Height (ft): Enter the height of the tank for a circular tank in feet. For horizontal tanks leave this block blank.

Length (ft): Enter the length of the tank for horizontal tanks in feet. For circular tanks leave this block blank.

Capacity (in Thousands Gallons): The tank capacity should be expressed in thousands of gallons of liquid. A storage tank with a capacity of 10,000 gallons should be entered as 10 in this box.

Vent Pressure Setting (psig): This value is the breather vent pressure setting and should be expressed in pounds per square inch-gauge (psig). If specific information on the setting is not available, a default value of 0.03 psig may be used. If the fixed-roof tank is of bolted or riveted construction in which the roof or shell plates are not vapor tight, assume the vent pressure setting is equal to the vent vacuum setting even if a breather vent is used. The estimating equation for fixed-roof tanks does not apply if the vent pressure setting exceeds 1.0 (one) psig.

Vent Vacuum Setting (psig): This value is the breather vent vacuum setting and should be expressed in psig. If specific information on the setting is not available, a default value of -0.03 psig may be used. If the fixed-roof tank is of bolted or riveted construction in which the roof or shell plates are not vapor tight, assume the vent vacuum setting is equal to the vent pressure setting even if a breather vent is used. The estimating equation for fixed-roof tanks does not apply if the vent vacuum setting exceeds -1.0 psig.

Color (Roof): Enter the color and shade of the paint on the roof of the tank. Table 7.1-7 provides a list of the most common paint colors.

Color (Shell): Enter the paint color and shade of the shell or side of the tank. Table 7.1-7 provides a list of the most common paint colors.

Paint Condition: Enter the estimate of how well the paint covers the tank surfaces. The paint condition should be expressed as either "Good" or "Poor."

Color (Shell): Enter the paint color and shade of the shell or side of the tank. Table 7.1-7 provides a list of the most common paint colors.

Solar Absorbance: This factor is the amount of solar energy that the liquid stored in the tank absorbs. This factor is related to the color and condition of the paint on the roof and shell of the storage tank. This factor, a dimensionless number, may be obtained from Table 7.1-7.

Type of Roof: Check the box that matches the type of roof for the fixed tank. The equation used to calculate the Roof Height (Ft) (below) should correspond to the box checked for this field.

Roof Height (ft): Enter the distance, in feet, that the roof extends above the tank shell. Leave this field blank for a horizontal tank.

For Cone Roofs, this value can be determined from the following formula:
Cone Roof Height = 0.5 x Tank Cone Roof Slope x Shell Diameter

A default value of 0.0625 ft/ft can be used if specific information on the tank cone roof slope is unknown.
For Dome Roofs, this value may be determined by using the following formula:

Dome Roof Height = Tank Dome Roof Radius
- (Tank Dome Roof Radius^2 - Tank Shell Radius^2)^0.5

NOTE: The value of the Tank Dome Roof Radius usually ranges from 0.8 to 1.2 times the diameter of the tank. If this value is unknown, use the tank diameter in its place. In this case, the Roof Height is equal to 0.268 times the Shell Radius.

Vapor Space Outage (ft): This is the height, expressed in feet, of the average vapor space in the tank, including any volume corrections for the tank roof. One-half of the actual diameter of a horizontal tank should be used as the value for the vapor space outage. A value for the vapor space outage for vertical tanks may be calculated using the formula listed below:

Vapor Space Outage = {Tank Height} - {Liquid Height} + {Roof Outage}

The Roof Outage may be calculated using one of the following formulas:

For Cone Roofs:
Roof Outage = 0.33 x {Tank Roof Height}

NOTE: If the slope of the cone is unknown, use 0.0625 ft/ft as a default value.

For Dome Roofs:
Roof Outage = {Tank Roof Height} x [0.5 + [0.167
x ({Tank Roof Height} / {Tank Shell Radius})^2]]

If the tank diameter is used in place of the tank dome roof radius, the
Roof Outage = 0.0685 x {Shell Diameter}.

Total Solar Insolation Factor (BTU/Sq Ft): This factor is the daily amount of energy that the tank receives due to exposure to the sun. Unless site specific information is available, a value of 1402 BTU/ft^2 per day should be used as a default for this factor.

2) CHEMICAL INFORMATION

Chemical: Enter the name(s) of the chemical(s) stored in the tank during the calendar year.

Vapor Molecular Weight: The molecular weight of the vapor should be for the specific chemical stored in the tank during the year. The value entered should be expressed in pounds per pound-mole. If more than one chemical was stored in the tank at separate times during the year, a separate Form 2.5 should be completed for each material. The vapor molecular weight for selected petroleum and volatile organic liquids may be determined from Tables 7.1-2 and 7.1-3, respectively, or by analyzing vapor samples.

If the tank contains a mixture of different liquids, then the following equation should be used for calculating the vapor molecular weight of the mixture:

$$\text{Vapor Molecular Weight} = M_a(P_aX_a/Pt)+M_b(P_bX_b/Pt)+ \ldots +M_z(P_zX_z/Pt)$$

where the a, b, . . . , z represent different liquids and the M_a, M_b, . . . M_z terms the molecular weights of the respective compounds in the liquid. The X_a, X_b, . . . X_z terms represent the respective mole fraction of each component of the liquid and the P_a, P_b, . . . P_z terms the respective true vapor pressures of each different liquid. Pt is the total vapor pressure found by Raoult's Law, which is shown below:

$$Pt=P_aX_a+P_bX_b+ \ldots +P_zX_z$$

A more detailed discussion on this topic, is provided in AP-42, Section 7.1.

CAS Number: Enter the Chemical Abstract Service (CAS) Registry Number(s) for the chemical(s) stored in the tank during the calendar year.

LST - [Average Liquid Surface Temperature (Rankine)]:

Avg.: This value is the daily average surface temperature of the liquid stored in the tank, expressed in Rankine (R). If this value is unknown, it may be calculated using the formula below:

LST = (0.44 x {D-Avg-AT (Rankine)}) + (0.56 x {LBT (Rankine)})
+ (0.0079 x {Solar Absorptance} x {Total Solar Insolation Factor})

The D-Avg-AT (Daily Average Ambient Temperature) and the LBT (Liquid Bulk Temperature) are defined in the instructions below. The above equation should not be used to estimate the temperature for insulated tanks. For insulated tanks, the average liquid surface temperature should be based on the liquid surface temperature measurements from the tank.

Max: The Daily Maximum Liquid Surface Temperatures may be calculated using the

following formula:
Daily Maximum LST = {LST} + (0.25 x {DVTR})

Min: The Daily Minimum Liquid Surface Temperatures may be calculated using the following formula:
Daily Minimum LST = {LST} - (0.25 x {DVTR})

Temperatures in degrees Fahrenheit may be converted to degrees Rankine using the formula:

Rankine = Fahrenheit + 460

Temperatures in Degrees Celsius may be converted to degrees Rankine using the formula:
Rankine = (1.8 x Celsius) + 492

VP - [Vapor Pressure at LST (Psia)]: Enter the vapor pressure in pounds per square inch absolute (Psia) for the liquid being stored at bulk liquid surface temperature.

> ***NOTE:*** If the liquid stored in the tank is one of those listed in Table 7.1-2 or 7.1-3, use the true vapor pressure listed there. If the liquid stored is not listed on Table 7.1-2 or 7.1-3, the true vapor pressure can be estimated using Antoines Equation. For more information on how to calculate the true vapor pressures for organic liquids using Antoine's Equation, consult AP-42, Section 7.1.

For Crude Oils

Use Figure 7.1-12a to calculate the true vapor pressure of the crude oil if the Reid vapor pressure is known. First find the stored liquid temperature (in Fahrenheit) on the scale at the right side of the page. The second step is to locate the Reid vapor pressure of the liquid on the scale that is in the middle of the figure. Next, draw a straight line from the stored liquid temperature, through the Reid vapor pressure point, to the true vapor pressure at the left side of the figure. Enter the true vapor pressure reading that is indicated on the scale that is on the left side of the page.

