# APPENDIX D
# AIR QUALITY

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**PXP PHASE IV EIR**
**CONSTRUCTION EMISSIONS**

| | Equipment | Load Factor (%) | BHP | Emission Factors (lb/BHP-hr) NOx | ROG | PM10 | CO2 | Hours per day | Emissions (lb/day) NOx | ROG | PM10 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Construction Equipment | Motor grader | 61 | 175 | 0.021 | 0.003 | 0.001 | 1.15 | 6 | 13.5 | 1.9 | 0.6 | 736.6 |
| | Backhoe | 55 | 85 | 0.023 | 0.002 | 0.0015 | 1.15 | 6 | 6.5 | 0.6 | 0.4 | 322.6 |
| | Hydrocrane F-750 | 43 | 260 | 0.023 | 0.003 | 0.0015 | 1.15 | 4 | 10.3 | 1.3 | 0.7 | 514.3 |
| | Manlift 40LF | 59 | 210 | 0.023 | 0.002 | 0.001 | 1.15 | 4 | 11.4 | 1.0 | 0.5 | 569.9 |
| | 28-ton hydrocrane RT | 43 | 260 | 0.023 | 0.002 | 0.0015 | 1.15 | 4 | 10.3 | 0.9 | 0.7 | 514.3 |
| | 100-ton Hydrocrane | 43 | 280 | 0.023 | 0.002 | 0.0015 | 1.15 | 4 | 11.1 | 1.0 | 0.7 | 553.8 |
| | 210-Ton Hydrocrane | 43 | 290 | 0.023 | 0.002 | 0.0015 | 1.15 | 4 | 11.5 | 1.0 | 0.7 | 573.6 |
| | D9 Dozer | 59 | 320 | 0.021 | 0.002 | 0.005 | 1.15 | 6 | 23.8 | 2.3 | 5.7 | 1302.7 |
| | Concrete Mixer Truck | 43 | 320 | 0.021 | 0.002 | 0.005 | 1.15 | 2 | 5.8 | 0.6 | 1.4 | 316.5 |
| | 980 Loader | 21 | 195 | 0.023 | 0.002 | 0.0015 | 1.15 | 6 | 5.7 | 0.5 | 0.4 | 282.6 |
| | Compactor 54" drum | 59 | 100 | 0.023 | 0.002 | 0.0015 | 1.15 | 4 | 5.4 | 0.5 | 0.4 | 271.4 |
| | Air Compressor 185 | 43 | 100 | 0.018 | 0.002 | 0.001 | 1.15 | 8 | 6.2 | 0.7 | 0.3 | 395.6 |
| | Welding Rig | 21 | 205 | 0.023 | 0.002 | 0.001 | 1.15 | 4 | 4.0 | 0.3 | 0.2 | 198.0 |
| | Welding Machine | 45 | 110 | 0.018 | 0.002 | 0.001 | 1.15 | 4 | 3.6 | 0.4 | 0.2 | 227.7 |
| **SUM** | | | | | | | | | **128.8** | **12.9** | **12.8** | **6779.6** |

**Notes:**
Emissions SUM are per ***piece*** of equipment per ***day***
B5 through B18 uses emissions factors for a similar horsepower pieces of equipment
All cranes use emissions factors based on average horsepower
Load factors and emission factors for other equipment were taken from Nonroad Engine and Vehicle Emission Study (EPA, 1991).
Other load factors are averages based on composite load factors taken from Median Life, Annual Activity, and Load-Factor Values for Nonroad Emissions Modeling (EPA, 2004)
NOx emission factors for portable engines are taken from the standards for the Statewide Registration Program
N2O and CH4 emission factors from "California's Greenhouse Gas Inventory", converted to g/BHP-hr
Estimates presented are *worst-case* scenario without mitigation.

