# Attachment 7b
# Operational Emissions Related to Propane Deliveries and Use

## Boiler Criteria Pollutant Emission Calculations

**Table 15-A Natural Gas Boiler Reference Data**

| Parameter | Value | Units |
|---|---|---|
| Heater Capacity | 30 | MMBtu/hr |
| Daily Operating Hours | 14 | hrs/day |
| Annual Operating Hours | 1,000 | hrs/yr |
| Conversion lb to tons | 2,000 | lbs/ton |
| Conversion lb to metric tons | 2,205 | lbs/ metric ton |
| Heating Value N.G. | 1,050 | Btu/scf |
| F-factor | 8,710 | scf/MMBtu |
| Conversion grains to lbs | 7,000 | gr/lb |
| Molecular Weight NOx | 46 | lbs/mol |
| Molecular Weight CO | 28 | lbs/mol |
| Molecular Volume | 379 | scf/mol |

**Table 15-B Emissions for the One Natural Gas Fired Boiler**

| Pollutant | Emission Factor | Units | Emission Factor (lb/MMBtu) | Emissions | | |
|---|---|---|---|---|---|---|
| | | | | lbs/hr | lbs/day | tons/yr |
| NOx | 9.0 | ppm @ 3% $O_2$ | 1.11E-02 | 0.33 | 4.67 | 0.17 |
| VOC | 5.5 | lbs/MMscf | 5.24E-03 | 0.16 | 2.20 | 0.08 |
| CO | 50 | ppm @ 3% $O_2$ | 3.76E-02 | 1.13 | 15.78 | 0.56 |
| SOx | 0.2 | gr/100 scf | 2.72E-04 | 0.01 | 0.11 | 0.004 |
| PM10 | 0.005 | lbs/MMBtu | 5.00E-03 | 0.15 | 2.10 | 0.08 |

**Notes:**

For NOx and CO, EF = (ppm/10^6) * f-factor * MW/ MV

VOC and PM10 emission factors from AP42 - Table 1.4-1 and Table 1.4-2

Sulfur emissions assume 0.2 grains Sulfur/100 scf natural gas

**Table 15-C LPG Boiler Reference Data**

| Parameter | Value | Units |
|---|---|---|
| Heater Capacity | 30 | MMBtu/hr |
| Daily Operating Hours | 14 | hrs/day |
| Annual Operating Hours | 1,000 | hrs/yr |
| Conversion lb to tons | 2,000 | lbs/ton |
| Conversion lb to metric tons | 2,205 | lbs/ metric ton |
| Heating Value LPG | 2,522 | Btu/scf |
| | 91.5 | MMBtu/1000 gal |
| F-factor | 8,710 | scf/MMBtu |
| Molecular Weight NOx | 46 | lbs/mol |
| Molecular Weight CO | 28 | lbs/mol |
| Molecular Volume | 379 | scf/mol |

**Table 15-D Emissions for the One Propane Fired Boiler**

| Pollutant | Emission Factor | Units | Emission Factor (lb/MMBtu) | Emissions | | |
|---|---|---|---|---|---|---|
| | | | | lbs/hr | lbs/day | tons/yr |
| NOx | 9.0 | ppm @ 3% $O_2$ | 1.11E-02 | 0.33 | 4.67 | 0.17 |
| VOC | 5.5 | lbs/MMscf | 5.24E-03 | 0.16 | 2.20 | 0.08 |
| CO | 50 | ppm @ 3% $O_2$ | 3.76E-02 | 1.13 | 15.78 | 0.56 |
| SOx | 0.0113 | lb/MMBtu | 1.13E-02 | 0.34 | 4.75 | 0.17 |
| PM10 | 0.005 | lbs/MMBtu | 5.00E-03 | 0.15 | 2.10 | 0.08 |

Notes:

For NOx and CO, EF = (ppm/10^6) * f-factor * MW/ MV

VOC and PM10 emission factors are vendor guarantees

Sulfur emission factor taken from SBAPCD Techical Information and References
http://www.sbcapcd.org/eng/tech/sulfur01.htm

## Emergency Engine Criteria Pollutant Emission Calculations

**Table 16-A Diesel ICE Emission Factors**

| Pollutant | Emission Factors (gm/bhp-hr) John Deere Model 6125H EPA Tier 3[1] |
|---|---|
| NOx[2] | 2.85 |
| NMHC (VOC)[2] | 0.15 |
| CO | 2.6 |
| PM10 | 0.15 |

**Table 16-B Engine Data**

| Source | Horsepower | Daily Hours | Annual Hours |
|---|---|---|---|
| Emergency Fire Pump Engine | 300 | 1 | 50 |

**Table 16-C Reference Data**

| Parameter | Value | Units |
|---|---|---|
| Fuel Consumption | 7,000 | Btu/hp-hr |
| Sulfur Content | 15 | ppm |
| Heating Value Diesel | 137,000 | Btu/gal |
| Density Diesel | 7.2 | lbs/gal |
| Conversion kg to lbs | 0.454 | kg/lb |
| Conversion gr to lbs | 454 | gr/lb |
| Conversion lb to tons | 2,000 | lbs/ton |
| Conversion lb to metric tons | 2,205 | lbs/metric ton |
| Molecular Weight S | 32 | lbs/mol |
| Molecular Weight SO2 | 64 | lbs/mol |
| Fuel Use (hourly) | 15.33 | gal/hr |
| Fuel Use (annual) | 766.42 | gal/yr |

**Table 16-D Emergency Fire Pump Engine Emissions**

| Pollutant | Emission Factor g/bhp-hr | lbs/hr | lbs/day | tons/yr |
|---|---|---|---|---|
| NOx | 2.85 | 1.88 | 1.88 | 0.05 |
| VOC | 0.15 | 0.10 | 0.10 | 0.002 |
| CO | 2.6 | 1.72 | 1.72 | 0.04 |
| PM10 | 0.15 | 0.10 | 0.10 | 0.002 |
| SOx | --- | 0.0033 | 0.0033 | 0.0001 |

**Notes:**

[1]Table 4 to Subpart III of 40 CFR Part 60 - Certification Requirements for Stationary Fire Pump Engines for model year 2009 and later

[2]Emission limit for NMHC+NOx assuming 95% NOx

**Cooling Tower Particulate Emission Calculations**

**Table 17-A Reference Data**

| Parameter | Value | Units |
|---|---|---|
| Daily Operating Hours | 16 | hrs/day |
| Annual Operating Hours | 3,300 | hrs/yr |
| Conversion lb to tons | 2,000 | lbs/ton |
| Density Water | 8.3453 | lbs/gal |
| Conversion min to hours | 60 | min/hr |
| PM10 Fraction of TSP | 100 | % |
| PM2.5 Fraction of PM10 | 100 | % |