For Refined Petroleum Stocks

The true vapor pressure values for some refined petroleum products can be obtained from Table 7.1-2. Figure 7.1-13A may be used to find the true vapor pressure if the Reid vapor pressure is known. In this case, the first step is to find the stored liquid temperature on the scale at the right of the page. The second step is to locate the approximate position for the Reid vapor pressure, using the slope of the distillation curve on the small graph in the center of the page. The third step is to line up these two points and extend a straight line to the true vapor pressure scale at the left side of the page. Enter this value as the true vapor pressure of the liquid.

Throughput (in Thousands of Gallons): This value is the **annual** amount of the organic

liquid that has been stored in the tank during the calendar year. This value must be expressed in **thousands of gallons** of liquid stored during the year. The value for the throughput should be the sum of the gallons of liquid stored in the tank at the beginning of the year plus the gallons replenished each time the tank was refilled minus any liquid left in the tank at the end of the year.

The following conversion factors should be used if the annual throughput is normally expressed in barrels. There are 42 gallons per barrel for U.S. petroleum products.

Working Loss Product Factor: This factor, a dimensionless number, is 0.75 for crude oils. For all other organic liquids, the product factor default is 1.0.

LBT (Rankine): The liquid bulk temperature should be calculated using the following formula:

LBT (Rankine) = {D-Avg-AT (Rankine)} + (6 x {Solar Absorptance}) - 1

DVTR (Rankine)]: This value for the Daily Vapor Temperature Range may be calculated using the formula:

DVTR = [0.72 x ({D-Max-AT (Rankine)} - {D-Min-AT (Rankine)})]
+ (0.028 x {Solar Absorptance} x {Total Solar Insolation Factor})

or using default values:

DVTR = 15.34 + (39.26 x {Solar Absorptance})

DVPR (psi)]: The value for the Daily Vapor Pressure Range may be calculated using the formula:

DVPR = Vapor Pressure at Daily Maximum LST (psia)
- Vapor Pressure at Daily Minimum LST (psia)

The vapor pressures at the daily maximum and minimum liquid surface temperatures may be found in the same manner as the Vapor Pressure at LST calculations discussed above. Use the respective temperatures in these calculations. A more detailed discussion on how to calculate vapor pressures at various temperatures is provided in AP-42, Section 7.1.

D-Min-AT (Rankine): This value is the Daily Minimum Ambient Temperature expressed in Rankine. The daily minimum ambient temperature information for selected cities may be found in Table 7.1.6 of the AP 42. If site-specific data is not available, a default value of 503.8 Rankine can be used for this value.

D-Max-AT (Rankine): This value is the Daily Maximum Ambient Temperature expressed

in Rankine. The daily maximum ambient temperature Information for selected cities may be found in Table 7.1.6 of the AP 42. If site-specific data is not available, a default value of 525.1 Rankine may be used for this value.

D-Avg-AT (Rankine)]: This value is the daily average ambient temperature based on an annual average expressed in degrees Rankine. This value may be calculated using the formula:

D-Avg-AT = [{D-Max-AT (Rankine)} + {D-Min-AT (Rankine)}] / 2

Using the above defaults for the maximum and minimum ambient temperatures will result in a value of 514.45 Rankine for the daily average ambient temperature.

Number of Turnovers: This value is calculated by dividing the throughput by the tank capacity. Both values must be expressed in thousands of gallons.

Turnover Factor: This factor, a dimensionless number, may be obtained from Figure 7.1-17. If the number of turnovers is greater than 36, this factor may be calculated using the following formula:

Turnover Factor = (180 + {Number of Turnovers})
/ (6 x {Number of Turnovers})

For less than 36 turnovers per year, enter 1.0 (one) as the turnover factor.

3) VOC EMISSION CALCULATIONS

For fixed-roof storage tanks, VOC pollutants are usually emitted by two separate mechanisms. The first, called breathing loss is described as the release of vapors from the tank caused by vapor expansion and contraction. These VOC emissions usually result from changes in temperature and barometric pressure. The second mechanism by which VOC pollutants can be released from a fixed-roof storage tank is called working loss. Working losses are the combined vapor losses that occur as a result of repeatedly filling the storage tank and emptying it with organic liquid during the year.

In each box or on the reverse side of the worksheet, show all the steps in calculating the breathing loss and working loss emission factors.

Breathing Loss Formula: The first equation of Block 3 calculates VOC breathing losses from a fixed-roof storage tank. Breathing loss must be expressed in pounds of VOC emitted annually.

> ***NOTE:*** There is no breathing loss associated with underground storage tanks. Enter zero in this block and make sure the point description indicates that the tank is an underground storage tank.

Working Loss Formula: The second equation of Block 3 calculates VOC working losses from a fixed-roof storage tank. Working loss must be expressed in pounds of VOC emitted annually. The working loss equation presented on Form 2.5 is based on 42 gallons per barrel for petroleum liquids.

Breathing Loss Emission Factor: The breathing loss emission factor is computed by dividing the breathing loss by the capacity (expressed in thousands of gallons). This will give an emission factor expressed in pounds of VOC emitted per thousand gallons of tank capacity.

Working Loss Emission Factor: The working loss emission factor is computed by dividing the working loss by the annual throughput (expressed in thousands of gallons). This will give an emission factor expressed in pounds of VOC emitted per thousand gallons of an organic liquid processed annually.

Enter the SCC for both the **Breathing Loss SCC** and the **Working Loss SCC** next to the corresponding emission factor.

ENTER THE FOLLOWING ON FORM 2.0, EMISSION POINT INFORMATION:

USE A SEPARATE FORM 2.0 FOR EACH EMISSION FACTOR.

Block 4 -	Enter the **Annual Throughput** value (expressed in thousands of gallons).
Block 6 -	Enter "25" in the VOC Box for Source of Emission Factor to indicate Form 2.5 was used to estimate the VOC emission factors for this tank.
Block 7 -	Enter the **Breathing Loss Emission Factor** or the **Working Loss Emission Factor** in the VOC box.

INSTRUCTIONS

FORM 2.5L GENERAL LIQUID STORAGE TANK INFORMATION

This is a **REQUIRED** form only **if SCC Emission Factors are used** to report emissions from either fixed-roof or floating-roof liquid storage tanks with a capacity greater than 250 gallons.

The U.S. Environmental Protection Agency (EPA) has a computer software package (TANKS) that may be used to calculate tank emission factors. If this method is used, attach a copy of the printout and list the tanks on Form 2.5L. Computer software may be obtained from the EPA's Technology Transfer Network on the CHIEF Bulletin Board System at (919)541-5285 or Internet address http://www.epa.gov/ttn/chief/tanks.html or by contacting EPA Region VII at (913) 551-7020. **If the TANKS program is used, you still must transfer the information to the appropriate fields on this form and the Form 2.0.**

If you want to calculate your own **emission factors,** Form 2.5 or 2.6 (whichever is appropriate) **must** be used to report both breathing and working loss emissions.

You will need to complete a Form 2.0 for each type of chemical stored. If the tank capacities are within the same range that would allow you to use the same SCC number, then grouping is acceptable on Form 2.0. However, tanks should be listed individually on Form 2.5L.

Complete **Facility Name, FIPS County Number, Plant Number and Year of Data.**
See Form 1.0 instructions, page 1.0-1.

Point or Tank Identification Number: This number is the unique identification number for each liquid storage tank. This identification number must match the point number entered on Forms 1.1, 1.2, and 2.0. Be sure to include the emission point number if it is different from the tank identification.

AIRS ID-Pt: To be completed by the APCP.

Capacity in Thousands of Gallons: The tank capacity should be expressed in thousands of gallons of liquid. A 10,000 gallon storage tank should be entered as 10 in the box.

Chemical: Enter the name of each liquid stored in the tank during the calendar year. If more than one liquid is stored in a tank during the calendar year, a different section of Form 2.5L must be filled out for each liquid.

Diameter: Enter the diameter of the storage tank in feet.

Height/Length of Tank: The height of the tank should be entered if the tank is circular, and the length of the tank should be entered for non-circular tanks (horizontal tanks). Circle the appropriate heading to indicate whether the value entered is the height or the length of the tank. This value should be expressed in feet.

