank in gallons. The program will automatically calculate the working volume based on the tank diameter and the maximum liquid height and display the result on the screen. You may use this estimate or provide a value for the volume. However, the program will display a warning message if the input working volume is inconsistent with the tank diameter and maximum liquid height entered ($\eth r^2$(max. ht.)* (7.48 gal./ft^3)).

If the working volume of the tank is measured in barrels, you may convert barrels to gallons by multiplying the number of barrels by 42.

Turnovers per Year. This is the estimated number of times per year the tank is emptied and refilled. You may calculate the number of turnovers per year by dividing the throughput by the working volume. Also, you may enter zero to describe a tank in which the liquid was stored for an entire year. The program will still calculate breathing losses.

For surge tanks or constant level tanks, the number of turnovers calculated by dividing the throughput by the working volume may be excessively high. In this case, the number of turnovers should be adjusted by multiplying by the average change in the liquid height in feet and dividing by the maximum liquid height. Enter this computed value as the turnover rate, or enter 4 as a default turnover rate. Then, adjust the net throughput by multiplying the adjusted turnovers by the working volume.

Net Throughput. This is the annual net throughput in gallons per year. If working volume and the number of turnovers per year have been entered, the program will automatically calculate the net throughput and display this result on the screen.

If the net throughput of the tank is measured in barrels, you may convert barrels to gallons by multiplying the number of barrels by 42.

Is Tank Heated? If the tank is heated, insulated, or otherwise regulated such that the ambient temperature conditions are not the sole factors that affect the surface temperature of the liquid, answer "Yes" to this question. When entering chemical data, you will be asked to provide the surface temperature (max., min., and avg.) and the bulk temperature of the liquid. Please note that if the max., min., and avg. liquid surface temperatures are the same, breather vent settings should be set at zero to avoid negative standing storage losses (see Vacuum and Pressure Setting below). In addition, if the tank is heated above 100°F or cooled below 40°F, an option other than Option 1 should be completed in the chemical database (e.g., Antoine's coefficients).

Shell Color/Shade. This is the color and shade combination of the paint on the shell of the tank (i.e., the sides). To view the list of available options, use the pull down menu. The color/shade combination must be chosen from the available options, since these are the only combinations for which there are paint factors in AP-42. If the shell paint color does not appear on the list of options, choose the color/shade combination that most closely approximates it. If the shell color is unknown, use White/White as the default.

Shell Condition. This is the condition of the paint on the tank shell. To view the list of available options, use the pull down menu. If the shell paint condition is unknown, use Good as the default condition.

Roof Color/Shade. This is the color and shade combination of the paint on the roof. To view the list of available options, use the pull down menu. The color/shade combination must be chosen from this list, since these are the only combinations for which there are paint factors in AP-42. If the color of the roof paint does not appear on the list of options, use the color/shade combination that most closely approximates it. If the roof color is unknown, use White/White as the default color.

Roof Condition. This is the condition of the paint on the tank roof. To view the list of available options, use the pull down menu. If the roof paint condition is unknown, use Good as the default condition.

Roof Type. The roof type may be either Dome or Cone. Display these options using the pull down menu.

Roof Height. This is the height of the tank roof in feet, not including the tank shell itself (the vertical distance from the top of the shell to the top of the roof). (See Figure 4-2.)

Roof Radius. This is the radius in feet of the arc of a domed roof. (See Figure 4-2.) This field is used only for tanks which have a dome roof, and will be disregarded for all cone roofs. The tank dome roof radius varies between a minimum of (0.8 x tank diameter) and a maximum of (1.2 x tank diameter). If the roof radius is not known, assume the dome roof radius is equivalent to the shell diameter.

Roof Slope. This is the slope of a cone roof in feet/feet. The program will calculate this value based on height and diameter values. This applies only if the roof is cone-shaped, and will be disregarded by the program for domed roofs. Assume a value of 0.0625 ft/ft if the roof slope is unknown. (See Figure 4-2.)

Vacuum Setting. This is the storage tank vacuum setting in pounds per square inch gauge (psig). The vacuum setting must be between 0 and -1 psig. The program will automatically change the value of the number from positive to negative. The default vacuum setting is -0.03 psig.

Note that the fixed roof tank emissions estimation procedures do not apply to low- or high-pressure tanks.

Pressure Setting. This is the storage tank pressure setting in psig. The pressure setting must be between 0 and 1 psig. The default pressure setting is 0.03 psig.

Note that the fixed roof tank emissions estimation procedures do not apply to low- or high-pressure tanks.

Note that for constant temperature tanks, the breather and pressure vent settings must be set to zero.

Please refer to Section 4.3 Site Selection below for instructions on entering the next category of data for this type of tank.
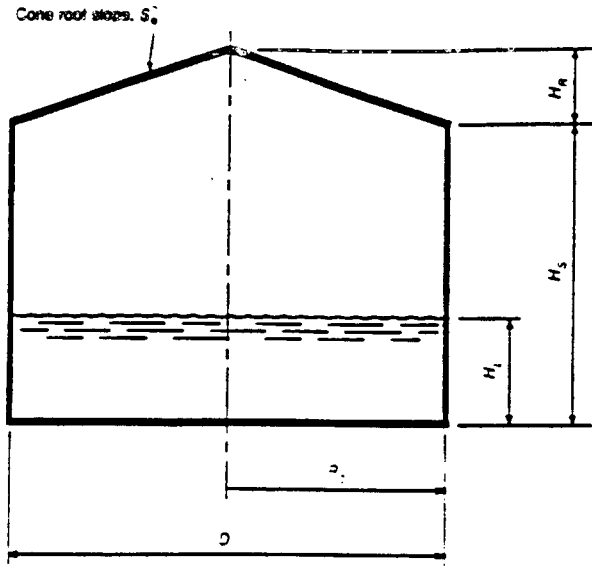
Cone roof slope, S_a

Cone roof
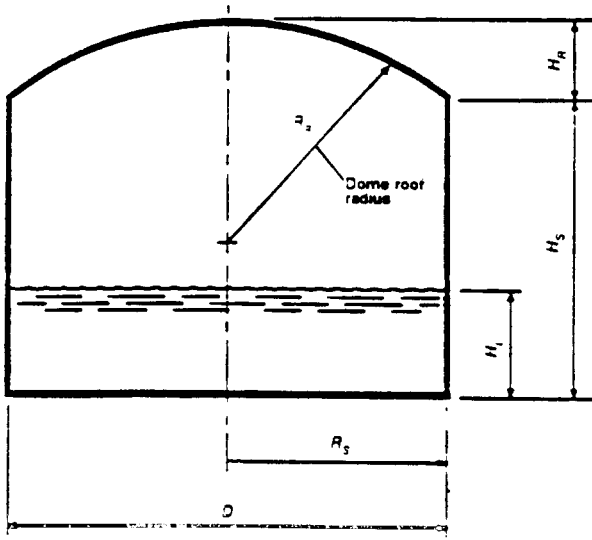
Dome roof

Figure 4-2. Fixed Roof Slope and Radius

4-6

4.2.2 Horizontal Fixed Roof Tank Information

There are 11 fields on the Horizontal Fixed Roof Tank data entry screen, in addition to the identification information described above. (See Figure 4-3.) These fields are described below. You also may refer to the example tank records Tank 3 and Tank 4, provided with the program.

Figure 4-3. Horizontal Fixed Roof Tank Data Entry Screen

Shell Length. This is the total length of the tank shell in feet. This must be between 5 and 75 feet; the program will not accept values outside this range. The length of the tank should be less than six times the diameter to ensure structural integrity.

Diameter. This is the width in feet of the cross section of the tank shell. This must be between 3 and 20 feet.

Working Volume. This is the working volume of the tank in gallons. This value must be supplied by you for horizontal fixed roof tanks. Base the working volume on the maximum liquid height during the time period for which the emissions calculation is needed.

If the working volume of the tank is measured in barrels, you may convert barrels to gallons by multiplying the number of barrels by 42.

Turnovers per Year. This is the number of times per year the tank is emptied and refilled. Calculate the number of turnovers per year by dividing the throughput per year by the working volume.

For surge tanks or constant level tanks, the number of turnovers calculated by dividing by the throughput may be excessively high. In this case, the number of turnovers should be determined by dividing the average change in the liquid height in feet by the maximum liquid height. Enter this computed value as the turnover rate, or enter 4 as a default turnover rate.

Net Throughput. This is the annual net throughput in gallons per year. If working volume and the number of turnovers per year have been entered, the program will automatically calculate the net throughput.

If the net throughput of the tank is measured in barrels, you may convert barrels to gallons by multiplying the number of barrels by 42.

Is the tank underground? Answer "Yes" if the tank is underground, "No" if it is not. Underground tanks are assumed to have no breathing losses, since the insulation of the earth limits the diurnal temperature change.

Is Tank Heated? If the tank is heated or temperature controlled such that the ambient temperature conditions are not the sole factors affecting the surface temperature of the liquid stored in the tank, answer "Yes" to this question. When entering chemical data, you will be asked to provide the surface temperature (max., min., and avg.) and the bulk temperature of the liquid. If the tank is heated above 100°F or cooled below 40°F, an option other than Option 1 should be completed in the chemical database (e.g., Antoine's coefficients).

Shell Color/Shade. This is the color and shade combination of the paint on the shell of the tank (i.e., the sides). To view the list of available options, use the pull down menu. If the tank color does not appear on the list of options, choose the color/shade combination that most closely approximates it. If the tank color is unknown, use White/White as the default color. This field is not applicable for underground tanks.

Shell Condition. This is the condition of the paint on the sides of the tank shell. If the condition of the shell paint is unknown, use Good as the default condition. This field is not applicable for underground tanks.

Vacuum Setting. This is the storage tank vacuum setting in psig. The vacuum setting must be between 0 and -1 psig. The program will automatically change the value of the number from positive to negative. The default vacuum setting is -0.03 psig.

Note that the fixed roof tank emissions estimation procedures do not apply to low- or high-pressure tanks.

Pressure Setting. This is the storage tank pressure setting in psig. The pressure setting must be between 0 and 1 psig. The default pressure setting is 0.03 psig.

Note that the fixed roof tank emissions estimation procedures do not apply to low- or high-pressure tanks.

Note that for constant temperature tanks and underground tanks, the breather and pressure vent settings must be set to zero.

Please refer to Section 4.4 Site Selection below for instructions on entering data for the next category for this type of tank.

4.2.3 External Floating Roof Tank Information

The information presented below applies to external floating roof tanks with and without domes. The difference between these two types, in terms of air emissions, is that wind speed is not a factor in estimating losses from domed external floating roof tanks. There are two data entry screens for external floating roof tanks. The first screen displays 12 fields, in addition to the identification information (see Figure 4-4). The second screen displays roof fitting information and is described below under Section 4.2 Fitting Information. You also may refer to the example tank records Tank 7 and Tank 8, provided with the program.

Figure 4-4. External Floating Roof Tank Data Entry Screen

Diameter. This is the width in feet of the vertical, cylindrical shell.

Working Volume. This is the working volume of the tank in gallons. You must supply this value for external floating roof tanks. Base the working volume on the maximum liquid height during the time period for which the emissions calculation is generated.

If the volume of the tank is measured in barrels, you may convert barrels to gallons by multiplying the number of barrels by 42.

Turnovers per Year. This is the number of times per year the tank is emptied and refilled. Calculate the number of turnovers per year by dividing the throughput per year by the working volume.

Net Throughput. This is the annual net throughput in gallons per year. If the working volume and the number of turnovers per year have been entered, the program will automatically calculate the net throughput.

If the net throughput of the tank is measured in barrels, you may convert barrels to gallons by multiplying the number of barrels by 42.

Internal Shell Condition. This is the internal condition of the tank shell. If the shell condition is unknown, use Light Rust as the default condition.

Paint Color/Shade. This is the color and shade combination of the paint on the shell of the tank (i.e., the sides). To view the list of available options, use the pull down menu. If the tank color does not appear on the list of options, choose the color/shade combination that most closely approximates it. If the tank color is not known, use White/White as the default color.

Paint Condition. This is the condition of the paint on the sides of the tank (the shell). If the paint condition is unknown, use Good as the default condition.

Tank Construction. Enter one of the two types of tank construction, either welded or riveted. Use the pull down menu to display these options; highlight the applicable type. Click to select the type highlighted. If the type of tank construction is not known, use Welded as the default value.

Primary Seal. Primary seals close the annular space between the edge of the floating roof and the tank wall. There are three basic types of primary rim seals in use on external floating roof tanks: mechanical shoe, liquid mounted, and vapor mounted. Note that the program assumes that all primary seals are average-fitting seals. If no specific information is available, use a mechanical shoe primary seal as the default value.

> Mechanical shoe -- A metallic shoe seal.

> Liquid mounted -- A resilient-filled nonmetallic seal that is mounted in contact with the liquid in the tank.

> Vapor mounted -- A resilient-filled nonmetallic seal that is mounted a few inches above the liquid in the tank.

Secondary Seal. Options for the secondary seal field vary with the tank construction and primary seal type as follows:

> Riveted tank options -- rim-mounted, shoe-mounted, or none.

> Welded tank options, mechanical shoe primary seals -- rim-mounted, shoe-mounted, or none.

> Welded tank options, resilient-filled seals (both liquid and vapor mounted) -- weather shield, rim-mounted, or none.

Use the pull down menu to display these options; highlight the applicable type. Click to select the type highlighted.

Roof Type. There are two types of external floating roofs: pontoon and double deck. Use the pull down menu to display these options; highlight the correct type. Click to select the type highlighted.

Fitting Category. Choose the category that defines the roof fittings for this tank. Typical roof fittings are described in AP-42 Section 7.1. The specific fitting types will appear on the roof fitting screen, reached by pressing View/Add Fittings. This screen is described below.

Typical -- The program will use the type and number of fittings typical for the tank type. The status of the fittings will be typical of current practices.

Detail -- Select this category to specify the individual fittings on the tank if tank-specific data are available.

Please refer to Section 4.3 Fitting Information below to continue entering data for this type of tank.

4.2.4 Internal Floating Roof Tank Information

As with external floating roof tanks, there are two data entry screens for internal floating roof tanks. The first screen displays 19 fields, in addition to the identification information (see Figure 4-5). The second screen contains deck fitting information and is described under Section 4.2 Fitting Information below. You also may refer to the example tank records Tank 5 and Tank 6, provided with the program.

Figure 4-5. Internal Floating Roof Data Entry Screen

Diameter. This is the width in feet of vertical, cylindrical shell.

Working Volume. This is the working volume of the tank in gallons. You must supply this value for internal floating roof tanks. Base the working volume on the maximum liquid height during the time period for which the emissions calculation is generated.

If the volume of the tank is measured in barrels, you may convert barrels to gallons by multiplying the number of barrels by 42.

Turnovers per Year. This is the number of times per year the tank is emptied and refilled. Calculate the number of turnovers per year by dividing the net throughput by the working volume.

For surge tanks or constant level tanks, the number of turnovers calculated by dividing by the throughput may be excessively high. In this case, the number of turnovers should be determined by dividing the average change in the liquid height in feet by the maximum liquid height. Enter this computed value as the turnover rate, or enter 4 as a default turnover rate.

Net Throughput. This is the annual net throughput in gallons per year. If the working volume and the number of turnovers per year have been entered, the program will automatically calculate the net throughput.

