2020 National Emissions Inventory Technical Support Document: Nonpoint Gasoline Distribution

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18.1 Sector Descriptions and Overview

This section includes discussion of all nonpoint sources in three EIS sectors: Bulk Gasoline Terminals, Gas Stations, and Industrial Processes – Storage and Transfer. Many of the sources in these sectors include sources reported to the point inventory as well; therefore, the EPA nonpoint survey is useful to avoid double-counting S/L/T-reported point emissions with EPA-estimated nonpoint emissions.

This section is broken into two categories: those sources related to stage 1 gasoline distribution and those related to aviation gasoline.

18.1.1 Stage 1 gasoline distribution

Stage 1 gasoline distribution is covered by the NEI in both the point and nonpoint data categories. In general terms, Stage 1 gasoline distribution is the emissions associated with gasoline handling excluding emissions from refueling activities. Stage I gasoline distribution includes the following gasoline emission points: 1) bulk terminals; 2) pipeline facilities; 3) bulk plants; 4) tank trucks; and 5) unloading at service stations. Emissions from Stage I gasoline distribution occur as gasoline vapors are released into the atmosphere. These Stage I processes are subject to EPA's maximum available control technology (MACT) standards for gasoline distribution [ref 1].

Emissions from gasoline distribution at bulk terminals and bulk plants take place when gasoline is loaded into a storage tank or tank truck, from working losses (for fixed roof tanks), and from working losses and roof seals (for floating roof tanks). Working losses consist of both breathing and emptying losses. Breathing losses are the expulsion of vapor from a tank vapor space that has expanded or contracted because of daily changes in temperature and barometric pressure; these emissions occur in the absence of any liquid level change in the tank. Emptying losses occur when the air that is drawn into the tank during liquid removal saturates with hydrocarbon vapor and expands, thus exceeding the fixed capacity of the vapor space and overflowing through the pressure vacuum valve [ref 2].

Emissions from tank trucks in transit occur when gasoline vapor evaporates from (1) loaded tank trucks during transportation of gasoline from bulk terminals/plants to service stations, and (2) empty tank trucks returning from service stations to bulk terminals/plants [ref 3]. Pipeline emissions result from the valves and pumps found at pipeline pumping stations and from the valves, pumps, and storage tanks at pipeline breakout stations. Stage I gasoline distribution emissions also occur when gasoline vapors are displaced from storage tanks during unloading of gasoline from tank trucks at service stations (Gasoline Service Station Unloading) and from gasoline vapors evaporating from service station storage tanks and from the lines going to the pumps (Underground Storage Tank Breathing and Emptying).

Table 18-1 shows all non-Aviation Gasoline SCCs in the nonpoint data category for EIS sectors Bulk Gasoline Terminals, Gas Stations, and Industrial Processes – Storage and Transfer. For Stage 1 Gasoline Distribution, the nonpoint SCCs covered by the EPA estimates are also noted. The SCC level 2, 3 and 4 SCC descriptions are also provided. The SCC level 1 description is "Storage and Transport" for all SCCs.

Table 18-1: Nonpoint bulk gasoline terminals, gas stations, and storage and transfer SCCs in the NEI

SCC	Description	Sector
2501050120	Petroleum and Petroleum Product Storage; Bulk Terminals: All Evaporative Losses; Gasoline	Bulk Gasoline Terminals
2501055120	Petroleum and Petroleum Product Storage; Bulk Plants: All Evaporative Losses; Gasoline	Bulk Gasoline Terminals
2501060051	Petroleum and Petroleum Product Storage; Gasoline Service Stations; Stage 1: Submerged Filling	Gas Stations
2501060052	Petroleum and Petroleum Product Storage; Gasoline Service Stations; Stage 1: Splash Filling	Gas Stations
2501060053	Petroleum and Petroleum Product Storage; Gasoline Service Stations; Stage 1: Balanced Submerged Filling	Gas Stations
2501060201	Petroleum and Petroleum Product Storage; Gasoline Service Stations; Underground Tank: Breathing and Emptying	Gas Stations
2501070053	Petroleum and Petroleum Product Storage; Diesel Service Stations; Stage 1: Balanced Submerged Filling	Gas Stations
2501995120	Petroleum and Petroleum Product Storage; All Storage Types: Working Loss; Gasoline	Industrial Processes - Storage and Transfer
2505010000	Petroleum and Petroleum Product Transport; Rail Tank Car; Total: All Products	Industrial Processes - Storage and Transfer
2505020000	Petroleum and Petroleum Product Transport; Marine Vessel; Total: All Products	Industrial Processes - Storage and Transfer
2505020030	Petroleum and Petroleum Product Transport; Marine Vessel; Crude Oil	Industrial Processes - Storage and Transfer
2505020060	Petroleum and Petroleum Product Transport; Marine Vessel; Residual Oil	Industrial Processes - Storage and Transfer
2505020090	Petroleum and Petroleum Product Transport; Marine Vessel; Distillate Oil	Industrial Processes - Storage and Transfer
2505020120	Petroleum and Petroleum Product Transport; Marine Vessel; Gasoline	Industrial Processes - Storage and Transfer
2505020150	Petroleum and Petroleum Product Transport; Marine Vessel; Jet Naphtha	Industrial Processes - Storage and Transfer

SCC	Description	Sector
2505020180	Petroleum and Petroleum Product Transport; Marine Vessel; Kerosene	Industrial Processes - Storage and Transfer
2505030120	Petroleum and Petroleum Product Transport; Truck; Gasoline	Industrial Processes - Storage and Transfer
2505040120	Petroleum and Petroleum Product Transport; Pipeline; Gasoline	Industrial Processes - Storage and Transfer
2510000000	Organic Chemical Storage; All Storage Types: Breathing Loss; Total: All Products	Industrial Processes - Storage and Transfer
2520010000	Inorganic Chemical Storage; Commercial/Industrial: Breathing Loss; Total: All Products	Industrial Processes - Storage and Transfer

18.1.2 Aviation gasoline distribution, stage 1 and 2

Aviation gasoline (also called "AvGas") is the only aviation fuel that contains lead as a knock-out component for small reciprocating, piston-engine crafts in civil aviation [ref 4]. Commercial and military aviation rarely use this fuel. AvGas is shipped to airports and is filled into bulk terminals, and then into tanker trucks. These processes fall under the definition of stage 1, displacement vapors during the transfer of gasoline from tank trucks to storage tanks, and vice versa. Stage 2 involves the transfer of fuel from the tanker trucks into general aviation aircraft.

Table 18-2 shows, for Aviation Gasoline, the nonpoint SCCs covered by the EPA estimates and by the S/L/T agencies that submitted data. The SCC level 2, 3 and 4 SCC descriptions are also provided. The SCC level 1 description is "Storage and Transport" for all SCCs.

Table 18-2: Nonpoint aviation gasoline distribution SCCs in the NEI

SCC	Description	Sector
2501080050	Petroleum and Petroleum Product Storage; Airports: Aviation Gasoline; Stage 1: Total	Gas Stations
2501080100	Petroleum and Petroleum Product Storage; Airports: Aviation Gasoline; Stage 2: Total	Gas Stations
2501080201	Petroleum and Petroleum Product Storage; Airports: Aviation Gasoline; Underground Tank: Breathing and Emptying	Gas Stations

18.2 Sources of data

Sources in the EIS sectors for Bulk Gasoline Terminals, Gas Stations, and Industrial Processes – Storage and Transfer do not focus solely on gasoline; however, for the purposes of developing the NEI, these SCCs are the only ones that EPA estimates in these sectors. EPA does not develop calculation tools that estimate emissions from transfer of naphtha, distillate oil, inorganic chemicals, kerosene, residual oil, or crude oil. Therefore, sector level emissions for these three EIS sectors will include sources not related to gasoline distribution, some from the point inventory.

A list of agencies that submitted emissions for bulk gasoline terminals, aviation gasoline distribution, and Stage 1 gasoline distribution from the gas stations and storage and transport sectors is provided in Section 6.2.3.

18.3 EPA-developed estimates

Bulk Terminals

The calculations for estimating VOC and HAP emissions from bulk terminals involve first multiplying the 1998 national VOC emissions developed in support of the Gasoline Distribution MACT standard by the ratio of the national volume of wholesale gasoline supplied between 1998 and 2020. Emissions from HAPs are calculated by multiplying VOC emissions by a national average speciation profile. National VOC and HAP emissions are allocated to states using data on refinery, bulk terminal, and natural gas plant stocks of motor gasoline in each state [ref 19]. State-level VOC and HAP emissions are then allocated to each county based on employment at petroleum bulk stations and terminals from the US Census County Business Patterns data for NAICS 42471 (Petroleum Bulk Stations and Terminals) [ref 10].

Pipelines

The calculations for estimating VOC and HAP emissions from pipelines involve first multiplying the 1998 national VOC emissions developed in support of the Gasoline Distribution MACT standard by the 2020 to 1998 ratio of national volume of wholesale gasoline supplied. Emissions from HAPs are calculated by multiplying VOC emissions by a national average speciation profile. National VOC and HAP emissions are allocated to Petroleum Administration for Defense (PAD) District using data on the movement of finished motor gasoline in PAD District [ref 21]. PAD District-level VOC and HAP emissions are then allocated to each county based on employment at petroleum bulk stations and terminals from the US Census County Business Patterns data for NAICS 42471 (Petroleum Bulk Stations and Terminals) [ref 10].

Bulk Plants

The calculations for estimating VOC and HAP emissions from bulk plants involve first calculating bulk plant gasoline throughput in the US based on data from the U.S. Energy Information Administration (EIA) [ref 5]. National bulk plant gasoline throughput is then allocated to each county based on the number of petroleum bulk stations and terminals from the US Census County Business Patterns data for NAICS 42471 [ref 10]. The number of petroleum bulk stations and terminals by county is multiplied by the emissions factor for VOC to estimate VOC emissions from bulk plants. County-level benzene speciation profiles are multiplied by VOC emissions to estimate benzene emissions from bulk plants. National average speciation profiles for all other HAPs are multiplied by VOC emissions to estimate HAP emissions from bulk plants.

