# USER'S GUIDE

# TO

# TANKS 5.2

# (released December 2025)

**Storage Tank Emissions Calculation Application**
**Version 5.2**

**December 2025**

**U.S. Environmental Protection Agency**
**Office of Clean Air Programs**
**Natural Resources Division**
**Emissions Data and Assessment Branch**
**Research Triangle Park, NC 27711**

## Table of Contents

## Abbreviations

| | |
|---|---|
| °C | degrees Celsius |
| °F | degrees Fahrenheit |
| °R | degrees Rankine |
| bbl | barrels |
| degrees R | degrees Rankine |
| ft | feet |
| ft/yr | feet per year |
| gal | gallons |
| gal/yr | gallons per year |
| in | inches |
| K | Kelvin |
| lb/lb-mole | pound per pound mole |
| mmHg | millimeters mercury |
| ppmv | parts per million by volume |
| psia | pounds per square inch absolute |
| psig | pounds per square inch gauge |
| R | Rankine |
| yr | year |

# 1.0 Introduction

The TANKS application is designed to estimate air emissions from organic liquids and petroleum distillates in storage tanks. The United States 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 manual provides general use instructions for the TANKS 5.2 application. 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 5.2 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 meteorological conditions and location of the tank (nearest city, ambient temperature, etc.) to 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 5.2 of TANKS, hereafter referred to as TANKS 5.2, represents an upgrade to TANKS 5.0 and TANKS 5.1. It includes several new features and revisions to maintain consistency with the EPA emissions calculation methodologies and to respond to users' comments.

Please note that the emissions estimating equations that form the basis of the TANKS 5.2 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 application is available for public use, but the program cannot be sold without written permission from API and the EPA.

Questions and comments can be sent at any time to: *https://www.epa.gov/chief/forms/contact-us-about-clearinghouse-inventories-and-emissions-factors*.

## 1.1 Accessing TANKS 5.2

TANKS 5.2 is available here: *https://www.tanks.app.cloud.gov*

More information about TANKS 5.2, including frequently asked questions (FAQs), is available here: *https://www.epa.gov/air-emissions-factors-and-quantification/tanks-emissions-estimation-software-version-50*

AP-42 Chapter 7 is available here: *https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-fifth-edition-volume-i-chapter-7-liquid-storage-0*.

## 1.2 TANKS 5.2 Main Menu

There are four pages on the TANKS 5.2 main menu.

**Tank Data.** The page includes a description, links to references and resources (including this User's Guide), a summary of tanks that you have created or imported, and the form to create a new tank. See *Section 2* for more information.

**Routine Losses.** The page is used to calculate routine losses for your tank or multiple tanks. See *Section 3* for more information.

**Non-Routine Losses.** The page is used to calculate roof landing losses for a floating roof tank or to calculate cleaning losses from any type of tank. See *Section 4* for more information.

**Customize.** The page is used to create custom chemicals that are not included in AP-42 Chapter 7 or custom meteorological locations that are not included in AP-42 Chapter 7. See *Section 5* for more information.

**Note that fields marked with a red asterisk (*) are required fields.**

See *Section 7* for a list of Definitions used throughout this document and within TANKS 5.2.

See *Section 8* for a list of Error Messages and explanations.

# 2.0 Tank Data

The “Tank Data” page includes a description, links to references and resources, a summary of tanks that you have created or imported, and the form to create a new tank.

Select “Tank Data,” as shown by the red oval in Figure 1:

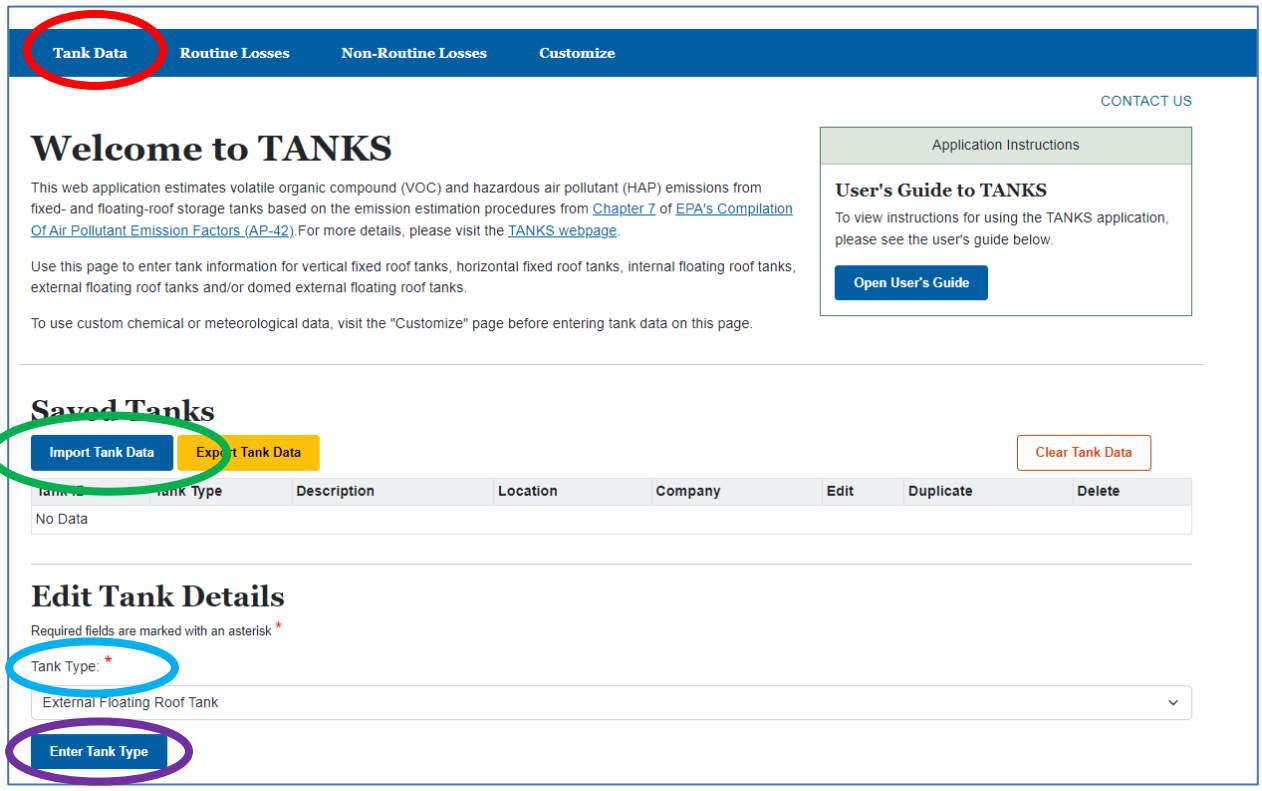


**Figure 1. Screenshot of TANKS 5.2 “Tank Data” page**

## 2.1 Importing Tank Data

If you have previously worked with tank data, saved the exported tank data file to your computer, and want to edit the data or generate emissions reports, select "Import Tank Data." Open the appropriate folder and choose the file you want to import into TANKS 5.2.

Once imported, those tanks will be listed underneath "Saved Tanks" (see green oval in Figure 1).

**Note that importing tank data replaces the entire tank data library and all custom data.**

See *Section 2.4* for "Exporting Tank Data" to export data (or save) from TANKS 5.2 to your computer.

TANKS 5.2 does not store your data within the application, all data is stored within your browser's local storage. The data will remain within your browser until you clear your local storage. In order to save your data long term, you should export your tank data to your computer.

## 2.2 Adding New Tanks

If you have no previously saved storage tanks or want to create a new set of tanks, tanks can be created using the form below the "New Tank Details" heading. First, choose the appropriate "Tank Type" underneath "New Tank Details" (see blue oval in Figure 1) from the following list:

- Vertical Fixed Roof Tank
- Horizontal Fixed Roof Tank
- Internal Floating Roof Tank
- External Floating Roof Tank
- Domed Floating Roof Tank

Then, click the "Enter Tank Type" button (see purple oval in Figure 1) to proceed with creating the selected type of tank.

If you want to use custom data that are not included in AP-42 Chapter 7, such as custom organic liquids, custom petroleum liquids, custom mixtures, or custom meteorological data, see *Section 5* before you begin adding new tanks.

Regardless of the tank type selected, there are three sections to complete: (1) Identification (*e.g.,* name and location); (2) Characteristics (*e.g.*, shell height, shell diameter, roof characteristics, tank/shell color, and deck fittings); and (3) Contents (*e.g.,* organic or petroleum liquids stored in your tank, sum of increases/decreases in liquid level, and throughput). The section headings can be expanded or collapsed by clicking on them (only one section will be expanded at a time). The input fields for the Identification and Contents sections are the same for all tank types, but the

input fields for the Characteristics section vary by tank type. Required input fields are indicated with a red asterisk.

### 2.2.1 Identification

1) Tank Identification
   a) Tank ID
   b) Tank Description
   c) Tank City
   d) Tank State
   e) Company
2) Meteorological Data
   a) Meteorological Location
      - Custom Locations [See *Section 5* for guidance on adding custom meteorological data]
      - AP-42 Meteorological Locations [See *Section 10* for the list of locations by state and see *Section 11* for the cities where monthly wind speed data or solar insolation factors were not available]

### 2.2.2 Tank Characteristics by Tank Type

Each tank type has slightly different characteristics. See *Section 7* for a list of definitions used in this section and throughout the document and see page 4 for a list of abbreviations used. Note that the temperatures on the Tank Data page are in degrees Rankine (°R). **To convert temperatures in degrees Fahrenheit (°F) to °R, add 459.67 to the temperature in °F.**

If you enter a zero into a numerical field and then want to change the value, a leading zero will remain. This leading zero disappears when the page is saved but can be removed by highlighting manually with the cursor and typing a new value.

If you enter a zero into the "Vacuum Setting (psig)" field and then want to enter a negative value, use the down arrow to change the number to -0.001 and then edit to the appropriate value.

#### *2.2.2.1 Vertical Fixed Roof Tanks*

These tanks consist of shells with permanently affixed roofs; the tank axis is perpendicular to the foundation. Tanks can be cylindrical, rectangular, or square. The fixed roof may be dome-shaped, cone-shaped, or flat. Vertical fixed roof tank shells are usually constructed of steel.

The "Tank Bottom Type" for tanks can be "flat or nominally flat bottom" or "cone-shaped bottom." According to Table 7.1-4 and Figure 7.1-20 of AP-42, Chapter 7, partial liquid heel

occurs on tanks with a cone-down bottom. The equations for partial liquid heel in Table 7.1-4 will not work if the slope is zero, which is the case for a flat or nominally flat bottom tank.

1) Tank Characteristics
   a) Tank Shape
      i) Cylinder
      ii) Rectangle
      iii) Square
   b) Shell Height (feet [ft])
   c) Shell Diameter (ft)
   d) Maximum Liquid Height (ft)
   e) Average Liquid Height (ft)
   f) Tank Bottom Type
      i) Flat or Nominally Flat Bottom
         - Liquid Heel Type
            1. Full Liquid Heel
               - Liquid Heel Height (ft)
            2. No Liquid Heel (also known as Drain Dry)
      ii) Cone-Shaped Bottom
         - Cone-Shaped Bottom Slope (ft/ft)
            - Liquid Heel Type
            1. Full Liquid Heel
               - Height of Liquid at the Tank Shell (ft)
            2. Partial Liquid Heel
               - Vertical Distance from the Bottom of the Shell Down to the Liquid Surface (ft)
            3. No Liquid Heel (also known as Drain Dry)
   g) Vapor Space Pressure at Normal Operating Conditions (pounds per square inch gauge [psig])
   h) Is Tank Insulated?
      i) Fully Insulated
         - Is Tank Heated?
            1. Heated
               a. Typical Maximum Liquid Bulk Temperature in Heating Cycle (degrees Rankine [°R])
               b. Typical Average Liquid Bulk Temperature in Heating Cycle (°R)
               c. Typical Minimum Liquid Bulk Temperature in Heating Cycle (°R)
               d. Number of Heating Cycles per Year
            2. Not Heated
               - Liquid Bulk Temperature (°R)
      ii) Partially Insulated
         - Liquid Bulk Temperature (°R)
      iii) Not Insulated
         - Liquid Bulk Temperature Calculation Method
            1. User Input

- Liquid Bulk Temperature (°R)

2. AP-42 Calculation [using Equation 1-33 of AP-42 Chapter 7]

2) Shell Characteristics
   a) Shell Color/Shade [see AP-42 Chapter 7; Table 7.1-6]
   b) Shell Condition
      i) Good
      ii) Average
      iii) Aged
3) Roof Characteristics
   a) Roof Color/Shade [see AP-42 Chapter 7; Table 7.1-6]
   b) Roof Condition
      i) Good
      ii) Average
      iii) Aged
   c) Roof Type
      i) Cone
         - Tank Cone Roof Slope (ft/ft)
      ii) Dome
         - Tank Dome Roof Radius (ft)
      iii) Flat
4) Breather Vent Settings
   a) Vacuum Setting (psig) *[see note in Section 2.2.2]*
   b) Pressure Setting (psig)
5) Control Device Settings
   a) Is Tank Equipped with a Control Device?
      i) Control Device
         - Control Device Efficiency (%)
      ii) No Control Device

### *2.2.2.2 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.

1) Tank Characteristics
   a) Shell Length (ft)
   b) Shell Diameter (ft)
   c) Maximum Liquid Height (ft)
   d) Minimum Liquid Height (ft)
   e) Vapor Space Pressure at Normal Operating Conditions (psig)
   f) Is Tank Insulated or Underground?

i) Fully Insulated or Underground
   - Is Tank Heated?
     (a) Heated
       (i) Typical Maximum Liquid Bulk Temperature in Heating Cycle (°R)
       (ii) Typical Average Liquid Bulk Temperature in Heating Cycle (°R)
       (iii) Typical Minimum Liquid Bulk Temperature in Heating Cycle (°R)
       (iv) Number of Heating Cycles per Year
     (b) Not Heated
       - Liquid Bulk Temperature (°R)

ii) Partially Insulated
   - Liquid Bulk Temperature (°R)

iii) Not Insulated and Not Underground
   - Liquid Bulk Temperature Calculation Method
     (a) User Input
       - Liquid Bulk Temperature (°R)
     (b) AP-42 Calculation [using Equation 1-33 of AP-42 Chapter 7]

2) Shell Characteristics (only if tank is "Partially Insulated" or " Not Insulated and Not Underground")
   a) Shell Color/Shade [see AP-42 Chapter 7; Table 7.1-6]
   b) Shell Condition
     i) Good
     ii) Average
     iii) Aged
3) Breather Vent Settings
   a) Vacuum Setting (psig) *[see note in Section 2.2.2]*
   b) Pressure Setting (psig)
4) Control Device Settings
   - Is Tank Equipped with a Control Device?
     i) Control Device
       - Control Device Efficiency (%)
     ii) No Control Device

### *2.2.2.3 Internal Floating Roof Tanks*

This type of tank has both a permanent fixed roof and a floating deck. There are two basic types of internal floating roof tanks: tanks in which the fixed roof is supported by vertical columns within the tank, and tanks with a self-supporting fixed roof and no internal support columns.

Under "Tank Construction and Rim Seal System," you are required to enter the primary seal type. If no specific information is available, a welded tank with an average-fitting vapor-mounted primary seal can be used to represent the most common or typical construction and rim-seal system in use for internal floating roof tanks.

Deck fittings are required for internal floating roof tanks. However, none of the individual Deck Fittings are marked as required fields; the combination of deck fittings used are unique for each internal floating roof tank. Please check your data to ensure that the correct information has been entered.

For each deck fitting, choose the appropriate cover from the drop-down menu. The corresponding loss factors from AP-42 Chapter 7, Table 7.1-12 will be applied within TANKS 5.2. For a list of typical deck fittings by tank type, see *Section 6*.