If the net throughput of the tank is measured in barrels, you may convert barrels to gallons by multiplying the number of barrels by 42.

Self-Supporting Roof? Answer "Y" if the tank roof has no supporting columns. Enter "N" if the tank has supporting columns. Most fixed roof tanks converted to an internal floating roof tank will have columns. Newly constructed internal floating roof tanks may be of either type. Tanks with columns have marginally higher emissions because of evaporation of liquid that clings to the column surface area.

Number of Columns. This is the number of columns supporting the roof. The program will estimate the number of columns based on the tank diameter. Use this estimate or enter a different number. Recalculate the number of columns at any time by double-clicking on the text box.

Effective Column Diameter. This is the average column diameter in feet. The column diameter is equal to 1.1 feet for 9 x 7 inch built-up columns, 0.7 feet for 8-inch diameter pipe columns. Use the pull down menu to select from these choices, or enter another value. Use 1.0 ft if no column construction details are known.

Internal Shell Condition. This is the internal condition of the tank shell. If the shell condition is unknown, use Light Rust as the default condition.

Shell Paint Color/Shade. This is the color and shade combination of the paint on the shell of the tank (i.e., the sides). To view the list of available options, use the pull down menu. If the shell paint color does not appear on the list of options, choose the color/shade combination that most closely approximates it. If the shell paint color is unknown, use White/White as the default color.

Shell Paint Condition. This is the condition of the paint on the sides of the tank (the shell). If the shell paint condition is unknown, use Good as the default condition.

Roof Color/Shade. This is the color and shade combination of the paint on the roof. To view the list of available options, use the pull down menu. If the color of the tank roof does not appear, use the color/shade combination that most closely approximates it. If the roof color is unknown, use White/White as the default color.

Roof Paint Condition. This is the condition of the paint on the tank roof. To view the list of available options, use the pull down menu. If the roof paint condition is unknown, use Good as the default condition.

Primary Seal. Primary rim seals close the annular space between the edge of the floating roof and the tank wall. There are three basic types of rim seals in use on internal floating roof tanks, mechanical shoe, liquid mounted, and vapor mounted. Both are resilient-filled nonmetallic seals. Note that the program assumes that all primary seals are average-fitting seals. The program does not allow the calculation of emissions based on tight-fitting seals because of the difficulty in verifying the fit as the liquid height changes. If no specific information is available, assume a vapor-mounted primary seal is in use.

> Mechanical Shoe Seal -- A metallic shoe seal.

> Liquid Mounted -- A seal that is mounted in contact with the liquid in the tank.

> Vapor Mounted -- A seal that is mounted a few inches above the liquid in the tank.

Secondary Seal. There are three options for secondary seals: rim-mounted, shoe mounted (when mechanical shoe seals are identified as primary seals), and none. Enter the appropriate selection.

Deck Type. There are two types of decks: bolted and welded. Use the pull down menu to display these options; highlight the correct type. Click to select the type highlighted.

Deck Fitting Category. Choose whether the deck fittings for this tank are typical or require tank-specific data entry. The typical deck fittings for internal floating roof tanks are described in detail in AP-42 Section 7.1.

> Typical -- The program will use the type and number of fittings typical for the tank type and deck defined on the previous screen. The status of the fittings will be typical of current practices.

> Detail -- Select this category to specify the individual fittings on the tank if tank-specific data are available.

Deck Construction. This applies only to bolted decks. Enter one of the two types of construction, either sheet or panel (use the pull down menu to view these options).

Deck Seam. Based on the deck construction you select, the available deck seam option will be available in this pull down box. You may not edit the deck seam name during tank data entry. Use the **Data\Deck Seam\Edit Database** option to modify the deck seam database. There are five default options provided with the program. They are given below.

> Continuous sheet construction 5 feet wide -- Choose this as the default option if the deck construction is unknown.

Continuous sheet construction 6 feet wide

Continuous sheet construction 7 feet wide

Rectangular panel construction 5 x 7.5 feet

Rectangular panel construction 5 x 12 feet

Deck Seam Length. The length of the deck seams applies only to bolted decks. If the deck construction has been specified, the program will automatically calculate the deck seam length based on the deck construction and tank diameter. You may enter another value if desired.

4.2.5 Domed External Floating Roof Tank Information

On the tank information screen, domed external floating roof tanks are treated the same as regular external floating roof tanks with the exception that wind speed is not a factor in calculating emissions from fittings and rim seals. Please refer to Section 4.2.3 External Floating Roof Tank Information above for information on each field. You also may refer to the example tank records Tank 9 and Tank 10, provided with the program.

4.3 Fitting Information

The second data entry screen for both internal and external floating roof tanks is the Specify Fittings screen (see Figure 4-6). In either case, if the fitting category chosen on the first screen is "Detail," then you must enter the fittings data. If the fitting category is "Typical," the roof fittings are automatically selected. If the typical fittings are modified, then the fitting category will be changed to "Detail."

This screen has three fields for each roof fitting type on the tank: fitting, status, and quantity. The fitting field describes the general fitting type while the status field provides more specific information about the fitting and cover. The quantity indicates the number of fittings on the roof or deck. The fitting and status fields are automatically filled in when selected from the fittings database and cannot be edited. Click the Estimate Quantity button to have the program estimate the number of fittings based on the tank information.

Figure 4-6. External Floating Roof Fittings Screen

4-14

4.4 Site Information

The Site Selection screen is identical for all five tank types (see Figure 4-7). Enter the nearest major city contained in the meteorological database on this screen. To display the list of cities in the database, use the pull down menu. To select a city from the list, move the highlight bar to the appropriate city and click.

If the tank's location is not included in the list of cities, it may be added to the list if all the meteorological data ares available. Use the **Data\Meteorological\Edit Database** option on the TANKS 4.0 main menu to add a new city to the meteorological database (see Section 6.2.1 Add Meteorological Data). After a city is selected, the screen displays the primary meteorological conditions for the selected site. These conditions include the daily average ambient temperature, the annual average minimum and maximum temperatures, the annual average wind speed, the annual average solar insolation factor, and the atmospheric pressure. These fields are display-only, and must be edited from the **Data\Meteorological\Edit Database** menu.

Modifying the meteorological data, or selecting a different city after entering information about the liquid stored in the tank, may affect the liquid information. Press "Calculate Mixture Properties" on the Tank Contents screen to update the liquid information.

Figure 4-7. Site Selection Screen

4.5 Liquid Information

After entering all tank, fitting (if applicable), and site (meteorological) data for the tank, click on the "Tank Contents" tab, as shown in Figure 4-8. The fields shown on this screen vary according to the type of tank, whether the tank is heated, and the liquid contents. The following liquid information fields apply to all tank records:
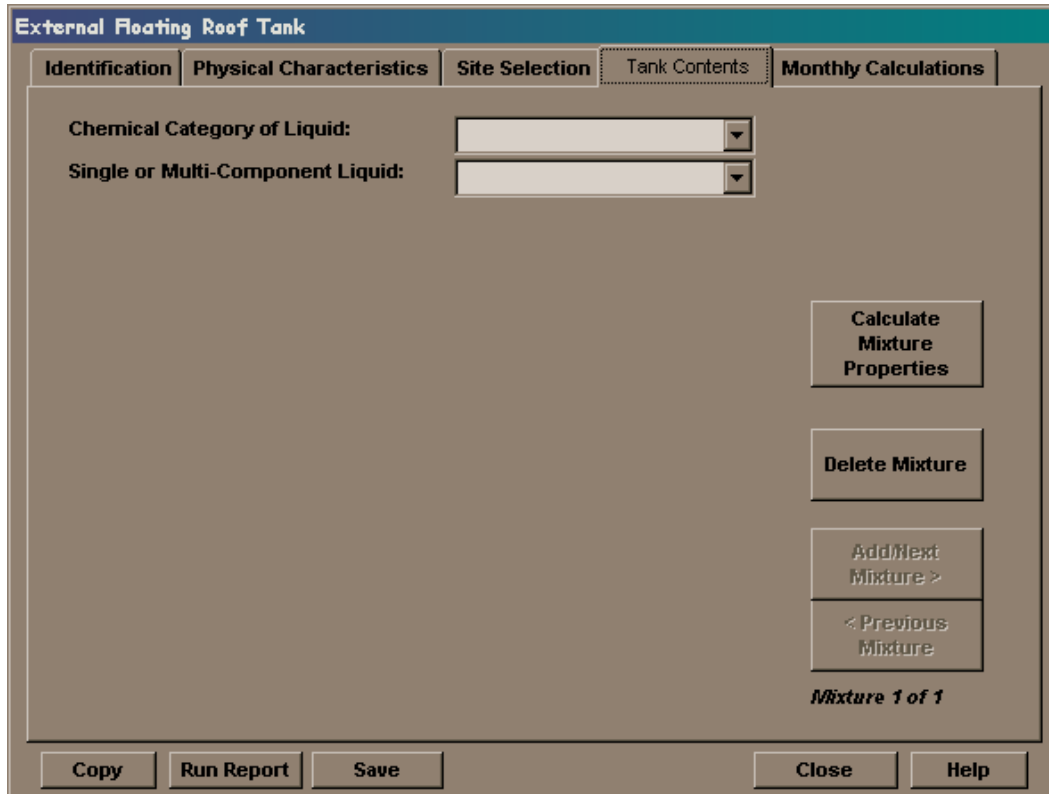
Figure 4-8. Storage Tank Contents – Tank Contents Screen

Chemical Category of Liquid. There are three chemical categories: Organic Liquids, Petroleum Distillates, and Crude Oils. Use the pull down menu to display these options; highlight the correct type. Click to select the type highlighted.

Crude oils are unrefined petroleum stocks. Petroleum distillates include refined petroleum stocks, jet fuels, gasoline, and distillate fuels. Organic liquids include all other organic compounds and mixtures.

Single- or Multi-Component Liquid. This field indicates whether the liquid stored in the tank consists of a single component or a mixture of components. If the contents of a mixture are unknown, partially known, or mixtures of components listed in the chemical database, select "Multiple." Use the pull down menu to view a table containing these two options; highlight the applicable type. Click to select the type highlighted.

Note: when changing this field from Single to Multiple, or vice versa, the program may erase other fields of liquid data.

Petroleum distillates and crude oils may be entered as single-component liquids if the emissions estimates for individual chemicals are not needed. If a breakdown of emissions by underlying components is needed (e.g., benzene emissions from storing gasoline), enter the liquid data as a Multi-Component Liquid.

4.5.1 Multiple-Component Liquid Option

If the Multiple-Component Liquid option is chosen, then the speciation field appears.

Speciation Option. There are four speciation options available: Full Speciation, Partial Speciation, Vapor Weight Speciation, or None. The first three options provide a method of estimating emissions of individual components within a mixture. The "multiple-none" option only calculates emissions for the entire mixture.

> **Full Speciation.** Selecting this option means that you will provide the names of each chemical component (in the chemical database) and the concentrations (percentage of total liquid weight). For example, use this option if you want to estimate emissions for a mixture that is 50 percent benzene and 50 percent toluene. The program will calculate the vapor pressure and other data for the entire mixture. After selecting Full Speciation, click on the "View/Add Components" button to reach the Specify Components Screen. See Section 4.4.5 Multi-Component Liquid-Full Speciation for options while using this screen.
>
> The program uses Raoult's Law for calculating speciated estimates. These calculations assume that the mixture is homogenous and made up of components with similar true vapor pressures; they also assume that the mixture behaves ideally.
>
> **Partial Speciation.** Selecting this option means that you will either (1) provide the chemical data (vapor pressure, molecular weight, vapor molecular weight, etc.) for the entire mixture, or (2) select the mixture from the chemical database (e.g., gasoline or crude oil), and, that you will identify any chemical components (in the chemical database) for which an emissions estimate is required. For each component that you list and provide the concentration (% total weight), the report will calculate the air emissions for the component in addition to calculating emissions of the total mixture. For example, use this option if you want to use one of the speciation profiles provided with the program or if you know your gasoline (RVP 7) has 4 percent benzene and want to know the emissions of gasoline and of benzene.
>
> **Vapor Weight Speciation.** Selecting this option means that you will either (1) provide the chemical data (vapor pressure, density, molecular weight, etc.) for the entire mixture, or (2) select the mixture from the chemical database (e.g., gasoline or crude oil), and that you will provide the percentage of total vapor weight for any other chemicals (in the chemical database) needed in an emissions report. For example, select this option if you have a headspace analysis of your tank. Include only condensible components of the vapor on the Specify Components Screen (e.g., do not include nitrogen or methane).
>
> **None.** Selecting this option means that you will provide the chemical data (liquid and vapor molecular weight, density, and vapor pressure) for the mixture or choose a chemical from the chemical database (e.g., a petroleum distillate or crude oil), but will not specify any chemical components. When using this option, you will not be able to obtain emissions estimates for individual components.

Section 7.1.4 of AP-42 presents the details of the speciation methodology used in TANKS. Section 7.1.5 of AP-42 presents example calculations for a tank storing a mixture of benzene, toluene, and cyclohexane.

After selecting the type of liquid and speciation, you may select a chemical from the database, enter data for a chemical not in the database, specify throughput volumes and chemicals/mixtures stored in the tank during various months, or enter component information for any multi-component liquids. These options are described below for each component-speciation combination.

4.5.2 Single Component Liquid

For a single-component liquid, the Tank Contents screen (see Figure 4-9) contains fields for the chemical name, Chemical Abstract Service (CAS) number (optional), average liquid temperature, vapor pressure (psia) at liquid surface temperature, and liquid and vapor molecular weights. Select a chemical or component name from the chemical database by using the pull-down menu in the Chemical Name field. The program will calculate or provide the remaining data using the chemical and meteorological databases. The example tank record Tank 1, provided with the program, contains a single component liquid.

Figure 4-9. Single Component Tank Contents Screen

You can force the program to update the data by clicking on "Calculate Mixture Properties."

Please note that the liquid surface temperature field may not be changed manually unless you are using the heated tank option.

4.5.3 Multi-Component Liquid -- No Speciation (None)

For multiple-component liquids with the speciation option designated as None, the Tank Contents Screen appears as shown in Figure 4-10. If the mixture is not in the chemical database, the program relies on you to provide all liquid data. Moreover, only annual reports or reports for a single month may be generated with the Multiple-None selection because the program lacks the chemical data necessary to compute vapor pressures at different average monthly temperatures for the mixture.

For floating roof tanks, the program does not require maximum and minimum temperature and vapor pressure values, therefore, these fields will not appear for external (including domed) and internal floating roof tanks. Heated fixed roof tanks require bulk temperature data in addition to the other fields shown in Figure 4-10. Refer to the list of field definitions in Section 4.6 Liquid/Component Information Data Fields for instructions on completing or altering any field.

Figure 4-10. Multi-Component No Speciation -- Tank Contents Screen

4.5.4 Multi-Component Liquid -- Partial Speciation

For multiple-component liquids with the speciation designated as partial, the Tank Contents Screen appears as shown in Figure 4-11. Use the pull down menu in the mixture name field to select a mixture from the chemical database or type in the mixture name. If the mixture is not in the chemical database, the program relies on you to provide all liquid data for the entire mixture. However, you may identify various components of the mixture that are contained in the chemical database. Using these data, the program will compute emissions estimates for each component. The sample record Tank 5, provided with the program, is an example of partial speciation.