Tank Trucks in Transit

The calculations for estimating VOC and HAP emissions from tank trucks in transit involve first calculating county-level total gasoline consumption by summing onroad gasoline consumption and nonroad gasoline consumption in each county. County-level gasoline consumption is multiplied by the emissions factor for VOC to estimate VOC emissions from tank trucks in transit. County-level benzene speciation profiles are multiplied by VOC emissions to estimate benzene emissions from tank trucks in transit. National average speciation profiles for all other HAPs are multiplied by VOC emissions to estimate HAP emissions from tank trucks in transit.

Underground Storage Tank (UST) Breathing and Storing

The calculations for estimating VOC and HAP emissions from UST breathing and storing involve first calculating county-level gasoline consumption by summing onroad gasoline consumption and nonroad gasoline consumption in each county. County-level gasoline consumption is multiplied by the emissions factor for VOC to estimate VOC emissions from UST breathing and storing. County-level benzene speciation profiles are multiplied by VOC emissions to estimate benzene emissions from UST breathing and storing. National average speciation profiles for all other HAPs are multiplied by VOC emissions to estimate HAP emissions from UST breathing and storing.

Gasoline Service Station Unloading

The calculations for estimating VOC and HAP emissions from gasoline service station unloading involve first calculating county-level total gasoline consumption by summing monthly onroad gasoline consumption and nonroad gasoline consumption in each county by fuel subtype. Monthly county-level gasoline consumption is then allocated to submerged, splash, and balanced filling technologies based on assumptions about the percentage of each filling technology used in each county. True vapor pressure is calculated for each county, month, and fuel subtype. Uncontrolled loading loss of liquid is calculated using true vapor pressure, temperature, molecular weight, and a saturation factor for the filling technology. Uncontrolled loading loss of liquid loaded is multiplied by monthly county-level gasoline consumption by fuel type to estimate VOC emissions from loading loss. Controlled VOC emissions are calculated by multiplying VOC emissions from loading loss by a control efficiency value. Controlled VOC emissions are subtracted from VOC emissions from loading loss to estimate monthly county-level VOC emissions by fuel subtype. Total county-level VOC emissions are calculated by summing monthly county-level VOC emissions by fuel subtype. County-level benzene speciation profiles are multiplied by VOC emissions to estimate benzene emissions from gasoline service station unloading. National average speciation profiles for all other HAPs are multiplied by VOC emissions to estimate HAP emissions from gasoline service station unloading.

Aviation Gasoline Stage 1

The calculations for estimating emissions from stage 1 aviation gasoline distribution involve first estimating the amount of aviation gasoline consumed in each county, based on state-level aviation gasoline consumption data from the Energy Information Administration (EIA) [ref 7]. State-level aviation gasoline consumption is distributed to the counties based on the proportion of Landing-Take Offs (LTOs) [ref 11]. The total amount of gasoline consumed is used to estimate non-fugitive and fugitive VOC emissions, as well as hazardous air pollutant (HAP) emissions.

Aviation Gasoline Stage 2

The calculations for estimating emissions from stage 2 aviation gasoline distribution involve first estimating the amount of aviation gasoline consumed in each county based on state-level aviation gasoline consumption data from the Energy Information Administration (EIA) [ref 7]. State-level aviation gasoline consumption is distributed to the counties based on the proportion of Landing-Take Offs (LTOs) [ref 11]. The total amount of gasoline consumed is used to estimate VOC and hazardous air pollutant (HAP) emissions.

18.3.1 Activity data

Bulk Terminals and Pipelines

Emissions from bulk terminals and pipelines are calculated by growing the 1998 emissions estimates developed in support of the Gasoline MACT standard. Therefore, there is no activity data for this source category.

Bulk Plants

The activity data for estimating emissions from bulk plants are national volume of bulk plant gasoline throughput. The EIA's Petroleum Navigator reports the volume of finished motor gasoline supplied in the U.S [ref 5]. The volume of finished motor gasoline is assumed to be the same as total gasoline consumption, and the volume of bulk plant gasoline throughput is assumed to be 9 percent of total gasoline consumption [ref 6].

$$GT_{US,bp} = V_{US} \times 0.09 \quad (1)$$

Where:

$GT_{US,bp}$	=	Bulk plant gasoline throughput in the U.S., in thousand barrels
V_{US}	=	Volume of finished motor gasoline in the U.S., in thousand barrels

Tank Trucks in Transit

The activity data for tank trucks in transit is county-level total gasoline consumption. State-level onroad motor gasoline consumption and nonroad gasoline consumption are estimated by splitting total motor gasoline consumption from EIA's State Energy Data System (SEDS) [ref 7] in to onroad and nonroad gasoline consumption using state-level MOVES data on onroad and nonroad CO_2 emissions [ref 8]. State-level onroad motor gasoline consumption is then allocated to the county, month, and fuel subtype using a MOVES-derived ratio of county onroad CO_2 to state onroad CO_2. State-level nonroad motor gasoline consumption is allocated to the county, month, and fuel subtype using the MOVES-derived ratio of county nonroad CO_2 to state nonroad CO_2. County-level onroad consumption and county-level nonroad consumption are estimated by summing county-level monthly consumption estimates.

$$GC_{OR,c} = \sum GC_{OR,m} \quad (2)$$

Where:

$GC_{OR,c}$	=	Onroad gasoline consumption in county *c*, in gallons
$GC_{OR,m}$	=	Onroad gasoline consumption in county *c* for month *m*, in gallons

$$GC_{NR,c} = \sum GC_{NR,m} \quad (3)$$

Where:

$GC_{NR,c}$	=	Nonroad gasoline consumption in county *c*, in gallons
$GC_{NR,m}$	=	Nonroad gasoline consumption in county *c* for month *m*, in gallons

County-level tank truck gasoline throughput is estimated by summing county-level onroad and nonroad estimates, and multiplying the sum by 1.09 to account for gasoline that is transported more than once in a given area (i.e., transported from bulk terminal to bulk plant and then from bulk plant to service station) [ref 6].

$$GC_{c,t} = (GC_{OR,c} + GC_{NR,c}) \times 1.09 \tag{4}$$

Where:

$GC_{c,t}$	=	Total gasoline consumption in county *c*, in gallons
$GC_{OR,c}$	=	Onroad gasoline consumption in county *c*, in gallons
$GC_{NR,c}$	=	Nonroad gasoline consumption in county *c*, in gallons

<u>Underground Storage Tank (UST) Breathing and Storing</u>

The activity data for underground storage tank breathing and storing is county-level gasoline consumption, calculated as described above in the tank trucks in transit section.

<u>Gasoline Service Station Unloading</u>

The activity data for gasoline service station unloading is county-level total gasoline consumption for each month and fuel subtype. State-level onroad motor gasoline consumption and nonroad gasoline consumption are estimated by splitting total motor gasoline consumption from SEDS [ref 7] into onroad and nonroad consumption using state-level MOVES data on onroad and nonroad CO_2 emissions [ref 8]. State-level onroad motor gasoline consumption is then allocated to the county, month, and fuel subtype using a MOVES-derived ratio of county onroad CO_2 to state onroad CO_2. State-level nonroad motor gasoline consumption is allocated to the county, month, and fuel subtype using the MOVES-derived ratio of county nonroad CO_2 to state nonroad CO_2.

County-level gasoline consumption is estimated by summing onroad gasoline consumption and nonroad gasoline consumption and multiplying the sum by 1.09 to account for gasoline that is transported more than once in a given area (i.e., transported from bulk terminal to bulk plant and then from bulk plant to service station) [ref 6].

$$GC_{c,t,m,f} = (GC_{c,OR,m,f} + GC_{c,NR,m,f}) \times 1.09 \tag{5}$$

Where:

$GC_{c,t,m,f}$	=	Total gasoline consumption in county *c* for month *m* for fuel subtype *f*, in gallons
$GC_{c,OR,m,f}$	=	Onroad gasoline consumption in county *c* for month *m* for fuel subtype *f*, in gallons
$GC_{c,NR,m,f}$	=	Nonroad gasoline consumption in county *c* for month *m* for fuel subtype *f*, in gallons

The county-level gasoline consumption is allocated to submerged, splash, and balanced filling technologies. Percentages of each filling technology are derived from the EIIP study [ref 3]. State, local, and tribal (SLT) agencies may submit input templates to update theses default assumptions about the percentage of delivered fuel by filling technology.

$$GC_{c,ft,m,f} = GC_{c,t,m,f} \times Perc_{ft,c} \tag{6}$$

Where:

$GC_{c,ft.m,f}$ = Total gasoline consumption in county c for filling technology ft for month m for fuel subtype f, in gallons
$GC_{c,t,m,f}$ = Total gasoline consumption in county c for month m for fuel subtype f, in gallons
$Perc_{ft,c}$ = Percentage of filling technology ft in county c

Aviation Gasoline Stage 1 and 2

The activity data for this source category is the amount of aviation gasoline consumed, which is estimated using data from the EIA's State Energy Data System (SEDS) [ref 7]. The SEDS MSN Code AVTCP is used to identify the total consumption of aviation gasoline in units of thousand barrels. Data are then converted to units of gallons.

$$AG_s = AGB_s \times 42 \, {}^{gallons}/_{barrel} \quad (7)$$

Where:

AG_s = Annual consumption of AvGas for state s, in gallons
AGB_s = Annual consumption of AvGas for state s, in barrels

18.3.2 Allocation procedure

Bulk Terminals

Emissions from bulk terminals are calculated by growing the 1998 emissions estimates developed in support of the Gasoline MACT standard [ref 2]. The national-level emissions are allocated to the states based on the fraction of refinery, bulk terminal, and natural gas plant stocks in each state [ref 19]. The state-level emissions are distributed to the counties based on employment in NAICS 42471 [ref 10].

Pipelines

Emissions from pipelines are calculated by growing the 1998 emissions estimates developed in support of the Gasoline MACT standard [ref 2]. The national-level emissions are allocated to the PAD Districts based on data on the movement of finished motor gasoline by pipeline between PAD Districts from the EIA [ref 21]. The emissions in each PAD District are distributed to the counties based on employment in NAICS 42471 [ref 10].