1) Tank Characteristics
    a) Shell Diameter (ft)
    b) Shell Height (ft)
    c) Tank Bottom Type
        i) Flat or Nominally Flat Bottom
            - Liquid Heel Type
                (a) Full Liquid Heel
                    - Liquid Heel Height (ft)
                (b) No Liquid Heel (also known as Drain Dry)
        ii) Cone-Shaped Bottom
            - Cone-Shaped Bottom Slope (ft/ft)
                - Liquid Heel Type
                    (i) Full Liquid Heel
                        - Height of Liquid at the Tank Shell (ft)
                    (ii) Partial Liquid Heel
                        - Vertical Distance from the Bottom of the Shell Down to the Liquid Surface (ft)
                    (iii) No Liquid Heel (also known as Drain Dry)
    d) Internal Shell Condition
        i) Light Rust
        ii) Dense Rust
        iii) Gunite Lining
    e) External Shell Color/Shade [see AP-42 Chapter 7; Table 7.1-6]
    f) External Shell Condition
        i) Good
        ii) Average
        iii) Aged
    g) Roof Color/Shade [see AP-42 Chapter 7; Table 7.1-6]
    h) Roof Paint Condition
        i) Good
        ii) Average
        iii) Aged
    i) Liquid Bulk Temperature Calculation Method
        i) User Input
            - Liquid Bulk Temperature (°R)

ii) AP-42 Calculation [using Equation 1-33 of AP-42 Chapter 7]

2) Tank Construction and Rim Seal System
   a) Tank Construction
      i) Riveted
      ii) Welded
   b) Self Supporting Roof?
      i) Yes
      ii) No
         (1) Number of Columns
         (2) Effective Column Diameter
            (a) 9 inch by 7 inch built-up column
            (b) 8 inch diameter pipe
            (c) Unknown
   c) Primary Seal
      i) Mechanical Shoe
      ii) Liquid-mounted
      iii) Vapor-mounted
   d) Secondary Seal
      i) Primary Only / None
      ii) Rim-mounted
   e) Seal Fit
      i) Average-fitting
      ii) Tight-fitting
3) Deck Characteristics
   a) Deck Type
      i) Bolted
         (1) Deck Construction
            (a) Sheet
               - Deck Seam
                  1. Sheet: 5 ft wide
                  2. Sheet: 6 ft wide
                  3. Sheet: 7 ft wide
                  4. Custom
                     - Sheet Width (ft)
            (b) Panel
               - Deck Seam
                  1. Panel: 5 by 7.5 ft
                  2. Panel: 5 by 12 ft
                  3. Custom
                     - Panel Length (ft)
                     - Panel Width (ft)
      ii) Welded

4) Deck Fittings and Count of Each Deck Fitting [see AP-42 Chapter 7, Table 7.1-12]

a) Access Hatch
b) Fixed Roof Support Column Well
c) Unslotted Guidepole and Well
d) Slotted Guidepole/Sample well
e) Gauge-float Well (Automatic Gauge)
f) Gauge-hatch/Sample Port
g) Vacuum Breaker
h) Deck Drain
i) Deck Leg
j) Deck Leg or Hanger (No opening through deck)
k) Rim Vent
l) Ladder Well
m) Ladder-slotted Guidepole Combination Well

#### *2.2.2.4 External Floating Roof Tanks*

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

Under "Tank Construction and Rim Seal System," you are required to enter the primary seal type. If no specific information is available, a welded tank with an average-fitting mechanical-shoe primary seal can be used to represent the most common or typical construction and rim-seal system in use for external and domed external floating roof tanks.

Deck fittings are required for external floating roof tanks. However, none of the individual Deck Fittings are marked as required fields; the combination of deck fittings used are unique for each external floating roof tank. Please check your data to ensure that the correct information has been entered.

For each deck fitting, choose the appropriate cover from the drop-down menu. The corresponding loss factors from AP-42 Chapter 7, Table 7.1-12 will be applied within TANKS 5.2. For a list of typical deck fittings by tank type, see *Section 6*.

1) Tank Characteristics
   a) Shell Diameter (ft)
   b) Shell Height (ft)
   c) Tank Bottom Type
      i) Flat or Nominally Flat Bottom
         - Liquid Heel Type
           (a) Full Liquid Heel
               - Liquid Heel Height (ft)
           (b) No Liquid Heel (also known as Drain Dry)
      ii) Cone-Shaped Bottom
         - Cone-Shaped Bottom Slope (ft/ft)

- Liquid Heel Type
  1. Full Liquid Heel
     - Height of Liquid at the Tank Shell (ft)
  2. Partial Liquid Heel
     - Vertical Distance from the Bottom of the Shell Down to the Liquid Surface (ft)
  3. No Liquid Heel (also known as Drain Dry)

d) Internal Shell Condition
   i) Light Rust
   ii) Dense Rust
   iii) Gunite Lining
e) External Shell Color/Shade [see AP-42 Chapter 7; Table 7.1-6]
f) External Shell Condition
   i) Good
   ii) Average
   iii) Aged
g) Roof Color/Shade [see AP-42 Chapter 7; Table 7.1-6]
h) Roof Paint Condition
   i) Good
   ii) Average
   iii) Aged
i) Liquid Bulk Temperature Calculation Method
   i) User Input
      - Liquid Bulk Temperature (°R)
   ii) AP-42 Calculation
      (1) Using Equation 2-11 of AP-42 Chapter 7 for double deck roofs or
      (2) Using Equation 2-8 of AP-42 Chapter 7 for pontoon deck roofs

2) Tank Construction and Rim Seal System
   a) Tank Construction
      i) Riveted
         (1) Primary Seal
             - Mechanical Shoe
         (2) Secondary Seal
             (a) Primary Only / None
             (b) Weather shield
             (c) Rim-mounted
         (3) Seal Fit
             - Average-fitting
      ii) Welded
         (1) Primary Seal
             (a) Mechanical Shoe
             (b) Liquid-mounted
             (c) Vapor-mounted
         (2) Secondary Seal

(a) None
(b) Weather shield
(c) Rim-mounted

(3) Seal Fit
(a) Average-fitting
(b) Tight-fitting

3) Deck Characteristics
   a) Deck Type
      - Welded
   b) Roof Type
      i) Double-deck
      ii) Pontoon
4) Deck Fittings and Count of Each Deck Fitting [see AP-42 Chapter 7, Table 7.1-12]
   a) Access Hatch
   b) Unslotted Guidepole and Well
   c) Slotted Guidepole/Sample well
   d) Gauge-float Well (automatic gauge)
   e) Gauge-hatch/Sample Port
   f) Vacuum Breaker
   g) Deck Drain
   h) Deck Leg (Pontoon area of pontoon roofs)
   i) Deck Leg (Double-deck roofs and center area of pontoon roofs)
   j) Deck Leg or Hanger (No opening through deck)
   k) Rim Vent

### *2.2.2.5 Domed External Floating Roof Tanks*

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

Under "Tank Construction and Rim Seal System," you are required to enter the primary seal type. If no specific information is available, a welded tank with an average-fitting mechanical-shoe primary seal can be used to represent the most common or typical construction and rim-seal system in use for external and domed external floating roof tanks.

Deck fittings are required for domed external floating roof tanks. However, none of the individual Deck Fittings are marked as required fields; the combination of deck fittings used are unique for each domed external floating roof tank. Please check your data to ensure that the correct information has been entered.

For each deck fitting, choose the appropriate cover from the drop-down menu. The corresponding loss factors from AP-42 Chapter 7, Table 7.1-12 will be applied within TANKS 5.2. For a list of typical deck fittings by tank type, see *Section 6*.

1) Tank Characteristics
   a) Shell Diameter (ft)
   b) Shell Height (ft)
   c) Tank Bottom Type
      i) Flat or Nominally Flat Bottom
         - Liquid Heel Type
            (a) Full Liquid Heel
               - Liquid Heel Height (ft)
            (b) No Liquid Heel (also known as Drain Dry)
      ii) Cone-Shaped Bottom
         - Cone-Shaped Bottom Slope (ft/ft)
            - Liquid Heel Type
               (i) Full Liquid Heel
                  - Height of Liquid at the Tank Shell (ft)
               (ii) Partial Liquid Heel
                  - Vertical Distance from the Bottom of the Shell Down to the Liquid Surface (ft)
               (iii) No Liquid Heel (also known as Drain Dry)
   d) Internal Shell Condition
      i) Light Rust
      ii) Dense Rust
      iii) Gunite Lining
   e) External Shell Color/Shade [see AP-42 Chapter 7; Table 7.1-6]
   f) External Shell Condition
      i) Good
      ii) Average
      iii) Aged
   g) Roof Color/Shade [see AP-42 Chapter 7; Table 7.1-6]
   h) Roof Paint Condition
      i) Good
      ii) Average
      iii) Aged
   i) Liquid Bulk Temperature Calculation Method
      i) User Input
         (1) Liquid Bulk Temperature (°R)
      ii) AP-42 Calculation [using Equation 1-33 of AP-42 Chapter 7]
2) Tank Construction and Rim Seal System
   - Tank Construction
      i) Riveted
         (1) Primary Seal

- Mechanical Shoe

(2) Secondary Seal
- (a) Primary Only / None
- (b) Weather shield
- (c) Rim-mounted

(3) Seal Fit
- Average-fitting

ii) Welded

(1) Primary Seal
- (a) Mechanical Shoe
- (b) Liquid-mounted
- (c) Vapor-mounted

(2) Secondary Seal
- (a) Primary Only / None
- (b) Weather shield
- (c) Rim-mounted

(3) Seal Fit
- (a) Average-fitting
- (b) Tight-fitting

3) Deck Characteristics

a) Deck Type
- Welded

b) Roof Type

i) Double-deck

ii) Pontoon

4) Deck Fittings and Count of Each Deck Fitting [see AP-42 Chapter 7, Table 7.1-12]

a) Access Hatch
b) Unslotted Guidepole and Well
c) Slotted Guidepole/Sample well
d) Gauge-float Well (automatic gauge)
e) Gauge-hatch/Sample Port
f) Vacuum Breaker
g) Deck Drain
h) Deck Leg (Pontoon area of pontoon roofs)
i) Deck Leg (Double-deck roofs and center area of pontoon roofs)
j) Deck Leg or Hanger (No opening through deck)
k) Rim Vent

### 2.2.3 Contents

This is for the entry of the tank contents. The information required varies by tank type and by input type (i.e., annual or monthly).

### *2.2.3.1 Fixed Roof Tanks*

*Annual Input*

1) Enter Annual Values
   a) Chemical Category of Liquid
      i) AP-42 Organic Liquids [see Table 7.1-3 of AP-42 Chapter 7]
         - Sum of Increases in Liquid Level Method
           (a) User Input
               (i) Chemical Name
               (ii) Annual Sum of Increases in Liquid Level (ft per year [ft/yr])
           (b) AP-42 Calculation [using Equation 1-39 of AP-42 Chapter 7]
               (i) Chemical Name
               (ii) Annual Throughput (gallons per year [gal/yr])
      ii) Custom Organic Liquids [See *Section 5* for guidance on adding custom organic liquids]
         - Sum of Increases in Liquid Level Method
           (a) User Input
               (i) Chemical Name
               (ii) Annual Sum of Increases in Liquid Level (ft/yr)
           (b) AP-42 Calculation [using Equation 1-39 of AP-42 Chapter 7]
           (c) Chemical Name
           (d) Annual Throughput (gal/yr)
      iii) AP-42 Petroleum Liquids [see Table 7.1-2 of AP-42 Chapter 7]
         - Sum of Increases in Liquid Level Method
         (1) User Input
           (a) Chemical Name
               (i) Annual Sum of Increases in Liquid Level (ft/yr)
           (b) AP-42 Calculation [using Equation 1-39 of AP-42 Chapter 7]
               (i) Chemical Name
               (ii) Annual Throughput (gal/yr)
      iv) Custom Petroleum Liquids [See *Section 5* for guidance on adding custom petroleum liquids]
         - Sum of Increases in Liquid Level Method
           (a) User Input
               (i) Chemical Name
               (ii) Speciation Option
                   1. None
                   2. Partial Speciation
                      - Components to Speciate
                   3. Full Speciation
               (iii) Annual Sum of Increases in Liquid Level (ft/yr)
           (b) AP-42 Calculation [using Equation 1-39 of AP-42 Chapter 7]
               (i) Chemical Name
               (ii) Speciation Option
                   1. None
                   2. Partial Speciation

- Components to Speciate

3. Full Speciation

(iii) Annual Throughput (gal/yr)

v) Custom Mixtures [See *Section 5* for guidance on adding custom mixtures]

- Sum of Increases in Liquid Level Method

(a) User Input

(i) Chemical Name

(ii) Speciation Option

1. None
2. Partial Speciation
   - Components to Speciate
3. Full Speciation

(iii) Annual Sum of Increases in Liquid Level (ft/yr)

(b) AP-42 Calculation [using Equation 1-39 of AP-42 Chapter 7]

(i) Chemical Name

(ii) Speciation Option

1. None
2. Partial Speciation
   - Components to Speciate
3. Full Speciation

(iii) Annual Throughput (gal/yr)

b) Working Loss Turnover Factor ($K_N$) Method

i) Set to 1

ii) AP-42 Calculation

(1) for turnovers > 36, $K_N = (180 + N)/6N$, where N is the number of turnovers per year

(2) for turnovers ≤ 36, $K_N = 1$

### *Monthly Input*

2) Enter Monthly Values

a) Chemical Category of Liquid

i) AP-42 Organic Liquids [see Table 7.1-3 of AP-42 Chapter 7]

- Sum of Increases in Liquid Level Method

(a) User Input

(i) Chemical Name by month

(ii) Sum of Increases in Liquid Level (ft) by month

(b) AP-42 Calculation [using Equation 1-39 of AP-42 Chapter 7 by month instead of annually]

(i) Chemical Name by month

(ii) Throughput (gal) by month

ii) Custom Organic Liquids [See *Section 5* for guidance on adding custom organic liquids]

- Sum of Increases in Liquid Level Method

(a) User Input

(i) Chemical Name by month
(ii) Sum of Increases in Liquid Level (ft) by month

(b) AP-42 Calculation [using Equation 1-39 of AP-42 Chapter 7 by month instead of annually]
(i) Chemical Name by month
(ii) Throughput (gal) by month

iii) AP-42 Petroleum Liquids [see Table 7.1-2 of AP-42 Chapter 7]

- Sum of Increases in Liquid Level Method

(a) User Input
(i) Chemical Name by month
(ii) Sum of Increases in Liquid Level (ft) by month

(b) AP-42 Calculation [using Equation 1-39 of AP-42 Chapter 7 by month instead of annually]
(i) Chemical Name by month
(ii) Throughput (gal) by month

iv) Custom Petroleum Liquids [See *Section 5* for guidance on adding custom petroleum liquids]

- Sum of Increases in Liquid Level Method

(a) User Input
(i) Chemical Name by month
(ii) Sum of Increases in Liquid Level (ft) by month
(iii) Speciation
1. None
2. Partial Speciation
   - Chemicals to Speciate
3. Full Speciation

(b) AP-42 Calculation [using Equation 1-39 of AP-42 Chapter 7 by month instead of annually]
(i) Chemical Name by month
(ii) Throughput (gal) by month
(iii) Speciation
1. None
2. Partial Speciation
   - Chemicals to Speciate
3. Full Speciation

v) Custom Mixtures [See *Section 5* for guidance on adding custom mixtures]

- Sum of Increases in Liquid Level Method

(a) User Input
(i) Chemical Name by month
(ii) Sum of Increases in Liquid Level (ft) by month
(iii) Speciation
1. None
2. Partial Speciation
   - Chemicals to Speciate
3. Full Speciation

(b) AP-42 Calculation [using Equation 1-39 of AP-42 Chapter 7 for month instead of year]
(i) Chemical Name by month
(ii) Throughput (gal) by month
(iii) Speciation
1. None
2. Partial Speciation
- Chemicals to Speciate
3. Full Speciation

b) Working Loss Turnover Factor ($K_N$) Method
i) Set to 1
ii) AP-42 Calculation
(1) for turnovers > 36, $K_N = (180 + N)/6N$, where N is the number of turnovers per year
(2) for turnovers ≤ 36, $K_N = 1$