Instructions for Form 2.5L
General Liquid Storage Tank Information
Continued

Throughput: This figure represents the annual amount of liquid stored in the storage tank during the calendar year. It must be expressed in thousands of gallons of liquid. For standing **(breathing)** loss, the throughput will be the same as **tank capacity.** Annual throughput for withdrawal **(working)** loss will be the amount stored in the tank at the beginning of the year plus the sum of the gallons replenished each time the tank was refilled minus any liquid left in the tank at the end of the year.

CAS Number: Enter the Chemical Abstract Service (CAS) Registry number for the chemical stored in the tank during the calendar year.

Enter the SCC for both the **Breathing Loss** (Standing Loss) and the **Working Loss** (Withdrawal Loss) in the appropriate box.

Choose Type of Tank: Put a check mark in the appropriate boxes telling whether it is a fixed or floating-roof storage tank and whether it is a horizontal or vertical tank.

ENTER THE FOLLOWING ON FORM 2.0, EMISSION POINT INFORMATION:

BLOCK 1 - Point or Tank Identification Number;
Point Description, including the type of tank and type of chemical (Example: Fixed Roof Tank-Gasoline);
SCC number and description;

BLOCK 4 - Annual Throughput (Thousands of gallons).

INSTRUCTIONS

FORM 2.6 ORGANIC LIQUID STORAGE, FLOATING-ROOF TANK WORKSHEET

This form is **REQUIRED** if a facility **wants to calculate its own working and breathing loss emission factors** for a floating-roof organic liquid storage tank(s) that has a capacity greater than 250 gallons. A separate Form 2.6 should be used to calculate the emission factors for each individual floating-roof tank (i.e., NO GROUPING OF FLOATING TANKS).

TANKS is a U.S. Environmental Protection Agency (EPA) computer software package that also may be used to calculate tank emission factors. If this software is used, please attach a copy of the printout and list the tank information on Form 2.5L. This computer software may be obtained from the EPA's Technology Transfer Network on the CHIEF Bulletin Board System at (919) 541-5285 or Internet address http://www.epa.gov/ttn/chief/tanks.html or by contacting EPA Region VII at (913) 551-7020.

All of the information concerning the calculation of VOC emission factors for floating-roof storage tanks was taken from the EPA Manual AP-42, Section 7. Reading this section from AP-42 may provide a more in-depth explanation of the emission calculations for this type of equipment.

Emissions can occur from floating-roof storage tanks by four mechanisms: rim seal loss, withdrawal loss, deck fitting loss and deck seam loss. This form only applies to freely vented internal floating-roof tanks or external floating roof tanks. This form does not apply to:

1) closed internal floating-roof tanks;
2) unstable or boiling stocks or from mixtures of hydrocarbons or petrochemicals whose vapor pressure is not readily known or cannot readily be predicted;
3) losses from tanks in which the materials used in the seal system and for the deck construction have become deteriorated or significantly permeated by the stored liquid.

NOTE: Tables, Figures and other attachments are not included with these instructions. Please refer to EPA Manual AP-42, Section 7, or contact the Air Pollution Control Program at (573) 751-4817.

Complete **Facility Name, County Number, Plant Number and Year of Data.**
See Form 1.0 instructions, page 1.0-1.

1) TANK INFORMATION

Point or Tank Identification Number: This is the unique identification number for each specific floating roof storage tank. This identification must match the point number entered on Form 1.1, Process Flow Diagram; Form 1.2, Summary of Emission Points; and Form 2.0, Emission Point Information.

AIRS ID-Pt: See Form 2.0 instructions.

Capacity (in Thousands of Gallons): The tank capacity should be expressed in thousands of gallons of liquid. A 10,000-gallon storage tank should be entered as 10 in this box.

Diameter: Enter the diameter of the storage tank in feet.

Seal Factor, a & b: These factors are based on the emissions from the type of seal(s) on the connection between the floating roof and the storage tank. The values for the seal factors, a & b may be found in the K_{Ra} and K_{Rb} columns of Table 7.1-8.

Clingage Factor: This factor is the tendency of the liquid to remain on the walls of the storage tank after emptying the tank. This factor is related to the shell condition of the tank.

The value for the clingage factor can be found in Table 7.1-10 below.

TABLE 7.1-10 AVERAGE CLINGAGE FACTORS (C) (bbl/1,000 ft^2)

	Shell Condition [a]		
Liquid	Light Rust	Dense Rust	Gunite Lined
Gasoline	0.0015	0.0075	0.15
Single component stocks	0.0015	0.0075	0.15
Crude oil	0.0060	0.030	0.60

[a] If no specific information is available, these values may be assumed to represent the most common or typical condition of tanks currently in use.

Shell Condition: Check the box that most appropriately describes the shell condition of the storage tank. The shell condition is used to determine the clingage factor for the organic liquid stored in the tank.

Type of Construction: Check the box that most appropriately describes the floating-roof tank construction. This will normally be either riveted or welded.

Type of Roof: Check the box that describes the type of roof on the floating-roof storage tank.

Length of Seam: Enter the total length of the deck seam for bolted decks on internal floating-roof tanks only. If the total length of the deck seam is not known, Table 7.1-16 may be used to determine the {Length of Seam}/{Area of Deck} component (Deck Seam Length Factor) of the Deck Seam Loss Calculation. For a deck constructed from continuous metal sheets with a 7-ft spacing between the seams, a value of 0.14 ft/ft^2 may be used for the above Deck Seam Length Factor. A value of 0.33 ft/ft^2 may be used for the Deck Seam Length Factor when a deck is constructed from rectangular panels 5 ft by 7.5 ft. Where tank-specific data concerning width of the deck sheets or size of deck panels is unavailable, a default value for the Deck Seam Length Factor may be assigned. A value of 0.20 ft/ft^2 may be assumed to represent the most common bolted decks currently in use.

Number of Columns: This value represents the number of columns that support the floating roof. Note: The Number of Columns equals zero (0) for self-supporting fixed roofs or external floating-roof tanks. For column-supported fixed roofs, use tank-specific information or a figure obtained from Table 7.1-11 for this storage tank.

Effective Column Diameter: This value is the effective size of the diameter of a column, expressed in feet. The effective column diameter may be found by taking the circumference of the column and dividing by mathematical pi (3.1416). Note: Tank-specific effective column diameter information should be used or a default value of 1.1 for 9-by-7-inch built-up columns may be used for this figure, or a default value of 0.7 may be used for 8-inch diameter pipe columns. A value of 1.0 should be used if the column construction details are not known.

Deck: Check the appropriate box for the type of deck construction. Neither welded deck internal floating roof tanks nor external floating roof tanks have deck seam losses and the

deck seam losses and the deck seam loss emissions should be entered as zero. Internal floating roof tanks with bolted decks may have deck seam losses.

Primary Seal: Check the primary seal type that is most consistent with the primary seal for this specific storage tank.

Secondary Seal: Check the secondary seal type that is most consistent with the secondary seal for this specific storage tank.

Area of Deck: Enter the area of the deck of the storage tank in square feet. See the Length of Seam field explanation if specific information on the Area of the Deck is not available.

Total Deck Fitting Loss Factor: This factor is based on the emissions that can result from various types of fittings and other attachments on the deck.

