DMK Environmental Engineering Inc.
P.O. Box 461 Monticello, Utah 84535
801-278-5133 Fax 801-951-4954
Email: DMKenv@Gmail.com.

# Emery Refining, L.L.C.
## 20,000 bbl/day Oil Refinery
## Green River, Utah
## Air Quality Notice of Intent
November, 2012

# Table of Contents

Introduction:.....4
General Information:.....5
Process Information:.....5
Description of the process:.....5
Operation Schedule:.....9
Construction Schedule:.....9
Equipment List:.....9
Distillation Plant:.....9
Wax Plant:.....10
Equipment Common to both plants:.....11
Emission Summary:.....12
Requirements to Obtain an Approval Order:.....12
Best Available Control Technology (BACT):.....12
New Sources in Non-attainment and Maintenance Areas:.....14
Major Source in Attainment or Unclassified Areas (PSD):.....14
Visibility:.....14
Emissions Impact Analysis (dispersion modeling):.....14
New Source Performance Standards (NSPS):.....15
National Ambient Air Quality Standards (NAAQS):.....16
National Emission Standards for Hazardous Air Pollutants (NESHAPS):.....17
State Implementation Plan (SIP):.....18
All Other Provisions of R307:.....18
Conclusion:.....18

Appendix A
Process Diagram
Appendix B
Emission Rate Summary
DAQ Form 1a & d
Appendix C
Emission Rate Calculations

# List of Tables

Table 1 Allowable Emissions in Tons per Year.....4

## Introduction:

In accordance with R307-400 of the Utah Air Quality Rules, Emery Refining, L.L.C. submits this Notice of Intent (NOI) for construction of a 20,000 barrel per day (bpd) oil refinery to be located at the north east corner of I-70 and Route 6, Green River, Utah (a street address has not yet been assigned). Emery Refining, L.L.C. is a new entity formed to replace Bridgehouse Refining L.L.C. which received an approval order to construct a 20,000 bpd refinery on the east end of Greenriver. If an approval order is issued to Emery Refining, the Bridgehouse refinery will not be built and its approval order may be revoked. The Emery Refining L.L.C. refinery will be almost identical to the approved Bridgehouse Refinery. All of the process equipment, feed streams, and products will be the same. The only differences will be in the location, physical layout, construction schedule and a minor change in fuel supply, which will not effect the emission rate of pollutants, but will change the applicability of NSPS subpart Ja to the combustion equipment. Also, all of the equipment for this refinery will be new, as opposed to some of the equipment was existing in the Bridgehouse refinery. This NOI is identical the the Bridgehouse NOI except for the changes mentioned above.

The refinery will be separated into two plants. A distillation plant and a wax plant.

Total air emissions from the refinery are calculated to be:

| | Total Annual Emissions Tons/yr |
|---|---|
| PM 10 | 5.51 |
| PM 2.5 | 5.51 |
| NOx | 17.1 |
| SOx | .57 |
| CO | 56.3 |
| VOC | 33.2 |
| HAPs | 2.39 |

The plant will be located in Emery County, which is an attainment area for all criteria pollutants. The plant will be a minor source for all air pollutants. The plant will not be subject to Prevention of Significant Deterioration (PSD).

Federal New Source Performance Standards Ja,Kb, GGGa, and QQQ will apply to the certain equipment in the refinery. No MACT apply. The plant will be subject to Title V requirements, because it is subject to NSPS, but since it will be a minor source, a Title V permit application and permit are not required at this time.

Best Available Control Technology for emissions from combustion, evaporation and fugitive dust are incorporated into the design of the plant.

We believe this NOI demonstrates that the plant will be in compliance with all requirements to obtain an Approval Order as specified in R307-401.

## General Information:

| | |
|---|---|
| Company Name and Address: | Emery Refining, L.L.C.<br>4265 San Felipe Street<br>Huston, Texas 77027-2918 |
| Company Phone Number: | 713-654-0912 |
| Company submitting application: | Same |
| Contact for Environmental matters: | Mr. Ron Chamness<br>4265 San Felipe Street<br>Huston, Texas 77027-2918 |
| Facility Name and Address: | Emery Refining<br>(address not yet assigned)<br>Green River, Utah 84525 |
| Owners name and Address: | Emery Refining, L.L.C.<br>4265 San Felipe Street<br>Huston, Texas 77027-2918 |
| UTM coordinates of the plant: | 564747 E, 4,316525 N, Zone 12S |
| County where facility is located: | Emery County |
| SIC Code: | 324 |
| Facility Area Designation: | Attainment for all pollutants |
| Current Approval Orders: | None (Bridgehouse AO to be revoked) |
| Current Title V Operating Permit: | None |
| Date of Approval Order: | Not Applicable |
| Date of Operating Permit: | Not Applicable |
| Type of Business at this facility: | Oil Refinery |
| Number of Employees: | Less than 100 |

# Process Information:

## Description of the process:

The refinery will consist of two independent processes that will operate on different feedstocks. Process flow diagrams of the two processes are shown in Appendix A.

### Distillation plant:

The first process will be an organic liquid distillation plant. The purpose of the distillation plant, is to separate organic liquids that are a mixture of various components, into products that are relatively uniform. Organic liquid feedstock, consisting mainly of Utah and Western Colorado sweet crude oil, kerogen oil, tar sands oil, and various types of transmix, condensate, and other related organic liquids, will be delivered to the plant by common carrier highway tank trucks. Feed to this plant will be a maximum of 10,000 bbl per day, or 3,650,000 bbl per year. The feedstock will be off-loaded via flexible stainless steel hoses that connect to the bottom of the tank trucks, and a system of above ground solid pipes and pumps. The feedstock will be pumped through this system into storage tanks.

From the storage tanks, the feedstock will be pumped through a de-salter system and then a series of heat exchangers, to increase its temperature. After the heat exchangers, the feedstock is pumped through a heater (36 million btu/hr, natural gas fired), and then through an atmospheric distillation tower. The feedstock exits the heater at approximately 650°F, and is piped into bottom of the atmospheric distillation tower. At 650°F and atmospheric pressure, most of the feedstock boils into gaseous form. As the gas rises through the tower, it cools and condenses into liquids. The difference in temperature, that various liquids condense at, is used to separate the feedstock into intermediate products. The tower contains a series of trays, that collect the liquids as they are condensed and removes the liquids from the tower. The lower in the tower that a tray is, the heaver (higher temperature of condensation) the liquid will be that condenses on that tray. Each tray produces what is called a "cut".

The atmospheric tower will be operated to produce the following cuts: atmospheric gas oil from the lowest trays, a heavy diesel fuel used for marine fuel, kerosene, and naphtha that will be used in commercial solvents. At the top of the tower, a small portion of the feed will be removed that is still in gaseous form. This in mainly methane, ethane, butane and propane. This gaseous cut will be compressed into portable pressure vessels, and transported by common carrier to costumers and sold as fuel.

The naphtha cut is split again in another separation tower called the naphtha stripper (existing equipment). This produced a light and heavy naphtha that are sold as petroleum sprits & paint and varnish solvents respectively.

The other cuts (except the gas oil cut) will pass through the heat exchangers used to preheat the feedstock. This heats the feedstock and cools the products. After cooling, these products are piped into storage tanks. From the storage tanks, the products are blended with each other to give the

optimum characteristics for sale of the products, and returned to the finished products tanks. From the finished products tanks, the products are bottom loaded into tank trucks at the loading rack, and shipped to the customers.

The atmospheric gas oil cut will be sent to a vacuum distillation tower for additional separation. The gas oil is reheated in the vacuum tower furnace (5 million btu/hr natural gas fired), and piped into the vacuum distillation tower. The separation principal in this tower is the same as in the atmospheric tower, except that the tower is placed under a vacuum (produced by electric powered vacuum pumps) of approximately 22 Psi. Under vacuum, compounds that would not boil into gaseous form at atmospheric pressure, do so. This allows for additional separation of the heavy liquids. The vacuum tower and associated vacuum gas oil (VGO) stripper will produce three cuts: light VGO, heavy VGO, and bottoms. These cuts follow a similar path, as the atmospheric tower products, through heat exchangers to storage tanks.

From the storage tanks the intermediate products are blended and pumped to the finished product tanks, then to the loading racks, and common carrier highway tanker trucks for shipping. Typical products of the distillation plant are as follows. The quantity, and characteristics of the products will vary based on the specific feedstock used.

| | |
|---|---|
| LPG | 200 bbl/day |
| Light Naphtha | 1,100 bbl/day |
| Heavy Naphtha | 900 bbl/day |
| Kerosene | 3,100 bbl/day |
| Marine Distillates | 3,700 bbl/day |
| Heavy Fuel Oil | 500 bbl/day |
| Asphalt | 500 bbl/day |

## Wax Plant:

The second process in the refinery will be a wax/lube oil plant. The feedstock will be Black or Yellow Wax crude from the Uintah Basin. Feed to this plant will be a maximum of 10,000 bbl per day, or 3,650,000 bbl per year. Heated crude (135 °F) is trucked to the refinery and offloaded. The feedstock will be off-loaded via flexible stainless steel hoses that connect to the bottom of the tank trucks, and a system of above ground solid pipes and pumps. The feedstock will be pumped through this system into storage tanks. From the storage tanks, the crude is piped to a de-salter. This is an inclosed vessel in which water mixed with the crude and an electric charge is applied to the mixture. This causes salt and other impurities to separate from the crude. An oily brine results, which is sent to an oil water separator. The water from the oil water separator will be trucked to a landfill disposal site. The oil from the oil water separator will be recycled into the plant feed.

After desalting, the crude passes through an atmospheric distillation tower called the naphtha column. Four cuts will be taken from this tower. The lightest will be petroleum spirits, which will make up about 10 bpd. Next will be varnish and paint solvents at 175 bpd, then mineral sprits at 231 bpd. The heaviest cut will be the feed for a second atmospheric distillation tower, called the diesel tower. This tower will produce two cuts. The lighter cut will be a diesel fuel at 2,261 bpd. The heaver cut will be piped to 12 evaporators. Both towers will produce a very small amount of overhead gas, that will be compressed and sold as fuel gas.

The evaporators will be set up in four parallel sets, of three units in series. The evaporators are vacuum vessels that condense wax oil on the walls of the vessel. Each of the three evaporators in series, produces a heaver grade of wax oil. The first will produce 3500 bpd of light wax oil, the second 1,195 bpd of medium wax oil, and the third 417 bpd of heavy wax oil. Each of these oils will be piped to storage tanks, and then on to additional separation.

From the storage tanks the wax oil is piped to either of two crystalizers. The light wax oil is sent to one unit, and the medium and heavy wax oils are sent to the other. The crystallizers are sealed coolers that chill the wax oil and cause the wax to solidify in the remaining oil. This mixture is sent to a series of three centrifugal separators that separate the wax from the remaining oil. The oil, which is lubrication grade oil, is piped to storage tanks, then to the loading rack, and shipped in highway trucks. The wax is sent to any of four packaging options; a slabber, priller, pelletizer, or bulk storage. Three grades of wax, 120, 140, 160 $^{o}$F melt points are produced. And three grades, light 1,822 bpd, medium 1,195 bpd and heavy 417 bpd, lubrication oils are produced.

## Combustion Sources:

The wax plant will use two heaters and three boilers. The heaters will be liquified natural gas (LNG) fired, 51 million btu/hr heaters, equipped with selective catalytic reduction to reduce NOx emissions. The boilers will be 3 million btu/hr each and will have low NOx burners.

Steam, used for steam stripping, will be produced in three 1.5 million btu/hr LNG fired boilers at the distillation plant, and three 3.0 million btu/hr at the wax plant. All of the boilers will be equipped with low NOx burners. The existing and new heaters at the distillation plant will be equipped with low NOx burners, and the new heaters at the wax plant will be equipped with selective catalytic reduction (SCR). The low NOx burners will be capable of reducing NOx to 40 ppmdv, the SCR will be capable of reducing NOx to 8 ppmdv.

All of the heaters and boilers will be fired by pipeline natural gas or LPG suplimented with the overhead gas from the distillation towers. The LNG will be trucked in from a Utah supplier. The liquified natural gas is re-vaporized prior to combustion, so it behaves and has the same emissions as pipeline natural gas. The total heat capacity of all the LNG fired equipment is 150 million btu/hr. Using the btu content from AP-42 of 1,028 btu/ft$^3$, the maximum hourly rate of LNG would be 145,915 ft$^3$ per hour. For purposes of the permit conditions, no restrictions on the hours of operation is requested, so assuming a full 8,760 hours per year of operation, the maximum LNG usage will be 1,28 x 10$^9$ ft$^3$/yr or 1,314,000 therms per year.

The refinery will have an emergency flare that will burn off gasses that may result from a process upset that could create an over pressure in any of the equipment. The flare will be used only during upset conditions and normal start-up and shut-down. The flare will have a small LNG pilot flame burning all of the time.

The refinery will have an emergency generator that will allow the refinery to shut down and stay warm in case of a grid power failure. Since the refinery handles wax which would solidify during any unscheduled shut-downs, the generator will be designed to run throughout a power failure, not just long enough to perform an emergency shut down of the refinery. Initially, the emergency generator will be sized at 1 mega-watt output. The emergency generator will be fueled with diesel fuel. For purposes of estimating emissions from the generator, we have assumed 100 hours per

year of operation. The fuel usage rate has been calculated at 63.9 gal/hr and 6,390 gallons per year.

Propane will be used as a backup fuel for all of the combustion sources that normally burn LNG. There will be three 30,000 gallon horizontal pressure tanks to store the propane back up fuel.

### Operation Schedule:

The refinery will operate 24 hours per day and 365 days per year. Shut-downs will take place only for planned maintenance, or unexpected upset conditions. Planned maintenance is anticipated to take 15 days once every 1 to 2 years. Each of the two plants would be taken off line at different times, so the the refinery as a whole will remain under operation 365 days per year, except for unplanned shutdowns.

### Construction Schedule:

Construction is planned to start in the Spring of 2013. The distillation plant should be in operation in the second half of 2014 and the wax plant in the second half of 2015.

## Equipment List:

Engineering for the plant has not yet progressed to a point where detailed equipment specifications have been produced.

### Distillation Plant:

#### Storage Tanks:

A: Fixed Roof Tanks

1) 1 @ 350 bbl
2) 2 @ 500 bbl
3) 8 @ 2,500 bbl
4) 1 @ 5,000 bbl
5) 11 @ 10,000 bbl

B: Internal Floating Roof Tanks

1) 8 @ 5,000 bbl
2) 5 @ 20,000 bbl

#### Atmospheric Distillation Unit:

A. Heater: 36 million btu/hr capacity, fueled by natural gas with low NOx burners.

B. Boiling vessel

C. Condensing vessel

### Vacuum Distillation Unit:

A: Heater: one at 5 million btu/hr capacity, fueled by natural gas, with low NOx burner

B: Boiling vessel

C: Condensing vessel

### Associated Equipment:

A: Cooling towers: dry fin non evaporative type

B: Heat Exchangers

C: Three boilers: 1.5 million btu/hr capacity each, fueled by natural gas, with low NOx burners

D: Piping, valves, flanges, pumps etc.

E: Oil / Water Separator: 20 gallon per minute

F: De-Salter

## Wax Plant:

### Storage Tanks:

A: Fixed Roof Tanks

1) 1 @ 2,500 bbl
2) 7 @ 5,000 bbl
3) 17 @ 10,000 bbl
4) 3 @ 20,000 bbl

B: Internal Floating Roof Tanks

1) 4 @ 2,500 bbl
2) 9 @ 20,000 bbl

### Atmospheric Distillation Unit Naphtha:

A. Heater: one at 51 million btu/hr capacity, fueled by natural gas, SCR NOx controls

B. Boiling Vessel

C. Condensing vessel

### Atmospheric Distillation Unit Diesel:

A: Heater: one at 51 million btu/hr capacity, fueled by natural gas, SCR NOx controls

B: Boiling vessel

C: Condensing vessel

### Evaporators:

A: Wiped Film Evaporators: 4 units in parallel

B: Short Path Evaporators: 4 sets in parallel of 2 units in series

### Crystallizers:

A: Light Wax Oil: 4 units in parallel

B: Medium & Heavy Wax Oil: 4 units in parallel

### Centrifuges:

A: Light Wax Oil: 4 sets in parallels of 3 units in series

B: Medium & Heavy Wax Oil: 4 sets in parallels of 3 units in series

### Wax Finishing:

A: Wax Slabbers: 2 units, one for light wax, one for medium and heavy wax

B: Priller: 2 units, one for light wax, one for medium and heavy wax. The priller uses a recirculating air stream with a fabric filter to collect the prilled wax. Air from the fabric filter is recirculated to the process and does not vent to the atmosphere.

C: Pelletizer

### Associated Equipment:

A: Cooling towers: dry fin non evaporative type

B: Three boilers, 3 million btu/hr capacity each, fueled by natural gas, low NOx burners

C: Piping, valves, flanges, pumps etc.

D: Oil / Water separator: 20 gallon per minute

E: De-salter

## Equipment Common to both plants:

A: Loading Racks:

B: Emergency Generator: 1 MW capacity

C: Emergency Flare

D: Fire Fighting Pump Engine: 150 HP, diesel

E: three 30,000 gallon propane tanks

E: Office and Laboratory

### Emission Summary:

Calculations of the projected Potential to Emit (PTE) are shown in Appendixes C.

**Table 1 Allowable Emissions in Tons per Year**

| Pollutant | Projected PTE |
|---|---|
| $PM_{10}$ | 5.51 |
| $PM_{2.5}$ | 5.51 |
| $SO_2$ | 0.57 |
| NOx | 17.1 |
| CO | 56.3 |
| VOC | 33.2 |
| HAPs | 2.39 |

## Requirements to Obtain an Approval Order:

### Best Available Control Technology (BACT):

The Utah Air Quality Rules at R307-401-8 (a) requires that in order to obtain an approval order, a new installation must show that the degree of pollution control for emissions is at least best available control technology (BACT). BACT is defined at 307-401-2 as:

"*Best available control technology*" *means an emissions limitation (including a visible emissions standard) based on the maximum degree of reduction for each air contaminant which would be emitted from any proposed stationary source or modification which the executive secretary, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR parts 60 and 61. If the executive*

*secretary determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard or combination thereof, may be prescribed instead to satisfy the requirement for the application of best available control technology. Such standard shall, to the degree possible, set forth the emissions reduction achievable by implementation of such design, equipment, work practice or operation, and shall provide for compliance by means which achieve equivalent results."*

## Products of Combustion ($PM_{10}$ and $PM_{2.5,}$ SOx, NOx CO,VOC,HAPs):

Distillation plant; Products of combustion from the existing heater (5 million btu/hr), three new boilers (1.5 million btu/hr each), and for the new furnace (36 million btu/hr) , will be controlled by using natural gas for fuel, and maintaining proper combustion conditions during operation of the burners. NOx emissions will be controlled by use of low NOx burners, capable of 40 ppmdv NOx concentration in all of the units. Low NOx burners and natural gas fuel is generally considered BACT for small combustion units.

Wax plant; Products of combustion from the two new heaters (51 million btu/hr each) and three new boilers (3 million btu/hr each) will be controlled by using natural gas for fuel, and maintaining proper combustion conditions during operation of the burners. In the boilers, NOx emissions will be controlled by use of low NOx burners capable of 40 ppmdv NOx concentration. The two new heaters will employ selective catalytic reduction (SCR) capable of 8 ppmdv NOx concentration. For natural gas fired heaters of this size, SCR, is generally considered to exceed the level of emission control defined as BACT. For boilers of this size, low NOx burners and natural gas fuel are generally considered BACT.

The two diesel engines, emergency generator 1,415 HP, and fire fighting pump, 150 HP, will be used only once per month, for approximately one hour as scheduled maintenance runs, or during an emergency. The limited use of these engines makes any attempt to add pollution controls cost prohibitive under the BACT definition. Therefore, proper maintenance of the engines is proposed as BACT.

## VOC:

VOC emissions from the storage tanks with liquids that have a vapor pressure in excess of .51 psi (crude and naphtha), will be controlled by use of internal floating roofs with liquid mounted primary seals, and rim mounted secondary seals. The control efficiency of the floating roof tanks has been calculated by comparing their predicted emission rate to that of an equivalent fixed roof tank. The control efficiency varies from tank to tank depending on its size, annual throughput and vapor pressure of its contents. The range is from 68.4% to 98.2% with the total for all tanks at 97.3%. Details are shown in Appendix C. Storage tanks with liquids with a vapor pressure higher than .51 psi (kerosene, diesel, heavy fuel oil, AGO, VGO and wax oils) will be uncontrolled. The total VOC emission rate from all of the uncontrolled tanks is calculated to be .987 tons per year. No economically viable options exist to control emissions that small from the tanks.

The loading racks that handle products with a vapor pressure above .51 psi (naphtha products) will be vented to the boilers. Combustion in the boilers will reduce the VOC emission rate by an estimated 98%. The total emission rate of VOC from the uncontrolled racks is calculated to be .69 tons per year. No economically viable options exist to control emissions that small from the loading racks.

Leaks from valves and pump seals etc., will be controlled by inspection and maintenance in

accordance with NSPS subpart GGGa. These VOC controls are generally considered BACT.

### Fugitive Dust:

Fugitive dust will be controlled by paving the roads that trucks use to deliver feedstock and ship products. Open areas will remain undisturbed by truck traffic.

## New Sources in Non-attainment and Maintenance Areas:

The plant is located in Emery county, which is an attainment area for all pollutants. Therefore, this regulation does not apply.

## Major Source in Attainment or Unclassified Areas (PSD):

The plant is not defined as a "Major Source", because the "potential to emit" of all criteria pollutants emitted from the plant are less than one hundred tons per year for each pollutant. Therefore, PSD major modification requirements do not apply to this NOI.

## Visibility:

R307-406-2 requires a visibility impact analysis for new major sources and major modifications. This plant is neither a major source or a major modification, therefore no visibility analysis is required for this NOI. The closest Nation to the refinery is Arches National approximately 48 kilometers to the east southeast of the refinery.

## Emissions Impact Analysis (dispersion modeling):

R307-410-4 requires that a new plant or modification to a plant that will produce an increase in the controlled emission rates in excess of the following levels, must be evaluated for the impact of its emissions:

| | |
|---|---|
| $PM_{10}$ | 15 tons/yr |
| $SO_2$ & NOx | 40 tons/yr |
| CO | 100 tons/yr |
| Lead | .6 tons/yr |

The emission increases associated with this NOI are all well below these levels. The emissions of HAPs are also below the levels which require a modeling analysis, therefore, an emissions impact analysis has not been performed for this NOI. Calculations of the emission rates are shown in Appendix C.

## New Source Performance Standards (NSPS):

There are 7 NSPS subparts that could potentially apply to this refinery, but do not for the reasons listed below:

- Subpart D (Fossil Fuel Fired Steam Generators after 1971) : This subpart applies only to units larger than 250 million btu/hr. The largest steam generators in the refinery will be 3 million btu/hr.
- Subpart Db (Industrial, Commercial,Institutional Steam Generators) : This subpart applies only to units larger than 100 million btu/hr.
- Subpart Dc (Small Industrial, Commercial,Institutional Steam Generators) : This subpart applies only to units larger than 10 million btu/hr.
- Subpart J (Petroleum Refineries) : This subpart has been superseded by subpart Ja for new refineries.
- Subpart VV & VVa (Equipment Leaks of VOC in the Synthetic Chemical Industry) : The refinery will not produce as intermediates or final products, the chemicals listed in 60.489, which define the applicability of these subparts. Some of those chemicals, are included along with other chemicals in the products produced at the refinery, however, this does not trigger applicability of these subparts. The refinery will be subject to Subpart GGGa, (Leaks of VOC in oil refineries). Subpart GGGa references Subpart VVa for the applicable emission standards and work practices. Other NSPS subparts applicable to the Synthetic Chemical Industry, are also not applicable to the refinery, for the same reason stated above.
- Subpart XX (Bulk Gasoline Terminals) : Based on the following definition, "Bulk gasoline terminal means any gasoline facility which receives gasoline by pipeline, ship or barge, and has a gasoline throughput greater than 75,700 liters per day.". The refinery does not contain a bulk gasoline terminal.
-

The following NSPS subparts do apply to certain equipment in the refinery:

- Subpart Ja (Petroleum Refineries constructed after 2007): This subpart applies to the flare and fuel gas combustion devices.
- Subpart Kb (storage tanks manufactured after 1984): this subpart applies to the following tanks based on the size of the tank and the vapor pressure of the liquid in the tank;
  - 1-00350-1 record-keeping only
  - 1-00500-1&2 record-keeping only
  - 1-02500-2&3 record-keeping only
  - 1-02500-4 to 8 record-keeping only
  - 1-05000-1 to 8 full applicability
  - 1-05000-9 record-keeping only
  - 1-10000-1 to 11 record-keeping only
  - 1-20000-1 to 4 full applicability
  - 2-02500-1 to 4 full applicability
  - 2-02500-5 record-keeping only
  - 2-05000-1 & 6 record-keeping only

- 2-10000- 1 to 17 record-keeping only
- 2-20000-1 to 3 record-keeping only
- 2-20000-4 to 12 full applicability
-

- Subpart GGGa (VOC leaks in Petroleum Refineries after November 7, 2006) : Applicable equipment is defined as "Each valve, pump, pressure relief device, sampling connection system, open-ended valve or line, and flange or other connector in VOC service. For the purposes of record keeping and reporting only, compressors are considered equipment."
- QQQ (VOC leaks from Petroleum Refinery Waste Water Systems) : This subpart applies to drains and oil water separators in the refinery.
- Subpart IIII (Compression Ignition Internal Combustion Engines): This subpart applies to engines manufactured after 2005. The refinery will have two internal combustion engines associated with the emergency generator and fire fighting pump.

## National Ambient Air Quality Standards (NAAQS):

The emission increases from the new refinery are small enough that no effect on maintaining the NAAQS will result. This conclusion is based on the fact that no air quality analysis is required under R307-410.

## National Emission Standards for Hazardous Air Pollutants (NESHAPS):

There are no NESHAPS that apply to this refinery. There are 17 NESHAP subparts that could potentially apply to this refinery, but do not for the reasons listed below:

- Subpart H (National Emission Standards for Organic Hazardous Air Pollutants for Equipment Leaks): This subpart applies only if called from another applicable subpart. There are no other subparts applicable to this refinery that call for Subpart H.
- Subpart I (National Emission Standards for Organic Hazardous Air Pollutants for Certain Processes Subject to the Negotiated Regulation for Equipment Leaks): Subpart I applies only to facilities that are a major source of HAPs, which this refinery is not.
- Subpart Q (cooling towers): does not apply because 1): no chromium is used and 2) the plant is not a major source of HAPs.
- Subpart T (halogenated solvent cleaning): does not apply, because no halogenated solvents will be used at the refinery.
- Subpart CC (National Emission Standards for Hazardous Air Pollutants From Petroleum Refineries): does not apply, because this refinery will not be a major source of HAPs.
- Subpart DD (off-site waste facilities): does not apply, because the plant is not a major source of HAPs.

- Subpart HH (National Emission Standards for Hazardous Air Pollutants From Oil and Natural Gas Production Facilities): This subpart applies to oil wells, not oil refineries.
- Subpart OO (National Emission Standards for Tanks—Level 1): This subpart applies only if called from another applicable subpart. There are no other applicable subparts that call for Subpart OO.
- Subpart QQ (National Emission Standards for Hazardous Air Pollutants From Surface Impoundments): This subpart does not apply, because the refinery will not have any surface impoundments. All waster water will be hauled off-site to a licensed waster disposal site.
- Subpart RR ( National Emission Standards for Hazardous Air Pollutants From Drains) : This subpart applies only if called from another applicable subpart. There are no other subparts applicable to this refinery that call for Subpart RR.
  EEEE (distribution of non gasoline organic liquids): does not apply, because the plant is not a major source.
- Subpart SS (National Emission Standards for Closed Vent Systems, Control Devices, Recovery Devices and Routing to a Fuel Gas System or a Process): This subpart applies only if called from another applicable subpart. There are no other subparts applicable to this refinery that call for Subpart SS.
- Subpart TT (National Emission Standards For Equipment Leaks--Control Level 1):This subpart applies only if called from another applicable subpart. There are no other subparts applicable to this refinery that call for Subpart TT.
- Subpart UU (National Emission Standards For Equipment Leaks--Control Level 2): This subpart applies only if called from another applicable subpart. There are no other subparts applicable to this refinery that call for Subpart UU.
- Subpart VV (National Emission Standards For Oil-Water Separators And Organic-Water Separators): This subpart applies only if called from another applicable subpart. There are no other subparts applicable to this refinery that call for Subpart VV.
- Subpart WW (National Emission Standards For Storage Vessels (tanks)--control Level 2): This subpart applies only if called from another applicable subpart. There are no other subparts applicable to this refinery that call for Subpart WW.
- DDDDD (National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters ): does not apply, because the plant is a not major source of HAPs.

## State Implementation Plan (SIP):

We are not aware of any provisions of the SIP, other than those discussed above, that would apply to this NOI.

## All Other Provisions of R307:

The plant will comply with all applicable provisions of R307.

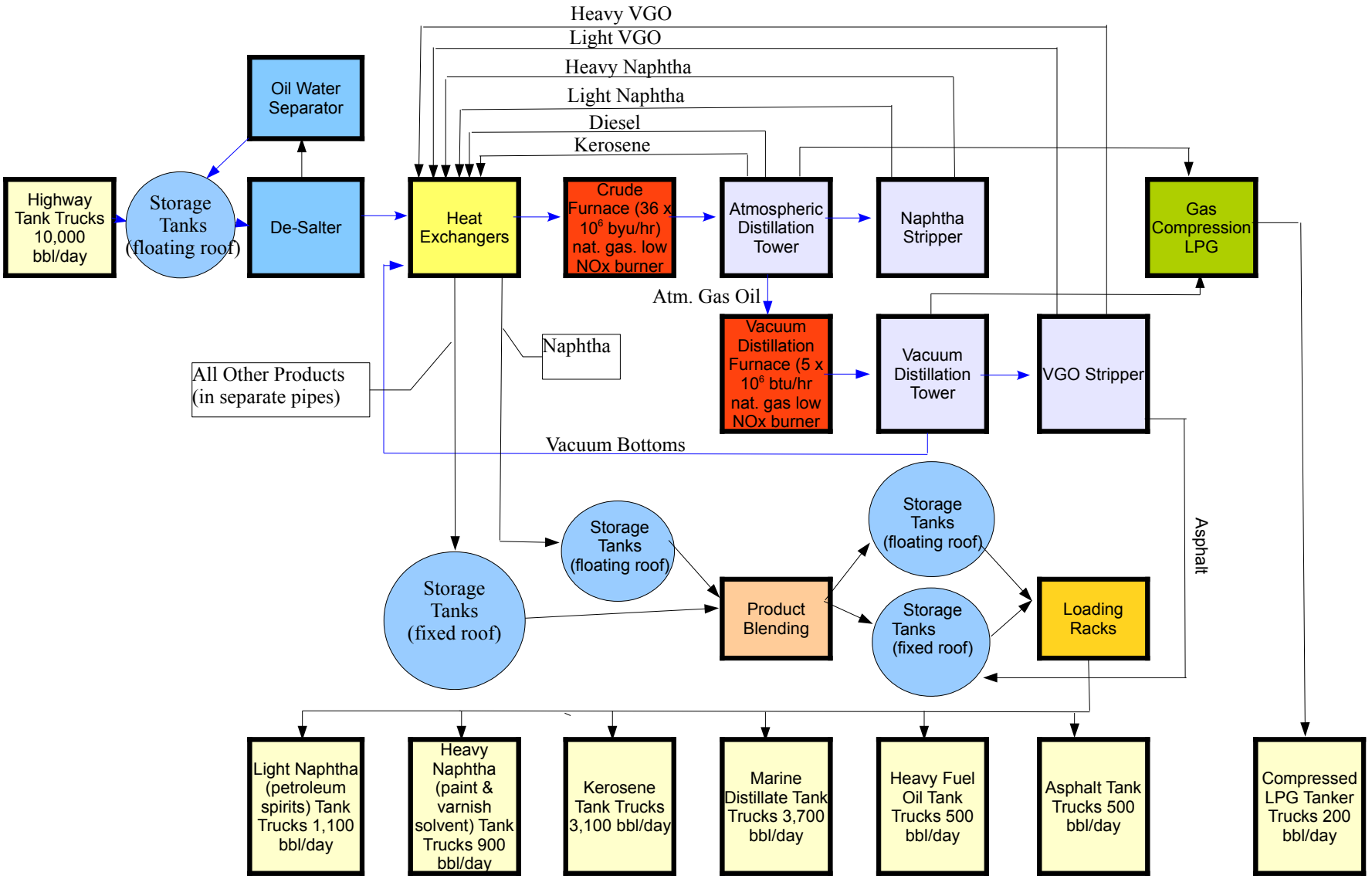
## Conclusion:

Based on the above analysis of applicable requirements and the information contained in this NOI, we believe that all of the requirements specified in R307-400-8 to obtain an approval order, have been met, and an approval order should be issued to Emery Refining, L.L.C. for this new oil refinery.