The Tank Contents screen contains fields for the mixture name, average, minimum, and maximum liquid surface temperature, bulk temperature, vapor pressure (psia) at liquid surface temperature, and liquid and vapor molecular weights.

Click on "Add/View Components" to access the Specify Components screen (see Figure 4-12). Use the pull down menu and the Add button to select any components of the mixture and specify the percentage of the total liquid weight of the mixture accounted for by the component. Once all components have been selected, click on the Close button. To delete the current chemical component, click on the Delete button.

Figure 4-11. Multi-Component -- Partial Tank Contents Screen

Figure 4-12. Storage Tank Contents -- Specify Components Screen

4.5.5 Multi-Component Liquid -- Vapor Weight Speciation

For multiple-component liquids with the speciation option designated as vapor weight, the Tank Contents Screen appears as shown in Figure 4-13. Use the pull down menu in the Mixture Name field to select a mixture from the chemical database or type in the mixture name. If the mixture is not in the chemical database, the program relies on you to provide all liquid data for the entire mixture. However, you may identify various components of the mixture that are contained in the chemical database. Using these data, the program will compute emissions estimates for each component. Sample record Tank 14, provided with the program, is an example of vapor weight speciation.

The Tank Contents screen contains fields for the mixture name, average, minimum, and maximum liquid surface temperatures, bulk temperature, vapor pressure (psia) at liquid surface temperature, and liquid and vapor molecular weights. Click on "Add/View Components" to access the Specify Components screen (see Figure 4-14). Use the pull down menu and the Add button to select any components of the mixture and specify the percentage of the total vapor weight of the mixture accounted for by the component. Once all components have been selected, click the Close button. To delete the current chemical component, click on the Delete button.

Figure 4-13. Multi-Component Vapor Weight Speciation -- Tank Contents Screen

Figure 4-14. Vapor Weight Speciation -- Specify Components Screen

4.5.6 Multi-Component Liquid -- Full Speciation

For multiple-component liquids with the speciation option designated as full, the Tank Contents Screen appears as shown in Figure 4-15. The Tank Contents screen contains fields for the mixture name, average, minimum, maximum liquid surface temperatures, bulk temperature, vapor pressure (psia) at liquid surface temperature, and liquid and vapor molecular weights. The example record Tank 2, provided with the program, is an example of full speciation.

Use the pull down menu to enter a mixture from the chemical database or type the mixture name. If the mixture is not in the chemical database, the program will use the chemical data for each component to calculate the properties of the entire liquid using Raoult's law. Therefore, you may wish to enter the component data first. Click on "View/Add Components" to access the Specify Components screen (see Figure 4-12). Use the pull down menu to and the Add button to select any components of the mixture and specify the percentage of the total liquid weight of the mixture accounted for by the component. Once all components have been selected, click on the Close button. To delete the current chemical component, click on the Delete Component button.

For Multiple - Full Speciation mixtures, you must provide the liquid concentration (by weight) for every chemical in the mixture. In other words, the concentration percentages you enter must add up to 100 percent. Rather than enter a percent of total weight value, you may express concentration as weight/weight by clicking on "Use Relative Weight". Enter the relative liquid weight in pounds (e.g., 2 lbs. benzene to 1 lb. xylene = 67% benzene and 33% xylene by weight).

Click on Close to return to the Tank Contents screen. Where full speciation of a multi-component liquid is selected, the program will calculate the fields shown on the Tank Contents Screen after each component of the mixture has been specified. You can force the program to update the data by clicking on "Calculate Mixture Properties." Refer to the list of field definitions in Section 4.5 Liquid/Component Information Data Fields for instructions on completing or altering any field.

Figure 4-15. Multi-Component -- Full Speciation Tank Contents Screen

4.5.7 Using Speciation Profiles

Speciation Profiles may be used with the partial, full, and vapor weight speciation options. The generic speciation profiles provided with the TANKS program must be used with the partial speciation option. To use a speciation profile, click the Copy Speciation Profile button after selecting the chemical category, multiple component liquid, and the speciation option. Select the desired profile from the pull down menu that appears and click Ok. Give the mixture a name, or select the mixture name from the chemical database. To view the components or modify the profile for the current tank, click on View/Add Components, and use the Next button to scroll through the components.

For example, if you want to use the profile "Gasoline (Oxygenated with MTBE)" to speciate emissions from Gasoline (RVP 7), select Petroleum Distillates, Multiple, Partial. From the pull down menu, select Gasoline (RVP 7) as the mixture name. Click on Copy Speciation Profile, select Gasoline (Oxygenated with MTBE) from the list, and click Ok. Click View/Add Components to view the speciation data.

4.6 Liquid/Component Information Data Fields

As mentioned above, the data fields that appear on the Tank Contents Screen and the Specify Components Screen depend on the tank type chosen, whether the tank is heated, the component designation (multiple or single), and the speciation option chosen. For single-component and multi-component, fully-speciated liquids, the program will calculate all required data. All of the possible data fields that may appear are described below. Please refer to this list for instructions on completing any field.

Chemical Name. Name of a chemical selected from the chemical database. To view a list of chemicals in the database, use the pull down menu move the highlight bar to the desired chemical and click. If the tank contains a chemical that is not included in the database, add that chemical using the **Data\Chemical\Edit Database** option from the main menu. (See Section 6.0 Database Utilities.)

CAS Number. The program will automatically fill this field in when a chemical is selected from the chemical list. The CAS number is an optional field and is not used in calculating emissions.

Mixture Name. Enter a descriptive name for the chemical or chemical mixture stored in the tank. If the mixture is available in the chemical database, you may select the data from the chemical database by using the pull down menu.

Average Liquid Surface Temperature. The average surface temperature of the liquid in degrees Fahrenheit may be re-calculated at any time by clicking on "Calculate Mixture Properties." For heated tanks, you must provide this value. In all cases, the average liquid surface temperature displayed is the annual average. However, the program will use monthly average liquid surface temperatures when monthly emissions estimates are required.

Minimum Liquid Surface Temperature. The minimum liquid surface temperature in degrees Fahrenheit may be re-calculated at any time by clicking on "Calculate Mixture Properties." For heated tanks, you must provide this value. The temperature must be less than the average liquid surface temperature.

Maximum Liquid Surface Temperature. The maximum liquid surface temperature in degrees Fahrenheit may be re-calculated at any time by clicking "Calculate Mixture Properties." For heated tanks, you must provide this value. This temperature must be greater than the average liquid surface temperature.

Bulk Temperature. This field holds the bulk liquid temperature, calculated using the annual average ambient temperature and the tank paint solar absorptance. It may be re-calculated at any time by clicking "Calculate Mixture Properties." For heated tanks, you must provide this value. This temperature is measured in degrees Fahrenheit.

Vapor Pressure at Liquid Surface Temperature. The average vapor pressure of the chemical should be given in pounds per square inch absolute (psia). Press "Calculate Mixture Properties" to calculate the vapor pressure based on the average liquid surface temperature.

Minimum Vapor Pressure. The minimum vapor pressure in pounds per square inch absolute (psia) is the vapor pressure of the mixture at the minimum liquid surface temperature.

Maximum Vapor Pressure. The maximum vapor pressure in pounds per square inch absolute (psia) is the vapor pressure of the mixture at the maximum liquid surface temperature.

Liquid Molecular Weight. The molecular weight of the component or mixture should be given in grams per mole. When a chemical from the chemical database is used, the program provides this weight from the chemical database; in this case the field is a "read-only" field that cannot be edited.

Liquid Density. The liquid density of the mixture should be given in pounds per gallon at $60°F$.

Vapor Molecular Weight. The molecular weight of the vapor should be given in grams per mole.

Percent of Total Liquid Weight. This field will appear on the Specify Components Screen when the multi-component partial, vapor weight, or full speciation option is selected. Enter the liquid weight percentage of each component in this field. The sum of the percentages for all components must be less than or equal to 100 for partial or vapor weight speciation and equal to 100 for full speciation. This field must be filled in for each chemical component for which an emissions estimate is required.

For fully speciated liquids, you may click "Use Relative Weight" to display this field as "Relative Liquid Weight (Lbs)" described below.

Relative Liquid Weight (Lbs). This field will appear on the Specify Components Screen when the multi-component full speciation option is selected. Use the "Use Relative Weight/Use Liquid Weight" button to toggle between displaying this field as "Percent of Total Liquid Weight" and "Relative Liquid Weight." Enter the relative liquid weight for each component (e.g., 2 lbs acetone for every 1 lb xylene). The program will convert the relative weights into percentages of total liquid weight for each component.

Percent of Total Vapor Weight. This field will appear on the Specify Components Screen when the multi-component vapor weight speciation option is selected. Enter the vapor weight percentage of each component in this field. The sum of the percentages for all components must be less than or equal to 100. This field must be filled in for each chemical component for which an emissions estimate is required.

4.7 Entering Monthly Data

Initially, the entire throughput volume entered for the tank, and the liquid information is assumed to apply to the entire year. However, it is possible to change the monthly throughput volumes and enter data for other chemicals or mixtures stored in the tank during the year. Initially, the Monthly Calculations tab shows the throughput for each calendar month as the total annual throughput (from the Physical Characteristics Screen) divided by 12. This default assumes that the same chemical mixture stays in the tank for the entire year, with the monthly throughput remaining constant. If the tank has a different monthly throughput from the default throughput listed, change the value for that month (see Figure 4-16).

Figure 4-16. Monthly Data Entry Screen

The following options are available to enter different throughput values and identify other mixtures and components stored in the tank:

Mixture Name. This field may be filled in based on entries made on the Tank Contents Screen. Use the pull down menu to view the options.
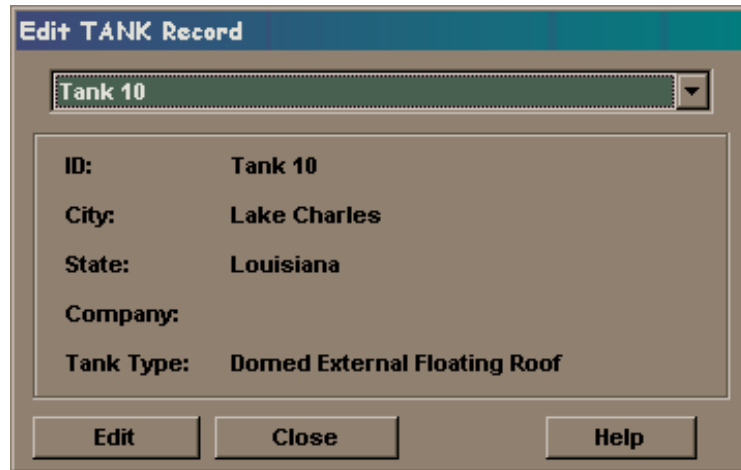
Active Months. To select or de-select a month, click on the check box next to the month.

Throughput. For each active month, enter the throughput in gallons for the liquid. For each month where there is no throughput for the tank, deselect the check box next the month. If the throughput is measured in barrels, convert barrels to gallons by multiplying the number of barrels by 42.

4-26

4.8 Editing Tank Records

To edit an existing tank record, select **Edit Record** from the **Data\Tanks** menu. A screen will a pull down menu will appear (see Figure 4-17). Use the pull down menu to select the tank you wish to edit. You can use the up and down arrows to scroll through the tank list. Enter or change data in the fields on these screens as described in Section 4.1 Tank Information.

Figure 4-17. Editing Tank Records

4.9 Deleting Tank Records

To delete one or more tanks from the storage tank database, select **Delete Record** from the **Data\Tanks** menu. Move the tanks you wish to delete over to the right hand box (see Figure 4-18) by highlighting the tank and clicking "Select." Pressing "Delete Records" deletes all marked tanks.

Figure 4-18. Deleting Storage Tank Records

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5.0 GENERATING REPORTS

The TANKS 4.0 reporting feature is designed to provide you with emissions reports that contain as much or as little information as you desire. You may limit the report to only contain the total emissions for an entire year, or you may view every calculated emissions factor for every month of the year.

Reports may include emissions estimates for the following types of loss: standing storage loss, working loss, withdrawal loss, rim seal loss, fitting loss, or deck seam loss. Consult AP-42 Section 7.1 for complete descriptions of these loss types and the emissions estimating equations.

There are two ways to generate an emissions report using TANKS 4.0. You may use the **Report** menu on the main menu or you may run an emissions report while viewing a tank record. The advantage of using the **Report** option from the main menu is that you may generate reports for more than one tank at a time. The advantage of running reports from within the Tank Records data entry/edit screens is that you may immediately correct errors in the data.

From the TANKS 4.0 Main Menu, select the Report option and choose the level of detail (see Section 5.2) to bring up the Choose Tank(s) for Report window as shown in Figure 5-1. Click and drag to select more than one tank, and click the Select button.

OR

From within a tank record, click "Run Report" to generate a report after all data have been entered. The window shown in Figure 5-2 will appear.

Figure 5.1. Multiple Tank Report Selection Window
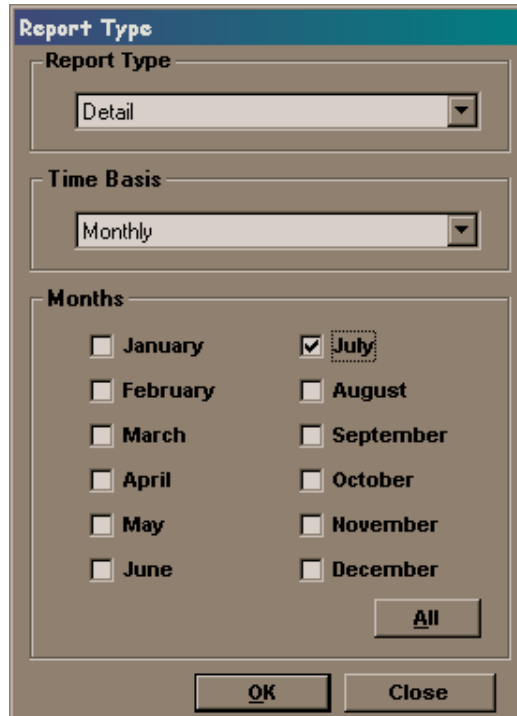
Figure 5.2. Single Tank Report Selection Window

5.1 Choosing a Time Period

The program may generate an emissions report for a one-year period or for selected months.

For a selected-months report, a list of months will appear (see Figure 5-2 and Figure 5-3). Select or de-select the month by clicking on the check boxes next to the months. This option is useful for tanks that store different products during the year or for determining emissions during the high ozone season. For the months selected, the program will add the losses together to provide a total for the time period selected. The program cannot calculate emissions for periods shorter than one month.
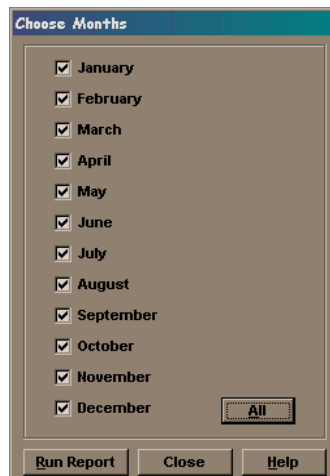
Figure 5-3. Generate Emissions Report -- Month Selection

5.2 Choosing the Level of Detail

The level of detail is either selected from the Report menu on the main menu screen, or on a pull down menu on the selection screen (see Figure 5-2). The following three levels of detail are available for the emissions report.