### *2.2.3.2 Floating Roof Tanks*

*Annual Input*

1) Enter Annual Values
a) Chemical Category of Liquid
i) AP-42 Organic Liquids [see Table 7.1-3 of AP-42 Chapter 7]
- Sum of Decreases in Liquid Level Method
(a) User Input
(i) Chemical Name
(ii) Annual Sum of Decreases in Liquid Level (ft/yr)
(b) AP-42 Calculation [using Equation 2-20 of AP-42 Chapter 7]
(i) Chemical Name
(ii) Annual Throughput (gal/yr)

ii) Custom Organic Liquids [See *Section 5* for guidance on adding custom organic liquids]
- Sum of Decreases in Liquid Level Method
(a) User Input
(i) Chemical Name
(ii) Annual Sum of Decreases in Liquid Level (ft/yr)
(b) AP-42 Calculation [using Equation 2-20 of AP-42 Chapter 7]
(i) Chemical Name
(ii) Annual Throughput (gal/yr)

iii) AP-42 Petroleum Liquids [see Table 7.1-2 of AP-42 Chapter 7]
- Sum of Decreases in Liquid Level Method
(a) User Input
(i) Chemical Name
(ii) Annual Sum of Decreases in Liquid Level (ft/yr)
(b) AP-42 Calculation [using Equation 2-20 of AP-42 Chapter 7]
(i) Chemical Name

(ii) Annual Throughput (gal/yr)

iv) Custom Petroleum Liquids [See *Section 5* for guidance on adding custom petroleum liquids]

- Sum of Decreases in Liquid Level Method

(a) User Input

(i) Chemical Name

(ii) Speciation Option

1. None
2. Partial Speciation
   - Components to Speciate
3. Full Speciation
4. Annual Sum of Decreases in Liquid Level (ft/yr)

(b) AP-42 Calculation [using Equation 2-20 of AP-42 Chapter 7]

(i) Chemical Name

(ii) Speciation Option

1. None
2. Partial Speciation
   - Components to Speciate
3. Full Speciation

(iii) Annual Throughput (gal/yr)

v) Custom Mixtures [See *Section 5* for guidance on adding custom mixtures]

- Sum of Decreases in Liquid Level Method

(a) User Input

(i) Chemical Name

(ii) Speciation Option

1. None
2. Partial Speciation
   - Components to Speciate
3. Full Speciation

(iii) Annual Sum of Decreases in Liquid Level (ft/yr)

(b) AP-42 Calculation [using Equation 2-20 of AP-42 Chapter 7]

(i) Chemical Name

(ii) Speciation Option

1. None
2. Partial Speciation
   - Components to Speciate
3. Full Speciation

(iii) Annual Throughput (gal/yr)

### *Monthly Input*

2) Enter Monthly Values

a) Chemical Category of Liquid

i) AP-42 Organic Liquids [see Table 7.1-3 of AP-42 Chapter 7]

- Sum of Decreases in Liquid Level Method

(a) User Input
(i) Chemical Name by month
(ii) Annual Sum of Decreases in Liquid Level (ft) by month
(b) AP-42 Calculation [using Equation 2-20 of AP-42 Chapter 7 by month instead of annually]
(i) Chemical Name by month
(ii) Throughput (gal) by month

ii) Custom Organic Liquids [See *Section 5* for guidance on adding custom organic liquids]

- Sum of Decreases in Liquid Level Method

(a) User Input
(i) Chemical Name by month
(ii) Annual Sum of Decreases in Liquid Level (ft) by month
(b) AP-42 Calculation [using Equation 2-20 of AP-42 Chapter 7 by month instead of annually]
(i) Chemical Name by month
(ii) Throughput (gal) by month

iii) AP-42 Petroleum Liquids [see Table 7.1-2 of AP-42 Chapter 7]

- Sum of Decreases in Liquid Level Method

(a) User Input
(i) Chemical Name by month
(ii) Annual Sum of Decreases in Liquid Level (ft) by month
(b) AP-42 Calculation [using Equation 2-20 of AP-42 Chapter 7 by month instead of annually]
(i) Chemical Name by month
(ii) Throughput (gal) by month

iv) Custom Petroleum Liquids [See *Section 5* for guidance on adding custom petroleum liquids]

- Sum of Decreases in Liquid Level Method

(a) User Input
(i) Chemical Name by month
(ii) Sum of Decreases in Liquid Level (ft) by month
(iii) Speciation
1. None
2. Partial Speciation
   - Chemicals to Speciate
3. Full Speciation

(b) AP-42 Calculation [using Equation 2-20 of AP-42 Chapter 7 by month instead of annually]
(i) Chemical Name by month
(ii) Throughput (gal) by month
(iii) Speciation
1. None
2. Partial Speciation
   - Chemicals to Speciate
3. Full Speciation

v) Custom Mixtures [See *Section 5* for guidance on adding custom mixtures]
- Sum of Decreases in Liquid Level Method
  (a) User Input
    (i) Chemical Name by month
    (ii) Sum of Decreases in Liquid Level (ft) by month
    (iii) Speciation
      1. None
      2. Partial Speciation
         - Chemicals to Speciate
      3. Full Speciation
  (b) AP-42 Calculation [using Equation 2-20 of AP-42 Chapter 7 by month instead of annually]
    (i) Chemical Name by month
    (ii) Throughput (gal) by month
    (iii) Speciation
      1. None
      2. Partial Speciation
         - Chemicals to Speciate
      3. Full Speciation

You can click "Save Tank" at any time during entry. If validation checks trigger, the errors will show on the screen. Note that you cannot "save" your tank until all validation errors are corrected.

Once saved, your tank will be added to the list underneath the "Saved Tanks" heading (see green circle in Figure 1).

## 2.3 Editing Tank Data

Once you have entered the tank data, you can choose to Edit, Duplicate, or Delete each tank.

Choosing Edit allows you to edit the tank. Choose the appropriate drop-down list, make changes and click "Save Tank" when you are finished. Because each tank type has different characteristics, you cannot change the tank type. If you attempt to change the Tank Type, it will create a new tank with that tank type.

Choosing Duplicate will open a copy of the chosen tank. Then you can change the identification, characteristics, or contents. Clicking "Save Tank" adds a new tank to the list underneath the "Saved Tanks." Because each tank type has different characteristics, you cannot change the tank type. If you attempt to change the Tank Type, it will create a new tank with that tank type.

Choosing Delete will delete the tank. **This cannot be undone.**

If you want to clear all tank data, choose "Clear Tank Data." **This cannot be undone.**

## 2.4 Exporting Tank Data

TANKS 5.2 will save your data locally within your browser. The data will remain within your browser until you clear your local storage. Do not clear your local storage until you have saved your tank data.

To save your tank data and any custom data (see *Section 5*) long term, you should export the tank data for later use. Click "Export Tank Data" as shown by the green oval in Figure 2. Check the "Downloads" page of your web browser to find the file (named *date*_exported_tank_data.xlsx). The file contains your tank data in tab "TankData" and your custom data in tab "CustomInputs."

Open and save the Excel spreadsheet file to your computer, in a location of your choice. If you will have multiple Tank Data files with different companies/locations/clients, it is recommended that you save each file with a new name immediately after exporting to avoid confusion about the contents of each file.

See *Section 2.1* for "Importing Tank Data."

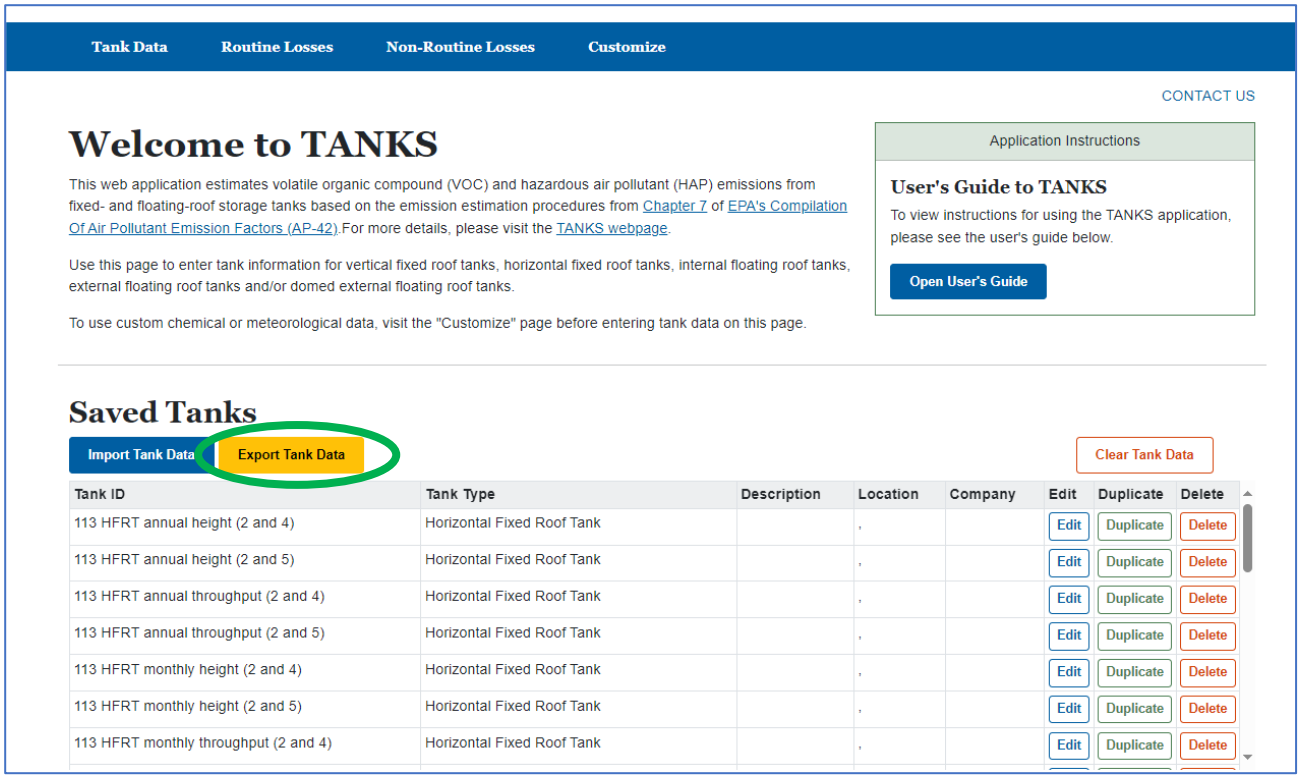


**Figure 2. Screenshot of TANKS 5.2 "Tank Data" Page: Export Tank Data**

# 3.0 Routine Losses Report

To calculate routine losses, defined as working and standing losses, for your tank or multiple tanks, click on the "Routine Losses" tab as shown by the red oval in Figure 3.

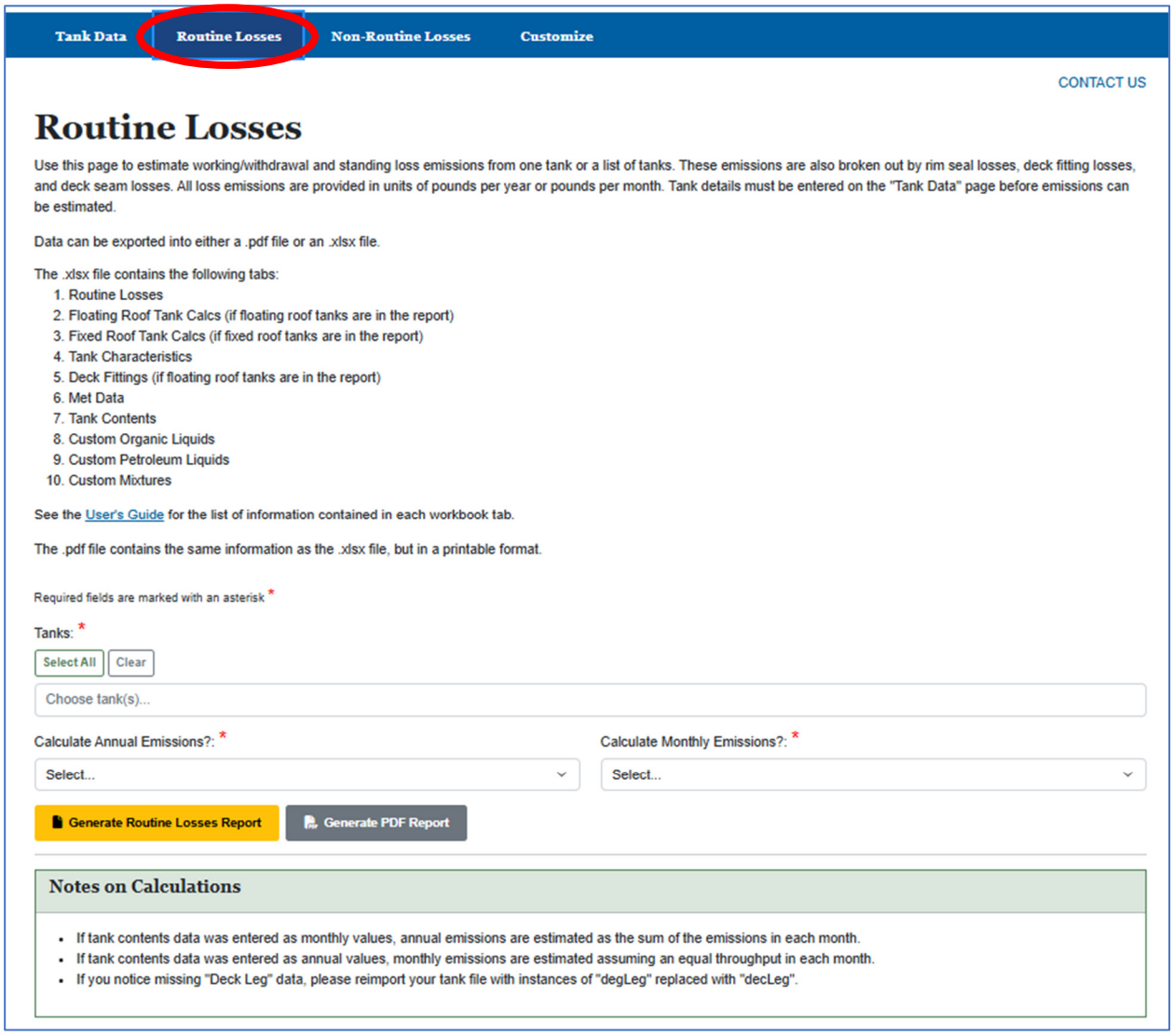


**Figure 3. Screenshot of TANKS 5.2 "Routine Losses" Page**

## 3.1 Choosing Tanks and Emissions Type for the Routine Losses Report

You can choose all tanks by choosing "Select All" or choose individual tanks by clicking "Choose tank(s)." All tanks from the Tank Data tab will be shown. Tanks can be searched by tank ID and tank location (city, state).

If you choose tanks individually, either click outside of the tank selection window or click "Tab" to close the tank selection window. Then, choose "Yes" or "No" for "Calculate Annual Emissions?" and choose "Yes" or "No" for "Calculate Monthly Emissions?" Note that you will receive an Error message if you choose "No" for both.

If monthly values were entered for a tank within Tank Data, annual emissions will be estimated as the sum of the emissions in each month.

If annual values were entered for a tank within Tank Data, monthly emissions will be estimated assuming an equal throughput in each month.

## 3.2 Generating the Routine Losses Excel Report

Click "Generate Routine Losses Report" to generate an .xlsx file named *"date*_exported_routine_losses.xlsx." The report contains standing losses, working losses, and total losses in pounds per year for each tank. You can save the file to your computer at any location. TANKS 5.2 does not save this information.

Data are exported into a file with multiple tabs: (1) Routine Losses; (2) Floating Roof Tank Calcs (if floating roof tanks are in the report); (3) Fixed Roof Tank Calcs (if fixed roof tanks are in the report); (4) Tank Characteristics; (5) Deck Fittings (if floating roof tanks are in the report); (6) Met Data; (7) Tank Contents; (8) Custom Organic Liquids; (9) Custom Petroleum Liquids; and (10) Custom Mixtures.