| Equipment | Quantity | Pounds per day NOx | ROG | PM10 | CO2 | Tons per quarter (66 work days) NOx | ROG | PM10 | CO2 | Total Tons (180 work days) NOx | ROG | PM10 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Motor grader | 1 | 13.5 | 1.9 | 0.6 | 736.6 | 0.4 | 0.1 | 0.0 | 24.3 | 1.2 | 0.2 | 0.1 | 66.3 |
| Backhoe | 2 | 12.9 | 1.1 | 0.8 | 645.2 | 0.4 | 0.0 | 0.0 | 21.3 | 1.2 | 0.1 | 0.1 | 58.1 |
| Hydrocrane F-750 | 4 | 41.1 | 5.4 | 2.7 | 2057.1 | 1.4 | 0.2 | 0.1 | 67.9 | 3.7 | 0.5 | 0.2 | 185.1 |
| Manlift 40LF | 4 | 45.6 | 4.0 | 2.0 | 2279.8 | 1.5 | 0.1 | 0.1 | 75.2 | 4.1 | 0.4 | 0.2 | 205.2 |
| 28-ton hydrocrane RT | 1 | 10.3 | 0.9 | 0.7 | 514.3 | 0.3 | 0.0 | 0.0 | 17.0 | 0.9 | 0.1 | 0.1 | 46.3 |
| 100-ton Hydrocrane | 1 | 11.1 | 1.0 | 0.7 | 553.8 | 0.4 | 0.0 | 0.0 | 18.3 | 1.0 | 0.1 | 0.1 | 49.8 |
| 210-Ton Hydrocrane | 1 | 11.5 | 1.0 | 0.7 | 573.6 | 0.4 | 0.0 | 0.0 | 18.9 | 1.0 | 0.1 | 0.1 | 51.6 |
| D9 Dozer | 2 | 47.6 | 4.5 | 11.3 | 2605.4 | 1.6 | 0.1 | 0.4 | 86.0 | 4.3 | 0.4 | 1.0 | 234.5 |
| Concrete Mixer Truck | 3 | 17.3 | 1.7 | 4.1 | 949.4 | 0.6 | 0.1 | 0.1 | 31.3 | 1.6 | 0.1 | 0.4 | 85.4 |
| 980 Loader | 1 | 5.7 | 0.5 | 0.4 | 282.6 | 0.2 | 0.0 | 0.0 | 9.3 | 0.5 | 0.0 | 0.0 | 25.4 |
| Compactor 54" drum | 1 | 5.4 | 0.5 | 0.4 | 271.4 | 0.2 | 0.0 | 0.0 | 9.0 | 0.5 | 0.0 | 0.0 | 24.4 |
| Air Compressor 185 | 2 | 12.4 | 1.4 | 0.7 | 791.2 | 0.4 | 0.0 | 0.0 | 26.1 | 1.1 | 0.1 | 0.1 | 71.2 |
| Welding Rig | 10 | 39.6 | 3.4 | 1.7 | 1980.3 | 1.3 | 0.1 | 0.1 | 65.3 | 3.6 | 0.3 | 0.2 | 178.2 |
| Welding Machine | 10 | 35.6 | 4.0 | 2.0 | 2277.0 | 1.2 | 0.1 | 0.1 | 75.1 | 3.2 | 0.4 | 0.2 | 204.9 |
| **Totals** | | **309.6** | **31.2** | **28.9** | **16517.7** | **10.2** | **1.0** | **1.0** | **545.1** | **27.9** | **2.8** | **2.6** | **1486.6** |

| Equipment | Quantity | Load Factor | BHP | Hours/day | Pounds per day N2O | CH4 | Total tons N2O | CH4 |
|---|---|---|---|---|---|---|---|---|
| Motor grader | 1 | 61 | 175 | 6 | 0.0055 | 0.0417 | 0.0005 | 0.0037 |
| Backhoe | 2 | 55 | 85 | 6 | 0.0048 | 0.0365 | 0.0004 | 0.0033 |
| Hydrocrane F-750 | 4 | 43 | 260 | 4 | 0.0154 | 0.1163 | 0.0014 | 0.0105 |
| Manlift 40LF | 4 | 59 | 210 | 4 | 0.0170 | 0.1289 | 0.0015 | 0.0116 |
| 28-ton hydrocrane RT | 1 | 43 | 260 | 4 | 0.0038 | 0.0291 | 0.0003 | 0.0026 |
| 100-ton Hydrocrane | 1 | 43 | 280 | 4 | 0.0041 | 0.0313 | 0.0004 | 0.0028 |
| 210-Ton Hydrocrane | 1 | 43 | 290 | 4 | 0.0043 | 0.0324 | 0.0004 | 0.0029 |
| D9 Dozer | 2 | 59 | 320 | 6 | 0.0195 | 0.1473 | 0.0018 | 0.0133 |
| Concrete Mixer Truck | 3 | 43 | 320 | 2 | 0.0071 | 0.0537 | 0.0006 | 0.0048 |
| 980 Loader | 1 | 21 | 195 | 6 | 0.0021 | 0.0160 | 0.0002 | 0.0014 |
| Compactor 54" drum | 1 | 59 | 100 | 4 | 0.0020 | 0.0153 | 0.0002 | 0.0014 |
| Air Compressor 185 | 2 | 43 | 100 | 8 | 0.0059 | 0.0447 | 0.0005 | 0.0040 |
| Welding Rig | 10 | 21 | 205 | 4 | 0.0148 | 0.1120 | 0.0013 | 0.0101 |
| Welding Machine | 10 | 45 | 110 | 4 | 0.0170 | 0.1288 | 0.0015 | 0.0116 |
| **Totals** | | | | | 0.1235 | 0.9341 | 0.0111 | 0.0841 |