Brief. A brief report includes the date the report was run, tank identification information, and the standing, working, and total emissions in pounds. A breakdown by component will be included when using Full, Partial, or Vapor Weight Speciation.

Summary. In addition to the data in the brief report, the summary report contains specific information about the tank, including tank dimensions, paint, roof and deck characteristics, breather vent settings, tank construction descriptions, and the choice of roof or deck fitting options, if applicable. The summary report also includes liquid temperature and vapor pressure information and a table of emissions by chemical component for each type of loss mechanism and for total losses.

Detail. In addition to the data presented in the summary report, the detail report includes all values calculated during report generation, grouped by loss category. These values include liquid temperatures, paint factors, vapor pressures, chemical data, fitting factors, and other constants. Data are provided for each month selected and for each chemical component.

5.3 Choosing the Tank

When an emissions report is being generated from the TANKS 4.0 Main Menu, a list of storage tanks from which to select will appear. (If generating a report within a tank record, this step does not apply.) Choose the tank for the report by moving them over to the right hand box by highlighting the tank and clicking "Select." Click **Run Report** when all the tanks you want in the report are selected.

The batch report feature makes it possible to generate reports for all tanks in the system or for a subset of tanks (for example, all tanks in a certain location).

5.4 Viewing and Printing Reports

When a report is generated, the program will always display Figure 5-4. Choose from the following options:

Window. View the report on screen. You will either come across a screen like Figure 5-5 or Figure 5-6.

Figure 5-5 is an emissions report. Use the Zoom option to increase or decrease the size of the report in the window. Use the Page option to scroll through the pages of the report. You can maximize this screen to view more of the report.

All other reports (including ancillary data reports) will look similar to Figure 5-6. You can maximize this screen to view more of the report. You may also use the controls at the bottom of this screen to move between pages, zoom the report window in and out, print, and export. See Appendix B, Error Messages for a complete list of error messages and suggested resolutions. Correct errors and/or fill in the blank fields before attempting to generate another report.
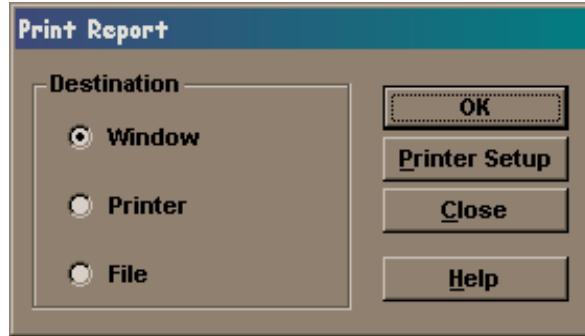
Figure 5-4. Print Report Window
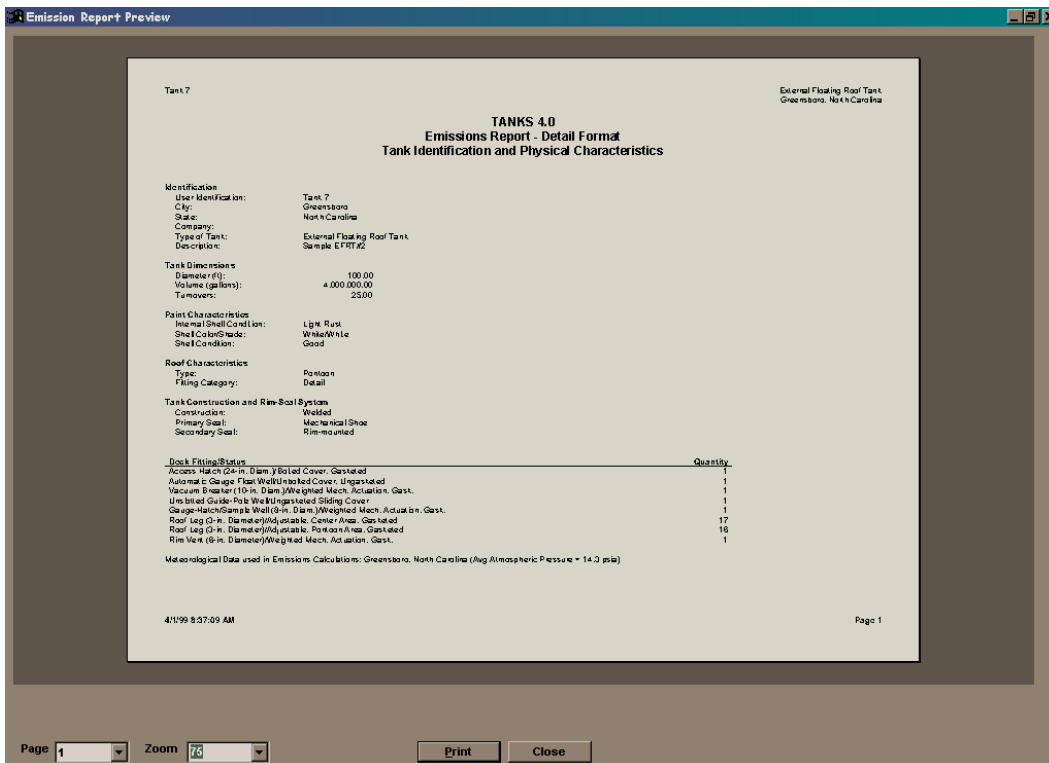
Figure 5-5. Detailed Emissions Report

TANKS 4.0
Error Report - The following errors must be corrected before emissions are calculated.   April 1, 1999

User ID: Error:
_____

Tank 7   Tank diameter cannot be zero.

1
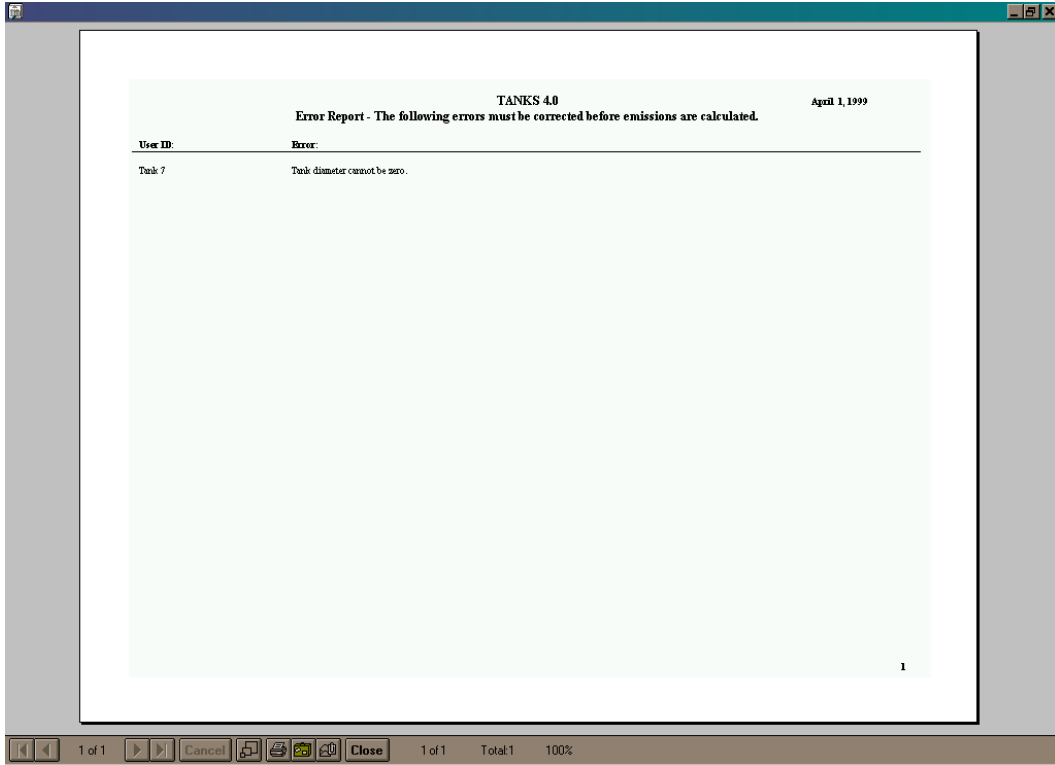
Figure 5-6. Emissions Calculation Error Report

Printer. Send the report directly to the printer. Use the Printer Setup button to change the printer location and printer options.

File. Export the Report to a file. TANKS 4.0 offers you five different formats in which to export the report or emissions data (see Figure 5-7). The options export the data used to generate the report. Upon selecting an export option, you will be given an opportunity to specify the new file name and path. Please consult Appendix A for a complete list of the data elements contained in each table.
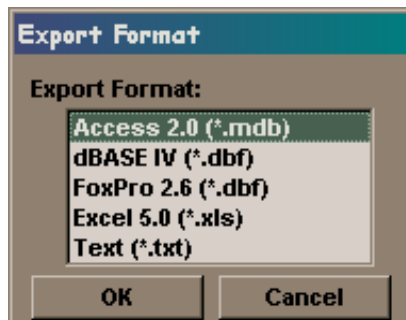
Figure 5-7. Export Format Options

5.5 Errors/Incomplete Data Reports

Sometimes errors or blank fields in the data will prevent report generation. The program will display an error report (see Figure 5-6) if data problems are serious enough to make an emissions calculation impossible. See Appendix B, Error Messages for a complete list of error messages and suggested resolutions. Correct errors and/or fill in the blank fields before attempting to generate another report.

5.6 Report Content

There are two types of information in an emissions report: tank data and the emissions calculations.

The tank data included in the reports are a restatement of information already entered about the tank, and may include identification, tank characteristics and description, site information, and information about the chemicals that make up the liquid in the tank.

The program calculates the emissions based on the tank data, meteorological and chemical data, and equations from AP-42 Section 7.1, Organic Liquid Storage Tanks.

Depending on the type of tank and the level of detail chosen, the report may distinguish between different chemical loss categories, including standing losses, working losses, roof or deck fitting losses, rim-seal losses, and deck-seam losses. Standing losses (also called storage or breathing losses) occur when the liquid expands and contracts due to changes in ambient temperature or barometric pressure. Working losses occur when the tank is emptied or filled. Roof or deck fitting losses result from leaks through the various types of floating roof fittings. Rim-seal losses are evaporative losses from the tank's rim seals. Deck-seam losses occur as a result of the joints in bolted deck seams. (See AP-42 Section 7.1.)

If Full, Partial, or Vapor Weight Speciation is used for a multi-component liquid, the reports provide a breakdown of emissions by chemical component.

6.0 DATABASE UTILITIES

Database Utilities options allow you to edit, delete, or add information to the system databases, perform various data maintenance tasks, and manipulate (backup, export, or import) your data. To use the Database Utilities effectively, you should understand the basic structure of the TANKS 4.0 data system.

The core of the TANKS 4.0 system data is comprised of six databases containing various factors required to estimate air emissions from storage tanks. These databases are located in the "Tank Database." The default location of this file is in the directory where you installed TANKS 4.0. The default filename is tankdata.mdb. Descriptions of these files are provided below. It is not recommended that you edit these databases outside of TANKS 4.0.

Chemical Database. The chemical database consists of data for various organic chemicals, petroleum liquids, and crude oils necessary to calculate vapor pressures at any ambient temperature.

Meteorological Database. The meteorological database consists of a list of cities along with meteorological data needed to estimate emissions resulting from heating and cooling of tanks by ambient conditions, wind losses, and barometric pressure changes.

Fitting Factor Database. The fitting factor database contains a list of common tank roof and deck fittings (e.g., access hatches) along with loss factors needed to calculate losses from roof and deck fittings.

Rim Seal Database. The rim seal database contains a list of common primary and secondary rim seals along with loss factors necessary to calculate losses from rim seals.

Deck Seam Database. The deck seam database contains the typical deck seam specifications used to calculate deck seam loss for internal floating roof tanks.

Profiles Database. The profiles database contains sets of component information that may be used for partial, full, and vapor weight speciation. These profiles enable you to use a chemical profile multiple times without having to enter the chemical information each time a new tank record is created.

These databases are used during data entry to input data into each tank record. The tank records are stored in four analogous "tank" databases described below. These database records are linked by an internal tank ID, created during data entry. The default location of the tank data is in the directory where you installed TANKS 4.0, called "Client1.mdb."

Fittings. The fittings database contains fitting data selected from the fitting factor database for each tank.

Mixture. The mixture database contains information about liquid mixtures in the storage tank such as the active months and the speciation options selected during data entry.

Components. The storage database contains information on individual components stored in each tank.

Tank. The tank database contains information on the construction type, dimensions, and ambient conditions relating to each tank.

6.1 Edit Chemical Database

Use this option to review the physical properties of chemicals that appear in the chemical database or add a new chemical to the database. Through this option, you may view, edit, or delete data on user-defined chemicals. Data on chemicals provided with TANKS 4.0 may only be viewed or printed; it may not be edited. If errors are found in the original data, EPA will identify them in announcements on the CHIEF bulletin board and provide instructions for correcting your system data.

The sources of the chemical data used in TANKS 4.0 include the following:

1. <u>Compilation of Air Pollutant Emission Factors, AP-42, Section 7.1: Organic Liquid Storage Tanks</u>, U.S. Environmental Protection Agency, Research Triangle Park, NC, September 1997.

2. Henry C. Barnett, et al., <u>Properties of Aircraft Fuels</u>, NACA-TN 3276, Lewis Flight Propulsion Laboratory, Cleveland, OH, August 1956.

3. <u>Manual of Petroleum Measurement Standards, Chapter 19, Section I - Evaporative Loss from Fixed Roof Tanks</u>, API Publication 2518, Second Edition, American Petroleum Institute, Washington, DC, 1991.

4. Dean, John A., ed., <u>Lange's Handbook of Chemistry</u>, Fourteenth edition. McGraw-Hill, 1992.

5. Weast, Robert C., Ph.D, ed., <u>CRC Handbook of Chemistry and Physics</u>, CRC Press, Inc., Boca Raton, FL, 1998.

To add, edit, or delete information in the chemical database, select the **Data\Chemical\Edit Database** menu option. The Edit Chemical Database screen will appear (see Figure 6-1).

6.1.1 Add Chemical Data

To add new chemical data, click the "Add New" button from the Chemical Information Screen. Enter data in the fields on this screen. The chemical name, category, liquid molecular weight, vapor molecular weight, liquid density, and one of the four Vapor Pressure Information options must be filled in. Incomplete records will not be added to the chemical database. Delete incomplete records if you do wish to save them.

Chemical Name. Enter the name of the chemical in this field. The name may be up to 30 characters long and consist of letters, numbers, symbols and spaces in any combination. You may not have duplicate chemical names.

CAS Number. Enter the CAS number for the chemical. This is an optional field.

Category. There are three chemical categories: crude oils, petroleum distillates, and organic liquids.

Crude oils are unrefined petroleum stocks. Petroleum distillates include refined petroleum stocks, jet fuels, gasoline, and distillate fuels. Organic liquids include all other organic compounds.

Figure 6-1. Chemical Information Screen

Use the pull down menu to display a table with these options; highlight the correct type. Click to select the type highlighted.

Vapor Molecular Weight. Enter the vapor molecular weight of the chemical (for single component liquids, the liquid molecular weight is equal to the vapor molecular weight).

Liquid Molecular Weight. Enter the liquid molecular weight of the chemical.