When reviewing the exported data, note how the output data will appear in the .xlsx file:

| Input Type on Tank Data page | Output type on Routine Losses page | Output Data in Routine Losses tab | Output Data in Floating Roof Tank Calcs and/or Fixed Roof Tank Calcs tabs |
|---|---|---|---|
| Monthly | Annual and Monthly | Annual and Monthly | Annual and Monthly (Annual columns are blank) |
| Monthly | Monthly | Monthly | Annual and Monthly (Annual columns are blank) |
| Monthly | Annual | Annual | Annual and Monthly (Annual columns are blank) |
| Annual | Annual and Monthly | Annual and Monthly | Annual and Monthly (Annual columns are blank) |
| Annual | Monthly | Monthly | Annual and Monthly (Annual columns are blank) |
| Annual | Annual | Annual | Annual |

### 3.2.1 Routine Losses

- Tank ID

- Tank Type
- Description
- City, State
- Company
- Meteorological Location
- Chemical Name
- Annual and monthly emissions, as applicable, by tank
    - Standing Losses
    - Rim Seal Losses
    - Deck Seam Losses
    - Deck Fitting losses
    - Working Losses
    - Total Losses

### 3.2.2 Floating Roof Tank Calcs

***Annual Input***

- Tank ID
- Tank Type
- Description
- City, State
- Company
- Chemical Name
- Annual Rim Seal Losses (lb/yr)
- Seal Factor A (lb-mole/ft-yr)
- Seal Factor B (lb-mole/ft-yr (mph^n))
- Annual Average Wind Speed (mph)
- Seal-related Wind Speed Exponent
- Annual Average Value of Vapor Pressure Function
- Annual Average Daily Avg. Liquid Surface Temp. (R)
- Annual Average Vapor Pressure at Daily Average Liquid Surface Temperature (psia)
- Liquid Bulk Temperature (°R)
- Tank Paint Solar Absorptance (Shell)
- Tank Paint Solar Absorptance (Roof)
- Annual Average Vapor Molecular Weight (lb/lb-mole)
- Annual Product Factor
- Number of Columns
- Effective Column Diameter (ft)
- Annual Net Throughput (gal/yr)
- Annual Sum of Decreases in Liquid Level (ft/yr)
- Annual Average Shell Clingage Factor (bbl/1000 sqft)
- Annual Average Organic Liquid Density (lb/gal)
- Annual Tot. Deck Fitting Loss Fact. (lb-mole/yr)
- Deck Seam Length (ft)
- Deck Seam Loss per Unit Length Factor (lb-mole/ft-yr)
- Deck Seam Length Factor (ft/sqft)

- Annual Withdrawal Losses (lb/yr)
- Annual Deck Fitting Losses (lb/yr)
- Annual Deck Seam Losses (lb/yr)

***Monthly input***

- Tank ID
- Tank Type
- Description
- City, State
- Company
- Chemical Name
- Annual Rim Seal Losses (lb/yr)
- Seal Factor A (lb-mole/ft-yr)
- Seal Factor B (lb-mole/ft-yr (mph^n))
- Annual Average Wind Speed (mph)
- Seal-related Wind Speed Exponent
- Annual Average Value of Vapor Pressure Function
- Annual Average Daily Avg. Liquid Surface Temp. (°R)
- Annual Average Vapor Pressure at Daily Average Liquid Surface Temperature (psia)
- Liquid Bulk Temperature (°R)
- Tank Paint Solar Absorptance (Shell)
- Tank Paint Solar Absorptance (Roof)
- Annual Average Vapor Molecular Weight (lb/lb-mole)
- Annual Product Factor
- By month
    - Rim Seal Losses (lb/mo)
    - Wind Speed (mph)
    - Average Value of Vapor Pressure Function
    - Average Liquid Surface Temp. (°R)
    - Average Vapor Pressure at Daily Average Liquid Surface Temperature (psia)
    - Average Vapor Molecular Weight (lb/lb-mole)
- Annual Withdrawal Losses (lb/yr)
- Annual Deck Fitting Losses (lb/yr)
- Annual Deck Seam Losses (lb/yr)
- Deck Seam Length (ft)
- Deck Seam Loss per Unit Length Factor (lb-mole/ft-yr)
- Deck Seam Length Factor (ft/sqft)
- Annual Tot. Deck Fitting Loss Fact. (lb-mole/yr)
- Number of Columns
- Effective Column Diameter (ft)
- Annual Net Throughput (gal/yr)
- Annual Sum of Decreases in Liquid Level (ft/yr)
- Annual Average Shell Clingage Factor (bbl/1000 sqft)
- Annual Average Organic Liquid Density (lb/gal)
    - By month:
        - Withdrawal Losses (lb/mo)
        - Throughput (gal/mo)

- Sum of Decreases in Liquid Level (ft/yr)
- Shell Clingage Factor (bbl/1000 sqft)
- Organic Liquid Density (lb/gal)
- Deck Fitting Losses (lb/mo)
- Tot. Deck Fitting Loss Fact. (lb-mole/mo)
- Deck Seam Losses (lb/mo)

### 3.2.3 Fixed Roof Tank Calcs

***Annual Input***

- Tank ID
- Tank Type
- Description
- City, State
- Company
- Chemical Name
- Annual Standing Losses (lb/yr)
- Annual Working Losses (lb/yr)
- Annual Vapor Space Volume (cu ft)
- Annual Stock Vapor Density (lb/cu ft)
- Annual Average Vapor Space Expansion Factor
- Annual Average Vented Vapor Saturation Factor
- Effective Diameter (ft)
- Vapor Space Outage (ft)
- Tank Shell Height (ft)
- Tank Shell Length (ft)
- Average Liquid Height (ft)
- Roof Outage (ft)
- Dome Radius (ft)
- Shell Radius (ft)
- Tank Cone Roof Slope (ft/ft)
- Annual Average Vapor Molecular Weight (lb/lb-mole)
- Annual Average Vapor Pressure at Daily Average Liquid Surface Temperature (psia)
- Annual Average Liquid Surface Temp (°R)
- Annual Average Ambient Temp (°R)
- Liquid Bulk Temperature (°R)
- Tank Paint Solar Absorptance (Shell)
- Tank Paint Solar Absorptance (Roof)
- Annual Average Vapor Temperature Range (°R)
- Annual Average Daily Vapor Pressure Range (psia)
- Breather Vent Press. Setting Range (psia)
- Annual Average Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia)
- Annual Average Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia)
- Annual Average Min. Liquid Surface Temp. (°R)
- Annual Average Max. Liquid Surface Temp. (°R)

- Annual Average Daily Ambient Temp. Range (°R)
- Vapor Space Pressure at Normal Operating Conditions (psig)
- Annual Throughput (gal/yr)
- Annual Turnovers
- Working Loss Turnover Factor
- Maximum Liquid Height (ft)
- Minimum Liquid Height (ft)
- Working Loss Product Factor Vent Setting Correction Factor
- Annual Sum of Increases in Liquid Level (ft/yr)

***Monthly Input***

- Tank Type
- Description
- City, State
- Company
- Chemical Name
- Annual Standing Losses (lb/yr)
- Annual Working Losses (lb/yr)
- Annual Vapor Space Volume (cu ft)
- Annual Stock Vapor Density (lb/cu ft)
- Annual Average Vapor Space Expansion Factor
- Annual Average Vented Vapor Saturation Factor
- By month
    - Standing Losses (lb/mo)
    - Stock Vapor Density (lb/cu ft)
    - Vapor Space Expansion Factor
    - Vented Vapor Saturation Factor
- Effective Diameter (ft)
- Vapor Space Outage (ft)
- Average Liquid Height (ft)
- Roof Outage (ft)
- Dome Radius (ft)
- Shell Radius (ft)
- Tank Cone Roof Slope (ft/ft)
- Annual Average Vapor Molecular Weight (lb/lb-mole)
- Annual Average Vapor Pressure at Daily Average Liquid Surface Temperature (psia)
- Annual Average Liquid Surface Temp (°R)
- Annual Average Ambient Temp (°R)
- Liquid Bulk Temperature (°R)
- Tank Paint Solar Absorptance (Shell)
- Tank Paint Solar Absorptance (Roof)
- By month
    - Vapor Molecular Weight (lb/lb-mole)
    - Vapor Pressure at Daily Average Liquid Surface Temperature (psia)
    - Daily Avg. Liquid Surface Temp. (°R)

        - Average Ambient Temp (°R)
    - Annual Average Vapor Temperature Range (°R)
    - Annual Average Daily Vapor Pressure Range (psia)
    - Breather Vent Press. Setting Range (psia)
    - Annual Average Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia)
    - Annual Average Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia)
    - Annual Average Min. Liquid Surface Temp. (°R)
    - Annual Average Max. Liquid Surface Temp. (°R)
    - Annual Average Daily Ambient Temp. Range (°R)
    - Vapor Space Pressure at Normal Operating Conditions (psig)
    - By month
        - Daily Vapor Temperature Range (°R)
        - Daily Vapor Pressure Range (psia)
        - Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia)
        - Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia)
        - Daily Min. Liquid Surface Temp. (°R)
        - Daily Max. Liquid Surface Temp. (°R)
        - Daily Ambient Temp. Range (°R)
    - Annual Throughput (gal/yr)
    - Annual Turnovers
    - Working Loss Turnover Factor
    - Annual Sum of Increases in Liquid Level (ft/yr)
    - Maximum Liquid Height (ft)
    - Minimum Liquid Height (ft)
    - Working Loss Product Factor
    - Vent Setting Correction Factor
    - By month
        - Working Losses (lb/mo)
        - Standing Losses (lb/mo)
        - Throughput (gal/mo)
        - Sum of Increases in Liquid Level (ft/yr)

### 3.2.4 Tank Characteristics

- Tank ID
- Tank Type
- Description
- City, State
- Company
- Meteorological Location
- Shell Length (ft) [used only for horizontal fixed roof tanks]
- Shell Side Length (ft) [used only for square vertical fixed roof tanks]
- Shell Side 1 Length (ft) [used only for rectangular vertical fixed roof tanks]
- Shell Side 2 Length (ft) [used only for rectangular vertical fixed roof tanks]

- Shell Height (ft)
- Shell Diameter (ft)
- Maximum Liquid Height (ft)
- Average Liquid Height (ft)
- Minimum Liquid Height (ft)
- Is Tank Heated?
- Typical Maximum Liquid Bulk Temperature in Heating Cycle (degrees R)
- Typical Average Liquid Bulk Temperature in Heating Cycle (degrees R)
- Typical Minimum Liquid Bulk Temperature in Heating Cycle (degrees R)
- Number of Heating Cycles per Year
- Roof Type
- Vacuum Setting (psig)
- Pressure Setting (psig)
- Vapor Space Pressure at Normal Operating Conditions (psig)
- Is Tank Insulated?
- Is Tank Insulated or Underground? [used only for horizontal fixed roof tanks]
- Tank Cone Roof Slope (ft/ft)
- Tank Dome Roof Radius (ft)
- Is Tank Equipped with a Control Device?
- Control Device Efficiency (%)
- Tank Shape [used only for vertical fixed roof tanks]
- Liquid Bulk Temperature Calculation Method
- Liquid Bulk Temperature (degrees R)
- Tank Bottom Type
- Cone-Shaped Bottom Slope (ft/ft)
- Liquid Heel Type at Tank Minimum
- Minimum Liquid Heel Height (ft)
- Self Supporting Roof?
- Number of Columns
- Effective Column Diameter
- Internal Shell Condition
- Primary Seal
- Secondary Seal
- Seal Fit
- Deck Type
- Tank Construction
- Deck Construction
- Deck Seam
- Panel/Sheet Width (ft)
- Panel Length (ft)
- Shell Color/Shade
- Shell Condition
- Roof Color/Shade
- Roof Condition

### 3.2.5 Deck Fittings [only for floating roof tanks]

- Tank ID
- Tank Type
- Description
- City, State
- Company
- Access Hatch fitting type and count
- Fixed Roof Support Column Well fitting type and count
- Unslotted Guidepole and Well fitting type and count
- Slotted Guidepole/Sample Well fitting type and count
- Gauge-float Well (Automatic Gauge) fitting type and count
- Gauge-hatch/Sample Port fitting type and count
- Vacuum Breaker fitting type and count
- Deck Drain fitting type and count
- Deck Leg fitting type and count
- Deck Leg or Hanger (No opening through deck) fitting type and count
- Rim Vent fitting type and count
- Ladder Well fitting type and count
- Ladder-slotted Guidepole Combination Well fitting type and count
- Deck Leg (Pontoon area of pontoon roofs) fitting type and count
- Deck Leg (Double-deck roofs and center area of pontoon roofs) fitting type and count

### 3.2.6 Met Data

- Tank ID
- Meteorological Location
- By month
    - Average Maximum Ambient Temperature (°F)
    - Average Minimum Ambient Temperature (°F)
    - Average Wind Speed (mph)
    - Average Daily Total Isolation Factor (Btu/ft$^2$/day)
- Annual Average Maximum Ambient Temperature (°F)
- Annual Average Minimum Ambient Temperature (°F)
- Annual Average Wind Speed (mph)
- Annual Average Total Insolation Factor (Btu/ft$^2$/day)
- Annual Average Atmospheric Pressure (psi)

### 3.2.7 Tank Contents

- Tank ID
- Input Type
- Chemical Category of Liquid
- Sum of Increases/Decreases in Liquid Level Method
- Working Loss Turnover Factor Method

- By month:
    - Chemical Name
    - Speciation Option
    - Components to Speciate
    - Throughput
    - Sum of Increases/Decreases in Liquid Level (ft/yr)
- Annual Chemical Name
- Annual Speciation Option
- Annual Components to Speciate
- Annual Throughput
- Annual Sum of Increases/Decreases in Liquid Level (ft/yr)

### 3.2.8 Custom Organic Liquids

- Tank ID
- Input Type
- Chemical Name
- Molecular Weight
- Liquid Density (lb/gal)
- Antoine's Equation Constant A
- Antoine's Equation Constant B (°C)
- Antoine's Equation Constant C (°C)

### 3.2.9 Custom Petroleum Liquids

- Tank ID
- Input Type
- Chemical Name
- Vapor Molecular Weight (lb/lb-mole)
- Liquid Molecular Weight (lb/lb-mole)
- Liquid Density (lb/gal)
- Vapor Pressure Equation Constant A
- Vapor Pressure Equation Constant B (°R)
- Is this a crude oil?
- Component Mole Fraction Type
- Chemical Component Name
- Mole Fraction

### 3.2.10 Custom Mixtures

- Tank ID
- Input Type
- Mixture Name
- Chemical Name
- Liquid Mole Fraction
- Molecular Weight
- Liquid Density (lb/gal)

- Antoine's Equation Constant A
- Antoine's Equation Constant B (°C)
- Antoine's Equation Constant C (°C)

## 3.3 Generating the Routine Losses PDF Report

Click “Generate PDF Report” to generate a .pdf file in your browser. The PDF report contains the same information as the Excel report in a printable format. The report contains a header page, with the TANKS version, along with the date and time that the report was generated. You can save the file to your computer at any location. TANKS 5.2 does not save this information.

When you generate the report, you are given the option of entering a one-line custom report identifier that appears at the top-left of each page of the report. There is no character limit on the custom identifier.

# 4.0 Non-Routine Losses Report

If you want to (1) calculate roof landing losses for a floating roof tank or (2) calculate cleaning losses from any type of tank, click on the "Non-Routine Losses" tab as shown by the red oval in Figure 4 and Figure 5.