For External Decks:

The value for the Total Deck Fitting Loss may be calculated using the actual tank-specific data for the number of each fitting type and then multiplying by the fitting loss factor for each fitting according to the following formula:

Total Fitting Loss Factor = $\{(N_{F1}*K_{F1}) + (N_{F2}*K_{F2}) + \cdots + (N_{Fn}*K_{Fn})]$

Where N_{Fi} is the number of roof fittings of a particular type ($i = 0,1,2,3 \ldots, n_f$)
K_{Fi} is the roof fitting loss factor for a particular fitting ($i = 0,1,2,3 \ldots, n_f$) (See discussion below)
n_f is the total number of different types of fittings

The roof fitting loss factor for a particular type of fitting, may be estimated by the following equation:

Roof Fitting Loss Factor for a Fitting = $K_{Fai} + (K_{Fbi} * \{\text{Avg. Wind Speed}\}^{mi})$

Where K_{Fai} is the loss factor for a particular type of fitting in lb-moles/yr;
K_{Fbi} is the loss factor for a particular type of fitting in lb-mole/(mph)^{m}yr
mi is the loss factor

Loss factors for the above equation are provided in Table 7.1-12 for most common roof fittings used on external floating roof tanks. Typical numbers of fittings are presented in Tables 7.1-12, 7.1-13, and 7.1-14. Where tank-specific data for the number and type of deck fittings are unavailable, values for the fitting loss factor may be obtained from Figures 7.1-23 and 7.1-24. The values presented in Figures 7.1-23 and 7.1-24 present the total fitting loss factor plotted against tank diameter for pontoon and double-deck external floating roofs, respectively.

For Internal Decks:

The value for the Total Deck Fitting Loss may be calculated using the actual tank-specific data for the number of each fitting type and then multiplying by the fitting loss factor for each fitting according to the following formula:

Total Fitting Loss Factor = $\{(N_{F1}*K_{F1}) + (N_{F2}*K_{F2}) + \cdots + (Nfn*KFn)]$

Where N_{Fi} is the number of roof fittings of a particular type ($i = 0,1,2,3 \ldots, n_f$)
K_{Fi} is the roof fitting loss factor for a particular fitting ($i = 0,1,2,3 \ldots, n_f$)

n_f is the total number of different types of fittings

Values of the deck fitting loss for a particular fitting type and the typical number of fittings are presented in Table 7.1-12 for internal floating roof decks. Where tank-specific data for the number and kind of deck fittings is unavailable, the loss factor may be approximated according to the tank diameter. Figures 7.1-25 and 7.1-26 present the Total Fitting Loss Factor plotted against tank diameter for column-supported fixed roofs and self-supported fixed roofs, respectively.

Seam Loss Factor: A value of 0.0 should be used for welded decks and external floating roof tanks. A value of 0.14 should be used for bolted decks.

2) CHEMICAL INFORMATION

Chemical: Enter the name(s) of the chemical(s) stored in the tank during the calendar year.

Vapor Molecular Weight: Enter the molecular weight of the vapor for the specific chemical stored in the tank during the year expressed in pounds per pound-mole. If more than one chemical was stored in the tank at separate times during the year, then complete a separate Form 2.6 for each material.

The vapor molecular weight for selected petroleum and volatile organic liquids may be determined from Tables 7.1-2 and 7.1-3, respectively or by analyzing vapor samples. If the tank contains a mixture of different liquids, with each liquid denoted by a, b, . . . z, then the following equation should be used for calculating the vapor molecular weight of the mixture:

$$\text{Vapor Molecular Weight} = M_a(P_aX_a/Pt)+M_b(P_bX_b/Pt)+ \cdots +M_z(P_zX_z/Pt)$$

where M_a, M_b, . . . M_z are the molecular weights of the respective compounds in the liquid. X_a, X_b, . . . X_z represent the respective mole fraction of each component of the liquid. P_a, P_b, . . . P_z represent the respective true vapor pressures of each different liquid. Pt is the total vapor pressure. Raoult's Law, shown below, may be used to find total vapor pressure.

$$Pt=P_aX_a+P_bX_b+ \cdots +P_zX_z$$

AP42, Section 7.1 provides a more detailed discussion on this topic.

Liquid Density: This value should be available from the Material Safety Data Sheets provided by the supplier for the specific material associated with this emission point. If the specific gravity is given on the MSDS (Material Safety Data Sheet), multiply the specific gravity by 8.34 to obtain the density expressed in pounds of material per gallon of liquid. A listing of the average organic liquid densities for selected petrochemicals is provided in Tables 7.1-2 and 7.1-3. If the liquid density for gasoline is not known, an average value of 6.1 lbs/gallon can be assumed.

Annual Throughput: This value is the annual amount of the organic liquid that has been stored in the storage tank during the calendar year. This value must be expressed in thousands of gallons of liquid stored during the year. The following conversion factors should be used if the annual throughput is normally expressed in barrels. There are 42 gallons per barrel for U.S. petroleum products and 31.5 gallons per barrel for other U.S. liquids.

Number of Turnovers: Calculate this entry by dividing the Annual Throughput by the Tank Capacity. Express both values in thousands of gallons.

Product Factor: This factor is a dimensionless number which, for crude oil, is 0.4. For all other organic liquids, the product factor default value is 1.0.

Vapor Pressure at Storage Temperature: Enter the vapor pressure in pounds per square inch (absolute psia) for the liquid being stored at bulk liquid surface temperature.

> ***NOTE:*** If the liquid stored in the tank is listed in Table 7.1-3, use the true vapor pressure listed there. If the liquid stored is not listed on Table 7.1-3, then the true vapor pressure may be estimated using Antoine's Equation. AP42, Section 7.1 has more information on how to calculate the true vapor pressures for organic liquids using Antoine's Equation.

For Crude Oils

Use Figure 7.1-13a or 7.1-13b to calculate the true vapor pressure of the crude oil if the Reid vapor pressure is known. First find the stored liquid temperature (in Fahrenheit) on the scale at the right side of the page. Then locate the Reid vapor pressure of the liquid on the scale that is in the middle of the figure. Next, draw a straight line from the stored liquid temperature, through the Reid vapor pressure point, to the true vapor pressure at the left side of the figure. Enter the true vapor pressure reading that is indicated on the scale that is on the left side of the page.

For Refined Petroleum Stocks

The true vapor pressure values for some refined petroleum products may be obtained from Table 7.1-2. Figure 7.1-14a or 7.1-14b may be used to find the true vapor pressure if the Reid vapor pressure is known. First find the stored liquid temperature on the scale at the right of the page. Second, locate the approximate position for the Reid vapor pressure, using the slope of the distillation curve on the small graph in the center of the page. Finally, line up these two points and extend a straight line to the true vapor pressure scale at the left side of the page. Enter this value as the true vapor pressure of the liquid.

Vapor Pressure Function: This can be calculated using the following equation:

$$P^* = \frac{P_{VA}/P_A}{[1+(1-[P_{VA}/P_A])^{0.5}]^2}$$

where:

P_{VA} = vapor pressure at daily average liquid surface temperature, psia;
P_A = atmospheric pressure, psia.

P* can be read directly from Figure 7.1-19.

3) METEOROLOGICAL CONDITIONS

Average Wind Speed: This value is the average wind speed at the tank site, expressed in miles per hour. The average wind speed numbers should be used for the areas surrounding the specific cities listed in the table below. A default value of 10 miles per hour may be used

for all other locations if other site specific information is not available.

Cities	Average Wind Speed (mph)
Columbia	9.9
Kansas City	10.8
Saint Louis	9.7
Springfield	10.7

Seal Related Wind Speed Exponent: The value for the Seal Related Wind Speed Exponent may be obtained from the (n) column of Table 7.1-8.

Average Temperature: This value is the average temperature at the tank site expressed in degrees Fahrenheit. A default value of 54.5 degrees Fahrenheit may be used if other information is not available.

4) VOC EMISSION CALCULATIONS

Rim Seal Loss: This equation calculates the portion of the VOC emissions that results from losses around the rim seal of a floating roof storage tank, expressed in pounds of VOC lost per year. The Rim Seal Loss emissions from floating roof tanks with a(n) "INTERNAL" roof or "DOMED EXTERNAL" roof are not dependent on the wind speed. Therefore, the {Average Wind Speed}^ {Seal Related Wind Exponent} portion of the equation should be set to 1 (one) when calculating the Rim Seal Loss emissions. Enter the results of the calculation in the box directly below the Rim Seal Loss formula on Form 2.6.

Withdrawal Loss: This equation calculates the portion of the VOC emissions that results from filling and emptying the floating roof storage tank. Express this value in pounds of VOC lost per year.