# *Appendix A*

## *Process Diagrams*

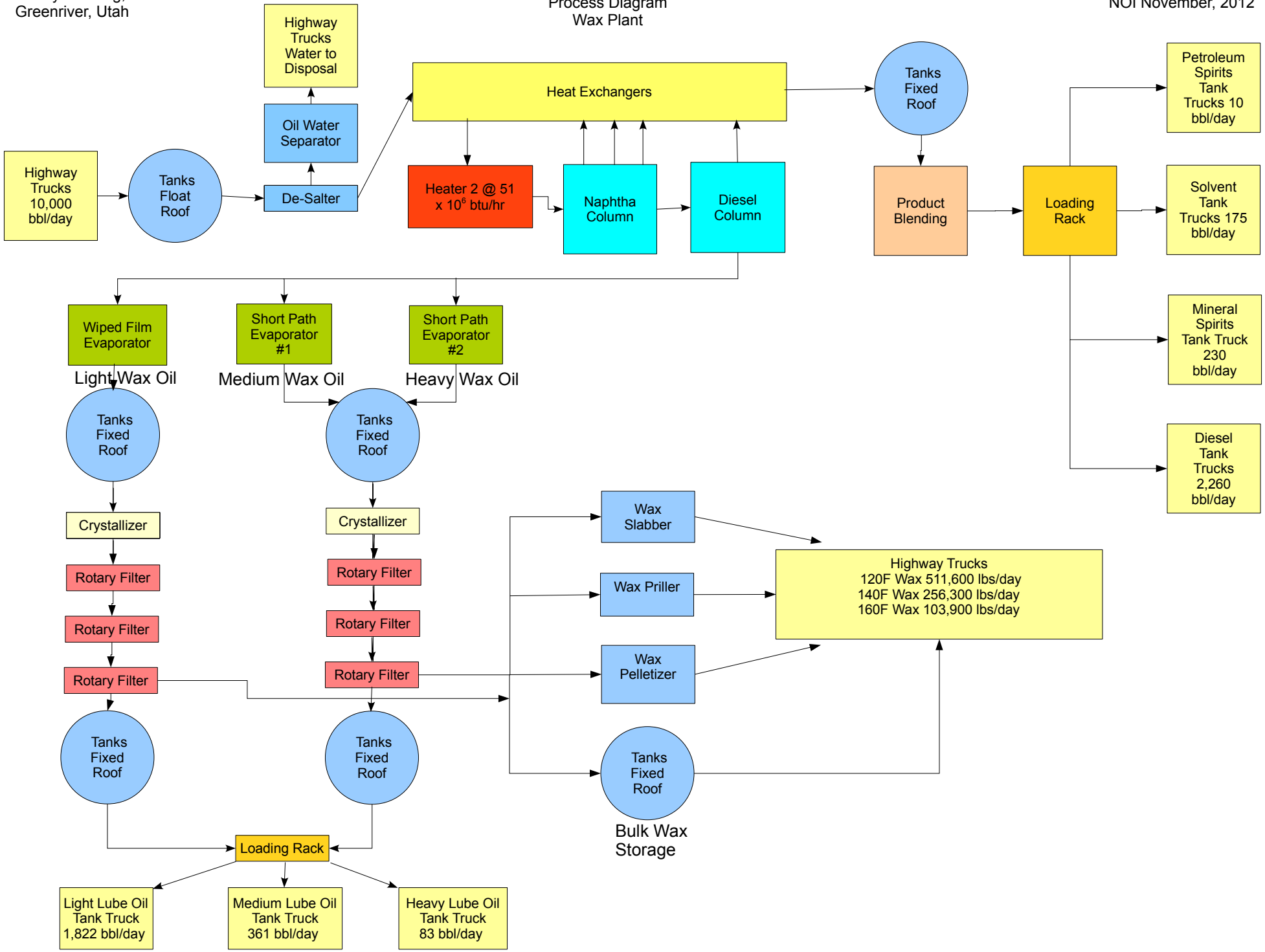
# Distillation Plant



Emery Refining, L.L.C.
Greenriver, Utah

Process Diagram
Wax Plant

NOI November, 2012



# *Appendix B*

## *Emission Rate Summary*

## *DAQ Form 1a & d*

# Utah Division of Air Quality Forms 1a & 1d

Controlled Tons Per Year (PTE)

| Pollutants | Permitted Emissions | Emission Increase | Proposed Emissions | Uncontrolled Emissions Tons per Year | Maximum Emission Rate lbs/hr |
|---|---|---|---|---|---|
| **Criteria Pollutants** | | | | | |
| $PM_{10}$ | 0.00 | 5.54 | 5.54 | 5.54 | 284.89 |
| $PM_{2.5}$ | 0.00 | 5.54 | 5.54 | 5.54 | 284.89 |
| NOx | 0.00 | 18.03 | 18.03 | 68.76 | 54.74 |
| $SO_2$ | 0.00 | 0.71 | 0.71 | 0.71 | 7.01 |
| CO | 0.00 | 56.56 | 56.56 | 56.56 | 26.53 |
| VOC | 0.00 | 36.02 | 36.02 | 338.38 | 9.60 |
| **Greenhouse Gases** | | | | | |
| $CO_2e$ | 0.00 | 80,306.76 | 80,306.76 | 49,558.49 | 18,875.48 |
| $CO_2$ | 0.00 | 80,228.07 | 80,228.07 | 80,228.07 | 18,856.96 |
| $CH_4$ | 0.00 | 1.52 | 1.52 | 1.52 | 0.37 |
| $N_2O$ | 0.00 | 0.15 | 0.15 | 0.15 | 0.03 |
| Hydroflourocarbons (HFCs) | 0.00 | ND | ND | ND | ND |
| Perflourocarbons (PFCs) | 0.00 | ND | ND | ND | ND |
| Sulfur Hexaflouride (SF6) | 0.00 | ND | ND | ND | ND |
| **Total Hazardous Air Pollutants** | | 2.71 | 2.71 | 21.93 | 5.61E-1 |
| **Organic HAPs from Combustion** | | 1.26 | 1.26 | 1.26 | 2.87E-1 |
| 2-Methylnaphthalene* | 0.00 | 1.60E-5 | 1.60E-5 | 1.60E-5 | 3.65E-6 |
| 3-Methylchloranthrene* | 0.00 | 1.20E-6 | 1.20E-6 | 1.20E-6 | 2.74E-7 |
| 7,12-Dimethylbenz(a)anthracene* | 0.00 | 1.07E-5 | 1.07E-5 | 1.07E-5 | 2.44E-6 |
| Acenaphthene* | 0.00 | 1.20E-6 | 1.20E-6 | 1.20E-6 | 2.74E-7 |
| Acenaphthylene* | 0.00 | 1.20E-6 | 1.20E-6 | 1.20E-6 | 2.74E-7 |
| Anthracene* | 0.00 | 1.60E-6 | 1.60E-6 | 1.60E-6 | 3.65E-7 |
| Benz(a)anthracene* | 0.00 | 1.20E-6 | 1.20E-6 | 1.20E-6 | 2.74E-7 |
| Benzene | 0.00 | 1.90E-3 | 1.90E-3 | 1.90E-3 | 3.26E-4 |
| Benzo(a)pyrene* | 0.00 | 8.00E-7 | 8.00E-7 | 8.00E-7 | 1.83E-7 |
| Benzo(b)fluoranthene* | 0.00 | 1.20E-6 | 1.20E-6 | 1.20E-6 | 2.74E-7 |
| Benzo(g,h,i)perylene* | 0.00 | 8.00E-7 | 8.00E-7 | 8.00E-7 | 1.83E-7 |
| Benzo(k)fluoranthene* | 0.00 | 1.20E-6 | 1.20E-6 | 1.20E-6 | 2.74E-7 |
| Chrysene* | 0.00 | 1.20E-6 | 1.20E-6 | 1.20E-6 | 2.74E-7 |
| Dibenzo(a,h)anthracene* | 0.00 | 8.00E-7 | 8.00E-7 | 8.00E-7 | 1.83E-7 |
| Dichlorobenzene | 0.00 | 8.00E-4 | 8.00E-4 | 8.00E-4 | 1.83E-4 |
| Fluoranthene* | 0.00 | 2.00E-6 | 2.00E-6 | 2.00E-6 | 4.57E-7 |
| Fluorene* | 0.00 | 1.87E-6 | 1.87E-6 | 1.87E-6 | 4.26E-7 |
| Formaldehyde | 0.00 | 5.01E-2 | 5.01E-2 | 5.01E-2 | 1.14E-2 |
| Hexane | 0.00 | 1.20E+0 | 1.20E+0 | 1.20E+0 | 2.74E-1 |
| Indeno(1,2,3-cd)pyrene* | 0.00 | 1.20E-6 | 1.20E-6 | 1.20E-6 | 2.74E-7 |

# Utah Division of Air Quality Forms 1a & 1d

Controlled Tons Per Year (PTE)

| Pollutants | Permitted Emissions | Emission Increase | Proposed Emissions | Uncontrolled Emissions Tons per Year | Maximum Emission Rate lbs/hr |
|---|---|---|---|---|---|
| Naphthalene | 0.00 | 4.07E-4 | 4.07E-4 | 4.07E-4 | 9.29E-5 |
| Phenanthrene* | 0.00 | 1.13E-5 | 1.13E-5 | 1.13E-5 | 2.59E-6 |
| Propylene | 0.00 | 1.77E-3 | 1.77E-3 | 1.77E-3 | 2.12E-5 |
| Pyrene* | 0.00 | 2.27E-3 | 2.27E-3 | 2.27E-3 | 5.18E-4 |
| Toluene | 0.00 | 2.42E-4 | 2.42E-4 | 2.42E-4 | 2.27E-6 |
| Total POM | 0.00 | 4.53E-4 | 4.53E-4 | 4.53E-4 | 0.00E+0 |
| Total PAH | 0.00 | 1.33E-4 | 1.33E-4 | 1.33E-4 | 1.51E-6 |
| Xylene | 0.00 | 2.57E-4 | 2.57E-4 | 2.59E-4 | 3.14E-5 |
| Propylene | 0.00 | 4.64E-3 | 4.64E-3 | 4.70E-3 | 6.76E-4 |
| Acetaldehyde | 0.00 | 5.01E-5 | 5.01E-5 | 5.03E-5 | 3.03E-6 |
| Acrolien | 0.00 | 7.26E-4 | 7.26E-4 | 7.41E-4 | 1.64E-4 |
| **Organic HAPs from Evaporation** | 0.00 | 1.42E+0 | 1.42E+0 | 2.07E+1 | 2.67E-1 |
| 1,2,4, Trimethylylbenzene | 0.00 | 1.85E-1 | 1.85E-1 | 2.94E+0 | 3.58E-2 |
| Benzene | 0.00 | 7.95E-2 | 7.95E-2 | 1.08E+0 | 1.36E-2 |
| Cyclohexane | 0.00 | 9.09E-2 | 9.09E-2 | 1.30E+0 | 1.43E-2 |
| Ethylbenzene | 0.00 | 8.83E-2 | 8.83E-2 | 1.12E+0 | 1.62E-2 |
| Hexane | 0.00 | 2.23E-1 | 2.23E-1 | 3.18E+0 | 3.61E-2 |
| Isopropylbenzene | 0.00 | 1.70E-3 | 1.70E-3 | 2.20E-2 | 4.43E-4 |
| Toluene | 0.00 | 3.66E-1 | 3.66E-1 | 5.06E+0 | 7.04E-2 |
| Xylene | 0.00 | 3.87E-1 | 3.87E-1 | 5.96E+0 | 7.97E-2 |
| **Metals from combustion** | 0.00 | 2.85E-2 | 2.85E-2 | 8.47E-3 | 6.51E-3 |
| Arsenic** | 0.00 | 1.31E-4 | 1.31E-4 | 3.88E-5 | 2.98E-5 |
| Barium | 0.00 | 2.87E-3 | 2.87E-3 | 8.53E-4 | 6.56E-4 |
| Beryllium** | 0.00 | 7.83E-6 | 7.83E-6 | 2.33E-6 | 1.79E-6 |
| Cadmium** | 0.00 | 7.18E-4 | 7.18E-4 | 2.13E-4 | 1.64E-4 |
| Chromium** | 0.00 | 9.14E-4 | 9.14E-4 | 2.71E-4 | 2.09E-4 |
| Cobalt** | 0.00 | 5.48E-5 | 5.48E-5 | 1.63E-5 | 1.25E-5 |
| Copper | 0.00 | 5.55E-4 | 5.55E-4 | 1.65E-4 | 1.27E-4 |
| Lead** | 0.00 | 3.26E-4 | 3.26E-4 | 9.69E-5 | 7.45E-5 |
| Manganese** | 0.00 | 2.48E-4 | 2.48E-4 | 7.37E-5 | 5.66E-5 |
| Mercury** | 0.00 | 1.70E-4 | 1.70E-4 | 5.04E-5 | 3.88E-5 |
| Molybdenum | 0.00 | 7.18E-4 | 7.18E-4 | 2.13E-4 | 1.64E-4 |
| Nickel** | 0.00 | 1.37E-3 | 1.37E-3 | 4.07E-4 | 3.13E-4 |
| Selenium** | 0.00 | 1.57E-5 | 1.57E-5 | 4.65E-6 | 3.58E-6 |
| Vanadium | 0.00 | 1.50E-3 | 1.50E-3 | 4.46E-4 | 3.43E-4 |
| Zinc | 0.00 | 1.89E-2 | 1.89E-2 | 5.62E-3 | 4.32E-3 |

# *Appendix C*

## *Emission Rate Calculations*

# Refinery Summary



| Pollutant | Controlled Emissions Tons/yr | | | | Controlled Emissions lbs/hr | | | | Uncontrolled Tons/yr | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Distillation Plant | Wax Plant | Common Equipment | Total | Distillation Plant | Wax Plant | Common Equipment | Total | Distillation Plant | Wax Plant | Common Equipment | Total |
| **Criteria Pollutants** | | | | | | | | | | | | |
| PM Total[1] | 1.47 | 3.59 | .468 | 5.54 | .336 | .821 | 284 | 284.89 | 1.47 | 3.59 | .468 | 5.54 |
| PM Condensible[1] | 1.105 | 2.70 | .00490 | 3.81 | .252 | .615 | 0.1143 | .98 | 1.105 | 2.70 | .00490 | 3.81 |
| PM Filterable[1] | .368 | .899 | .463 | 1.73 | .084 | .205 | 284 | 283.91 | .368 | .899 | .463 | 1.73 |
| $SO_2$ | .1139 | .278 | .314 | .705 | .0260 | .0634 | 6.92 | 7.011 | .1139 | 0.278 | .314 | .705 |
| $NO_2$ | 9.7 | 6.26 | 2.08 | 18.0 | 2.21 | 1.43 | 51.1 | 54.7 | 19.4 | 47.3 | 2.08 | 68.8 |
| CO | 16.3 | 39.7 | .545 | 56.6 | 3.72 | 9.07 | 13.74 | 26.5 | 16.3 | 39.7 | .545 | 56.6 |
| VOC | 23.4 | 11.72 | .945 | 36.0 | 4.40 | 2.68 | 2.52 | 9.6 | 97 | 223 | 18.6 | 338.4 |
| **Greenhouse Gases** | | | | | | | | | | | | |
| $CO_2$ | 23,295 | 56,829 | 104.9 | 80,228 | 5,318 | 12,975 | 564 | 18,857 | 23,295 | 56,829 | 104.9 | 80,228 |
| $N_2O$ | .0439 | .107 | ND | .151 | .01003 | .0245 | ND | .035 | .0439 | .107 | ND | .151 |
| Methane | .439 | 1.07 | .00515 | 1.52 | .1003 | .245 | .02783 | .37 | .439 | 1.07 | .00515 | 1.52 |
| Hydrofluorocarbons | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | .00 |
| Perfluorocarbons | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | .00 |
| $SF_6$ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | .00 |
| **$CO_2e$** | 23,317 | 56,884 | 105.0 | 80,307 | 5,324 | 12,987 | 565 | 18,875 | 23,317 | 26,136 | 105.0 | 49,558 |
| **Other Pollutants** | | | | | | | | | | | | |
| Ammonia | .596 | 1.10 | ND | 1.69 | .139 | .256 | ND | .39 | .609 | 1.12 | ND | 1.73 |
| **HAPs** | | | | | | | | | | | | |
| Total Organic HAPs | 1.01 | 1.61 | .0599 | 2.69 | .180 | .369 | 0.00579 | .55 | 7.6 | 14.3 | .0599 | 21.93 |
| Total Metalic HAPs | 0.00830 | 0.0202 | 0.00 | 0.0285 | 0.00189 | 0.00462 | 0.00 | 0.0065 | 0.00847 | 0.0137 | 0.00 | 0.0222 |
| Total HAPS | 1.02 | 1.63 | .0599 | 2.71 | .182 | .373 | 0.00579 | .56 | 7.6 | 14.3 | .0599 | 21.95 |
| **Organic HAPs from Combustion** | | | | | | | | | | | | |
| 2-Methylnaphthalene* | 4.65E-6 | 1.14E-5 | 0.00E+0 | 1.60E-5 | 1.06E-6 | 2.59E-6 | 0.00E+0 | 3.65E-6 | 4.65E-6 | 1.14E-5 | 0.00E+0 | 1.60E-5 |
| 3-Methylchloranthrene* | 3.49E-7 | 8.51E-7 | 0.00E+0 | 1.20E-6 | 7.97E-8 | 1.94E-7 | 0.00E+0 | 2.74E-7 | 3.49E-7 | 8.51E-7 | 0.00E+0 | 1.20E-6 |
| 7,12-Dimethylbenz(a)anthracene* | 3.10E-6 | 7.57E-6 | 0.00E+0 | 1.07E-5 | 7.08E-7 | 1.73E-6 | 0.00E+0 | 2.44E-6 | 3.10E-6 | 7.57E-6 | 0.00E+0 | 1.07E-5 |
| Acenaphthene* | 3.49E-7 | 8.51E-7 | 0.00E+0 | 1.20E-6 | 7.97E-8 | 1.94E-7 | 0.00E+0 | 2.74E-7 | 3.49E-7 | 8.51E-7 | 0.00E+0 | 1.20E-6 |
| Acenaphthylene* | 3.49E-7 | 8.51E-7 | 0.00E+0 | 1.20E-6 | 7.97E-8 | 1.94E-7 | 0.00E+0 | 2.74E-7 | 3.49E-7 | 8.51E-7 | 0.00E+0 | 1.20E-6 |
| Anthracene* | 4.65E-7 | 1.14E-6 | 0.00E+0 | 1.60E-6 | 1.06E-7 | 2.59E-7 | 0.00E+0 | 3.65E-7 | 4.65E-7 | 1.14E-6 | 0.00E+0 | 1.60E-6 |
| Benz(a)anthracene* | 3.49E-7 | 8.51E-7 | 0.00E+0 | 1.20E-6 | 7.97E-8 | 1.94E-7 | 0.00E+0 | 2.74E-7 | 3.49E-7 | 8.51E-7 | 0.00E+0 | 1.20E-6 |
| Benzene | 4.07E-4 | 9.93E-4 | 4.99E-4 | 1.90E-3 | 9.29E-5 | 2.27E-4 | 5.98E-6 | 3.26E-4 | 4.07E-4 | 9.93E-4 | 4.99E-4 | 1.90E-3 |
| Benzo(a)pyrene* | 2.33E-7 | 5.68E-7 | 0.00E+0 | 8.00E-7 | 5.31E-8 | 1.30E-7 | 0.00E+0 | 1.83E-7 | 2.33E-7 | 5.68E-7 | 0.00E+0 | 8.00E-7 |
| Benzo(b)fluoranthene* | 3.49E-7 | 8.51E-7 | 0.00E+0 | 1.20E-6 | 7.97E-8 | 1.94E-7 | 0.00E+0 | 2.74E-7 | 3.49E-7 | 8.51E-7 | 0.00E+0 | 1.20E-6 |
| Benzo(g,h,i)perylene* | 2.33E-7 | 5.68E-7 | 0.00E+0 | 8.00E-7 | 5.31E-8 | 1.30E-7 | 0.00E+0 | 1.83E-7 | 2.33E-7 | 5.68E-7 | 0.00E+0 | 8.00E-7 |
| Benzo(k)fluoranthene* | 3.49E-7 | 8.51E-7 | 0.00E+0 | 1.20E-6 | 7.97E-8 | 1.94E-7 | 0.00E+0 | 2.74E-7 | 3.49E-7 | 8.51E-7 | 0.00E+0 | 1.20E-6 |
| Chrysene* | 3.49E-7 | 8.51E-7 | 0.00E+0 | 1.20E-6 | 7.97E-8 | 1.94E-7 | 0.00E+0 | 2.74E-7 | 3.49E-7 | 8.51E-7 | 0.00E+0 | 1.20E-6 |
| Dibenzo(a,h)anthracene* | 2.33E-7 | 5.68E-7 | 0.00E+0 | 8.00E-7 | 5.31E-8 | 1.30E-7 | 0.00E+0 | 1.83E-7 | 2.33E-7 | 5.68E-7 | 0.00E+0 | 8.00E-7 |
| Dichlorobenzene | 2.33E-4 | 5.68E-4 | 0.00E+0 | 8.00E-4 | 5.31E-5 | 1.30E-4 | 0.00E+0 | 1.83E-4 | 2.33E-4 | 5.68E-4 | 0.00E+0 | 8.00E-4 |
| Fluoranthene* | 5.82E-7 | 1.42E-6 | 0.00E+0 | 2.00E-6 | 1.33E-7 | 3.24E-7 | 0.00E+0 | 4.57E-7 | 5.82E-7 | 1.42E-6 | 0.00E+0 | 2.00E-6 |
| Fluorene* | 5.43E-7 | 1.32E-6 | 0.00E+0 | 1.87E-6 | 1.24E-7 | 3.02E-7 | 0.00E+0 | 4.26E-7 | 5.43E-7 | 1.32E-6 | 0.00E+0 | 1.87E-6 |
| Formaldehyde | 1.45E-2 | 3.55E-2 | 8.92E-5 | 5.01E-2 | 3.32E-3 | 8.10E-3 | 2.15E-6 | 1.14E-2 | 1.45E-2 | 3.55E-2 | 8.92E-5 | 5.01E-2 |
| Hexane | 3.49E-1 | 8.51E-1 | 0.00E+0 | 1.20E+0 | 7.97E-2 | 1.94E-1 | 0.00E+0 | 2.74E-1 | 3.49E-1 | 8.51E-1 | 0.00E+0 | 1.20E+0 |
| Indeno(1,2,3-cd)pyrene* | 3.49E-7 | 8.51E-7 | 0.00E+0 | 1.20E-6 | 7.97E-8 | 1.94E-7 | 0.00E+0 | 2.74E-7 | 3.49E-7 | 8.51E-7 | 0.00E+0 | 1.20E-6 |
| Naphthalene | 1.18E-4 | 2.88E-4 | 0.00E+0 | 4.07E-4 | 2.70E-5 | 6.59E-5 | 0.00E+0 | 9.29E-5 | 1.18E-4 | 2.88E-4 | 0.00E+0 | 4.07E-4 |
| Phenanthrene* | 3.30E-6 | 8.04E-6 | 0.00E+0 | 1.13E-5 | 7.52E-7 | 1.84E-6 | 0.00E+0 | 2.59E-6 | 3.30E-6 | 8.04E-6 | 0.00E+0 | 1.13E-5 |
| Propylene | 9.69E-7 | 2.36E-6 | 1.77E-3 | 1.77E-3 | 2.21E-7 | 5.40E-7 | 2.04E-5 | 2.12E-5 | 9.69E-7 | 2.36E-6 | 1.77E-3 | 1.77E-3 |
| Pyrene* | 6.59E-4 | 1.61E-3 | 0.00E+0 | 2.27E-3 | 1.50E-4 | 3.67E-4 | 0.00E+0 | 5.18E-4 | 6.59E-4 | 1.61E-3 | 0.00E+0 | 2.27E-3 |
| Toluene | 1.71E-5 | 4.17E-5 | 1.83E-4 | 2.42E-4 | 0.00E+0 | 0.00E+0 | 2.27E-6 | 2.27E-6 | 1.71E-5 | 4.17E-5 | 1.83E-4 | 2.42E-4 |

# Refinery Summary



| Pollutant | Controlled Emissions Tons/yr | | | | Controlled Emissions lbs/hr | | | | Uncontrolled Tons/yr | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Distillation Plant | Wax Plant | Common Equipment | Total | Distillation Plant | Wax Plant | Common Equipment | Total | Distillation Plant | Wax Plant | Common Equipment | Total |
| Total POM | 1.32E-4 | 3.22E-4 | 0.00E+0 | 4.53E-4 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 1.32E-4 | 3.22E-4 | 0.00E+0 | 4.53E-4 |
| Total PAH | 0.00E+0 | 0.00E+0 | 1.33E-4 | 1.33E-4 | 0.00E+0 | 0.00E+0 | 1.51E-6 | 1.51E-6 | 0.00E+0 | 0.00E+0 | 1.33E-4 | 1.33E-4 |
| Xylene | 3.80E-5 | 9.26E-5 | 1.26E-4 | 2.57E-4 | 8.67E-6 | 2.11E-5 | 1.56E-6 | 3.14E-5 | 3.88E-5 | 9.46E-5 | 1.26E-4 | 2.59E-4 |
| Propylene | 8.35E-4 | 2.04E-3 | 1.77E-3 | 4.64E-3 | 1.91E-4 | 4.65E-4 | 2.04E-5 | 6.76E-4 | 8.53E-4 | 2.08E-3 | 1.77E-3 | 4.70E-3 |
| Acetaldehyde | 2.28E-6 | 5.56E-6 | 4.23E-5 | 5.01E-5 | 5.20E-7 | 1.27E-6 | 1.24E-6 | 3.03E-6 | 2.33E-6 | 5.68E-6 | 4.23E-5 | 5.03E-5 |
| Acrolien | 2.09E-4 | 5.09E-4 | 8.01E-6 | 7.26E-4 | 4.77E-5 | 1.16E-4 | 1.78E-7 | 1.64E-4 | 2.13E-4 | 5.20E-4 | 8.01E-6 | 7.41E-4 |
| **Organic HAPs from Evaporation** | | | | | | | | | | | | |
| 1,2,4, Trimethylylbenzene | 5.49E-2 | 1.03E-1 | 2.75E-2 | 1.85E-1 | 1.19E-2 | 2.35E-2 | 4.29E-4 | 3.58E-2 | 7.64E-1 | 2.15E+0 | 2.75E-2 | 2.94E+0 |
| Benzene | 3.91E-2 | 3.59E-2 | 4.55E-3 | 7.95E-2 | 4.73E-3 | 8.28E-3 | 6.29E-4 | 1.36E-2 | 3.91E-1 | 6.82E-1 | 4.55E-3 | 1.08E+0 |
| Cyclohexane | 4.76E-2 | 4.01E-2 | 3.19E-3 | 9.09E-2 | 4.39E-3 | 9.21E-3 | 7.26E-4 | 1.43E-2 | 4.22E-1 | 8.75E-1 | 3.19E-3 | 1.30E+0 |
| Ethylbenzene | 4.40E-2 | 4.12E-2 | 3.17E-3 | 8.83E-2 | 6.65E-3 | 9.45E-3 | 9.22E-5 | 1.62E-2 | 4.95E-1 | 6.23E-1 | 3.17E-3 | 1.12E+0 |
| Hexane | 1.21E-1 | 1.03E-1 | 0.00E+0 | 2.23E-1 | 1.27E-2 | 2.35E-2 | 0.00E+0 | 3.61E-2 | 1.13E+0 | 2.05E+0 | 0.00E+0 | 3.18E+0 |
| Isopropylbenzene | 8.79E-4 | 6.98E-4 | 1.21E-4 | 1.70E-3 | 1.40E-4 | 2.76E-4 | 2.77E-5 | 4.43E-4 | 8.26E-3 | 1.37E-2 | 1.21E-4 | 2.20E-2 |
| Toluene | 1.78E-1 | 1.82E-1 | 5.73E-3 | 3.66E-1 | 2.72E-2 | 4.18E-2 | 1.31E-3 | 7.04E-2 | 2.02E+0 | 3.03E+0 | 5.73E-3 | 5.06E+0 |
| Xylene | 1.63E-1 | 2.13E-1 | 1.10E-2 | 3.87E-1 | 2.85E-2 | 4.87E-2 | 2.52E-3 | 7.97E-2 | 1.99E+0 | 3.96E+0 | 1.10E-2 | 5.96E+0 |
| **Metals from combustion** | | | | | | | | | | | | |
| Arsenic** | 3.80E-5 | 9.26E-5 | 0.00E+0 | 1.31E-4 | 8.67E-6 | 2.11E-5 | 0.00E+0 | 2.98E-5 | 3.88E-5 | 0.00E+0 | 0.00E+0 | 3.88E-5 |
| Barium | 8.35E-4 | 2.04E-3 | 0.00E+0 | 2.87E-3 | 1.91E-4 | 4.65E-4 | 0.00E+0 | 6.56E-4 | 8.53E-4 | 0.00E+0 | 0.00E+0 | 8.53E-4 |
| Beryllium** | 2.28E-6 | 5.56E-6 | 0.00E+0 | 7.83E-6 | 5.20E-7 | 1.27E-6 | 0.00E+0 | 1.79E-6 | 2.33E-6 | 0.00E+0 | 0.00E+0 | 2.33E-6 |
| Cadmium** | 2.09E-4 | 5.09E-4 | 0.00E+0 | 7.18E-4 | 4.77E-5 | 1.16E-4 | 0.00E+0 | 1.64E-4 | 2.13E-4 | 0.00E+0 | 0.00E+0 | 2.13E-4 |
| Chromium** | 2.66E-4 | 6.48E-4 | 0.00E+0 | 9.14E-4 | 6.07E-5 | 1.48E-4 | 0.00E+0 | 2.09E-4 | 2.71E-4 | 0.00E+0 | 0.00E+0 | 2.71E-4 |
| Cobalt** | 1.59E-5 | 3.89E-5 | 0.00E+0 | 5.48E-5 | 3.64E-6 | 8.88E-6 | 0.00E+0 | 1.25E-5 | 1.63E-5 | 0.00E+0 | 0.00E+0 | 1.63E-5 |
| Copper | 1.61E-4 | 3.94E-4 | 0.00E+0 | 5.55E-4 | 3.68E-5 | 8.99E-5 | 0.00E+0 | 1.27E-4 | 1.65E-4 | 0.00E+0 | 0.00E+0 | 1.65E-4 |
| Lead** | 9.49E-5 | 2.32E-4 | 0.00E+0 | 3.26E-4 | 2.17E-5 | 5.29E-5 | 0.00E+0 | 7.45E-5 | 9.69E-5 | 0.00E+0 | 0.00E+0 | 9.69E-5 |
| Manganese** | 7.21E-5 | 1.76E-4 | 0.00E+0 | 2.48E-4 | 1.65E-5 | 4.02E-5 | 0.00E+0 | 5.66E-5 | 7.37E-5 | 0.00E+0 | 0.00E+0 | 7.37E-5 |
| Mercury** | 4.93E-5 | 1.20E-4 | 0.00E+0 | 1.70E-4 | 1.13E-5 | 2.75E-5 | 0.00E+0 | 3.88E-5 | 5.04E-5 | 0.00E+0 | 0.00E+0 | 5.04E-5 |
| Molybdenum | 2.09E-4 | 5.09E-4 | 0.00E+0 | 7.18E-4 | 4.77E-5 | 1.16E-4 | 0.00E+0 | 1.64E-4 | 2.13E-4 | 0.00E+0 | 0.00E+0 | 2.13E-4 |
| Nickel** | 3.99E-4 | 9.72E-4 | 0.00E+0 | 1.37E-3 | 9.10E-5 | 2.22E-4 | 0.00E+0 | 3.13E-4 | 4.07E-4 | 0.00E+0 | 0.00E+0 | 4.07E-4 |
| Selenium** | 4.56E-6 | 1.11E-5 | 0.00E+0 | 1.57E-5 | 1.04E-6 | 2.54E-6 | 0.00E+0 | 3.58E-6 | 4.65E-6 | 0.00E+0 | 0.00E+0 | 4.65E-6 |
| Vanadium | 4.37E-4 | 1.06E-3 | 0.00E+0 | 1.50E-3 | 9.97E-5 | 2.43E-4 | 0.00E+0 | 3.43E-4 | 4.46E-4 | 0.00E+0 | 0.00E+0 | 4.46E-4 |
| Zinc | 5.50E-3 | 1.34E-2 | 0.00E+0 | 1.89E-2 | 1.26E-3 | 3.07E-3 | 0.00E+0 | 4.32E-3 | 5.62E-3 | 0.00E+0 | 0.00E+0 | 5.62E-3 |

* Polycyclic Organic Matter (POM), defined as a Hazardous Air Pollutant in Section 112(b) of the Clean Air Act
** Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act
1 All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM10, PM2.5 or PM1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 or 201a (or equivalent) sampling train. EPA has recently modified Method 202. Most of the data used to generate the condensible emission factors were from older test methods and may not represent the results that the current method will produce.