Note that clicking "Clear Non-Routine Losses Data" removes the events you have entered for landing and cleaning. **This cannot be undone.**

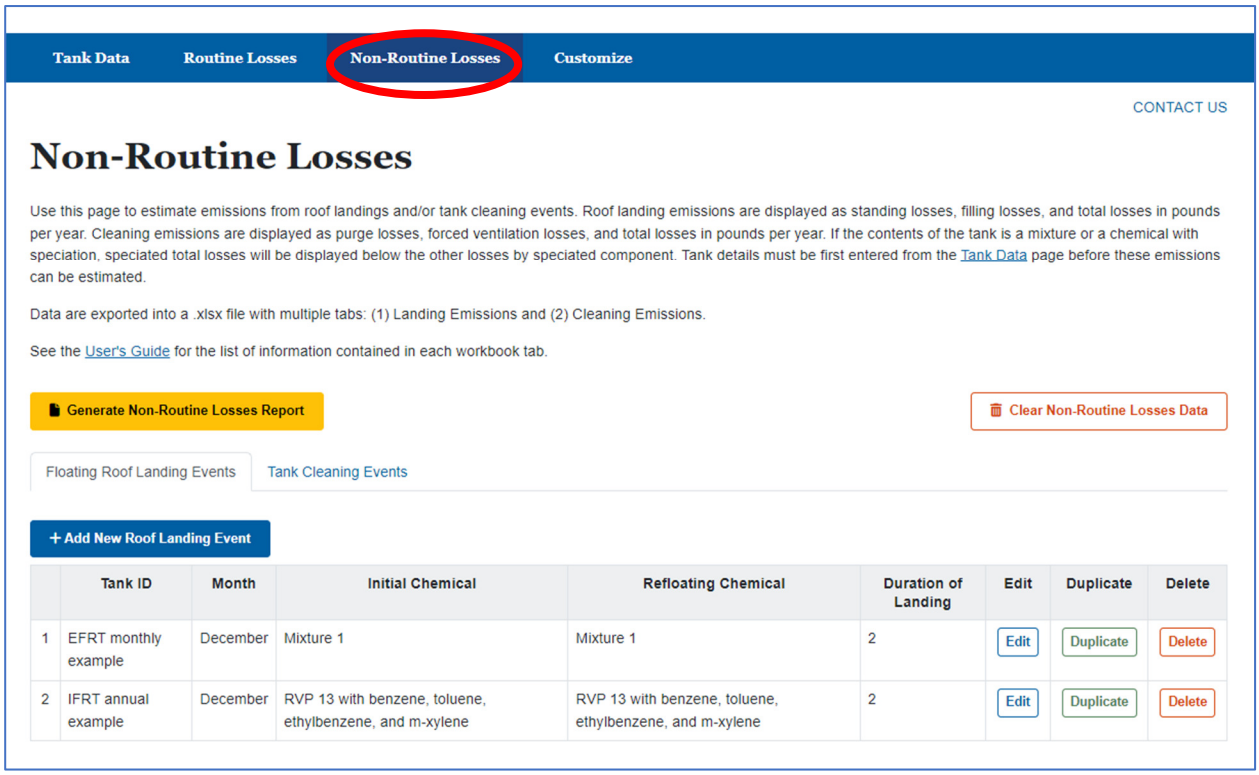


**Figure 4. Screenshot of TANKS 5.2 "Non-Routine Losses" Page—Floating Roof Landing Events**

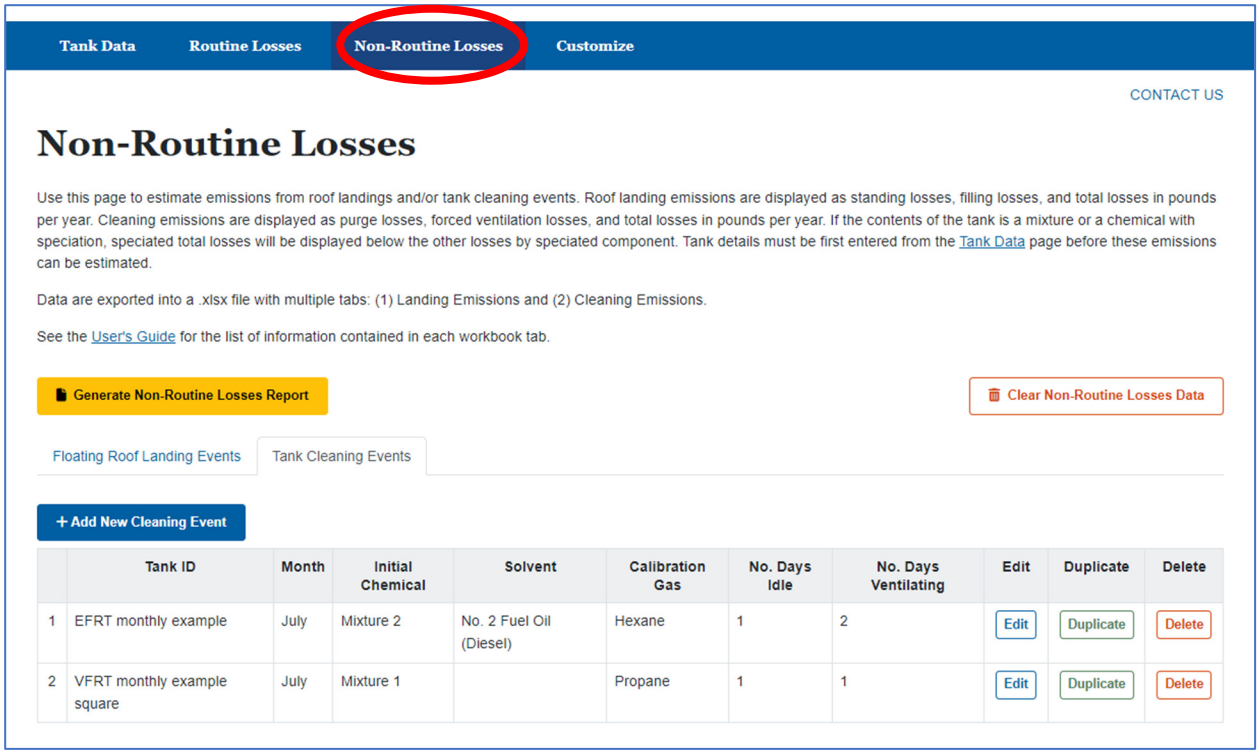


**Figure 5. Screenshot of TANKS 5.2 "Non-Routine Losses" Page—Tank Cleaning Events**

## 4.1 Data Entry for Landing Losses

For roof landings from floating roof tanks, the emissions are displayed as standing losses, filling losses, and total losses in pounds per year. Tank details for one or more floating roof tanks must be first entered in the Tank Data page before these emissions can be estimated.

Choose "Floating Roof Landing Events." See **Figure 4**.

### 4.1.1 Adding New Roof Landing Events

Click "+Add New Roof Landing Event" to add the following information:

- Tank ID
- Month During Which the Landing Event Occurred
- Chemical in Tank During Roof Landing (can also be "Empty")
    - All chemicals entered into the tank within "Tank Data" will be listed in the drop-down list
- Chemical Added to Tank during Refilling (can also be "No Refill")
    - All chemicals entered into the tank within "Tank Data" will be listed in the drop-down list
- Landed Roof Leg Height (ft)

- Type of Liquid Heel Present during Roof Landing
    - Full Liquid Heel
        - Height of Liquid at the Tank Shell (ft)
    - Partial Liquid Heel [Note: This option is not available for tanks with flat or nominally flat bottoms]
        - Vertical Distance from the Bottom of the Shell Down to the Liquid Surface (ft)
    - No Liquid Heel (also known as Drain Dry)
- Number of Days the Tank Is Standing Idle

After entering the data, you can click "Calculate" to show your landing losses or click "Save."

### 4.1.2 Editing Roof Landing Events

Once you have entered the landing events, you can choose to Edit, Duplicate, or Delete each event.

Choosing Edit allows you to edit the landing event. Choose the appropriate item, make changes and click "Save" when you are finished.

Choosing Duplicate will open a copy of the chosen landing event. Then you can change any information. Clicking "Save" adds a new landing event to the list.

Choosing Delete will delete the landing event. **This cannot be undone.**

If you want to clear all landing events, choose "Clear Non-Routine Losses Data." **This also deletes cleaning events. It cannot be undone.**

## 4.2 Data Entry for Cleaning Losses

For tank cleaning, the emissions are displayed as purge losses, forced ventilation losses, and total losses in pounds per year. Note that the Day 1 sludge depth should be the height of the chemical in the tank at the beginning of ventilation, NOT including the depth of solvent added or the equivalent additional height from the sump (if any).

Choose "Tank Cleaning Events." See **Figure 5**.

### 4.2.1 Fixed Roof Tanks

For tank cleaning events for fixed roof tanks, you will need the following information:

- Tank

- Month During Which the Tank Cleaning Occurred
- Chemical Stored at the Start of Cleaning
- Type of Liquid Heel Present at the Start of Cleaning
    - Full Liquid Heel
        - Height of the Stock Liquid and Sludge at the Tank Shell at the Start of Cleaning (ft)
    - Partial Liquid Heel
        - Vertical Distance from the Bottom of the Shell Down to the Liquid Surface at the Start of Cleaning (ft)
        - Note: This option is not available for tanks with flat or nominally flat bottoms
    - No Liquid Heel (also known as Drain Dry)
- Does the Tank Have a Sump?
    - Sump Diameter (inches [in])
    - Depth of Liquid Remaining in the Sump (in)
- Number of Days that the Tank is Standing Idle After Emptying and Before Forced Ventilation Begins
- Were Emissions Routed to a Control Device Prior to Starting Ventilation?
- Number of Days in which Forced Ventilation Was Used
- For Each Day with Forced Ventilation:
    - Average Concentration (parts per million by volume [ppmv])
    - Vent Time (hr/day)
    - Average Sludge Depth (in) **** See Note below**
    - Was Ventilation Stopped?
    - Were Emissions Routed to a Control Device?
- Control Device Efficiency (%)
    - if a control device is indicated above
- Was Tank Bottom Flooded with Solvent at the Start of the Cleaning?
    - Chemical Category of Solvent
    - Solvent Name
    - Equivalent Depth of Solvent that was Added to the Tank for Cleaning (in)
- Average Ventilation Rate During Continued Forced Ventilation ($ft^3$/min)
- Calibration Gas Used During Continued Forced Ventilation
    - Methane
    - Ethane
    - Propane
    - Butane
    - Pentane
    - Hexane
    - Heptane

** Note: The Day 1 sludge depth should be the height of the chemical in the tank at the beginning of ventilation, NOT including the depth of solvent added or the equivalent additional height from the sump (if any).

### 4.2.2 Floating Roof Tanks

For tank cleaning events for floating roof tanks, you will need the following information:

- Tank
- Month During Which the Tank Cleaning Occurred
- Chemical Stored at the Start of Cleaning
- Floating Roof Leg Height (ft)
- Type of Liquid Heel Present at the Start of Cleaning
    - Full Liquid Heel
        - Height of the Stock Liquid and Sludge at the Tank Shell at the Start of Cleaning (ft)
    - Partial Liquid Heel
        - Vertical Distance from the Bottom of the Shell Down to the Liquid Surface at the Start of Cleaning (ft) [Note that this option is not available for tanks with flat or nominally flat bottoms]
    - No Liquid Heel (also known as Drain Dry)
- Does the Tank Have a Sump?
    - Sump Diameter (in)
    - Depth of Liquid Remaining in the Sump (in)
- Were Emissions Routed to a Control Device Prior to Starting Ventilation?
- Number of Days in which Forced Ventilation Was Used
- For Each Day with Forced Ventilation:
    - Average Concentration (ppmv)
    - Vent Time (hr/day)
    - Average Sludge Depth (in) **** See Note below**
    - Was Ventilation Stopped?
    - Were Emissions Routed to a Control Device?
- Control Device Efficiency (%)
    - if a control device is indicated above
- Was Tank Bottom Flooded with Solvent at the Start of the Cleaning?
    - Chemical Category of Solvent
    - Solvent Name
    - Equivalent Depth of Solvent that was Added to the Tank for Cleaning (in)
- Average Ventilation Rate During Continued Forced Ventilation ($ft^3$/min)
- Calibration Gas Used During Continued Forced Ventilation
    - Methane
    - Ethane
    - Propane
    - Butane
    - Pentane
    - Hexane
    - Heptane

** Note: The Day 1 sludge depth should be the height of the chemical in the tank at the beginning of ventilation, NOT including the depth of solvent added or the equivalent additional height from the sump (if any).

## 4.3 Editing Roof Cleaning Events

Once you have entered the cleaning events, you can choose to Edit, Duplicate, or Delete each event.

Choosing Edit allows you to edit the cleaning event. Choose the appropriate item, make changes and click "Save" when you are finished.

Choosing Duplicate will open a copy of the chosen cleaning event. Then you can change any information. Clicking "Save" adds a new cleaning event to the list.

Choosing Delete will delete the cleaning event. **This cannot be undone.**

If you want to clear all cleaning events, choose "Clear Non-Routine Losses Data." **This also deletes landing events. It cannot be undone.**

## 4.4 Running the Non-Routine Losses Report

Click "Generate Non-Routine Losses Report." The resulting xlsx file (named *"date*_report_nonroutine_losses.xlsx") contains standing losses, working losses, and total losses in pounds per year for each tank. You can save the file to your computer at any location. TANKS 5.2 does not save this information.

Data are exported into a file with two tabs: (1) Landing Emissions; and (2) Cleaning Emissions. The report includes all landing and cleaning events entered on the main page.

## 4.5 Contents of the Non-Routine Losses Report

### 4.5.1 Landing Emissions

- Tank ID
- Tank Type
- Description
- City
- State
- Company
- Number of Days

- Month
- Floating Roof Leg Height
- Roof Landing Heel Height
- Roof Landing Heel Type
- Landing Chemical
- Refill Chemical
- Standing Losses (lb)
- Filling Losses (lb)
- Total Losses (lb)

### 4.5.2 Cleaning Emissions

- Tank ID
- Tank Type
- Description
- City
- State
- Company
- Month Cleaning Occurred
- Number of Days Idle
- Number of Days Cleaning
- Number of Days Ventilation
- Cleaning Heel Type
- Floating Roof Leg Height
- Liquid Height
- Has Sump?
- Sump Diameter
- Sump Depth
- Solvent Added?
- Solvent Category
- Solvent Name
- Solvent Density
- Solvent Molecular Weight
- Solvent Antoine A
- Solvent Antoine B
- Solvent Antoine C
- Solvent Depth
- Average Ventilation Rate
- Control Efficiency
- Calibration Gas
- Purge Controlled?
- Cleaning Chemical

- Total Purge Losses (lb)
- Total Controlled Forced Ventilation Losses (lb)
- Total Losses (lb)
- Day 1 - Average Concentration (ppmv)
- Day 1 - Ventilation Time (hr/day)
- Day 1 - Average Sludge Depth (in)
- Day 1 - Was Ventilation Stopped?
- Day 1 - Were Emissions Routed to a Control Device?
- Information for Day 1 continues for the number of days in which forced ventilation was used

# 5.0 Customize

If you want to (1) create tanks that contain custom contents (chemicals that are not included in AP-42 Chapter 7) or (2) your tank is located in a city and state that is not included in AP-42 Chapter 7, click on the "Customize" tab as shown by the red oval in Figure 6.

If data for a custom mixture, custom petroleum liquid, or custom organic liquid are changed after being added to a tank, you will need to edit the Contents in the Tank Data page to reselect the custom mixture, custom petroleum liquid, or custom organic liquid before calculating emissions. This is a known issue that will be corrected in a future version.

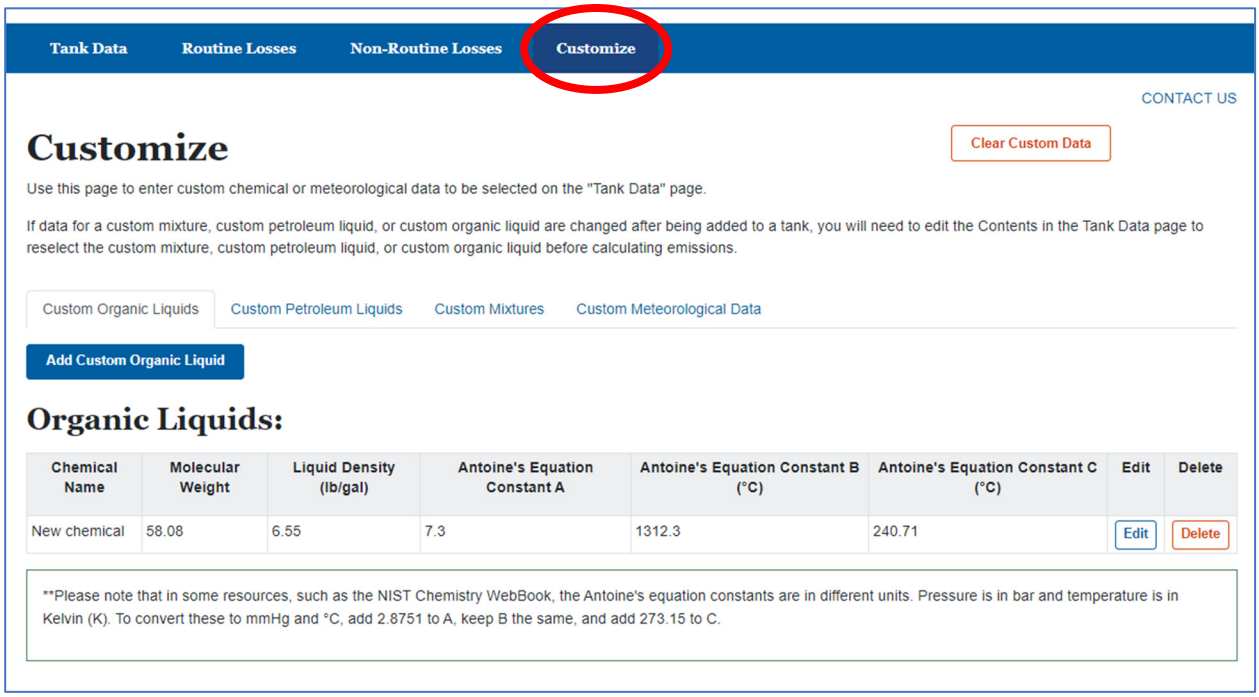


**Figure 6. Screenshot of TANKS 5.2 "Customize" Page**

Note that clicking "Clear Custom Data" removes the custom entries from all categories. **This cannot be undone.** However, if you have a Tank Data file that uses these custom entries, you can simply go back to the "Tank Data" tab and click "Import Tank Data" again.