**On-road vehicle types for RO Water Treatment Plant: Emissions per day**

**ON-ROAD SOURCES**

| | | | NOX | | ROC | | | | | | CO | | CO2 | PM10 | | | | SOX | | Emissions (lbs/day) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Vehicle Class | Number | VMT | Run Exhaust (g/mi) | Start-Up (g/st) | Run Exhaust (g/mi) | Start-Up (g/st) | Hot-Soak (g/trip) | Rest Loss (g/hr) | Run Evap (g/hr) | Diurnal Evap (g/hr) | Run Exhaust (g/mi) | Start-Up (g/st) | Run Exhaust (g/mi) | Run Exhaust (g/mi) | Start-Up (g/st) | Tire Wear (g/mi) | Brake Wear (g/mi) | Run Exhaust (g/mi) | Start-Up (g/st) | NOX | ROC | CO | CO2 | PM10 | SOX |
| LDA-CAT | 20 | 10 | 0.273 | 0.534 | 0.148 | 1.497 | 0.261 | 0.115 | 3.18 | 0.263 | 4.661 | 15.203 | 456 | 0.009 | 0.014 | 0.008 | 0.013 | 0.004 | 0.003 | 0.17 | 0.23 | 3.44 | 201.06 | 0.01 | 0.00 |
| HHD-Dsl | 0 | 0 | 8.37 | | 0.535 | | | | | | 1.938 | | | 0.229 | | 0.036 | 0.013 | 0.021 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| LHD1-DSL | 3 | 10 | 6.375 | | 0.266 | | | | | | 1.535 | | 1505 | 0.252 | | 0.012 | 0.013 | 0.014 | | 0.43 | 0.02 | 0.10 | 99.54 | 0.02 | 0.00 |
| | | | | | | | | | | | | | | | | | | | lbs/day | 0.60 | 0.25 | 3.54 | 300.60 | 0.03 | 0.00 |
| | | | | | | | | | | | | | | | | | | | tons/yr | 0.1 | 0.0 | 0.3 | 27.1 | 0.0 | 0.0 |

Assumptions:

Onroad emissions factors and mpg from EMFAC 2002, Summer 2008, 85 degrees F, 60% RH

Assumes startup after 12 hours
Vehicle speed = 35 mph

VMT assumes 10 miles round trip each day (from either Pismo Beach or San Luis Obispo) and quantity of vehicles at worst-case scenario
20 min hot soak per trip
15 min rest each trip
45 minute run time total
Light Duty Truck (LDT) assumes all fuel types
Heavy-Duty Truck (HHD) assumes diesel fuel
Medium Heavy Duty Truck (MHD) assumes diesel fuel
180 work days total
CH4 & N2O emission factors from "California's Greenhouse Gas Inventory" (www.arb.ca.gov/cc/ccei/inventory/docs)

| Class | mi/gal | miles/day | Total miles | Total gallons | N2O g/gal | CH4 g/gal | N2O tons | CH4 Tons |
|---|---|---|---|---|---|---|---|---|
| LDT-CAT | 18.97 | 200 | 36000 | 1898 | 0.075 | 0.375 | 0.0002 | 0.0008 |
| HDD-DSL | 4.65 | 0 | 0 | 0 | 0.255 | 0.574 | 0.0000 | 0.0000 |
| MHD-DSL | 6.7 | 30 | 5400 | 806 | 0.255 | 0.574 | 0.0002 | 0.0005 |

# Health Risk Assessment – DRAFT REPORT
# PXP Arroyo Grande Oil Field, Phase IV Development

Based on the Protocol approved by the San Luis Obispo County APCD (Paul Reitz, November 2007).

Date: December 28th, 2007.
Prepared by: Interact PMTI (contact: Uliana Micovic, 805-218-4774 cell, email: umicovic@interactpmti.com).

## *1. Introduction*

PXP proposes Phase IV operations at the Arroyo Grande Oil Field Facility as per the Project Description (Padre 2006). The current Health Risk Assessment (HRA) has been prepared to address the baseline and proposed operations.

## *2. Current Operations and Project Description*

### Current Operations

Arroyo Grande Oil Field produces oil and gas, separates water, gas and oil into three separate phases, treats oil and gas, and sells oil and gas. Producing wells are stimulated by injecting steam into injection wells. Six steam generators produce steam for oil stimulation. The steam generators are fuelled with utility natural gas, gas produced by the facility and/or landfill gas. Currently four existing steam generators (A-1, A-3, A-5 and A-6) are used at various loads. Generators A-2 and A-4 are not currently used.

The facility has a tank battery to store and ship oil to buyers. All tanks are fixed roof tanks with emissions controlled through a closed vapor control system with 95% efficiency. Currently, tanks Nos. 10435, 10436, 10398, and 10399, are in operation. The oil loading is also controlled through the same vapor control system. Current oil throughput is approximately 24,500,000 gallons per year, 1,400 – 1,800 barrels per day on average.

A portion of electricity to the facility is supplied from a Cogeneration unit that includes a turbine operated on natural gas.

The facility's fugitive emissions that also include emissions from the producing wells and connecting lines are controlled with an ongoing Leak Inspection and Maintenance program.

The facility also has two heater treaters (4 and 6 MMBtu/hr rating) that currently do not consume fuel, but are designed to combust natural gas.

The facility operates a gas plant that treats the produced gas so it can be combusted in the facility's equipment. The gas plant emissions are fugitive ROC from various piping components, such as flanges, connectors, valves and compressor seals.