For "EXTERNAL" Floating Roof Tanks

The **[1 + ({No. of Columns} x {Effective Column Diameter} / {Diameter})]** portion of the equation should be set to 1 (one) when calculating the Withdrawal Loss. Enter the results of the calculation in the box directly below the Withdrawal Loss formula on Form 2.6.
Note: The factor of 23.81 used in this equation converts from thousands of gallons to barrels for the Annual Throughput of petroleum products. If a non-petroleum liquid is being stored in the tank, a value of "31.75" should be substituted for the "23.81" figure.

Deck Fitting Loss: This equation calculates the portion of the VOC emissions that results from the Deck Fitting Losses from fittings and other attachments on the deck of the floating roof storage tank. Express this value in pounds of VOC lost per year. Enter the results of the calculation in the box directly below the Deck Fitting Loss formula on Form 2.6.

Deck Seam Loss: Neither internal floating roof tanks with welded decks nor external floating roof tanks have deck seam losses. Internal floating roof tanks with bolted decks may have deck seam losses. Enter the results of the calculation in the box directly below the Deck Seam Loss formula on Form 2.6.

Working Loss Emission Factor: Compute the Working Loss Emission Factor by dividing the Withdrawal Loss by the Annual Throughput (expressed in thousands of gallons) from

Block 2, Chemical Information. This will give an emission factor in pounds of VOC emitted per thousand gallons of an organic liquid processed annually.

Breathing Loss Emission Factor: Compute the Breathing Loss Emission Factor by adding the Rim Seal Loss, Deck Fitting Loss and Deck Seam Loss together. Divide by the Capacity (expressed in thousands of gallons) from Block 1, Tank Information. This will give an emission factor in pounds of VOC emitted per thousand gallons of an organic liquid stored annually.

Enter the SCC for both **Working Loss** (Withdrawal Loss) and the **Breathing Loss** (Standing Loss) in the appropriate boxes next to the Emission Factors.

ENTER THE FOLLOWING ON FORM 2.0, EMISSION POINT INFORMATION:

NOTE: USE A SEPARATE FORM 2.0 FOR THE WORKING AND BREATHING LOSS EMISSION FACTOR.

Block 4 - Enter **Annual Throughput** (Thousands of gallons).
Block 7 - Enter the **Working Loss Emission Factor** or the **Breathing Loss Emission Factor** in the VOC box.

INSTRUCTIONS

FORM 2.7 HAUL ROAD FUGITIVE EMISSIONS WORKSHEET

This form is **REQUIRED** if a facility must calculate the emission factor(s) from one or more unpaved haul roads located on the facility site. If the Form 2.7 is not used to calculate an emission factor, the company still needs to show how they calculated their Annual VMT.

Use Form 2.7 to derive an emission factor for each haul road activity, according to each industry's SIC (Standard Industrial Classification). If you decide to use Form 2.7 to derive your own emission factors for a haul road, the following instructions apply:

- Use a separate Form 2.7 for each haul road and each vehicle type if capacities of the haul trucks vary.

You may group separate haul roads as one point if certain conditions are met:

a) The physical characteristics of the roads and trucks are so similar that if separate emission factors were calculated, the results would be the same.

b) Truck and road characteristics are so different that calculation of emission factors would yield different results for the different roads. In this case, the reported emission factor is the weighted average of the factors for each road. These emission factors are "weighted" by the VMT.

Example: Suppose a facility has haul roads with VMTs of 1,000, 1,200, and 1,800 miles, respectively. The facility wishes to group and report the haul roads as one point. Further, assume the PM_{10} emission factors have been calculated to be 3.0, 3.2, and 2.1 lbs. PM_{10}/VMT, respectively.

	3.0 lbs. x 1000 VMT =	3,000 lbs.
	3.2 lbs. x 1200 VMT =	3,840 lbs.
	2.1 lbs. x 1800 VMT =	3,780 lbs.
Totals	4000 VMT	10,620 lbs.

10,620 lbs. PM_{10} ÷ 4,000 VMT = 2.655 lbs. PM_{10}/VMT.

Report the appropriate factor on Form 2.0 for the combined haul roads.

Complete **Facility Name, FIPS County Number, Plant Number and Year of Data.**
See Form 1.0 instructions, page 1.0-1.

1) HAUL ROAD INFORMATION

Point Number: This number is the unique identification number for each specific haul road. This identification number must match the point number entered on Form 1.1, Process Flow Diagram, Form 1.2, Summary of Emission Points and Form 2.0, Emission Point Information.

Length of Road: Report the length of the haul road to the nearest tenth of a mile.

Silt Content: Enter the Silt Content of the road surface, if known. Obtain the Silt Content by measuring the proportion of loose, dry surface dust that passes a 200 mesh screen, using ASTM-C-136 method. Table 13.2.2-1 at the end of this instruction set lists some typical Silt Content values. A default value of 8.3 percent may be used for the Silt Content of the road surface if no other information is available.

The PM_{10} emission factor equation of Section [5] requires that the Silt Content be entered as a percent, not the decimal equivalent. Example: If the default value of 8.3% is selected, enter as 8.3 not .083 in the formula.

Surface Material of Road: Enter the type of material that makes up the road surface.

Surface Material Moisture Content of Road: Enter the moisture content of the material that makes up the road. Determining road surface silt and moisture contents are given in AP-42 Appendices C.1 and C.2. It is emphasized that the moisture content to be used in the PM_{10} emission factor of Section [5] **must** reference dry, worst-case conditions. If the default value of 0.2% is selected, enter 0.2 not .002 in the equation.

Days of Rain with at least 0.01 Inches per Year: Enter the number of days of rain if this information is available. The default value of 105 days is the recommended value unless other specific information on the number of days of rain is available.

Type of Dust Control: Check the appropriate box for any control measures that are adequate to reduce the amount of dust released and used every working day when it does not rain. Enter the dust control method and efficiency in the appropriate boxes in Block [3] on Form 2.0, Emission Point Information.

2) HAUL TRUCK INFORMATION

If more than one haul truck is used on the same haul road, attach a page to this form that indicates the following information for each additional haul truck used.

Make/Model of Truck: Enter the Make and Model for this specific haul truck.

Unloaded Truck Weight (in Tons): List the weight of this specific haul truck when empty.

Average Weight of Material Per Load (in Tons): Enter the average weight of the haul truck per load. Calculate this figure by subtracting the Unloaded Truck Weight from the Average Loaded Truck Weight.

Average Loaded Truck Weight (in Tons): Enter the Unloaded Truck Weight plus the average amount of material that this specific haul truck hauls at one time.

Average Truck Speed (in Mph): Enter the Average Speed of the haul truck when it is loaded.

3) MATERIAL HAULED INFORMATION

Type of Material Hauled: Enter the type of material normally hauled. Some examples are gravel, fines, slag, rip rap, etc.

List Any Permit Condition Limiting the Amount Hauled: If a permit issued by an air pollution control agency has a condition limiting the amount of material hauled during the year, then report the permitted amount of material that can be hauled in this box.

Annual Amount Hauled (in Tons): Report the annual amount of material that the specific haul truck associated with this emission point hauled.

Maximum Hourly Amount Hauled: Report the maximum theoretical amount of material that this specific haul truck could haul per hour if operated every day for the entire year.

An alternative method to calculate the Maximum Hourly Amount Hauled is to divide the maximum amount hauled by the total annual hours of operation.

4) CALCULATION OF ANNUAL VEHICLE MILES TRAVELED (VMT)

Annual VMT: This figure for the Annual VMT is a calculated number and is not based on odometer readings for the specific haul truck. The formula to calculate the Annual VMT is:

Annual VMT = 2 x (Length of Haul Road) x (Annual Amount Hauled)
÷ (Average Weight of Material per Load)

Perform the Annual VMT calculation for this haul road and haul truck and enter the results. The Annual VMT units will be miles traveled.

NOTE: If the sum of all the Annual VMT Miles for all haul roads and haul trucks is less than 100 Annual VMT traveled for the entire facility, then the emissions do not need to be reported on a Form 2.0 for purposes of calculating an emissions fee. If the sum of the Annual VMT is less than 100 VMT, additional documentation should be provided to verify the actual amount of the VMT figure.