**Table 17-C Reference Data**

| Parameter | Value | Units |
|---|---|---|
| Daily Operating Hours | 16 | hrs/day |
| Annual Operating Hours | 3,300 | hrs/yr |
| Conversion lb to tons | 2,000 | lbs/ton |
| Density Water | 8.3453 | lbs/gal |
| Conversion min to hours | 60 | min/hr |
| PM10 Fraction of TSP | 100 | % |
| PM2.5 Fraction of PM10 | 100 | % |

**Table 17-B Cooling Tower Emissions - 16,600 TDS**

| Parameter | Units | Value |
|---|---|---|
| Water Circulation Rate | gpm | 149,000 |
| Total Liquid Drift | (%) | 0.00050 |
| Maximum TDS of Circulated Water | (ppmw) | 16,600 |
| **Cooling Tower Emissions** | | |
| TSP | lb/hr | 6.19 |
| | lb/day | 99.08 |
| | ton/yr | 10.22 |
| PM10 | lb/hr | 6.19 |
| | lb/day | 99.08 |
| | ton/yr | 10.22 |
| PM2.5 | lb/hr | 6.19 |
| | lb/day | 99.08 |
| | ton/yr | 10.22 |

**Table 17-D Cooling Tower Emissions - 1,600 TDS**

| Parameter | Units | Value |
|---|---|---|
| Water Circulation Rate | gpm | 149,000 |
| Total Liquid Drift | (%) | 0.00050 |
| Maximum TDS of Circulated Water | (ppmw) | 1,600 |
| **Cooling Tower Emissions** | | |
| TSP | lb/hr | 0.60 |
| | lb/day | 9.55 |
| | ton/yr | 0.98 |
| PM10 | lb/hr | 0.60 |
| | lb/day | 9.55 |
| | ton/yr | 0.98 |
| PM2.5 | lb/hr | 0.60 |
| | lb/day | 9.55 |
| | ton/yr | 0.98 |

**Notes:**

TSP Emission Rate = based on USEPA AP-42, Section 13.4 Wet Cooling Towers, Table 13.4-1, modified to design
Rates calculated as follows:
E lb/hr = Water Circulation Rate gpm * 60 min/hr * (Drift % / 100) * 8.3453 lb/gal * TDS lb PM / 1,000,000 lb water
E lb/day = E lb/hr * hrs/day
E ton/yr = E lb/hr * hr/yr * ton/2,000 lb
PM10 calculated from TSP, assumes 100% of TSP

## HTF Tank Vent Emissions

### Table 18-A Reference Data

| Parameter | Value | Units | Reference |
|---|---|---|---|
| Annual Operating Hours | 730 | hrs/yr | Assumed |
| Daily Operating Hours | 2.00 | hrs/day | Assumed |
| Conversion lbs to tons | 2,000 | lbs/ton | Constant |
| HTF Vent Uncontrolled Emissions | 17 | tons/yr | WorleyParsons |
| Control Efficiency Air Pollution Control Device | 99.50% | % | Assumed |
| Waste Loadout Emissions | 169.74 | lb/yr | Tanks 4.09 |
| Duration of Pump Out | 2 | hours/even | Assumed |
| Number of Wate Hauls | 12 | per year | Assumed |

### Table 18-B HTF Vent VOC Emissions

| Source | Emissions | | |
|---|---|---|---|
| | Lbs/hr | Lbs/day | Tons/yr |
| HTF Vent | 0.23 | 0.47 | 0.09 |
| Waste Load Out | 7.07 | 14.15 | 0.08 |

**Table 19-A Motor Vehicle Combustion Criteria Pollutant Emissions**

| Vehicle | Distance | | Speed | CO | VOC | NOx | SOx | Exh. PM10 | Fug. PM10 | Diesel PM | Exh. PM2.5 | Fug. PM2.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Miles/yr | Miles/day | Miles/hr | lb/hr | | | | | | | | |
| Mirror Wash Truck | 3000 | 24 | 5 | 0.06 | 0.01 | 0.19 | 2.08E-04 | 0.008 | 0.74 | 0.008 | 0.007 | 0.16 |
| Maintenance Vehicles | 96000 | 384 | 20 | 0.23 | 0.02 | 0.03 | 0.000 | 0.001 | 2.95 | 0.000 | 0.001 | 0.63 |
| Weed Abatement | 340 | 40 | 5 | 0.06 | 0.01 | 0.19 | 2.08E-04 | 0.008 | 0.74 | 0.008 | 0.007 | 0.16 |
| Soil Stabilizer Application | 340 | 40 | 5 | 0.06 | 0.01 | 0.19 | 2.08E-04 | 0.008 | 0.74 | 0.008 | 0.007 | 0.16 |
| Total | | | | 0.42 | 0.06 | 0.62 | 6.24E-04 | 0.024 | 5.17 | 0.023 | 0.022 | 1.10 |
| Vehicle | Distance | | Speed | CO | VOC | NOx | SOx | Exh. PM10 | Fug. PM10 | Diesel PM | Exh. PM2.5 | Fug. PM2.5 |
| | Miles/yr | Miles/day | Miles/hr | lb/day | | | | | | | | |
| Mirror Wash Truck | 3000 | 24 | 5 | 0.29 | 0.07 | 0.93 | 9.98E-04 | 0.037 | 3.55 | 0.037 | 0.034 | 0.75 |
| Maintenance Vehicles | 96000 | 384 | 20 | 4.51 | 0.33 | 0.66 | 0.000 | 0.024 | 56.71 | 0.000 | 0.023 | 12.02 |
| Weed Abatement | 340 | 40 | 5 | 0.49 | 0.12 | 1.56 | 1.66E-03 | 0.062 | 5.91 | 0.062 | 0.057 | 1.25 |
| Soil Stabilizer Application | 340 | 40 | 5 | 0.49 | 0.12 | 1.56 | 1.66E-03 | 0.062 | 5.91 | 0.062 | 0.057 | 1.25 |
| Total | | | | 5.77 | 0.64 | 4.70 | 4.32E-03 | 0.18 | 72.07 | 0.16 | 0.17 | 15.28 |
| Vehicle | Distance | | Speed | CO | VOC | NOx | SOx | Exh. PM10 | Fug. PM10 | Diesel PM | Exh. PM2.5 | Fug. PM2.5 |
| | Miles/yr | Miles/day | Miles/hr | lb/yr | | | | | | | | |
| Mirror Wash Truck | 3000 | 24 | 5 | 0.0182 | 0.0044 | 0.0583 | 0.0001 | 0.0023 | 0.2216 | 0.0023 | 0.0021 | 0.0470 |
| Maintenance Vehicles | 96000 | 384 | 20 | 0.5828 | 0.1417 | 1.8671 | 0.0020 | 0.0738 | 7.0900 | 0.0738 | 0.0679 | 1.5032 |
| Weed Abatement | 340 | 40 | 5 | 0.0021 | 0.0005 | 0.0066 | 0.0000 | 0.0003 | 0.0251 | 0.0003 | 0.0002 | 0.0053 |
| Soil Stabilizer Application | 340 | 40 | 5 | 0.0021 | 0.0005 | 0.0066 | 0.0000 | 0.0003 | 0.1256 | 0.0003 | 0.0002 | 0.0266 |
| Total | | | | 0.6051 | 0.1471 | 1.9387 | 0.0021 | 0.0767 | 7.4623 | 0.0767 | 0.0705 | 1.5822 |