Bulk Plants

The national volume of bulk plant gasoline throughput is allocated to counties using County Business Patterns employment data for NAICS code 42471 (Petroleum Bulk Stations and Terminals) [ref 10]. The number of petroleum bulk stations and terminals employees is first summed to the national level.

$$Emp_{US} = \sum Emp_c \quad (8)$$

Where:

Emp_{US} = Number of petroleum bulk stations and terminals employees in the U.S.
Emp_c = Number of petroleum bulk stations and terminals employees in county c

The fraction of petroleum bulk stations and terminals employees by county is calculated by dividing the total number of petroleum bulk stations and terminals employees in each county by the total number of petroleum bulk stations and terminals employees in the U.S.

$$EmpFrac_c = \frac{Emp_c}{Emp_{US}} \quad (9)$$

Where:

$EmpFrac_c$	=	Total fraction of petroleum bulk stations and terminals employees in county *c*
Emp_c	=	Number of petroleum bulk stations and terminals employees in county *c*
Emp_{US}	=	Number of petroleum bulk stations and terminals employees in the U.S.

The county-level volume of bulk plant gasoline throughput is calculated by multiplying the fraction of petroleum bulk stations and terminals employees in each county by the national volume of bulk plant gasoline throughput.

$$GT_{c.bp} = GT_{US,bp} \times EmpFrac_c \quad (10)$$

Where:

$GT_{c,bp}$	=	Bulk plant gasoline throughput in county *c*, in thousand barrels
$GT_{US,bp}$	=	Bulk plant gasoline throughput in the U.S., in thousand barrels, from equation 1
$EmpFrac_c$	=	Total fraction of petroleum bulk stations and terminals employees in county *c*

Employment data are obtained from the U.S. Census Bureau's County Business Patterns (CBP) [ref 10]. Due to concerns with releasing confidential business information, the CBP does not release exact numbers for a given North American Industrial Classification Standard (NAICS) code if the data can be traced to an individual business. This is the case if a particular county has 2 or fewer establishments under a given NAICS code. In prior years, the CBP data reported the counties where data was withheld, along with dataset ranges for the withheld data (e.g., 20-99 employees). A gap-filling procedure was implemented using state-level data, which did not feature withheld data, to estimate employment counts in all counties.

Beginning in 2018, the Census Bureau stopped reporting dataset ranges for counties with withheld data. As such, the prior gap-filling methods required updating. For all post-2017 inventories, year-specific employment data from the County Business Patterns dataset is used to determine the total amount of withheld data in each state. The 2017 version of the County Business Patterns is then used to determine the counties for which withheld data exist and the data ranges for those counties, and it is to these counties that the difference between the state-level total employment and county-level total employment are allocated. To estimate employment in counties and states with withheld data, the following procedure is used for NAICS code 42471.

To gap-fill withheld state-level employment data:

a. The 2017 version of CBP is used to determine the states for which data is withheld and the employment size range in those states.
b. State-level data for states with known employment in NAICS 42471 are summed to the national level.
c. The total sum of state-level known employment from step b is subtracted from the national total reported employment for NAICS 42471 in the national-level CBP to determine the employment total for the withheld states.
d. Each of the withheld states is assigned the midpoint of the range code reported for that state. Table 18-3 lists the range codes and midpoints.
e. The midpoints for the states with withheld data are summed to the national level.

f. An adjustment factor is created by dividing the number of withheld employees (calculated in step c of this section) by the sum of the midpoints (step e).
g. For the states with withheld employment data, the midpoint of the range for that state (step d) is multiplied by the adjustment factor (step f) to calculate the adjusted state-level employment for landfills.

These same steps are then followed to fill in withheld data in the county-level business patterns.

h. The 2017 version of CBP is used to determine the counties for which data is withheld and the employment size range in those counties.
i. County-level data for counties with known employment are summed by state.
j. County-level known employment is subtracted from the state total reported in state-level CBP (or, if the state-level data are withheld, from the state total estimated using the procedure discussed above).
k. Each of the withheld counties is assigned the midpoint of the range code (Table 18-3).
l. The midpoints for the counties with withheld data are summed to the state level.
m. An adjustment factor is created by dividing the number of withheld employees (step i) by the sum of the midpoints (step k).
n. For counties with withheld employment data, the midpoints (step j) are multiplied by the adjustment factor (step l) to calculate the adjusted county-level employment for landfills.

Table 18-3: Ranges and midpoints for data withheld from state and county business patterns

Employment Code	Ranges	Midpoint
A	0-19	10
B	20-99	60
C	100-249	175
E	250-499	375
F	500-999	750
G	1,000-2,499	1,750
H	2,500-4,999	3,750
I	5,000-9,999	7,500
J	10,000-24,999	17,500
K	25,000-49,999	37,500
L	50,000-99,999	75,000
M	100,000+	

Tank Trucks in Transit, Underground Storage Tank (UST) Breathing and Storing, and Gasoline Service Station Unloading

The activity data for these sources is available at the county-level; therefore, county allocation is not needed.

Aviation Gasoline Distribution Stage 1 and 2

State-level gasoline consumption (from equation 7) is allocated to the county-level using the ratio of county-to-state-level LTOs. State and county LTO data were compiled by the U.S. EPA's Office of Air Quality, Planning and Standards (OAQPS) [ref 11].

$$RLTO_c = \frac{LTO_c}{LTO_s} \tag{11}$$

Where:

$RLTOc$ = The ratio of landing-take offs (LTOs) in county *c*
$LTOc$ = The number of LTOs in county *c*
$LTOs$ = The number of LTOs in state *s*

LTO data for turbine-powered airplanes were excluded because turbine-powered planes do not use aviation gasoline. Additionally, LTOs at airports that do not have aviation gasoline refueling, according to data from FAA Form 5010, were also excluded [ref 12].

The state-level gasoline consumption values from equation 7 are multiplied by the proportion of LTOs in each county to estimate the county-level amount of aviation gasoline consumed.

$$AG_c = AG_s \times RLTO_c \tag{12}$$

Where:

AG_c = Annual consumption of AvGas in county *c*, in gallons
$RLTOc$ = The ratio of landing-take offs (LTOs) in county *c*

18.3.3 Emission factors

CAP emission factors for all SCCs are provided in the "Wagon Wheel Emission Factor Compendium" on the 2020 NEI Supporting Data and Summaries site. The sources for these emissions factors, and locations of where to obtain factors to compute HAPs are discussed below.

Bulk Terminals

Emissions from bulk terminals are calculated by growing the 1998 emissions estimates developed in support of the Gasoline MACT standard. Therefore, there are no activity-based emissions factors for bulk terminals.

HAP emissions are estimated using speciation profiles that are available on the NEI Supporting Data and Summaries webpage by clicking on "EIS Augmentation Datasets" and selecting the HAP Augmentation Profile file for nonpoint.

Pipelines

Emissions from pipelines are calculated by growing the 1998 emissions estimates developed in support of the Gasoline MACT standard. Therefore, there are no activity-based emissions factors for pipelines. HAP emissions are estimated using speciation profiles available on the NEI Supporting Data and Summaries webpage by clicking on "EIS Augmentation Datasets" and selecting the HAP Augmentation Profile file for nonpoint.

Bulk Plants

The VOC emissions factor for bulk plants is 8.62 pounds of VOC per 1,000 gallons of gasoline [ref 13]. HAP emissions are available on the NEI Supporting Data and Summaries webpage by clicking on "EIS Augmentation Datasets" and selecting the HAP Augmentation Profile file for nonpoint. Speciation profiles for benzene emissions from bulk plants are based on county-specific refueling emissions data from MOVES [ref 8].

Tank Trucks in Transit

The VOC emission factor is the sum of the individual emission factors reported in the Gasoline Distribution EIIP guidance document for gasoline-filled trucks (traveling to service station/bulk plant for delivery) and vapor-filled trucks (traveling to bulk terminal/plant for reloading) [ref 3].

HAP emissions are calculated using speciation profiles available on the NEI Supporting Data and Summaries webpage by clicking on "EIS Augmentation Datasets" and selecting the HAP Augmentation Profile file for nonpoint. Speciation profiles for benzene emissions from bulk plants are based on county-specific refueling emissions data from MOVES.

Underground Storage Tank (UST) Breathing and Storing

The VOC emissions factor for underground storage tank breathing and storing is 1 pound per 1,000 gallons. The VOC emissions factor for underground storage tank breathing and storing is recommended by the Gasoline Distribution EIIP guidance document [ref 3].

HAP emissions are calculated using speciation profiles available on the NEI Supporting Data and Summaries webpage by clicking on "EIS Augmentation Datasets" and selecting the HAP Augmentation Profile file for nonpoint. Speciation profiles for benzene emissions from bulk plants are based on county-specific refueling emissions data from MOVES.

Gasoline Service Station Unloading

To calculate the VOC emissions factor for gasoline service station unloading, first calculate the true vapor pressure for each county and month using the following equation and data from MOVES [ref 8]: Geographic-specific information on the temperature of gasoline and the method of loading were obtained from a Stage I and II gasoline emission inventory study prepared for the EIIP.

The true vapor pressure is calculated using the following equation:

$$P_{c,m,f} = \left\{\left[0.7553 - \left(\frac{413}{T_{c.m} + 459.6}\right)\right] S^{0.5} \log_{10}\left(RVP_{c,m,f}\right) - \left[1.854 - \left(\frac{1042}{T_{c.m} + 459.6}\right)\right] S^{0.5} + \left[\left(\frac{2416}{T_{c.m} + 459.6}\right) - 2.013\right] \log_{10}\left(RVP_{c,m,f}\right) - \left(\frac{8742}{T_{c.m} + 459.6}\right) + 15.64\right\} \quad (13)$$

Where:

$P_{c,m,f}$ = Stock true vapor pressure for county *c* in month *m* for fuel subtype *f*, in pounds per square inch absolute
$T_{c,m}$ = Stock temperature for county *c* in month *m*, in degrees Fahrenheit
$RVP_{c,m,f}$ = Reid vapor pressure for county *c* in month *m* for fuel subtype *f*, in pounds per square inch
S = Slope of the ASTM distillation curve at 10 percent evaporated, in degrees Fahrenheit per percent (assumed that S=3.0 for gasoline per Figure 7.1-14a of AP-42) [ref 13]

The following equation is used to calculate the VOC emissions factor for gasoline service station unloading:

$$L_{c,m,f} = 12.46 \times S_{ft} \times P_{c,m,f} \times M/T \quad (14)$$

Where:

$L_{c,m,f}$ = Uncontrolled loading loss of liquid loaded, in pounds per thousand gallons
S_{ft} = Saturation factor for filling technology ft
$P_{c,m,f}$ = True vapor pressure of liquid loaded, in pounds per square inch absolute
M = Molecular weight of vapors, in pounds per pound per mole
T = Temperature of liquid loaded (Rankine) [ref 13]

HAP emissions are calculated using speciation profiles available on the NEI Supporting Data and Summaries webpage by clicking on "EIS Augmentation Datasets" and selecting the HAP Augmentation Profile file for nonpoint. Speciation profiles for benzene emissions from bulk plants are based on county-specific refueling emissions data from MOVES.