### Proposed Operations

PXP proposes to drill 95 new producing wells, and produce enough steam to stimulate oil production. To achieve higher steam production, PXP proposes to install three new steam generators, 85 MMBtu/hr each. As the most conservative assumption, it is assumed that all three

steam generators will be used at 100% load, although in reality the steam generators will need to be taken offline for maintenance, and their use will fluctuate.

As the most conservative assumption, it was also assumed that the existing six steam generators will be used at 100% load (A-1 through A-6). The existing 4 MMBtu/hr heater treater will be removed. A new 8 MMBtu/hr heater with two burners – 4 MMBtu/hr each – will be installed as replacement for the 4 MMBtu/hr heater treater. The existing 6 MMBtu/hr heater treater will be on stand by, and will only be used during maintenance of the main heater treater.

Oil throughput through the existing tanks and loading racks will be up to 76,650,000 gallons per year (1,825,000 bbl/year), 5,000 barrels per day (bbls/day) of oil. It is assumed that the oil will be evenly distributed through each of the facility eight storage tanks at approx. 228,000 bbls/year. (Tanks Nos. 10397, 10433, 10434 and 10401 would be operational in addition to the currently used tanks listed in the previous section).

Fugitive emissions through the oil/liquid components and the Gas Plant (gas phase) components will stay the same as currently occurring, because no additional components or other equipment with fugitive components will be installed.

As the most conservative approach, it is assumed that for the proposed project, the existing turbine/cogen will be operating at 100% load; currently it operates at approximately 83-86%. Solvent use is assumed to double during the project.

PXP proposes to install a water treatment plant that will treat produced water to the requirements that would allow the water to be discharged into the environment. The proposed water treatment plant will produce 20,000 bbls/day of treated water. The HAPs emissions sources of the water treatment facility would be three air strippers designed to remove the residual organic components and ammonia from the treated water.

Current (Baseline) and Project emission sources and their parameters used in the HRA are identified in Table 1.

## *3. Models and Software Used*

The HRA has been prepared according to "*The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* (OEHHA, August 2003). The HRA has been prepared using the most recent version of the California Air Resources Board (CARB) Hotspots Analysis and Reporting Program (HARP version 1.3) software.

Cancer and non-cancer (acute and chronic) health impacts have been estimated using the new risk assessment guidelines developed by the Office of Environmental Health Hazard Assessment (OEHHA).

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## Table 1. Emission Sources Parameters

| HARP Source ID | Source Name | UTM E (m) | UTM N (m) | X Length (m) | Y Length (m) | Stack Height (m) | Eleva-tion (ft) | Stack Diam. (m) | Stack Diam. (ft) | T (K) | Exhaust Velocity (m/s) | Exhaust Velocity (ft/min) | Oper. Schedule |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1001 | Generator A-1 | 716515 | 3896230 | | | 10.4 | 233.4 | 0.9 | 3.0 | 464.6 | 11.70 | 2303.1 | 24/7 |
| 1002 | Generator A-2 | 716514 | 3896234 | | | 10.4 | 233.8 | 0.9 | 3.0 | 464.6 | 11.70 | 2303.1 | 24/7 |
| 1003 | Generator A-3 | 716513 | 3896238 | | | 10.4 | 234.5 | 0.9 | 3.0 | 464.6 | 11.70 | 2303.1 | 24/7 |
| 1004 | Generator A-4 | 716890 | 3895690 | | | 10.4 | 132 | 0.9 | 3.0 | 464.6 | 11.70 | 2303.1 | 24/7 |
| 1005 | Generator A-5 | 716892 | 3895692 | | | 10.4 | 132.7 | 0.9 | 3.0 | 464.6 | 11.70 | 2303.1 | 24/7 |
| 1006 | Generator A-6 | 716892 | 3895694 | | | 10.4 | 133.1 | 0.9 | 3.0 | 464.6 | 11.70 | 2303.1 | 24/7 |
| **1017*** | Generator A-7 | 716894 | 3895694 | | | 10.4 | 133.3 | 0.9 | 3.0 | 464.6 | 11.70 | 2303.1 | 24/7 |
| **1018*** | Generator A-8 | 716896 | 3895694 | | | 10.4 | 133.5 | 0.9 | 3.0 | 464.6 | 11.70 | 2303.1 | 24/7 |
| **1019*** | Generator A-9 | 716518 | 3896240 | | | 10.4 | 233.2 | 0.9 | 3.0 | 464.6 | 11.70 | 2303.1 | 24/7 |
| 1020 | Turbine | 716860 | 3896107 | | | 12.2 | 153 | 1.52 | 5.0 | 532.9 | 15.53 | 3057.1 | 24/7 |
| **1030*** | Heater, Stack 1 | 716544 | 3896175 | | | 5.49 | 224.6 | 0.76 | 2.5 | 449.8 | 1.04 | 204.0 | 24/7 |
| **1031*** | Heater, Stack 2 | 716544 | 3896176 | | | 5.49 | 224.5 | 0.76 | 2.5 | 449.8 | 1.04 | 204.0 | 24/7 |
| **1060*** | Air Stripper 1 | 716354 | 3896365 | | | 9.14 | 282.2 | 3.66 | 12.0 | 305.4 | 3.37 | 663.1 | 24/7 |
| **1061*** | Air Stripper 2 | 716352 | 3896365 | | | 9.14 | 282.9 | 3.66 | 12.0 | 305.4 | 3.37 | 663.1 | 24/7 |
| **1062*** | Air Stripper 3 | 716350 | 3896365 | | | 9.14 | 283.5 | 3.66 | 12.0 | 305.4 | 3.37 | 663.1 | 24/7 |
| **2001*** | New Wells | 716973 | 3896449 | 1000 | 1000 | | 177.1 | | | | | | 24/7 |
| 2020 | Existing Fugitives | 716973 | 3896449 | 1000 | 1000 | | 177.1 | | | | | | 24/7 |
| 2030 | Gas Plant | 716440 | 3896485 | 100 | 100 | | 289 | | | | | | 24/7 |
| 3000 | Solvent Use | 716973 | 3896449 | 1000 | 1000 | | 177.1 | | | | | | 24/7 |
| 3050 | Tanks | 716600 | 3896170 | 100 | 100 | 6.01 | 211.7 | | | | | | 24/7 |
| 3060 | Loading Racks | 716700 | 3896170 | 100 | 100 | | 189.5 | | | | | | 2/5 |