**Table 19-B 2009 Motor Vehicle Emission Factors**

| Vehicle Use | Vehicle Type | Vehicle Class | Emission Factors | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CO (lb/mi) | VOC (lb/mi) | NOx (lb/mi) | SOx (lb/mi) | Exh. PM10 (lb/mi) | Fug. PM10 (lb/mi) | Diesel PM (lb/mi) | Exh. PM2.5 (lb/mi) | Fug. PM2.5 (lb/mi) |
| Mirror Wash Truck | Water Trucks, Freightliner 4000 gallon | HHDT-DSL | 1.21E-02 | 2.95E-03 | 3.89E-02 | 4.16E-05 | 1.54E-03 | 1.48E-01 | 1.54E-03 | 1.42E-03 | 3.13E-02 |
| Weed Abatement | Water Trucks, Freightliner 4000 gallon | HHDT-DSL | 1.21E-02 | 2.95E-03 | 3.89E-02 | 4.16E-05 | 1.54E-03 | 1.48E-01 | 1.54E-03 | 1.42E-03 | 3.13E-02 |
| Soil Stabilizer Application | Water Trucks, Freightliner 4000 gallon | HHDT-DSL | 1.21E-02 | 2.95E-03 | 3.89E-02 | 4.16E-05 | 1.54E-03 | 1.48E-01 | 1.54E-03 | 1.42E-03 | 3.13E-02 |
| Maintenance Vehicles | On-Site 3/4 Ton Pick-Up, Ford | LDT2-CAT | 1.17E-02 | 8.68E-04 | 1.71E-03 | 0.00E+00 | 6.35E-05 | 1.48E-01 | 0.00E+00 | 5.89E-05 | 3.13E-02 |

**Notes:**

The emission factors, except fugitive emissions from entrained road dust, were compiled by running the California Air Resources Board's EMFAC2007 (version 2.3) Burden Model and dividing calculated daily emissions by daily vehicle-miles-traveled.
Welding trucks, fuel/lube trucks and flatbed trucks are assumed to be Medium-Duty Catalyst Equipped Vehicles.
Pickup trucks and construction worker commuting vehicles are assumed to be Light-Duty Trucks 1.
All other vehicles are assumed to be heavy heavy-duty diesel vehicles.
All the emission factors account for the emissions from start, running and idling exhaust. In addition, the VOC emission factors take into account diurnal, hot soak, running and resting emissions, and fugitive PM10 and PM2.5 emission factors take into account tire and brake wear and entrained paved or unpaved road dust.

Emissions [pounds/day] = Emission factor [pounds/mile] x Vehicle miles traveled [miles/day]
Control Efficiency of Dust Suppressant = 80.00%

## Summary of Criteria Pollutant Emissions

**Table 20-A Summary of Hourly Emissions (Lbs/Hr)**

| Source | NOx | SOx | CO | VOC | PM10 | PM2.5 |
|---|---|---|---|---|---|---|
| Boiler No. 1 | 0.33 | 0.01 | 1.13 | 0.16 | 0.15 | 0.15 |
| Boiler No. 2 | 0.33 | 0.01 | 1.13 | 0.16 | 0.15 | 0.15 |
| Cooling Tower | 0.00 | 0.00 | 0.00 | 0.00 | 0.60 | 0.60 |
| Emergency Fire Pump Engine | 1.88 | 0.00 | 1.72 | 0.10 | 0.10 | 0.10 |
| HTF Vent | 0.00 | 0.00 | 0.00 | 0.23 | 0.00 | 0.00 |
| Waste Loadout | 0.00 | 0.00 | 0.00 | 7.07 | 0.00 | 0.00 |
| Maintenance Vehicles | 0.62 | 0.00 | 0.42 | 0.06 | 5.19 | 1.12 |
| **Total** | **3.17** | **0.02** | **4.39** | **7.78** | **6.19** | **2.11** |

**Table 20-B Summary of Daily Emissions (Lbs/Day)**

| Source | NOx | SOx | CO | VOC | PM10 | PM2.5 |
|---|---|---|---|---|---|---|
| Boiler No. 1 | 4.67 | 0.11 | 15.78 | 2.20 | 2.10 | 2.10 |
| Boiler No. 2 | 4.67 | 0.11 | 15.78 | 2.20 | 2.10 | 2.10 |
| Cooling Tower | 0.00 | 0.00 | 0.00 | 0.00 | 9.55 | 9.55 |
| Emergency Fire Pump Engine | 1.88 | 0.00 | 1.72 | 0.10 | 0.10 | 0.10 |
| HTF Vent | 0.00 | 0.00 | 0.00 | 0.47 | 0.00 | 0.00 |
| Waste Loadout | 0.00 | 0.00 | 0.00 | 14.15 | 0.00 | 0.00 |
| Maintenance Vehicles | 4.70 | 0.00 | 5.77 | 0.64 | 72.26 | 15.45 |
| **Total** | **15.92** | **0.24** | **39.05** | **19.75** | **86.11** | **29.30** |

**Table 20-C Summary of Annual Emissions (Tons/Yr)**

| Source | NOx | SOx | CO | VOC | PM10 | PM2.5 |
|---|---|---|---|---|---|---|
| Boiler No. 1 | 0.17 | 0.004 | 0.56 | 0.08 | 0.08 | 0.08 |
| Boiler No. 2 | 0.17 | 0.004 | 0.56 | 0.08 | 0.08 | 0.08 |
| Cooling Tower | 0.00 | 0.00 | 0.00 | 0.00 | 0.98 | 0.98 |
| Emergency Fire Pump Engine | 0.05 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 |
| HTF Vent | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 |
| Waste Loadout | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 |
| Maintenance Vehicles | 1.94 | 0.00 | 0.61 | 0.15 | 7.54 | 1.65 |
| **Total** | **2.32** | **0.01** | **1.78** | **0.48** | **8.68** | **2.79** |

**Table 20-D Summary of Project Criteria Pollutant Emissions**

| Period | NOx | SOx | CO | VOC | PM10 | PM2.5 |
|---|---|---|---|---|---|---|
| Hourly Emissions (Lbs/Hr) | 3.17 | 0.02 | 4.39 | 7.78 | 6.19 | 2.11 |
| Daily Emissions (Lbs/Day) | 15.92 | 0.24 | 39.05 | 19.75 | 86.11 | 29.30 |
| Annual Emissions (Tons/Yr) | 2.32 | 0.01 | 1.78 | 0.48 | 8.68 | 2.79 |