# Distillation Plant Summary



| Pollutant | Controlled Emissions Tons/yr | | | | | | Controlled Emissions lbs/hr | | | | | | Uncontrolled Tons/yr | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Combustion | Storage Tanks | Vacuum Distillation | Equipment Leaks | Oil Water Separator | Total | Combustion | Storage Tanks | Vacuum Distillation | Equipment Leaks | Oil Water Separator | Total | Combustion | Storage Tanks | Vacuum Distillation | Equipment Leaks | Oil Water Separator | Total |
| **Criteria Pollutants** | | | | | | | | | | | | | | | | | | |
| PM Total[1] | 1.47 | | | | | 1.47 | .336 | | | | | .336 | 1.47 | | | | | 1.47 |
| PM Condensible[1] | 1.105 | | | | | 1.105 | .252 | | | | | .252 | 1.11 | | | | | 1.105 |
| PM Filterable[1] | .368 | | | | | .368 | .084 | | | | | .0841 | .37 | | | | | .368 |
| $SO_2$ | .114 | | | | | .1139 | .026 | | | | | .0260 | .11 | | | | | .114 |
| $NO_2$ | 9.7 | | | | | 9.7 | 2.213 | | | | | 2.21 | 19.39 | | | | | 19.4 |
| CO | 16.3 | | | | | 16.3 | 3.718 | | | | | 3.72 | 16.28 | | | | | 16.3 |
| VOC | 1.066 | 6.01 | 12.67 | 2.55 | 1.05 | 23.4 | .243 | .160 | 2.89 | .862 | .240 | 4.40 | 1.07 | 31.0 | 12.7 | 25.49 | 26.28 | 97 |
| **Greenhouse Gases** | | | | | | | | | | | | | | | | | | |
| $CO_2$ | 23,295 | | | | | 23,295 | 5,318 | | | | | 5,318 | 23,295 | | | | | 23,295 |
| $N_2O$ | .0439 | | | | | .0439 | .010 | | | | | .010 | .04 | | | | | .0439 |
| Methane | .439 | | | | | .439 | .100 | | | | | .100 | .44 | | | | | .439 |
| Hydrofluorocarbons | ND | | | | | ND | ND | | | | | ND | .00 | | | | | ND |
| Perfluorocarbons | ND | | | | | ND | ND | | | | | ND | .00 | | | | | ND |
| $SF_6$ | ND | | | | | ND | ND | | | | | ND | .00 | | | | | ND |
| **$CO_2e$** | 23,317 | | | | | 23,317 | 5,324 | | | | | 5,324 | 23,317 | | | | | 23,317 |
| **Other Pollutants** | | | | | | | | | | | | | | | | | | |
| Ammonia | .596 | | | | | .596 | .139 | | | | | .139 | .61 | | | | | .61 |
| **HAPs** | | | | | | | | | | | | | | | | | | |
| Total Organic HAPs | .366 | .227 | .000 | .298 | .123 | 1.01 | .084 | .000 | .000 | .068 | .028 | 1.80E-1 | .366 | 1.174 | .000 | 2.978 | 3.070 | 7.59E+0 |
| Total Metalic HAPs | 8.30E-3 | 0.00 | 0.00 | 0.00 | 0.00 | 8.30E-3 | 1.89E-3 | 0.00 | 0.00 | 0.00 | 0.00 | 1.89E-3 | 8.47E-3 | 0.00 | 0.00 | 0.00 | 0.00 | 8.47E-3 |
| Total HAPS | .374 | .227 | .000 | .298 | .123 | 1.022 | .086 | .000 | .000 | .068 | .028 | 1.82E-1 | .375 | 1.174 | .000 | 2.978 | 3.070 | 7.60E+0 |
| **Organic HAPs from Combustion** | | | | | | | | | | | | 0.00E+0 | 0.00E+0 | | | | | 0.00E+0 |
| 2-Methylnaphthalene* | 4.65E-6 | | | | | 4.65E-6 | 1.06E-6 | | | | | 1.06E-6 | 4.65E-6 | | | | | 4.65E-6 |
| 3-Methylchloranthrene* | 3.49E-7 | | | | | 3.49E-7 | 7.97E-8 | | | | | 7.97E-8 | 3.49E-7 | | | | | 3.49E-7 |
| 7,12-Dimethylbenz(a)anthracene* | 3.10E-6 | | | | | 3.10E-6 | 7.08E-7 | | | | | 7.08E-7 | 3.10E-6 | | | | | 3.10E-6 |
| Acenaphthene* | 3.49E-7 | | | | | 3.49E-7 | 7.97E-8 | | | | | 7.97E-8 | 3.49E-7 | | | | | 3.49E-7 |
| Acenaphthylene* | 3.49E-7 | | | | | 3.49E-7 | 7.97E-8 | | | | | 7.97E-8 | 3.49E-7 | | | | | 3.49E-7 |
| Anthracene* | 4.65E-7 | | | | | 4.65E-7 | 1.06E-7 | | | | | 1.06E-7 | 4.65E-7 | | | | | 4.65E-7 |
| Benz(a)anthracene* | 3.49E-7 | | | | | 3.49E-7 | 7.97E-8 | | | | | 7.97E-8 | 3.49E-7 | | | | | 3.49E-7 |
| Benzene | 4.07E-4 | | | | | 4.07E-4 | 9.29E-5 | | | | | 9.29E-5 | 4.07E-4 | | | | | 4.07E-4 |
| Benzo(a)pyrene* | 2.33E-7 | | | | | 2.33E-7 | 5.31E-8 | | | | | 5.31E-8 | 2.33E-7 | | | | | 2.33E-7 |
| Benzo(b)fluoranthene* | 3.49E-7 | | | | | 3.49E-7 | 7.97E-8 | | | | | 7.97E-8 | 3.49E-7 | | | | | 3.49E-7 |
| Benzo(g,h,i)perylene* | 2.33E-7 | | | | | 2.33E-7 | 5.31E-8 | | | | | 5.31E-8 | 2.33E-7 | | | | | 2.33E-7 |
| Benzo(k)fluoranthene* | 3.49E-7 | | | | | 3.49E-7 | 7.97E-8 | | | | | 7.97E-8 | 3.49E-7 | | | | | 3.49E-7 |
| Chrysene* | 3.49E-7 | | | | | 3.49E-7 | 7.97E-8 | | | | | 7.97E-8 | 3.49E-7 | | | | | 3.49E-7 |
| Dibenzo(a,h)anthracene* | 2.33E-7 | | | | | 2.33E-7 | 5.31E-8 | | | | | 5.31E-8 | 2.33E-7 | | | | | 2.33E-7 |
| Dichlorobenzene | 2.33E-4 | | | | | 2.33E-4 | 5.31E-5 | | | | | 5.31E-5 | 2.33E-4 | | | | | 2.33E-4 |
| Fluoranthene* | 5.82E-7 | | | | | 5.82E-7 | 1.33E-7 | | | | | 1.33E-7 | 5.82E-7 | | | | | 5.82E-7 |
| Fluorene* | 5.43E-7 | | | | | 5.43E-7 | 1.24E-7 | | | | | 1.24E-7 | 5.43E-7 | | | | | 5.43E-7 |
| Formaldehyde | 1.45E-2 | | | | | 1.45E-2 | 3.32E-3 | | | | | 3.32E-3 | 1.45E-2 | | | | | 1.45E-2 |
| Hexane | 3.49E-1 | | | | | 3.49E-1 | 7.97E-2 | | | | | 7.97E-2 | 3.49E-1 | | | | | 3.49E-1 |
| Indeno(1,2,3-cd)pyrene* | 3.49E-7 | | | | | 3.49E-7 | 7.97E-8 | | | | | 7.97E-8 | 3.49E-7 | | | | | 3.49E-7 |
| Naphthalene | 1.18E-4 | | | | | 1.18E-4 | 2.70E-5 | | | | | 2.70E-5 | 1.18E-4 | | | | | 1.18E-4 |
| Phenanthrene* | 3.30E-6 | | | | | 3.30E-6 | 7.52E-7 | | | | | 7.52E-7 | 3.30E-6 | | | | | 3.30E-6 |
| Propylene | 9.69E-7 | | | | | 9.69E-7 | 2.21E-7 | | | | | 2.21E-7 | 9.69E-7 | | | | | 9.69E-7 |
| Pyrene* | 6.59E-4 | | | | | 6.59E-4 | 1.50E-4 | | | | | 1.50E-4 | 6.59E-4 | | | | | 6.59E-4 |
| Toluene | 1.71E-5 | | | | | 1.71E-5 | 0.00E+0 | | | | | 0.00E+0 | 1.71E-5 | | | | | 1.71E-5 |
| Total POM | 1.32E-4 | | | | | 1.32E-4 | 0.00E+0 | | | | | 0.00E+0 | 1.32E-4 | | | | | 1.32E-4 |
| Total PAH | 0.00E+0 | | | | | 0.00E+0 | 0.00E+0 | | | | | 0.00E+0 | 0.00E+0 | | | | | 0.00E+0 |
| Xylene | 3.80E-5 | | | | | 3.80E-5 | 8.67E-6 | | | | | 8.67E-6 | 3.88E-5 | | | | | 3.88E-5 |
| Propylene | 8.35E-4 | | | | | 8.35E-4 | 1.91E-4 | | | | | 1.91E-4 | 8.53E-4 | | | | | 8.53E-4 |
| Acetaldehyde | 2.28E-6 | | | | | 2.28E-6 | 5.20E-7 | | | | | 5.20E-7 | 2.33E-6 | | | | | 2.33E-6 |
| Acrolien | 2.09E-4 | | | | | 2.09E-4 | 4.77E-5 | | | | | 4.77E-5 | 2.13E-4 | | | | | 2.13E-4 |
| **Organic HAPs from Evaporation** | | | | | | 0.00E+0 | 6.07E-5 | | | | | | | | | | | 0.00E+0 |
| 1,2,4, Trimethylylbenzene | | 2.68E-3 | | 3.69E-2 | 1.52E-2 | 5.49E-2 | 3.64E-6 | 0.00E+0 | | 8.43E-3 | 3.48E-3 | .012 | | 1.38E-2 | | 3.69E-1 | 3.81E-1 | 7.64E-1 |
| Benzene | | 1.85E-2 | | 1.45E-2 | 6.00E-3 | 3.91E-2 | 3.68E-5 | 0.00E+0 | | 3.32E-3 | 1.37E-3 | .005 | | 9.58E-2 | | 1.45E-1 | 1.50E-1 | 3.91E-1 |
| Cyclohexane | | 2.85E-2 | | 1.35E-2 | 5.58E-3 | 4.76E-2 | 2.17E-5 | 0.00E+0 | | 3.09E-3 | 1.27E-3 | .004 | | 1.47E-1 | | 1.35E-1 | 1.40E-1 | 4.22E-1 |
| Ethylbenzene | | 1.49E-2 | | 2.06E-2 | 8.48E-3 | 4.40E-2 | 1.65E-5 | 0.00E+0 | | 4.70E-3 | 1.94E-3 | .007 | | 7.71E-2 | | 2.06E-1 | 2.12E-1 | 4.95E-1 |
| Hexane | | 6.52E-2 | | 3.92E-2 | 1.62E-2 | 1.21E-1 | 1.13E-5 | 0.00E+0 | | 8.96E-3 | 3.69E-3 | .013 | | 3.37E-1 | | 3.92E-1 | 4.04E-1 | 1.13E+0 |
| Isopropylbenzene | | 4.75E-4 | | 2.86E-4 | 1.18E-4 | 8.79E-4 | 4.77E-5 | 0.00E+0 | | 6.53E-5 | 2.69E-5 | .000 | | 2.45E-3 | | 2.86E-3 | 2.95E-3 | 8.26E-3 |
| Toluene | | 5.92E-2 | | 8.42E-2 | 3.47E-2 | 1.78E-1 | 9.10E-5 | 0.00E+0 | | 1.92E-2 | 7.93E-3 | .027 | | 3.06E-1 | | 8.42E-1 | 8.68E-1 | 2.02E+0 |
| Xylene | | 3.79E-2 | | 8.84E-2 | 3.65E-2 | 1.63E-1 | 1.04E-6 | 0.00E+0 | | 2.02E-2 | 8.33E-3 | .029 | | 1.96E-1 | | 8.84E-1 | 9.12E-1 | 1.99E+0 |
| **Metals from combustion** | | | | | | | | | | | | | | | | | | 0.00E+0 |
| Arsenic** | 3.80E-5 | | | | | 3.80E-5 | 8.67E-6 | | | | | 8.67E-6 | 3.88E-5 | | | | | 3.88E-5 |
| Barium | 8.35E-4 | | | | | 8.35E-4 | 1.91E-4 | | | | | 1.91E-4 | 8.53E-4 | | | | | 8.53E-4 |
| Beryllium** | 2.28E-6 | | | | | 2.28E-6 | 5.20E-7 | | | | | 5.20E-7 | 2.33E-6 | | | | | 2.33E-6 |
| Cadmium** | 2.09E-4 | | | | | 2.09E-4 | 4.77E-5 | | | | | 4.77E-5 | 2.13E-4 | | | | | 2.13E-4 |
| Chromium** | 2.66E-4 | | | | | 2.66E-4 | 6.07E-5 | | | | | 6.07E-5 | 2.71E-4 | | | | | 2.71E-4 |
| Cobalt** | 1.59E-5 | | | | | 1.59E-5 | 3.64E-6 | | | | | 3.64E-6 | 1.63E-5 | | | | | 1.63E-5 |
| Copper | 1.61E-4 | | | | | 1.61E-4 | 3.68E-5 | | | | | 3.68E-5 | 1.65E-4 | | | | | 1.65E-4 |
| Lead** | 9.49E-5 | | | | | 9.49E-5 | 2.17E-5 | | | | | 2.17E-5 | 9.69E-5 | | | | | 9.69E-5 |
| Manganese** | 7.21E-5 | | | | | 7.21E-5 | 1.65E-5 | | | | | 1.65E-5 | 7.37E-5 | | | | | 7.37E-5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Mercury** | 4.93E-5 | 4.93E-5 | 1.13E-5 | 1.13E-5 | 5.04E-5 | 5.04E-5 |
| Molybdenum | 2.09E-4 | 2.09E-4 | 4.77E-5 | 4.77E-5 | 2.13E-4 | 2.13E-4 |
| Nickel** | 3.99E-4 | 3.99E-4 | 9.10E-5 | 9.10E-5 | 4.07E-4 | 4.07E-4 |
| Selenium** | 4.56E-6 | 4.56E-6 | 1.04E-6 | 1.04E-6 | 4.65E-6 | 4.65E-6 |
| Vanadium | 4.37E-4 | 4.37E-4 | 9.97E-5 | 9.97E-5 | 4.46E-4 | 4.46E-4 |
| Zinc | 5.50E-3 | 5.50E-3 | 1.26E-3 | 1.26E-3 | 5.62E-3 | 5.62E-3 |

* Polycyclic Organic Matter (POM), defined as a Hazardous Air Pollutant in Section 112(b) of the Clean Air Act
** Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act
1 All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM10, PM2.5 or PM1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 or 201a (or equivalent) sampling train. EPA has recently modified Method 202. Most of the data used to generate the condensible emission factors were from older test methods and may not represent the results that the current method will produce.
2 Uncontrolled emission rate for equipment leaks assumes 10 times the emissions of the controlled emission rate.

# Wax Plant Summary



| Pollutant | Controlled Emissions Tons/yr | | | | | Controlled Emissions lbs/hr | | | | | Uncontrolled Tons/yr | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Combustion | Storage Tanks | Equipment Leaks | Oil Water Separator | Total | Combustion | Storage Tanks | Equipment Leaks | Oil Water Separator | Total | Combustion | Storage Tanks | Equipment Leaks [2] | Oil Water Separator | Total |
| **Criteria Pollutants** | | | | | | | | | | | | | | | |
| PM Total[1] | 3.59 | | | | 3.59 | .821 | | | | .821 | 3.59 | | | | 3.59 |
| PM Condensible[1] | 2.70 | | | | 2.70 | .615 | | | | .615 | 2.70 | | | | 2.70 |
| PM Filterable[1] | .90 | | | | .90 | .205 | | | | .205 | .899 | | | | .90 |
| $SO_2$ | .28 | | | | .28 | .063 | | | | .063 | .278 | | | | .28 |
| $NO_2$ | 6.26 | | | | 6.26 | 1.430 | | | | 1.43 | 47.3 | | | | 47.3 |
| CO | 39.7 | | | | 39.73 | 9.070 | | | | 9.07 | 39.7 | | | | 39.7 |
| VOC | 2.60 | 4.41 | 3.66 | 1.05 | 11.72 | .594 | 1.007 | .835 | .240 | 2.68 | 2.60 | 157.8 | 36.57 | 26.28 | 223 |
| **Greenhouse Gases** | | | | | | | | | | | | | | | .00 |
| $CO_2$ | 56,829 | | | | 56,829 | 12,975 | | | | 12,975 | 56,829 | | | | 56,829 |
| $N_2O$ | .11 | | | | .11 | .024 | | | | .024 | .11 | | | | .11 |
| Methane | 1.07 | | | | 1.07 | .245 | | | | .245 | 1.07 | | | | 1.07 |
| Hydrofluorocarbons | ND | | | | ND | ND | | | | ND | ND | | | | ND |
| Perfluorocarbons | ND | | | | ND | ND | | | | ND | ND | | | | ND |
| $SF_6$ | ND | | | | ND | ND | | | | ND | ND | | | | ND |
| **$CO_2e$** | 56,884 | | | | 56,884 | 12,987 | | | | 12,987 | 26,136 | | | | 26,136 |
| **Other Pollutants** | | | | | | | | | | | | | | | |
| Ammonia | 1.10 | | | | 1.10 | .256 | | | | .256 | 1.12 | | | | 1.12 |
| **HAPs** | | | | | | | | | | | | | | | |
| Total Organic HAPs | .893 | .169 | .427 | .123 | 1.61 | .204 | .039 | .098 | .028 | .369 | .896 | 6.040 | 4.272 | 3.070 | 14.28 |
| Total Metalic HAPs | 2.02E-2 | 0.00 | 0.00 | 0.00 | 2.02E-2 | 4.62E-3 | 0.00 | 0.00 | 0.00 | .005 | 1.37E-2 | 0.00 | 0.00 | 0.00 | .01 |
| Total HAPS | .914 | .169 | .427 | .123 | 1.632 | .209 | .039 | .098 | .028 | .373 | .910 | 6.040 | 4.272 | 3.070 | 14.29 |
| **Organic HAPs from Combustion** | | | | | | | | | | | | | | | |
| 2-Methylnaphthalene* | 1.14E-5 | | | | 1.14E-5 | 2.59E-6 | | | | 2.59E-6 | 1.14E-5 | | | | 1.14E-5 |
| 3-Methylchloranthrene* | 8.51E-7 | | | | 8.51E-7 | 1.94E-7 | | | | 1.94E-7 | 8.51E-7 | | | | 8.51E-7 |
| 7,12-Dimethylbenz(a)anthracene* | 7.57E-6 | | | | 7.57E-6 | 1.73E-6 | | | | 1.73E-6 | 7.57E-6 | | | | 7.57E-6 |
| Acenaphthene* | 8.51E-7 | | | | 8.51E-7 | 1.94E-7 | | | | 1.94E-7 | 8.51E-7 | | | | 8.51E-7 |
| Acenaphthylene* | 8.51E-7 | | | | 8.51E-7 | 1.94E-7 | | | | 1.94E-7 | 8.51E-7 | | | | 8.51E-7 |
| Anthracene* | 1.14E-6 | | | | 1.14E-6 | 2.59E-7 | | | | 2.59E-7 | 1.14E-6 | | | | 1.14E-6 |
| Benz(a)anthracene* | 8.51E-7 | | | | 8.51E-7 | 1.94E-7 | | | | 1.94E-7 | 8.51E-7 | | | | 8.51E-7 |
| Benzene | 9.93E-4 | | | | 9.93E-4 | 2.27E-4 | | | | 2.27E-4 | 9.93E-4 | | | | 9.93E-4 |
| Benzo(a)pyrene* | 5.68E-7 | | | | 5.68E-7 | 1.30E-7 | | | | 1.30E-7 | 5.68E-7 | | | | 5.68E-7 |
| Benzo(b)fluoranthene* | 8.51E-7 | | | | 8.51E-7 | 1.94E-7 | | | | 1.94E-7 | 8.51E-7 | | | | 8.51E-7 |
| Benzo(g,h,i)perylene* | 5.68E-7 | | | | 5.68E-7 | 1.30E-7 | | | | 1.30E-7 | 5.68E-7 | | | | 5.68E-7 |
| Benzo(k)fluoranthene* | 8.51E-7 | | | | 8.51E-7 | 1.94E-7 | | | | 1.94E-7 | 8.51E-7 | | | | 8.51E-7 |
| Chrysene* | 8.51E-7 | | | | 8.51E-7 | 1.94E-7 | | | | 1.94E-7 | 8.51E-7 | | | | 8.51E-7 |
| Dibenzo(a,h)anthracene* | 5.68E-7 | | | | 5.68E-7 | 1.30E-7 | | | | 1.30E-7 | 5.68E-7 | | | | 5.68E-7 |
| Dichlorobenzene | 5.68E-4 | | | | 5.68E-4 | 1.30E-4 | | | | 1.30E-4 | 5.68E-4 | | | | 5.68E-4 |
| Fluoranthene* | 1.42E-6 | | | | 1.42E-6 | 3.24E-7 | | | | 3.24E-7 | 1.42E-6 | | | | 1.42E-6 |
| Fluorene* | 1.32E-6 | | | | 1.32E-6 | 3.02E-7 | | | | 3.02E-7 | 1.32E-6 | | | | 1.32E-6 |
| Formaldehyde | 3.55E-2 | | | | 3.55E-2 | 8.10E-3 | | | | 8.10E-3 | 3.55E-2 | | | | 3.55E-2 |
| Hexane | 8.51E-1 | | | | 8.51E-1 | 1.94E-1 | | | | 1.94E-1 | 8.51E-1 | | | | 8.51E-1 |
| Indeno(1,2,3-cd)pyrene* | 8.51E-7 | | | | 8.51E-7 | 1.94E-7 | | | | 1.94E-7 | 8.51E-7 | | | | 8.51E-7 |
| Naphthalene | 2.88E-4 | | | | 2.88E-4 | 6.59E-5 | | | | 6.59E-5 | 2.88E-4 | | | | 2.88E-4 |
| Phenanthrene* | 8.04E-6 | | | | 8.04E-6 | 1.84E-6 | | | | 1.84E-6 | 8.04E-6 | | | | 8.04E-6 |
| Propylene | 2.36E-6 | | | | 2.36E-6 | 5.40E-7 | | | | 5.40E-7 | 2.36E-6 | | | | 2.36E-6 |
| Pyrene* | 1.61E-3 | | | | 1.61E-3 | 3.67E-4 | | | | 3.67E-4 | 1.61E-3 | | | | 1.61E-3 |
| Toluene | 4.17E-5 | | | | 4.17E-5 | 0.00E+0 | | | | 0.00E+0 | 4.17E-5 | | | | 4.17E-5 |
| Total POM | 3.22E-4 | | | | 3.22E-4 | 0.00E+0 | | | | 0.00E+0 | 3.22E-4 | | | | 3.22E-4 |
| Total PAH | 0.00E+0 | | | | 0.00E+0 | 0.00E+0 | | | | 0.00E+0 | 0.00E+0 | | | | 0.00E+0 |
| Xylene | 9.26E-5 | | | | 9.26E-5 | 2.11E-5 | | | | 2.11E-5 | 9.46E-5 | | | | 9.46E-5 |
| Propylene | 2.04E-3 | | | | 2.04E-3 | 4.65E-4 | | | | 4.65E-4 | 2.08E-3 | | | | 2.08E-3 |
| Acetaldehyde | 5.56E-6 | | | | 5.56E-6 | 1.27E-6 | | | | 1.27E-6 | 5.68E-6 | | | | 5.68E-6 |
| Acrolien | 5.09E-4 | | | | 5.09E-4 | 1.16E-4 | | | | 1.16E-4 | 5.20E-4 | | | | 5.20E-4 |
| **Organic HAPs from Evaporation** | | | | | | | | | | | | | | | |
| 1,2,4, Trimethylylbenzene | | 3.47E-2 | 5.30E-2 | 1.52E-2 | 1.03E-1 | 8.88E-6 | 7.92E-3 | 1.21E-2 | 3.48E-3 | 2.35E-2 | 3.97E-5 | 1.24E+0 | 5.30E-1 | 3.81E-1 | 2.15 |
| Benzene | | 9.02E-3 | 2.09E-2 | 6.00E-3 | 3.59E-2 | 8.99E-5 | 2.06E-3 | 4.76E-3 | 1.37E-3 | 8.28E-3 | 4.02E-4 | 3.23E-1 | 2.09E-1 | 1.50E-1 | .68 |
| Cyclohexane | | 1.51E-2 | 1.94E-2 | 5.58E-3 | 4.01E-2 | 5.29E-5 | 3.45E-3 | 4.43E-3 | 1.27E-3 | 9.21E-3 | 2.36E-4 | 5.41E-1 | 1.94E-1 | 1.40E-1 | .87 |
| Ethylbenzene | | 3.23E-3 | 2.95E-2 | 8.48E-3 | 4.12E-2 | 4.02E-5 | 7.36E-4 | 6.74E-3 | 1.94E-3 | 9.45E-3 | 1.80E-4 | 1.15E-1 | 2.95E-1 | 2.12E-1 | .62 |
| Hexane | | 3.02E-2 | 5.63E-2 | 1.62E-2 | 1.03E-1 | 2.75E-5 | 6.89E-3 | 1.28E-2 | 3.69E-3 | 2.35E-2 | 1.23E-4 | 1.08E+0 | 5.63E-1 | 4.04E-1 | 2.05 |
| Isopropylbenzene | | 1.70E-4 | 4.10E-4 | 1.18E-4 | 6.98E-4 | 1.16E-4 | 3.88E-5 | 9.37E-5 | 2.69E-5 | 2.76E-4 | 5.20E-4 | 6.08E-3 | 4.10E-3 | 2.95E-3 | .01 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Toluene | | 2.67E-2 | 1.21E-1 | 3.47E-2 | 1.82E-1 | 2.22E-4 | 6.11E-3 | 2.76E-2 | 7.93E-3 | 4.18E-2 | 9.93E-4 | 9.56E-1 | 1.21E+0 | 8.68E-1 | 3.03 |
| Xylene | | 4.98E-2 | 1.27E-1 | 3.65E-2 | 2.13E-1 | 2.54E-6 | 1.14E-2 | 2.90E-2 | 8.33E-3 | 4.87E-2 | 1.14E-5 | 1.78E+0 | 1.27E+0 | 9.12E-1 | 3.96 |
| **Metals from combustion** | | | | | | | | | | | | | | | |
| Arsenic** | 9.26E-5 | | | | 9.26E-5 | 2.11E-5 | | | | 2.11E-5 | 1.37E-2 | | | | |
| Barium | 2.04E-3 | | | | 2.04E-3 | 4.65E-4 | | | | 4.65E-4 | 0.00E+0 | | | | |
| Beryllium** | 5.56E-6 | | | | 5.56E-6 | 1.27E-6 | | | | 1.27E-6 | 0.00E+0 | | | | |
| Cadmium** | 5.09E-4 | | | | 5.09E-4 | 1.16E-4 | | | | 1.16E-4 | 0.00E+0 | | | | |
| Chromium** | 6.48E-4 | | | | 6.48E-4 | 1.48E-4 | | | | 1.48E-4 | 0.00E+0 | | | | |
| Cobalt** | 3.89E-5 | | | | 3.89E-5 | 8.88E-6 | | | | 8.88E-6 | 0.00E+0 | | | | |
| Copper | 3.94E-4 | | | | 3.94E-4 | 8.99E-5 | | | | 8.99E-5 | 0.00E+0 | | | | |
| Lead** | 2.32E-4 | | | | 2.32E-4 | 5.29E-5 | | | | 5.29E-5 | 0.00E+0 | | | | |
| Manganese** | 1.76E-4 | | | | 1.76E-4 | 4.02E-5 | | | | 4.02E-5 | 0.00E+0 | | | | |
| Mercury** | 1.20E-4 | | | | 1.20E-4 | 2.75E-5 | | | | 2.75E-5 | 0.00E+0 | | | | |
| Molybdenum | 5.09E-4 | | | | 5.09E-4 | 1.16E-4 | | | | 1.16E-4 | 0.00E+0 | | | | |
| Nickel** | 9.72E-4 | | | | 9.72E-4 | 2.22E-4 | | | | 2.22E-4 | 0.00E+0 | | | | |
| Selenium** | 1.11E-5 | | | | 1.11E-5 | 2.54E-6 | | | | 2.54E-6 | 0.00E+0 | | | | |
| Vanadium | 1.06E-3 | | | | 1.06E-3 | 2.43E-4 | | | | 2.43E-4 | 0.00E+0 | | | | |
| Zinc | 1.34E-2 | | | | 1.34E-2 | 3.07E-3 | | | | 3.07E-3 | 0.00E+0 | | | | |

* Polycyclic Organic Matter (POM), defined as a Hazardous Air Pollutant in Section 112(b) of the Clean Air Act
** Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act
1 All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM10, PM2.5 or PM1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 or 201a (or equivalent) sampling train. EPA has recently modified Method 202. Most of the data used to generate the condensible emission factors were from older test methods and may not represent the results that the current method will produce.
2 Uncontrolled emission rate for equipment leaks assumes 10 times the emissions of the controlled emission rate.

# Common Equipment Summary



| Pollutant | Controlled Emissions Tons/yr | | | | | Controlled Emissions lbs/hr | | | | | Uncontrolled Tons/yr | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Emergency Generator | Fire Pump | Flare | Loading Rack | Total | Emergency Generator | Fire Pump | Flare | Loading Rack | Total | Emergency Generator | Fire Pump | Flare | Loading Rack | Total |
| **Criteria Pollutants** | | | | | | | | | | | | | | | |
| PM Total[1] | .0334 | .0113 | .423 | | .468 | .668 | .901 | 282 | | 284 | .0334 | .0113 | .423 | | .468 |
| PM Condensible[1] | 0.00463 | .0002728 | ND | | .00490 | 0.0925 | .02183 | ND | | | 0.00463 | .0002728 | ND | | .00490 |
| PM Filterable[1] | .0288 | .01098 | .423 | | .463 | .575 | .879 | 282 | | 284 | .0288 | .01098 | .423 | | .463 |
| $SO_2$ | .303 | .01028 | 4.84E-5 | | .314 | 6.07 | .822 | 3.23E-2 | | 6.92 | .303 | .01028 | 4.84E-5 | | .314 |
| $NO_2$ | 1.92 | .1563 | 2.31E-4 | | 2.08 | 38.4 | 12.50 | 1.54E-1 | | 51.1 | 1.92 | .1563 | 2.31E-4 | | 2.08 |
| CO | .5106 | .03366 | 1.25E-3 | | .545 | 10.21 | 2.693 | 8.36E-1 | | 13.74 | .5106 | .03366 | 1.25E-3 | | .545 |
| VOC | .0492 | .01276 | 4.75E-4 | .882 | .945 | .984 | 1.020 | 3.17E-1 | .201 | 2.52 | .0492 | .01276 | 4.75E-4 | 18.5 | 18.6 |
| **Greenhouse Gases** | | | | | | | | | | | | | | | |
| $CO_2$ | 99.1 | 5.81 | | | 104.9 | 99.1 | 465 | | | 5.64E+2 | 99.1 | 5.81 | | | 104.9 |
| $N_2O$ | ND | ND | | | ND | ND | ND | | | ND | ND | ND | | | ND |
| Methane | .00487 | 2.87E-4 | | | .00515 | .00487 | 2.30E-2 | | | 2.78E-2 | .00487 | 2.87E-4 | | | .00515 |
| Hydrofluorocarbons | ND | ND | | | ND | ND | ND | | | ND | ND | ND | | | ND |
| Perfluorocarbons | ND | ND | | | ND | ND | ND | | | ND | ND | ND | | | ND |
| $SF_6$ | ND | ND | | | ND | ND | ND | | | ND | ND | ND | | | ND |
| **$CO_2e$** | 99.2 | 5.8 | | | 105.0 | 99.2 | 465 | | | 565 | 99.2 | 5.8 | | | 105.0 |
| **Other Pollutants** | | | | | | | | | | | | | | | |
| Ammonia | ND | ND | | | ND | ND | ND | | | ND | ND | ND | | | ND |
| **HAPs** | | | | | | | | | | | | | | | |
| Total Organic HAPs | .004 | .000 | .000 | .055 | .05989 | .000 | .000 | .000 | .006 | 5.79E-3 | .004 | .000 | .000 | .055 | 5.99E-2 |
| Total Metalic HAPs | 0.00E+0 | 0.00 | 0.00 | 0.00 | .00000 | 0.00E+0 | 0.00 | 0.00 | 0.00 | 0.00E+0 | 0.00E+0 | 0.00 | 0.00 | 0.00 | 0.00E+0 |
| Total HAPS | .004 | .000 | .000 | .055 | .05989 | .000 | .000 | .000 | .006 | 5.79E-3 | .004 | .000 | .000 | .055 | 5.99E-2 |
| **Organic HAPs from Combustion** | | | | | | | | | | | | | | | |
| 2-Methylnaphthalene* | | | | | | | | | | | | | | | |
| 3-Methylchloranthrene* | | | | | | | | | | | | | | | |
| 7,12-Dimethylbenz(a)anthracene* | | | | | | | | | | | | | | | |
| Acenaphthene* | | | | | | | | | | | | | | | |
| Acenaphthylene* | | | | | | | | | | | | | | | |
| Anthracene* | | | | | | | | | | | | | | | |
| Benz(a)anthracene* | | | | | | | | | | | | | | | |
| Benzene | 4.66E-4 | 3.31E-5 | | | 4.99E-4 | 4.66E-6 | 1.32E-6 | | | 5.98E-6 | 4.66E-4 | 3.31E-5 | | | 4.99E-4 |
| Benzo(a)pyrene* | | | | | | | | | | | | | | | |
| Benzo(b)fluoranthene* | | | | | | | | | | | | | | | |
| Benzo(g,h,i)perylene* | | | | | | | | | | | | | | | |
| Benzo(k)fluoranthene* | | | | | | | | | | | | | | | |
| Chrysene* | | | | | | | | | | | | | | | |
| Dibenzo(a,h)anthracene* | | | | | | | | | | | | | | | |
| Dichlorobenzene | | | | | | | | | | | | | | | |
| Fluoranthene* | | | | | | | | | | | | | | | |
| Fluorene* | | | | | | | | | | | | | | | |
| Formaldehyde | 4.74E-5 | 4.18E-5 | | | 8.92E-5 | 4.74E-7 | 1.67E-6 | | | 2.15E-6 | 4.74E-5 | 4.18E-5 | | | 8.92E-5 |
| Hexane | | | | | | | | | | | | | | | |
| Indeno(1,2,3-cd)pyrene* | | | | | | | | | | | | | | | |
| Naphthalene | | | | | | | | | | | | | | | |
| Phenanthrene* | | | | | | | | | | | | | | | |
| Propylene | 1.68E-3 | 9.14E-5 | | | 1.77E-3 | 1.68E-5 | 3.66E-6 | | | 2.04E-5 | 1.68E-3 | 9.14E-5 | | | 1.77E-3 |
| Pyrene* | | | | | | | | | | | | | | | |
| Toluene | 1.69E-4 | 1.45E-5 | | | 1.83E-4 | 1.69E-6 | 5.80E-7 | | | 2.27E-6 | 1.69E-4 | 1.45E-5 | | | 1.83E-4 |
| Total POM | | | | | | | | | | | | | | | |
| Total PAH | 1.27E-4 | 5.95E-6 | | | 1.33E-4 | 1.27E-6 | 2.38E-7 | | | 1.51E-6 | 1.27E-4 | 5.95E-6 | | | 1.33E-4 |
| Xylene | 1.16E-4 | 1.01E-5 | | | 1.26E-4 | 1.16E-6 | 4.04E-7 | | | 1.56E-6 | 1.16E-4 | 1.01E-5 | | | 1.26E-4 |
| Propylene | 1.68E-3 | 9.14E-5 | | | 1.77E-3 | 1.68E-5 | 3.66E-6 | | | 2.04E-5 | 1.68E-3 | 9.14E-5 | | | 1.77E-3 |
| Acetaldehyde | 1.51E-5 | 2.72E-5 | | | 4.23E-5 | 1.51E-7 | 1.09E-6 | | | 1.24E-6 | 1.51E-5 | 2.72E-5 | | | 4.23E-5 |
| Acrolien | 4.73E-6 | 3.28E-6 | | | 8.01E-6 | 4.73E-8 | 1.31E-7 | | | 1.78E-7 | 4.73E-6 | 3.28E-6 | | | 8.01E-6 |
| **Organic HAPs from Evaporation** | | | | | | | | | | | | | | | |
| 1,2,4, Trimethylylbenzene | | | | 2.75E-2 | .0275 | | | | 4.29E-4 | 4.29E-4 | | | | 2.75E-2 | .0275 |
| Benzene | | | | 4.55E-3 | .00455 | | | | 6.29E-4 | 6.29E-4 | | | | 4.55E-3 | .00455 |
| Cyclohexane | | | | 3.19E-3 | .00319 | | | | 7.26E-4 | 7.26E-4 | | | | 3.19E-3 | .00319 |
| Ethylbenzene | | | | 3.17E-3 | .00317 | | | | 9.22E-5 | 9.22E-5 | | | | 3.17E-3 | .00317 |
| Hexane | | | | 0.00E+0 | .00000 | | | | 0.00E+0 | 0.00E+0 | | | | 0.00E+0 | .00000 |
| Isopropylbenzene | | | | 1.21E-4 | .0001211 | | | | 2.77E-5 | 2.77E-5 | | | | 1.21E-4 | .0001211 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Toluene | 5.73E-3 | .00573 | 1.31E-3 | 1.31E-3 | 5.73E-3 | .00573 |
| Xylene | 1.10E-2 | .01103 | 2.52E-3 | 2.52E-3 | 1.10E-2 | .01103 |
| **Metals from combustion** | | | | | | |
| Arsenic** | | | | | | |
| Barium | | | | | | |
| Beryllium** | | | | | | |
| Cadmium** | | | | | | |
| Chromium** | | | | | | |
| Cobalt** | | | | | | |
| Copper | | | | | | |
| Lead** | | | | | | |
| Manganese** | | | | | | |
| Mercury** | | | | | | |
| Molybdenum | | | | | | |
| Nickel** | | | | | | |
| Selenium** | | | | | | |
| Vanadium | | | | | | |
| Zinc | | | | | | |