Aviation Gasoline Distribution Stage 1

CAP emission factors for stage 1 aviation gasoline distribution are provided in the "Wagon Wheel Emission Factor Compendium" on the 2020 NEI Supporting Data and Summaries site. The emissions factors for fugitive and non-fugitive VOC are taken from the TRC report *Estimation of Alkylated Lead Emissions, Final Report* [ref 4]. The emissions factors for the HAPs are taken from multiple sources: the TRC report; the EPA report *Locating and Estimating Air Emissions from Source of Ethylene Dichloride* [ref 14]; a memorandum to EPA/OAQPS [ref 15], and a personal email between EPA/OAQPS employees [ref 16]. HAP emission factors are available on the NEI Supporting Data and Summaries webpage by clicking on "EIS Augmentation Datasets" and selecting the HAP Augmentation Profile file for nonpoint.

Aviation Gasoline Distribution Stage 2

CAP emission factors for stage 2 of aviation gasoline distribution are provided in the "Wagon Wheel Emission Factor Compendium" on the 2020 NEI Supporting Data and Summaries site. The emissions factors for VOC are taken from the TRC report *Estimation of Alkylated Lead Emissions, Final Report* [ref 4]. The emissions factors for the HAPs are taken from multiple sources: the TRC report; the EPA report *Locating and Estimating Air Emissions from Source of Ethylene Dichloride* [ref 14]; a memorandum to EPA/OAQPS [ref 15]; and a personal email between OAQPS employees [ref 16]. HAP emission factors are available on the NEI Supporting Data and Summaries webpage by clicking on "EIS Augmentation Datasets" and selecting the HAP Augmentation Profile file for nonpoint.

18.3.4 Controls

There are county-level control efficiencies for service station unloading, including assumptions about the percentage of gasoline unloaded under different filling technologies: splash, submerged, or balanced. There are no controls assumed for all other sources.

18.3.5 Emissions

Bulk Terminals

Emissions of VOCs for bulk terminals and pipelines are calculated by multiplying 1998 national emissions estimates developed in support of the Gasoline Distribution MACT standard (Table 18-4) by the 2020 to 1998 ratio of the national volume of wholesale gasoline supplied [ref 17, ref 18]. Emissions are converted from megagrams (Mg) to tons.

$$E_{VOC,US,bt} = E_{MACT,US,bt} \times \frac{G_{2020}}{G_{1998}} \times 1.1023\ ton\ per\ Mg \tag{15}$$

Where:

$E_{VOC,US,bt}$ = Annual national-level emissions of VOC from bulk terminals, in tons
$E_{MACT,US,bt}$ = 1998 national VOC emission estimates developed for Gasoline Distribution MACT standard from bulk terminals, in Mg
G_{20120} = National volume of wholesale gasoline supplied in 2020, in thousand barrels per day
G_{1998} = National volume of wholesale gasoline supplied in 1998, in thousand barrels per day

Table 18-4: 1998 Post-MACT Control Emissions

Emission Point	1998 Post-MACT Control Emissions (Mg)	Reference
Pipelines	79,830	2
Bulk Terminals	137,555	2

National VOC emissions are allocated to states using the fraction of refinery, bulk terminal, and natural gas plant stocks of motor gasoline in each state [ref 19].

$$GasFrac_s = \frac{M_s}{M_{US}} \quad (16)$$

Where:

$GasFrac_s$ = Fraction of motor gasoline in state *s*
M_s = Amount of motor gasoline in state *s*
M_{US} = Amount of motor gasoline in the U.S.

The fraction of stocks of motor gasoline in each state is then used to distribute the VOC and HAP emissions.

$$E_{VOC,bt,s} = GasFrac_s \times E_{VOC,US,bt} \quad (17)$$

Where:

$E_{VOC,bt,s}$ = Annual VOC emissions in state *s* from bulk terminals, in tons
$GasFrac_s$ = Fraction of motor gasoline in state *s*
$E_{VOC,US,bt}$ = Annual national-level VOC emissions from bulk terminals, in tons

State-level VOC emissions are allocated to counties using the fraction of petroleum bulk stations and terminals facilities employees in each county from the US Census County Business patterns data for NAICS code 42471 [ref 10].

$$EmpFrac_c = \frac{Emp_c}{Emp_s} \quad (18)$$

Where:

$EmpFrac_c$ = Fraction of petroleum bulk stations and terminals facilities employees in county *c*
Emp_c = Number of petroleum bulk stations and terminals facilities employees in county *c*
Emp_s = Number of petroleum bulk stations and terminals facilities employees in state *s*

Due to concerns with releasing confidential business information, the CBP does not release exact numbers for a given NAICS code if the data can be traced to an individual business. Instead, a series of range codes is used. Many counties and some smaller states have only one petroleum bulk station and terminal facility, leading to withheld data in the county and/or state business pattern data. To estimate employment in counties and states with withheld data, the procedure discussed in Section is used for NAICS code 42471.

The fraction of petroleum bulk stations and terminals facilities employees in each county is then used to distribute the VOC emissions.

$$E_{VOC,bt,c} = EmpFrac_c \times E_{VOC,bt,s} \qquad (19)$$

Where:

$E_{VOC,bt,c}$ = Annual VOC emissions from bulk terminals in county *c*, in tons
$EmpFrac_c$ = Fraction of petroleum bulk stations and terminals facilities employees in county *c*
$E_{VOC,bt,s}$ = Annual VOC emissions from bulk terminals in state *s*, in tons

Emissions of HAPs are calculated by multiplying emissions of VOCs by a national average speciation profile [ref 20].

$$E_{p,c,bt} = E_{VOC,c,bt} \times S_p \qquad (20)$$

Where:

$E_{p,bt}$ = Annual emissions of pollutant *p* in county *c* from bulk terminal, in tons
$E_{VOC,bt}$ = Annual VOC emissions in county *c* from bulk terminals, in tons
S_p = Speciation profile of pollutant *p*, as a fraction of VOC emissions

Pipelines

Emissions of VOCs for pipelines are calculated by multiplying 1998 national estimates developed in support of the Gasoline Distribution MACT standard (Table 18-4) by the 2020 to 1998 ratio of the national volume of wholesale gasoline supplied [ref 17, ref 18]. Emissions are converted to tons.

$$E_{VOC,US,pl} = E_{MACT,US.,pl} \times \frac{G_{2020}}{G_{1998}} \times 1.1023\ ton\ per\ Mg \qquad (21)$$

Where:

$E_{VOC,US,pl}$ = Annual national-level emissions of VOC from pipelines, in tons
$E_{MACT,US,pl}$ = 1998 national VOC emission estimates developed for Gasoline Distribution MACT standard from pipelines, in Mg
G_{2020} = National volume of wholesale gasoline supplied in 2020, in thousand barrels per day
G_{1998} = National volume of wholesale gasoline supplied in 1998, in thousand barrels per day

National VOC and HAP emissions are allocated to PAD Districts using the fraction of the total amount of finished motor gasoline that originated in each PAD District in 2020. There are five PAD Districts across the United States. PAD District 1 comprises seventeen states plus the District of Columbia along the Atlantic Coast; PAD District 2 comprises fifteen states in the Midwest; PAD District 3 comprises six states in South Central U.S.; PAD District 4 comprises five states in the Rocky Mountains; and PAD District 5 comprises seven states along the West Coast.

These data are reported in Table 37 of Volume 1 of Petroleum Supply Annual [ref 21]. States in each PAD District are shown in Table 18-5.

$$PADDFrac_{PD} = \frac{M_{PD}}{M_{US}} \quad (22)$$

Where:

$PADDFrac_{PD}$ = Fraction of motor gasoline in PAD District *PD*
M_{PD} = Amount of finished motor gasoline in PAD District *PD*, in thousand barrels
M_{US} = Amount of finished motor gasoline in the U.S., in thousand barrels

$$E_{VOC,PD,pl} = PADDFrac_{PD} \times E_{VOC,US,pl} \quad (23)$$

Where:

$E_{VOC,PD,pl}$ = Annual VOC emissions from pipelines in PAD District *PD*, in tons
$PADDFrac_{PD}$ = Fraction of motor gasoline in PAD District *PD*
$E_{VOC,US,pl}$ = Annual national-level VOC emissions of from pipelines, in tons

Pipeline emissions in each PAD District are allocated to counties based on County Business Patterns employment data. Because employment data for NAICS code 48691 (Pipeline Transportation of Refined Petroleum Products) are often withheld due to confidentiality reasons, the number of employees in NAICS code 42471 (Petroleum Bulk Stations and Terminals) are used for this allocation. To better account for the location of refined petroleum pipelines, however, no activity is allocated to States which had employees in this NAICS code but did not have employees in NAICS code 48691 (i.e., District of Columbia, Idaho, Maine, New Hampshire, Vermont, and West Virginia). To allocate pipeline emissions in each PAD District to counties, first the county level employment data for NAICS code 42471 is summed to the PAD District.

$$Emp_{PD} = \sum Emp_c \quad (24)$$

Where:

Emp_{PD} = Number of petroleum bulk stations and terminals facilities employees in PAD District *PD*
Emp_c = Number of petroleum bulk stations and terminals facilities employees in county *c*

The fraction of petroleum bulk stations and terminals employees in each county is used to allocate the emissions from the PAD District to counties.

$$EmpFrac_c = \frac{Emp_c}{Emp_{PD}} \quad (25)$$

Where:

$EmpFrac_c$ = Fraction of petroleum bulk stations and terminals facilities employees in county *c*
Emp_c = Number of petroleum bulk stations and terminals facilities employees in county *c*
Emp_{PD} = Number of petroleum bulk stations and terminals facilities employees in PAD District *PD*

Due to concerns with releasing confidential business information, the CBP does not release exact numbers for a given NAICS code if the data can be traced to an individual business. Instead, a series of range codes is used. Many counties and some smaller states have only one petroleum bulk station and terminal facility, leading to withheld data in the county and/or state business pattern data. To estimate employment in counties and states with withheld data, the procedure discussed in Section 18.3.2 is used for NAICS code 42471.