**Notes:**

Summary of emissions with natural gas fired boilers, 1,600 ppm TDS in the cooling water, and 3,000 hours of operation per year for the cooling tower

## Summary of Criteria Pollutant Emissions

**Table 20-E Summary of Hourly Emissions (Lbs/Hr)**

| Source | NOx | SOx | CO | VOC | PM10 | PM2.5 |
|---|---|---|---|---|---|---|
| Boiler No. 1 | 0.33 | 0.34 | 1.13 | 0.16 | 0.15 | 0.15 |
| Boiler No. 2 | 0.33 | 0.34 | 1.13 | 0.16 | 0.15 | 0.15 |
| Cooling Tower | 0.00 | 0.00 | 0.00 | 0.00 | 0.60 | 0.60 |
| Emergency Fire Pump Engine | 1.88 | 0.00 | 1.72 | 0.10 | 0.10 | 0.10 |
| HTF Vent | 0.00 | 0.00 | 0.00 | 0.23 | 0.00 | 0.00 |
| Waste Loadout | 0.00 | 0.00 | 0.00 | 7.07 | 0.00 | 0.00 |
| Maintenance Vehicles | 0.62 | 0.00 | 0.42 | 0.06 | 5.19 | 1.12 |
| **Total** | **3.17** | **0.68** | **4.39** | **7.78** | **6.19** | **2.11** |

**Table 20-F Summary of Daily Emissions (Lbs/Day)**

| Source | NOx | SOx | CO | VOC | PM10 | PM2.5 |
|---|---|---|---|---|---|---|
| Boiler No. 1 | 4.67 | 4.75 | 15.78 | 2.20 | 2.10 | 2.10 |
| Boiler No. 2 | 4.67 | 4.75 | 15.78 | 2.20 | 2.10 | 2.10 |
| Cooling Tower | 0.00 | 0.00 | 0.00 | 0.00 | 9.55 | 9.55 |
| Emergency Fire Pump Engine | 1.88 | 0.00 | 1.72 | 0.10 | 0.10 | 0.10 |
| HTF Vent | 0.00 | 0.00 | 0.00 | 0.47 | 0.00 | 0.00 |
| Waste Loadout | 0.00 | 0.00 | 0.00 | 14.15 | 0.00 | 0.00 |
| Maintenance Vehicles | 4.70 | 0.00 | 5.77 | 0.64 | 72.26 | 15.45 |
| **Total** | **15.92** | **9.50** | **39.05** | **19.75** | **86.11** | **29.30** |

**Table 20-G Summary of Annual Emissions (Tons/Yr)**

| Source | NOx | SOx | CO | VOC | PM10 | PM2.5 |
|---|---|---|---|---|---|---|
| Boiler No. 1 | 0.17 | 0.17 | 0.56 | 0.08 | 0.08 | 0.08 |
| Boiler No. 2 | 0.17 | 0.17 | 0.56 | 0.08 | 0.08 | 0.08 |
| Cooling Tower | 0.00 | 0.00 | 0.00 | 0.00 | 0.98 | 0.98 |
| Emergency Fire Pump Engine | 0.05 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 |
| HTF Vent | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 |
| Waste Loadout | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 |
| Maintenance Vehicles | 1.94 | 0.00 | 0.61 | 0.15 | 7.54 | 1.65 |
| **Total** | **2.32** | **0.34** | **1.78** | **0.48** | **8.68** | **2.79** |

**Table 20-H Summary of Project Criteria Pollutant Emissions**

| Period | NOx | SOx | CO | VOC | PM10 | PM2.5 |
|---|---|---|---|---|---|---|
| Hourly Emissions (Lbs/Hr) | 3.17 | 0.68 | 4.39 | 7.78 | 6.19 | 2.11 |
| Daily Emissions (Lbs/Day) | 15.92 | 9.50 | 39.05 | 19.75 | 86.11 | 29.30 |
| Annual Emissions (Tons/Yr) | 2.32 | 0.34 | 1.78 | 0.48 | 8.68 | 2.79 |

**Notes:**

Summary of emissions with LPG fired boilers, 1,600 ppm TDS in the cooling water, and 3,000 hours of operation per year for the cooling tower

## Summary of Criteria Pollutant Emissions

**Table 20-I Summary of Hourly Emissions (Lbs/Hr)**

| Source | NOx | SOx | CO | VOC | PM10 | PM2.5 |
|---|---|---|---|---|---|---|
| Boiler No. 1 | 0.33 | 0.01 | 1.13 | 0.16 | 0.15 | 0.15 |
| Boiler No. 2 | 0.33 | 0.01 | 1.13 | 0.16 | 0.15 | 0.15 |
| Cooling Tower | 0.00 | 0.00 | 0.00 | 0.00 | 6.19 | 6.19 |
| Emergency Fire Pump Engine | 1.88 | 0.00 | 1.72 | 0.10 | 0.10 | 0.10 |
| HTF Vent | 0.00 | 0.00 | 0.00 | 0.23 | 0.00 | 0.00 |
| Waste Loadout | 0.00 | 0.00 | 0.00 | 7.07 | 0.00 | 0.00 |
| Maintenance Vehicles | 0.62 | 0.00 | 0.42 | 0.06 | 5.19 | 1.12 |
| **Total** | **3.17** | **0.02** | **4.39** | **7.78** | **11.79** | **7.71** |

**Table 20-J Summary of Daily Emissions (Lbs/Day)**

| Source | NOx | SOx | CO | VOC | PM10 | PM2.5 |
|---|---|---|---|---|---|---|
| Boiler No. 1 | 4.67 | 0.11 | 15.78 | 2.20 | 2.10 | 2.10 |
| Boiler No. 2 | 4.67 | 0.11 | 15.78 | 2.20 | 2.10 | 2.10 |
| Cooling Tower | 0.00 | 0.00 | 0.00 | 0.00 | 99.08 | 99.08 |
| Emergency Fire Pump Engine | 1.88 | 0.00 | 1.72 | 0.10 | 0.10 | 0.10 |
| HTF Vent | 0.00 | 0.00 | 0.00 | 0.47 | 0.00 | 0.00 |
| Waste Loadout | 0.00 | 0.00 | 0.00 | 14.15 | 0.00 | 0.00 |
| Maintenance Vehicles | 4.70 | 0.00 | 5.77 | 0.64 | 72.26 | 15.45 |
| **Total** | **15.92** | **0.24** | **39.05** | **19.75** | **175.64** | **118.83** |