* Polycyclic Organic Matter (POM), defined as a Hazardous Air Pollutant in Section 112(b) of the Clean Air Act
** Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act
1 All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM10, PM2.5 or PM1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 or 201a (or equivalent) sampling train. EPA has recently modified Method 202. Most of the data used to generate the condensible emission factors were from older test methods and may not represent the results that the current method will produce.

| Pollutant | Emission Factor | | | | | Production Rate | | Hours of Operation | Emission Rates | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Uncontrolled | | Controlled | | AP-42 Table | | | | Uncontrolled | | Controlled | | Flow Rate (dscfm) @ 3% $O_2$ | Concentration PPMdv |
| | Value | Units | Value | Units | | Value | Units | (hrs/yr) | (lbs/hr) | (tons/yr) | (lbs/hr) | (tons/yr) | | |
| | UEF | | CEF | | | PR | | OP | UER | | CER | | | |
| | A | B | C | D | | E | F | G | H | I | J | K | | |
| **Criteria Pollutants** | | | | | | | | | A/1028xE | HxG/2000 | C/1028xE | JxE/2000 | | |
| PM Total[1] | 7.6 | lb/$10^6$ ft$^3$ | 7.6 | lb/$10^6$ ft$^3$ | 1.4-2 | 36.00 | $10^6$ Btu/hr | 8,760 | 0.266 | 1.17 | 0.266 | 1.166 | | |
| PM Condensible[1] | 5.7 | lb/$10^6$ ft$^3$ | 5.7 | lb/$10^6$ ft$^3$ | 1.4-2 | 36.00 | $10^6$ Btu/hr | 8,760 | 0.200 | 0.87 | 0.200 | 0.874 | | |
| PM Filterable[1] | 1.9 | lb/$10^6$ ft$^3$ | 1.9 | lb/$10^6$ ft$^3$ | 1.4-2 | 36.00 | $10^6$ Btu/hr | 8,760 | 0.067 | 0.29 | 0.067 | 0.291 | | |
| $SO_2$ | 0.6 | lb/$10^6$ ft$^3$ | 0.6 | lb/$10^6$ ft$^3$ | 1.4-2 | 36.00 | $10^6$ Btu/hr | 8,760 | 0.021 | 0.09 | 0.021 | 0.090 | 6,137 | 0.34 |
| $NO_2$ | 100 | lb/$10^6$ ft$^3$ | 50.0 | lb/$10^6$ ft$^3$ | Note 2 | 36.00 | $10^6$ Btu/hr | 8,760 | 3.502 | 15.34 | 1.75 | 7.669 | 6,137 | 39.86 |
| CO | 84 | lb/$10^6$ ft$^3$ | 84 | lb/$10^6$ ft$^3$ | 1.4-1 | 36.00 | $10^6$ Btu/hr | 8,760 | 2.942 | 12.88 | 2.94 | 12.884 | 6,137 | 110.02 |
| VOC | 5.5 | lb/$10^6$ ft$^3$ | 5.5 | lb/$10^6$ ft$^3$ | 1.4-2 | 36.00 | $10^6$ Btu/hr | 8,760 | 0.193 | 0.84 | 0.19 | 0.844 | 6,137 | 2.52 |
| **Greenhouse Gases** | | | | | | | | | AxEx2.2 | HxG/2000 | CxEx 2.2 | JxE/2000 | | |
| $CO_2$ | 53.02 | Kg/$10^6$ btu | 53.02 | Kg/$10^6$ btu | C-1 | 36.00 | $10^6$ Btu/hr | 8,760 | 4,208 | 18,431 | 4,208 | 18,431 | | |
| $N_2O$ | 1.00E-4 | Kg/$10^6$ btu | 1.00E-4 | Kg/$10^6$ btu | C-1 | 36.00 | $10^6$ Btu/hr | 8,760 | 7.94E-3 | 3.48E-2 | 7.94E-3 | 3.48E-2 | | |
| Methane | 1.00E-3 | Kg/$10^6$ btu | 1.00E-3 | Kg/$10^6$ btu | C-1 | 36.00 | $10^6$ Btu/hr | 8,760 | 7.94E-2 | 3.48E-1 | 7.94E-2 | 3.48E-1 | | |
| Hydrofluorocarbons | ND | | ND | | | | | | | | | | | |
| Perfluorocarbons | ND | | ND | | | | | | | | | | | |
| $SF_6$ | ND | | ND | | | | | | | | | | | |
| **Total** | | | | | | | | | | | | | | |
| **Other Pollutants** | | | | | | | | | | | | | | |
| Ammonia | 3.1 | lb/$10^6$ ft$^3$ | 3.1 | lb/$10^6$ ft$^3$ | Fire | 36.00 | $10^6$ Btu/hr | 8,760 | 0.110 | 0.48 | 0.1100 | 0.47 | | |
| **HAPS** | | | | | | | | | | | | | | |
| Total Organic HAPs | 1.8824 | lb/$10^6$ ft$^3$ | 1.8824 | lb/$10^6$ ft$^3$ | | 36.00 | $10^6$ Btu/hr | 8,760 | 0.066 | 0.2888 | 0.0659 | 0.2888 | | |
| Total Metalic HAPs | 6.1E-3 | lb/$10^6$ ft$^3$ | 6.1E-3 | lb/$10^6$ ft$^3$ | | 36.00 | $10^6$ Btu/hr | 8,760 | 0.000 | 9.3E-4 | 2.12E-4 | 9.1E-4 | | |
| Total HAPS | 1.8885 | lb/$10^6$ ft$^3$ | 1.8885 | lb/$10^6$ ft$^3$ | | 36.00 | $10^6$ Btu/hr | 8,760 | 0.066 | 0.2898 | 0.0661 | 0.2898 | | |
| 2-Methylnaphthalene* | 2.4E-05 | lb/$10^6$ ft$^3$ | 2.4E-05 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 8.40E-07 | 3.68E-06 | 8.40E-7 | 3.68E-6 | | |
| 3-Methylchloranthrene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 6.30E-08 | 2.76E-07 | 6.30E-8 | 2.76E-7 | | |
| 7,12-Dimethylbenz(a)anthracene* | < 1.60E-05 | lb/$10^6$ ft$^3$ | < 1.60E-05 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 5.60E-07 | 2.45E-06 | 5.60E-7 | 2.45E-6 | | |
| Acenaphthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 6.30E-08 | 2.76E-07 | 6.30E-8 | 2.76E-7 | | |
| Acenaphthylene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 6.30E-08 | 2.76E-07 | 6.30E-8 | 2.76E-7 | | |
| Anthracene* | < 2.40E-06 | lb/$10^6$ ft$^3$ | < 2.40E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 8.40E-08 | 3.68E-07 | 8.40E-8 | 3.68E-7 | | |
| Benz(a)anthracene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 6.30E-08 | 2.76E-07 | 6.30E-8 | 2.76E-7 | | |
| Benzene | 2.1E-03 | lb/$10^6$ ft$^3$ | 2.1E-03 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 7.35E-05 | 3.22E-04 | 7.35E-5 | 3.22E-4 | | |
| Benzo(a)pyrene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 4.20E-08 | 1.84E-07 | 4.20E-8 | 1.84E-7 | | |
| Benzo(b)fluoranthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 6.30E-08 | 2.76E-07 | 6.30E-8 | 2.76E-7 | | |
| Benzo(g,h,i)perylene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 4.20E-08 | 1.84E-07 | 4.20E-8 | 1.84E-7 | | |
| Benzo(k)fluoranthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 6.30E-08 | 2.76E-07 | 6.30E-8 | 2.76E-7 | | |
| Chrysene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 6.30E-08 | 2.76E-07 | 6.30E-8 | 2.76E-7 | | |
| Dibenzo(a,h)anthracene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 4.20E-08 | 1.84E-07 | 4.20E-8 | 1.84E-7 | | |
| Dichlorobenzene | 1.2E-03 | lb/$10^6$ ft$^3$ | 1.2E-03 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 4.20E-05 | 1.84E-04 | 4.20E-5 | 1.84E-4 | | |
| Fluoranthene* | 3.0E-06 | lb/$10^6$ ft$^3$ | 3.0E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 1.05E-07 | 4.60E-07 | 1.05E-7 | 4.60E-7 | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fluorene* | 2.8E-06 | lb/$10^6$ ft$^3$ | 2.8E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 9.81E-08 | 4.29E-07 | 9.81E-8 | 4.29E-7 |
| Formaldehyde | 7.5E-02 | lb/$10^6$ ft$^3$ | 7.5E-02 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 2.63E-03 | 1.15E-02 | 2.63E-3 | 1.15E-2 |
| Hexane | 1.8E+00 | lb/$10^6$ ft$^3$ | 1.8E+00 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 6.30E-02 | 2.76E-01 | 6.30E-2 | 2.76E-1 |
| Indeno(1,2,3-cd)pyrene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 6.30E-08 | 2.76E-07 | 6.30E-8 | 2.76E-7 |
| Naphthalene | 6.1E-04 | lb/$10^6$ ft$^3$ | 6.1E-04 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 2.14E-05 | 9.36E-05 | 2.14E-5 | 9.36E-5 |
| Phenanthrene* | 1.7E-05 | lb/$10^6$ ft$^3$ | 1.7E-05 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 5.95E-07 | 2.61E-06 | 5.95E-7 | 2.61E-6 |
| Pyrene* | 5.0E-06 | lb/$10^6$ ft$^3$ | 5.0E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 36.00 | $10^6$ Btu/hr | 8,760 | 1.75E-07 | 7.67E-07 | 1.75E-7 | 7.67E-7 |
| Toluene | 3.4E-03 | lb/$10^6$ ft$^3$ | 3.4E-03 | lb/$10^6$ ft$^3$ | | 36.00 | $10^6$ Btu/hr | 8,760 | 1.19E-04 | 5.22E-04 | 1.19E-4 | 5.22E-4 |
| Total POM | | | | | | | | | | 1.35E-05 | | 1.35E-05 |
| Total PAH | | | | | | | | | | 1.04E-04 | | 1.04E-04 |
| **Metals** | | | | | | | | | | | | |
| Arsenic** | 2.0E-04 | lb/$10^6$ ft$^3$ | 2.0E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 36.00 | $10^6$ Btu/hr | 8,760 | 7.00E-06 | 3.07E-5 | 6.86E-06 | 3.00E-5 |
| Barium | 4.4E-03 | lb/$10^6$ ft$^3$ | 4.4E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 36.00 | $10^6$ Btu/hr | 8,760 | 1.54E-04 | 6.75E-4 | 1.51E-04 | 6.61E-4 |
| Beryllium** | < 1.20E-05 | lb/$10^6$ ft$^3$ | < 1.20E-05 | lb/$10^6$ ft$^3$ | 1.4-4 | 36.00 | $10^6$ Btu/hr | 8,760 | 4.20E-07 | 1.84E-6 | < 4.11E-07 | 1.80E-6 |
| Cadmium** | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 36.00 | $10^6$ Btu/hr | 8,760 | 3.85E-05 | 1.69E-4 | 3.77E-05 | 1.65E-4 |
| Chromium** | 1.4E-03 | lb/$10^6$ ft$^3$ | 1.4E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 36.00 | $10^6$ Btu/hr | 8,760 | 4.90E-05 | 2.15E-4 | 4.80E-05 | 2.10E-4 |
| Cobalt** | 8.4E-05 | lb/$10^6$ ft$^3$ | 8.4E-05 | lb/$10^6$ ft$^3$ | 1.4-4 | 36.00 | $10^6$ Btu/hr | 8,760 | 2.94E-06 | 1.29E-5 | 2.88E-06 | 1.26E-5 |
| Copper | 8.5E-04 | lb/$10^6$ ft$^3$ | 8.5E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 36.00 | $10^6$ Btu/hr | 8,760 | 2.98E-05 | 1.30E-4 | 2.91E-05 | 1.28E-4 |
| Lead** | 5.0E-04 | lb/$10^6$ ft$^3$ | 5.0E-04 | lb/$10^6$ ft$^3$ | 1.4-2 | 36.00 | $10^6$ Btu/hr | 8,760 | 1.75E-05 | 7.67E-5 | 1.71E-05 | 7.51E-5 |
| Manganese** | 3.8E-04 | lb/$10^6$ ft$^3$ | 3.8E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 36.00 | $10^6$ Btu/hr | 8,760 | 1.33E-05 | 5.83E-5 | 1.30E-05 | 5.71E-5 |
| Mercury** | 2.6E-04 | lb/$10^6$ ft$^3$ | 2.6E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 36.00 | $10^6$ Btu/hr | 8,760 | 9.11E-06 | 3.99E-5 | 8.91E-06 | 3.90E-5 |
| Molybdenum | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 36.00 | $10^6$ Btu/hr | 8,760 | 3.85E-05 | 1.69E-4 | 3.77E-05 | 1.65E-4 |
| Nickel** | 2.1E-03 | lb/$10^6$ ft$^3$ | 2.1E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 36.00 | $10^6$ Btu/hr | 8,760 | 7.35E-05 | 3.22E-4 | 7.20E-05 | 3.15E-4 |
| Selenium** | < 2.40E-05 | lb/$10^6$ ft$^3$ | < 2.40E-05 | lb/$10^6$ ft$^3$ | 1.4-4 | 36.00 | $10^6$ Btu/hr | 8,760 | 8.40E-07 | 3.68E-6 | < 8.23E-07 | 3.60E-6 |
| Vanadium | 2.3E-03 | lb/$10^6$ ft$^3$ | 2.3E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 36.00 | $10^6$ Btu/hr | 8,760 | 8.05E-05 | 3.53E-4 | 7.89E-05 | 3.45E-4 |
| Zinc | 2.9E-02 | lb/$10^6$ ft$^3$ | 2.9E-02 | lb/$10^6$ ft$^3$ | 1.4-4 | 36.00 | $10^6$ Btu/hr | 8,760 | 1.02E-03 | 4.45E-3 | 9.94E-04 | 4.35E-3 |

* Polycyclic Organic Matter (POM), defined as a Hazardous Air Pollutant in Section 112(b) of the Clean Air Act

* *Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act

1 All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM10, PM2.5 or PM1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

Heat content of natural gas is assumed to be 1028 btu/scf from EPA's greenhouse gas reporting requirement 40 cfr 98.30 Table C-1.

2 Uncontrolled & controlled emission factor from AP-42 Table 1.4-2, controlled emission factor based on low NOx burners.

| Pollutant | Emission Factor | | | | | Production Rate | | Hours of Operation | Emission Rates | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Uncontrolled | | Controlled | | AP-42 Table | | | | Uncontrolled | | Controlled | | Flow Rate (dscfm) @ 3% $O_2$ | Concentration PPMdv |
| | Value | Units | Value | Units | | Value | Units | (hrs/yr) | (lbs/hr) | (tons/yr) | (lbs/hr) | (tons/yr) | | |
| | UEF | | CEF | | | PR | | OP | UER | | CER | | | |
| | A | B | C | D | | E | F | G | H | I | J | K | | |
| **Criteria Pollutants** | | | | | | | | | A/1028xE | HxG/2000 | C/1028xE | JxE/2000 | | |
| PM Total[1] | 7.6 | lb/$10^6$ ft$^3$ | 7.6 | lb/$10^6$ ft$^3$ | 1.4-2 | 5.00 | $10^6$ Btu/hr | 8,760 | 0.037 | 0.16 | 0.037 | 0.162 | | |
| PM Condensible[1] | 5.7 | lb/$10^6$ ft$^3$ | 5.7 | lb/$10^6$ ft$^3$ | 1.4-2 | 5.00 | $10^6$ Btu/hr | 8,760 | 0.028 | 0.12 | 0.028 | 0.121 | | |
| PM Filterable[1] | 1.9 | lb/$10^6$ ft$^3$ | 1.9 | lb/$10^6$ ft$^3$ | 1.4-2 | 5.00 | $10^6$ Btu/hr | 8,760 | 0.009 | 0.04 | 0.009 | 0.040 | | |
| $SO_2$ | 0.6 | lb/$10^6$ ft$^3$ | 0.6 | lb/$10^6$ ft$^3$ | 1.4-2 | 5.00 | $10^6$ Btu/hr | 8,760 | 0.003 | 0.01 | 0.003 | 0.013 | 852 | 0.34 |
| $NO_2$ | 100 | lb/$10^6$ ft$^3$ | 50.0 | lb/$10^6$ ft$^3$ | Note 2 | 5.00 | $10^6$ Btu/hr | 8,760 | 0.486 | 2.13 | 0.24 | 1.065 | 852 | 39.86 |
| CO | 84 | lb/$10^6$ ft$^3$ | 84 | lb/$10^6$ ft$^3$ | 1.4-1 | 5.00 | $10^6$ Btu/hr | 8,760 | 0.409 | 1.79 | 0.41 | 1.789 | 852 | 110.02 |
| VOC | 5.5 | lb/$10^6$ ft$^3$ | 5.5 | lb/$10^6$ ft$^3$ | 1.4-2 | 5.00 | $10^6$ Btu/hr | 8,760 | 0.027 | 0.12 | 0.03 | 0.117 | 852 | 2.52 |
| **Greenhouse Gases** | | | | | | | | | AxEx2.2 | HxG/2000 | CxEx 2.2 | JxE/2000 | | |
| $CO_2$ | 53.02 | Kg/$10^6$ btu | 53.02 | Kg/$10^6$ btu | C-1 | 5.00 | $10^6$ Btu/hr | 8,760 | 584 | 2,560 | 584 | 2,560 | | |
| $N_2O$ | 1.00E-4 | Kg/$10^6$ btu | 1.00E-4 | Kg/$10^6$ btu | C-1 | 5.00 | $10^6$ Btu/hr | 8,760 | 1.10E-3 | 4.83E-3 | 1.10E-3 | 4.83E-3 | | |
| Methane | 1.00E-3 | Kg/$10^6$ btu | 1.00E-3 | Kg/$10^6$ btu | C-1 | 5.00 | $10^6$ Btu/hr | 8,760 | 1.10E-2 | 4.83E-2 | 1.10E-2 | 4.83E-2 | | |
| Hydrofluorocarbons | ND | | ND | | | | | | | | | | | |
| Perfluorocarbons | ND | | ND | | | | | | | | | | | |
| $SF_6$ | ND | | ND | | | | | | | | | | | |
| **Total** | | | | | | | | | | | | | | |
| **Other Pollutants** | | | | | | | | | | | | | | |
| Ammonia | 3.1 | lb/$10^6$ ft$^3$ | 3.1 | lb/$10^6$ ft$^3$ | Fire | 5.00 | $10^6$ Btu/hr | 8,760 | 0.015 | 0.07 | 0.0153 | 0.07 | | |
| **HAPS** | | | | | | | | | | | | | | |
| Total Organic HAPs | 1.8824 | lb/$10^6$ ft$^3$ | 1.8824 | lb/$10^6$ ft$^3$ | | 5.00 | $10^6$ Btu/hr | 8,760 | 0.009 | 0.0401 | 0.0092 | 0.0401 | | |
| Total Metalic HAPs | 6.1E-3 | lb/$10^6$ ft$^3$ | 6.1E-3 | lb/$10^6$ ft$^3$ | | 5.00 | $10^6$ Btu/hr | 8,760 | 0.000 | 1.3E-4 | 2.95E-5 | 1.3E-4 | | |
| Total HAPS | 1.8885 | lb/$10^6$ ft$^3$ | 1.8885 | lb/$10^6$ ft$^3$ | | 5.00 | $10^6$ Btu/hr | 8,760 | 0.009 | 0.0402 | 0.0092 | 0.0402 | | |
| 2-Methylnaphthalene* | 2.4E-05 | lb/$10^6$ ft$^3$ | 2.4E-05 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 1.17E-07 | 5.11E-07 | 1.17E-7 | 5.11E-7 | | |
| 3-Methylchloranthrene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 8.75E-09 | 3.83E-08 | 8.75E-9 | 3.83E-8 | | |
| 7,12-Dimethylbenz(a)anthracene* | < 1.60E-05 | lb/$10^6$ ft$^3$ | < 1.60E-05 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 7.78E-08 | 3.41E-07 | 7.78E-8 | 3.41E-7 | | |
| Acenaphthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 8.75E-09 | 3.83E-08 | 8.75E-9 | 3.83E-8 | | |
| Acenaphthylene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 8.75E-09 | 3.83E-08 | 8.75E-9 | 3.83E-8 | | |
| Anthracene* | < 2.40E-06 | lb/$10^6$ ft$^3$ | < 2.40E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 1.17E-08 | 5.11E-08 | 1.17E-8 | 5.11E-8 | | |
| Benz(a)anthracene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 8.75E-09 | 3.83E-08 | 8.75E-9 | 3.83E-8 | | |
| Benzene | 2.1E-03 | lb/$10^6$ ft$^3$ | 2.1E-03 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 1.02E-05 | 4.47E-05 | 1.02E-5 | 4.47E-5 | | |
| Benzo(a)pyrene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 5.84E-09 | 2.56E-08 | 5.84E-9 | 2.56E-8 | | |
| Benzo(b)fluoranthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 8.75E-09 | 3.83E-08 | 8.75E-9 | 3.83E-8 | | |
| Benzo(g,h,i)perylene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 5.84E-09 | 2.56E-08 | 5.84E-9 | 2.56E-8 | | |
| Benzo(k)fluoranthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 8.75E-09 | 3.83E-08 | 8.75E-9 | 3.83E-8 | | |
| Chrysene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 8.75E-09 | 3.83E-08 | 8.75E-9 | 3.83E-8 | | |
| Dibenzo(a,h)anthracene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 5.84E-09 | 2.56E-08 | 5.84E-9 | 2.56E-8 | | |
| Dichlorobenzene | 1.2E-03 | lb/$10^6$ ft$^3$ | 1.2E-03 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 5.84E-06 | 2.56E-05 | 5.84E-6 | 2.56E-5 | | |
| Fluoranthene* | 3.0E-06 | lb/$10^6$ ft$^3$ | 3.0E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 1.46E-08 | 6.39E-08 | 1.46E-8 | 6.39E-8 | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fluorene* | 2.8E-06 | lb/$10^6$ ft$^3$ | 2.8E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 1.36E-08 | 5.96E-08 | 1.36E-8 | 5.96E-8 |
| Formaldehyde | 7.5E-02 | lb/$10^6$ ft$^3$ | 7.5E-02 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 3.65E-04 | 1.60E-03 | 3.65E-4 | 1.60E-3 |
| Hexane | 1.8E+00 | lb/$10^6$ ft$^3$ | 1.8E+00 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 8.75E-03 | 3.83E-02 | 8.75E-3 | 3.83E-2 |
| Indeno(1,2,3-cd)pyrene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 8.75E-09 | 3.83E-08 | 8.75E-9 | 3.83E-8 |
| Naphthalene | 6.1E-04 | lb/$10^6$ ft$^3$ | 6.1E-04 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 2.97E-06 | 1.30E-05 | 2.97E-6 | 1.30E-5 |
| Phenanthrene* | 1.7E-05 | lb/$10^6$ ft$^3$ | 1.7E-05 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 8.27E-08 | 3.62E-07 | 8.27E-8 | 3.62E-7 |
| Pyrene* | 5.0E-06 | lb/$10^6$ ft$^3$ | 5.0E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 5.00 | $10^6$ Btu/hr | 8,760 | 2.43E-08 | 1.07E-07 | 2.43E-8 | 1.07E-7 |
| Toluene | 3.4E-03 | lb/$10^6$ ft$^3$ | 3.4E-03 | lb/$10^6$ ft$^3$ | | 5.00 | $10^6$ Btu/hr | 8,760 | 1.65E-05 | 7.24E-05 | 1.65E-5 | 7.24E-5 |
| Total POM | | | | | | | | | | 1.88E-06 | | 1.88E-06 |
| Total PAH | | | | | | | | | | 1.45E-05 | | 1.45E-05 |
| **Metals** | | | | | | | | | | | | |
| Arsenic** | 2.0E-04 | lb/$10^6$ ft$^3$ | 2.0E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 5.00 | $10^6$ Btu/hr | 8,760 | 9.73E-07 | 4.26E-6 | 9.52E-07 | 4.17E-6 |
| Barium | 4.4E-03 | lb/$10^6$ ft$^3$ | 4.4E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 5.00 | $10^6$ Btu/hr | 8,760 | 2.14E-05 | 9.37E-5 | 2.10E-05 | 9.18E-5 |
| Beryllium** | < 1.20E-05 | lb/$10^6$ ft$^3$ | < 1.20E-05 | lb/$10^6$ ft$^3$ | 1.4-4 | 5.00 | $10^6$ Btu/hr | 8,760 | 5.84E-08 | 2.56E-7 | < 5.71E-08 | 2.50E-7 |
| Cadmium** | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 5.00 | $10^6$ Btu/hr | 8,760 | 5.35E-06 | 2.34E-5 | 5.24E-06 | 2.29E-5 |
| Chromium** | 1.4E-03 | lb/$10^6$ ft$^3$ | 1.4E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 5.00 | $10^6$ Btu/hr | 8,760 | 6.81E-06 | 2.98E-5 | 6.67E-06 | 2.92E-5 |
| Cobalt** | 8.4E-05 | lb/$10^6$ ft$^3$ | 8.4E-05 | lb/$10^6$ ft$^3$ | 1.4-4 | 5.00 | $10^6$ Btu/hr | 8,760 | 4.09E-07 | 1.79E-6 | 4.00E-07 | 1.75E-6 |
| Copper | 8.5E-04 | lb/$10^6$ ft$^3$ | 8.5E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 5.00 | $10^6$ Btu/hr | 8,760 | 4.13E-06 | 1.81E-5 | 4.05E-06 | 1.77E-5 |
| Lead** | 5.0E-04 | lb/$10^6$ ft$^3$ | 5.0E-04 | lb/$10^6$ ft$^3$ | 1.4-2 | 5.00 | $10^6$ Btu/hr | 8,760 | 2.43E-06 | 1.07E-5 | 2.38E-06 | 1.04E-5 |
| Manganese** | 3.8E-04 | lb/$10^6$ ft$^3$ | 3.8E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 5.00 | $10^6$ Btu/hr | 8,760 | 1.85E-06 | 8.10E-6 | 1.81E-06 | 7.93E-6 |
| Mercury** | 2.6E-04 | lb/$10^6$ ft$^3$ | 2.6E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 5.00 | $10^6$ Btu/hr | 8,760 | 1.26E-06 | 5.54E-6 | 1.24E-06 | 5.42E-6 |
| Molybdenum | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 5.00 | $10^6$ Btu/hr | 8,760 | 5.35E-06 | 2.34E-5 | 5.24E-06 | 2.29E-5 |
| Nickel** | 2.1E-03 | lb/$10^6$ ft$^3$ | 2.1E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 5.00 | $10^6$ Btu/hr | 8,760 | 1.02E-05 | 4.47E-5 | 1.00E-05 | 4.38E-5 |
| Selenium** | < 2.40E-05 | lb/$10^6$ ft$^3$ | < 2.40E-05 | lb/$10^6$ ft$^3$ | 1.4-4 | 5.00 | $10^6$ Btu/hr | 8,760 | 1.17E-07 | 5.11E-7 | < 1.14E-07 | 5.01E-7 |
| Vanadium | 2.3E-03 | lb/$10^6$ ft$^3$ | 2.3E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 5.00 | $10^6$ Btu/hr | 8,760 | 1.12E-05 | 4.90E-5 | 1.10E-05 | 4.80E-5 |
| Zinc | 2.9E-02 | lb/$10^6$ ft$^3$ | 2.9E-02 | lb/$10^6$ ft$^3$ | 1.4-4 | 5.00 | $10^6$ Btu/hr | 8,760 | 1.41E-04 | 6.18E-4 | 1.38E-04 | 6.05E-4 |

* Polycyclic Organic Matter (POM), defined as a Hazardous Air Pollutant in Section 112(b) of the Clean Air Act

* *Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act

1 All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM10, PM2.5 or PM1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

Heat content of natural gas is assumed to be 1028 btu/scf from EPA's greenhouse gas reporting requirement 40 cfr 98.30 Table C-1.