## 5.1 Entering Custom Data

### 5.1.1 Custom Organic Liquids

For custom organic liquids, you will need the following information:

- Chemical Name
- Molecular weight
- Liquid density (lb/gal)
- Antoine's Equation Constant A (dimensionless)
- Antoine's Equation Constant B (°C)
- Antoine's Equation Constant C (°C)
- You also have the option to use the chemical data in AP-42 Table 7.1-3 as a template by selecting the chemical from the drop-down list using Template Chemical. You can then adjust the required fields as needed.

### 5.1.2 Custom Petroleum Liquids

For custom petroleum liquids, you will need the following information:

- Chemical Name
- Vapor Molecular Weight (lb/lb-mole)
- Liquid Molecular Weight (lb/lb-mole)
- Vapor Pressure Equation Constant A (dimensionless)
- Vapor Pressure Equation Constant B (°R)
- Whether the petroleum liquid is a crude oil
- You can also add one or more components in order to speciate emissions:
    - Component Mole Fraction Type
        - Liquid Mole Fraction
        - Vapor Mole Fraction
    - Chemical Name
    - Mole Fraction
- You also have the option to use the chemical data in AP-42 Table 7.1-2 as a template by collecting the chemical from the drop-down list using Template Chemical. You can then adjust the required fields as needed.

### 5.1.3 Custom Mixtures

For custom mixtures, you will need the following information:

- Mixture Name
- Chemical Category of Each Liquid Component
- Organic Liquid Name of Each Component
- Liquid Mole Fraction of Each Component
    - Note that the sum of all liquid mole fractions must be 1.
- You cannot create a mixture containing multiple petroleum liquids, but you can create a mixture using the organic liquid components that are known to be contained in a specific petroleum liquid. You can also create a custom petroleum liquid using the option above.

### 5.1.4 Custom Meteorological Data

For custom meteorological data, you will need the following information:

- Location Name

- Monthly Data:
  - Average Maximum Ambient Temperature (°F)
  - Average Minimum Ambient Temperature (°F)
  - Average Wind Speed (mph)
  - Average Daily Total Insolation Factor (Btu/ft$^2$/day)
- Annual Data:
  - Average Maximum Ambient Temperature (°F)
  - Average Minimum Ambient Temperature (°F)
  - Average Wind Speed (mph)
  - Average Daily Total Insolation Factor (Btu/ft$^2$/day)
  - Average Atmospheric Pressure (psi)

## 5.2 Sources for Custom Data

### 5.2.1 Chemical Data

- These reference books are available at most public and university libraries (in person or online) with an appropriate library card or user account:
  - *CRC Handbook of Chemistry and Physics*.
  - *Perry's Chemical Engineers' Handbook*.
  - Reid, Prausnitz and Sherwood, *Properties of Liquids and Gases*, McGraw Hill.
  - Yaws and Yang, *Property Data: To Estimate Vapor Pressure Easily, Hydrocarbon Processing*.
  - Boublík, Fried and Hála, *The Vapor Pressures of Pure Substances, Selected Values of the Temperature Dependence of the Vapor Pressures of Some Pure Substances in the Normal and Low Pressure Region*, Elsevier Science Publishers.
- NIST Chemistry WebBook, which is available online at: http://webbook.nist.gov/chemistry/.

****Please note that in some resources, such as the NIST Chemistry WebBook, the Antoine's equation constants are in different units. Pressure is in bar and temperature is in Kelvin (K). To convert these to mmHg and °C, add 2.8751 to A, keep B the same, and add 273.15 to C.**

### 5.2.2 Meteorological Data

- United States: National Solar Radiation Data Base. Available at https://nsrdb.nrel.gov/about/u-s-data.html.
- International: NASA Surface Meteorology and Solar Energy Data Set. Available at https://power.larc.nasa.gov/.

# 6.0 Typical Deck Fittings by Tank Type

| Deck Fitting | Fitting/Cover Type | Quantity | Typical for EFRT? | Typical for DEFRT? | Typical for IFRT? | Notes |
|---|---|---|---|---|---|---|
| Access Hatch | Bolted Cover, Gasketed | 1 | Y | Y | N | |
| Access Hatch | Unbolted Cover, Gasketed | 1 | N | N | N | |
| Access Hatch | Unbolted Cover, Ungasketed | 1 | N | N | Y | |
| Fixed Roof Support Column Well | Built-Up Column, Gasketed Sliding Cover | 1 | N | N | N | A |
| Fixed Roof Support Column Well | Built-Up Column, Ungasketed Sliding Cover | 1 | N | N | Y | A |
| Fixed Roof Support Column Well | Round pipe, Flexible Fabric Sleeve Seal | 1 | N | N | N | A |
| Fixed Roof Support Column Well | Round pipe, gasketed sliding cover | 1 | N | N | N | A |
| Fixed Roof Support Column Well | Round pipe, ungasketed sliding cover | 1 | N | N | N | A |
| Unslotted Guidepole and Well | Ungasketed Sliding Cover | 1 | Y | Y | N | |
| Unslotted Guidepole and Well | Ungasketed Sliding Cover with pole sleeve | 1 | N | N | N | |
| Unslotted Guidepole and Well | Gasketed Sliding Cover | 1 | N | N | N | |
| Unslotted Guidepole and Well | Gasketed Sliding Cover with pole wiper | 1 | N | N | N | |
| Unslotted Guidepole and Well | Gasketed Sliding Cover with pole sleeve | 1 | N | N | N | |
| Slotted Guidepole/Sample Well | Ungasketed or gasketed Sliding Cover | 1 | N | N | N | |
| Slotted Guidepole/Sample Well | Ungasketed or gasketed Sliding Cover, with float | 1 | N | N | N | |
| Slotted Guidepole/Sample Well | Gasketed sliding cover, with pole wiper | 1 | N | N | N | |
| Slotted Guidepole/Sample Well | Gasketed sliding cover, with pole sleeve | 1 | N | N | N | |
| Slotted Guidepole/Sample Well | Gasketed sliding cover, with pole sleeve and pole wiper | 1 | N | N | N | |
| Slotted Guidepole/Sample Well | Gasketed sliding cover, with float and pole wiper | 1 | N | N | N | |
| Slotted Guidepole/Sample Well | Gasketed sliding cover, with float, pole sleeve, and pole wiper | 1 | N | N | N | |
| Slotted Guidepole/Sample Well | Flexible enclosure | 1 | N | N | N | |
| Gauge-float Well (Automatic Gauge) | Bolted Cover, Gasketed | 1 | N | N | N | |
| Gauge-float Well (Automatic Gauge) | Unbolted Cover, Gasketed | 1 | N | N | N | |
| Gauge-float Well (Automatic Gauge) | Unbolted Cover, Ungasketed | 1 | Y | Y | Y | |
| Gauge-hatch/Sample Port | Weighted Mech. Actuation, Gasketed | 1 | Y | Y | N | |
| Gauge-hatch/Sample Port | Weighted Mech. Actuation, Ungasketed | 1 | N | N | N | |
| Gauge-hatch/Sample Port | Slit Fabric Seal 10% Open area | 1 | N | N | Y | |
| Vacuum Breaker | Weighted Mech. Actuation, Gasketed | 1 | Y | Y | Y | |

Notes:
IFRT = Internal Floating Roof Tan
EFRT = External Floating Roof Tank
DEFRT = Domed Floating Roof Tank
A = Not used with self-supporting roofs.
B = Not used on welded internal floating roof tanks.
C = Not used on pontoon floating roof tanks, only double deck roofs
D = Used only with mechanical shoe primary seals

| Deck Fitting | Fitting/Cover Type | Quantity | Typical for EFRT? | Typical for DEFRT? | Typical for IFRT? | Notes |
|---|---|---|---|---|---|---|
| Vacuum Breaker | Weighted Mech. Actuation, Ungasketed | 1 | N | N | N | |
| Deck Drain | Stub drain (1 inch diameter) | 1 | N | N | Y | B |
| Deck Drain | Open | 1 | Y | Y | N | |
| Deck Drain | 90% closed | 1 | N | N | N | |
| Deck Leg | Adjustable | 1 | N | N | Y | |
| Deck Leg (Pontoon area of pontoon roofs) | Adjustable - ungasketed | 1 | Y | Y | N | |
| Deck Leg (Pontoon area of pontoon roofs) | Adjustable - gasketed | 1 | N | N | N | |
| Deck Leg (Pontoon area of pontoon roofs) | Adjustable - sock | 1 | N | N | N | |
| Deck Leg (Double-deck roofs and center area of pontoon roofs) | Adjustable - ungasketed | 1 | Y | Y | N | C |
| Deck Leg (Double-deck roofs and center area of pontoon roofs) | Adjustable - gasketed | 1 | N | N | N | |
| Deck Leg (Double-deck roofs and center area of pontoon roofs) | Adjustable - sock | 1 | N | N | N | |
| Deck Leg or Hanger (No opening through deck) | Fixed | 1 | N | N | N | |
| Rim Vent | Weighted Mech. Actuation, Gasketed | 1 | Y | Y | N | D |
| Rim Vent | Weighted Mech. Actuation, Ungasketed | 1 | N | N | N | D |
| Ladder Well | Sliding Cover, Gasketed | 1 | N | N | N | A |
| Ladder Well | Sliding Cover, Ungasketed | 1 | N | N | Y | A |
| Ladder-slotted Guidepole Combination Well | Sliding cover, ungasketed | 1 | | | | |
| Ladder-slotted Guidepole Combination Well | Ladder sleeve, ungasketed sliding cover | 1 | | | | |
| Ladder-slotted Guidepole Combination Well | Ladder sleeve, gasketed sliding cover | 1 | | | | |

Notes:
IFRT = Internal Floating Roof Tan
EFRT = External Floating Roof Tank
DEFRT = Domed Floating Roof Tank
A = Not used with self-supporting roofs.
B = Not used on welded internal floating roof tanks.
C = Not used on pontoon floating roof tanks, only double deck roofs
D = Used only with mechanical shoe primary seals

## 7.0 Definitions

**Aged.** This is one of the choices for shell condition or roof condition. For paint, paint is noticeably faded and dull; for mill-finish aluminum, surface is dull.

**Annual Sum of Decreases in Liquid Level.** If this value is unknown, it can be estimated from pump utilization records. Over the course of a year, the sum of increases in liquid level and the sum of decreases in liquid level, will be approximately the same. This value is used for floating roof tanks.

**Annual Sum of Increases in Liquid Level.** If this value is unknown, it can be estimated from pump utilization records. Over the course of a year, the sum of increases in liquid level and the sum of decreases in liquid level, will be approximately the same. This value is used for fixed roof tanks.

**Annual Throughput.** This is the annual throughput in gallons per year. If the throughput of the tank is measured in barrels, you may convert barrels to gallons by multiplying the number of barrels by 42.

**Antoine's Equation.** A correlation between vapor pressure and temperature for organic liquids. See Equation 1-28 of AP-42 Chapter 7. The pressure unit is mmHg and the temperature unit is degrees Celsius. For petroleum liquids, see *Vapor Pressure Equation*.

$$\log P_{VA} = A - \left( \frac{B}{T_{LA} + C} \right)$$

where:

log = log 10
A = constant in vapor pressure equation, dimensionless
B = constant in vapor pressure equation, °C
C = constant in vapor pressure equation, °C
$T_{LA}$ = average daily liquid surface temperature, °C
$P_{VA}$ = vapor pressure at average daily liquid surface temperature, mm Hg

**Antoine's Equation Constant A.** The A constant used in the Antoine's equation for organic liquids. It is dimensionless. For petroleum liquids, see *Vapor Pressure Equation Constant A*.

**Antoine's Equation Constant B.** The B constant used in the Antoine's equation for organic liquids. The unit is degrees Celsius. For petroleum liquids, see *Vapor Pressure Equation Constant B*.

**Antoine's Equation Constant C.** The C constant used in the Antoine's equation for organic liquids. The unit is degrees Celsius.

**AP-42.** Compilation of Air Pollutant Emissions Factors from Stationary Sources (AP-42) has been published since 1972 as the primary compilation of EPA's emissions factor information. It contains emissions factors and process information for more than 200 air pollution source categories. A source category is a specific industry sector or group of similar emitting sources. The emissions factors have been developed and compiled from source test data, material balance studies, and engineering estimates. See https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors-stationary-sources.

**AP-42 Chapter 7.** AP-42 chapter for Organic Liquid Storage Tanks. See https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-fifth-edition-volume-i-chapter-7-liquid-storage-0.

**Asterisks.** Red asterisks within TANKS 5.2 indicate required fields.

**Average-Fitting.** This is a choice for rim seals. If the rim seals are not *tight-fitting*, choose average-fitting.

**Average.** This is one of the choices for shell condition or roof condition. For mill-finish aluminum, surface is oxidized but still bright.

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

**Barrels.** A unit of tank throughput which is equal to 42 gallons.

**Bolted.** This is one of deck type choices for Deck Type for floating roof tanks. Bolted is only used for Internal Floating Roof Tanks.

**Breather Vent Settings.** These are the pressure setting and vacuum setting on fixed roof tanks. If specific information on the breather vent pressure setting and vacuum setting is not available, assume 0.03 psig for breather vent pressure and -0.03 psig for breather vent vacuum as typical values.

**Chemical Category of Liquid.** This is the type of liquid contained in the specific tank. The choices are the following: AP-42 Organic Liquids, AP-42 Petroleum Liquids, Custom Organic Liquids (if applicable), Custom Petroleum Liquids (if applicable), or Custom Mixtures (if applicable). If no custom materials have been added, those options will not be shown.

**Chemical Name.** After you have chosen the Chemical Category, the list of chemical names will populate.

**Chemicals to Speciate.** If you have chosen a custom petroleum liquid or a custom mixture and chose to partially speciate your monthly emissions, this choice will determine the chemical(s) that will show in your Routine Losses Report.

**City.** This is an optional field used to identify the city in which the storage tank is located. This may be different from the City chosen for the Meteorological Location.

**Clear Custom Data.** This removes the custom entries from all categories. It cannot be undone.

**Clear Non-Routine Losses Data.** This removes the events you have entered for landing losses and cleaning losses . It cannot be undone.

**Company.** This is an optional field used to identify the company which owns or uses the storage tank.

**Components to Speciate.** If you have chosen a custom petroleum liquid or a custom mixture and chose to partially speciate your annual emissions, this choice will determine the component(s) that will show in your Routine Losses Report.

**Cone.** One of the roof types available for vertical fixed roof tanks.

**Cone-Shaped Bottom.** This is one of the choices for a tank bottom type. According to Table 7.1-4 and Figure 7.1-20 of AP-42 Chapter 7, partial liquid heel only occurs on tanks with a cone-down bottom.

**Cone-Shaped Bottom Slope.** The slope of the cone-shaped bottom. The value should be positive for cone-down bottom and negative for a cone-up bottom. A slight cone-up bottom might have an upward slope on the order of 1:120. The default value is 0.0625 ft/ft.