**Table 20-K Summary of Annual Emissions (Tons/Yr)**

| Source | NOx | SOx | CO | VOC | PM10 | PM2.5 |
|---|---|---|---|---|---|---|
| Boiler No. 1 | 0.17 | 0.00 | 0.56 | 0.08 | 0.08 | 0.08 |
| Boiler No. 2 | 0.17 | 0.00 | 0.56 | 0.08 | 0.08 | 0.08 |
| Cooling Tower | 0.00 | 0.00 | 0.00 | 0.00 | 10.22 | 10.22 |
| Emergency Fire Pump Engine | 0.05 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 |
| HTF Vent | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 |
| Waste Loadout | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 |
| Maintenance Vehicles | 1.94 | 0.00 | 0.61 | 0.15 | 7.54 | 1.65 |
| **Total** | **2.32** | **0.01** | **1.78** | **0.48** | **17.91** | **12.02** |

**Table 20-L Summary of Project Criteria Pollutant Emissions**

| Period | NOx | SOx | CO | VOC | PM10 | PM2.5 |
|---|---|---|---|---|---|---|
| Hourly Emissions (Lbs/Hr) | 3.17 | 0.02 | 4.39 | 7.78 | 11.79 | 7.71 |
| Daily Emissions (Lbs/Day) | 15.92 | 0.24 | 39.05 | 19.75 | 175.64 | 118.83 |
| Annual Emissions (Tons/Yr) | 2.32 | 0.01 | 1.78 | 0.48 | 17.91 | 12.02 |

**Notes:**

Summary of emissions with natural gas fired boilers, 166,000 ppm TDS in the cooling water, and 3,000 hours of operation per year for the cooling tower

## Summary of Criteria Pollutant Emissions

**Table 20-M Summary of Hourly Emissions (Lbs/Hr)**

| Source | NOx | SOx | CO | VOC | PM10 | PM2.5 |
|---|---|---|---|---|---|---|
| Boiler No. 1 | 0.33 | 0.34 | 1.13 | 0.16 | 0.15 | 0.15 |
| Boiler No. 2 | 0.33 | 0.34 | 1.13 | 0.16 | 0.15 | 0.15 |
| Cooling Tower | 0.00 | 0.00 | 0.00 | 0.00 | 6.19 | 6.19 |
| Emergency Fire Pump Engine | 1.88 | 0.00 | 1.72 | 0.10 | 0.10 | 0.10 |
| HTF Vent | 0.00 | 0.00 | 0.00 | 0.23 | 0.00 | 0.00 |
| Waste Loadout | 0.00 | 0.00 | 0.00 | 7.07 | 0.00 | 0.00 |
| Maintenance Vehicles | 0.62 | 0.00 | 0.42 | 0.06 | 5.19 | 1.12 |
| **Total** | **3.17** | **0.68** | **4.39** | **7.78** | **11.79** | **7.71** |

**Table 20-N Summary of Daily Emissions (Lbs/Day)**

| Source | NOx | SOx | CO | VOC | PM10 | PM2.5 |
|---|---|---|---|---|---|---|
| Boiler No. 1 | 4.67 | 4.75 | 15.78 | 2.20 | 2.10 | 2.10 |
| Boiler No. 2 | 4.67 | 4.75 | 15.78 | 2.20 | 2.10 | 2.10 |
| Cooling Tower | 0.00 | 0.00 | 0.00 | 0.00 | 99.08 | 99.08 |
| Emergency Fire Pump Engine | 1.88 | 0.00 | 1.72 | 0.10 | 0.10 | 0.10 |
| HTF Vent | 0.00 | 0.00 | 0.00 | 0.47 | 0.00 | 0.00 |
| Waste Loadout | 0.00 | 0.00 | 0.00 | 14.15 | 0.00 | 0.00 |
| Maintenance Vehicles | 4.70 | 0.00 | 5.77 | 0.64 | 72.26 | 15.45 |
| **Total** | **15.92** | **9.50** | **39.05** | **19.75** | **175.64** | **118.83** |

**Table 20-O Summary of Annual Emissions (Tons/Yr)**

| Source | NOx | SOx | CO | VOC | PM10 | PM2.5 |
|---|---|---|---|---|---|---|
| Boiler No. 1 | 0.17 | 0.17 | 0.56 | 0.08 | 0.08 | 0.08 |
| Boiler No. 2 | 0.17 | 0.17 | 0.56 | 0.08 | 0.08 | 0.08 |
| Cooling Tower | 0.00 | 0.00 | 0.00 | 0.00 | 10.22 | 10.22 |
| Emergency Fire Pump Engine | 0.05 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 |
| HTF Vent | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 |
| Waste Loadout | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 |
| Maintenance Vehicles | 1.94 | 0.00 | 0.61 | 0.15 | 7.54 | 1.65 |
| **Total** | **2.32** | **0.34** | **1.78** | **0.48** | **17.91** | **12.02** |

**Table 20-P Summary of Project Criteria Pollutant Emissions**

| Period | NOx | SOx | CO | VOC | PM10 | PM2.5 |
|---|---|---|---|---|---|---|
| Hourly Emissions (Lbs/Hr) | 3.17 | 0.68 | 4.39 | 7.78 | 11.79 | 7.71 |
| Daily Emissions (Lbs/Day) | 15.92 | 9.50 | 39.05 | 19.75 | 175.64 | 118.83 |
| Annual Emissions (Tons/Yr) | 2.32 | 0.34 | 1.78 | 0.48 | 17.91 | 12.02 |

**Notes:**

Summary of emissions with LPG fired boilers, 166,000 ppm TDS in the cooling water, and 3,000 hours of operation per year for the cooling tower