2 Uncontrolled & controlled emission factor from AP-42 Table 1.4-2, controlled emission factor based on low NOx burners.

| Pollutant | Emission Factor | | | | | Production Rate | | Hours of Operation | Emission Rates | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Uncontrolled | | Controlled | | AP-42 Table | | | | Uncontrolled | | Controlled | | Flow Rate (dscfm) @ 3% $O_2$ | Concentration PPMdv |
| | Value | Units | Value | Units | | Value | Units | (hrs/yr) | (lbs/hr) | (tons/yr) | (lbs/hr) | (tons/yr) | | |
| | UEF | | CEF | | | PR | | OP | UER | | CER | | | |
| | A | B | C | D | | E | F | G | H | I | J | K | | |
| **Criteria Pollutants** | | | | | | | | | A/1028xE | HxG/2000 | C/1028xE | JxE/2000 | | |
| PM Total[1] | 7.6 | lb/$10^6$ ft$^3$ | 7.6 | lb/$10^6$ ft$^3$ | 1.4-2 | 4.50 | $10^6$ Btu/hr | 8,760 | 0.033 | 0.15 | 0.033 | 0.146 | | |
| PM Condensible[1] | 5.7 | lb/$10^6$ ft$^3$ | 5.7 | lb/$10^6$ ft$^3$ | 1.4-2 | 4.50 | $10^6$ Btu/hr | 8,760 | 0.025 | 0.11 | 0.025 | 0.109 | | |
| PM Filterable[1] | 1.9 | lb/$10^6$ ft$^3$ | 1.9 | lb/$10^6$ ft$^3$ | 1.4-2 | 4.50 | $10^6$ Btu/hr | 8,760 | 0.008 | 0.04 | 0.008 | 0.036 | | |
| $SO_2$ | 0.6 | lb/$10^6$ ft$^3$ | 0.6 | lb/$10^6$ ft$^3$ | 1.4-2 | 4.50 | $10^6$ Btu/hr | 8,760 | 0.003 | 0.01 | 0.003 | 0.011 | 767 | 0.34 |
| $NO_2$ | 100 | lb/$10^6$ ft$^3$ | 50.0 | lb/$10^6$ ft$^3$ | 1.4-1 | 4.50 | $10^6$ Btu/hr | 8,760 | 0.438 | 1.92 | 0.22 | 0.959 | 767 | 39.86 |
| CO | 84 | lb/$10^6$ ft$^3$ | 84 | lb/$10^6$ ft$^3$ | 1.4-1 | 4.50 | $10^6$ Btu/hr | 8,760 | 0.368 | 1.61 | 0.37 | 1.611 | 767 | 110.02 |
| VOC[2] | 5.5 | lb/$10^6$ ft$^3$ | 5.5 | lb/$10^6$ ft$^3$ | 1.4-2 | 4.50 | $10^6$ Btu/hr | 8,760 | 0.024 | 0.11 | 0.02 | 0.105 | 767 | 2.52 |
| **Greenhouse Gases** | | | | | | | | | AxEx2.2 | HxG/2000 | CxEx 2.2 | JxE/2000 | | |
| $CO_2$ | 53.02 | Kg/$10^6$ btu | 53.02 | Kg/$10^6$ btu | C-1 | 4.50 | $10^6$ Btu/hr | 8,760 | 526 | 2,304 | 526 | 2,304 | | |
| $N_2O$ | 1.00E-4 | Kg/$10^6$ btu | 1.00E-4 | Kg/$10^6$ btu | C-1 | 4.50 | $10^6$ Btu/hr | 8,760 | 9.92E-4 | 4.35E-3 | 9.92E-4 | 4.35E-3 | | |
| Methane | 1.00E-3 | Kg/$10^6$ btu | 1.00E-3 | Kg/$10^6$ btu | C-1 | 4.50 | $10^6$ Btu/hr | 8,760 | 9.92E-3 | 4.35E-2 | 9.92E-3 | 4.35E-2 | | |
| Hydrofluorocarbons | ND | | ND | | | | | | | | | | | |
| Perfluorocarbons | ND | | ND | | | | | | | | | | | |
| $SF_6$ | ND | | ND | | | | | | | | | | | |
| **Total** | | | | | | | | | | | | | | |
| **Other Pollutants** | | | | | | | | | | | | | | |
| Ammonia | 3.1 | lb/$10^6$ ft$^3$ | 3.1 | lb/$10^6$ ft$^3$ | Fire | 4.50 | $10^6$ Btu/hr | 8,760 | 0.014 | 0.06 | 0.0137 | 0.06 | | |
| **HAPS** | | | | | | | | | | | | | | |
| Total Organic HAPs | 1.8824 | lb/$10^6$ ft$^3$ | 1.8824 | lb/$10^6$ ft$^3$ | | 4.50 | $10^6$ Btu/hr | 8,760 | 0.008 | 0.0361 | 0.0082 | 0.0361 | | |
| Total Metalic HAPs | 6.1E-3 | lb/$10^6$ ft$^3$ | 6.1E-3 | lb/$10^6$ ft$^3$ | | 4.50 | $10^6$ Btu/hr | 8,760 | 0.000 | 1.2E-4 | 2.65E-5 | 1.1E-4 | | |
| Total HAPS | 1.8885 | lb/$10^6$ ft$^3$ | 1.8885 | lb/$10^6$ ft$^3$ | | 4.50 | $10^6$ Btu/hr | 8,760 | 0.008 | 0.0362 | 0.0083 | 0.0362 | | |
| 2-Methylnaphthalene* | 2.4E-05 | lb/$10^6$ ft$^3$ | 2.4E-05 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 1.05E-07 | 4.60E-07 | 1.05E-7 | 4.60E-7 | | |
| 3-Methylchloranthrene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 7.88E-09 | 3.45E-08 | 7.88E-9 | 3.45E-8 | | |
| 7,12-Dimethylbenz(a)anthracene* | < 1.60E-05 | lb/$10^6$ ft$^3$ | < 1.60E-05 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 7.00E-08 | 3.07E-07 | 7.00E-8 | 3.07E-7 | | |
| Acenaphthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 7.88E-09 | 3.45E-08 | 7.88E-9 | 3.45E-8 | | |
| Acenaphthylene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 7.88E-09 | 3.45E-08 | 7.88E-9 | 3.45E-8 | | |
| Anthracene* | < 2.40E-06 | lb/$10^6$ ft$^3$ | < 2.40E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 1.05E-08 | 4.60E-08 | 1.05E-8 | 4.60E-8 | | |
| Benz(a)anthracene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 7.88E-09 | 3.45E-08 | 7.88E-9 | 3.45E-8 | | |
| Benzene | 2.1E-03 | lb/$10^6$ ft$^3$ | 2.1E-03 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 9.19E-06 | 4.03E-05 | 9.19E-6 | 4.03E-5 | | |
| Benzo(a)pyrene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 5.25E-09 | 2.30E-08 | 5.25E-9 | 2.30E-8 | | |
| Benzo(b)fluoranthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 7.88E-09 | 3.45E-08 | 7.88E-9 | 3.45E-8 | | |
| Benzo(g,h,i)perylene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 5.25E-09 | 2.30E-08 | 5.25E-9 | 2.30E-8 | | |
| Benzo(k)fluoranthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 7.88E-09 | 3.45E-08 | 7.88E-9 | 3.45E-8 | | |
| Chrysene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 7.88E-09 | 3.45E-08 | 7.88E-9 | 3.45E-8 | | |
| Dibenzo(a,h)anthracene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 5.25E-09 | 2.30E-08 | 5.25E-9 | 2.30E-8 | | |
| Dichlorobenzene | 1.2E-03 | lb/$10^6$ ft$^3$ | 1.2E-03 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 5.25E-06 | 2.30E-05 | 5.25E-6 | 2.30E-5 | | |
| Fluoranthene* | 3.0E-06 | lb/$10^6$ ft$^3$ | 3.0E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 1.31E-08 | 5.75E-08 | 1.31E-8 | 5.75E-8 | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fluorene* | 2.8E-06 | lb/$10^6$ ft$^3$ | 2.8E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 1.23E-08 | 5.37E-08 | 1.23E-8 | 5.37E-8 |
| Formaldehyde | 7.5E-02 | lb/$10^6$ ft$^3$ | 7.5E-02 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 3.28E-04 | 1.44E-03 | 3.28E-4 | 1.44E-3 |
| Hexane | 1.8E+00 | lb/$10^6$ ft$^3$ | 1.8E+00 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 7.88E-03 | 3.45E-02 | 7.88E-3 | 3.45E-2 |
| Indeno(1,2,3-cd)pyrene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 7.88E-09 | 3.45E-08 | 7.88E-9 | 3.45E-8 |
| Naphthalene | 6.1E-04 | lb/$10^6$ ft$^3$ | 6.1E-04 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 2.67E-06 | 1.17E-05 | 2.67E-6 | 1.17E-5 |
| Phenanthrene* | 1.7E-05 | lb/$10^6$ ft$^3$ | 1.7E-05 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 7.44E-08 | 3.26E-07 | 7.44E-8 | 3.26E-7 |
| Pyrene* | 5.0E-06 | lb/$10^6$ ft$^3$ | 5.0E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 4.50 | $10^6$ Btu/hr | 8,760 | 2.19E-08 | 9.59E-08 | 2.19E-8 | 9.59E-8 |
| Toluene | 3.4E-03 | lb/$10^6$ ft$^3$ | 3.4E-03 | lb/$10^6$ ft$^3$ | | 4.50 | $10^6$ Btu/hr | 8,760 | 1.49E-05 | 6.52E-05 | 1.49E-5 | 6.52E-5 |
| Total POM | | | | | | | | | | 1.69E-06 | | 1.69E-06 |
| Total PAH | | | | | | | | | | 1.30E-05 | | 1.30E-05 |
| **Metals** | | | | | | | | | | | | |
| Arsenic** | 2.0E-04 | lb/$10^6$ ft$^3$ | 2.0E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 4.50 | $10^6$ Btu/hr | 8,760 | 8.75E-07 | 3.83E-6 | 8.57E-07 | 3.75E-6 |
| Barium | 4.4E-03 | lb/$10^6$ ft$^3$ | 4.4E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 4.50 | $10^6$ Btu/hr | 8,760 | 1.93E-05 | 8.44E-5 | 1.89E-05 | 8.26E-5 |
| Beryllium** | < 1.20E-05 | lb/$10^6$ ft$^3$ | < 1.20E-05 | lb/$10^6$ ft$^3$ | 1.4-4 | 4.50 | $10^6$ Btu/hr | 8,760 | 5.25E-08 | 2.30E-7 | < 5.14E-08 | 2.25E-7 |
| Cadmium** | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 4.50 | $10^6$ Btu/hr | 8,760 | 4.82E-06 | 2.11E-5 | 4.71E-06 | 2.06E-5 |
| Chromium** | 1.4E-03 | lb/$10^6$ ft$^3$ | 1.4E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 4.50 | $10^6$ Btu/hr | 8,760 | 6.13E-06 | 2.68E-5 | 6.00E-06 | 2.63E-5 |
| Cobalt** | 8.4E-05 | lb/$10^6$ ft$^3$ | 8.4E-05 | lb/$10^6$ ft$^3$ | 1.4-4 | 4.50 | $10^6$ Btu/hr | 8,760 | 3.68E-07 | 1.61E-6 | 3.60E-07 | 1.58E-6 |
| Copper | 8.5E-04 | lb/$10^6$ ft$^3$ | 8.5E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 4.50 | $10^6$ Btu/hr | 8,760 | 3.72E-06 | 1.63E-5 | 3.64E-06 | 1.60E-5 |
| Lead** | 5.0E-04 | lb/$10^6$ ft$^3$ | 5.0E-04 | lb/$10^6$ ft$^3$ | 1.4-2 | 4.50 | $10^6$ Btu/hr | 8,760 | 2.19E-06 | 9.59E-6 | 2.14E-06 | 9.39E-6 |
| Manganese** | 3.8E-04 | lb/$10^6$ ft$^3$ | 3.8E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 4.50 | $10^6$ Btu/hr | 8,760 | 1.66E-06 | 7.29E-6 | 1.63E-06 | 7.13E-6 |
| Mercury** | 2.6E-04 | lb/$10^6$ ft$^3$ | 2.6E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 4.50 | $10^6$ Btu/hr | 8,760 | 1.14E-06 | 4.99E-6 | 1.11E-06 | 4.88E-6 |
| Molybdenum | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 4.50 | $10^6$ Btu/hr | 8,760 | 4.82E-06 | 2.11E-5 | 4.71E-06 | 2.06E-5 |
| Nickel** | 2.1E-03 | lb/$10^6$ ft$^3$ | 2.1E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 4.50 | $10^6$ Btu/hr | 8,760 | 9.19E-06 | 4.03E-5 | 9.00E-06 | 3.94E-5 |
| Selenium** | < 2.40E-05 | lb/$10^6$ ft$^3$ | < 2.40E-05 | lb/$10^6$ ft$^3$ | 1.4-4 | 4.50 | $10^6$ Btu/hr | 8,760 | 1.05E-07 | 4.60E-7 | < 1.03E-07 | 4.51E-7 |
| Vanadium | 2.3E-03 | lb/$10^6$ ft$^3$ | 2.3E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 4.50 | $10^6$ Btu/hr | 8,760 | 1.01E-05 | 4.41E-5 | 9.86E-06 | 4.32E-5 |
| Zinc | 2.9E-02 | lb/$10^6$ ft$^3$ | 2.9E-02 | lb/$10^6$ ft$^3$ | 1.4-4 | 4.50 | $10^6$ Btu/hr | 8,760 | 1.27E-04 | 5.56E-4 | 1.24E-04 | 5.44E-4 |

* Polycyclic Organic Matter (POM), defined as a Hazardous Air Pollutant in Section 112(b) of the Clean Air Act

* *Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act

1 All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM10, PM2.5 or PM1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

Heat content of natural gas is assumed to be 1028 btu/scf from EPA's greenhouse gas reporting requirement 40 cfr 98.30 Table C-1.

2 The VOC emissions calculated here are only from the combustion of natural gas. VOC from the loading racks will be vented to one or more boiler. Those emissions are accounted for on the loading rack calculation page, but should be added to any emission limitation set on the boilers.

| Pollutant | Emission Factor | | | | | Production Rate | | Hours of Operation | Emission Rates | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Uncontrolled | | Controlled | | | | | | Uncontrolled | | Controlled | | Flow Rate (dscfm) @ 3% $O_2$ | Concentration PPMdv |
| | Value | Units | Value | Units | AP-42 Table | Value | Units | (hrs/yr) | (lbs/hr) | (tons/yr) | (lbs/hr) | (tons/yr) | | |
| | UEF | | CEF | | | PR | | OP | UER | | CER | | | |
| | A | B | C | D | | E | F | G | H | I | J | K | | |
| **Criteria Pollutants** | | | | | | | | | A/1028xE | HxG/2000 | C/1028xE | JxE/2000 | | |
| PM Total[1] | 7.6 | lb/$10^6$ ft$^3$ | 7.6 | lb/$10^6$ ft$^3$ | 1.4-2 | 51.00 | $10^6$ Btu/hr | 8,760 | 0.377 | 1.65 | 0.377 | 1.65 | | |
| PM Condensible[1] | 5.7 | lb/$10^6$ ft$^3$ | 5.7 | lb/$10^6$ ft$^3$ | 1.4-2 | 51.00 | $10^6$ Btu/hr | 8,760 | 0.283 | 1.24 | 0.283 | 1.24 | | |
| PM Filterable[1] | 1.9 | lb/$10^6$ ft$^3$ | 1.9 | lb/$10^6$ ft$^3$ | 1.4-2 | 51.00 | $10^6$ Btu/hr | 8,760 | 0.094 | 0.41 | 0.094 | 0.413 | | |
| $SO_2$ | 0.6 | lb/$10^6$ ft$^3$ | 0.6 | lb/$10^6$ ft$^3$ | 1.4-2 | 51.00 | $10^6$ Btu/hr | 8,760 | 0.029 | 0.13 | 0.029 | 0.128 | 8,694 | 0.34 |
| $NO_2$ | 100 | lb/$10^6$ ft$^3$ | 10 | lb/$10^6$ ft$^3$ | Note 2 | 51.00 | $10^6$ Btu/hr | 8,760 | 4.961 | 21.73 | 0.50 | 2.17 | 8,694 | 7.97 |
| CO | 84 | lb/$10^6$ ft$^3$ | 84 | lb/$10^6$ ft$^3$ | 1.4-1 | 51.00 | $10^6$ Btu/hr | 8,760 | 4.167 | 18.25 | 4.17 | 18.3 | 8,694 | 110.02 |
| VOC | 5.5 | lb/$10^6$ ft$^3$ | 5.5 | lb/$10^6$ ft$^3$ | 1.4-2 | 51.00 | $10^6$ Btu/hr | 8,760 | 0.273 | 1.20 | 0.27 | 1.20 | 8,694 | 2.52 |
| **Greenhouse Gases** | | | | | | | | | AxEx2.2 | HxG/2000 | CxEx 2.2 | JxE/2000 | | |
| $CO_2$ | 53.02 | Kg/$10^6$ btu | 53.02 | Kg/$10^6$ btu | C-1 | 51.00 | $10^6$ Btu/hr | 8,760 | 5,961 | 26,110 | 5,961 | 26,110 | | |
| $N_2O$ | 1.00E-4 | Kg/$10^6$ btu | 1.00E-4 | Kg/$10^6$ btu | C-1 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.12E-2 | 4.92E-2 | 1.12E-2 | 4.92E-2 | | |
| Methane | 1.00E-3 | Kg/$10^6$ btu | 1.00E-3 | Kg/$10^6$ btu | C-1 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.12E-1 | 4.92E-1 | 1.12E-1 | 4.92E-1 | | |
| Hydrofluorocarbons | ND | | ND | | | | | | | | | | | |
| Perfluorocarbons | ND | | ND | | | | | | | | | | | |
| $SF_6$ | ND | | ND | | | | | | | | | | | |
| **CO2e** | | | | | | | | | 5,967 | 26,136 | 5,967 | 26,136 | | |
| **Other Pollutants** | | | | | | | | | | | | | | |
| Ammonia | 2.3 | lb/$10^6$ ft$^3$ | 2.3 | lb/$10^6$ ft$^3$ | Note 4 | 51.00 | $10^6$ Btu/hr | 8,760 | 0.114 | 0.50 | 0.1141 | 0.49 | 8,694 | 4.95 |
| **HAPS** | | | | | | | | | | | | | | |
| Total Organic HAPs | 1.8824 | lb/$10^6$ ft$^3$ | 1.8824 | lb/$10^6$ ft$^3$ | | 51.00 | $10^6$ Btu/hr | 8,760 | 0.093 | 0.4092 | 0.0934 | 0.4092 | | |
| Total Metalic HAPs | 6.1E-3 | lb/$10^6$ ft$^3$ | 6.1E-3 | lb/$10^6$ ft$^3$ | | 51.00 | $10^6$ Btu/hr | 8,760 | 0.000 | 1.3E-3 | 3.01E-4 | 1.3E-3 | | |
| Total HAPS | 1.8885 | lb/$10^6$ ft$^3$ | 1.8885 | lb/$10^6$ ft$^3$ | | 51.00 | $10^6$ Btu/hr | 8,760 | 0.094 | 0.4105 | 0.0937 | 0.4105 | | |
| 2-Methylnaphthalene* | 2.4E-05 | lb/$10^6$ ft$^3$ | 2.4E-05 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.19E-06 | 5.22E-06 | 1.19E-6 | 5.22E-6 | | |
| 3-Methylchloranthrene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-08 | 3.91E-07 | 8.93E-8 | 3.91E-7 | | |
| 7,12-Dimethylbenz(a)anthracene* | < 1.60E-05 | lb/$10^6$ ft$^3$ | < 1.60E-05 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 7.94E-07 | 3.48E-06 | 7.94E-7 | 3.48E-6 | | |
| Acenaphthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-08 | 3.91E-07 | 8.93E-8 | 3.91E-7 | | |
| Acenaphthylene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-08 | 3.91E-07 | 8.93E-8 | 3.91E-7 | | |
| Anthracene* | < 2.40E-06 | lb/$10^6$ ft$^3$ | < 2.40E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.19E-07 | 5.22E-07 | 1.19E-7 | 5.22E-7 | | |
| Benz(a)anthracene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-08 | 3.91E-07 | 8.93E-8 | 3.91E-7 | | |
| Benzene | 2.1E-03 | lb/$10^6$ ft$^3$ | 2.1E-03 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.04E-04 | 4.56E-04 | 1.04E-4 | 4.56E-4 | | |
| Benzo(a)pyrene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 5.95E-08 | 2.61E-07 | 5.95E-8 | 2.61E-7 | | |
| Benzo(b)fluoranthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-08 | 3.91E-07 | 8.93E-8 | 3.91E-7 | | |
| Benzo(g,h,i)perylene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 5.95E-08 | 2.61E-07 | 5.95E-8 | 2.61E-7 | | |
| Benzo(k)fluoranthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-08 | 3.91E-07 | 8.93E-8 | 3.91E-7 | | |
| Chrysene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-08 | 3.91E-07 | 8.93E-8 | 3.91E-7 | | |
| Dibenzo(a,h)anthracene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 5.95E-08 | 2.61E-07 | 5.95E-8 | 2.61E-7 | | |
| Dichlorobenzene | 1.2E-03 | lb/$10^6$ ft$^3$ | 1.2E-03 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 5.95E-05 | 2.61E-04 | 5.95E-5 | 2.61E-4 | | |
| Fluoranthene* | 3.0E-06 | lb/$10^6$ ft$^3$ | 3.0E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.49E-07 | 6.52E-07 | 1.49E-7 | 6.52E-7 | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fluorene* | 2.8E-06 | lb/$10^6$ ft$^3$ | 2.8E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.39E-07 | 6.08E-07 | 1.39E-7 | 6.08E-7 |
| Formaldehyde | 7.5E-02 | lb/$10^6$ ft$^3$ | 7.5E-02 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 3.72E-03 | 1.63E-02 | 3.72E-3 | 1.63E-2 |
| Hexane | 1.8E+00 | lb/$10^6$ ft$^3$ | 1.8E+00 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-02 | 3.91E-01 | 8.93E-2 | 3.91E-1 |
| Indeno(1,2,3-cd)pyrene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-08 | 3.91E-07 | 8.93E-8 | 3.91E-7 |
| Naphthalene | 6.1E-04 | lb/$10^6$ ft$^3$ | 6.1E-04 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 3.03E-05 | 1.33E-04 | 3.03E-5 | 1.33E-4 |
| Phenanthrene* | 1.7E-05 | lb/$10^6$ ft$^3$ | 1.7E-05 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.43E-07 | 3.69E-06 | 8.43E-7 | 3.69E-6 |
| Pyrene* | 5.0E-06 | lb/$10^6$ ft$^3$ | 5.0E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 2.48E-07 | 1.09E-06 | 2.48E-7 | 1.09E-6 |
| Toluene | 3.4E-03 | lb/$10^6$ ft$^3$ | 3.4E-03 | lb/$10^6$ ft$^3$ | | 51.00 | $10^6$ Btu/hr | 8,760 | 1.69E-04 | 7.39E-04 | 1.69E-4 | 7.39E-4 |
| Total POM | | | | | | | | | | 1.92E-05 | | 1.92E-05 |
| Total PAH | | | | | | | | | | 1.48E-04 | | 1.48E-04 |
| **Metals** | | | | | | | | | | | | |
| Arsenic** | 2.0E-04 | lb/$10^6$ ft$^3$ | 2.0E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 9.92E-06 | 4.35E-5 | 9.71E-06 | 4.25E-5 |
| Barium | 4.4E-03 | lb/$10^6$ ft$^3$ | 4.4E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 2.18E-04 | 9.56E-4 | 2.14E-04 | 9.36E-4 |
| Beryllium** | < 1.20E-05 | lb/$10^6$ ft$^3$ | < 1.20E-05 | lb/$10^6$ ft$^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 5.95E-07 | 2.61E-6 | < 5.83E-07 | 2.55E-6 |
| Cadmium** | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 5.46E-05 | 2.39E-4 | 5.34E-05 | 2.34E-4 |
| Chromium** | 1.4E-03 | lb/$10^6$ ft$^3$ | 1.4E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 6.95E-05 | 3.04E-4 | 6.80E-05 | 2.98E-4 |
| Cobalt** | 8.4E-05 | lb/$10^6$ ft$^3$ | 8.4E-05 | lb/$10^6$ ft$^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 4.17E-06 | 1.83E-5 | 4.08E-06 | 1.79E-5 |
| Copper | 8.5E-04 | lb/$10^6$ ft$^3$ | 8.5E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 4.22E-05 | 1.85E-4 | 4.13E-05 | 1.81E-4 |
| Lead** | 5.0E-04 | lb/$10^6$ ft$^3$ | 5.0E-04 | lb/$10^6$ ft$^3$ | 1.4-2 | 51.00 | $10^6$ Btu/hr | 8,760 | 2.48E-05 | 1.09E-4 | 2.43E-05 | 1.06E-4 |
| Manganese** | 3.8E-04 | lb/$10^6$ ft$^3$ | 3.8E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.89E-05 | 8.26E-5 | 1.85E-05 | 8.08E-5 |
| Mercury** | 2.6E-04 | lb/$10^6$ ft$^3$ | 2.6E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.29E-05 | 5.65E-5 | 1.26E-05 | 5.53E-5 |
| Molybdenum | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 5.46E-05 | 2.39E-4 | 5.34E-05 | 2.34E-4 |
| Nickel** | 2.1E-03 | lb/$10^6$ ft$^3$ | 2.1E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.04E-04 | 4.56E-4 | 1.02E-04 | 4.47E-4 |
| Selenium** | < 2.40E-05 | lb/$10^6$ ft$^3$ | < 2.40E-05 | lb/$10^6$ ft$^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.19E-06 | 5.22E-6 | < 1.17E-06 | 5.11E-6 |
| Vanadium | 2.3E-03 | lb/$10^6$ ft$^3$ | 2.3E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.14E-04 | 5.00E-4 | 1.12E-04 | 4.89E-4 |
| Zinc | 2.9E-02 | lb/$10^6$ ft$^3$ | 2.9E-02 | lb/$10^6$ ft$^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.44E-03 | 6.30E-3 | 1.41E-03 | 6.17E-3 |

* Polycyclic Organic Matter (POM), defined as a Hazardous Air Pollutant in Section 112(b) of the Clean Air Act

* *Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act

1 All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM10, PM2.5 or PM1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

Heat content of natural gas is assumed to be 1028 btu/scf from EPA's greenhouse gas reporting requirement 40 cfr 98.30 Table C-1.

2 Uncontrolled emission factor from AP-42 Table 1.4-2, controlled emission factor is 90% reduction based on selective catalytic reduction.

3 ppmdv value for VOC assumes a molecular weight of 80

4 Ammonia emission factor is calculated from the expected ammonia slip concentration of 5 ppmdv

| Pollutant | Emission Factor | | | | | Production Rate | | Hours of Operation | Emission Rates | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Uncontrolled | | Controlled | | | | | | Uncontrolled | | Controlled | | Flow Rate (dscfm) @ 3% $O_2$ | Concentration PPMdv |
| | Value | Units | Value | Units | AP-42 Table | Value | Units | (hrs/yr) | (lbs/hr) | (tons/yr) | (lbs/hr) | (tons/yr) | | |
| | UEF | | CEF | | | PR | | OP | UER | | CER | | | |
| | A | B | C | D | | E | F | G | H | I | J | K | | |
| **Criteria Pollutants** | | | | | | | | | A/1028xE | HxG/2000 | C/1028xE | JxE/2000 | | |
| PM Total[1] | 7.6 | lb/$10^6$ ft$^3$ | 7.6 | lb/$10^6$ ft$^3$ | 1.4-2 | 51.00 | $10^6$ Btu/hr | 8,760 | 0.377 | 1.65 | 0.377 | 1.651 | | |
| PM Condensible[1] | 5.7 | lb/$10^6$ ft$^3$ | 5.7 | lb/$10^6$ ft$^3$ | 1.4-2 | 51.00 | $10^6$ Btu/hr | 8,760 | 0.283 | 1.24 | 0.283 | 1.239 | | |
| PM Filterable[1] | 1.9 | lb/$10^6$ ft$^3$ | 1.9 | lb/$10^6$ ft$^3$ | 1.4-2 | 51.00 | $10^6$ Btu/hr | 8,760 | 0.094 | 0.41 | 0.094 | 0.413 | | |
| $SO_2$ | 0.6 | lb/$10^6$ ft$^3$ | 0.6 | lb/$10^6$ ft$^3$ | 1.4-2 | 51.00 | $10^6$ Btu/hr | 8,760 | 0.029 | 0.13 | 0.029 | 0.128 | 8,694 | 0.34 |
| $NO_2$ | 100 | lb/$10^6$ ft$^3$ | 10 | lb/$10^6$ ft$^3$ | Note 2 | 51.00 | $10^6$ Btu/hr | 8,760 | 4.961 | 21.73 | 0.50 | 2.173 | 8,694 | 7.97 |
| CO | 84 | lb/$10^6$ ft$^3$ | 84 | lb/$10^6$ ft$^3$ | 1.4-1 | 51.00 | $10^6$ Btu/hr | 8,760 | 4.167 | 18.25 | 4.17 | 18.253 | 8,694 | 110.02 |
| VOC | 5.5 | lb/$10^6$ ft$^3$ | 5.5 | lb/$10^6$ ft$^3$ | 1.4-2 | 51.00 | $10^6$ Btu/hr | 8,760 | 0.273 | 1.20 | 0.27 | 1.195 | 8,694 | 2.52 |
| **Greenhouse Gases** | | | | | | | | | AxEx2.2 | HxG/2000 | CxEx 2.2 | JxE/2000 | | |
| $CO_2$ | 53.02 | Kg/$10^6$ btu | 53.02 | Kg/$10^6$ btu | C-1 | 51.00 | $10^6$ Btu/hr | 8,760 | 5,961 | 26,110 | 5,961 | 26,110 | | |
| $N_2O$ | 1.00E-4 | Kg/$10^6$ btu | 1.00E-4 | Kg/$10^6$ btu | C-1 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.12E-2 | 4.92E-2 | 1.12E-2 | 4.92E-2 | | |
| Methane | 1.00E-3 | Kg/$10^6$ btu | 1.00E-3 | Kg/$10^6$ btu | C-1 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.12E-1 | 4.92E-1 | 1.12E-1 | 4.92E-1 | | |
| Hydrofluorocarbons | ND | | ND | | | | | | | | | | | |
| Perfluorocarbons | ND | | ND | | | | | | | | | | | |
| $SF_6$ | ND | | ND | | | | | | | | | | | |
| **Total** | | | | | | | | | | | | | | |
| **Other Pollutants** | | | | | | | | | | | | | | |
| Ammonia | 2.3 | lb/$10^6$ ft$^3$ | 2.3 | lb/$10^6$ ft$^3$ | Note 4 | 51.00 | $10^6$ Btu/hr | 8,760 | 0.114 | 0.50 | 0.1141 | 0.49 | 8,694 | 4.95 |
| **HAPS** | | | | | | | | | | | | | | |
| Total Organic HAPs | 1.8824 | lb/$10^6$ ft$^3$ | 1.8824 | lb/$10^6$ ft$^3$ | | 51.00 | $10^6$ Btu/hr | 8,760 | 0.093 | 0.4092 | 0.0934 | 0.4092 | | |
| Total Metalic HAPs | 6.1E-3 | lb/$10^6$ ft$^3$ | 6.1E-3 | lb/$10^6$ ft$^3$ | | 51.00 | $10^6$ Btu/hr | 8,760 | 0.000 | 1.3E-3 | 3.01E-4 | 1.3E-3 | | |
| Total HAPS | 1.8885 | lb/$10^6$ ft$^3$ | 1.8885 | lb/$10^6$ ft$^3$ | | 51.00 | $10^6$ Btu/hr | 8,760 | 0.094 | 0.4105 | 0.0937 | 0.4105 | | |
| 2-Methylnaphthalene* | 2.4E-05 | lb/$10^6$ ft$^3$ | 2.4E-05 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.19E-06 | 5.22E-06 | 1.19E-6 | 5.22E-6 | | |
| 3-Methylchloranthrene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-08 | 3.91E-07 | 8.93E-8 | 3.91E-7 | | |
| 7,12-Dimethylbenz(a)anthracene* | < 1.60E-05 | lb/$10^6$ ft$^3$ | < 1.60E-05 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 7.94E-07 | 3.48E-06 | 7.94E-7 | 3.48E-6 | | |
| Acenaphthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-08 | 3.91E-07 | 8.93E-8 | 3.91E-7 | | |
| Acenaphthylene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-08 | 3.91E-07 | 8.93E-8 | 3.91E-7 | | |
| Anthracene* | < 2.40E-06 | lb/$10^6$ ft$^3$ | < 2.40E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.19E-07 | 5.22E-07 | 1.19E-7 | 5.22E-7 | | |
| Benz(a)anthracene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-08 | 3.91E-07 | 8.93E-8 | 3.91E-7 | | |
| Benzene | 2.1E-03 | lb/$10^6$ ft$^3$ | 2.1E-03 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.04E-04 | 4.56E-04 | 1.04E-4 | 4.56E-4 | | |
| Benzo(a)pyrene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 5.95E-08 | 2.61E-07 | 5.95E-8 | 2.61E-7 | | |
| Benzo(b)fluoranthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-08 | 3.91E-07 | 8.93E-8 | 3.91E-7 | | |
| Benzo(g,h,i)perylene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 5.95E-08 | 2.61E-07 | 5.95E-8 | 2.61E-7 | | |
| Benzo(k)fluoranthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-08 | 3.91E-07 | 8.93E-8 | 3.91E-7 | | |
| Chrysene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-08 | 3.91E-07 | 8.93E-8 | 3.91E-7 | | |
| Dibenzo(a,h)anthracene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 5.95E-08 | 2.61E-07 | 5.95E-8 | 2.61E-7 | | |
| Dichlorobenzene | 1.2E-03 | lb/$10^6$ ft$^3$ | 1.2E-03 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 5.95E-05 | 2.61E-04 | 5.95E-5 | 2.61E-4 | | |
| Fluoranthene* | 3.0E-06 | lb/$10^6$ ft$^3$ | 3.0E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.49E-07 | 6.52E-07 | 1.49E-7 | 6.52E-7 | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fluorene* | 2.8E-06 | lb/$10^6$ $ft^3$ | 2.8E-06 | lb/$10^6$ $ft^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.39E-07 | 6.08E-07 | 1.39E-7 | 6.08E-7 |
| Formaldehyde | 7.5E-02 | lb/$10^6$ $ft^3$ | 7.5E-02 | lb/$10^6$ $ft^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 3.72E-03 | 1.63E-02 | 3.72E-3 | 1.63E-2 |
| Hexane | 1.8E+00 | lb/$10^6$ $ft^3$ | 1.8E+00 | lb/$10^6$ $ft^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-02 | 3.91E-01 | 8.93E-2 | 3.91E-1 |
| Indeno(1,2,3-cd)pyrene* | < 1.80E-06 | lb/$10^6$ $ft^3$ | < 1.80E-06 | lb/$10^6$ $ft^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.93E-08 | 3.91E-07 | 8.93E-8 | 3.91E-7 |
| Naphthalene | 6.1E-04 | lb/$10^6$ $ft^3$ | 6.1E-04 | lb/$10^6$ $ft^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 3.03E-05 | 1.33E-04 | 3.03E-5 | 1.33E-4 |
| Phenanthrene* | 1.7E-05 | lb/$10^6$ $ft^3$ | 1.7E-05 | lb/$10^6$ $ft^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 8.43E-07 | 3.69E-06 | 8.43E-7 | 3.69E-6 |
| Pyrene* | 5.0E-06 | lb/$10^6$ $ft^3$ | 5.0E-06 | lb/$10^6$ $ft^3$ | 1.4-3 | 51.00 | $10^6$ Btu/hr | 8,760 | 2.48E-07 | 1.09E-06 | 2.48E-7 | 1.09E-6 |
| Toluene | 3.4E-03 | lb/$10^6$ $ft^3$ | 3.4E-03 | lb/$10^6$ $ft^3$ | | 51.00 | $10^6$ Btu/hr | 8,760 | 1.69E-04 | 7.39E-04 | 1.69E-4 | 7.39E-4 |
| Total POM | | | | | | | | | | 1.92E-05 | | 1.92E-05 |
| Total PAH | | | | | | | | | | 1.48E-04 | | 1.48E-04 |
| **Metals** | | | | | | | | | | | | |
| Arsenic** | 2.0E-04 | lb/$10^6$ $ft^3$ | 2.0E-04 | lb/$10^6$ $ft^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 9.92E-06 | 4.35E-5 | 9.71E-06 | 4.25E-5 |
| Barium | 4.4E-03 | lb/$10^6$ $ft^3$ | 4.4E-03 | lb/$10^6$ $ft^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 2.18E-04 | 9.56E-4 | 2.14E-04 | 9.36E-4 |
| Beryllium** | < 1.20E-05 | lb/$10^6$ $ft^3$ | < 1.20E-05 | lb/$10^6$ $ft^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 5.95E-07 | 2.61E-6 | < 5.83E-07 | 2.55E-6 |
| Cadmium** | 1.1E-03 | lb/$10^6$ $ft^3$ | 1.1E-03 | lb/$10^6$ $ft^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 5.46E-05 | 2.39E-4 | 5.34E-05 | 2.34E-4 |
| Chromium** | 1.4E-03 | lb/$10^6$ $ft^3$ | 1.4E-03 | lb/$10^6$ $ft^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 6.95E-05 | 3.04E-4 | 6.80E-05 | 2.98E-4 |
| Cobalt** | 8.4E-05 | lb/$10^6$ $ft^3$ | 8.4E-05 | lb/$10^6$ $ft^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 4.17E-06 | 1.83E-5 | 4.08E-06 | 1.79E-5 |
| Copper | 8.5E-04 | lb/$10^6$ $ft^3$ | 8.5E-04 | lb/$10^6$ $ft^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 4.22E-05 | 1.85E-4 | 4.13E-05 | 1.81E-4 |
| Lead** | 5.0E-04 | lb/$10^6$ $ft^3$ | 5.0E-04 | lb/$10^6$ $ft^3$ | 1.4-2 | 51.00 | $10^6$ Btu/hr | 8,760 | 2.48E-05 | 1.09E-4 | 2.43E-05 | 1.06E-4 |
| Manganese** | 3.8E-04 | lb/$10^6$ $ft^3$ | 3.8E-04 | lb/$10^6$ $ft^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.89E-05 | 8.26E-5 | 1.85E-05 | 8.08E-5 |
| Mercury** | 2.6E-04 | lb/$10^6$ $ft^3$ | 2.6E-04 | lb/$10^6$ $ft^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.29E-05 | 5.65E-5 | 1.26E-05 | 5.53E-5 |
| Molybdenum | 1.1E-03 | lb/$10^6$ $ft^3$ | 1.1E-03 | lb/$10^6$ $ft^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 5.46E-05 | 2.39E-4 | 5.34E-05 | 2.34E-4 |
| Nickel** | 2.1E-03 | lb/$10^6$ $ft^3$ | 2.1E-03 | lb/$10^6$ $ft^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.04E-04 | 4.56E-4 | 1.02E-04 | 4.47E-4 |
| Selenium** | < 2.40E-05 | lb/$10^6$ $ft^3$ | < 2.40E-05 | lb/$10^6$ $ft^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.19E-06 | 5.22E-6 | < 1.17E-06 | 5.11E-6 |
| Vanadium | 2.3E-03 | lb/$10^6$ $ft^3$ | 2.3E-03 | lb/$10^6$ $ft^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.14E-04 | 5.00E-4 | 1.12E-04 | 4.89E-4 |
| Zinc | 2.9E-02 | lb/$10^6$ $ft^3$ | 2.9E-02 | lb/$10^6$ $ft^3$ | 1.4-4 | 51.00 | $10^6$ Btu/hr | 8,760 | 1.44E-03 | 6.30E-3 | 1.41E-03 | 6.17E-3 |

* Polycyclic Organic Matter (POM), defined as a Hazardous Air Pollutant in Section 112(b) of the Clean Air Act

* *Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act

1 All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM10, PM2.5 or PM1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

Heat content of natural gas is assumed to be 1028 btu/scf from EPA's greenhouse gas reporting requirement 40 cfr 98.30 Table C-1.