**Control Device.** This is any device that could reduce the amount of emissions from a tank.

**Control Device Efficiency (%).** The average amount that the control device reduces the emissions from a tank.

**Custom.** For internal floating roof tanks with a welded deck, you can enter custom sheet width or custom panel length and panel width instead of choosing the options from AP-42 Chapter 7.

**Custom Meteorological Data.** If your tank is in a city that is not in AP-42 Chapter 7 and you have meteorological data, you can create a custom location for use with your tank data. See *Section 5.1.4*.

**Custom Mixture.** If your tank contains a mixture of organic liquids and you have the composition data, you can create a custom mixture. However, the sum of all liquid mole fractions must be 1. You cannot create a mixture containing multiple petroleum liquids, but you can create a mixture using the organic liquid components that are known to be contained in a specific petroleum liquid. See *Section 5.1.3*.

**Custom Organic Liquids.** If your tank contains an organic liquid that is not in AP-42 Chapter 7 and you have composition data and Antoine constants, you can create a custom organic liquid for use within the Tank Data section. See *Section 5.1.1*.

**Custom Petroleum Liquids.** If your tank contains a petroleum liquid that is not in AP-42 Chapter 7 and you have composition data and vapor pressure constants, you can create a custom petroleum liquid for use within the Tank Data section See *Section 5.1.2*.

**Deck Construction.** This applies only to internal floating roof tanks with bolted decks. Choose either Sheet or Panel from the drop-down list.

**Deck Fittings.** This applies only to floating roof tanks. For each fitting type, choose the appropriate cover from the drop-down menu and enter the count. The corresponding loss factors from AP-42 Chapter 7, Table 7.1-12 will be applied within TANKS 5.2. For a list of typical deck fittings by tank type, see *Section 6*.

**Deck Roof Type.** This deck characteristic applies only to external floating roof tanks. Choose Double-deck or Pontoon from the drop-down menu.

**Deck Seam.** This deck characteristic applies only to internal floating roof tanks. Based on your choice of Deck Type and Deck Construction, choose the appropriate deck seam from the drop-down menu. Typical deck seam length factors are shown in Table 7.1-16 of AP-42 Chapter 7. There is also an option to add custom sheet width or custom panel length and custom panel width.

**Deck Type.** This deck characteristic applies to internal or external floating roof tanks. Choose either Welded or Bolted. Welded is only used for External Floating Roof Tanks. Bolted is only used for Internal Floating Roof Tanks.

**Description.** This is an optional field where you may enter additional information about a tank.

**Dome.** One of the roof types available for vertical fixed roof tanks.

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

**Effective Column Diameter.** This is the average column diameter in feet for an internal floating roof tank without a self supporting roof. Once you choose the type of column from the drop-down menu, TANKS 5.2 will use the correct column diameter. As shown in Section 7.1.3.2.2 of AP-42 Chapter 7, 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, and 1.0 feet if no column construction details are known.

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

**External 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 drop-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 color is unknown, use White as the default.

**External Shell Condition.** This is the condition of the paint on the external tank shell (Good, Average, or Aged). To view the list of available options, use the drop-down menu. If the shell paint condition is unknown, use Average.

**Fahrenheit (°F).** To convert temperatures in degrees Fahrenheit (°F) to Rankine, add 459.67 to the temperature in Fahrenheit.

**Flat.** One of the roof types available for vertical fixed roof tanks.

**Flat or Nominally Flat Bottom.** This is one of the choices for a tank bottom type.

**Full Liquid Heel.** According to Table 7.1-4 and Figure 7.1-20 of AP-42 Chapter 7, full liquid heel only occurs on tanks with a flat or nominally flat bottom. See Figure 7.1-20 of AP-42 Chapter 7 for an illustration.

**Full Speciation.** See *Speciation Option: Full Speciation*.

**Good.** This is one of the choices for shell condition or roof condition. For paint, paint is in good condition

**Height of Liquid Heel.** See Figure 7.1-23 and Table 7.1-4 of AP-42 Chapter 7.

**Horizontal Fixed Roof Tanks.** This type of tank is 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.

**Internal Floating Roof Tanks.** This type of tank has both a permanent fixed roof and a floating deck. There are two basic types of internal floating roof tanks: tanks in which the fixed roof is

supported by vertical columns within the tank, and tanks with a self-supporting fixed roof and no internal support columns.

**Internal Shell Condition.** This is the condition of the paint on the internal tank shell (Light Rust, Dense Rust, or Gunite Lining). To view the list of available options, use the drop-down menu. If the tank is sludge-lined, choose Gunite Lining.

**Is Tank Heated?** If the tank is 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. Only Fully Insulated (vertical fixed roof) or Fully Insulated or Underground (horizontal fixed roof) tanks can be heated.

**Is Tank Insulated?** Vertical fixed roof tanks can be Fully Insulated, Partially Insulated, or Not Insulated. Only Fully Insulated tanks can be heated.

**Is Tank Insulated or Underground?** If the horizontal fixed roof tank is underground, no breathing or standing losses occur because the insulating nature of the earth limits the diurnal temperature change. Only Fully Insulated or Underground tanks can be heated.

**Liquid Bulk Temperature.** The liquid bulk temperature should preferably be based on measurements or estimated from process knowledge.

**Liquid Bulk Temperature Calculation Method.** You can either enter the liquid bulk temperature or choose "AP-42 Calculation" and TANKS 5.2 will calculate the liquid bulk temperature using Equation 1-33 in AP-42 Chapter 7.

**Liquid Density.** This is a measure of a material's mass per unit of volume. The liquid density of the mixture should be given in pounds per gallon at 60°F.

**Liquid Heel.** This is the liquid remaining in the bottom of a floating roof tank after the floating roof is landed. If the remaining liquid covers the entire bottom of the tank, this is known as a full liquid heel. The liquid evaporates into the vapor space beneath the landed floating roof and daily changes in ambient temperature cause this vapor space to breathe in a manner similar to a fixed roof tank. A partial liquid heel may be left in tanks with sloped bottoms if the withdrawal of liquid ceases while some free standing liquid remains in a sump or elsewhere in the bottom of the tank.

**Liquid Heel Type.** The choices are Full Liquid Heel, Partial Liquid Heel, and No Liquid Heel (or Drain Dry). See Figure 7.1-20 and Figure 7.1-23 of AP-42 Chapter 7.

**Liquid Molecular Weight.** The molecular weight of the component or mixture should be given in pound per pound mole (lb/lb-mole). When a chemical from the chemical database is used, the program provides this weight from the chemical database.

**Maximum Liquid Height.** This is the maximum height in feet of the liquid within the tank shell, measured from the bottom of the tank shell. This must be less than or equal to the shell height. For horizontal fixed roof tanks, this value must be greater than the Minimum Liquid Height; otherwise, your Routine Losses report will not run. If unknown, for vertical tanks use one foot less than the shell height and for horizontal tanks use (π/4) D where D is the diameter of a vertical cross-section of the horizontal tank

**Meteorological Data.** This data includes maximum temperature, minimum temperature, wind speed, insolation factors, atmospheric pressure by month for multiple cities in each state. TANKS 5.2 contains pre-defined data for all locations listed in Table 7.1-7 of AP-42 Chapter 7. See *Section 10* for a list of cities by state. See *Section 5.1.4* to create your own locations.

**Meteorological Location.** This is the meteorological location of the tank. You can choose from Chapter 7 of AP-42 locations or custom locations. See *Section 10* for a list of cities by state. See *Section 5.1.4* to create your own locations.

**Mixtures.** Any tank can contain a mixture of chemicals as Tank Contents, but you must create a custom mixture. TANKS 5.2 does not contain any pre-defined mixtures. See *Section 5.1.3* to create your own mixtures.

**Minimum Liquid Heel Height.** This is the minimum height in feet of the liquid remaining in the tank after emptying and prior to cleaning.

**Minimum Liquid Height.** This is the minimum height in feet of the liquid within the tank shell. For horizontal fixed roof tanks, this value must be less than the Maximum Liquid Height; otherwise, your Routine Losses report will not run. If unknown, for vertical tanks use 1 foot and for horizontal tanks use 0.

**Molecular Weight.** The sum of the atomic masses of all atoms in a molecule, based on a scale in which the atomic masses of hydrogen, carbon, nitrogen, and oxygen are 1, 12, 14, and 16, respectively.

**Net Throughput.** This is the annual net throughput in gallons per year. 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.

**No Liquid Heel**. Also known as Drain Dry. See Figure 7.1-20 of AP-42 Chapter 7.

**Non Routine Losses.** Emissions from floating roof landings and cleanings.

**Organic Liquids.** TANKS 5.2 contains multiple organic liquids listed in Table 7.1-3 of AP-42 Chapter 7. You can also create custom organic liquids. [See chapter 5.1.1.]

**Partial Liquid Heel.** See Figure 7.1-20 of AP-42 Chapter 7. If your tank has a flat or nominally flat bottom, you cannot have a partial liquid heel..

**Partial Speciation.** See *Speciation Option: Partial Speciation*.

**Petroleum Liquids.** TANKS 5.2 contains multiple petroleum liquids listed in Table 7.1-2 of AP-42 Chapter 7. You can also create custom petroleum liquids. [See chapter 5.1.2.]

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

**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. If no specific information is available, a welded tank with an average-fitting mechanical-shoe primary seal can be used to represent the most common or typical construction and rim-seal system in use for external and domed external floating roof tanks. If no specific information is available, a welded tank with an average-fitting vapor-mounted primary seal can be used to represent the most common or typical construction and rim-seal system in use for internal floating roof tanks. See Table 7.1-8 of AP-42 Chapter 7.

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.

**Rankine (°R).** To convert temperatures in degrees Fahrenheit (°F) to Rankine, add 459.67 to the temperature in Fahrenheit.

**Riveted.** This is one of choices for Tank Construction for floating roof tanks.

**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 drop-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 Table 7.1-6 of AP-42 Chapter 7. 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, choose White.

**Roof Paint Condition.** This is the condition of the paint on the tank roof, from Table 7.1-6 of AP-42 Chapter 7 (Good, Average, or Aged). To view the list of available options, use the drop-down menu. If the roof paint condition is unknown, choose Average.

**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).

**Roof Radius.** This is the radius in feet of the arc of a domed roof. This field is used only for tanks which have a domed roof. The tank dome roof radius typically 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 only applies if the roof is cone-shaped. Assume a value of 0.0625 ft/ft if the roof slope is unknown.

**Roof Type.** The roof type may be either Dome or Cone. Choose either using the drop-down menu.

**Routine Losses.** Working and standing losses from floating roof and fixed roof organic liquid storage tanks.

**Save Tank.** You can click "Save Tank" at any time during Tank Data entry. If validation checks trigger, the errors will show on the screen. You cannot "save" your tank until all validation errors are corrected.

**Secondary Seal.** There are three options for secondary seals: Rim-mounted, Shoe mounted (when mechanical shoe seals are identified as primary seals), and Primary Only / None. Choose the appropriate option from the drop-down menu.

**Seal Fit.** Choose Average-fitting or Tight-fitting from the drop-down menu. Tight-fitting seals are only available for welded tanks. It is not appropriate to use the values for tight-fitting seals unless the seal is known to be maintained with gaps no greater than 1/8 inch through the full range of liquid level in the tank.

**Self Supporting Roof.** 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.

**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 drop-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 Chapter 7. 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 as the default.

**Shell Condition.** This is the condition of the paint on the tank shell (Good, Average, or Aged). To view the list of available options, use the drop-down menu. If the shell paint condition is unknown, use Average as the default condition.

**Shell Diameter.** This is the width in feet of a cylindrical shell. This should be at least 0.5 feet.

**Shell Height.** This is the height of the internal floating roof tank, external floating roof tank, domed external floating roof tank or vertical fixed roof tank in feet. This should be between 0.5 feet and 80 feet.

**Shell Length.** This is the total length of the horizontal fixed roof tank shell in feet. This should be at least 0.5 feet. The length of the tank is usually less than six times the diameter to ensure structural integrity.

**Speciated Emissions.** The petroleum liquids from AP-42 Chapter 7 were not speciated using the old speciation profiles from TANKS 4.09D because a custom petroleum liquid with the exact speciation profile used in the tank is considered more accurate. Therefore, if you want to include speciated emissions from petroleum liquids, you must create a customized petroleum liquid and include the specific mole fractions (either vapor or liquid) for each component (e.g., benzene, toluene, xylenes).

**Speciation Option: Full Speciation.** Selecting this option means that you will provide the names of each chemical component. The program will calculate the vapor pressure and other data for the entire mixture. After selecting Full Speciation, click on "Chemicals to Speciate." 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.

**Speciation Option: None.** Selecting this option means that you will not specify any chemical components. When using this option, you will not be able to obtain emissions estimates for individual components.

**Speciation Option: Partial Speciation.** Selecting this option means that you will identify any chemical components for which an emissions estimate is required. For each component that you list and provide the concentration, 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 know your gasoline (RVP 7) has 4 percent benzene (or a mole fraction of 0.04) and want to know the emissions of gasoline and of benzene.

**State.** This is an optional field used to identify the state in which the tank is located. This may be different from the State chosen for the Meteorological Location.

**Sum of Decreases in Liquid Level.** If this value is unknown, it can be estimated from pump utilization records. This value is used for floating roof tanks with monthly inputs.

**Sum of Increases in Liquid Level.** If this value is unknown, it can be estimated from pump utilization records. This value is used for fixed roof tanks with monthly inputs.

**Tank ID.** This field is the user-defined unique identifier for the tank. The ID can consist of any combination of letters, numbers, symbols, or spaces.

**Tank Bottom Type.** The choices are Flat or Nominally Flat or Cone-Shaped Bottom. According to Table 7.1-4 and Figure 7.1-20 of AP-42 Chapter 7, partial liquid heel occurs on tanks with a cone-down bottom. If your tank has a flat or nominally flat bottom, you cannot have a partial liquid heel. The equations for partial liquid heel in Table 7.1-4 will not work if the slope is zero, which is the case for a flat or nominally flat bottom tank

**Tank Cone Roof Slope.** The slope of the roof on a vertical fixed roof tank. The default is 0.0625 ft/ft.

**Tank Construction.** The choices are Riveted or Welded.

**Tank Shape.** The choices are Cylinder, Rectangle, or Square. This determines how the standing and working losses are determined for fixed roof tanks.

**Throughput (by month).** This is the throughput in gallons per month. If the throughput of the tank is measured in barrels, you may convert barrels to gallons by multiplying the number of barrels by 42.

**Tight-fitting.** This means that the rim seal is maintained with no gaps greater than 1/8 inch wide between the rim seal and the tank shell. It is not appropriate to use the values for tig-fitting seals unless the seal is known to be maintained with gaps no greater than 1/8 inch through the full range of liquid level in the tank. Tight-fitting seals are only available for welded tanks.

**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.

**User Input.** The user can enter a specific value instead of choosing from a drop-down menu.

**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 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. If you enter a zero into the “Vacuum Setting (psig)” field and then want to enter a negative value, use the down arrow to change the number to -0.001 and then edit to the appropriate value.

**Vapor Molecular Weight.** The molecular weight of the vapor should be given in lb/lb-mole.

**Vertical Fixed Roof Tanks**. This type of tank consists of shells with permanently affixed roofs; the tank axis is perpendicular to the foundation. Tanks can be cylindrical, rectangular, or square. The fixed roof may be dome-shaped, cone-shaped, or flat. Vertical fixed roof tank shells are usually constructed of steel.

**Vapor Pressure Equation.** A correlation describing the relation between vapor pressure and temperature for petroleum liquid stocks. See Equation 1-27 of AP-42 Chapter 7. The pressure unit is psia and the temperature unit is degrees Rankine.

$$P_{VA} = \exp\left[A - \left(\frac{B}{T_{LA}}\right)\right]$$

where:

| | | |
|---|---|---|
| exp | = | exponential function |
| A | = | constant in the vapor pressure equation, dimensionless |
| B | = | constant in the vapor pressure equation, °R |
| $T_{LA}$ | = | average daily liquid surface temperature, °R |
| $P_{VA}$ | = | true vapor pressure, psia |

**Vapor Pressure Equation Constant A.** The A constant used in the vapor pressure equation. It is dimensionless.

**Vapor Pressure Equation Constant B.** The B constant used in the vapor pressure equation. The unit is degrees Rankine**.**

**Vapor Space Pressure at Normal Operating Conditions.** The pressure at normal operating conditions within the fixed roof tank. The approximate range of pressures is from zero (atmospheric pressure) to 15 psig. This is an actual pressure reading (the gauge pressure). If the tank is held at atmospheric pressure (not held under a vacuum or at a steady pressure) this should be zero.