**Table 21**
**Boiler HAP Emission Calculations**

**Table 21 Boiler HAP Emission Calculations**

| Pollutant | Emission Factor | | Boiler No. 1 | | Boiler No. 2 | |
|---|---|---|---|---|---|---|
| | lbs/MMscf | lb/MMBtu | lbs/hr | lbs/yr | lbs/hr | lbs/yr |
| 7,12-Dimethylbenz(a)anthracene | 1.60E-05 | 1.57E-08 | 4.71E-07 | 4.71E-04 | 4.71E-07 | 4.71E-04 |
| Acenaphthene | 1.80E-06 | 1.76E-09 | 5.29E-08 | 5.29E-05 | 5.29E-08 | 5.29E-05 |
| Acenaphthylene | 1.80E-06 | 1.76E-09 | 5.29E-08 | 5.29E-05 | 5.29E-08 | 5.29E-05 |
| Anthracene | 2.40E-06 | 2.35E-09 | 7.06E-08 | 7.06E-05 | 7.06E-08 | 7.06E-05 |
| Benz(a)anthracene | 1.80E-06 | 1.76E-09 | 5.29E-08 | 5.29E-05 | 5.29E-08 | 5.29E-05 |
| Benzene | 2.10E-03 | 2.06E-06 | 6.18E-05 | 6.18E-02 | 6.18E-05 | 6.18E-02 |
| Benzo(a)pyrene | 1.20E-06 | 1.18E-09 | 3.53E-08 | 3.53E-05 | 3.53E-08 | 3.53E-05 |
| Benzo(b)fluoranthene | 1.80E-06 | 1.76E-09 | 5.29E-08 | 5.29E-05 | 5.29E-08 | 5.29E-05 |
| Benzo(g,h,i)perylene | 1.20E-06 | 1.18E-09 | 3.53E-08 | 3.53E-05 | 3.53E-08 | 3.53E-05 |
| Benzo(k)fluoranthene | 1.80E-06 | 1.76E-09 | 5.29E-08 | 5.29E-05 | 5.29E-08 | 5.29E-05 |
| Chrysene | 1.80E-06 | 1.76E-09 | 5.29E-08 | 5.29E-05 | 5.29E-08 | 5.29E-05 |
| Dibenz(a,h)anthracene | 1.20E-06 | 1.18E-09 | 3.53E-08 | 3.53E-05 | 3.53E-08 | 3.53E-05 |
| Dichlorobenzene | 1.20E-03 | 1.18E-06 | 3.53E-05 | 3.53E-02 | 3.53E-05 | 3.53E-02 |
| Fluoranthene | 3.00E-06 | 2.94E-09 | 8.82E-08 | 8.82E-05 | 8.82E-08 | 8.82E-05 |
| Formaldehyde | 7.50E-02 | 7.35E-05 | 2.21E-03 | 2.21E+00 | 2.21E-03 | 2.21E+00 |
| Hexane | 1.80E+00 | 1.76E-03 | 5.29E-02 | 5.29E+01 | 5.29E-02 | 5.29E+01 |
| Indeno(1,2,3-cd)pyrene | 1.80E-06 | 1.76E-09 | 5.29E-08 | 5.29E-05 | 5.29E-08 | 5.29E-05 |
| Naphthalene | 6.10E-04 | 5.98E-07 | 1.79E-05 | 1.79E-02 | 1.79E-05 | 1.79E-02 |
| Phenanthrene | 1.70E-05 | 1.67E-08 | 5.00E-07 | 5.00E-04 | 5.00E-07 | 5.00E-04 |
| Pyrene | 5.00E-06 | 4.90E-09 | 1.47E-07 | 1.47E-04 | 1.47E-07 | 1.47E-04 |
| Toluene | 3.40E-03 | 3.33E-06 | 1.00E-04 | 1.00E-01 | 1.00E-04 | 1.00E-01 |
| **Total** | | | **5.54E-02** | **5.54E+01** | **5.54E-02** | **5.54E+01** |

## Chloroform Annual Total Emissions Calculation

### Table 22 Cooling Tower TAC Emissions

| Item | Value |
|---|---|
| Emission Factor (lb chloroform/lb chlorine added)[a] | 0.0034 |
| Sodium Hypochlorite Solution Use (gal/month) | 2,865 |
| Sodium Hypochlorite Density (lb/gal) | 10 |
| Sodium Hypochlorite Solution Concentration (%) | 12.5% |
| lb Chlorine Equivalent/lb Sodium Hypochlorite | 0.95 |
| Chloroform Emissions (lb/yr) | 138.8 |
| Operating Hours (hrs/yr) | 3,300 |
| Chloroform Emissions (lbs/hr) | 0.042 |

**Notes:**

[a] From: Michael B. Rogozen, Harvey E. Ritch, Michael A. Guttman, Daniel Grosjean and Edwin L. Williams II

Sources and Concentrations of Chloroform Emissions in the South Coast Air Basin, Final Report, prepared by Science Applications International Corporation, Manhattan Beach, CA, for the California Air Resources Board, Sacramento, CA, April 8, 1988. Downloaded from http://www.arb.ca.gov/research/apr/past/statnry.htm#Toxic%20Air%20Contaminants.

Emissions [lb/yr] = Emission factor [lb chloroform/lb chlorine] x
Sodium hypochlorite use [gal/month] x Sodium hypochlorite density [lb/gal] x
Sodium hypochlorite concentration [percent] / 100 x lb Chlorine equivalent/lb Sodium hypochlorite x 12 [months/yr]

**Table 23 HTF Vent HAP Emissions**

| Pollutant | HTF Vent | |
|---|---|---|
| | lbs/hr | lbs/yr |
| Benzene | 2.33E-01 | 169.983 |
| Phenol | 0.00 | 0.00 |
| Biphenyl | 2.33E-05 | 0.017 |
| **Notes:** | | |
| Benzene is 99.99% of total emissions, biphenyl makes up 0.01% and phenol is negligable. | | |