The fraction of petroleum bulk stations and terminals facilities employees in each county is then used to distribute the VOC emissions.

$$E_{VOC,c,pl} = EmpFrac_c \times E_{VOC,PD,pl} \quad (26)$$

Where:

$E_{VOC,c,pl}$ = Annual VOC emissions from pipelines in county *c*, in tons
$EmpFrac_c$ = Fraction of petroleum bulk stations and terminals facilities employees in county *c*
$E_{VOC,PD,pl}$ = Annual VOC emissions from pipelines in PAD District *PD*, in tons

Emissions of HAPs are calculated by multiplying emissions of VOCs by a national average speciation profile [ref 13]. Total VOC emission estimates are used so emissions represent total emissions.

$$E_{p,c,pl} = E_{VOC,c,pl} \times S_p \quad (27)$$

Where:

$E_{p,c,pl}$ = Annual emissions of pollutant *p* from pipelines in county *c*, in tons
$E_{VOC,c,pl}$ = Annual VOC emissions from pipelines in county *c*, in tons
S_p = Speciation profile of pollutant *p*, as a fraction of VOC emissions

Table 18-5: States by PAD District

PAD District 1	PAD District 2	PAD District 3	PAD District 4	PAD District 5
Connecticut	Illinois	Alabama	Colorado	Alaska
Delaware	Indiana	Arkansas	Idaho	Arizona
Florida	Iowa	Louisiana	Montana	California
Georgia	Kansas	Mississippi	Utah	Hawaii
Maine	Kentucky	New Mexico	Wyoming	Nevada
Maryland	Michigan	Texas		Oregon
Massachusetts	Minnesota			Washington
New Hampshire	Missouri			
New Jersey	Nebraska			
New York	North Dakota			
North Carolina	Ohio			
Pennsylvania	Oklahoma			
Rhode Island	South Dakota			
South Carolina	Tennessee			
Vermont	Wisconsin			
Virginia				

PAD District 1	PAD District 2	PAD District 3	PAD District 4	PAD District 5
West Virginia				

Bulk Plants

VOC emissions from bulk plants are estimated by multiplying the VOC emission factor by county-level volume of bulk plant gasoline throughput.

$$E_{VOC,c,bp} = EF_{VOC,bp}/1000\ gallons \times GT_{c,bp} \times 42\ gallons\ per\ barrel \tag{28}$$

Where:

$E_{VOC,c,bp}$ = Annual emissions of VOC from bulk plants in county *c*, in pounds
$EF_{VOC,bp}$ = Emissions factor for VOC from bulk plants, in pounds per 1,000 gallons
$GT_{c,bp}$ = Gasoline throughput for bulk plants in county *c*, in thousand barrels

Benzene emissions are estimated by multiplying VOC emissions by county-level speciation profiles from MOVES [ref 8].

$$E_{BZ,c,bp} = E_{VOC,c,bp} \times S_{BZ,c} \tag{29}$$

Where:

$E_{BZ,c,bp}$ = Annual emissions of benzene from bulk plants in county *c*, in pounds
$E_{VOC,c,bp}$ = Annual emissions of VOC from bulk plants in county *c*, in pounds
$S_{BZ,c}$ = Speciation profile for benzene for bulk plants in county *c*, as a fraction of VOC

All other HAPs emissions are estimated by multiplying VOC emissions by the national average speciation profiles.

$$E_{p,c,bp} = E_{VOC,c,bp} \times S_{p,c} \tag{30}$$

Where:

$E_{p,c,bp}$ = Annual emissions of pollutant *p* from bulk plants in county *c*, in pounds
$E_{VOC,c,bp}$ = Annual emissions of VOC from bulk plants in county *c*, in pounds
$S_{p,c}$ = Speciation profile for pollutant *p* for bulk plants in county *c*, as a fraction of VOC

Tank Trucks in Transit

VOC emissions from tank trucks in transit are calculated by multiplying county-level total gasoline consumption by the VOC emission factor for tank trucks in transit.

$$E_{VOC,c,tt} = EF_{VOC,tt} \times \frac{GC_{c,t}}{1000\ gallons} \tag{31}$$

Where:

$E_{VOC,c,tt}$ = Annual emissions of VOC from tank trucks in transit in county *c*, in pounds

$EF_{VOC,tt}$ = Emissions factor for VOC from tank trucks in transit, in pounds per 1,000 gallons
$GC_{c,t}$ = Gasoline consumption for tank trucks in transit in county *c*, gallons

Benzene emissions are estimated by multiplying VOC emissions by county-level speciation profiles from MOVES.

$$E_{BZ,c,tt} = E_{VOC,c,tt} \times S_{BZ,c} \quad (32)$$

Where:

$E_{BZ,c,tt}$ = Annual emissions of benzene from tank trucks in transit in county *c*, in pounds
$E_{VOC,c,tt}$ = Annual emissions of VOC from tank trucks in transit in county *c*, in pounds
$S_{BZ,c}$ = Speciation profile for benzene for tank trucks in transit in county *c*, as a fraction of VOC

All other HAPs emissions are estimated by multiplying VOC emissions by the national average speciation profiles.

$$E_{p,c,tt} = E_{VOC,c,tt} \times S_{p,c} \quad (33)$$

Where:

$E_{p,c,tt}$ = Annual emissions of pollutant *p* from tank trucks in transit in county *c*, in pounds
$E_{VOC,c,tt}$ = Annual emissions of VOC from tank trucks in transit in county *c*, in pounds
$S_{p,c}$ = Speciation profile for pollutant *p* for tank trucks in transit in county *c*, as a fraction of VOC

Underground Storage Tank (UST) Breathing and Storing

VOC emissions from UST breathing and storing are calculated by multiplying county-level total gasoline consumption by the VOC emission factor for UST breathing and storing.

$$E_{VOC,c,ust} = EF_{VOC,ust} \times \frac{GC_{c,t}}{1000\ gallons} \quad (34)$$

Where:

$E_{VOC,c,ust}$ = Annual emissions of VOC from UST breathing and storing in county *c*, in pounds
$EF_{VOC,ust}$ = Emissions factor for VOC from UST breathing and storing, in pounds per 1,000 gallons
$GC_{c,t}$ = Gasoline consumption for UST breathing and storing in county *c*, in gallons

Benzene emissions are estimated by multiplying VOC emissions by county-level speciation profiles from MOVES.

$$E_{BZ,c,ust} = E_{VOC,c,ust} \times S_{BZ,c} \quad (35)$$

Where:

$E_{BZ,c,ust}$ = Annual emissions of benzene from UST breathing and storing in county *c*, in pounds
$E_{VOC,c,ust}$ = Annual emissions of VOC from UST breathing and storing in county *c*, in pounds
$S_{BZ,c}$ = Speciation profile for benzene for UST breathing and storing in county *c*, as a fraction of VOC

All other HAPs emissions are estimated by multiplying VOC emissions by the national average speciation profiles.

$$E_{p,c,ust} = E_{VOC,c,ust} \times S_{p,c} \quad (36)$$

Where:

$E_{p,c,ust}$ = Annual emissions of pollutant *p* from UST breathing and storing in county *c*, in pounds
$E_{VOC,c,ust}$ = Annual emissions of VOC from UST breathing and storing in county *c*, in pounds
$S_{p,c}$ = Speciation profile for pollutant *p* for UST breathing and storing in county *c*, as a fraction of VOC

<u>Gasoline Service Station Unloading</u>

County-level uncontrolled loading loss of liquid loaded VOC emissions are calculated by multiplying the loading loss calculated in equation 9 by the total gasoline consumption in each county for each filling technology.

$$E_{VOC,c,m,f,ft,ll} = \frac{GC_{c,ft,m,f}}{1000\ gallons} \times L_{c,m,f} \quad (37)$$

Where:

$E_{VOC,c,m,f,ft,ll}$ = VOC emissions from loading loss in county *c* for month *m* for filling technology *ft* and fuel subtype *f*, in pounds
$GC_{c,ft,m,f}$ = Total gasoline consumption in county *c* for month *m* for filling technology *ft* and fuel subtype *f*, in gallons
$L_{c,m,f}$ = Uncontrolled loading loss of liquid loaded for county *c* for month *m* and fuel subtype *f*, in pounds per thousand gallons

County-level controlled VOC emissions are calculated by multiplying loading loss VOC emissions by a county-level control efficiency. Emissions are divided by 100 to convert the control efficiency from a percentage.

$$E_{VOC,c,m.f,ft,ct} = E_{VOC,c,m,f,ft,ll} \times CE_c/100 \quad (38)$$

Where:

$E_{VOC,c,m,f,ft,ct}$ = Controlled VOC emissions in county *c* for month *m* for filling technology *ft* and fuel subtype *f*, in pounds
$E_{VOC,c,m,f,ft,ll}$ = VOC emissions from loading loss in county *c* month *m* for filling technology *ft* and fuel subtype *f*, in pounds
CE_c = Control efficiency value for county *c*, as a percentage

County-level monthly VOC emissions by fuel subtype and filling technology are calculated by subtracting controlled VOC emissions from VOC emissions from loading loss.

$$E_{VOC,c,m,f,ft} = E_{VOC,c,m,f,ft,ll} - E_{VOC,c,m.f,ft,ct} \quad (39)$$

Where:

$E_{VOC,c,m,f,ft}$ = VOC emissions in from gasoline service station unloading county *c* for month *m* for filling technology *ft* and fuel subtype *f*, in pounds
$E_{VOC,c,m,f,ft,ct}$ = Controlled VOC emissions in county *c* for month *m* for filling technology *ft* and fuel subtype

f, in pounds

$E_{VOC,c,m,f,ft,ll}$ = VOC emissions from loading loss in county *c* month *m* for filling technology *ft* and fuel subtype *f*, in pounds

County-level total VOC emissions by filling technology are calculated by summing VOC emissions for each month and fuel subtype.

$$E_{VOC,c,ft} = \sum E_{VOC,c,m,f,ft} \tag{40}$$

Where:

$E_{VOC,c,ft}$ = Annual VOC emissions in from filling type *ft* for gasoline service station unloading for county *c*, in pounds

$E_{VOC,c,m,f,ft}$ = VOC emissions in from gasoline service station unloading county *c* for month *m* for filling technology *ft* and fuel subtype *f*, in pounds

Benzene emissions are estimated by multiplying VOC emissions by county-level speciation profiles from MOVES.

$$E_{BZ,c,ssu} = E_{VOC,c,ssu} \times S_{BZ,c} \tag{41}$$

Where:

$E_{BZ,c,ssu}$ = Annual emissions of benzene from gasoline service station unloading in county *c*, in pounds

$E_{VOC,c,ssu}$ = Annual emissions of VOC from gasoline service station unloading in county *c*, in pounds

$S_{BZ,c}$ = Speciation profile for benzene for gasoline service station unloading in county *c*, as a fraction of VOC

All other HAPs emissions are estimated by multiplying VOC emissions by the national average speciation profiles.

$$E_{p,c,ust} = E_{VOC,c,ust} \times S_{p,c} \tag{42}$$

Where:

$E_{p,c,ssu}$ = Annual emissions of pollutant *p* from gasoline service station unloading in county *c*, in pounds

$E_{VOC,c,ssu}$ = Annual emissions of VOC from gasoline service station unloading in county *c*, in pounds

$S_{p,c}$ = Speciation profile for pollutant *p* for gasoline service station unloading in county *c*, as a fraction of VOC

<u>Aviation Gasoline Distribution Stage 1</u>

The annual aviation gasoline consumed in each county is used with the emissions factors located in the "Wagon Wheel Emission Factor Compendium" on the 2020 NEI Supporting Data and Summaries site to estimate emissions. Emissions of non-fugitive VOC from multiple sources, including tank truck filling and storage tank breathing, are estimated by multiplying gasoline consumed by the emissions. For VOC, emissions are multiplied by a conversion factor to convert from tons to pounds.

$$NFE_{r,c} = AG_c \times EF_{VOC,r} \div 2000\ {}^{lbs}/_{ton} \tag{43}$$

Where:

$NFE_{r,c}$ = Annual non-fugitive VOC emissions for source *r* in county *c*, in tons per year
$EF_{VOC,r}$ = VOC emission factor for source *r,* units vary based on pollutant.

Fugitive VOC emissions from valves and pumps are estimated by multiplying gasoline consumed by the emissions factor. Assumptions concerning bulk terminals used in these calculations can be found in Table 18-6.

Table 18-6: Assumptions for Bulk Terminals Using Aviation Gasoline

Parameter	Data	Reference
Number of Bulk Plant Equivalents (U.S.)	2,442 plants	4, Table 2-8
Number of valves per bulk plant	50 valves/plant	
Number of pumps per bulk plant	2 pumps/plant	
Number of seals per bulk plant	4 seals/pump	
Number of days per year used	300 days	

$$VFE_c = BPE \times V \times EF_{VOC,r} \times D \times {}^{LTO_c}/_{LTO_{US}} \div 2000\ {}^{lbs}/_{ton} \tag{44}$$

$$PFE_c = BPE \times P \times S \times EF_{VOC,r} \times D \times {}^{LTO_c}/_{LTO_{US}} \div 2000\ {}^{lbs}/_{ton} \tag{45}$$

Where:

PFE_c = Annual fugitive VOC emissions from valves in county *c,* in tons
VFE_c = Annual fugitive VOC emissions from pumps in county *c*, in tons
BPE = Number of bulk plant equivalents in the U.S.
V = Number of valves per plant in the U.S.
P = Number of pumps per plant in the U.S.
S = Number of seals per plant in the U.S.
D = Number of days used per year
$LTOc$ = The number of LTOs in county *c*
LTO_{US} = The number of LTOs in the United States

Total Annual VOC emissions in each county are estimated by summing the fugitive emissions (from equations 35 and 36) and all sources of non-fugitive emissions (from equation 34).

$$E_{VOC,c} = \sum_r NFE_c + PFE_c + VFE_c \tag{46}$$

Where:

$E_{VOC,c}$ = Annual VOC emissions in county *c*, in tons

Emissions of all HAPs, except ethylene dichloride, are estimated by applying speciation factors to the annual VOC emissions. For HAPs, no conversion factor is needed, and the emissions are reported in tons.

$$E_{h,c} = E_{VOC,c} \times SF_h \tag{47}$$

Where:

$E_{h,c}$ = Annual emissions of HAP *h* in county *c*, in tons per year
SF_h = Speciation factor for HAP *h*, in tons of HAP emissions per ton of VOC emissions

Ethylene dichloride emissions are calculated by multiplying the gasoline consumed in each county (from equation 33) by the emission factor. For ethylene dichloride, emissions are multiplied by a conversion factor to convert from to pounds tons.

$$E_{e,c} = AG_c \times EF_e \times 0.0005 \, {}^{tons}/_{lb} \tag{48}$$

Where:

$E_{e,c}$ = Annual emissions of ethylene dichloride in county *c*, in tons
EF_e = Emission factor for ethylene dichloride, in lbs. of ethylene dichloride per gallon of AvGas

<u>Aviation Gasoline Distribution Stage 2</u>

The annual aviation gasoline consumed in each county is used with the emissions factors to estimate emissions. Emissions of VOC are estimated by multiplying gasoline consumed by the emissions factor. For VOC, emissions are multiplied by a conversion factor to convert from tons to pounds.

$$E_{VOC.c} = AG_c \times EF_{VOC} \times 0.0005 \, {}^{tons}/_{lb} \tag{49}$$

Where:

$E_{VOC,c}$ = Annual VOC emissions in county *c*, in tons
AG_c = Annual consumption of AvGas in county *c*, in gallons
EF_{VOC} = VOC emission factor, in tons of VOC per gallon of AvGas

Emissions of all HAPs, except ethylene dichloride and lead, are estimated by applying speciation factors to the annual VOC emissions. For HAPs, no conversion factor is needed, and the emissions are reported in tons.

$$E_{h,c} = E_{VOC,c} \times SF_h \tag{50}$$

Where:

$E_{h,c}$ = Annual emissions of HAP *h* in county *c*, in tons per year
$E_{VOC,c}$ = Annual VOC emissions in county *c*, in tons
SF_h = Speciation factor for HAP *h*, in tons of HAP emissions per ton of VOC emissions

Ethylene dichloride and lead emissions are calculated by multiplying the gasoline consumed (from equation 12) by the emission factor. For lead and ethylene dichloride, emissions are multiplied by a conversion factor to convert from pounds to tons.

$$E_{p,c} = AG_c \times EF_p \times 0.0005 \, {}^{tons}/_{lb} \tag{51}$$

Where:

Ep,c = Annual emissions of pollutant *p* in county *c,* in tons
EF_p = Emission factor for pollutant *p*, in lbs. of pollutant per gallon of AvGas

18.3.6 Point Source Subtraction

There are no point source-specific SCCs for stage 1 and stage 2 aviation gasoline distribution; therefore, point source subtraction is not performed for these sources. However, some stage I gasoline emissions are reported in the point source inventory. To avoid double counting of emissions, point source emissions are subtracted from the total emissions from each source category to estimate the nonpoint emissions from each source category. Point source emissions are mapped to nonpoint source SCCs using the "Gas Distribution" crosswalk in the file "NEI PT-NP Crosswalk_complete_WagonWheel_August2021.xlsx" available on the [2020 NEI Supplemental nonpoint data FTP site](#).

The point source emissions table is also provided as an input template and for 2020, EPA created a "default" set of point source emission, populating this table with information directly from the 2020 S/L/T Point inventory submittals. S/L/T agencies could replace these default submittals, and those that did are listed in Section 6.2.2.

$$NPE_{p,c,scc} = E_{p,c,scc} - PE_{p,c,scc} \qquad (52)$$

Where:

$NPE_{p,c,scc}$	=	Annual nonpoint source emissions of pollutant *p* from each SCC in county *c*
$E_{p,c,scc}$	=	Annual total emissions of pollutant *p* from each SCC in county *c*
$PE_{p,c,scc}$	=	Annual total point source emissions of pollutant *p* from each SCC in county *c*

18.3.7 Example calculations

The tables below show sample calculations for estimating VOC for stage I gasoline distribution. The values in these equations are demonstrating program logic and are not representative of any specific NEI year or county.

<u>Bulk Terminals</u>

The values in these equations are demonstrating program logic and are not representative of any specific NEI year or county.

Table 18-7: Sample calculations for VOC emissions from Stage I Gasoline Distribution – Bulk Terminals

Eq. #	Equation	Values	Result
15	$E_{VOC,US,bt} = E_{MACT,US,bt} \times \frac{G_{2020}}{G_{1998}} \times 1.1023\ ton\ per\ Mg$	$137555\ Mg \times \frac{9327 thousand\ barrels\ per\ day}{8253\ thousand\ barrels\ per\ day} \times 1.1023\ ton\ per\ Mg$	171359 tons VOC emissions in the US
16	$GasFrac_s = \frac{M_S}{M_{US}}$	$\frac{205\ thousand\ barrels}{16798\ thousand\ barrels}$	.0052
17	$E_{VOC,bt,s} = GasFrac_s \times E_{VOC,US,bt}$	$.0052 \times 171359\ tons$	891.1 tons VOC emissions in state
18	$EmpFrac_c = \frac{Emp_c}{Emp_s}$	$\frac{6.54\ employees}{732\ employees}$	.0089
19	$E_{VOC,bt,c} = EmpFrac_c \times E_{VOC,bt,s}$	$.0089 \times 891.1\ tons$	7.93 tons VOC emissions

Pipelines

The values in these equations are demonstrating program logic and are not representative of any specific NEI year or county.