**Welded.** This is one of deck type choices for Deck Type for floating roof tanks. Welded is only used for External Floating Roof Tanks. This is also one of choices for Tank Construction for floating roof tanks.

**Working Loss Turnover Factor ($K_N$) Method.** If your tank is vapor balanced or if flashing occurs within the tank, you should choose "Set to 1." Otherwise, you can choose "AP-42 Calculation."

# 8.0 Error Messages

**Average Liquid Height**. Values must be greater than zero, less than or equal to the maximum liquid height, and rounded to the nearest thousandth.

**Cannot read properties of undefined (reading 'components').** You need to add one or more components to your custom petroleum liquid, using either vapor mole fractions or liquid mole fractions, in order to calculate emissions. Go to Customize, Custom Petroleum Liquids, choose the specific petroleum liquid and Edit. Go to the bottom and add one or more components. Then go to "Tank Data," choose the applicable tank, and choose the specific petroleum liquid as the contents. Then choose whether to speciate emissions by component(s).

**Maximum Liquid Height**. Values must be greater than zero, less than or equal to the tank shell height, and rounded to the nearest thousandth.

**Minimum Liquid Height**. Values must be greater than or equal to zero, less than the maximum liquid height, and rounded to the nearest thousandth.

**Number of Days in which Forced Ventilation was Used.** Values must be greater than zero, less than or equal to 31, and rounded to the nearest integer.

**Shell Diameter**. Values must be greater than or equal to five and rounded to the nearest thousandth.

**Shell Height**: Values must be greater than or equal to 5, less than or equal to 80, and rounded to the nearest thousandth.

**Shell Length**. Values must be greater than or equal to 5, less than or equal to 6 times the shell diameter, and rounded to the nearest thousandth. *[for horizontal fixed roof tanks]*

**Shell Side 1 Length**. Values must be greater than or equal to 5, less than or equal to 6 times the shell diameter, and rounded to the nearest thousandth. *[for rectangular vertical fixed roof tanks]*

**Shell Side 2 Length**. Values must be greater than or equal to 5, less than or equal to 6 times the shell diameter, and rounded to the nearest thousandth. *[for rectangular vertical fixed roof tanks]*

**Shell Side Length**. Values must be greater than or equal to 5, less than or equal to 6 times the shell diameter, and rounded to the nearest thousandth. *[for square vertical fixed roof tanks]*

**Vapor Space Pressure at Normal Operating Conditions**. Values must be 0 to 15 psig rounded to the nearest thousandth.

# 9.0 Frequently Asked Questions (FAQs)

## Topic 1: Asphalt Binder Antoine Constants

**Q1**: AP-42, Chapter 11.2.2 provides Antoine's constants for an average asphalt binder. Can these constants be used in TANKS 5.2?

**A1**: No, the Antoine constants in Chapter 11.1.1.5 are not appropriate for direct use in Chapter 7. Chapter 11 uses a different Antoine's equation, different units of pressure and temperature, and appears to reverse the A and B terms in relation to Chapter 7:

**Chapter 11:**

$Log_{10} P = B - (0.05223 * A)/ T$

P = vapor pressure, mmHg
B = 9.00346
A = 75,350.06
T = temperature, K

**Chapter 7:** [Equation 1-27 of AP-42 Chapter 7]

$P = \exp [A - (B/ T)]$

P = vapor pressure, psia
A = constant in the vapor pressure equation, dimensionless
B = constant in the vapor pressure equation, °R
T = temperature, R

You will need to create a custom petroleum liquid for asphalt to calculate emissions using TANKS 5.2. Asphalt is a complex combination of high molecular weight organic compounds, so you will need to know the composition of the asphalt stored in your tank, using the material safety data sheet (MSDS) or other sources listed in *Section 5.2.1*.

## Topic 2: Custom Mixture with Organic Liquid and Petroleum Liquid

**Q2**: How do you create a custom mixture that contains an organic liquid and a petroleum liquid?

**A2**: Custom mixtures within TANKS 5.2 do not currently allow the inclusion of petroleum liquids along with organic chemicals. The EPA is considering this change as a future enhancement to the TANKS application.

## Topic 3: Routine Losses Report

**Q3**: How do I save and print the calculated tank emissions?

**A3:** See *Section 3.0* for directions on running a routine losses report, which contains standing losses, working losses, and total losses in pounds per year for each tank. The Routine Losses Excel Report was not intended to be printed. The Routine Losses PDF Report can be printed.

Either report can be saved to your computer at any location you choose.

## Topic 4: Speciated Emissions

**Q4**: I have added custom organic liquids, but I cannot add them as components of a custom petroleum liquid. Is this a known issue?

**A4**: Yes, this is a known issue. Currently, custom petroleum liquids can only be speciated by default organic chemicals (*i.e.*, the organic compounds from AP-42 Chapter 7). The ability to add custom organic liquids as components of custom petroleum liquids will be added to TANKS 5.2 during a future update.

## Topic 5: Working Loss Turnover Factor ($K_N$)

**Q5**: When I run a Routine Losses report for annual emissions from fixed roof tanks, the total emissions are correct, but when I run a Routine Losses report for monthly emissions from fixed roof tanks, the total emissions are higher than expected. Is this a known issue?

**A5**: Yes, this is a known issue. The working loss turnover factor ($K_N$) is not being determined correctly for monthly emissions, resulting in working losses being overestimated when monthly throughput data are entered. The EPA will correct this issue as part of future enhancements to the TANKS application.

**Q6**: When I set up a fixed roof tank and I have the option of selecting the working loss turnover factor as "Set to 1", the routine losses report does not reflect the correct working loss turnover factor. Is this a known issue?

**A6**: Yes, this is a known issue. The working loss turnover factor ($K_N$) is not being set to equal one. TANKS 5.2 incorrectly sets the working loss turnover factor equal to (180 + N)/6N when turnovers are greater than 36, regardless of whether flashing occurs in the tank. This leads to an underestimate of working loss emissions. The EPA will correct this issue as part of future enhancements to the TANKS application.

**Q7**: When I set up a fixed roof tank and I have the option of choosing the working loss turnover factor, what do I do if my tank is splash loaded?

**A7**: In this case, you should enter a working loss turnover factor that is greater than 1. However, TANKS 5.2 is not yet set up to allow this entry. The EPA will correct this issue as part of future enhancements to the TANKS application.

# 10.0 Meteorological Locations by State

| CITY | STATE |
|---|---|
| Birmingham | Alabama |
| Huntsville | Alabama |
| Mobile | Alabama |
| Montgomery | Alabama |
| Anchorage | Alaska |
| Annette | Alaska |
| Barrow | Alaska |
| Bethel | Alaska |
| Bettles | Alaska |
| Big Delta | Alaska |
| Cold Bay | Alaska |
| Fairbanks | Alaska |
| Gulkana | Alaska |
| Homer | Alaska |
| Juneau | Alaska |
| King Salmon | Alaska |
| Kodiak | Alaska |
| Kotzebue | Alaska |
| Mcgrath | Alaska |
| Nome | Alaska |
| St. Paul Island | Alaska |
| Talkeetna | Alaska |
| Unalakleet | Alaska |
| Valdez | Alaska |
| Yakutat | Alaska |
| Phoenix | Arizona |
| Prescott | Arizona |
| Tucson | Arizona |
| Fort Smith | Arkansas |
| Little Rock | Arkansas |
| Arcata | California |
| Bakersfield | California |
| Bishop | California |
| Daggett | California |
| Fresno | California |
| Long Beach | California |
| Los Angeles Airport | California |
| Redding | California |
| Sacramento | California |
| San Diego | California |
| San Francisco Airport | California |
| Santa Barbara | California |
| Santa Maria | California |
| Stockton | California |
| Alamosa | Colorado |
| Colorado Springs | Colorado |
| Denver | Colorado |
| Grand Junction | Colorado |
| Limon | Colorado |
| Pueblo | Colorado |
| Bridgeport | Connecticut |
| Hartford | Connecticut |
| Wilmington | Delaware |
| Daytona Beach | Florida |
| Fort Myers | Florida |
| Gainesville | Florida |
| Jacksonville | Florida |
| Key West | Florida |
| Miami | Florida |
| Orlando | Florida |
| Pensacola | Florida |
| Tallahassee | Florida |
| Tampa | Florida |
| Vero Beach | Florida |
| West Palm Beach | Florida |
| Athens | Georgia |
| Atlanta | Georgia |
| Augusta | Georgia |
| Columbus | Georgia |
| Macon | Georgia |
| Savannah | Georgia |
| Hilo | Hawaii |
| Honolulu | Hawaii |
| Kahului | Hawaii |
| Lihue | Hawaii |
| Boise | Idaho |
| Lewiston | Idaho |
| Pocatello | Idaho |
| Chicago | Illinois |
| Moline | Illinois |
| Peoria | Illinois |
| Rockford | Illinois |
| Springfield | Illinois |
| Evansville | Indiana |
| Fort Wayne | Indiana |
| Indianapolis | Indiana |
| South Bend | Indiana |
| Des Moines | Iowa |
| Dubuque | Iowa |
| Mason City | Iowa |
| Sioux City | Iowa |
| Waterloo | Iowa |
| Concordia | Kansas |
| Dodge City | Kansas |
| Goodland | Kansas |
| Russell | Kansas |
| Topeka | Kansas |
| Wichita | Kansas |
| Cincinnati | Kentucky |
| Jackson | Kentucky |
| Lexington | Kentucky |
| Louisville | Kentucky |
| Paducah | Kentucky |
| Baton Rouge | Louisiana |
| Lake Charles | Louisiana |
| New Orleans | Louisiana |
| Shreveport | Louisiana |
| Bangor | Maine |
| Caribou | Maine |
| Portland | Maine |
| Baltimore | Maryland |
| Boston | Massachusetts |
| Worcester | Massachusetts |
| Alpena | Michigan |

| CITY | STATE |
|---|---|
| Detroit Metro Airport | Michigan |
| Detroit | Michigan |
| Flint | Michigan |
| Grand Rapids | Michigan |
| Houghton Lake | Michigan |
| Lansing | Michigan |
| Muskegon | Michigan |
| Sault St. Marie | Michigan |
| Traverse City | Michigan |
| Duluth | Minnesota |
| International Falls | Minnesota |
| Minneapolis-St. Paul | Minnesota |
| Rochester | Minnesota |
| St. Cloud | Minnesota |
| Jackson | Mississippi |
| Meridian | Mississippi |
| Tupelo | Mississippi |
| Columbia | Missouri |
| Kansas City | Missouri |
| Springfield | Missouri |
| St. Louis - Lambert | Missouri |
| St. Louis - Sprit | Missouri |
| Billings | Montana |
| Glasgow | Montana |
| Great Falls | Montana |
| Harve City | Montana |
| Helena | Montana |
| Kalispell | Montana |
| Missoula | Montana |
| Grand Island | Nebraska |
| Lincoln | Nebraska |
| Norfolk | Nebraska |
| North Platte | Nebraska |
| Omaha | Nebraska |
| Scotts Bluff | Nebraska |
| Valentine | Nebraska |
| Ely | Nevada |
| Las Vegas | Nevada |
| Lovelock | Nevada |

| CITY | STATE |
|---|---|
| Mercury | Nevada |
| Reno | Nevada |
| Tonopah | Nevada |
| Winnemucca | Nevada |
| Concord | New Hampshire |
| Atlantic City | New Jersey |
| Newark | New Jersey |
| Albuquerque | New Mexico |
| Gallup | New Mexico |
| Roswell | New Mexico |
| Albany | New York |
| Binghamton | New York |
| Buffalo | New York |
| New York - LaGuardia Airport | New York |
| Long Island | New York |
| Massena | New York |
| New York – Kennedy Airport | New York |
| Rochester | New York |
| Syracuse | New York |
| Asheville | North Carolina |
| Charlotte | North Carolina |
| Greensboro | North Carolina |
| Raleigh-Durham | North Carolina |
| Wilmington | North Carolina |
| Bismarck | North Dakota |
| Fargo | North Dakota |
| Minot | North Dakota |
| Williston | North Dakota |
| Akron | Ohio |
| Cleveland | Ohio |
| Columbus | Ohio |
| Dayton | Ohio |
| Mansfield | Ohio |
| Toledo | Ohio |
| Youngstown | Ohio |
| Oklahoma City | Oklahoma |
| Tulsa | Oklahoma |
| Astoria | Oregon |
| Burns | Oregon |

| CITY | STATE |
|---|---|
| Eugene | Oregon |
| Medford | Oregon |
| Pendleton | Oregon |
| Salem | Oregon |
| Allentown | Pennsylvania |
| Bradford | Pennsylvania |
| Erie | Pennsylvania |
| Middletown | Pennsylvania |
| Philadelphia | Pennsylvania |
| Pittsburgh | Pennsylvania |
| Scranton | Pennsylvania |
| Williamsport | Pennsylvania |
| Providence | Rhode Island |
| Charleston | South Carolina |
| Columbia | South Carolina |
| Greer | South Carolina |
| Aberdeen | South Dakota |
| Huron | South Dakota |
| Pierre | South Dakota |
| Rapid City | South Dakota |
| Sioux Falls | South Dakota |
| Bristol | Tennessee |
| Chattanooga | Tennessee |
| Knoxville | Tennessee |
| Memphis | Tennessee |
| Nashville | Tennessee |
| Abilene | Texas |
| Amarillo | Texas |
| Austin | Texas |
| Brownsville | Texas |
| Corpus Christi | Texas |
| Dallas-Fort Worth | Texas |
| El Paso | Texas |
| Houston | Texas |
| Lubbock | Texas |
| Lufkin | Texas |
| Midland | Texas |
| Port Arthur | Texas |
| San Angelo | Texas |
| San Antonio | Texas |

| CITY | STATE |
|---|---|
| Victoria | Texas |
| Waco | Texas |
| Cedar City | Utah |
| Salt Lake City | Utah |
| Burlington | Vermont |
| DC - Dulles | Virginia |
| DC-Reagan | Virginia |
| Lynchburg | Virginia |
| Norfolk | Virginia |
| Richmond | Virginia |
| Roanoke | Virginia |

| CITY | STATE |
|---|---|
| Olympia | Washington |
| Quillayute | Washington |
| Seattle | Washington |
| Spokane | Washington |
| Stampede Pass | Washington |
| Yakima | Washington |
| Beckley | West Virginia |
| Charleston | West Virginia |
| Elkins | West Virginia |
| Huntington | West Virginia |
| Eau Claire | Wisconsin |

| CITY | STATE |
|---|---|
| Green Bay | Wisconsin |
| La Crosse | Wisconsin |
| Madison | Wisconsin |
| Milwaukee | Wisconsin |
| Casper | Wyoming |
| Cheyenne | Wyoming |
| Lander | Wyoming |
| Rock Springs | Wyoming |
| Sheridan | Wyoming |

# 11.0 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 |
| Redding, CA | Sacramento, CA |
| Santa Barbara, CA | Santa Maria, CA |
| Stockton, CA | Sacramento, CA |
| Fort Myers, FL | Tampa, FL |
| Gainesville, FL | Tallahassee, FL |
| Pensacola, FL | Mobile, AL |
| Vero Beach, FL | West Palm Beach, FL |
| Columbus, GA | Macon, GA |
| Dubuque, IA | Moline, IL |
| Concordia, KS | Grand Island, NE |
| Jackson, KY | Lexington, KY |
| Paducah, KY | Evansville, IN |
| Muskegon, MI | Grand Rapids, MI |
| Sault St. Marie, MI | MI Green Bay, WI |
| Tupelo, MS | Memphis, TN |
| Lincoln, NE | Omaha, NE |
| Valentine, NE | North Platte, NE |
| Williston, ND | Glasgow, MT |
| Aberdeen, SD | Sioux Falls, SD |
| 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 |