**Table 24**
**Summary of TAC Emissions**

| Pollutant | Boiler No. 1 | | Boiler No. 2 | | Fire Pump Engine | | HTF Vent | | Waste Loadout | | Cooling Tower | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Lbs/Hr | Lbs/Yr | Lbs/Hr | Lbs/Yr | Lbs/Hr | Lbs/Yr | Lbs/Hr | Lbs/Yr | Lbs/Hr | Lbs/Yr | Lbs/Hr | Lbs/Yr | Lbs/Hr | Lbs/Yr |
| 7,12-Dimethylbenz(a)anthracene | 1.57E-08 | 4.71E-07 | 4.71E-04 | 4.71E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 4.71E-04 | 9.41E-07 |
| Acenaphthene | 1.76E-09 | 5.29E-08 | 5.29E-05 | 5.29E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 5.29E-05 | 1.06E-07 |
| Acenaphthylene | 1.76E-09 | 5.29E-08 | 5.29E-05 | 5.29E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 5.29E-05 | 1.06E-07 |
| Acetaldehyde | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Acrolein | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Anthracene | 2.35E-09 | 7.06E-08 | 7.06E-05 | 7.06E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 7.06E-05 | 1.41E-07 |
| Benz(a)anthracene | 1.76E-09 | 5.29E-08 | 5.29E-05 | 5.29E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 5.29E-05 | 1.06E-07 |
| Benzene | 2.06E-06 | 6.18E-05 | 6.18E-02 | 6.18E-05 | 0.00E+00 | 0.00E+00 | 2.33E-01 | 1.70E+02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.95E-01 | 1.70E+02 |
| Benzo(a)pyrene | 1.18E-09 | 3.53E-08 | 3.53E-05 | 3.53E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.53E-05 | 7.06E-08 |
| Benzo(b)fluoranthene | 1.76E-09 | 5.29E-08 | 5.29E-05 | 5.29E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 5.29E-05 | 1.06E-07 |
| Benzo(g,h,i)perylene | 1.18E-09 | 3.53E-08 | 3.53E-05 | 3.53E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.53E-05 | 7.06E-08 |
| Benzo(k)fluoranthene | 1.76E-09 | 5.29E-08 | 5.29E-05 | 5.29E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 5.29E-05 | 1.06E-07 |
| Biphenyl | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.33E-05 | 1.70E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.33E-05 | 1.70E-02 |
| Chrysene | 1.76E-09 | 5.29E-08 | 5.29E-05 | 5.29E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 5.29E-05 | 1.06E-07 |
| Chloroform | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 4.21E-02 | 1.39E+02 | 4.21E-02 | 1.39E+02 |
| Dibenz(a,h)anthracene | 1.18E-09 | 3.53E-08 | 3.53E-05 | 3.53E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.53E-05 | 7.06E-08 |
| Dichlorobenzene | 1.18E-06 | 3.53E-05 | 3.53E-02 | 3.53E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.53E-02 | 7.06E-05 |
| Fluoranthene | 2.94E-09 | 8.82E-08 | 8.82E-05 | 8.82E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 8.82E-05 | 1.76E-07 |
| Fluorene | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Formaldehyde | 7.35E-05 | 2.21E-03 | 2.21E+00 | 2.21E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.21E+00 | 4.41E-03 |
| Hexane | 1.76E-03 | 5.29E-02 | 5.29E+01 | 5.29E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 5.29E+01 | 1.06E-01 |
| Indeno(1,2,3-cd)pyrene | 1.76E-09 | 5.29E-08 | 5.29E-05 | 5.29E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 5.29E-05 | 1.06E-07 |
| Naphthalene | 5.98E-07 | 1.79E-05 | 1.79E-02 | 1.79E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.79E-02 | 3.59E-05 |
| Phenanthrene | 1.67E-08 | 5.00E-07 | 5.00E-04 | 5.00E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 5.00E-04 | 1.00E-06 |
| Phenol | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Pyrene | 4.90E-09 | 1.47E-07 | 1.47E-04 | 1.47E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.47E-04 | 2.94E-07 |
| Toluene | 3.33E-06 | 1.00E-04 | 1.00E-01 | 1.00E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.00E-01 | 2.00E-04 |
| Total PAH | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Xylenes | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Diesel Particulate Matter | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 9.91E-02 | 4.96E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 9.91E-02 | 4.96E+00 |
| **Total** | | | | | | | | | | | | | **5.57E+01** | **3.14E+02** |

**Boiler GHG Pollutant Emission Calculations**

**Table 25-A Natural Gas Reference Data**

| Parameter | Value | Units |
|---|---|---|
| Heater Capacity | 30 | MMBtu/hr |
| Annual Operating Hours | 1,000 | hrs/yr |
| Conversion kg to metric tons | 1,000 | kg/metric ton |

**Table 25-C LPG**

| Parameter | Value | Units |
|---|---|---|
| Heater Capacity | 30 | MMBtu/hr |
| Annual Operating Hours | 1,000 | hrs/yr |
| Conversion lb to metric tons | 2,205 | lbs/ metric ton |
| Heating Value N.G. | 91.5 | MMBtu/1000 gal |

**Table 25-B GHG Emissions for the One Natural Gas Fired Boiler**

| Pollutant | Emission Factor Kg/MMBtu | Emissions metric tons/yr |
|---|---|---|
| $CO_2$ | 5.28E+01 | 1,583 |
| $CH_4$ | 5.90E-03 | 0.177 |
| $N_20$ | 1.00E-04 | 0.003 |
| $CO_2e$ | | 1,588 |

**Notes:**

$CO_2e = CO_2$ emisions + 21 x $CH_4$ emissions + 310 x $N_20$ emissions

**Table 25-D GHG Emissions for the One LPG Fired Boiler**

| Pollutant | Emission Factor Kg/gal | Emission Factor Lb/MMBtu | Emissions metric tons/yr |
|---|---|---|---|
| $CO_2$ | 5.74E+00 | 1.38E+02 | 1,882 |
| $CH_4$ | 2.00E-04 | 4.82E-03 | 0.07 |
| $N_20$ | 1.00E-04 | 2.41E-03 | 0.033 |
| $CO_2e$ | | | 1,894 |

## Emergency Engine GHG Emission Calculations

**Table 26-A Engine Data**

| Source | Horsepower | Daily Hours | Annual Hours |
|---|---|---|---|
| Emergency Fire Pump Engine | 300 | 1 | 50 |

**Table 26-B Reference Data**

| Parameter | Value | Units |
|---|---|---|
| Fuel Consumption | 7,000 | Btu/hp-hr |
| Heating Value Diesel | 137,000 | Btu/gal |
| Density Diesel | 7.2 | lbs/gal |
| Conversion kg to metric tons | 1,000 | kg/metric ton |
| Fuel Use (hourly) | 15.33 | gal/hr |
| Fuel Use (annual) | 766.42 | gal/yr |

**Table 26-C Emergency Fire Pump Engine GHG Emissions**

| Pollutant | Emission Factor kg/gallon | Emissions metric tons/yr |
|---|---|---|
| $CO_2$ | 10.15 | 7.78 |
| $CH_4$ (Industrial) | 0.0003 | 2.30E-04 |
| $N_20$ | 0.0001 | 7.66E-05 |
| $CO_2e$ | | 7.81 |

**Notes:**

$CO_2e = CO_2$ emisions + 21 x $CH_4$ emissions + 310 x $N_20$ emissions

## GHG Emission Summary

**Table 27-A GHG Summary**

| Source | GHG Emissions MT CO2e |
|---|---|
| Boiler 1 Natural Gas | 1588.00 |
| Boiler 2 Natural Gas | 1588.00 |
| Fire Pump Engine | 7.81 |
| Project Total | 3,184 |

**Table 27-B GHG Summary**

| Source | GHG Emissions MT CO2e |
|---|---|
| Boiler 1 LPG | 1,894 |
| Boiler 2 LPG | 1,894 |
| Fire Pump Engine | 7.81 |
| Project Total | 3,795 |

## Propane Delivery Truck Trip Criteria Pollutant Emission Calculations

### Delivery Truck Reference Data

| Vehicle Use | | Propane Delivery | Chemical Delivery | Evaporation Pond Cleanout |
|---|---|---|---|---|
| Vehicle Type | | Water Pull (8000 gallon) CAT | Off-Site Low Boy Trucks | Off-Site Pipe Hauling Trucks |
| Vehicle Class | --- | HHDT-DSL | HHDT-DSL | HHDT-DSL |
| Fuel Type | --- | Diesel | Diesel | Diesel |
| Fuel Consumption | gal/mile | 0.1864 | 0.1864 | 0.1864 |
| Number of Refill Trips | --- | 82 per year | 30 per month | 700 every 3.5 years |
| Destination | | Bakersfield | Bakersfield | Buttonwillow |
| Round Trip Distance | miles/trip | 160 | 160 | 212 |
| Maximum Monthly fuel Use | | | | |
| Maximum Annual Fuel Use | gal/year | 2,445 | 10,735 | 27,658 |
| Total Maximum VMT | miles/day | 160 | 320 | 4,240 |
| | miles/month | 1,120 | 4,800 | 133,560 |
| | miles/year | 13,120 | 57,600 | 148,400 |