* Denotes the emission new sources introduced with the proposed project.

## *4. Data Sources*

**The facility boundaries** have been obtained from a survey prepared by a licensed surveyor from Engineering Development Associates (EDA) and converted from State Plane (California) Coordinates to UTM NAD83 (HARP default).

. The emission sources are identified in Table 1. The existing sources include six steam generators, four storage tanks, oil loading racks, solvent use, turbine/cogen, gas plant and other fugitives sources. The proposed sources include 95 new wells and associated connection lines, three new steam generators, a new/replacement heater treater with two burners/stacks, and three air stripper towers for the proposed water reclamation plant. The proposed sources ID's are marked with an asterisk. Several existing sources currently offline will be put in operation for the proposed project: four storage tanks, and two currently idle steam generators.

**The equipment coordinates** have been estimated using the surveyed boundary coordinates, area maps, aerial photos, and facility maps. The coordinates have been verified using Wikimapia.org software, and confirmed with the operator. Facility solvents' use and fugitive emissions, including emissions from wells were assigned the coordinates of the facility center, because these emissions occur throughout the whole oil lease.

**The current (baseline) facility equipment lists and emissions** have been assembled from the SLO County APCD emissions inventories for 2005 and 2006, gas analysis results, and review of the existing equipment permits to operate.

Emissions from the storage tanks and from truck loading were estimated using a different True Vapor Pressure (TVP) than was used in the 2005 and 2006 emission inventories (see Appendix B for the TVP laboratory results). The TVP analysis for the Arroyo Grande oil was performed in December 2007 to get a more current TVP value. The obtained TVP is 0.432 psia at 165 F. The TVP that has been used for reporting purposes until 2006 was obtained in 1995 (TVP = 8.78 psia). However, the December 2007 TVP result is more representative of the heavy crude oil produced from the Arroyo Grande Oil Field (API gravity = 14.1, see December 2007 Lab Analysis, Appendix B), and thus it was used for the tanks and truck loading emissions estimates.

Storage Tanks' head space vapors were analyzed for VOCs in December 2007 (see Appendix B). These concentrations were used to determine HAPs emissions from tanks and truck loading, multiplying the HAPs weight ratio by the TOC emissions from the tanks and loading.

TOC emissions from the storage tanks were estimated using the spreadsheet provided by the SLO County APCD. TOC emissions from loading were estimated using the AP-42 method, page 5.2-4 (see Table 2 below).

**The proposed project equipment lists and parameters** have been assembled using the proposed equipment information obtained from PXP. **The proposed project equipment emissions** have been estimated based on the predicted worst case fuel use, and based on the equipment emission factors approved by the APCD (see below).

**Hazardous Air Pollutants (HAPs) emission factors** have been obtained from the reference documents listed in Table 2. Emissions sources or calculation methods are also listed in Table 2. The HAPs emission factors are listed in Table 3.

**Water Reclamation Plant HAPs emissions** occur only from the air strippers, which are open to the atmosphere. All other equipment of the proposed water reclamation plant is closed to the atmosphere. PXP conducted a pilot test for the proposed facility and analyzed water quality after various water treatment stages. The air strippers would be located downstream of the 1st Stage Reverse Osmosis (RO) treatment. It was conservatively assumed that 100% VOCs and ammonia are removed from the water via air stripers, thus all VOCs and ammonia found in the 1st Stage RO treatment permeate was assumed to be emitted through the air strippers. The laboratory analysis or the water that has passed through the 1st Stage RO is contained in Appendix D.