Table 18-8: Sample calculations for VOC emissions from Stage I Gasoline Distribution - Pipelines

Eq. #	Equation	Values	Result
21	$E_{VOC,US,pl} = E_{MACT,US.,pl} \times \frac{G_{2020}}{G_{1998}} \times 1.1023\ ton\ per\ Mg$	$137555\ Mg \times \frac{9327\ thousand\ barrels\ per\ day}{8253\ thousand\ barrels\ per\ day} \times 1.1023\ ton\ per\ Mg$	171359 tons VOC emissions in the US
22	$PADDFrac_{PD} = \frac{M_{PD}}{M_{US}}$	$\frac{3{,}856\ thousand\ barrels\ in\ district}{119{,}634\ gasoline\ in\ US}$	0.32
23	$E_{VOC,PD,pl} = PADDFrac_{PD} \times E_{VOC,US,pl}$	$0.32 \times 171359\ tons$	5,523 tons VOC emissions in district
24	$Emp_{PD} = \sum Emp_c$	$\sum Emp_c$	10641 employees in district
25	$EmpFrac_c = \frac{Emp_c}{Emp_{PD}}$	$\frac{6.54\ employees}{10641\ employees}$	.00061
26	$E_{VOC,c,pl} = EmpFrac_c \times E_{VOC,PD,pl}$	$.00061 \times 5{,}523\ tons$	3.37 tons VOC emissions

Bulk Plants

The values in these equations are demonstrating program logic and are not representative of any specific NEI year or county.

Table 18-9: Sample calculations for VOC emissions from Stage I Gasoline Distribution – Bulk Plants

Eq. #	Equation	Values	Result
1	$GT_{US,bp} = V_{US} \times 0.09$	$3404186\ thousand\ barrels \times 0.09$	306377 thousand barrels
8	$Emp_{US} = \sum Emp_c$	$\sum Emp_c$	73908 employees in the US
9	$EmpFrac_c = \frac{Emp_c}{Emp_{US}}$	$\frac{6.54\ employees}{73908\ employees}$	.000089
10	$GT_c = GT_{US} \times EmpFrac_c$	$306377\ thousand\ barrels \times .000089$	27.11 thousand barrels

Eq. #	Equation	Values	Result
28	$E_{VOC,c,bp} = \frac{EF_{VOC,bp}}{1000\ gallon} \times GT_{c,bp} \times 42\ gallons\ per\ Mbbl$	$8.62\ pounds\ per\ 1{,}000\ gallons \div 1000\ gallons \times 27.11\ thousand\ barrels \times 42\ gallons\ per\ Mbbl$	9.8 pounds VOC emissions

<u>Tank Trucks in Transit</u>

The values in these equations are demonstrating program logic and are not representative of any specific NEI year or county.

Table 18-10: Sample calculations for VOC emissions from Stage I Gasoline Distribution – Tank Trucks in Transit

Eq. #	Equation	Values	Result
2	$GC_{OR,c} = \sum GC_{OR,m}$	$\sum GC_{OR,m}$	44,007,116.5 gallons of onroad gasoline consumed
3	$GC_{NR,c} = \sum GC_{NR,m}$	$\sum GC_{NR,m}$	913,078.6 gallons of nonroad gasoline consumed
4	$GC_{c,t} = (GC_{OR,c} + GC_{NR,c}) \times 1.09$	$(44{,}007{,}116.5\ gallons + 913{,}078.6\ gallons) \times 1.09$	48,963,012.6 gallons of gasoline consumed
31	$E_{VOC,c,tt} = \left(EF_{VOC,tt} \times GC_{c,t}\right)/1000\ gallons$	$(.06\ pounds\ per\ 1000\ gallons \times 48{,}963{,}012.6\ gallons)/1000\ gallons$	2937.7 pounds VOC emissions

<u>Underground Storage Tank (UST) Breathing and Storing</u>

The values in these equations are demonstrating program logic and are not representative of any specific NEI year or county.

Table 18-11: Sample calculations for VOC emissions from Stage I Gasoline Distribution - Underground Storage Tank (UST) Breathing and Storing

Eq. #	Equation	Values	Result
2	$GC_{OR,c} = \sum GC_{OR,m}$	$\sum GC_{OR,m}$	44,007,116.5 gallons of onroad gasoline consumed
3	$GC_{NR,c} = \sum GC_{NR,m}$	$\sum GC_{NR,m}$	913,078.6 gallons of nonroad gasoline consumed

Eq. #	Equation	Values	Result
4	$GC_{c,t} = (GC_{OR,c} + GC_{NR,c}) \times 1.09$	$(4{,}4007{,}116.5\ gallons + 913{,}078.6\ gallons) \times 1.09$	48,963,012.6 gallons of gasoline consumed
34	$E_{VOC,c,ust} = \left(EF_{VOC,ust} \times GC_{c,t}\right)/1000\ gallons$	$(1\ pound\ per\ 1000\ gallons \times 48{,}963{,}012.62\ gallons)/1000\ gallons$	48,963 pounds VOC emissions

Gasoline Service Station Unloading

These sample calculations use splash filling as an example, and the equations use fuel subtype 10 and January as an example. These calculations would need to be repeated using every month and both fuel subtypes to calculate values for each filling technology (splash, submerged, and balance). The values in these equations are demonstrating program logic and are not representative of any specific NEI year or county.

Table 18-12: Sample calculations for VOC emissions from Stage I Gasoline Distribution - Gasoline Service Station Unloading

Eq. #	Equation	Values	Result
5	$GC_{c,t,m,f} = (GC_{c,OR,m,f} + GC_{c,NR,m,f}) \times 1.09$	$(1{,}650{,}266.8\ gallons + 11{,}985.2\ gallons) \times 1.09$	18,111,854.7 gallons
6	$GC_{c,ft,m,f} = GC_{c,t,m,f} \times Perc_{ft,c}$	$18{,}111{,}854.7\ gallons \times 0\ \%\ splash\ filling$	0 gallons splash filling
13	$P_{c,m,f} = \left\{\left[0.7553 - \left(\frac{413}{T_{c.m} + 459.6}\right)\right] S^{0.5} \log_{10}(RVP_{c,m,f}) - \left[1.854 - \left(\frac{1042}{T_{c.m} + 459.6}\right)\right] S^{0.5} + \left[\left(\frac{2416}{T_{c.m} + 459.6}\right) - 2.013\right] \log_{10}(RVP_{c,m,f}) - \left(\frac{8742}{T_{c.m} + 459.6}\right) + 15.64\right\}$	$\left\{\left[0.7553 - \left(\frac{413}{60 + 459.6}\right)\right] 3^{0.5} \log_{10}(10.61) - \left[1.854 - \left(\frac{1042}{60 + 459.6}\right)\right] 3^{0.5} + \left[\left(\frac{2416}{60 + 459.6}\right) - 2.013\right] \log_{10}(10.61) - \left(\frac{8742}{60 + 459.6}\right) + 15.64\right\}$	5.54 pounds per square inch absolute
14	$L_{c,m,f} = 12.46\ \times S_{ft} \times P_{c,m,f} \times M/T$	$12.46\ \times 1.45\ saturation\ factor \times 5.54\ pounds\ per\ square\ inch\ absolute \times \frac{65.5\ pounds\ per\ pound\ per\ mole}{520\ Rankine}$	12.61 pounds per 1000 gallons

Eq. #	Equation	Values	Result
35	$E_{VOC,c,m,f,ft,ll} = \frac{GC_{c,ft,m,f}}{1000\ gallons} \times L_{c,m,f}$	$\frac{0\ gallons\ splash\ filling}{1000\ gallons} \times 12.61\ pounds\ per\ 1000\ gallons$	0 pounds VOC emissions from uncontrolled loading loss in January for fueling subtype 10 for splash filling
36	$E_{VOC,c,m.f,ft,ct} = E_{VOC,c,m,f,ft,ll} \times CE_c/100$	$0\ pounds \times 0\ control\ efficiency/100$	0 pounds controlled VOC emissions in January for fueling subtype 10 for splash filling
37	$E_{VOC,c,m,f,ft} = E_{VOC,c,m,f,ft,ll} - E_{VOC,c,m.f,ft,ct}$	$0\ pounds - 0\ pounds$	0 pounds total VOC emissions in January for fueling subtype 10 for splash filling
38	$E_{VOC,c,ft} = \sum E_{VOC,c,m,f,ft}$	$\sum E_{VOC,c,m,f,ft}$	0 pounds total VOC emissions for splash filling

Aviation Gasoline Distribution Stage 1

Table 18-13 lists sample calculations to determine the VOC emissions from stage 1 aviation gasoline distribution. The values in these equations are demonstrating program logic and are not representative of any specific NEI year or county.