Maximum Hourly VMT: The formula to calculate the Maximum Hourly Design Rate (MHDR), is [2 x (Length of Haul Road) x (Maximum Hourly Amount Hauled)] / (Average Weight of Material per Load).

5) CALCULATION OF HAUL ROAD EMISSION FACTOR

Block 5 provides an equation from the AP-42 section on Unpaved Roads (Sec. 13.2.2) to calculate the PM_{10} emission factor. The PM_{10} Emission Factor for each haul road and specific haul truck is a calculated number. The figure can be calculated using the formula presented below:

PM10 Emission Factor =
2.6 x ({Silt Content (%)} / 12)^0.8 x [({Unloaded Truck Wt} + {Average Loaded Truck Wt}) / 6]^0.4 x [(365 - {Days of Rain}) / 365] / [{Surface Material Moisture Content (%)} /0.2]^0.3

* If average truck speed is < 15 (mph), multiply the above equation by (average speed / 15)

Calculate the PM10 **Emission Factor** for this specific haul road and enter the results. The units on the emission factor are pounds of PM_{10} emitted per VMT.

Example: Assume average truck speed is 10; unloaded truck weight is 15 tons; average loaded truck weight is 30 tons; use default values of 8.3 for silt content, 105 for days of rain and 0.2 for surface material moisture content.

2.6 x [8.3 ÷ 12]^0.8 x [(15 + 30) / 6]^0.4 x [(365 – 105) / 365] / [0.2 / 0.2]^0.3 x (10 / 15)

2.6 x 0.74 x 2.24 x 0.71 x 1 x 0.67 = 2.05 lbs PM_{10}/VMT

Instructions for Form 2.7
Haul Road Fugitive Emissions Worksheet
Continued

ENTER THE FOLLOWING ON FORM 2.0, EMISSION POINT INFORMATION:

Block 1 -	If a more specific SCC cannot be located, use the Stone Quarrying SCC number 3-05-020-11;
Block 4 -	Annual **VMT** is the Annual Throughput; units will be VMT, <u>not</u> tons.
Block 7 -	Enter the PM_{10} Haul Road Emission Factor.
Block 9 -	The applicable efficiency listed under the heading "Type of Dust Control" may be entered in the PM_{10} box. Higher control efficiency for watering of haul roads will be allowed provided appropriate records are kept.

Table 13.2.2-1. TYPICAL SILT CONTENT VALUES OF SURFACE MATERIAL ON INDUSTRIAL AND RURAL UNPAVED ROADS[a]

Industry	Road Use Or Surface Material	Plant Sites	No. Of Samples	Silt Content (%)	
				Range	Mean
Copper smelting	Plant road	1	3	16 - 19	17
Iron and steel production	Plant road	19	135	0.2 - 19	6.0
Sand and gravel processing	Plant road	1	3	4.1 - 6.0	4.8
	Material storage area	1	1	-	7.1
Stone quarrying and processing	Plant road	2	10	2.4 - 16	10
	Haul road to/from pit	4	20	5.0-15	8.3
Taconite mining and processing	Service road	1	8	2.4 - 7.1	4.3
	Haul road to/from pit	1	12	3.9 - 9.7	5.8
Western surface coal mining	Haul road to/from pit	3	21	2.8 - 18	8.4
	Plant road	2	2	4.9 - 5.3	5.1
	Scraper route	3	10	7.2 - 25	17
	Haul road (freshly graded)	2	5	18 - 29	24
Construction sites	Scraper routes	7	20	0.56-23	8.5
Lumber sawmills	Log yards	2	2	4.8-12	8.4
Municipal solid waste landfills	Disposal routes	4	20	2.2 - 21	6.4
Publicly accessible roads	Gravel/crushed limestone	9	46	0.1-15	6.4
	Dirt (i.e., local material compacted, bladed, and crowned)	8	24	0.83-68	11

[a]References 1,5-16.

INSTRUCTIONS

FORM 2.8 STORAGE PILE WORKSHEET

This form is **REQUIRED** if a facility is reporting emissions from one or more open storage piles that are on the facility site.

Due to an APCP policy change in March 1998, the methodology for calculating storage pile emissions has been modified. There are now two different categories of emissions from storage piles: **(1) activity and (2) wind erosion**. The activity portion of storage pile emissions submittals includes the vehicle activity and load in/load out components and is calculated in the same manner as in previous EIQs. The wind erosion component is now calculated using pile area **(acres)** instead of **tons** stored as the throughput.

The rationale for the separation of these two categories is the physical difference in the nature of emissions from storage piles. Load in/load out and vehicle activity emissions are generated by human activity around the pile and can be represented by tons stored in the pile. However, wind erosion emissions can occur without disturbance of the pile and only occur during specific meteorological conditions.

With the use of the revised methodology, two different Source Classification Codes (SCC) are required. For quarry and associated industry storage piles, use SCC No. 3-05-020-07, Stone Quarrying, Open Storage (lb/ton) with activity emissions and use SCC No. 3-05-025-07, Sand/Gravel Storage Piles (lb/acre) with wind erosion emissions. **This will require the use of two emission point information forms (Form 2.0) for each different type of storage pile but the point number should be the same.** Assign an activity SCC associated with a pound per ton emission factor to one Form 2.0 and a wind erosion SCC associated with a pound per acre emission factor to the other. For other types of storage piles such as coal, a facility may use an industry-specific SCC if appropriate for activity emissions (lb/ton) and wind erosion emissions (lb/acre).

If you want to continue using SCC No. 3-05-020-07 with the default PM_{10} emission factor of 0.12 lb/ton for all storage pile emissions, complete all the information on Form 2.8 for Block 1, STORAGE PILE INFORMATION and report the information on one Form 2.0. If you are not using SCC emission factors, fill out Form 2.8 completely.

Use Form 2.8 to derive two emission factors for each storage pile, using various criteria inputs. When calculating the PM_{10} emission factor for a storage pile, the following instructions apply.

Use a separate Form 2.8 for each storage pile emission point identified on Form 1.1, Process Flow Diagram and Form 1.2, Summary of Emission Points.

You may group and report separate storage piles as one point if they meet certain conditions: a) the physical characteristics of the pile and the surrounding environment are so similar that, if you calculate separate emission factors, the results would be the same; or b) the physical characteristics of the piles and the characteristics of the surrounding environment are so different that if you calculated emission factors for each pile, the results would not be equal. In this case, the reported emission factor will be the weighted average of the emission factor for each pile.

Activity Emission Factor Example: Suppose a facility has three distinct storage piles with annual throughputs of 100,000, 200,000 and 500,000 tons, respectively. Also assume the respective calculated PM_{10} activity emission factors are .18, .135 and .165 lbs/ton of material stored.

100,000 tons x .18 lbs/ton	=	18,000 lbs.
200,000 tons x .135 lbs/ton	=	27,000 lbs.
500,000 tons x .165 lbs/ton	=	82,500 lbs.
800,000 tons		127,500 lbs.

127,500 lbs. PM_{10} / 800,000 tons = .1594 lbs. PM_{10} /ton.

You would enter this weighted average result of .1594 on Form 2.0 for the activity portion as the emission factor for the point.

Complete Facility Name, County Number, Plant Number and Year of Data.
See Form 1.0 instructions, page 1.0-1.

1) STORAGE PILE INFORMATION

Point Number: This number is the unique identification number for each specific storage pile. This identification number must match the point number entered on Form 1.1, Process Flow Diagram; Form 1.2, Summary of Emission Points; and Form 2.0, Emission Point Information.

NOTE: Again, using the revised approach, there will be two Form 2.0 completed but the same point number will be used for each storage pile or group (one for activity and one for wind erosion).

SCC Number for Activity: List the SCC in tons that identifies the type of storage material for activity emissions.

SCC Number for Wind Erosion: List the SCC in **acres** that identifies the type of storage material for wind erosion emissions.

Type of Material Stored: Enter the type of material in the open storage pile for this emission point. Examples of some common storage pile materials include gravel, fines, pea gravel, crushed stone dust, crushed cinder, etc.