### Table 2. Information Sources of HAPs Emission Factors

| Equipment | Source and Assumptions | Emission Factor Calculation or Source |
|---|---|---|
| **Turbine/Cogen** | US EPA AP-42 Emission Factors for natural gas fired turbines, Table 3.1-3 (April 2000). | **Fuel use x EF =**<br>**= MMscf/hr x lb/MMscf =**<br>**= lb HAPs/hr** |
| **Steam Generators and Heater Treater** | VC APCD AB 2588 Combustion Emission Factors datasheet - natural gas fired external combustion equipment:<br>10 – 100 MMBtu/hr for steam generators;<br>& < 10 MMBtu/hr for heater treater. | **Fuel use x EF =**<br>**= MMscf/hr x lb/MMscf =**<br>**= lb HAPs/hr** |
| **Fugitive Components including Gas Plant, & new wells** | CARB, VOC Species Profile, Table II, Profile 316, "Refinery – Pipes, Valves & Flanges – Composite". | VOC emissions from the Annual Emissions Inventory (AEI) and estimates for the new wells components:<br>**VOC lbs/year x HAP weight fraction in VOCs= lbs HAP/year** |
| **Oil Shipping Tanks** | Oil TVP analysis at 165 ºF – see attached (December 2007, Appendix B), TVP=0.432 psia.<br><br>TVP of 0.5 is conservatively used for calculations. RVP of 0.14 psia is adjusted per the APCD spreadsheet, App. C.<br><br>It is assumed that the project throughput of 76,650,000 gals/year (1,825,000 bbls/yr) will be equally distributed through all the facility storage tanks (approx. 228,000 bbls/year per each tank). | VOC emissions depending on throughput calculated using the spreadsheet provided by the SLO County APCD for tank emissions and EFs (see Appendix C).<br><br>HAPs emission factors for the tanks truck loading were derived from the analysis of the tank head space gas (see attached lab report). The obtained HAPs concentrations were used in conjunction with the estimated TOC emissions from the tanks.<br><br>**HAP Emissions = TOC x HAPs weight ratio in tank head space.** |
| **Solvents** | MSDS of a generic material | VOC emissions from the AEI |

| | | |
|---|---|---|
| **Tanker-truck Loading Operations** | Oil TVP analysis at 165 ºF – see Appendix B, TVP=0.432 psia.<br><br>TVP of 0.5 psia was conservatively used for calculations.<br><br>HAPs in the vapor phase of the loaded oil is assumed to be the same as in the shipping tank head space. Analysis of shipping/stock tank head space for volatiles is given in Appendix B.<br><br>VOC emissions depending on throughput, calculated using the APCD-provided spreadsheet, based on AP-42, page 5.2-4 method for tanker trucks loading. | **Loading TOC EF =**<br>**= CF x 12.46 x (S x TVP x MW) / T**<br><br>where, S – 1.0 (loading code, per AP-42);<br>TVP – true vapor pressure = 0.5 psia;<br>MW – 50 lb/lb-mole;<br>T – temperature of bulk loaded liquid, R = (F+460);<br>CF – control factor (at 95% emissions control, CF = 0.05);<br><br>**Loading TOC EF =**<br>**= 0.05 x 12.46 x (1 x 0.5 x 50) / (162+460) =**<br>**= 0.025**<br><br>**HAP Emissions = TOC x HAPs weight ratio in tank head space.** |
| **Air Strippers** | It is assumed that all the HAPs contained in the water entering air strippers will be stripped and emitted into the atmosphere. Total emissions were divided by three (3) to account for the emissions distribution between the three proposed air strippers. | Emissions were calculated using HAPs concentrations measured during the Water Treatment Facility Pilot test (see attached lab analysis – Appendix D) multiplied by 20,000 bbls/day, which is the proposed Water Treatment Facility production capacity. |

MMscf – million standard cubic feet; lb – pound; bbls/day – barrels per day; MMBtu – million British thermal units;
EF – emission factor; AEI – Annual Emissions Inventory; TVP – True Vapor Pressure; RVP – Reid Vapor Pressure.
VC APCD – Ventura County Air Pollution Control District; CARB – California Air Resources Board.

The HAPs emission summaries are given for each source: maximum hourly, and average annual emissions in Tables 4, 5, 6 and 7 below.

**Location-specific Digital Elevation Model (DEM) data sets** were used for dispersion modeling: arroyo_grande_ne_ca.dem and pismo_beach_ca.dem, obtained from USGS.

**Meteorology.** Per the discussion with the SLO County APCD (telephone conversation with Paul Reitz, November 2, 2007), the worst-case meteorological dataset (HARP screening meteorology) was used as a first approximation. Default HARP averaging time conversion factors were used.