2 Uncontrolled emission factor from AP-42 Table 1.4-2, controlled emission factor is 90% reduction based on selective catalytic reduction.

3 ppmdv value for VOC assumes a molecular weight of 80

4 Ammonia emission factor is calculated from the expected ammonia slip concentration of 5 ppmdv

| Pollutant | Emission Factor | | | | | Production Rate | | Hours of Operation | Emission Rates | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Uncontrolled | | Controlled | | | | | | Uncontrolled | | Controlled | | | |
| | Value | Units | Value | Units | AP-42 Table | Value | Units | (hrs/yr) | (lbs/hr) | (tons/yr) | (lbs/hr) | (tons/yr) | Flow Rate (dscfm) @ 3% O2 | Concentration PPMdv |
| | UEF | | CEF | | | PR | | OP | UER | | CER | | | |
| | A | B | C | D | | E | F | G | H | I | J | K | | |
| **Criteria Pollutants** | | | | | | | | | A/1028xE | HxG/2000 | C/1028xE | JxE/2000 | | |
| PM Total[1] | 7.6 | lb/$10^6$ ft$^3$ | 7.6 | lb/$10^6$ ft$^3$ | 1.4-2 | 9.00 | $10^6$ Btu/hr | 8,760 | 0.067 | 0.29 | 0.067 | 0.291 | | |
| PM Condensible[1] | 5.7 | lb/$10^6$ ft$^3$ | 5.7 | lb/$10^6$ ft$^3$ | 1.4-2 | 9.00 | $10^6$ Btu/hr | 8,760 | 0.050 | 0.22 | 0.050 | 0.219 | | |
| PM Filterable[1] | 1.9 | lb/$10^6$ ft$^3$ | 1.9 | lb/$10^6$ ft$^3$ | 1.4-2 | 9.00 | $10^6$ Btu/hr | 8,760 | 0.017 | 0.07 | 0.017 | 0.073 | | |
| $SO_2$ | 0.6 | lb/$10^6$ ft$^3$ | 0.6 | lb/$10^6$ ft$^3$ | 1.4-2 | 9.00 | $10^6$ Btu/hr | 8,760 | 0.005 | 0.02 | 0.005 | 0.023 | 1,534 | 0.34 |
| $NO_2$ | 100 | lb/$10^6$ ft$^3$ | 50.0 | lb/$10^6$ ft$^3$ | 1.4-1 | 9.00 | $10^6$ Btu/hr | 8,760 | 0.875 | 3.83 | 0.44 | 1.917 | 1,534 | 39.86 |
| CO | 84 | lb/$10^6$ ft$^3$ | 84 | lb/$10^6$ ft$^3$ | 1.4-1 | 9.00 | $10^6$ Btu/hr | 8,760 | 0.735 | 3.22 | 0.74 | 3.221 | 1,534 | 110.02 |
| VOC[2] | 5.5 | lb/$10^6$ ft$^3$ | 5.5 | lb/$10^6$ ft$^3$ | 1.4-2 | 9.00 | $10^6$ Btu/hr | 8,760 | 0.048 | 0.21 | 0.05 | 0.211 | 1,534 | 2.52 |
| **Greenhouse Gases** | | | | | | | | | AxEx2.2 | HxG/2000 | CxEx 2.2 | JxE/2000 | | |
| $CO_2$ | 53.02 | Kg/$10^6$ btu | 53.02 | Kg/$10^6$ btu | C-1 | 9.00 | $10^6$ Btu/hr | 8,760 | 1,052 | 4,608 | 1,052 | 4,608 | | |
| $N_2O$ | 1.00E-4 | Kg/$10^6$ btu | 1.00E-4 | Kg/$10^6$ btu | C-1 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.98E-3 | 8.69E-3 | 1.98E-3 | 8.69E-3 | | |
| Methane | 1.00E-3 | Kg/$10^6$ btu | 1.00E-3 | Kg/$10^6$ btu | C-1 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.98E-2 | 8.69E-2 | 1.98E-2 | 8.69E-2 | | |
| Hydrofluorocarbons | ND | | ND | | | | | | | | | | | |
| Perfluorocarbons | ND | | ND | | | | | | | | | | | |
| $SF_6$ | ND | | ND | | | | | | | | | | | |
| **Total** | | | | | | | | | | | | | | |
| **Other Pollutants** | | | | | | | | | | | | | | |
| Ammonia | 3.1 | lb/$10^6$ ft$^3$ | 3.1 | lb/$10^6$ ft$^3$ | Fire | 9.00 | $10^6$ Btu/hr | 8,760 | 0.027 | 0.12 | 0.0275 | 0.12 | | |
| **HAPS** | | | | | | | | | | | | | | |
| Total Organic HAPs | 1.8824 | lb/$10^6$ ft$^3$ | 1.8824 | lb/$10^6$ ft$^3$ | | 9.00 | $10^6$ Btu/hr | 8,760 | 0.016 | 0.0722 | 0.0165 | 0.0722 | | |
| Total Metalic HAPs | 6.1E-3 | lb/$10^6$ ft$^3$ | 6.1E-3 | lb/$10^6$ ft$^3$ | | 9.00 | $10^6$ Btu/hr | 8,760 | 0.000 | 2.3E-4 | 5.31E-5 | 2.3E-4 | | |
| Total HAPS | 1.8885 | lb/$10^6$ ft$^3$ | 1.8885 | lb/$10^6$ ft$^3$ | | 9.00 | $10^6$ Btu/hr | 8,760 | 0.017 | 0.0724 | 0.0165 | 0.0724 | | |
| 2-Methylnaphthalene* | 2.4E-05 | lb/$10^6$ ft$^3$ | 2.4E-05 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 2.10E-07 | 9.20E-07 | 2.10E-7 | 9.20E-7 | | |
| 3-Methylchloranthrene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.58E-08 | 6.90E-08 | 1.58E-8 | 6.90E-8 | | |
| 7,12-Dimethylbenz(a)anthracene* | < 1.60E-05 | lb/$10^6$ ft$^3$ | < 1.60E-05 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.40E-07 | 6.14E-07 | 1.40E-7 | 6.14E-7 | | |
| Acenaphthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.58E-08 | 6.90E-08 | 1.58E-8 | 6.90E-8 | | |
| Acenaphthylene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.58E-08 | 6.90E-08 | 1.58E-8 | 6.90E-8 | | |
| Anthracene* | < 2.40E-06 | lb/$10^6$ ft$^3$ | < 2.40E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 2.10E-08 | 9.20E-08 | 2.10E-8 | 9.20E-8 | | |
| Benz(a)anthracene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.58E-08 | 6.90E-08 | 1.58E-8 | 6.90E-8 | | |
| Benzene | 2.1E-03 | lb/$10^6$ ft$^3$ | 2.1E-03 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.84E-05 | 8.05E-05 | 1.84E-5 | 8.05E-5 | | |
| Benzo(a)pyrene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.05E-08 | 4.60E-08 | 1.05E-8 | 4.60E-8 | | |
| Benzo(b)fluoranthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.58E-08 | 6.90E-08 | 1.58E-8 | 6.90E-8 | | |
| Benzo(g,h,i)perylene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.05E-08 | 4.60E-08 | 1.05E-8 | 4.60E-8 | | |
| Benzo(k)fluoranthene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.58E-08 | 6.90E-08 | 1.58E-8 | 6.90E-8 | | |
| Chrysene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.58E-08 | 6.90E-08 | 1.58E-8 | 6.90E-8 | | |
| Dibenzo(a,h)anthracene* | < 1.20E-06 | lb/$10^6$ ft$^3$ | < 1.20E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.05E-08 | 4.60E-08 | 1.05E-8 | 4.60E-8 | | |
| Dichlorobenzene | 1.2E-03 | lb/$10^6$ ft$^3$ | 1.2E-03 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.05E-05 | 4.60E-05 | 1.05E-5 | 4.60E-5 | | |
| Fluoranthene* | 3.0E-06 | lb/$10^6$ ft$^3$ | 3.0E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 2.63E-08 | 1.15E-07 | 2.63E-8 | 1.15E-7 | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fluorene* | 2.8E-06 | lb/$10^6$ ft$^3$ | 2.8E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 2.45E-08 | 1.07E-07 | 2.45E-8 | 1.07E-7 |
| Formaldehyde | 7.5E-02 | lb/$10^6$ ft$^3$ | 7.5E-02 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 6.57E-04 | 2.88E-03 | 6.57E-4 | 2.88E-3 |
| Hexane | 1.8E+00 | lb/$10^6$ ft$^3$ | 1.8E+00 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.58E-02 | 6.90E-02 | 1.58E-2 | 6.90E-2 |
| Indeno(1,2,3-cd)pyrene* | < 1.80E-06 | lb/$10^6$ ft$^3$ | < 1.80E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.58E-08 | 6.90E-08 | 1.58E-8 | 6.90E-8 |
| Naphthalene | 6.1E-04 | lb/$10^6$ ft$^3$ | 6.1E-04 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 5.34E-06 | 2.34E-05 | 5.34E-6 | 2.34E-5 |
| Phenanthrene* | 1.7E-05 | lb/$10^6$ ft$^3$ | 1.7E-05 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.49E-07 | 6.52E-07 | 1.49E-7 | 6.52E-7 |
| Pyrene* | 5.0E-06 | lb/$10^6$ ft$^3$ | 5.0E-06 | lb/$10^6$ ft$^3$ | 1.4-3 | 9.00 | $10^6$ Btu/hr | 8,760 | 4.38E-08 | 1.92E-07 | 4.38E-8 | 1.92E-7 |
| Toluene | 3.4E-03 | lb/$10^6$ ft$^3$ | 3.4E-03 | lb/$10^6$ ft$^3$ | | 9.00 | $10^6$ Btu/hr | 8,760 | 2.98E-05 | 1.30E-04 | 2.98E-5 | 1.30E-4 |
| Total POM | | | | | | | | | | 3.38E-06 | | 3.38E-06 |
| Total PAH | | | | | | | | | | 2.61E-05 | | 2.61E-05 |
| **Metals** | | | | | | | | | | | | |
| Arsenic** | 2.0E-04 | lb/$10^6$ ft$^3$ | 2.0E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.75E-06 | 7.67E-6 | 1.71E-06 | 7.51E-6 |
| Barium | 4.4E-03 | lb/$10^6$ ft$^3$ | 4.4E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 9.00 | $10^6$ Btu/hr | 8,760 | 3.85E-05 | 1.69E-4 | 3.77E-05 | 1.65E-4 |
| Beryllium** | < 1.20E-05 | lb/$10^6$ ft$^3$ | < 1.20E-05 | lb/$10^6$ ft$^3$ | 1.4-4 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.05E-07 | 4.60E-7 | < 1.03E-07 | 4.51E-7 |
| Cadmium** | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 9.00 | $10^6$ Btu/hr | 8,760 | 9.63E-06 | 4.22E-5 | 9.43E-06 | 4.13E-5 |
| Chromium** | 1.4E-03 | lb/$10^6$ ft$^3$ | 1.4E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.23E-05 | 5.37E-5 | 1.20E-05 | 5.26E-5 |
| Cobalt** | 8.4E-05 | lb/$10^6$ ft$^3$ | 8.4E-05 | lb/$10^6$ ft$^3$ | 1.4-4 | 9.00 | $10^6$ Btu/hr | 8,760 | 7.35E-07 | 3.22E-6 | 7.20E-07 | 3.15E-6 |
| Copper | 8.5E-04 | lb/$10^6$ ft$^3$ | 8.5E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 9.00 | $10^6$ Btu/hr | 8,760 | 7.44E-06 | 3.26E-5 | 7.29E-06 | 3.19E-5 |
| Lead** | 5.0E-04 | lb/$10^6$ ft$^3$ | 5.0E-04 | lb/$10^6$ ft$^3$ | 1.4-2 | 9.00 | $10^6$ Btu/hr | 8,760 | 4.38E-06 | 1.92E-5 | 4.29E-06 | 1.88E-5 |
| Manganese** | 3.8E-04 | lb/$10^6$ ft$^3$ | 3.8E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 9.00 | $10^6$ Btu/hr | 8,760 | 3.33E-06 | 1.46E-5 | 3.26E-06 | 1.43E-5 |
| Mercury** | 2.6E-04 | lb/$10^6$ ft$^3$ | 2.6E-04 | lb/$10^6$ ft$^3$ | 1.4-4 | 9.00 | $10^6$ Btu/hr | 8,760 | 2.28E-06 | 9.97E-6 | 2.23E-06 | 9.76E-6 |
| Molybdenum | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.1E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 9.00 | $10^6$ Btu/hr | 8,760 | 9.63E-06 | 4.22E-5 | 9.43E-06 | 4.13E-5 |
| Nickel** | 2.1E-03 | lb/$10^6$ ft$^3$ | 2.1E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 9.00 | $10^6$ Btu/hr | 8,760 | 1.84E-05 | 8.05E-5 | 1.80E-05 | 7.88E-5 |
| Selenium** | < 2.40E-05 | lb/$10^6$ ft$^3$ | < 2.40E-05 | lb/$10^6$ ft$^3$ | 1.4-4 | 9.00 | $10^6$ Btu/hr | 8,760 | 2.10E-07 | 9.20E-7 | < 2.06E-07 | 9.01E-7 |
| Vanadium | 2.3E-03 | lb/$10^6$ ft$^3$ | 2.3E-03 | lb/$10^6$ ft$^3$ | 1.4-4 | 9.00 | $10^6$ Btu/hr | 8,760 | 2.01E-05 | 8.82E-5 | 1.97E-05 | 8.63E-5 |
| Zinc | 2.9E-02 | lb/$10^6$ ft$^3$ | 2.9E-02 | lb/$10^6$ ft$^3$ | 1.4-4 | 9.00 | $10^6$ Btu/hr | 8,760 | 2.54E-04 | 1.11E-3 | 2.49E-04 | 1.09E-3 |

* Polycyclic Organic Matter (POM), defined as a Hazardous Air Pollutant in Section 112(b) of the Clean Air Act

* *Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act

1 All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM10, PM2.5 or PM1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

Heat content of natural gas is assumed to be 1028 btu/scf from EPA's greenhouse gas reporting requirement 40 cfr 98.30 Table C-1.

2 The VOC emissions calculated here are only from the combustion of natural gas. VOC from the loading racks will be vented to one or more boiler. Those emissions are accounted for on the loading rack calculation page, but should be a

| A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|
| **Calculation Formula** | | **A x B** | | | **C / I** | **C / J** | **C x D** | **H x 392.75** | **I x E x .74558** |
| **Fuel Input** | | | **System Efficiency** | | | | **Energy Output** | | |
| gal/hr | Btu/gal | $10^6$ btu/hr | Engine Thermal Efficiency | | Engine Heat Rate Btu/hp-hr | | Engine $10^6$ btu/hr | Engine Horsepower Hp | |
| | | | Assumed | | | | | | |
| 22.0 | 128,750 | 2.83 | 30.0% | | 8,487 | | 0.85 | 334 | |

See note 1

| A | B | D | E | F | G | H | I | K | M | N |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **Calculation Formula** | **F x G** | **I x H** | **B x I** | **B x K/2000** |
| | ***Emission Factor*** | | | ***Design Rate*** | | ***Production Rate*** | | | ***Emission Rate*** | |
| Pollutant | *Uncontrolled* | *Units (fuel input)* | *AP-42 Table Number* | *$10^6$ Btu/hr (fuel input)* | *Load Factor* | *Operating Hours per Year* | *$10^6$ Btu/hr* | *$10^6$ Btu/yr* | *lbs/hr* | *tons/yr* |
| Criteria Pollutants | | | | | | | | | | |
| CO | 0.95 | lbs/$10^6$ Btu | 3.3-1 | 2.83 | 100% | 25.0 | 2.83 | 71 | 2.69 | 0.0337 |
| Lead | ND | lbs/$10^6$ Btu | | | | | | | | |
| NOx | 4.41 | lbs/$10^6$ Btu | 3.3-1 | 2.83 | 100% | 25.0 | 2.83 | 71 | 12.50 | 0.156 |
| Filterable $PM_{10}$ | 0.310 | lbs/$10^6$ Btu | 3.3-1 | 2.83 | 100% | 25.0 | 2.83 | 71 | 0.879 | 0.0110 |
| $SO_2$ | 0.290 | lbs/$10^6$ Btu | 3.4-1 | 2.83 | 100% | 25.0 | 2.83 | 71 | 0.82 | 0.0103 |
| Sulfur Content of Fuel | 0.500 | % | | 2.83 | 100% | 25.0 | | | | |
| VOC | 0.360 | lbs/$10^6$ Btu | 3.4-1 | 2.83 | 100% | 25.0 | 2.83 | 71 | 1.020 | 0.0128 |
| HAPs | | | | | | | | | | |
| Organic | | | | | | | | | | |
| CAS Number *Name* | | | | | | | | | | lbs/yr |
| 71432 Benzene | 9.33E-4 | lbs/$10^6$ Btu | 3.4-3 | 2.83 | 100% | 25.0 | 2.83 | 71 | 2.64E-3 | 6.61E-2 |
| 108883 Toluene | 4.09E-4 | lbs/$10^6$ Btu | 3.4-3 | 2.83 | 100% | 25.0 | 2.83 | 71 | 1.16E-3 | 2.90E-2 |
| 1330207 Xylenes | 2.85E-4 | lbs/$10^6$ Btu | 3.4-3 | 2.83 | 100% | 25.0 | 2.83 | 71 | 8.08E-4 | 2.02E-2 |
| Propylene | 2.58E-3 | lbs/$10^6$ Btu | 3.4-3 | 2.83 | 100% | 25.0 | 2.83 | 71 | 7.31E-3 | 1.83E-1 |
| 50000 Formaldehyde | 1.18E-3 | lbs/$10^6$ Btu | 3.4-3 | 2.83 | 100% | 25.0 | 2.83 | 71 | 3.34E-3 | 8.36E-2 |
| 75070 Acetaldehyde | 7.67E-4 | lbs/$10^6$ Btu | 3.4-3 | 2.83 | 100% | 25.0 | 2.83 | 71 | 2.17E-3 | 5.44E-2 |
| 107028 Acrolien | 9.25E-5 | lbs/$10^6$ Btu | 3.4-3 | 2.83 | 100% | 25.0 | 2.83 | 71 | 2.62E-4 | 6.56E-3 |
| *PAH* | | | | | | | | | | |
| 91203 Naphthalene | 8.48E-5 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 2.40E-4 | 6.01E-3 |
| Acenaphthylene | 5.06E-6 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 1.43E-5 | 3.59E-4 |
| Acenaphthene | 1.42E-6 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 4.03E-6 | 1.01E-4 |
| Fluorene | 2.92E-5 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 8.28E-5 | 2.07E-3 |
| Phenathrene | 2.94E-5 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 8.33E-5 | 2.08E-3 |
| Anthranthene | 1.87E-6 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 5.30E-6 | 1.33E-4 |
| Fluoranthane | 7.61E-6 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 2.16E-5 | 5.39E-4 |
| Pyrene | 4.78E-6 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 1.35E-5 | 3.39E-4 |
| Benz(a)anthracene | 1.68E-6 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 4.76E-6 | 1.19E-4 |
| Chrysene | 3.53E-7 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 1.00E-6 | 2.50E-5 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Benzo(b)fluoranthene | 9.91E-8 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 2.81E-7 | 7.02E-6 |
| Benzo(k)fluoranthene | 1.55E-7 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 4.39E-7 | 1.10E-5 |
| Benzo(a)pyrene | 1.88E-7 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 5.33E-7 | 1.33E-5 |
| Indeno(1,2,3-cd)pyrene | 3.75E-7 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 1.06E-6 | 2.66E-5 |
| Dibenz(a,h)anthracene | 5.83E-7 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 1.65E-6 | 4.13E-5 |
| Benzo(g,hl)perylene | 4.89E-7 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 1.39E-6 | 3.47E-5 |
| Total PAH | 1.68E-4 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 4.76E-4 | 1.19E-2 |
| Total Organic HAPs | 6.41E-3 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 1.82E-2 | 4.55E-1 |
| Metals | ND | | | | | | | | | |
| Total HAPs | 6.41E-3 | lbs/$10^6$ Btu | 3.4-4 | 2.83 | 100% | 25.0 | 2.83 | 71 | 1.82E-2 | 4.55E-1 |
| | | | | | | | | | | |
| Other Pollutants | | | | | | | | | | tons/yr |
| CO2 | 164 | lbs/$10^6$ Btu | 3.4-1 | 2.83 | 100% | 25.0 | 2.83 | 71 | 4.65E+2 | 5.81E+0 |
| Methane | 0.0081 | lbs/$10^6$ Btu | 3.4-1 | 2.83 | 100% | 25.0 | 2.83 | 71 | 2.30E-2 | 2.87E-4 |
| TOC | 0.09 | lbs/$10^6$ Btu | 3.4-1 | 2.83 | 100% | 25.0 | 2.83 | 71 | 2.55E-1 | 3.19E-3 |
| PM (condensible) | 7.70E-3 | lbs/$10^6$ Btu | 3.4-2 | 2.83 | 100% | 25.0 | 2.83 | 71 | 2.18E-2 | 2.73E-4 |
| PM (filterable) | | | | | | | | | | |
| 1 µg | 4.80E-2 | lbs/$10^6$ Btu | 3.4-2 | 2.83 | 100% | 25.0 | 2.83 | 71 | 1.36E-1 | 1.70E-3 |
| 3 µg | 4.79E-2 | lbs/$10^6$ Btu | 3.4-2 | 2.83 | 100% | 25.0 | 2.83 | 71 | 1.36E-1 | 1.70E-3 |
| 10 µg | 4.96E-2 | lbs/$10^6$ Btu | 3.4-2 | 2.83 | 100% | 25.0 | 2.83 | 71 | 1.41E-1 | 1.76E-3 |
| Total Filterable PM | 6.20E-2 | lbs/$10^6$ Btu | 3.4-2 | 2.83 | 100% | 25.0 | 2.83 | 71 | 1.76E-1 | 2.20E-3 |
| PM (total) | 6.97E-2 | lbs/$10^6$ Btu | 3.4-2 | 2.83 | 100% | 25.0 | 2.83 | 71 | 1.98E-1 | 2.47E-3 |

Notes 1. 22 gal/hr = 334 hp/hr x 2,544 btu/hp x 1/30% x 1 gal/128,750 btu

| | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| | Calculation Formula | | A x B | | | C / I | C / J | C x D | H x 392.75 | I x E x .74558 |
| | Fuel Input | | | System Efficiency | | | | Energy Output | | |
| | gal/hr | Btu/gal | $10^6$ btu/hr | Engine Thermal Efficiency | Generator Efficiency | Engine Heat Rate Btu/hp-hr | System Heat Rate Btu/kw-hr | Engine $10^6$ btu/hr | Engine Horsepower Hp | Generator Kilowatts kW |
| | | | | Assumed | | | | | | |
| | 93.3 | 128,750 | 12.01 | 30.0% | 94.8% | 8,487 | 12,013 | 3.60 | 1,415 | 1,000 |

See note 1

| A | B | D | E | F | G | H | I | K | M | N |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Calculation Formula | F x G | I x H | B x I | B x K/2000 |
| | Emission Factor | | | Design Rate | | Production Rate | | | Emission Rate | |
| Pollutant | Uncontrolled | Units (fuel input) | AP-42 Table Number | $10^6$ Btu/hr (fuel input) | Load Factor | Operating Hours per Year | $10^6$ Btu/hr | $10^6$ Btu/yr | lbs/hr | tons/yr |
| Criteria Pollutants | | | | | | | | | | |
| Total $PM_{10}$ | 0.0573 | lbs/$10^6$ Btu | 3.4-2 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 0.688 | 0.0344 |
| Condensable | 0.0077 | lbs/$10^6$ Btu | 3.4-2 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 0.0925 | 0.00463 |
| Filterable $PM_{10}$ | 0.0496 | lbs/$10^6$ Btu | 3.4-2 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 0.596 | 0.0298 |
| Filterable $PM_{2.5}$ | 0.0479 | lbs/$10^6$ Btu | 3.4-2 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 0.575 | 0.0288 |
| $SO_2$ | 0.505 | lbs/$10^6$ Btu | 3.4-1 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 6.07 | 0.303 |
| NOx | 3.20 | lbs/$10^6$ Btu | 3.4-1 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 38.4 | 1.92 |
| CO | 0.85 | lbs/$10^6$ Btu | 3.4-1 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 10.21 | 0.511 |
| VOC | 0.082 | lbs/$10^6$ Btu | 3.4-1 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 0.984 | 0.0492 |
| Lead | ND | lbs/$10^6$ Btu | | | | | | | | |
| Sulfur Content of Fuel | 0.50 | % | | | | | | | | |
| HAPs | | | | | | | | | | |
| Organic | | | | | | | | | | |
| CAS Number *Name* | | | | | | | | | | lbs/yr |
| 71432 Benzene | 7.76E-4 | lbs/$10^6$ Btu | 3.4-3 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 9.32E-3 | 9.32E-1 |
| 108883 Toluene | 2.81E-4 | lbs/$10^6$ Btu | 3.4-3 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 3.38E-3 | 3.38E-1 |
| 1330207 Xylenes | 1.93E-4 | lbs/$10^6$ Btu | 3.4-3 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 2.32E-3 | 2.32E-1 |
| Propylene | 2.79E-3 | lbs/$10^6$ Btu | 3.4-3 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 3.35E-2 | 3.35E+0 |
| 50000 Formaldehyde | 7.89E-5 | lbs/$10^6$ Btu | 3.4-3 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 9.48E-4 | 9.48E-2 |
| 75070 Acetaldehyde | 2.52E-5 | lbs/$10^6$ Btu | 3.4-3 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 3.03E-4 | 3.03E-2 |
| 107028 Acrolien | 7.88E-6 | lbs/$10^6$ Btu | 3.4-3 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 9.47E-5 | 9.47E-3 |
| *PAH* | | | | | | | | | | |
| 91203 Naphthalene | 1.30E-4 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 1.56E-3 | 1.56E-1 |
| Acenaphthylene | 9.23E-6 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 1.11E-4 | 1.11E-2 |
| Acenaphthene | 4.68E-6 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 5.62E-5 | 5.62E-3 |
| Fluorene | 1.28E-5 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 1.54E-4 | 1.54E-2 |
| Phenathrene | 4.08E-5 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 4.90E-4 | 4.90E-2 |
| Anthranthene | 1.23E-6 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 1.48E-5 | 1.48E-3 |

| A | B | D | E | F | G | H | I | K | M | N |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Calculation Formula | F x G | I x H | B x I | B x K/2000 |
| | Emission Factor | | | Design Rate | | Production Rate | | | Emission Rate | |
| Pollutant | Uncontrolled | Units (fuel input) | AP-42 Table Number | $10^6$ Btu/hr (fuel input) | Load Factor | Operating Hours per Year | $10^6$ Btu/hr | $10^6$ Btu/yr | lbs/hr | tons/yr |
| Fluoranthane | 4.03E-6 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 4.84E-5 | 4.84E-3 |
| Pyrene | 3.71E-6 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 4.46E-5 | 4.46E-3 |
| Benz(a)anthracene | 6.22E-7 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 7.47E-6 | 7.47E-4 |
| Chrysene | 1.53E-6 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 1.84E-5 | 1.84E-3 |
| Benzo(b)fluoranthene | 1.11E-6 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 1.33E-5 | 1.33E-3 |
| Benzo(k)fluoranthene | 2.18E-7 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 2.62E-6 | 2.62E-4 |
| Benzo(a)pyrene | 2.57E-7 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 3.09E-6 | 3.09E-4 |
| Indeno(1,2,3-cd)pyrene | 4.14E-7 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 4.97E-6 | 4.97E-4 |
| Dibenz(a,h)anthracene | 3.46E-7 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 4.16E-6 | 4.16E-4 |
| Benzo(g,hl)perylene | 5.56E-7 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 6.68E-6 | 6.68E-4 |
| Total PAH | 2.12E-4 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 2.55E-3 | 2.55E-1 |
| Total Organic HAPs | 4.36E-3 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 5.24E-2 | 5.24E+0 |
| Metals | ND | | | | | | | | | |
| Total HAPs | 4.36E-3 | lbs/$10^6$ Btu | 3.4-4 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 5.24E-2 | 5.24E+0 |
| | | | | | | | | | | |
| Other Pollutants | | | | | | | | | | tons/yr |
| CO2 | 165 | lbs/$10^6$ Btu | 3.4-1 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 1.98E+3 | 9.91E+1 |
| Methane | 0.0081 | lbs/$10^6$ Btu | 3.4-1 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 9.73E-2 | 4.87E-3 |
| TOC | 0.09 | lbs/$10^6$ Btu | 3.4-1 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 1.08E+0 | 5.41E-2 |
| PM (condensible) | 7.70E-3 | lbs/$10^6$ Btu | 3.4-2 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 9.25E-2 | 4.63E-3 |
| PM (filterable) | | | | | | | | | | |
| 1 µg | 4.80E-2 | lbs/$10^6$ Btu | 3.4-2 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 5.77E-1 | 2.88E-2 |
| 3 µg | 4.79E-2 | lbs/$10^6$ Btu | 3.4-2 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 5.75E-1 | 2.88E-2 |
| 10 µg | 4.96E-2 | lbs/$10^6$ Btu | 3.4-2 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 5.96E-1 | 2.98E-2 |
| Total Filterable PM | 6.20E-2 | lbs/$10^6$ Btu | 3.4-2 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 7.45E-1 | 3.72E-2 |
| PM (total) | 6.97E-2 | lbs/$10^6$ Btu | 3.4-2 | 12.01 | 100% | 100.0 | 12.01 | 1,201 | 8.37E-1 | 4.19E-2 |

1. 93.3 gal/hr = 1415 hp/hr x 2,544 btu/hp x 1/30% x 1 gal/128,750 btu

**Emission Rates for Vacuum Distillation Column Pump Exhaust**

| Source | Pollutant | Emission Factor (lb/1000 bbl) **EF** | Annual Throughput (1000 bbl/yr) **AT** | Operating Hours/yr | Emission Rate (lbs/hr) **ER** | Emission Rate (ton/yr) **ER** |
|---|---|---|---|---|---|---|
| Vacuum Distillation Column Vacuum Pump | VOC | 50 | 507 | 8,760 | 2.89 | 12.67 |

***Example Calculations***

**Emission Rate (ER):**

**Source of Equation or Data:**

**1. ER**= (**EF**)(**AT**)(1 ton / 2,000 lbs) = 12.67 tons/yr — Calculated by DMK

**EF**= Emission Factor — 50.00 lb/1000 bbl — AP-42 Fifth Edition Table 5.1-1.

**AT**= Annual Throughput of the Vacuum Unit — 507 1000 bbl/yr — Estimate based on information provided by Bridgehouse Refining L.L.C.

***Notes:***

HAPs = 0 because all product handled is gas oil which has no detectable HAPs.

Feed to vacuum tower is estimated by ratio of heat input of the atmospheric tower heater to the vacuum tower heater (5/36) times the input to the atmospheric tower.