Liquid Density at 60°F. Enter the liquid density of the chemical in pounds per gallon.

Vapor Pressure Information: One of the four Vapor Pressure Information options must be filled out completely.

Option 1: Vapor Pressures. Enter the vapor pressure in pounds per square inch absolute (psia) at each of seven listed temperatures. All seven temperatures must be filled in.

Option 2: Antoine's Equation (using °C). Enter A, B, and C, the constants in Antoine's Equation:

$$\log_{10}(P) \; = \; A \; - \; \frac{B}{T \, + \, C}$$

where:

$$P \; = \; vapor \; pressure, \quad mmHg$$
$$T \; = \; temperature, \quad °C$$

6-3

Option 3: Antoine's Equation (using K). Enter A and B for the following form of Antoine's Equation:

$$\log_{10}(P) = \frac{-0.05223\ A}{T} + B$$

where:

$$P = vapor\ pressure,\quad mmHg$$
$$T = temperature,\ K$$

Option 4: Reid Vapor Pressure and ASTM Slope. This option applies only to petroleum distillates and crude oils.

   Reid Vapor Pressure. Enter the Reid vapor pressure in pounds per square inch absolute (psia).

   ASTM Slope. This field applies only to petroleum distillates. The ASTM slope is the slope of the ASTM-D86 distillation data at 10 volume percent evaporated and may be calculated from the distillation data:

$$S = \frac{T\ (15)\ -\ T\ (5)}{10}$$

where:

$$S = Stock\ ASTM\text{-}D86\ Distallation\ Slope\ at\ 10\ volume\ percent$$
$$evaporated,\ °F\ per\ volume\ percent$$

$$T\ (5) = temperature\ at\ which\ 5\ volume\ percent\ is\ evaporated,\ °F$$

$$T\ (15) = temperature\ at\ which\ 15\ volume\ percent\ is\ evaporated,\ °F$$

6.1.2 View/Edit Chemical Data

You can use the pull down menus on the chemical name or CAS number fields to navigate between records. When editing of chemical data is complete, the chemical name, chemical category, molecular weight, and liquid density at 60°F fields must contain data. Completion of one of the four Vapor Pressure Information options is also required. (The CAS number field is optional.) Incomplete records will not be saved in the chemical database. Delete incomplete records if you do want to save them. **Note: You cannot edit chemical data included with the program; only user-added chemicals may be modified.**

6.1.3 Delete Chemical Data

To delete one or more chemicals navigate to the record using the pull down menus on the chemical name or CAS number fields and click "Delete." **Note: You cannot delete chemical data included with the program; only user-added chemicals may be modified or deleted.**

6.2 Edit Meteorological Database

The meteorological database contains weather data such as temperatures, wind speed, and solar insolation factors for a specific city or location. Through this option, you may view, edit, or delete data on user-defined locations. Meteorological data provided with TANKS 4.0 may only be viewed or printed; it may not be edited. If errors are found in the original data, EPA will identify them in announcements on the CHIEF bulletin board and provide instructions for correcting your system data.

The sources of the meteorological data used in TANKS 4.0 include the following:

1. Monthly and Annual North American Comparative Climatic Data, National Climatic Data Center, Asheville, NC, 1996

2. National Climatic Data Center Diskette Documentation, National Oceanic and Atmospheric Administration, Asheville, NC, December 1991.

3. National Solar Radiation Database, National Renewable Energy Laboratory, Golden, CO, 1990.

The meteorological database contains several cities where some data were unavailable. Any missing data for those cities was filled in using data from nearby locations. Appendix C contains a list of these cities and the data elements that have been filled in with alternative data.

Select **DATA\Meteorological\Edit Database** option from the main menu to add, edit, or delete meteorological data (see Figure 6-2).

6.2.1 Add Meteorological Data

To add new meteorological data, click the "Add New" button from the Edit Meteorological Data Screen. Enter data in every field on this screen; incomplete records will not be added to the meteorological database. Delete incomplete records if you do want to save them.

City. Enter the name of the city or site in this field. The name may be up to 50 characters long and consist of letters, numbers, symbols, and spaces in any combination.

State. Enter the name of the state where the city or site is located in this field. The state name may be up to 20 characters long and consist of letters, numbers, symbols, and spaces in any combination.

Annual Average Ambient Temperature. Enter the annual average ambient temperature in degrees Fahrenheit (°F) for this site in this field.

Atmospheric Pressure. Enter the annual average atmospheric pressure in pounds per square inch absolute (psia). The default setting is 14.7 psia.

Figure 6-2. Edit Meteorological Information Screen

Daily Minimum Ambient Temperature. There are thirteen daily minimum ambient temperature fields: one for each of the twelve months and one for the annual daily minimum ambient temperature. Enter the daily minimum ambient temperature for each month and for the year at the site.

Daily Maximum Ambient Temperature. There are thirteen daily maximum ambient temperature fields: one for each of the twelve months and one for the annual daily maximum ambient temperature. Enter the daily maximum ambient temperature for each month and for the year at the site.

Solar Insolation Factor. There are thirteen solar insolation factor fields: one for each of the twelve months and one for the annual solar insolation factor. Enter the solar insolation factor in BTU per square foot per day (BTU/ft.ft.day) for each month and for the year at the site. The solar insolation factor is a measure of the intensity of solar energy at a given location.

Average Wind Speed. There are thirteen average Wind Speed fields: one for each of the twelve months and one for the annual average Wind Speed. Enter the average Wind Speed in miles per hour for each month and for the year at the site.

6.2.2 View/Edit Meteorological Data

You can use the pull down menus on the boxed city field to navigate between records. When editing user-supplied meteorological data, make sure that every field on the screen is filled out. Incomplete records will not be added to the meteorological database. Delete incomplete records if you

do want to save them. **Note: You cannot edit meteorological data included with the program; only user-added locations may be modified or deleted.**

6.2.3 Delete Meteorological Data

To delete a location navigate to the record using the pull down menus on the boxed city field and click Delete. **Note: You cannot delete meteorological data included with the program; only user-added locations may be modified or deleted.**

6.3 Roof Fitting Database

This option allows you to view, edit, add, or delete entries in the roof fitting database. These options work in a similar manner as the options for the chemical and meteorological databases described above. Data on original roof fittings may only be viewed; it may not be edited or deleted. If errors are found in the original data, EPA will identify them in announcements on the CHIEF bulletin board and supply instructions for correcting any problems.

To add, edit, or delete data in the roof fittings database, choose the **DATA\Fittings\Edit Database** option from the main menu. The program will display the Edit Fittings Database Screen as shown in Figure 6-3.

Figure 6-3. Edit Fittings Screen

6.3.1 Add Roof Fitting Data

To add new roof fittings, click on the "Add New" button. Fill in each field as described below.

Fitting Type. Enter the name of the fitting type (e.g., Access Hatch (24-in. Diameter)).

Status. Enter information about the cover of the fitting (e.g., Unbolted Cover, Gasketed).

Loss Factors. Enter the loss factors for K-fa, K-fb, and M. These factors are described in more detail in AP 42, Section 7.1, and a table of roof fitting factors is provided in Table 7.1-11 of AP-42. These factors are used in the following formula:

$$K_F = K_{Fa} + K_{Fb} (K_v V)^M$$

where:

        K_F is the total fitting loss factor (lb-mole/yr)
        K_{Fa} is the non-wind speeddependent loss factor (lb-mole/yr)
        K_{Fb} is the wind speed dependent loss factor (lb-mole/(mph)^{M}yr)
        K_v is the fitting wind speed correction factor (dimensionless; $K_v = 0.7$)
        V is the average wind speed (mph)
        M is the wind speed exponent factor (dimensionless)

Default Quantity. Enter the typical number of the fitting in a roof or deck. This number will be entered into the tank record when the roof fitting is selected, but may be edited from the tank data entry screens.

API Certification Number. Certification number provided by the American Petroleum Institute. This is an optional field right now. These numbers may not yet be available from the American Petroleum Institute.

6.3.2 View/Edit Roof Fitting Data

You can use the pull down menus on the fitting type and status fields to navigate between records. When editing user-supplied fitting data, make sure that every required field on the screen is filled out. Incomplete records will not be added to the fittings database. Delete incomplete records if you do want to save them. **Note: You cannot edit fitting data included with the program; only user-added data may be modified or deleted.**

6.3.3 Delete Roof Fitting Data

To delete a fitting record navigate to the record using the pull down menu on the fitting type and status fields and click "Delete." **Note: You cannot delete deck fitting data included with the program; only user-added deck fittings may be modified or deleted.**

6.4 Rim Seal Database

This option allows you to view, edit, add, or delete data in the rim seal system database. These options work in a similar manner as the options for the roof fitting database described above. Data on program supplied rim seals may only be viewed or printed; it may not be edited or deleted. If errors are found in the original data, EPA will identify them in announcements on the CHIEF bulletin board and supply instructions for correcting any problems.

To add, edit, modify, or print information in the rim seals database choose the **DATA\Rim Seal\Edit Database** option from the main menu. The program will display the Edit Rim Seals Database menu as shown in Figure 6-4.

Figure 6-4. Edit Rim Seal Database Screen

6.4.1 Add Rim Seal Data

To add new records to the rim seal database, select **Add Seal** from the *Modify Rim Seal Database* menu. The program will display the Rim Seal Configuration screen as shown in Figure 6-4. Fill in each field as described below.

Primary Seal. Enter the name of the primary seal type.

Secondary Seal?. Enter a description of the secondary seal. Otherwise, type "None" in this field.

Rim Seal Factors. Enter the rim seal loss factors K-ra, K-rb, and N. These are described in greater detail in AP 42, Section 7.1. These factors are used to calculate the total rim seal loss factor as follows:

$$K_R \; = \; K_{ra} \; + K_{rb} \; (V)^N$$

where:

K_R is the total rim seam loss factor (lb-mole/ft.yr)
K_{ra} is the non-wind speed dependent loss factor (lb-mole/ft.yr)
K_{rb} is the wind speed dependent loss factor (lb-mole/(mph)^{N}ft.yr)
V is the average wind speed (mph)
N is the seal related wind speed exponent (dimensionless)

Applicability of Factors. Indicate the types of tanks to which the rim seal configuration applies. This will determine whether the rim seal is available during data entry for each tank type. Enter 'Yes' or 'No' to indicate applicability for each type of tank.

API Certification Number. Certification number provided by the American Petroleum Institute. This is an optional field right now. These numbers may not yet be available from the American Petroleum Institute.

6.4.2 Edit/View Rim Seal Data

To navigate to a rim seal record, use the pull down menus on the primary seal, secondary seal, and applicable tank construction fields. Refer to Section 6.4.1 Add Rim Seal Data above for instructions on editing each field. Please be aware that changing rim seal data will change data for previously entered tanks using that particular rim seal. **Note: Only user-added rim seal data may be edited or deleted.**

6.4.3 Delete Rim Seal Data

To delete a rim seal navigate to the record using the pull down menus on the primary seal, secondary seal, and applicable tank construction fields and click Delete. **Note: You cannot delete decks seam data included with the program; only user-added deck seams may be modified or deleted.**

6.5 Deck Seam Database

Through this option, you may view, edit, or delete data on user-defined deck seams. Data on deck seams provided with TANKS 4.0 may only be viewed; it may not be edited or deleted. If errors are found in the original data, EPA will identify them in announcements on the CHIEF bulletin board and provide instructions for correcting your system data.

To add, edit, or delete information in the deck seam database, select the **Data\Deck Seams\Edit Database** menu option. The Edit Deck Seam Database screen will appear (see Figure 6-5).

6.5.1 Add Deck Seam data

To add new records to the deck seam database, click on the "Add New" button. Fill in each field as described below.

Name. The unique identifier for the deck seam. This field is automatically filled in as you enter data for the deck seam. The name must be unique to the database.

Construction. Use the pull down menu to select the correct construction, either panel or sheet.

Loss Factor, KD. Enter the deck seam loss per unit seam length factor. The default value is 0.14 (lb-mole/ft-yr).

Figure 6-5. Edit Deck Seam Database Screen

Default SD. Enter the Deck Seam Loss Factor (ft/ft^2) The default calculation for decks seams of panel construction is:

(Panel Width + Panel Length)/(Panel Width*Panel Length)

The default calculation for decks seams of sheet construction is:

1/(Sheet Width)

The field will be filled in with the default calculation if the appropriate length/width fields are filled in. Use this value or enter another value. If the deck seam length is specified in a tank record, the default SD will not be used. It will be recalculated using the tank parameters.

Panel Width. For a deck seam with panel construction, enter the panel width in feet.

Panel Length. For a deck seam with panel construction, enter the panel length in feet.

Sheet Width. For a deck seam with sheet construction, enter the sheet width in feet.

API Certification Number. Certification number provided by the American Petroleum Institute. This is an optional field right now. These numbers may not yet be available from the American Petroleum Institute.

6.5.2 Edit/View Deck Seam data

To navigate to a deck seam, use the pull down menu on the name field. Refer to Section 6.5.1 Add Deck Seam Data above for instructions on editing each field. Please be aware that changing deck seam data will change data for previously entered tanks using that particular deck seam. **Note: Only user-added deck seam data may be edited or deleted.**

6.5.3 Delete Deck Seam data

To delete a deck seam, navigate to the record using the pull down menu on the name field and click "Delete." **Note: You cannot delete deck seam data included with the program; only user-added deck seams may be modified or deleted.**

6.6 Profiles Database

Through this option, you may view, edit, or delete data on user-defined profiles. Data on profiles provided with TANKS 4.0 may only be viewed; it may not be edited. If errors are found in the original data, EPA will identify them in announcements on the CHIEF bulletin board and provide instructions for correcting your system data.

To add, edit, or delete information in the profiles database, select the **Data\Profiles\Edit Database** menu option. The Edit Profiles Database screen will appear (see Figure 6-6).

Figure 6-6. Edit Profiles Database Screen

6.6.1 Add Profile Data

To add new records to the profiles database, click on the "Add New" button. Fill in each field as described below.

Profile Name. Enter the name of the profile in this field. The name may be up to 50 characters long and consist of letters, numbers, symbols, and spaces in any combination. You may not have duplicate profile names.

Profile Type. Select either partial, vapor, or full. Partial type profiles use the percent of total liquid weight. Full profile types use either the percent of total liquid weight or the relative weight. The sum of the percentages for all components must be equal to 100 for full type profiles using percent of total liquid weight. Vapor type profiles use the percentage of total vapor weight.

Chemical Name. Use the pull down menu to choose the component chemical name from the available chemicals.

CAS Number. Use the pull down menu to select the CAS number for the chemical.

Percent of Total Liquid Weight. This field is used for partial and full type profiles. Enter the liquid weight percentage of each component in this field. The sum of the percentages for all components must be less than or equal to 100 for partial type profiles and equal to 100 for full type profiles. This field must be filled in for each chemical component. (For a full profile type, you can use either the percent of total liquid weight, or the relative weight. Use the "Relative Weight/Liquid Weight" button to toggle between these two options.)

Percent of Total Vapor Weight. This field is used only for vapor type profiles. Enter the vapor weight percentage of each component in this field. The sum of the percentages for all components must be less than or equal to 100. This field must be filled in for each chemical component.