Table 18-13: Sample Calculations for VOC emissions from Aviation Gasoline Distribution - Stage 1

Eq. #	Equation	Values	Result
7	$AG_s = AGB_s \times 42\ ^{gallons}/_{barrel}$	$57{,}000\ barrels \times 42\ ^{gallons}/_{barrel}$	2,394,000 gallons of AvGas consumed in the state
11	$RLTO_c = \frac{LTO_c}{LTO_s}$	$\frac{3{,}064\ LTOs\ in\ county}{689{,}947\ LTOs\ in\ AL}$	0.00444 fraction of LTOs
12	$AG_c = AG_s \times RLTO_c$	$2{,}394{,}000\ gal\ AvGas\ in\ Al \times 4.44 \times 10^{-3} fraction$	10,633 gallons of AvGas consumed
43	$NFE_{r,c} = AG_c \times EF_{VOC,r} \div 2000\ ^{lbs}/_{ton}$	$10{,}633\ gal\ AvGas\ in\ county \times 9.02 \times 10^{-3} lbs.VOC\ per\ gal\ AvGas \div 2000\ ^{lbs}/_{ton}$	0.048 tons VOC emissions from tank filling
		$10{,}633\ gal\ AvGas\ in\ county \times 3.61 \times 10^{-3} lbs.VOC\ per\ gal\ AvGas \div 2000\ ^{lbs}/_{ton}$	0.0192 tons VOC emissions from storage tank working
		$10{,}633\ gal\ AvGas\ in\ county \times 1.03 \times 10^{-2} lbs.VOC\ per\ gal\ AvGas \div 2000\ ^{lbs}/_{ton}$	0.0548 tons VOC emissions from composite
		$10{,}633\ gal\ AvGas\ in\ county \times 1.69 \times 10^{-3} lbs.VOC\ per\ gal\ AvGas \div 2000\ ^{lbs}/_{ton}$	0.00901 tons VOC emissions from breathing losses
44	$VFE_c = BPE \times V \times EF_{VOC,r} \times D \times {}^{LTO_c}/_{LTO_{US}} \div 2000\ ^{lbs}/_{ton}$	$2{,}442\ plants\ in\ US \times 50\ ^{valves}/_{plant} \times 0.573\ lbs.per\ valve\ per\ day \times 300\ days \times {}^{3{,}064}/_{28{,}353{,}661} \div 2000\ ^{lbs}/_{ton}$	1.13 tons fugitive VOC emissions from valves
45	$PFE_c = BPE \times P \times S \times EF_{VOC,r} \times D \times {}^{LTO_c}/_{LTO_{US}} \div 2000\ ^{lbs}/_{ton}$	$2{,}442\ plants\ in\ US \times 2\ ^{pumps}/_{plant} \times 4\ ^{seals}/_{pump} \times 5.95\ lbs.per\ seal\ per\ day \times 300\ days \times {}^{3.064}/_{28{,}353{,}661} \div 2000\ ^{lbs}/_{ton}$	1.89 tons fugitive VOC emissions from pumps
46	$E_{VOC,c} = \sum_r NFE_c + PFE_c + VFE_c$	$0.131\ tons + 1.13\ tons + 1.89\ tons$	3.15 total annual tons VOC emissions from AvGas distribution

Aviation Gasoline Distribution Stage 2

Table 18-14 lists sample calculations to determine the VOC, lead, and ethylene dichloride emissions from stage 2 aviation gasoline distribution in an example county. The values in these equations are demonstrating program logic and are not representative of any specific NEI year or county.

Table 18-14: Sample Calculations for VOC emissions from Aviation Gasoline Distribution - Stage 2

Eq. #	Equation	Values	Result
7	$AG_s = AGB_s \times 42\ ^{gallons}/_{barrel}$	$57{,}000\ barrels \times 42\ ^{gallons}/_{barrel}$	2,394,000 gallons of AvGas consumed in the state
11	$RLTO_c = \frac{LTO_c}{LTO_s}$	$\frac{3{,}064\ LTOs\ in\ county}{689{,}947\ LTOs\ in\ state}$	0.00444 fraction of LTOs
12	$AG_c = AG_s \times RLTO_c$	$2{,}394{,}000\ gal\ AvGas\ in\ state \times 4.44 \times 10^{-3} fraction$	10,633 gallons of AvGas consumed
49	$E_{VOC.c} = AG_c \times EF_{VOC} \times 0.0005\ ^{tons}/_{lb}$	$10{,}633\ gal\ of\ AvGas\ in\ county \times 0.0136\ lbs.VOC\ per\ gal \times 0.0005\ ^{tons}/_{lb}$	0.0723 tons VOC emissions from AvGas distribution

18.3.8 Improvements/Changes in the 2020 NEI

There are no significant changes to the methodology used to calculate emissions from aviation gasoline distribution. Activity data was updated to reflect the most recent, best available data at the time of the NEI.

For stage 1 gasoline distribution, the methodology used to calculate county-level gasoline consumption for tank trucks in transit and gasoline service station unloading was updated. For the 2017 NEI, national-level motor gasoline consumption reported by EIA was allocated to onroad and nonroad consumption and then to the county-level using MOVES data on CO_2 emissions. For the 2020 NEI, state-level data on total motor gasoline consumption reported by SEDS is allocated using CO_2 emissions from MOVES to onroad and nonroad consumption and then to the county-level. This methodology is explained in more detail in section 18.3.1.

For prior inventory years, the U.S. Census Bureau denoted counties for which County Business Patterns (CBP) data was withheld and reported an employment size range. A gap-filling procedure was implemented using state-level data, which was used to estimate the number of employees not reported in the county-level dataset. An average value for number of employees for each employment size range was used to allocate the difference to the counties with withheld data. Beginning in reference year 2018, data are still only published for a county and NAICS code if there are three or more establishments. However, the CBP data no longer includes an employment size range for counties in which data is withheld for a NAICS code. For the 2020 NEI, the gap-filling method was updated. 2020 employment data from the CBP dataset is used to determine the total amount of withheld data in each state. The 2017 version of the CBP is then used to determine the counties for which data is withheld and the employment size range in those counties. The difference between the state-level total employment and the county-level total employment is allocated to the counties identified using 2017 CBP.

18.3.9 Puerto Rico and U.S. Virgin Islands

Since insufficient data exists to calculate emissions for the counties in Puerto Rico and the US Virgin Islands, emissions are based on two proxy counties in Florida: 12011, Broward County for Puerto Rico and 12087, Monroe County for the US Virgin Islands. The total emissions in pounds for these two Florida counties are divided by their respective populations creating a pound per capita emission factor. For each Puerto Rico and US Virgin Island County, the pound per capita emission factor is multiplied by the county population (from the same year as the inventory's activity data) which serves as the activity data. In these cases, the throughput (activity data) unit and the emissions denominator unit are "EACH".

18.4 References

1. U.S. Environmental Protection Agency, “National Emission Standards for Source Categories: Gasoline Distribution (Stage I), 40 CFR Part 63.” Office of Air Quality Planning and Standards, February 28, 1997. Pages 9087-9093.
2. U.S. Environmental Protection Agency, "Gasoline Distribution Industry (Stage I) - Background Information for Proposed Standards," EPA-453/R94-002a, Office of Air Quality Planning and Standards, January 1994.
3. Eastern Research Group, Inc., "Volume III: Chapter 11, Gasoline Marketing (Stage I and Stage II), Revised Final," prepared for the Emission Inventory Improvement Program, January 2001.
4. TRC Environmental Corporation. 1993. *Estimation of Alkylated Lead Emissions, Final Report.* Prepared for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. RTP, NC.
5. U.S. Department of Energy, Energy Information Administration, Petroleum Navigator – Product Supplied.
6. Cavalier, Julia, MACTEC, Inc., personal communication, "RE: Percentage of Gasoline Transported Twice By Truck," with Stephen Shedd, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Emission Standards Division, July 6, 2004.
7. Energy Information Administration. 2022. State Energy Data System (SEDS): 1960-2020 (complete). Consumption in Physical Units. U.S. Department of Energy. Washington, D.C.
8. 2020 MOVES run results provided by Alison Eyth, U.S. Environmental Protection Agency, Emissions Inventory and Analysis Group, November, 16, 2022.
9. Pacific Environmental Services, Inc., "Draft Summary of the Analysis of the Emissions Reported in the 1999 NEI for Stage I and Stage II Operations at Gasoline Service Stations," prepared for the U.S. Environmental Protection Agency and the Emission Inventory Improvement Program, September 2002.
10. U.S. Census Bureau, 2020 County Business Patterns, released April 2022.
11. [2020 Aircraft NEI All Info.xlsx], electronic file from Janice Godfrey, U.S. Environmental Protection Agency, OAQPS, to U.S. Environmental Protection Agency, OAQPS. Aircraft operations data for 2020 compiled from FAA’s Terminal Area Forecasts (TAF) and 5010 Forms.
12. Federal Aviation Administration (FAA). 2017. Form 5010. Airport Data and Contact Information.
13. U.S. Environmental Protection Agency, “Compilation of Air Pollutant Emission Factors, AP 42, Fifth Edition, Volume I: Stationary Point and Area Sources, Chapter 7: Liquid Storage Tanks,” Office of Air Quality Planning and Standards, Emission Inventory Group, September 1997.
14. U.S. Environmental Protection Agency. 1984. Locating and Estimating Air Emissions from Sources of Ethylene Dichloride. Table 16, EPA-450/4-84-007d. RTP, NC.
15. Memorandum from Greg LaFlam and Tracy Johnson (PES) to Stephen Shedd (EPA/OAQPS). *Speciated Hazardous Air Pollutants - Baseline Emissions and Emissions Reductions Under the Gasoline Distribution NESHAP.* August 9, 1996.
16. Personal Communication via e-mail from Stephen Shedd (EPA/OAQPS) to Laurel Driver (EPA/OAQPS). E-mail dated May 29, 2002.
17. U.S. Department of Energy, Energy Information Administration, “U.S. Daily Average Supply and Distribution of Crude Oil and Petroleum Products,” Table 2 in Petroleum Supply Annual 2020, Volume 1, released August 31, 2021
18. U.S. Department of Energy, Energy Information Administration, “U.S. Daily Average Supply and Distribution of Crude Oil and Petroleum Products,” Table 2 in Petroleum Supply Annual 1998, Volume 1, released June 1999
19. U.S. Department of Energy, Energy Information Administration, "Refinery, Bulk Terminal, and Natural Gas Plant Stocks of Selected Petroleum Products by PAD District and State” Table 35 in Petroleum Supply Annual 2020, Volume 1, released August 31, 2021
20. Hester, Charles, MACTEC, Inc. Memorandum from Charles Hester, MACTEC, Inc., to Stephen Shedd, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Emission Standards

Division, "Review of Data on HAP Content in Gasoline," May 18, 2006.

21. U.S. Department of Energy, Energy Information Administration, "Movements of Crude Oil and Petroleum Products by Pipeline Between PAD Districts," Table 37 in Petroleum Supply Annual 2020, Volume 1, released August 31, 2021

United States Environmental Protection Agency	Office of Air Quality Planning and Standards Air Quality Assessment Division Research Triangle Park, NC	Publication No. EPA-454/R-23-001r March 2023