| | | | |
|---|---|---|---|
| Benzene | 71432 | 1.50 | na |
| 2-butanone (MEK) | 78933 | 590.00 | na |
| Naphthalene | 91203 | 9.40 | na |
| Ethyl Benzene | 100414 | 0.79 | na |
| Toluene | 108883 | 0.67 | na |
| Chlorobenzene | 108907 | 2.20 | na |
| Ammonia, mg/L **** | 7664417 | 15.00 mg/L | na |
| **Tanks and Truck Loading** | **CAS** | **TOC Weight Fraction** | |
| Xylenes | 1210 | 5.48E-07 | na |
| Benzene | 71432 | 1.31E-05 | na |
| Toluene | 108883 | 8.49E-07 | na |
| Ethylbenzene | 100414 | 2.38E-06 | na |
| Toluene | 108883 | 5.48E-07 | na |
| $H_2S$ | 7783064 | 8.09E-03 | na |

na – not applicable; µg/L – micrograms per liter; MMBtu – million British Thermal Units; MMscf – million standard cubic feet.
* For Heater Treater and Steam Generators these emission factors (lbs/MMBtu) are calculated from the original emission factors by dividing over 1020 (Btu/scf). The original factors are contained in the VC APCD AB 2588 Combustion Emission Factors: http://www.vcapcd.org/pubs/Engineering/AirToxics/combem.pdf.
** These factors are from the VC APCD AB 2588 Combustion Emission Factors: http://www.vcapcd.org/pubs/Engineering/AirToxics/combem.pdf.
*** These factors are from the AP-42,Volume I, Chapter 3, Stationary Internal Combustion Sources: http://www.epa.gov/ttn/chief/ap42/ch03/index.html.
**** HAPs concentrations before the air strippers (source: pilot test, see attached lab reports for the RO Permeate [ROP]) are in micrograms per liter for organics, and in milligrams per liter (mg/L) for ammonia.

**Table 4. HAPs Emissions – Baseline, Maximum Hour, lbs/hour**

| | PAHs-w/ | Xylenes | Formaldehyde | Benzene | Acetaldehyde | Ethyl Benzene | Acrolein | Toluene | Hexane | Propylene | MEK |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Generator A-1 | 1.96E-05 | 9.66E-04 | 6.03E-04 | 2.84E-04 | 1.52E-04 | 3.38E-04 | 1.32E-04 | 1.30E-03 | 2.26E-04 | 2.60E-02 | |
| Generator A-2** | | | | | | | | | | | |
| Generator A-3 | 1.96E-05 | 9.66E-04 | 6.03E-04 | 2.84E-04 | 1.52E-04 | 3.38E-04 | 1.32E-04 | 1.30E-03 | 2.26E-04 | 2.60E-02 | |
| Generator A-4** | | | | | | | | | | | |
| Generator A-5 | 1.96E-05 | 9.66E-04 | 6.03E-04 | 2.84E-04 | 1.52E-04 | 3.38E-04 | 1.32E-04 | 1.30E-03 | 2.26E-04 | 2.60E-02 | |
| Generator A-6 | 1.18E-05 | 5.79E-04 | 3.62E-04 | 1.71E-04 | 9.12E-05 | 2.03E-04 | 7.94E-05 | 7.79E-04 | 1.35E-04 | 1.56E-02 | |
| Turbine | | 1.33E-03 | 1.47E-02 | 2.48E-04 | 8.28E-04 | 6.62E-04 | 1.33E-04 | 2.69E-03 | | | |
| Heater, Stack 1* | | | | | | | | | | | |
| Heater, Stack 2* | | | | | | | | | | | |
| Existing Fugitives | | 2.03E-04 | | 1.01E-04 | | | | 5.07E-04 | 3.45E-03 | 1.01E-04 | |
| Gas Plant | | 3.25E-04 | | 1.63E-04 | | | | 8.13E-04 | 5.53E-03 | 1.63E-04 | |
| Solvent Use | | 6.79E-04 | | 1.36E-04 | | | | | | | |
| Tanks | | 2.25E-08 | | 5.39E-07 | | 3.49E-08 | | 9.77E-08 | | | |
| Loading Racks | | 3.84E-08 | | 9.17E-07 | | 5.95E-08 | | 1.66E-07 | | | |
| **TOTAL** | **7.06E-05** | **6.01E-03** | **1.69E-02** | **1.67E-03** | **1.38E-03** | **1.88E-03** | **6.09E-04** | **8.69E-03** | **9.79E-03** | **9.38E-02** | **0.00E+00** |

* Heater Treater does not currently burn fuel.
** Steam Generators A-2 and A-4 currently do not operate.
PAH w/ – polyaromatic hydrocarbons with individual components.

**Table 4 (cont.). HAPs Emissions – Baseline, Maximum Hour, lbs/hour**

| | Naphtha-lene | Chloro-benzene | Ammonia, NH3 | Cyclo-hexane | H2S | Methanol | PAHs-w/o | Propylene Oxide | 1,3-Butadiene |
|---|---|---|---|---|---|---|---|---|---|
| Generator A-1 | | | | | | | | | |
| Generator A-2** | | | | | | | | | |
| Generator A-3 | | | | | | | | | |
| Generator A-4** | | | | | | | | | |
| Generator A-5 | | | | | | | | | |
| Generator A-6 | | | | | | | | | |
| Turbine | 2.69E-05 | | | | | | 4.55E-05 | 6.00E-04 | 8.90E-06 |
| Heater, Stack 1* | | | | | | | | | |
| Heater, Stack 2* | | | | | | | | | |
| Existing Fugitives | | | | 1.01E-04 | 2.73E-03 | | | | |
| Gas Plant | | | | 1.63E-04 | 4.39E-03 | | | | |
| Solvent Use | | | | | | 2.74E-04 | | | |
| Tanks | | | | | 3.33E-04 | | | | |
| Loading Racks | | | | | 5.67E-04 | | | | |
| **TOTAL** | **2.69E-05** | **0.00E+00** | **0.00E+00** | **2.64E-04** | **8.02E-03** | **2.74E-04** | **4.55E-05** | **6.00E-04** | **8.90E-06** |