Relative Weight. This can be used for a full profile. Enter the relative liquid weight for each component (e.g., 2 lbs acetone for every 1 lb xylene). The program will convert the relative weights into percentages of total liquid weight for each component. This field must be filled in for each component. (For a full profile type, you can use either the percent of total liquid weight or the relative weight. Use the "Relative Weight/Liquid Weight" button to toggle between these two options.)

Liquid Molecular Weight. The liquid molecular weight of the chemical will be automatically filled in based on the chemical selection.

Vapor Molecular Weight. The vapor molecular weight of the chemical will be automatically filled in based on the chemical selection.

6.6.2 View/Edit Profile Data

To navigate to a profile, use the pull down menu on the profile name field. To navigate between components, use the "Previous" and "Next" buttons. Refer to Section 6.6.1 Add Profile Data above for instructions on editing each field. Please be aware that changing profile data will not change data for previously entered tanks using that particular profile. **Note: Only user-added profile data may be edited or deleted.**

6.6.3 Delete Profile Data

To delete an entire profile, navigate to the profile using the pull down menu on the profile name field and click the "Delete Profile" button. To delete a component in a profile, navigate to the component using the "Next" and "Previous" buttons and click "Delete." **Note: You cannot delete profile data included with the program; only user-added profiles and components may be modified or deleted.**

6.7 Generating Ancillary Data Reports

Reports for the chemical, meteorological, fitting, rim seal, deck seam, and profile databases are all generated in the same manner. Choose the **Export/Print** menu option under the menu heading for the database from the main menu. You will encounter a screen similar to Figure 6-7. Use the buttons to move the records you want in your report to the right hand box. Click "Print" when you have selected all the records you want in your report. You will encounter the screen shown in Figure 5-4. Instructions for viewing the report or exporting the data are the same as detailed in Section 5.3.
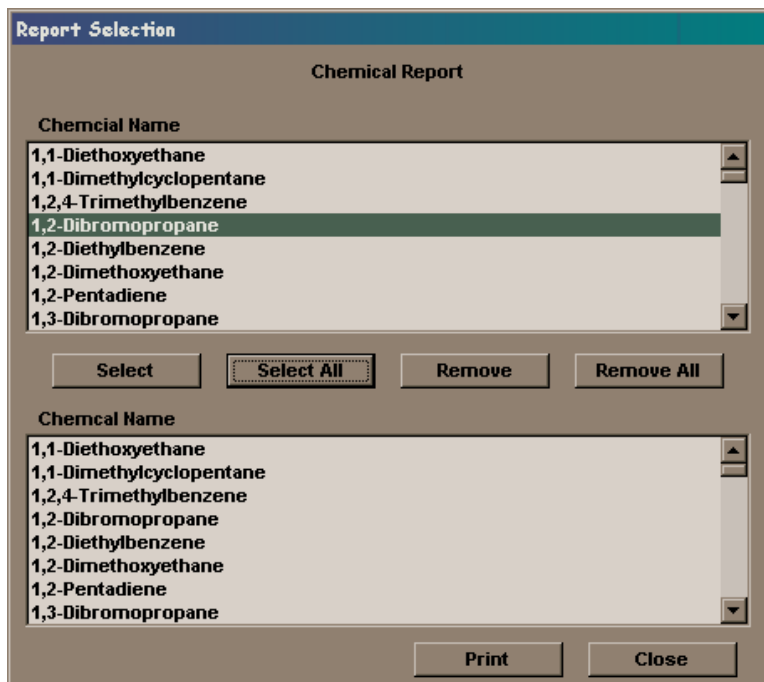
Figure 6-7. Ancillary Data Report Selection Screen

6.8 Importing Data From Version 3.1

To import data from version 3.1 select the **DATA\Tanks\Import from Version 3.1** option from the main menu. You will encounter Figure 6-8. Type the file location, or use the "Browse" buttons to assist you in identifying each file location. You must provide locations for the tank, mixture, fittings, and storage databases. Providing locations for the chemical, cities, fit_tbl, and rim_seal databases is optional, but if you have used custom ancillary data for your tanks you will need to import these data along with the tank data. Click "OK." The results of your import will be provided to you in an import report (see Figure 6-9). You may view this report, print it, or export it to a file. (See Section 5.2 for more information on reports.)

The program attempts to add imported tank records to the current "client database". If you have specified locations for the ancillary data, the program will attempt to add imported data to the current "tank database." The "Tank Database" contains the chemical, meteorological, fitting, rim seal, deck seam, and profile information. The "Client Database" stores the information used during data entry for each tank record. The current location of these files is shown at the bottom of the main TANKS screen.
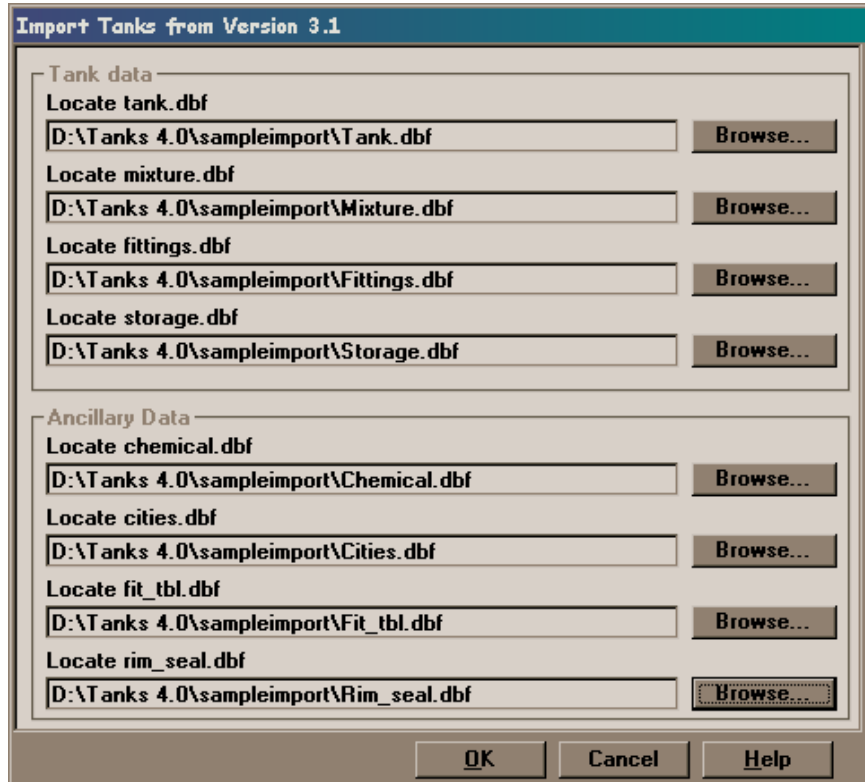
Figure 6-8. Import from Version 3.1 Screen
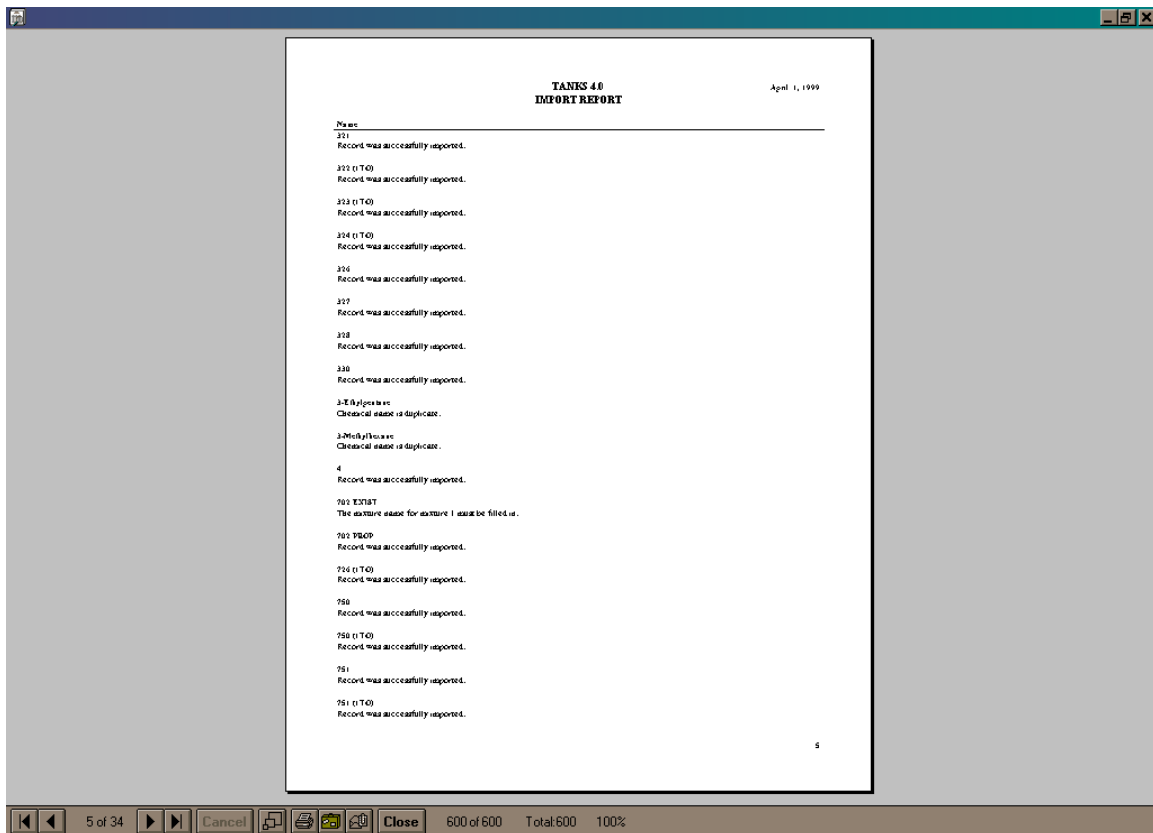
Figure 6-9. Import Report Screen

Hints on Importing TANKS 3.1 Data:

•   When importing records from TANKS 3.1, make sure that none of the records have the same TANK ID. TANKS 4.0 will not import records with duplicate TANK ID's.

•   When importing chemical data from TANKS 3.1, make sure that the vapor molecular weight field is completed for each chemical. Early versions of TANKS 3.1 allowed the user to leave the vapor molecular weight field blank when adding a new chemical to the chemical database. TANKS 4.0 will not import an chemical record if the vapor molecular weight field is blank.

6.9 Change Database Locations
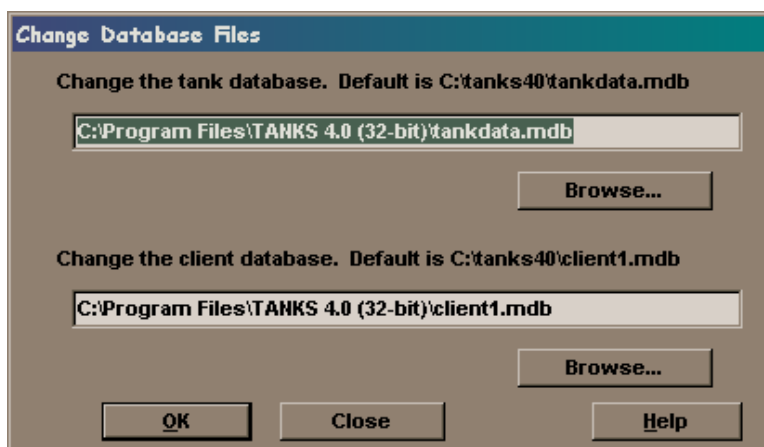
Figure 6-10. Change Database Locations Screen

This option allows you to change the "Tank Database" and the "Client Database" currently being used by TANKS 4.0. These locations are shown at the bottom of the main TANKS screen. The "Tank Database" contains the chemical, meteorological, fitting, rim seal, deck seam, and profile information. The "Client Database" stores the information used during data entry for each tank record. Activate this option by selecting the **File\Change Database Locations** options from the main menu. When you activate this option, you will encounter Figure 6-10. Type the new location into the text boxes, or use the "Browse" buttons to assist you in specifying the locations. You may change only one of the locations. Simply do not make any changes to the other text box. Click OK when you have specified the new location(s). You will be asked if you want to backup the tank and client databases before the locations are changed. See Section 6.11.1 for more information on backing up data.

6.10 Create New Client Database

This option allows you to create separate databases for subsets of tanks. For example, you could create a new client database for each company, or for each location. It is also recommended that you create a new client database before importing data from version 3.1. The "Client Database" stores the information used during data entry for each tank record. To create a new client database, select the **File\Create New Client Database** option from the main menu. When this option is selected, the program will ask you to select a file name and location.

6.11 Backup/Restore from Backup

This option allows you to backup and restore TANKS 4.0 data to and from locations specified by you.

6.11.1 Backup Data

To backup the tank data and the system data, select the **Backup/Backup Tank Database** or **Backup/Backup Client database** option from the main menu. The "Tank Database" contains the chemical, meteorological, fitting, rim seal, deck seam, and profile information. The "Client Database" stores the information used during data entry for each tank record. The data will be copied to the file location selected.

6.11.2 Restore Data From Backup

To restore TANKS 4.0 data from a backup, select the **Backup\Restore Tank Database From Backup or Backup\Restore Client Database From Backup** option from the main menu. The "Tank Database" contains the chemical, meteorological, fitting, rim seal, deck seam, and profile information. The "Client Database" stores the information used during data entry for each tank record. When this option is selected, the program will ask for the file location. The system will **overwrite** current data with the file selected - it does not append the data to the current database, it replaces the data in the current database.

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APPENDIX A: DATA DICTIONARY

The Data Dictionary is a listing of data fields in each of the 14 TANKS databases. During normal operation there is no need to edit or work with the databases directly. The Data Dictionary is provided for your reference. Do not change program data. Never modify the database structures.

CHEMICAL - Contains properties and characteristics of chemicals from the chemical list.

Name	Type	Size
Counter	Number (Long)	4
NAME	Text	50
CAS	Text	10
CATEGORY	Text	25
MOLWT	Number (Double)	8
VP_MOLWT	Number (Double)	8
L_DENS	Number (Double)	8
VP_40	Number (Double)	8
VP_50	Number (Double)	8
VP_60	Number (Double)	8
VP_70	Number (Double)	8
VP_80	Number (Double)	8
VP_90	Number (Double)	8
VP_100	Number (Double)	8
VP_COEF_A	Number (Double)	8
VP_COEF_B	Number (Double)	8
VP_COEF_C	Number (Double)	8
VP_2_A	Number (Double)	8
VP_2_B	Number (Double)	8
REID	Number (Double)	8
ASTM_SLOPE	Number (Double)	8
VP_A	Number (Double)	8
VP_B	Number (Double)	8
VP_X_MIN	Number (Double)	8
VP_X_MAX	Number (Double)	8
USER_DEF	Yes/No	1

Table Indexes

Name	Number of Fields
chemname	1
Fields:	NAME, Ascending
Counter	1
Fields:	Counter, Ascending
zCAS	1
Fields:	CAS, Ascending

COMPONENTS - Stores information on individual mixture components.