### Delivery Truck Criteria Pollutant Emissions

| Trip Type | 2009 Motor Vehicl Emission Factors | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | CO | VOC | Nox | SOx | Exh. PM10 | Fug PM10 | Diesel PM | Exh. PM2.5 | Fug PM2.5 |
| | lb/mi | lb/mi | lb/mi | lb/mi | lb/mi | lb/mi | lb/mi | lb/mi | lb/mi |
| Propane Delivery | 0.01214 | 0.00295 | 0.03890 | 0.00004 | 0.00154 | 0.73855 | 0.00154 | 0.00142 | 0.15659 |
| Chemical Delivery | 0.01214 | 0.00295 | 0.03890 | 0.00004 | 0.00154 | 0.00097 | 0.00154 | 0.00142 | 0.00019 |
| Evaporation Pond Cleanout | 0.01214 | 0.00295 | 0.03890 | 0.00004 | 0.00154 | 0.00097 | 0.00154 | 0.00142 | 0.00019 |
| | | | | | | | | | |
| Trip Type | Daily Emissions | | | | | | | | |
| | CO | VOC | Nox | SOx | Exh. PM10 | Fug PM10 | Diesel PM | Exh. PM2.5 | Fug PM2.5 |
| | lb/day | lb/day | lb/day | lb/day | lb/day | lb/day | lb/day | lb/day | lb/day |
| Propane Delivery | 1.94 | 0.47 | 6.22 | 0.01 | 0.25 | 118.17 | 0.25 | 0.23 | 25.05 |
| Chemical Delivery | 7.77 | 1.89 | 24.89 | 0.03 | 0.98 | 0.62 | 0.98 | 0.91 | 0.12 |
| Evaporation Pond Cleanout | 51.48 | 12.52 | 164.93 | 0.18 | 6.52 | 4.12 | 6.52 | 6.00 | 0.79 |
| **Total** | **61.19** | **14.88** | **196.05** | **0.21** | **7.75** | **122.91** | **7.75** | **7.13** | **25.97** |
| Trip Type | Monthly Emissions | | | | | | | | |
| | CO | VOC | Nox | SOx | Exh. PM10 | Fug PM10 | Diesel PM | Exh. PM2.5 | Fug PM2.5 |
| | lb/month | lb/month | lb/month | lb/month | lb/month | lb/month | lb/month | lb/month | lb/month |
| Propane Delivery | 13.60 | 3.31 | 43.57 | 0.05 | 1.72 | 827.17 | 1.72 | 1.59 | 175.38 |
| Chemical Delivery | 116.56 | 28.34 | 373.42 | 0.40 | 14.77 | 9.32 | 14.77 | 13.59 | 1.80 |
| Evaporation Pond Cleanout | 1621.60 | 394.29 | 5195.23 | 5.55 | 205.48 | 129.73 | 205.48 | 189.04 | 24.99 |
| **Total** | **1,751.8** | **425.9** | **5,612.2** | **6.0** | **222.0** | **966.2** | **222.0** | **204.2** | **202.2** |
| Trip Type | Annual Emissions | | | | | | | | |
| | CO | VOC | Nox | SOx | Exh. PM10 | Fug PM10 | Diesel PM | Exh. PM2.5 | Fug PM2.5 |
| | ton/yr | ton/yr | ton/yr | ton/yr | ton/yr | ton/yr | ton/yr | ton/yr | ton/yr |
| Propane Delivery | 159.29 | 38.73 | 510.34 | 0.55 | 20.18 | 9689.73 | 20.18 | 18.57 | 2054.44 |
| Chemical Delivery | 1398.69 | 340.09 | 4481.06 | 4.79 | 177.23 | 111.90 | 177.23 | 163.05 | 21.55 |
| Evaporation Pond Cleanout | 1801.78 | 438.10 | 5772.48 | 6.17 | 228.31 | 144.14 | 228.31 | 210.04 | 27.77 |
| **Total** | **3359.76** | **816.93** | **10763.89** | **11.51** | **425.72** | **9945.77** | **425.72** | **391.67** | **2103.76** |

**Notes:**

Assumes a maximum of one propane delivery tuck, two chemical delivery trucks, and 20 evaporation pond cleanout trucks in one day

Assumes a maximum of seven propane deliveries in one month

Monthly evporation pond delivery truck emissions assumes clean out occurs at the maximum daily rate everyday for one month; and there are 31 days in month

## Propane Truck Trips GHG Emission Calculations

### Delivery Truck Reference Data

| Vehicle Use | | Propane Delivery | Chemical Delivery | Evaporation Pond Cleanout |
|---|---|---|---|---|
| Vehicle Type | | Water Pull (8000 gallon) CAT | Off-Site Low Boy Trucks | Off-Site Pipe Hauling Trucks |
| Vehicle Class | --- | HHDT-DSL | HHDT-DSL | HHDT-DSL |
| Fuel Type | --- | Diesel | Diesel | Diesel |
| Fuel Consumption | gal/mile | 0.1864 | 0.1864 | 0.1864 |
| Number of Refill Trips | --- | 82 per year | 30 per month | 700 every 3.5 years |
| Destination | | Bakersfield | Bakersfield | Buttonwillow |
| Round Trip Distance | miles/trip | 160 | 160 | 212 |
| Maximum Monthly fuel Use | | | | |
| Maximum Annual Fuel Use | gal/year | 2,445 | 10,735 | 27,658 |
| Total Maximum VMT | miles/day | 160 | 320 | 4,240 |
| | miles/month | 1,120 | 4,800 | 133,560 |
| | miles/year | 13,120 | 57,600 | 148,400 |

### Delivery Truck GHG Emissions

| Pollutant | Emission Factor | Units | Emissions metric ton/yr | | | |
|---|---|---|---|---|---|---|
| | | | Propane Delivery | Chemical Delivery | Evaporation Pond | Delivery Total |
| $CO_2$ | 9.96000 | kg/gallon | 24.35 | 106.92 | 275.47 | **406.75** |
| $CH_4$ | 0.00510 | g/mi | 6.69E-05 | 2.94E-04 | 7.57E-04 | **1.12E-03** |
| $N_20$ | 0.00480 | g/mi | 6.30E-05 | 2.76E-04 | 7.12E-04 | **1.05E-03** |
| $CO_2e$ | --- | --- | 24.38 | 107.01 | 275.71 | **407.09** |