Moisture Content of Stored Material: Enter the moisture content of the storage pile if known. For examples, refer to Table 13.2.4-1 or Table 2.1.2-2 at the end of this instruction set. You may use a default value of 0.7% for the moisture content of the storage pile if no

other information is available.

Use the moisture content percentage, not the decimal equivalent, when calculating the Load In-Load Out Factor in Section 3-A. Example: If the default value of 0.7% is selected, enter as .7 in the formula.

Area of Storage Piles: Estimate the number of acres of land that is under this specific storage pile.

Silt Content: Enter the Silt Content of the storage pile if known. Calculate the Silt Content by measuring the proportion of dry aggregate material that passes a 200 mesh screen, using ASTM-C-136 method. The Silt Content for some common materials stored in open storage piles is listed in Table 13.2.4-1 and Table 2.1.2-2. You may use a default value of 1.6% may be used for the storage pile if no other information is available.

Use the Silt Content percentage, not the decimal equivalent, when calculating the Wind Erosion and Activity Factors in Section 3-B and 3-C.
Example: If the default value of 1.6% is selected, enter as 1.6 in the formula.

Storage Duration: Enter the average number of days per year that aggregate material remains in the storage pile. Table 2.1.2-2 lists some estimates on the storage duration for various types of storage material.

Annual Amount Stored: Enter the total amount of all aggregate material produced and subsequently stored in the storage pile during the year. Enter tons of material stored per year.

Maximum Hourly Amount Stored: List the largest quantity of aggregate that can be loaded into or out of the storage pile in an hour. Enter the maximum number of tons of material stored per hour.

Raw Material Loading Method: Check the box that best corresponds to the main method of loading or removing material from the storage pile.

Raw Material Unloading Method: Check the box that best corresponds to the main method of unloading or adding material to the storage pile.

2) OTHER FACTORS AFFECTING EMISSION RATES

Mean Wind Speed: The statistical mean of all wind speeds at a height 10 centimeters above the storage piles, regardless of the wind direction. You may use a default value of 10 miles per hour for the Mean Wind Speed figure.

Percent of Time the Wind Velocity is Greater than 12 MPH:
The percent of time that the unobstructed wind velocity exceeds 12 miles per hour at the mean pile height. You may use a default value of 32%.

Dry Days Per Year: The number of days that at least 0.01 inches of rain did not fall. You may use a default value of 260 days.

Vehicle Activity Factor: Use the following table to select the correct value for VAF (Vehicle Activity Factor) for this storage pile. You may use a default value of 1.0.

MATERIAL	VAF VALUE
Coal	0.08
Coke	0.25
Gravel	0.25
Iron Ore	0.06
Limestone	0.25
Sand (Fines)	1.00
Slag	1.00
Top Soil (Overburden)	0.25
All Others	1.00

3) STORAGE PILE EMISSION FACTOR CALCULATIONS

A.1 LOAD IN-LOAD OUT FACTOR

The Load In-Load Out factor is a calculated number that represents the amount of PM_{10} emissions that will result from the Load In-Load Out process. Use this formula to calculate the factor:

Load In-Load Out Factor =
0.00224 x ({Mean Wind Speed} / 5)^1.3 / ({Moisture Content (%)} / 2)^1.4 lb/ton
(The Values 1.3 and 1.4 are exponents).

Perform the calculation for the Load In-Load Out Factor and enter the results in Block 3-A.1 of this form.

A.2 VEHICLE ACTIVITY FACTOR

The Activity Factor is a calculated number that represents the amount of PM_{10} released into the atmosphere due to vehicular traffic around the storage pile. Use this formula to calculate the factor:

Activity Factor =
0.05 x ({Silt Content (%)} / 1.5) x ({Dry Days per Year} / 235)
x {Vehicle Activity Factor} lb/ton

Perform the calculation for the Activity Factor and enter the results in Block 3-A.2 of this form

B. WIND EROSION PORTION FACTOR

The Wind Erosion Factor is a calculated number that represents the amount of PM_{10} released into the atmosphere from this storage pile due to wind erosion. Use this formula to calculate the factor:

Wind Erosion Factor =
0.85 x ({Silt Content (%)} / 1.5) x ({Storage Duration (Days)}
x ({Dry Days per Year} / 235) x ({% of Time Wind > 12 MPH} / 15) lb/acre

Perform the calculation for the Wind Erosion Factor and enter the results in Block 3-B of this form.

4) COMBINED ANNUAL STORAGE PILE PM_{10} EMISSION FACTORS

(A) Add the Load In-Load Out Factor (3-A.1), and Vehicle Activity Factor (3-A.2) together and enter the result in Block 4-A of this form. When using this worksheet, always express the units as pounds of PM_{10} emitted per ton of aggregate stored in piles.

(B) Enter the result of the calculation in Block 3-B. When using this worksheet, always express wind erosion units in pounds of PM_{10} per acre of storage.

ENTER THE FOLLOWING ON FORM 2.0, EMISSION POINT INFORMATION FOR THE ACTIVITY PORTION OF STORAGE PILE EMISSIONS:

Block 1 - Enter the SCC. If you use the default SCC, enter **3-05-020-07 (lb/ton).**

Block 7 - Enter the combined Activity PM_{10} Emission Factor (Block 4-A) for this storage pile in the appropriate box.

Instructions for Form 2.8
Storage Pile Worksheet
Continued

ENTER THE FOLLOWING ON A SEPARATE FORM 2.0, EMISSION POINT INFORMATION FOR THE WIND EROSION PORTION OF STORAGE PILE EMISSIONS:

Block 1 - Enter the SCC. If you use the default SCC, enter **3-05-025-07 (lb/acre).**

Block 7 - Enter the Wind Erosion PM_{10} Emission Factor (Block 4-B) for this storage pile in the appropriate box.

Table 13.2.4-1. TYPICAL SILT AND MOISTURE CONTENTS OF MATERIALS AT VARIOUS INDUSTRIES[a]

Industry	No. Of Facilities	Material	Silt Content (%)			Moisture Content (%)		
			No. Of Samples	Range	Mean	No. Of Samples	Range	Mean
Iron and steel production	9	Pellet ore	13	1.3 - 13	4.3	11	0.64 - 4.0	2.2
		Lump ore	9	2.8 - 19	9.5	6	1.6 - 8.0	5.4
		Coal	12	2.0 - 7.7	4.6	11	2.8 - 11	4.8
		Slag	3	3.0 - 7.3	5.3	3	0.25 - 2.0	0.92
		Flue dust	3	2.7 - 23	13	1	—	7
		Coke breeze	2	4.4 - 5.4	4.9	2	6.4 - 9.2	7.8
		Blended ore	1	—	15	1	—	6.6
		Sinter	1	—	0.7	0	—	—
		Limestone	3	0.4 - 2.3	1.0	2	ND	0.2
Stone quarrying and processing	2	Crushed limestone	2	1.3 - 1.9	1.6	2	0.3 - 1.1	0.7
		Various limestone products	8	0.8 - 14	3.9	8	0.46 - 5.0	2.1
Taconite mining and processing	1	Pellets	9	2.2 - 5.4	3.4	7	0.05 - 2.0	0.9
		Tailings	2	ND	11	1	—	0.4
Western surface coal mining	4	Coal	15	3.4 - 16	6.2	7	2.8 - 20	6.9
		Overburden	15	3.8 - 15	7.5	0	—	—
		Exposed ground	3	5.1 - 21	15	3	0.8 - 6.4	3.4
Coal-fired power plant	1	Coal (as received)	60	0.6 - 4.8	2.2	59	2.7 - 7.4	4.5
Municipal solid waste landfills	4	Sand	1	—	2.6	1	—	7.4
		Slag	2	3.0 - 4.7	3.8	2	2.3 - 4.9	3.6
		Cover	5	5.0 - 16	9.0	5	8.9 - 16	12
		Clay/dirt mix	1	—	9.2	1	—	14
		Clay	2	4.5 - 7.4	6.0	2	8.9 - 11	10
		Fly ash	4	78 - 81	80	4	26 - 29	27
		Misc. fill materials	1	—	12	1	—	11

[a] References 1-10. ND = no data.