Name	Type	Size
ID	Number (Long)	4
MIX ID	Number (Long)	4
COMP ID	Number (Long)	4
NAME	Text	50
CAS	Text	10
WT_FRACT	Number (Double)	8
VP_FRACT	Number (Double)	8
WEIGHT	Number (Double)	8
MOLWT	Number (Double)	8
VP_MOLWT	Number (Double)	8
L_DENS	Number (Double)	8
ALS_TEMP	Number (Double)	8
VP	Number (Double)	8

Table Indexes

Name	Number of Fields
ID	1
Fields:	ID, Ascending
IDMIX	3
Fields:	ID, Ascending
	MIX ID, Ascending
	COMP ID, Ascending

DECKSEAM. - contains the typical decks seam specifications used to calculate deck seam loss for floating roof tanks

Name	Type	Size
Counter	Number (Long)	4
NAME	Text	255
CONSTRUC	Text	20
SWIDTH	Number (Double)	8
PWIDTH	Number (Double)	8
PLENGTH	Number (Double)	8
KD	Number (Double)	8
SD	Number (Double)	8
APICERT	Text	50
USER_DEF	Yes/No	1

Table Indexes

Name	Number of Fields
Counter	1
Fields:	Counter, Ascending
NAME	1
Fields:	NAME, Ascending

EMISSION - Stores emissions report data. Each record represents one set of calculations performed in a report.

Name	Type	Size
ID	Number (Long)	4
MIX ID	Number (Long)	4
PRIMARY	Yes/No	1
NAME	Text	50
MONTH	Text	20
TANK_TYPE	Text	100
USER ID	Text	50
CITY	Text	50
STATE	Text	20
COMPANY	Text	50
DESC	Text	255
MET CTYST	Text	72
AMB_T	Number (Double)	8
T_MIN	Number (Double)	8
T_MAX	Number (Double)	8
INSOL	Number (Double)	8
P_A	Number (Double)	8
S_LOSS	Number (Double)	8
W_LOSS	Number (Double)	8
RIM_LOSS	Number (Double)	8
WD_LOSS	Number (Double)	8
DECKF_LOSS	Number (Double)	8
DECKS_LOSS	Number (Double)	8
MOLES	Number (Double)	8
L_WT_FRACT	Number (Double)	8
V_WT_FRACT	Number (Double)	8
L_MO_FRACT	Number (Double)	8
V_MO_FRACT	Number (Double)	8
MOLWT	Number (Double)	8
VP_MOLWT	Number (Double)	8
L_DENS	Number (Double)	8
ALPHA	Number (Double)	8
ALPHA_2	Number (Double)	8
ALS_TEMP	Number (Double)	8
MLS_TEMP	Number (Double)	8
XLS_TEMP	Number (Double)	8
BULK_T	Number (Double)	8
A_VP	Number (Double)	8
M_VP	Number (Double)	8
X_VP	Number (Double)	8
DIAMETER	Number (Double)	8
EFF_DIAM	Number (Double)	8
HEIGHT_S	Number (Double)	8
HEIGHT_R	Number (Double)	8
HEIGHT_L	Number (Double)	8
HEIGHT_AL	Number (Double)	8
VOLUME	Number (Double)	8
Q_NET	Number (Double)	8
TURNOVER	Number (Double)	8
SHL COLSHD	Text	50
SHL_COND	Text	13
PT_COND	Text	4
RF_COLSHD	Text	50
RF_COND	Text	4
RF_TYPE	Text	20
VP_RANGE	Number (Double)	8
T_RANGE	Number (Double)	8
VT_RANGE	Number (Double)	8
RF_OUT	Number (Double)	8
VS_OUT	Number (Double)	8
VS_VOL	Number (Double)	8
V_DENS	Number (Double)	8
BV_RANGE	Number (Double)	8
K_E	Number (Double)	8
K_S	Number (Double)	8

Name	Type	Size
K_N	Number (Double)	8
K_P	Number (Double)	8
M_KR	Number (Double)	8
M_P	Number (Double)	8
M_KC	Number (Double)	8
M_C	Number (Double)	8
VENT_P	Number (Double)	8
VENT_V	Number (Double)	8
C_SLOPE	Number (Double)	8
D_RADIUS	Number (Double)	8
NC	Number (Double)	8
FC	Number (Double)	8
M_FF	Number (Double)	8
SD	Number (Double)	8
KD	Number (Double)	8
N_FACT	Number (Double)	8
TANK_CONSTRUCT	Text	29
RIM_PRIM	Text	50
RIM_SEC	Text	50
M_KRA	Number (Double)	8
M_KRB	Number (Double)	8
FITTING	Text	12
M_V	Number (Double)	8
DECK_TYPE	Text	6
DECK_CONSTRUCT	Text	50
DECK_SEAM	Text	50
DECK_SEAM_LENGTH	Number (Double)	8
COL_NO	Number (Double)	8
COL_DIAM	Number (Double)	8
SELF_SUP	Yes/No	1
UNDER	Yes/No	1
HEATED	Yes/No	1

Table Indexes

Name	Number of Fields
COMPID	5

Fields: ID, Ascending
MIX ID, Ascending
NAME, Ascending
MONTH, Ascending
PRIMARY, Ascending

ID	1

Fields: ID, Ascending

MIX ID	1

Fields: MIX ID, Ascending

USER ID	1

Fields: USER ID, Ascending

ERROR - Stores information on emissions calculation errors.

Name	Type	Size
ID	Number (Long)	4
USER ID	Text	50
Error	Memo	-

Table Indexes

Name	Number of Fields	
ID	1	
Fields:	ID, Ascending	

FITTING (Ancillary)- Contains characteristics of specific roof/deck fitting types.

Name	Type	Size
Counter	Number (Long)	4
FIT_TYPE	Text	50
COVR_TYPE	Text	50
K_FA	Number (Double)	8
K_FB	Number (Double)	8
K_M	Number (Double)	8
QUANTITY	Number (Double)	8
TYP_EFLT	Yes/No	1
TYP_IFLT	Yes/No	1
D_ROOF	Yes/No	1
P_SEAL	Yes/No	1
WELD_DECK	Yes/No	1
SELF_SUP	Yes/No	1
API_CERT	Text	50
USER_DEF	Yes/No	1

Table Indexes

Name	Number of Fields	
Counter	1	
Fields:	Counter, Ascending	
COVR_TYPE	1	
Fields:	COVR_TYPE, Ascending	
FIT_TYPE	1	
Fields:	FIT_TYPE, Ascending	
TYPE	2	
Fields:	FIT_TYPE, Ascending	
	COVR_TYPE, Ascending	

FITTINGS (Tank)- Contains information about roof/deck fittings for floating roof tanks.

Name	Type	Size
ID	Number (Long)	4
FIT ID	Number (Long)	4
FIT_TYPE	Text	50
COVR_TYPE	Text	50
K_FA	Number (Double)	8
K_FB	Number (Double)	8
K_M	Number (Double)	8
QUANTITY	Number (Double)	8

Table Indexes

Name	Number of Fields	
fitid	2	
Fields:	ID, Ascending	
	FIT ID, Ascending	
ID	1	
Fields:	ID, Ascending	

IMPORT ERRORS - Contains information on import errors.

Name	Type	Size
IDX_ID	Text	10
ID	Text	255
Error	Text	255

Table Indexes

Name	Number of Fields	
ID	1	
Fields:	IDX_ID, Ascending	

MET- Contains meteorological data for specific locations.

Name	Type	Size
Counter	Number (Long)	4
CTYST	Text	72
CITY	Text	50
STATE	Text	20
A_TEMP_DAA	Number (Double)	8
TAX_JAN	Number (Double)	8
TAX_FEB	Number (Double)	8
TAX_MAR	Number (Double)	8
TAX_APR	Number (Double)	8
TAX_MAY	Number (Double)	8
TAX_JUN	Number (Double)	8
TAX_JUL	Number (Double)	8
TAX_AUG	Number (Double)	8
TAX_SEP	Number (Double)	8
TAX_OCT	Number (Double)	8
TAX_NOV	Number (Double)	8
TAX_DEC	Number (Double)	8
TAX_ANN	Number (Double)	8
TAN_JAN	Number (Double)	8
TAN_FEB	Number (Double)	8
TAN_MAR	Number (Double)	8
TAN_APR	Number (Double)	8
TAN_MAY	Number (Double)	8
TAN_JUN	Number (Double)	8
TAN_JUL	Number (Double)	8
TAN_AUG	Number (Double)	8
TAN_SEP	Number (Double)	8
TAN_OCT	Number (Double)	8
TAN_NOV	Number (Double)	8
TAN_DEC	Number (Double)	8
TAN_ANN	Number (Double)	8
INSOL_JAN	Number (Double)	8
INSOL_FEB	Number (Double)	8
INSOL_MAR	Number (Double)	8
INSOL_APR	Number (Double)	8
INSOL_MAY	Number (Double)	8
INSOL_JUN	Number (Double)	8
INSOL_JUL	Number (Double)	8
INSOL_AUG	Number (Double)	8
INSOL_SEP	Number (Double)	8
INSOL_OCT	Number (Double)	8
INSOL_NOV	Number (Double)	8
INSOL_DEC	Number (Double)	8
INSOL_ANN	Number (Double)	8
WIND_JAN	Number (Double)	8
WIND_FEB	Number (Double)	8
WIND_MAR	Number (Double)	8
WIND_APR	Number (Double)	8
WIND_MAY	Number (Double)	8
WIND_JUN	Number (Double)	8
WIND_JUL	Number (Double)	8
WIND_AUG	Number (Double)	8
WIND_SEP	Number (Double)	8
WIND_OCT	Number (Double)	8
WIND_NOV	Number (Double)	8
WIND_DEC	Number (Double)	8
WIND_ANN	Number (Double)	8
ATMOS_PRS	Number (Double)	8
USER DEF	Yes/No	1

Table Indexes

Name	Number of Fields
Counter	1
Fields:	Counter, Ascending
CTYST	1
Fields:	CTYST, Ascending

MIXTURES - Contains information on liquid mixtures. Each record represents one mixture in a tank.

Name	Type	Size
ID	Number (Long)	4
MIX ID	Number (Long)	4
MIX NAME	Text	50
CAS	Text	10
C_CATEGORY	Text	25
COMPONENT	Text	8
SPEC_OPT	Text	25
MOLWT	Number (Double)	8
VP_MOLWT	Number (Double)	8
L_DENS	Number (Double)	8
VP	Number (Double)	8
VP_MIN	Number (Double)	8
VP_MAX	Number (Double)	8
ALS_TEMP	Number (Double)	8
MLS_TEMP	Number (Double)	8
XLS_TEMP	Number (Double)	8
BULK_TEMP	Number (Double)	8
JANUARY	Yes/No	1
FEBRUARY	Yes/No	1
MARCH	Yes/No	1
APRIL	Yes/No	1
MAY	Yes/No	1
JUNE	Yes/No	1
JULY	Yes/No	1
AUGUST	Yes/No	1
SEPTEMBER	Yes/No	1
OCTOBER	Yes/No	1
NOVEMBER	Yes/No	1
DECEMBER	Yes/No	1
JAN_THRU	Number (Double)	8
FEB_THRU	Number (Double)	8
MAR_THRU	Number (Double)	8
APR_THRU	Number (Double)	8
MAY_THRU	Number (Double)	8
JUN_THRU	Number (Double)	8
JUL_THRU	Number (Double)	8
AUG_THRU	Number (Double)	8
SEP_THRU	Number (Double)	8
OCT_THRU	Number (Double)	8
NOV_THRU	Number (Double)	8
DEC_THRU	Number (Double)	8

Table Indexes

Name	Number of Fields
ID	1
Fields:	ID, Ascending
IDMIX	2
Fields:	ID, Ascending
	MIX ID, Ascending
NAME	2
Fields:	ID, Ascending
	MIX NAME, Ascending

PROFILE COMPONENTS - Stores chemical component information for profiles.

Name	Type	Size
spec id	Number (Long)	4
NAME	Text	50
CAS	Text	10
WT_FRACT	Number (Double)	8
VP_FRACT	Number (Double)	8
WEIGHT	Number (Double)	8
MOLWT	Number (Double)	8
VP_MOLWT	Number (Double)	8

Table Indexes

Name	Number of Fields
ID	1
Fields:	spec id, Ascending

PROFILE NAMES - Stores the unique profile names.

Name	Type	Size
SPEC ID	Number (Long)	4
Profile Name	Text	50
TYPE	Text	50
USER	Yes/No	1

Table Indexes

Name	Number of Fields
Profile Name	1
Fields:	Profile Name, Ascending
SPEC ID	1
Fields:	SPEC ID, Ascending

RIM SEAL - Stores information on rim seal factors.

Name	Type	Size
Counter	Number (Long)	4
PRIM_SEAL	Text	50
SECND_SEAL	Text	50
K_RA	Number (Double)	8
K_RB	Number (Double)	8
N_FACTOR	Number (Double)	8
EFLT	Yes/No	1
DEFT	Yes/No	1
IFLT	Yes/No	1
WELDED	Yes/No	1
RIVETED	Yes/No	1
API_CERT	Text	50
USER_DEF	Yes/No	1

Table Indexes

Name	Number of Fields
Counter	1
Fields:	Counter, Ascending
prim	1
Fields:	PRIM_SEAL, Ascending
primsec	2
Fields:	PRIM_SEAL, Ascending
	SECND_SEAL, Ascending
RIMID	4
Fields:	PRIM_SEAL, Ascending
	SECND_SEAL, Ascending
	WELDED, Ascending
	RIVETED, Ascending

TANK - Contains information about the tank type, structure, and characteristics.

Name	Type	Size
ID	Number (Long)	4
USER ID	Text	50
TANK_TYPE	Text	100
CITY	Text	50
STATE	Text	20
COMPANY	Text	50
DESC	Text	255
MET CTYST	Text	72
ATMOS_PRS	Number (Double)	8
DIAMETER	Number (Double)	8
HEIGHT S	Number (Double)	8
HEIGHT ML	Number (Double)	8
HEIGHT AL	Number (Double)	8
VOLUME	Number (Double)	8
VENT_P	Number (Double)	8
VENT_V	Number (Double)	8
SHL COLSHD	Text	50
SHL_COND	Text	13
PT_COND	Text	4
RF_COLSHD	Text	50
RF_COND	Text	4
RF_TYPE	Text	20
RF_HEIGHT	Number (Double)	8
D_RADIUS	Number (Double)	8
C_SLOPE	Number (Double)	8
Q_NET	Number (Double)	8
TURNOVER	Number (Double)	8
TANK_CONSTRUCT	Text	29
RIM_PRIM	Text	50
RIM_SEC	Text	50
FITTING	Text	12
DECK_TYPE	Text	6
DECK_CONSTRUCT	Text	50
DECK_SEAM	Text	50
DECK_SEAM_LENGTH	Number (Double)	8
SD	Number (Double)	8
COL_NO	Number (Double)	8
COL_DIAM	Number (Double)	8
HEATED	Yes/No	1
SELF_SUP	Yes/No	1
UNDER	Yes/No	1

Table Indexes

Name	Number of Fields
ID	1
Fields:	ID, Ascending
USER ID	1
Fields:	USER ID, Ascending

APPENDIX B: ERROR MESSAGES

[Field name] cannot be 0 - This field must have a non-zero value. Enter a value other than zero.

[Field name] cannot exceed [field name] - One field cannot logically be greater than another. For example, liquid height cannot be greater than shell height. Change one or both fields so that the first field is less than or equal to the second.

Average [field name] > Maximum [field name] - When there are three fields, Minimum, Maximum and Average, the Average value must be less than the Maximum value. Change one or both fields.