**EMISSION RATE CALCULATIONS**

| Source | Criteria Pollutants | Emission Factor | Emission Factor Units | Production Rate | Production Rate Units | Emission Rate (lbs/hr) | Emission Rate (tons/yr) |
|---|---|---|---|---|---|---|---|
| Flare | $PM_{10}$ | 1747 | gr/dscf | 3.39E+03 | dscf/yr | 282 | 0.4232 |
| | SOx | 0.20 | gr/dscf | 3.39E+03 | dscf/yr | 0.0323 | 4.84E-5 |
| | NOx | 0.068 | lb/$10^6$ Btu | 6.78E+06 | Btu/yr | 1.537E-01 | 2.31E-4 |
| | CO | 0.37 | lb/$10^6$ Btu | 6.78E+06 | Btu/yr | 8.365E-01 | 1.25E-3 |
| | VOC | 0.14 | lb/$10^6$ Btu | 6.78E+06 | Btu/yr | 3.17E-01 | 4.75E-4 |

**CALCULATIONS:**

1. Emission Rate Calculation for NOx, CO and VOC, emission factors from AP-42 Fifth Edition Table 13.5-1
2. Emission Rate Calculation for SO2, emission factor derived from assumption of .1 gr H2S/scf
3. Emission Rate for PM10, emission factor from AP-42 Table 13.5-1 footnote C lightly smoking flares

Gas Flow Rate to Flare:
Assume shutdown causes all atmospheric towers and re-boilers to vent to flare:

| | height (ft) | diameter ft) | volume $ft^3$ |
|---|---|---|---|
| Dist. Plant Atm Tower | 40 | 4 | 502.4 |
| Wax Plant Naphtha Tow | 40 | 3 | 282.6 |
| Wax Plant Diesel Tower | 40 | 3 | 282.6 |
| Dist. Plant Naphtha Strip | 20 | 2 | 62.8 |
| Total | | | 1130.4 |

Assume 3 shutdowns per year

1130.4 $ft^3$ x 3 = 3391.2 ft3 / yr to flare

Assume 2,000 btu/ft3 of gas sent to flare

3391.2 ft3 x 2000 btu/ft3 = 6,782,400 btu/yr

Convert PM emission factor to gr/dscf

40 ug/liter x 28.31 liter/ft3 x 1.543 gr/ug = 1747

Assume shutdown takes one hour per event

| Pollutant | Emission Factor | | | | | Production Rate | | Hours of Operation | Emission Rates | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Uncontrolled | | Controlled | | AP-42 Table | | | | Uncontrolled | | Controlled | |
| | Value | Units | Value | Units | | Value | Units | (hrs/yr) | (lbs/hr) | (tons/yr) | (lbs/hr) | (tons/yr) |
| | UEF | | CEF | | | PR | | OP | UER | | CER | |
| | A | B | C | D | | E | F | G | H | I | J | K |
| **Criteria Pollutants** | | | | | | | | | A/1050xE | HxG/2000 | C/1050xE | JxE/2000 |
| PM Total[1] | 7.6 | lb/10$^6$ ft$^3$ | 7.6 | lb/10$^6$ ft$^3$ | 1.4-2 | 0.05 | 10$^6$ Btu/hr | 8,760 | 3.62E-4 | 1.59E-3 | 3.62E-4 | 1.59E-3 |
| PM Condensible[1] | 5.7 | lb/10$^6$ ft$^3$ | 5.7 | lb/10$^6$ ft$^3$ | 1.4-2 | 0.05 | 10$^6$ Btu/hr | 8,760 | 2.71E-4 | 1.19E-3 | 2.71E-4 | 1.19E-3 |
| PM Filterable[1] | 1.9 | lb/10$^6$ ft$^3$ | 1.9 | lb/10$^6$ ft$^3$ | 1.4-2 | 0.05 | 10$^6$ Btu/hr | 8,760 | 9.05E-5 | 3.96E-4 | 9.05E-5 | 3.96E-4 |
| $SO_2$ | 0.6 | lb/10$^6$ ft$^3$ | 0.6 | lb/10$^6$ ft$^3$ | 1.4-2 | 0.05 | 10$^6$ Btu/hr | 8,760 | 2.86E-5 | 1.25E-4 | 2.86E-5 | 1.25E-4 |
| $NO_2$ | 100 | lb/10$^6$ ft$^3$ | 100 | lb/10$^6$ ft$^3$ | 1.4-1 | 0.05 | 10$^6$ Btu/hr | 8,760 | 4.76E-3 | 2.09E-2 | 4.76E-3 | 2.09E-2 |
| CO | 84 | lb/10$^6$ ft$^3$ | 84 | lb/10$^6$ ft$^3$ | 1.4-1 | 0.05 | 10$^6$ Btu/hr | 8,760 | 4.00E-3 | 1.75E-2 | 4.00E-3 | 1.75E-2 |
| VOC | 5.5 | lb/10$^6$ ft$^3$ | 5.5 | lb/10$^6$ ft$^3$ | 1.4-2 | 0.05 | 10$^6$ Btu/hr | 8,760 | 2.62E-4 | 1.15E-3 | 2.62E-4 | 1.15E-3 |
| **Greenhouse Gases** | | | | | | | | | | | | |
| Ammonia | 3.1 | lb/10$^6$ ft$^3$ | 3.1 | lb/10$^6$ ft$^3$ | Fire | 0.05 | 10$^6$ Btu/hr | 8,760 | 1.50E-4 | 6.55E-4 | 1.50E-4 | 6.55E-4 |
| $CO_2$ | 120,000 | lb/10$^6$ ft$^3$ | 120,000 | lb/10$^6$ ft$^3$ | 1.4-1 | 0.05 | 10$^6$ Btu/hr | 8,760 | 6 | 25 | 6 | 25 |
| Methane | 2.3 | lb/10$^6$ ft$^3$ | 2.3 | lb/10$^6$ ft$^3$ | 1.4-1 | 0.05 | 10$^6$ Btu/hr | 8,760 | 1.10E-4 | 4.80E-4 | 1.10E-4 | 4.80E-4 |
| $N_2O$ | 2.2 | lb/10$^6$ ft$^3$ | 2.2 | lb/10$^6$ ft$^3$ | 1.4-1 | 0.05 | 10$^6$ Btu/hr | 8,760 | 1.05E-4 | 4.59E-4 | 1.05E-4 | 4.59E-4 |
| TOC | 11 | lb/10$^6$ ft$^3$ | 11 | lb/10$^6$ ft$^3$ | 1.4-1 | 0.05 | 10$^6$ Btu/hr | 8,760 | 5.24E-4 | 2.29E-3 | 5.24E-4 | 2.29E-3 |
| **HAPS** | | | | | | | | | | | | |
| Total Organic HAPs | 1.8824 | lb/10$^6$ ft$^3$ | 1.8824 | lb/10$^6$ ft$^3$ | | 0.05 | 10$^6$ Btu/hr | 8,760 | 8.96E-5 | 3.93E-4 | 8.96E-5 | 3.93E-4 |
| Total Metalic HAPs | 6.1E-3 | lb/10$^6$ ft$^3$ | 6.1E-3 | lb/10$^6$ ft$^3$ | | 0.05 | 10$^6$ Btu/hr | 8,760 | 2.89E-7 | 1.26E-6 | 2.89E-7 | 1.26E-6 |
| Total HAPS | 1.8885 | lb/10$^6$ ft$^3$ | 1.8885 | lb/10$^6$ ft$^3$ | | 0.05 | 10$^6$ Btu/hr | 8,760 | 8.99E-5 | 3.94E-4 | 8.99E-5 | 3.94E-4 |
| 2-Methylnaphthalene* | 2.4E-05 | lb/10$^6$ ft$^3$ | 2.4E-05 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | 1.14E-09 | 5.01E-09 | 1.14E-09 | 5.01E-09 |
| 3-Methylchloranthrene* | < 1.80E-06 | lb/10$^6$ ft$^3$ | < 1.80E-06 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | < 8.57E-11 | < 3.75E-10 | < 8.57E-11 | < 3.75E-10 |
| 7,12-Dimethylbenz(a)anthracene* | < 1.60E-05 | lb/10$^6$ ft$^3$ | < 1.60E-05 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | < 7.62E-10 | < 3.34E-09 | < 7.62E-10 | < 3.34E-09 |
| Acenaphthene* | < 1.80E-06 | lb/10$^6$ ft$^3$ | < 1.80E-06 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | < 8.57E-11 | < 3.75E-10 | < 8.57E-11 | < 3.75E-10 |
| Acenaphthylene* | < 1.80E-06 | lb/10$^6$ ft$^3$ | < 1.80E-06 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | < 8.57E-11 | < 3.75E-10 | < 8.57E-11 | < 3.75E-10 |
| Anthracene* | < 2.40E-06 | lb/10$^6$ ft$^3$ | < 2.40E-06 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | < 1.14E-10 | < 5.01E-10 | < 1.14E-10 | < 5.01E-10 |
| Benz(a)anthracene* | < 1.80E-06 | lb/10$^6$ ft$^3$ | < 1.80E-06 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | < 8.57E-11 | < 3.75E-10 | < 8.57E-11 | < 3.75E-10 |
| Benzene | 2.1E-03 | lb/10$^6$ ft$^3$ | 2.1E-03 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | 1.00E-07 | 4.38E-07 | 1.00E-07 | 4.38E-07 |
| Benzo(a)pyrene* | < 1.20E-06 | lb/10$^6$ ft$^3$ | < 1.20E-06 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | < 5.71E-11 | < 2.50E-10 | < 5.71E-11 | < 2.50E-10 |
| Benzo(b)fluoranthene* | < 1.80E-06 | lb/10$^6$ ft$^3$ | < 1.80E-06 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | < 8.57E-11 | < 3.75E-10 | < 8.57E-11 | < 3.75E-10 |
| Benzo(g,h,i)perylene* | < 1.20E-06 | lb/10$^6$ ft$^3$ | < 1.20E-06 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | < 5.71E-11 | < 2.50E-10 | < 5.71E-11 | < 2.50E-10 |
| Benzo(k)fluoranthene* | < 1.80E-06 | lb/10$^6$ ft$^3$ | < 1.80E-06 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | < 8.57E-11 | < 3.75E-10 | < 8.57E-11 | < 3.75E-10 |
| Chrysene* | < 1.80E-06 | lb/10$^6$ ft$^3$ | < 1.80E-06 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | < 8.57E-11 | < 3.75E-10 | < 8.57E-11 | < 3.75E-10 |
| Dibenzo(a,h)anthracene* | < 1.20E-06 | lb/10$^6$ ft$^3$ | < 1.20E-06 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | < 5.71E-11 | < 2.50E-10 | < 5.71E-11 | < 2.50E-10 |
| Dichlorobenzene | 1.2E-03 | lb/10$^6$ ft$^3$ | 1.2E-03 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | 5.71E-08 | 2.50E-07 | 5.71E-08 | 2.50E-07 |
| Fluoranthene* | 3.0E-06 | lb/10$^6$ ft$^3$ | 3.0E-06 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | 1.43E-10 | 6.26E-10 | 1.43E-10 | 6.26E-10 |
| Fluorene* | 2.8E-06 | lb/10$^6$ ft$^3$ | 2.8E-06 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | 1.33E-10 | 5.84E-10 | 1.33E-10 | 5.84E-10 |
| Formaldehyde | 7.5E-02 | lb/10$^6$ ft$^3$ | 7.5E-02 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | 3.57E-06 | 1.56E-05 | 3.57E-06 | 1.56E-05 |
| Hexane | 1.8E+00 | lb/10$^6$ ft$^3$ | 1.8E+00 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | 8.57E-05 | 3.75E-04 | 8.57E-05 | 3.75E-04 |
| Indeno(1,2,3-cd)pyrene* | < 1.80E-06 | lb/10$^6$ ft$^3$ | < 1.80E-06 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | < 8.57E-11 | < 3.75E-10 | < 8.57E-11 | < 3.75E-10 |
| Naphthalene | 6.1E-04 | lb/10$^6$ ft$^3$ | 6.1E-04 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | 2.90E-08 | 1.27E-07 | 2.90E-08 | 1.27E-07 |
| Phenanthrene* | 1.7E-05 | lb/10$^6$ ft$^3$ | 1.7E-05 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | 8.10E-10 | 3.55E-09 | 8.10E-10 | 3.55E-09 |
| Pyrene* | 5.0E-06 | lb/10$^6$ ft$^3$ | 5.0E-06 | lb/10$^6$ ft$^3$ | 1.4-3 | 0.05 | 10$^6$ Btu/hr | 8,760 | 2.38E-10 | 1.04E-09 | 2.38E-10 | 1.04E-09 |
| Toluene | 3.4E-03 | lb/10$^6$ ft$^3$ | 3.4E-03 | lb/10$^6$ ft$^3$ | | 0.05 | 10$^6$ Btu/hr | 8,760 | 1.62E-07 | 7.09E-07 | 1.62E-07 | 7.09E-07 |
| Total POM | | | | | | | | | | | | 1.84E-08 |
| Total PAH | | | | | | | | | | | | 1.42E-07 |
| **Metals** | | | | | | | | | | | | |
| Arsenic** | 2.0E-04 | lb/10$^6$ ft$^3$ | 2.0E-04 | lb/10$^6$ ft$^3$ | 1.4-4 | 0.05 | 10$^6$ Btu/hr | 8,760 | 9.52E-09 | 4.17E-08 | 9.52E-09 | 4.17E-08 |
| Barium | 4.4E-03 | lb/10$^6$ ft$^3$ | 4.4E-03 | lb/10$^6$ ft$^3$ | 1.4-4 | 0.05 | 10$^6$ Btu/hr | 8,760 | 2.10E-07 | 9.18E-07 | 2.10E-07 | 9.18E-07 |
| Beryllium** | < 1.20E-05 | lb/10$^6$ ft$^3$ | < 1.20E-05 | lb/10$^6$ ft$^3$ | 1.4-4 | 0.05 | 10$^6$ Btu/hr | 8,760 | < 5.71E-10 | < 2.50E-09 | < 5.71E-10 | < 2.50E-09 |
| Cadmium** | 1.1E-03 | lb/10$^6$ ft$^3$ | 1.1E-03 | lb/10$^6$ ft$^3$ | 1.4-4 | 0.05 | 10$^6$ Btu/hr | 8,760 | 5.24E-08 | 2.29E-07 | 5.24E-08 | 2.29E-07 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chromium** | 1.4E-03 | lb/$10^6$ $ft^3$ | 1.4E-03 | lb/$10^6$ $ft^3$ | 1.4-4 | 0.05 | $10^6$ Btu/hr | 8,760 | 6.67E-08 | 2.92E-07 | 6.67E-08 | 2.92E-07 |
| Cobalt** | 8.4E-05 | lb/$10^6$ $ft^3$ | 8.4E-05 | lb/$10^6$ $ft^3$ | 1.4-4 | 0.05 | $10^6$ Btu/hr | 8,760 | 4.00E-09 | 1.75E-08 | 4.00E-09 | 1.75E-08 |
| Copper | 8.5E-04 | lb/$10^6$ $ft^3$ | 8.5E-04 | lb/$10^6$ $ft^3$ | 1.4-4 | 0.05 | $10^6$ Btu/hr | 8,760 | 4.05E-08 | 1.77E-07 | 4.05E-08 | 1.77E-07 |
| Lead** | 5.0E-04 | lb/$10^6$ $ft^3$ | 5.0E-04 | lb/$10^6$ $ft^3$ | 1.4-2 | 0.05 | $10^6$ Btu/hr | 8,760 | 2.38E-08 | 1.04E-07 | 2.38E-08 | 1.04E-07 |
| Manganese** | 3.8E-04 | lb/$10^6$ $ft^3$ | 3.8E-04 | lb/$10^6$ $ft^3$ | 1.4-4 | 0.05 | $10^6$ Btu/hr | 8,760 | 1.81E-08 | 7.93E-08 | 1.81E-08 | 7.93E-08 |
| Mercury** | 2.6E-04 | lb/$10^6$ $ft^3$ | 2.6E-04 | lb/$10^6$ $ft^3$ | 1.4-4 | 0.05 | $10^6$ Btu/hr | 8,760 | 1.24E-08 | 5.42E-08 | 1.24E-08 | 5.42E-08 |
| Molybdenum | 1.1E-03 | lb/$10^6$ $ft^3$ | 1.1E-03 | lb/$10^6$ $ft^3$ | 1.4-4 | 0.05 | $10^6$ Btu/hr | 8,760 | 5.24E-08 | 2.29E-07 | 5.24E-08 | 2.29E-07 |
| Nickel** | 2.1E-03 | lb/$10^6$ $ft^3$ | 2.1E-03 | lb/$10^6$ $ft^3$ | 1.4-4 | 0.05 | $10^6$ Btu/hr | 8,760 | 1.00E-07 | 4.38E-07 | 1.00E-07 | 4.38E-07 |
| Selenium** | < 2.40E-05 | lb/$10^6$ $ft^3$ | < 2.40E-05 | lb/$10^6$ $ft^3$ | 1.4-4 | 0.05 | $10^6$ Btu/hr | 8,760 | < 1.14E-09 | < 5.01E-09 | < 1.14E-09 | < 5.01E-09 |
| Vanadium | 2.3E-03 | lb/$10^6$ $ft^3$ | 2.3E-03 | lb/$10^6$ $ft^3$ | 1.4-4 | 0.05 | $10^6$ Btu/hr | 8,760 | 1.10E-07 | 4.80E-07 | 1.10E-07 | 4.80E-07 |
| Zinc | 2.9E-02 | lb/$10^6$ $ft^3$ | 2.9E-02 | lb/$10^6$ $ft^3$ | 1.4-4 | 0.05 | $10^6$ Btu/hr | 8,760 | 1.38E-06 | 6.05E-06 | 1.38E-06 | 6.05E-06 |

* Polycyclic Organic Matter (POM), defined as a Hazardous Air Pollutant in Section 112(b) of the Clean Air Act

* *Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act

1 All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM10, PM2.5 or PM1
emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate
matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

**EMISSION RATE CALCULATIONS from Tanks 4.0.9d**

| Tank ID# | Tanks Program ID # | Tank Contents | Tank Throughput gal/yr | Total Emissions VOC | | | | | Hazardous Air Pollutants (controlled lbs/yr) | | | | | | | | | Hazardous Air Pollutants (uncontrolled lbs/yr) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | uncontrolled lbs/yr | controlled lbs/yr | Control Efficiency % | controlled (ton/yr) | controlled (lbs/hr) | 1,2,4 – Trimethylbenzene | Benzene | Cyclohexane | Ethylbenzene | Hexane(-n) | Isopropyl benzene | Toluene | Xylene (-m) | Total | 1,2,4 – Trimethylbenzene | Benzene | Cyclohexane | Ethylbenze | Hexane(-n) | Isopropyl benzene | Toluene | Xylene (-m) | Total |
| Distillation Plant | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-00350-1 | Set 01 | Slop | 171,429 | 729.42 | 230.47 | 68.4% | 0.1152 | 0.02631 | - | 1.82 | 3.79 | 0.14 | 7.54 | 0.03 | 1.69 | 0.60 | 15.61 | - | 5.76 | 12.00 | 0.44 | 23.86 | 0.09 | 5.35 | 1.90 | 49.40 |
| 1-00500-1 | Set 02 | Naphtha | 857,143 | 2,088.37 | 253.99 | 87.8% | 0.1270 | 0.02899 | - | 1.99 | 4.15 | 0.19 | 8.20 | 0.04 | 1.95 | 0.81 | 17.33 | - | 16.36 | 34.12 | 1.56 | 67.42 | 0.33 | 16.03 | 6.66 | 142.49 |
| 1-00500-2 | Set 02 | Naphtha | 857,143 | 2,088.37 | 253.99 | 95.0% | 0.1270 | 0.02899 | - | 1.99 | 4.15 | 0.19 | 8.20 | 0.04 | 1.95 | 0.81 | 17.33 | - | 39.80 | 83.00 | 3.80 | 164.00 | 0.80 | 39.00 | 16.20 | 346.60 |
| 1-02500-1 | | Water | 1,800,000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | #VALUE! | #VALUE! | #VALUE! | #VALUE! | #VALUE! | #VALUE! | ### | #VALUE! | #VALUE! |
| 1-02500-2 | Set 03 | Diesel | 3,428,571 | 61.58 | 61.58 | 0.0% | 3.08E-2 | 7.03E-3 | 2.68 | 0.14 | - | 0.19 | 0.03 | - | 1.51 | 3.60 | 8.15 | 2.68 | 0.14 | - | 0.19 | 0.03 | - | 1.51 | 3.60 | 8.15 |
| 1-02500-3 | Set 03 | Diesel | 3,428,571 | 61.58 | 61.58 | 0.0% | 3.08E-2 | 7.03E-3 | 2.68 | 0.14 | - | 0.19 | 0.03 | - | 1.51 | 3.60 | 8.15 | 2.68 | 0.14 | - | 0.19 | 0.03 | - | 1.51 | 3.60 | 8.15 |
| 1-02500-4 | Set 04 | Fuel Oil | 2,790,000 | 0.53 | 0.53 | 0.0% | 2.65E-4 | 6.05E-5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-02500-5 | Set 04 | Fuel Oil | 2,790,000 | 0.53 | 0.53 | 0.0% | 2.65E-4 | 6.05E-5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-02500-6 | Set 04 | Fuel Oil | 2,790,000 | 0.53 | 0.53 | 0.0% | 0.00027 | 0.0001 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-02500-7 | Set 04 | Fuel Oil | 2,790,000 | 0.53 | 0.53 | 0.0% | 0.00027 | 0.0001 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-02500-8 | Set 04 | Fuel Oil | 2,790,000 | 0.53 | 0.53 | 0.0% | 0.00027 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-05000-1 | Set 05 | Naphtha | 8,316,000 | 20,277.26 | 356.54 | 98.2% | 0.18 | 0.04 | - | 2.73 | 5.68 | 0.40 | 10.93 | 0.12 | 3.15 | 1.86 | 24.87 | - | 155.26 | 323.03 | 22.75 | 621.61 | 6.82 | 179.15 | 105.78 | 1,414.41 |
| 1-05000-2 | Set 05 | Naphtha | 8,316,000 | 20,277.26 | 356.54 | 98.2% | 0.18 | 0.04 | - | 2.73 | 5.68 | 0.40 | 10.93 | 0.12 | 3.15 | 1.86 | 24.87 | - | 155.26 | 323.03 | 22.75 | 621.61 | 6.82 | 179.15 | 105.78 | 1,414.41 |
| 1-05000-3 | Set 05 | Naphtha | 8,316,000 | 20,277.26 | 356.54 | 98.2% | 0.18 | 0.04 | - | 2.69 | 5.59 | 0.36 | 10.81 | 0.10 | 2.98 | 1.66 | 24.19 | - | 152.99 | 317.92 | 20.47 | 614.79 | 5.69 | 169.48 | 94.41 | 1,375.74 |
| 1-05000-4 | Set 05 | Naphtha | 8,316,000 | 20,277.26 | 356.54 | 98.2% | 0.18 | 0.04 | - | 2.69 | 5.59 | 0.36 | 10.81 | 0.10 | 2.98 | 1.66 | 24.19 | - | 152.99 | 317.92 | 20.47 | 614.79 | 5.69 | 169.48 | 94.41 | 1,375.74 |
| 1-05000-5 | Set 05 | Naphtha | 8,316,000 | 20,277.26 | 356.54 | 98.2% | 0.18 | 0.04 | - | 2.69 | 5.59 | 0.36 | 10.81 | 0.10 | 2.98 | 1.66 | 24.19 | - | 152.99 | 317.92 | 20.47 | 614.79 | 5.69 | 169.48 | 94.41 | 1,375.74 |
| 1-05000-6 | Set 05 | Naphtha | 8,316,000 | 20,277.26 | 356.54 | 98.2% | 0.18 | 0.04 | - | 2.69 | 5.59 | 0.36 | 10.81 | 0.10 | 2.98 | 1.66 | 24.19 | - | 152.99 | 317.92 | 20.47 | 614.79 | 5.69 | 169.48 | 94.41 | 1,375.74 |
| 1-05000-7 | Set 05 | Naphtha | 8,316,000 | 20,277.26 | 356.54 | 98.2% | 0.18 | 0.04 | - | 2.69 | 5.59 | 0.36 | 10.81 | 0.10 | 2.98 | 1.66 | 24.19 | - | 152.99 | 317.92 | 20.47 | 614.79 | 5.69 | 169.48 | 94.41 | 1,375.74 |
| 1-05000-8 | Set 05 | Naphtha | 8,316,000 | 20,277.26 | 356.54 | 98.2% | 0.18 | 0.04 | - | 2.69 | 5.59 | 0.36 | 10.81 | 0.10 | 2.98 | 1.66 | 24.19 | - | 152.99 | 317.92 | 20.47 | 614.79 | 5.69 | 169.48 | 94.41 | 1,375.74 |
| 1-05000-9 | Set 06 | Kerosene | 9,374,400 | 218.15 | 218.15 | 0.0% | 0.11 | 0.02 | - | 1.58 | - | 4.35 | 3.28 | - | 14.36 | 8.82 | 32.39 | - | 1.58 | - | 4.35 | 3.28 | - | 14.36 | 8.82 | 32.39 |
| 1-10000-1 | Set 07 | Kerosene | 18,748,800 | 361.05 | 361.05 | 0.0% | 0.18 | 0.04 | - | 2.61 | - | 7.21 | 5.44 | - | 23.77 | 14.60 | 53.63 | - | 2.61 | - | 7.21 | 5.44 | - | 23.77 | 14.60 | 53.63 |
| 1-10000-2 | Set 07 | Kerosene | 18,748,800 | 361.05 | 361.05 | 0.0% | 0.18 | 0.04 | - | 2.61 | - | 7.21 | 5.44 | - | 23.77 | 14.60 | 53.63 | - | 2.61 | - | 7.21 | 5.44 | - | 23.77 | 14.60 | 53.63 |
| 1-10000-3 | Set 07 | Kerosene | 18,748,800 | 361.05 | 361.05 | 0.0% | 0.18 | 0.04 | - | 2.61 | - | 7.21 | 5.44 | - | 23.77 | 14.60 | 53.63 | - | 2.61 | - | 7.21 | 5.44 | - | 23.77 | 14.60 | 53.63 |
| 1-10000-4 | Set 08 | Fuel Oil | 11,160,000 | 1.01 | 1.01 | 0.0% | 0.00051 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-10000-5 | Set 08 | Fuel Oil | 11,160,000 | 1.01 | 1.01 | 0.0% | 0.00051 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-10000-6 | Set 08 | Fuel Oil | 11,160,000 | 1.01 | 1.01 | 0.0% | 0.00051 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-10000-7 | Set 08 | Fuel Oil | 11,160,000 | 1.01 | 1.01 | 0.0% | 0.00051 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-10000-8 | Set 08 | Fuel Oil | 11,160,000 | 1.01 | 1.01 | 0.0% | 0.00051 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-10000-9 | Set 08 | Fuel Oil | 11,160,000 | 1.01 | 1.01 | 0.0% | 0.00051 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-10000-10 | Set 08 | Fuel Oil | 11,160,000 | 1.01 | 1.01 | 0.0% | 0.00051 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-10000-11 | Set 08 | Fuel Oil | 11,160,000 | 1.01 | 1.01 | 0.0% | 0.00051 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-20000-1 | Set 09 | Crude | 50,400,000 | 62,099 | 1,399 | 97.7% | 0.70 | 0.16 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-20000-2 | Set 09 | Crude | 50,400,000 | 62,099 | 1,399 | 97.7% | 0.70 | 0.16 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-20000-3 | Set 09 | Crude | 50,400,000 | 62,099 | 1,399 | 97.7% | 0.70 | 0.16 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-20000-4 | Set 09 | Crude | 50,400,000 | 62,099 | 1,399 | 97.7% | 0.70 | 0.16 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-20000-5 | Set 09 | Crude | 50,400,000 | 62,099 | 1,399 | 97.7% | 0.70 | 0.16 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Subtotal | | | 497,921,657 | 479,052.38 | 12,023 | 1525.9% | 6.01 | 1.372 | 5.36 | 37.09 | 56.99 | 29.84 | 130.32 | 0.95 | 118.46 | 75.72 | 454.73 | #VALUE! | #VALUE! | #VALUE! | #VALUE! | #VALUE! | #VALUE! | ### | #VALUE! | #VALUE! |
| Wax Plant | | | | | | | | | | | | | | | | | - | | | | | | | | | |
| 2-02500-1 | Set 10 | Slop | 720,000 | 3,522.44 | 283.41 | 92.0% | 0.14 | 0.03 | - | 2.23 | 4.65 | 0.19 | 9.24 | 0.04 | 2.11 | 0.79 | 19.25 | - | 27.72 | 57.79 | 2.36 | 114.84 | 0.50 | 26.22 | 9.82 | 239.25 |
| 2-02500-2 | Set 11 | Naphtha | 3,547,733 | 8,533.66 | 523.68 | 93.9% | 0.26 | 0.06 | - | 4.09 | 8.53 | 0.42 | 16.77 | 0.10 | 4.12 | 1.84 | 35.87 | - | 66.65 | 139.00 | 6.84 | 273.28 | 1.63 | 67.14 | 29.98 | 584.52 |
| 2-02500-3 | Set 11 | Naphtha | 3,547,733 | 8,533.66 | 523.68 | 93.9% | 0.26 | 0.06 | - | 4.09 | 8.53 | 0.42 | 16.77 | 0.10 | 4.12 | 1.84 | 35.87 | - | 66.65 | 139.00 | 6.84 | 273.28 | 1.63 | 67.14 | 29.98 | 584.52 |
| 2-02500-4 | Set 11 | Naphtha | 3,547,733 | 8,533.66 | 523.68 | 93.9% | 0.26 | 0.06 | - | 4.09 | 8.53 | 0.42 | 16.77 | 0.10 | 4.12 | 1.84 | 35.87 | - | 66.65 | 139.00 | 6.84 | 273.28 | 1.63 | 67.14 | 29.98 | 584.52 |
| 2-02500-5 | Set 12 | Lube Oil | 1,260,000 | 0.31 | 0.31 | 0.0% | 0.00016 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-05000-1 | Set 13 | Diesel | 3,584,000 | 80.38 | 80.38 | 0.0% | 0.040 | 0.01 | 3.50 | 0.18 | - | 0.25 | 0.04 | - | 1.97 | 4.70 | 10.64 | 3.50 | 0.18 | - | 0.25 | 0.04 | - | 1.97 | 4.70 | 10.64 |
| 2-05000-2 | Set 13 | Diesel | 3,584,000 | 80.38 | 80.38 | 0.0% | 0.040 | 0.01 | 3.50 | 0.18 | - | 0.25 | 0.04 | - | 1.97 | 4.70 | 10.64 | 3.50 | 0.18 | - | 0.25 | 0.04 | - | 1.97 | 4.70 | 10.64 |
| 2-05000-3 | Set 13 | Diesel | 3,584,000 | 80.38 | 80.38 | 0.0% | 0.040 | 0.01 | 3.50 | 0.18 | - | 0.25 | 0.04 | - | 1.97 | 4.70 | 10.64 | 3.50 | 0.18 | - | 0.25 | 0.04 | - | 1.97 | 4.70 | 10.64 |
| 2-05000-4 | Set 14 | Lube Oil | 4,868,000 | 0.95 | 0.95 | 0.0% | 0.00048 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-05000-5 | Set 14 | Lube Oil | 4,868,000 | 0.95 | 0.95 | 0.0% | 0.00048 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-05000-6 | Set 14 | Lube Oil | 4,868,000 | 0.95 | 0.95 | 0.0% | 0.00048 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-05000-7 | | Water | 2,800,000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | #VALUE! | #VALUE! | #VALUE! | #VALUE! | #VALUE! | #VALUE! | ### | #VALUE! | #VALUE! |
| 2-10000-1 | Set 15 | Diesel | 16,200,000 | 270.74 | 270.74 | 0.0% | 0.14 | 0.03 | 11.77 | 0.60 | - | 0.85 | 0.13 | - | 6.62 | 15.82 | 35.79 | 11.77 | 0.60 | - | 0.85 | 0.13 | - | 6.62 | 15.82 | 35.79 |
| 2-10000-2 | Set 15 | Diesel | 16,200,000 | 270.74 | 270.74 | 0.0% | 0.14 | 0.03 | 11.77 | 0.60 | - | 0.85 | 0.13 | - | 6.62 | 15.82 | 35.79 | 11.77 | 0.60 | - | 0.85 | 0.13 | - | 6.62 | 15.82 | 35.79 |
| 2-10000-3 | Set 15 | Diesel | 16,200,000 | 270.74 | 270.74 | 0.0% | 0.14 | 0.03 | 11.77 | 0.60 | - | 0.85 | 0.13 | - | 6.62 | 15.82 | 35.79 | 11.77 | 0.60 | - | 0.85 | 0.13 | - | 6.62 | 15.82 | 35.79 |
| 2-10000-4 | Set 15 | Diesel | 16,200,000 | 270.74 | 270.74 | 0.0% | 0.14 | 0.03 | 11.77 | 0.60 | - | 0.85 | 0.13 | - | 6.62 | 15.82 | 35.79 | 11.77 | 0.60 | - | 0.85 | 0.13 | - | 6.62 | 15.82 | 35.79 |
| 2-10000-5 | Set 15 | Diesel | 16,200,000 | 270.74 | 270.74 | 0.0% | 0.14 | 0.03 | 11.77 | 0.60 | - | 0.85 | 0.13 | - | 6.62 | 15.82 | 35.79 | 11.77 | 0.60 | - | 0.85 | 0.13 | - | 6.62 | 15.82 | 35.79 |
| 2-10000-6 | Set 16 | L Wax Oil | 6,017,000 | 0.54 | 0.54 | 0.0% | 0.00027 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-10000-7 | Set 16 | M Wax Oil | 6,017,000 | 0.54 | 0.54 | 0.0% | 0.00027 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-10000-8 | Set 16 | M Wax Oil | 6,017,000 | 0.54 | 0.54 | 0.0% | 0.00027 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-10000-9 | Set 16 | M Wax Oil | 6,017,000 | 0.54 | 0.54 | 0.0% | 0.00027 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-10000-10 | Set 16 | H Wax Oil | 6,017,000 | 0.54 | 0.54 | 0.0% | 0.00027 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-10000-11 | Set 16 | H Wax Oil | 6,017,000 | 0.54 | 0.54 | 0.0% | 0.00027 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