TABLE 2.1.2-2. REPRESENTATIVE SILT CONTENT, MOISTURE CONTENT AND THE DURATION OF STORAGE PARAMETERS FOR SPECIFIC STORAGE MATERIALS[4,5]

Material in storage	Silt content, weight %	Moisture content, weight %	Duration of storage, days
Coal	4	6	107
Coke	1	1	50
Iron ore	11	1	43
Limestone	2	2	76
Sand	10		
Sinter	1.5	1	90
Slag	2	1	60
Top soil	40		

INSTRUCTIONS
FORM 2.9 STACK TEST
CONTINUOUS EMISSION MONITORING WORKSHEET

This form is **REQUIRED** only if stack tests or continuous emission monitoring results are used to derive emission factors.

Complete this form if you use the results from a stack test or a Continuous Emission Monitor (CEM) to calculate an annual emissions factor for a pollutant emitted from the tested stack. If the testing determined the emission rate for more than one pollutant, you must complete a separate Form 2.9 to calculate the emission factor for each pollutant. The same emission point may emit other pollutants that do not have an emission rate established by the testing. If a stack emits an untested pollutant, determine the amount of the pollutant emitted by another method and enter it on Form 2.0, Emission Point Information, along with the stack test emissions.

The documentation from the testing report provided to verify the emission and production rate should include the minimum number of summary pages necessary to validate the emission and production rate and other testing information reported.

> *NOTE:* Do **NOT** send the entire stack test report or all the results from the continuous emissions monitoring.

Complete **Facility Name, FIPS County Number, Plant Number and Year of Data.**
See Form 1.0 instructions, page 1.0-1.

Point Number: This number is the unique identification number for each specific stack or CEM location. This identification number must match the point number entered on Form 1.1, Process Flow Diagram, Form 1.2, Summary of Emission Points and Form 2.0, Emission Point Information.

Source Classification Code (SCC) Number: List the SCC that identifies the process.

Stack Number: This is the number used to uniquely identify the specific stack. This stack number must match the stack number shown in the flow diagram of Form 1.1.

Pollutant Tested: This is the criterion or toxic pollutant tested.

CAS Number: Enter the Chemical Abstract Service (CAS) Registry number for the chemical tested.

1) EMISSION SOURCE INFORMATION

Equipment Make/Model: Enter the description of the type of equipment that is the source of emission.

Control Device Type: Give a general description of the type of any pollution control devices used for the pollutant tested. The pollutant for which the control device is used must be the same as the pollutant tested in the stack test or monitoring.

Control Efficiency (%): This is the estimated efficiency of the control equipment or a measure of the effectiveness of the control equipment in reducing the amount of the specific pollutant tested and released.

Limitations on Emissions, Production or Operating Time (if any): These are any enforceable conditions that may have been placed on the process by an air permit or other restriction. Typically, air permit conditions may limit the annual amount of the emissions or the amount of a pollutant that may be emitted in a specific time. The permit might also restrict the production rate to a certain maximum level or limit the amount of time that the process may be operated. Any condition that creates an enforceable limitation on the emission point should be entered in this box.

Instructions for Form 2.9
Stack Test Continuous Emission Monitoring Worksheet
Continued

2) STACK TEST INFORMATION

Testing Firm Name and Address: Enter the name and address of the firm that actually performed the stack test.

U.S. Environmental Protection Agency (EPA) Method(s) Used: Enter the number of the EPA Reference Method followed in testing procedures for the specific pollutant in the stack test.

Test Date(s): Enter the date and/or dates of the stack test for the pollutant being tested.

Results: Enter the results of the stack test as they apply to meeting any limitations or to finding the emission rate of the pollutant. You may report this information in an attachment.

Compliance: Compliance means whether the stack test indicated the emissions from the stack were within any permit or other limiting conditions. Checking the Yes box means that the test indicated any limiting conditions were met.

> *NOTE:* Do **NOT** send the entire stack test report or all the results from the continuous emissions monitoring.

How Tested: This box identifies the conditions of the stack test. Checking the Operational Rate means that the stack test was conducted when the equipment was running at the normal operating rate. The operational rate test is acceptable for calculating the actual emissions from the stack test. Checking the Maximum Design Rate indicates the stack test was performed while the equipment was running at the maximum rate possible. The Maximum Design Rate test can be used only for calculating the maximum potential emissions for the pollutant. The Both box would indicate that both operating conditions were tested.

Latest Calibration of Testing Equipment: This is the last date that the testing equipment passed a calibration test before it was used to perform this stack test. NOTE: Failure to calibrate test equipment may result in rejection of test data.

Agency Observing Test: This indicates which agency observed the test. Checking the EPA box would indicate that an observer from the Environmental Protection Agency was present during the test. Checking the MO DNR box would indicate that a member of the Missouri Department of Natural Resources was present during the testing. Checking the Other box indicates a member of an agency other than the EPA or MO DNR was present. Please fill in the agency represented.

> *NOTE:* If no box is selected the APCP will not accept the test, unless prior approval is given.

Name of Observer(s): This is the full name of the person(s) observing the test. Please include the full name of each agency observer if more than one person or agency was represented.

3) CONTINUOUS EMISSION MONITORING INFORMATION

Concentration of Pollutant: This is the weighted average concentration of the pollutant emitted as indicated by the monitoring results for the entire year. Use the WEIGHTED AVERAGE concentration figure to determine the emissions of the pollutant. Obtain the weighted average for the concentration figure by multiplying the concentration and flow rate figures for each averaging period and summing these numbers. Then divide the figure calculated in step 1 by the sum of the average flow rates for the entire year. This will give the weighted average for the concentration figure for the entire year. Make sure to enter the concentration figure in mass per volume of gas in the Units box.

Flow Rate of Stack: This is the average flow rate indicated by the monitoring results for the entire year. Make sure to enter the flow rate figure in volume of gas per time in the Units box.

Latest Calibration of Monitor: This is the date the monitoring system was last calibrated.

Results of Calibration: Give the results of the latest calibration test. Typically, the results of CEM calibration are expressed with relative accuracy or percent variation from a known test standard.

Monitor Averaging Period: This is the time frame for which the CEM averages the results of the monitoring.

% Monitor Down Time: This is the percentage of time that the CEM system has not been operating or has not been operating properly for the year. A high percentage of Down Time for the CEM may result in rejection of the data for determining the emissions of a pollutant.

4) EMISSION FACTOR CALCULATION

Emission Rate: This is the rate determined from a stack test done under operating conditions or the average rate from continuous monitoring for the entire year. Report the emission rate in pounds of pollutant emitted per hour of operation. The emission rate can be based on input or output rates from the process. The method should be consistent with that used in the production rate, in the testing and the annual throughput figures entered on Form 2.0, Emission Point Information.

Production Rate: This is the amount of material used in or produced by the process during the stack test or monitoring. Express the production rate figure in units per hour of operation. Express the production rate in the same units as the **Annual Throughput** in Block 4 on Form 2.0. The units must correspond to the SCC Emission Factor Units. **Documentation** should include a summary page from the test data that verifies both the emission and the production rates.

Emission Factor: This is found by dividing the emission rate by the production rate. Additionally, if the stack has a control device to control the pollutant of the test or monitoring, the emission factor found above should also be divided by [(100 minus the Control Efficiency Percent) divided by 100]. Enter this calculated emission factor in the Emission Factor box. Also, enter the emission factor units expressed in pounds per unit in the Units box.

Instructions for Form 2.9
Stack Test Continuous Emission Monitoring Worksheet
Continued

ENTER THE FOLLOWING ON FORM 2.0, EMISSION POINT INFORMATION:

Block 3 - If a control device is being used, enter the **Control Device Type** and **Control Efficiency (%)**.

Block 7 - Enter in the appropriate pollutant box, the calculated **Emission Factor** for the pollutant tested at this Stack or CEM emission point.

If the stack is the source of another pollutant that was not tested, some other method must determine the amount of that pollutant and be entered on Form 2.0.