Average [field name] < Minimum [field name] - When there are three fields, Minimum, Maximum and Average, the Average value must be greater than the Minimum value. Change one or both fields.

[Field name] must be greater than 0 - This field's value must be greater than 0. Enter the correct value.

[Field name] cannot be less than 0 - This field's value cannot be less than 0. Enter the correct value.

[Field name] must be specified - This field must have a value. Enter the correct value.

Liquid weight percents do not add up to 100 percent - When using weight percentages and the full speciation option, the weight percents must total between 99.9 and 100.1 percent. Change one or more of the chemical component weight percentages.

Vapor pressures must not be greater than [value] psia. (The atmospheric pressure of the nearest city.) - A vapor pressure above the atmospheric pressure will result in errors with emissions estimation procedures. A mixture with a vapor pressure equal to the atmospheric pressure is at its boiling point. The storage tank equations do not apply to boiling liquids. Check the site meteorological data and liquid information for accuracy.

Breather vent range exceeds vapor pressure range - The breather vent range must be less than the vapor pressure range of the stored liquid or the standing losses calculated will be less than zero. Check the breather vent settings. If the settings are correct assume standing storage losses are zero. Otherwise, correct the settings prior to generating a new report. Note that the fixed roof tank equations do not apply to pressure tanks.

Monthly throughput values do not agree with total throughput values - The sum of all monthly throughput values does not agree with the annual throughput to within 1%.

The tank must have fittings - A floating roof tank must have at least one fitting. If you do not know details about the fittings on your tank, choose Typical.

Tank errors must be fixed before mixture information can be checked - There is not enough information available to evaluate the liquid contents of the tank. Please fill in all the physical characteristics for the tank.

Duplicate [field] - This record already exists in the database. If you want to import this record, change the unique identifiers to a combination not in the current database.

[Field] was not found in the current database. You must enter information for this [field] before you can import this record - Import the chemical, cities, fittings, or rim seal database where your user-entered ancillary data exist along with the tank information.

The vapor mole fractions or vapor weight percents for the component information you entered add up to more than one. Therefore, the component information is inconsistent with the information specified for the mixture. - The components you have entered are impossible based on the mixture properties. Change the name and/or liquid weight percentage for each component.

Based on the vapor pressure range and the breather vent pressure settings for the tank, the calculated value for the expansion factor is negative. Please check the breather vent pressure settings and the vapor pressure values. For heated tanks at constant temperature, the breather vents must be set to zero. - Change the pressure settings on the tank. The vapor space expansion factor is negative (see Equation 1-16 in AP-42, Section 7.1).

The throughput, volume and turnovers must agree within 10%. Throughput = tank volume * turnovers. The terms of this equation must agree within plus or minus 10 percent.

The volume, maximum shell height and diameter must agree within 10%. For a vertical fixed roof tank, volume * 0.133698 (converted to ft^3) must equal maximum liquid height * (diameter/2)^2 * pi within 10 percent.

The volume does not agree with the shell length and diameter. For horizontal tanks, volume * 0.133698 (converted to ft^3) must not be greater than shell length * (diameter/2)^2 * pi by more than 10 percent.

You may not run a monthly report for more than one month for a mixture not part of the chemical database. Add this chemical to the chemical database if you want to run monthly reports for this chemical. - When no vapor pressure calculation equation is available (the mixture is not part of the chemical data base), the vapor pressure entered by the user on the Tank Contents screen is used in the monthly emission calculations. Emissions estimates are not accurate when the same vapor pressure is used for more than one month since mixture vapor pressure varies with temperature.

You have not selected a mixture for any of the months. - At least one of the months must be active and have a mixture name.

APPENDIX C: CITIES WITH ALTERNATE METEOROLOGICAL DATA

For some of the cities in the Meteorological Database, monthly wind speed data or solar insolation factors were not available. For each of these cities, meteorological data from another city were used. The following is a list of these cities and the corresponding city from which the missing data were taken:

City	**City used for Insolation Factors**
Unakleet, AK	Nome, AK
Valdez, AK	Yakutat, AK
Bishop, CA	Fresno, CA
Eureka, CA	Medford, OR
Redding, CA	Sacramento, CA
Santa Barbara, CA	Santa Maria, CA
Stockton, CA	Sacramento, CA
Fort Myers, FL	Tampa, FL
Gainsville, FL	Tallahassee, FL
Pensacola, FL	Mobile, AL
Vero Beach, FL	West Palm Beach, FL
Columbus, GA	Macon, GA
Cairo, IL	Evansville, IN
Dubuque, IA	Moline, IL
Concordia, KS	Grand Island, NE
Jackson, KY	Lexington, KY
Paducah, KY	Evansville, IN
Marquette, MI	Duluth, MN
Muskegon, MI	Grand Rapids, MI
Sault St. Marie, MI	Green Bay, WI
Tupelo, MS	Memphis, TN
Lincoln, NE	Omaha, NE
Valentine, NE	North Platte, NE
JFK AP, NY	LaGuardia AP, NY
Williston, ND	Glasgow, MT
Block Island, RI	Providence, RI
Aberdeen, SD	Sioux Falls, SD
Oak Ridge, TN	Knoxville, TN
Galveston, TX	Port Arthur, TX
Milford, TX	Dallas-Fort Worth, TX
Walla Walla, WA	Pendleton, OR
Beckley, WV	Charleston, WV

City	**City used for Wind Speed Data**
Unakleet, AK	Nome, AK
Bishop, CA	Fresno, CA
Lewiston, ID	Boise, ID
Dubuque, IA	Moline, IA
Milford, TX	Dallas-Fort Worth, TX

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APPENDIX D: FREQUENTLY ASKED QUESTIONS

Please refer to the CHIEF web site (http://www.epa.gov/ttn/chief/faq/tanksfaq.html) for the most up-to-date list of frequently asked questions.

HOW DO I ESTIMATE EMISSIONS FROM A HEATED TANK?

If a tank is heated, the vapor space can be assumed to be at a constant temperature and no breathing losses will occur. The tank must be heated to a uniform temperature and well insulated, thus isolating it from heat gains and losses due to insolation and variations in ambient temperature. Changes in atmospheric pressure are assumed to have only negligible contributions to breathing losses and are not considered.

The menu selection "Is Tank Heated" on the Physical Characterics screen should be answered "Yes" to estimate emissions from vertical and horizontal fixed roof tanks. This will allow you to enter the temperature data directly on the Tank Contents screen. There are temperature data input fields for Average, Minimum and Maximum Liquid Surface Temperature and for Bulk Liquid Temperature (degrees Fahrenheit). The temperature at which the tank is heated should be entered in all four data fields. If the tank is not well insulated, daily variations in liquid surface temperatures may be observed. The Minimum and Maximum Liquid Surface Temperatures, if available, should be input to estimate breathing losses.

You also should check the information in the chemical database to ensure that appropriate data are available for the program to estimate vapor pressure at the desired temperature. For example, if Option 1 is used in the chemical database for estimating vapor pressure (valid in the temperature range from 40 to 100 F) and the desired temperature is over 100 F, the program will calculate a vapor pressure at 100 F (it will not extrapolate to higher temperatures). Options 2, 3 or 4 in the chemical database should be used for estimating vapor pressures at temperatures greater than 100 F.

HOW DOES THE TANKS MODEL GENERATE SPECIATED EMISSIONS?

The model offers several options for speciating emissions into their component parts. When the user is able to specify the properties and amounts of the liquids stored, the program relies upon Raoult's Law and Dalton's Law to estimate component emissions. If liquid properties are not known, Version 4.0 of TANKS has default liquid speciation profiles for crude oil and selected petroleum products. The last option uses tank headspace vapor speciation data for fixed roof tanks. The user must supply this data.

HOW DO I CALULATE EMISSIONS FROM A FIXED ROOF TANK WITH A ROOF GEOMETRY OTHER THAN A COME OR DOME?

The model is programmed to handle cone and dome roofs which are the most common geometries. Other geometries must use one of these options to calculate the "Roof Outage" (the additional tank shell height in feet that would produce a volume of space equivalent to the space

under the roof alone). The Roof Outage is one component of the Vapor Space Outage used in the breathing loss calculation.

You must calculate the Roof Outage external to the program based on the geometry of the roof. Once a value of the outage is obtained, modify the program using either the dome or cone roof options by varying either the dome roof radius or the cone roof slope until an equivalent outage is calculated. As an example, if the tank has a flat roof, the "Cone Roof" option can be selected and the slope set to "0".

HOW DO I OBTAIN PHYSICAL PROPERTY DATA FOR CHEMICALS THAT ARE NOT IN THE CHEMICAL DATABASE?

Two of the best resources are the CRC Handbook of Chemistry and Physics, Lange's Handbook of Chemistry, and Perry's Chemical Engineering Handbook. These references should be available at most technical libraries. Other references are:

Reid, Prausnitz and Sherwood, *Properties of Liquids and Gases*, McGraw Hill, 1987.

Yaws and Yang, *Property Data: To Estimate Vapor Pressure Easily*, Hydrocarbon Processing, October 1989.

Baublik, Fried and Hola, *The Vapor Pressures of Pure Substances, Selected Values of the Temperature Dependent Vapor Pressure in the Normal and Low Pressure Regions*, Elsevier Science Publishers, Amsterdam, 1984.

I HAVE A TANK THAT IS OPERATED WITH LITTLE OR NO CHANGE IN THE LIQUID LEVEL (i.e., a "constant level" tank). I BELIEVE THE MODEL IS OVERESTIMATING THE WORKING LOSSES FROM THE TANK. WHAT SHOULD I DO?

The inputs to the working loss equation should be modified for constant level tanks since the working losses are based on changes in the height of the liquid. First, determine the annual tank turnover rate by dividing the tank throughput by the tank volume. Next, determine the average change in liquid height and divide it by the maximum liquid height to establish a ratio. Multiply the annual tank turnover rate by this ratio to obtain the adjusted annual turnover rate for input to the model. As an alternative, a typical "rule of thumb" for constant level tanks is to use 4 turnovers to estimate working loss.

MY STORAGE TANK HAS A NITROGEN BLANKET. HOW SHOULD I ESTIMATE EMISSIONS?

Whether the tank is of fixed roof or internal floating roof design, no modifications to the equations are required. The gas blanket will not affect emissions if the tank is operated near atmospheric pressure.

CAN I USE TANKS TO ESTIMATE EMISSIONS FROM A FIXED ROOF TANK OPERATED UNDER "LOW-PRESSURE" CONDITIONS?

Low pressure conditions are defined by API as an operating range of 1 to 15 psig. The TANKS model uses equations developed under atmospheric conditions and is not programmed to estimate emissions from low-pressure tanks. However, you may use API Bulletin 2516, *Evaporation Loss From Low-Pressure Tanks*, to determine if your storage pressure is sufficient to prevent standing storage losses from the material stored. Working losses can be calculated as a percentage of the throughput.

I VENT MY TANK TO A CONTROL DEVICE. HOW SHOULD I ESTIMATE EMISSIONS?

TANKS estimates uncontrolled emissions. If you have test data from the outlet of the control device, you can use it to estimate emissions rather than using the model. If you have a limited amount of data, but have conducted inlet and outlet testing, you can calculate the efficiency of the control device and apply it to emissions estimated by the model.

WHAT DO I DO IF MY TANK COLOR IS NOT FOUND IN AP-42?

You should select the most similar color available to represent your tank. If you have a paint with high reflectivity, use white.

CAN I USE THE TANKS MODEL TO ESTIMATE EMISSIONS FROM A TANK STORING AN INORGANIC LIQUID?

Although the equations used in the model were developed to estimate evaporative losses from storage of organic liquids, it is possible to use the model if the inorganic liquid has a measurable vapor pressure and data are available for one of the vapor pressure options in the chemical database. Emission estimates produced by the model will be of unknown accuracy due to the absence of confirmatory testing for emissions from inorganic liquid storage tanks.

MY TANK FITTINGS ARE NOT IN AP-42. HOW CAN I CALCULATE EMISSIONS?

Loss factors for the most common fitting types and control configurations have been developed through testing conducted by the American Petroleum Institute (API) and reviewed by EPA. The fittings tested were generic designs that approximated evaporative loss mechanisms common to most vendor components. In most cases, if the exact design is not found, one that is of similar geometry will be available and should be selected.

API, with the support of EPA, has developed the Tank Seals and Fittings (TSF) Program which can be used to develop loss factors for vendor specific component designs. You should contact API for further information if you want to conduct testing to establish a loss factor for your component.

HOW CAN I ESTIMATE EMISSIONS FROM DEGASSING AND CLEANING OPERATIONS DURING A TANK TURNAROUND?

The following procedure can be used to approximate emissions from each step of the operation:

Emptying (degassing):

For a fixed roof tank, calculate emissions from one turnover with the turnover factor (K_n) = 1 to account for vapors displaced during filling and then add the emissions from 1 turnover calculated as if the tank had a floating roof to account for clingage.

For a floating roof tank, calculate emissions for one turnover then add the emissions from the tank assuming it has a fixed roof with a height equal to the height of the roof legs (about 6 or 7 ft.) to approximate the vapor displaced from the space under the floating roof.

Cleaning (sludge handling):

Most wet sludges are about 80% to 90% liquid by weight. A conservative approach for estimating emissions is to assume the sludge is 80% liquid. The remainder is assumed to be VOC and emitted. As an alternative, the actual sludge moisture content can be determined.

HOW CAN I ESTIMATE EMISSIONS FROM ROOF LANDING LOSSES in the TANKS program?

In November 2006, Section 7.1 of AP42 was updated with subsection 7.1.3.2.2 Roof Landings. The TANKS program has not been updated with these new algorithms for internal floating roof tanks and it is based on the 1997 version of section 7.1.

It is possible to estimate these losses in TANKS by using a portion of the guidance developed for degassing and cleaning a tank by modeling the vapor space under the roof as a fixed roof and calculating the emissions from one turnover. This estimation is less accurate than using section 7.1.3.2.2 of AP42.

MY TANK CONTAINS A TWO-PHASE LIQUID. WHAT DO I DO?

Use the properties (P_{va}, M_v, etc.) of the top phase to estimate emissions. Calculate throughput using the overall liquid.

IF MY HORIZONTAL FIXED ROOF TANK IS UNDERGROUND, HOW DO I ESTIMATE EMISSIONS?

You should select the Horizontal Tank option and from the Physical Characteristics screen and answer "Yes" to the question, "Is the tank underground?" Since the surrounding earth limits the diurnal temperature change, the model assumes that there are no breathing losses from the tank (breathing losses from atmospheric pressure fluctuations are assumed to be negligible). Only working losses will be calculated.

I HAVE A GASOLINE SERVICE STATION WITH UNDERGROUND FIXED ROOF TANKS THAT ARE VAPOR BALANCED. WHAT EQUATIONS SHOULD I USE TO ESTIMATE EMISSIONS?

Use the equations presented in Section 7.1.3.3 of AP-42 for variable vapor space tanks.

MY TANK STORES DIFFERENT LIQUIDS DURING THE YEAR. HOW DO I ACCOUNT FOR THIS VARIABILITY?

Estimate emissions for the time period over which each liquid was stored, and sum the emissions to obtain the annual emissions. Version 4.0 of the TANKS program simplifies the calculation of emissions for tanks storing multiple liquids throughout the year.