**EMISSION RATE CALCULATIONS from Tanks 4.0.9d**

| Tank ID# | Tanks Program ID # | Tank Contents | Tank Throughput gal/yr | Total Emissions VOC | | | | | Hazardous Air Pollutants (controlled lbs/yr) | | | | | | | | | Hazardous Air Pollutants (uncontrolled lbs/yr) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | uncontrolled lbs/yr | controlled lbs/yr | Control Efficiency % | controlled (ton/yr) | controlled (lbs/hr) | 1,2,4 – Trimethylbenzene | Benzene | Cyclohexane | Ethylbenze | Hexane(-n) | Isopropyl benzene | Toluene | Xylene (-m) | Total | 1,2,4 – Trimethylbenzene | Benzene | Cyclohexane | Ethylbenze | Hexane(-n) | Isopropyl benzene | Toluene | Xylene (-m) | Total |
| 2-10000-12 | Set 16 | H Wax Oil | 6,017,000 | 0.54 | 0.54 | 0.0% | 0.00027 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-10000-13 | Set 16 | H Wax Oil | 6,017,000 | 0.54 | 0.54 | 0.0% | 0.00027 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-10000-14 | Set 17 | Lube Oil | 4,600,000 | 1.25 | 1.25 | 0.0% | 0.00063 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-10000-15 | Set 17 | Lube Oil | 4,600,000 | 1.25 | 1.25 | 0.0% | 0.00063 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-10000-16 | Set 17 | Lube Oil | 4,600,000 | 1.25 | 1.25 | 0.0% | 0.00063 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-10000-17 | Set 18 | Wax | 5,128,000 | 0.46 | 0.46 | 0.0% | 0.00023 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-20000-1 | Set 19 | L Wax Oil | 10,584,000 | 0.96 | 0.96 | 0.0% | 0.00048 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-20000-2 | Set 19 | L Wax Oil | 10,584,000 | 0.96 | 0.96 | 0.0% | 0.00048 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-20000-3 | Set 20 | Wax | 6,233,787 | 0.56 | 0.56 | 0.0% | 0.00028 | 0.00 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-20000-4 | Set 21 | Crude | 10,800,000 | 31,650.21 | 595.45 | 98.1% | 0.30 | 0.07 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-20000-5 | Set 21 | Crude | 10,800,000 | 31,650.21 | 595.45 | 98.1% | 0.30 | 0.07 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-20000-6 | Set 21 | Crude | 10,800,000 | 31,650.21 | 595.45 | 98.1% | 0.30 | 0.07 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-20000-7 | Set 21 | Crude | 10,800,000 | 31,650.21 | 595.45 | 98.1% | 0.30 | 0.07 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-20000-8 | Set 21 | Crude | 10,800,000 | 31,650.21 | 595.45 | 98.1% | 0.30 | 0.07 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-20000-9 | Set 21 | Crude | 10,800,000 | 31,650.21 | 595.45 | 98.1% | 0.30 | 0.07 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-20000-10 | Set 21 | Crude | 10,800,000 | 31,650.21 | 595.45 | 98.1% | 0.30 | 0.07 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-20000-11 | Set 21 | Crude | 10,800,000 | 31,650.21 | 595.45 | 98.1% | 0.30 | 0.07 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2-20000-12 | Set 21 | Crude | 10,800,000 | 31,650.21 | 595.45 | 98.1% | 0.30 | 0.07 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Subtotal | | | 313,444,987 | 315,584.32 | 8,822.51 | 1256.6% | 4.41 | 1.007 | 69.35 | 18.04 | 30.24 | 6.45 | 60.32 | 0.34 | 53.48 | 99.51 | 337.73 | #VALUE! | #VALUE! | #VALUE! | #VALUE! | #VALUE! | #VALUE! | ### | #VALUE! | #VALUE! |
| fixed roof tanks subtotal | | | 380,589,730 | 3044.200 | 3044.200 | 0.0% | 1.52 | 0.348 | 74.710 | 13.230 | 0.000 | 31.360 | 20.430 | 0.000 | 127.700 | 153.020 | 420.450 | #VALUE! | #VALUE! | #VALUE! | #VALUE! | #VALUE! | #VALUE! | ### | #VALUE! | #VALUE! |
| Refinery Total | | | 811,366,644 | 794,636.70 | 20,845.37 | 97.4% | 10.42 | 2.38 | 74.71 | 55.13 | 87.23 | 36.29 | 190.64 | 1.29 | 171.94 | 175.23 | 792.46 | #VALUE! | #VALUE! | #VALUE! | #VALUE! | #VALUE! | #VALUE! | ### | #VALUE! | #VALUE! |

**Distillation Plant**

Default Zero Emission Rate

| Source | Emission Factor (kg/hr-source) | Emission Factor (lb/hr-source) EF | Percent VOC (%) P | Number of Sources (#) N | Operating Time (hr/yr) OP | Emission Rate (ton/yr) ER |
|---|---|---|---|---|---|---|
| Valves | 7.80E-06 | 1.72E-05 | 100 | 94 | 8,760 | 0.0071 |
| Pumps | 2.40E-05 | 5.29E-05 | 100 | 28 | 8,760 | 0.0065 |
| Other | 4.00E-06 | 8.82E-06 | 100 | 23 | 8,760 | 0.0009 |
| Connectors | 7.50E-06 | 1.65E-05 | 100 | 28 | 8,760 | 0.0020 |
| Flanges | 3.10E-07 | 6.83E-07 | 100 | 207 | 8,760 | 0.0006 |
| Open Ended Lines | 2.00E-06 | 4.41E-06 | 100 | 0 | 8,760 | 0.0000 |
| **Total** | | | | | | **0.017** |

Pegged Emission Rates 10,000 ppm

| Source | Emission Factor (kg/hr-source) | Emission Factor (lb/hr-source) EF | Percent VOC (%) P | Number of Sources (#) N | Operating Time (hr/yr) OP | Emission Rate (ton/yr) ER |
|---|---|---|---|---|---|---|
| Valves | 6.40E-02 | 1.41E-01 | 100 | 2 | 8,760 | 1.24 |
| Pumps | 7.40E-02 | 1.63E-01 | 100 | 1 | 8,760 | 0.71 |
| Other | 7.30E-02 | 1.61E-01 | 100 | 1 | 8,760 | 0.70 |
| Connectors | 2.80E-02 | 6.17E-02 | 100 | 1 | 8,760 | 0.27 |
| Flanges | 8.50E-02 | 1.87E-01 | 100 | 1 | 8,760 | 0.85 |
| Open Ended Lines | 3.00E-02 | 6.61E-02 | 100 | 0 | 8,760 | 0.00 |
| **Total** | | | | | | **3.78** |

Total

| Source | Emission Rate (ton/yr) |
|---|---|
| Pumps | 0.721 |
| Other | 0.706 |
| Connectors | 0.272 |
| Flanges | 0.85 |
| Open Ended Lines | 0.0 |
| **Total** | **2.55** |

**Wax Plant**

Default Zero Emission Rate

| Source | Emission Factor (kg/hr-source) | Emission Factor (lb/hr-source) EF | Percent VOC (%) P | Number of Sources (#) N | Operating Time (hr/yr) OP | Emission Rate (ton/yr) ER |
|---|---|---|---|---|---|---|
| Valves | 7.80E-06 | 1.72E-05 | 100 | 200 | 8,760 | 0.0151 |
| Pumps | 2.40E-05 | 5.29E-05 | 100 | 80 | 8,760 | 0.0185 |
| Other | 4.00E-06 | 8.82E-06 | 100 | 36 | 8,760 | 0.0014 |
| Connectors | 7.50E-06 | 1.65E-05 | 100 | 43 | 8,760 | 0.0031 |
| Flanges | 3.10E-07 | 6.83E-07 | 100 | 473 | 8,760 | 0.0014 |
| Open Ended Lines | 2.00E-06 | 4.41E-06 | 100 | 0 | 8,760 | 0.0000 |
| **Total** | | | | | | **0.040** |

Pegged Emission Rates 10,000 ppm

| Source | Emission Factor (kg/hr-source) | Emission Factor (lb/hr-source) EF | Percent VOC (%) P | Number of Sources (#) N | Operating Time (hr/yr) OP | Emission Rate (ton/yr) ER |
|---|---|---|---|---|---|---|
| Valves | 6.40E-02 | 1.41E-01 | 100 | 2 | 8,760 | 1.24 |
| Pumps | 7.40E-02 | 1.63E-01 | 100 | 1 | 8,760 | 0.71 |
| Other | 7.30E-02 | 1.61E-01 | 100 | 1 | 8,760 | 0.70 |
| Connectors | 2.80E-02 | 6.17E-02 | 100 | 1 | 8,760 | 0.27 |
| Flanges | 8.50E-02 | 1.87E-01 | 100 | 2 | 8,760 | 1.94 |
| Open Ended Lines | 3.00E-02 | 6.61E-02 | 100 | 0 | 8,760 | 0.00 |
| **Total** | | | | | | **4.87** |

Total

| Source | Emission Rate (ton/yr) |
|---|---|
| Pumps | 0.733 |
| Other | 0.706 |
| Connectors | 0.273 |
| Flanges | 1.94 |
| Open Ended Lines | 0.0 |
| **Total** | **3.66** |

The number of pumps and valves are from the plant design. Flanges are estimated from the ratio of valves in the plant design to the typical number shown in Table 2-4 of Emission Estimation Protocol for Petroleum Refineries, May 2011, by RTI International. (see next page)

Median number of components for small refinery from Table 2-4 of Emission Estimation Protocol for Petroleum Refineries, May 2011, by RTI International

| | Valves | | | Pumps | | Compressors | Pressure Relief Valves | Flanges | | | Open Lines | Sampling Connections |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Distillation Plant** | gas | light liquid | heavy liquid | light liquid | heavy liquid | gas | gas oil | gas | light liquid | heavy liquid | | |
| Crude Distillation Plant | 75 | 251 | 216 | 8 | 8 | 2 | 6 | 164 | 555 | 454 | 39 | 10 |
| Product Blending | 67 | 205 | 202 | 6 | 11 | 1 | 10 | 230 | 398 | 341 | 33 | 14 |
| Vacuum Distillation | 54 | 26 | 84 | 6 | 6 | 2 | 2 | 105 | 121 | 230 | 16 | 4 |
| Total | 196 | 482 | 502 | 20 | 25 | 5 | 18 | 499 | 1074 | 1025 | 88 | 28 |
| | | | | | | | | | | | | |
| **Wax Plant** | | | | | | | | | | | | |
| Naphtha Distillation | 75 | 251 | 216 | 8 | 8 | 2 | 6 | 164 | 555 | 454 | 39 | 10 |
| Diesel Distillation | 75 | 251 | 216 | 8 | 8 | 2 | 6 | 164 | 555 | 454 | 39 | 10 |
| MEK Dewaxing | 145 | 1208 | 200 | 35 | 39 | 3 | 10 | 452 | 1486 | 2645 | 19 | 17 |
| Lube Oil Processing | 153 | 242 | 201 | 7 | 5 | 2 | 5 | 167 | 307 | 249 | 60 | 6 |
| Total | 448 | 1952 | 833 | 58 | 60 | 9 | 27 | 947 | 2903 | 3802 | 157 | 43 |

**Example Calculation: Distillation Plant Valves**

**Source of Equation or Data:**

**Emission Rates (ER):**

**ER**= (**EF**)(**P**/100)(**N**)(**OP**)(1 ton / 2000 lb) = 0.0071 ton/yr — Calculated by DMK.

**1.**

**EF**= Emission Factor — 1.72E-05 lb/hr-source — EPA document 453/R-95-017 for Connectors and Sampling Connections. Table 2.2 of Emission Estimation Protocol for Petroleum Refineries Version 2.1.1 Final ICR Version – Corrected

**P** = Percent VOC in Stream — 100 % — Assume 100%

**N**= Number of Sources — 94 — Plant Design

**OP**= Hours of Operation — 8,760 hr/yr — No permit restriction

| | **HAPs Emission Rates** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | HAPs to VOC ratio from Tanks Program | | | | Distillation Plant | | Wax Plant | |
| | Naphtha | Kerosene | Diesel | Average | tons/yr | lbs/hr | tons/yr | lbs/hr |
| 1,2,4, Trimethylylbenzene | 0.00% | 0.00% | 4.35% | 1.45% | 0.0369 | 0.00843 | 0.0530 | 0.01210 |
| Benzene | 0.77% | 0.72% | 0.22% | 0.57% | 0.0145 | 0.00332 | 0.0209 | 0.00476 |
| Cyclohexane | 1.59% | 0.00% | 0.00% | 0.53% | 0.0135 | 0.00309 | 0.0194 | 0.00443 |
| Ethylbenzene | 0.11% | 1.99% | 0.31% | 0.81% | 0.0206 | 0.00470 | 0.0295 | 0.00674 |
| Hexane | 3.07% | 1.50% | 0.05% | 1.54% | 0.0392 | 0.00896 | 0.0563 | 0.01285 |
| Isopropylbenzene | 0.03% | 0.00% | 0.00% | 0.01% | 0.0003 | 0.00007 | 0.0004 | 0.00009 |
| Toluene | 0.88% | 6.58% | 2.45% | 3.30% | 0.0842 | 0.01923 | 0.1208 | 0.02758 |
| Xylene | 0.52% | 4.04% | 5.84% | 3.47% | 0.0884 | 0.02019 | 0.1269 | 0.02897 |
| Total VOC Emissions | 6.98% | 14.85% | 13.22% | 11.68% | 0.2978 | 0.06798 | 0.4272 | 0.09752 |

**Example Calculation: Distillation Benzene tons/yr**

0.0145 tons/yr = 0.57% Benzene / VOC x 2.55 tons/yr VOC

**Emission Rates for Oil/Water Separator**

| Source | Pollutant | Emission Factor Uncontrolled (lb/1000 gal) EF | Emission Factor Controlled (lb/1000 gal) EF | Feed Rate (gal/hr) FR | Operating Hours (hr/yr) OP | Emission Rate Uncontrolled (ton/yr) | Emission Rate Controlled (lbs/hr) | Emission Rate Controlled (ton/yr) ER |
|---|---|---|---|---|---|---|---|---|
| Distillation Plant Oil Water Separator | VOC | 5 | 0.2 | 1,200 | 8,760 | 26.28 | 0.240 | 1.05 |
| Wax plant Oil Water Separator | VOC | 5 | 0.2 | 1,200 | 8,760 | 26.28 | 0.240 | 1.05 |
| Total | | | | 2,400 | | 52.56 | 0.48 | 2.10 |

***Example Calculations***

**Origin of Information:**

**Emission Rate (ER):**

**Source of Equation or Data:**

**1. ER**= (**EF**)(**FR**)(**OP**)(1 ton / 2,000 lbs) = 1.05 ton/yr — Calculated by DMK

**EF**= Emission Factor 0.20 lb/1000 gal — AP-42, Fifth Edition, Table 5.1-2 (1/95).
**FR** = Feed Rate 1200 gal/hr
**OP**= Operating Hours 8,760 hr/yr — Hours in one year

| | HAPs Emission Rates | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | HAPs to VOC ratio from Tanks Program | | | | Distillation Plant | | Wax Plant | |
| | Naphtha | Kerosene | Diesel | Average | tons/yr | lbs/hr | tons/yr | lbs/hr |
| 1,2,4, Trimethylylbenzene | 0.00% | 0.00% | 4.35% | 1.45% | 0.0152 | 0.00348 | 0.0152 | 0.00348 |
| Benzene | 0.77% | 0.72% | 0.22% | 0.57% | 0.0060 | 0.00137 | 0.0060 | 0.00137 |
| Cyclohexane | 1.59% | 0.00% | 0.00% | 0.53% | 0.0056 | 0.00127 | 0.0056 | 0.00127 |
| Ethylbenzene | 0.11% | 1.99% | 0.31% | 0.81% | 0.0085 | 0.00194 | 0.0085 | 0.00194 |
| Hexane | 3.07% | 1.50% | 0.05% | 1.54% | 0.0162 | 0.00369 | 0.0162 | 0.00369 |
| Isopropylbenzene | 0.03% | 0.00% | 0.00% | 0.01% | 0.0001 | 0.00003 | 0.0001 | 0.00003 |
| Toluene | 0.88% | 6.58% | 2.45% | 3.30% | 0.0347 | 0.00793 | 0.0347 | 0.00793 |
| Xylene | 0.52% | 4.04% | 5.84% | 3.47% | 0.0365 | 0.00833 | 0.0365 | 0.00833 |
| Total VOC Emissions | 6.98% | 14.85% | 13.22% | 11.68% | 0.1228 | 0.02803 | 0.1228 | 0.02803 |

**Example Calculation: Distillation Benzene tons/yr**

0.0060 tons/yr = 0.57% Benzene / VOC x 1.05 tons/yr VOC

| Petroleum Refining Process - Petroleum Loading Racks | Process Rate (gal/yr) | Operating Hours (hr/yr) | Avg. Emission Factor $L_L$ (lb/10^3 gal) | Control Tech | Control Eff. % | Avg VOC Emission Rate (lb/hr) | Uncontrolled Emission Rate (tons/yr) | Avg VOC Emission Rate (ton/yr) |
|---|---|---|---|---|---|---|---|---|
| **Distillation Plant** | | | | | | | | |
| Naphtha products | 30,660,000 | 8760 | 1.17 | Vented to Boiler | 98% | 0.082 | 18.0 | 0.360 |
| Kerosene | 47,523,000 | 8760 | 0.012 | Bottom Loading | 0% | 0.063 | 0.274 | 0.274 |
| Diesel | 56,721,000 | 8760 | 0.0088 | Bottom Loading | 0% | 0.057 | 0.248 | 0.248 |
| Heavy Fuel Oil | 7,665,000 | 8760 | 2.72E-5 | Bottom Loading | 0% | 0.000024 | 1.04E-4 | 1.04E-4 |
| Asphalt | 7,665,000 | 8760 | 1.85E-6 | Bottom Loading | 0% | 0.00000162 | 7.07E-6 | 7.07E-6 |
| Subtotal | 150,234,000 | | | | | 0.20 | 18.5 | 0.882 |
| **Wax Plant** | | | | | | | | |
| Naphtha products | 6,387,500 | 8760 | 1.17E+0 | Vented to Boiler | 98% | 0.017 | 3.75 | 0.075 |
| Diesel | 34,662,833 | 8760 | 0.0088 | Bottom Loading | 0% | 0.035 | 0.152 | 0.152 |
| Light Lube Oil | 27,934,667 | 8760 | 3.01E-6 | Bottom Loading | 0% | 9.59E-6 | 4.20E-5 | 4.20E-5 |
| Medium Lube Oil | 18,310,833 | 8760 | 3.15E-6 | Bottom Loading | 0% | 6.59E-6 | 2.88E-5 | 2.88E-5 |
| Heavy Lube Oil | 6,387,500 | 8760 | 3.29E-6 | Bottom Loading | 0% | 2.40E-6 | 1.05E-5 | 1.05E-5 |
| Subtotal | 93,683,333 | | | | | | | |
| **Refinery Total** | 243,917,333 | | | | | 0.201 | 18.5 | 0.882 |
| uncontrolled subtotal | 206,869,833 | | | | | 0.154 | 0.674 | 0.674 |

**CALCULATIONS:**

1. Emissions from Loading Petroleum liquid

**Origin of Information:**

2. LL = 12.46(SPM/T)

| | | |
|---|---|---|
| LL = loading loss, pounds per 1000 gallons (lbs/$10^3$ gal) of liquid loaded | lbs/$10^3$ gal | AP-42, Sec. 5.2 |
| S = a saturation factor | 0.60 | AP-42, Sec 5.2, Table 5.2-1 |
| P = true vapor pressure of liquid loaded, pounds per square inch absolute | psia | Tanks 4.0.9d Program |
| M = molecular weight of vapors, pounds per pound - mole (lb/lb-mole) | lb/lb-mole | Tanks 4.0.9d Program |
| T = temperature of bulk liquid loaded, $^oR(^oF + 460)$ | $^oR$ | Annual Average Temp. of Liquid Surface or Peak Annual Temp. |

3. Inputs for Calculations for Load Racks:

| | Vapor Pressure | Vapor Molecular Wt. | Loading T$^o$ | | | | | |
|---|---|---|---|---|---|---|---|---|
| Naphtha | 1.0245 | 80 | 62 | = | 12.46(SPM/T) | 1.17 | lbs/$10^3$ gal | Calculated |
| Kerocene | 0.0062 | 130 | 62 | = | 12.46(SPM/T) | 0.0115 | lbs/$10^3$ gal | Calculated |
| Diesel | 0.0047 | 130 | 62 | = | 12.46(SPM/T) | 0.0088 | lbs/$10^3$ gal | Calculated |
| Heavy Fuel Oil | 0.00001 | 190 | 62 | = | 12.46(SPM/T) | 2.72E-5 | lbs/$10^3$ gal | Calculated |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Asphalt | 0.000001 | 200 | 350 | = | 12.46(SPM/T) | 1.85E-6 | lbs/$10^3$ gal | Calculated |
| Light Lube Oil | 0.000001 | 210 | 62 | = | 12.46(SPM/T) | 3.01E-6 | lbs/$10^3$ gal | Calculated |
| Medium Lube Oil | 0.000001 | 220 | 62 | = | 12.46(SPM/T) | 3.15E-6 | lbs/$10^3$ gal | Calculated |
| Heavy Lube Oil | 0.000001 | 230 | 62 | = | 12.46(SPM/T) | 3.29E-6 | lbs/$10^3$ gal | Calculated |

4. Average VOC Emission Rates

| | | |
|---|---|---|
| (24,000 gal/hr) (0.009 lb/10^3 gal) / (1000 gal/10^3 gal) = | 0.00 | lb/hr |
| (0.21 lb/hr) (6500 hr/yr) / (2000 lb/ ton) = | 0.00 | ton/yr |

Note that the emissions for the naphtha racks will be emitted through one or more of the boiler stacks, but are accounted for here.

| % of VOC emissions | Naphtha | Kerosene | Diesel | Total |
|---|---|---|---|---|
| 1,2,4, Trimethylylbenzene | 0.52% | 4.04% | 5.84% | 10.41% |
| Benzene | 0.77% | 0.72% | 0.22% | 1.71% |
| Cyclohexane | 0.88% | 6.58% | 2.45% | 9.91% |
| Ethylbenzene | 0.11% | 1.99% | 0.31% | 2.42% |
| Hexane | 0.00% | 0.00% | 4.35% | 4.35% |
| Isopropylbenzene | 0.03% | 0.00% | 0.00% | 0.03% |
| Toluene | 1.59% | 0.00% | 0.00% | 1.59% |
| Xylene | 3.07% | 1.50% | 0.05% | 4.62% |
| Total Emissions | 6.98% | 14.85% | 13.22% | |

| lbs/hr | | | | |
|---|---|---|---|---|
| 1,2,4, Trimethylylbenzene | 4.29E-4 | 2.53E-3 | 3.31E-3 | 6.27E-003 |
| Benzene | 6.29E-4 | 4.10E-4 | 1.26E-4 | 1.17E-003 |
| Cyclohexane | 7.26E-4 | 1.57E-6 | 1.39E-3 | 2.11E-003 |
| Ethylbenzene | 9.22E-5 | 3.22E-8 | 1.78E-4 | 2.70E-004 |
| Hexane | 0.00E+0 | 0.00E+0 | 2.46E-3 | 2.46E-003 |
| Isopropylbenzene | 2.77E-5 | 0.00E+0 | 0.00E+0 | 2.77E-005 |
| Toluene | 1.31E-3 | 0.00E+0 | 0.00E+0 | 1.31E-003 |
| Xylene | 2.52E-3 | 9.90E-8 | 2.72E-5 | 2.55E-003 |
| Total Emissions | 5.73E-3 | 3.57E-7 | 7.49E-3 | 1.32E-002 |

| tons/yr | | | | |
|---|---|---|---|---|
| 1,2,4, Trimethylylbenzene | 1.88E-3 | 1.11E-2 | 1.45E-2 | 2.75E-002 |
| Benzene | 2.76E-3 | 1.80E-3 | 2.31E-7 | 4.55E-003 |
| Cyclohexane | 3.18E-3 | 6.86E-6 | 1.73E-7 | 3.19E-003 |
| Ethylbenzene | 4.04E-4 | 1.41E-7 | 2.77E-3 | 3.17E-003 |
| Hexane | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+000 |
| Isopropylbenzene | 1.21E-4 | 0.00E+0 | 0.00E+0 | 1.21E-004 |
| Toluene | 5.73E-3 | 0.00E+0 | 0.00E+0 | 5.73E-003 |
| Xylene | 1.10E-2 | 4.34E-7 | 5.05E-9 | 1.10E-002 |
| Total Emissions | 2.51E-2 | 1.56E-6 | 0.00E+0 | 2.51E-002 |

| From Tanks 4.0.9d Program HAPs & VOC in lbs/yr | | | | | HAPs as a % of VOC | | |
|---|---|---|---|---|---|---|---|
| | Naphtha | Kerosene | Diesel | | Naphtha | Kerosene | Diesel |
| | Set 05 | Set 07 | Set 15 | | | | |
| 1,2,4, Trimethylylbenzene | | | 11.77 | | 0.00% | 0.00% | 4.35% |
| Benzene | 2.73 | 1.58 | 0.6 | | 0.77% | 0.72% | 0.22% |
| Cyclohexane | 5.68 | | | | 1.59% | 0.00% | 0.00% |
| Ethylbenzene | 0.4 | 4.35 | 0.85 | | 0.11% | 1.99% | 0.31% |
| Hexane | 10.93 | 3.28 | 0.13 | | 3.07% | 1.50% | 0.05% |
| Isopropylbenzene | 0.12 | | | | 0.03% | 0.00% | 0.00% |
| Toluene | 3.15 | 14.36 | 6.62 | | 0.88% | 6.58% | 2.45% |
| Xylene | 1.86 | 8.82 | 15.82 | | 0.52% | 4.04% | 5.84% |
| Total VOC Emissions | 356.54 | 218.15 | 270.74 | | 6.98% | 14.85% | 13.22% |

The HAPs as a % of VOC is used to calculate HAPs emissions for the loading racks, oil water separators,and equipments leaks. HAPs as a % of VOC is calculated by dividing the lbs/yr of each HAP by the Total VOC emission rate in lbs/yr as calculated by the Tanks 4.0.9d program.

| **ACUTE** Hazardous Air Pollutants | Health Classification | Applicable Factor Safety | TLV-Ceiling 1-Hour (ug/m3) | TLV-Ceiling 1-Hour (ppm) | Molecular Weight | Toxic Screening Level (TSL) 1-Hour Average ug/m3 | **Acute Emission Threshold Values (in lb/hr)** Distance to Property Boundary and Emission Threshold Factors | | | | | | | Bridgehouse Emission Rate lbs/hr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Vertically Restricted/Fugitive Releases | | | | Vertically Unrestricted Releases | | | |
| | | | | | | | <20 m | 20-50 m | 50-100 m | >100 m | <50 m | 50-100 m | >100 m | |
| | | | | | | | 0.038 | 0.051 | 0.092 | 0.180 | 0.154 | 0.224 | 0.310 | |
| Acetaldehyde | Acute | 10 | 45041 | 25.0 | 44.05 | 4504 | 1.7116 | 2.2971 | 4.1438 | 8.1074 | 6.9363 | 10.0892 | 13.9627 | 3.03E-6 |
| Acrolein | Acute | 10 | 229 | 0.1 | 56.06 | 23 | 0.0087 | 0.0117 | 0.0211 | 0.0413 | 0.0353 | 0.0514 | 0.0711 | 1.64E-4 |
| Formaldehyde | Acute/Carc. | 10 | 368 | 0.3 | 30.03 | 37 | 0.0140 | 0.0188 | 0.0339 | 0.0663 | 0.0567 | 0.0825 | 0.1142 | 1.14E-2 |
| 1,2,4-Trichlorobenzene | Acute | 10 | 37,108 | 5.0 | 181.46 | 3711 | 1.4101 | 1.8925 | 3.4140 | 6.6795 | 5.7147 | 8.3123 | 11.5036 | 3.58E-2 |
| **CARCINOGENIC** Hazardous Air Pollutants | Health Classification | Applicable Factor Safety | TLV-TWA 8-Hour (ug/m3) | TLV-TWA 8-Hour (ppm) | Molecular Weight | Toxic Screening Level (TSL) 24-Hour Average ug/m3 | **Carcinogenic Emission Threshold Values (in lb/hr)** Distance to Property Boundary and Emission Threshold Factors | | | | | | | |
| | | | | | | | Vertically Restricted/Fugitive Releases | | | | Vertically Unrestricted Releases | | | |
| | | | | | | | <20 m | 20-50 m | 50-100 m | >100 m | <50 m | 50-100 m | >100 m | |
| | | | | | | | 0.017 | 0.022 | 0.041 | 0.090 | 0.066 | 0.081 | 0.123 | |
| Arsenic Compounds (inorg. incl. arsinec | A1 Carc. | 30 | 10.0 | 0.003 | 74.92 | 0.33 | 0.0004 | 0.0005 | 0.0009 | 0.0018 | 0.0015 | 0.0022 | 0.0031 | 2.98E-5 |
| Benzene (incl.benzene for gas) | A1 Carc. | 30 | 1,597 | 0.5 | 78.11 | 53 | 0.0607 | 0.0815 | 0.1470 | 0.2875 | 0.2460 | 0.3578 | 0.4952 | 1.40E-2 |
| Beryllium Compounds | A1 Carc. | 30 | 0.05 | 0.0001 | 9.01 | 0.002 | 0.000002 | 0.000003 | 0.000005 | 0.000009 | 0.000008 | 0.000011 | 0.000016 | 1.79E-6 |
| Chromium Compounds | A1 Carc. | 90 | 10 | na | Various MWs | 0.11 | 0.0004 | 0.0005 | 0.0009 | 0.0018 | 0.0015 | 0.0022 | 0.0031 | 2.09E-4 |
| Nickel Compounds | A1 Carc. | 90 | 100 | na | Various MWs | 1.11 | 0.0038 | 0.0051 | 0.0092 | 0.0180 | 0.0154 | 0.0224 | 0.0310 | 2.22E-4 |
| Cadium Compounds | A2 Carc. | 90 | 2 | na | Various MWs | 0.022 | 0.0001 | 0.0001 | 0.0002 | 0.0004 | 0.0003 | 0.0004 | 0.0006 | 1.64E-4 |
| **CHRONIC** Hazardous Air Pollutants | Health Classification | Applicable Factor Safety | TLV-TWA 8-Hour (ug/m3) | TLV-TWA 8-Hour (ppm) | Molecular Weight | Toxic Screening Level (TSL) 24-Hour Average ug/m3 | Chronic Emission Threshold Values (in lb/hr) Distance to Property Boundary and Emission Threshold Factors | | | | | | | |
| | | | | | | | Vertically Restricted/Fugitive Releases | | | | Vertically Unrestricted Releases | | | |
| | | | | | | | <20 m | 20-50 m | 50-100 m | >100 m | <50 m | 50-100 m | >100 m | |
| | | | | | | | 0.051 | 0.066 | 0.123 | 0.269 | 0.198 | 0.224 | 0.368 | |
| Ethyl benzene | Chronic | 30 | 434,192 | 100.00 | 106.16 | 14,473 | 16.499 | 22.144 | 39.946 | 78.155 | 66.866 | 97.259 | 134.600 | 1.62E-2 |
| **CHRONIC** Hazardous Air Pollutants | Health Classification | Applicable Factor Safety | TLV-TWA 8-Hour (ug/m3) | TLV-TWA 8-Hour (ppm) | Molecular Weight | Toxic Screening Level (TSL) 24-Hour Average ug/m3 | Chronic Emission Threshold Values (in lb/hr) Distance to Property Boundary and Emission Threshold Factors | | | | | | | |
| | | | | | | | Vertically Restricted/Fugitive Releases | | | | Vertically Unrestricted Releases | | | |
| | | | | | | | <20 m | 20-50 m | 50-100 m | >100 m | <50 m | 50-100 m | >100 m | |
| | | | | | | | 0.051 | 0.066 | 0.123 | 0.269 | 0.198 | 0.224 | 0.368 | |
| Hexane | Chronic | 30 | 176,237 | 50.00 | 86.18 | 5,875 | 6.697 | 8.988 | 16.214 | 31.723 | 27.141 | 39.477 | 54.634 | 3.10E-1 |
| Manganese Compounds | Chronic | 30 | 200 | na | Various MWs | 6.7 | 0.008 | 0.010 | 0.018 | 0.036 | 0.031 | 0.045 | 0.062 | 5.66E-5 |
| Mercury Compounds | Chronic | 30 | 10 | na | Various MWs | 0.33 | 0.000 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.003 | 3.88E-5 |
| Naphthalene | Chronic | 30 | 52,429 | 10.00 | 128.19 | 1,748 | 1.992 | 2.674 | 4.824 | 9.437 | 8.074 | 11.744 | 16.253 | 9.29E-5 |
| **CHRONIC** Hazardous Air Pollutants | Health Classification | Applicable Factor Safety | TLV-TWA 8-Hour (ug/m3) | TLV-TWA 8-Hour (ppm) | Molecular Weight | Toxic Screening Level (TSL) 24-Hour Average ug/m3 | Chronic Emission Threshold Values (in lb/hr) Distance to Property Boundary and Emission Threshold Factors | | | | | | | |
| | | | | | | | Vertically Restricted/Fugitive Releases | | | | Vertically Unrestricted Releases | | | |
| | | | | | | | <20 m | 20-50 m | 50-100 m | >100 m | <50 m | 50-100 m | >100 m | |
| | | | | | | | 0.051 | 0.066 | 0.123 | 0.269 | 0.198 | 0.224 | 0.368 | |
| Propylene oxide | Chronic | 30 | 4,751 | 2.00 | 58.08 | 158 | 0.181 | 0.242 | 0.437 | 0.855 | 0.732 | 1.064 | 1.473 | 6.76E-4 |
| Toluene | Chronic | 30 | 75,362 | 20.00 | 92.13 | 2,512 | 2.864 | 3.843 | 6.933 | 13.565 | 11.606 | 16.881 | 23.362 | 7.04E-2 |
| Xylenes (isomers and mixture) | Chronic | 30 | 434,192 | 100.00 | 106.16 | 14,473 | 16.499 | 22.144 | 39.946 | 78.155 | 66.866 | 97.259 | 134.600 | 7.97E-2 |
| | | | | | | | | | | | | | | N-Nitroso-N-methylurea |

Note: Organic HAPs are released from both stack and fugitive sources so the emission rate is compared to the column “Fugitive <20 meters”, Metal HAPs are released from combustion stacks only, so they are compared to the column “Vertically unrestricted < 50 meters”.