* Heater Treater does not currently burn fuel.
** Steam Generators A-2 and A-4 do not currently operate.
PAH w/o – polyaromatic hydrocarbons without individual components.

**Table 5. HAPs Emissions – Baseline, Annual, lbs/year**

| | PAHs-w/ | Xylenes | Formaldehyde | Benzene | Acetaldehyde | Ethyl Benzene | Acrolein | Toluene | Hexane | Propylene | MEK |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Generator A-1 | 4.37E-02 | 2.15E+00 | 1.34E+00 | 6.34E-01 | 3.39E-01 | 7.54E-01 | 2.95E-01 | 2.90E+00 | 5.03E-01 | 5.79E+01 | |
| Generator A-2** | | | | | | | | | | | |
| Generator A-3 | 1.38E-01 | 6.79E+00 | 4.24E+00 | 2.00E+00 | 1.07E+00 | 2.38E+00 | 9.30E-01 | 9.13E+00 | 1.59E+00 | 1.83E+02 | |
| Generator A-4** | | | | | | | | | | | |
| Generator A-5 | 1.38E-01 | 6.79E+00 | 4.24E+00 | 2.00E+00 | 1.07E+00 | 2.38E+00 | 9.31E-01 | 9.14E+00 | 1.59E+00 | 1.83E+02 | |
| Generator A-6 | 1.57E-02 | 7.71E-01 | 4.81E-01 | 2.27E-01 | 1.21E-01 | 2.70E-01 | 1.06E-01 | 1.04E+00 | 1.80E-01 | 2.07E+01 | |
| Turbine | | 9.66E+00 | 1.07E+02 | 1.81E+00 | 6.04E+00 | 4.83E+00 | 9.66E-01 | 1.96E+01 | | | |
| Heater, Stack 1* | | | | | | | | | | | |
| Heater, Stack 2* | | | | | | | | | | | |
| Existing Fugitives | | 1.78E+00 | | 8.88E-01 | | | | 4.44E+00 | 3.02E+01 | 8.88E-01 | |
| Gas Plant | | 2.85E+00 | | 1.43E+00 | | | | 7.13E+00 | 4.85E+01 | 1.43E+00 | |
| Solvent Use | | 5.95E+00 | | 1.19E+00 | | | | | | | |
| Tanks | | 1.97E-04 | | 4.72E-03 | | 3.06E-04 | | 8.56E-04 | | | |
| Loading Racks | | 3.36E-04 | | 8.04E-03 | | 5.21E-04 | | 1.46E-03 | | | |
| **TOTAL** | **3.35E-01** | **3.67E+01** | **1.17E+02** | **1.02E+01** | **8.63E+00** | **1.06E+01** | **3.23E+00** | **5.34E+01** | **8.25E+01** | **4.46E+02** | **0.00E+00** |

* Heater Treater does not currently burn fuel.
** Steam Generators A-2 and A-4 do not currently operate.
PAH w/ – polyaromatic hydrocarbons with individual components.

**Table 5 (cont.). HAPs Emissions – Baseline, Annual, lbs/year**

| | Naphtha-lene | Chloro-benzene | Ammonia, NH3 | Cyclo-hexane | H2S | Methanol | PAHs-w/o | Propylene Oxide | 1,3-Butadiene |
|---|---|---|---|---|---|---|---|---|---|
| Generator A-1 | | | | | | | | | |
| Generator A-2** | | | | | | | | | |
| Generator A-3 | | | | | | | | | |
| Generator A-4** | | | | | | | | | |
| Generator A-5 | | | | | | | | | |
| Generator A-6 | | | | | | | | | |
| Turbine | 1.96E-01 | | | | | | 3.32E-01 | 4.38E+00 | 6.49E-02 |
| Heater, Stack 1* | | | | | | | | | |
| Heater, Stack 2* | | | | | | | | | |
| Existing Fugitives | | | | 8.88E-01 | 2.39E+01 | | | | |
| Gas Plant | | | | 1.43E+00 | 3.84E+01 | | | | |
| Solvent Use | | | | | | 2.40E+00 | | | |
| Tanks | | | | | 2.91E+00 | | | | |
| Loading Racks | | | | | 4.96E+00 | | | | |
| **TOTAL** | **1.96E-01** | **0.00E+00** | **0.00E+00** | **2.31E+00** | **7.02E+01** | **2.40E+00** | **3.32E-01** | **4.38E+00** | **6.49E-02** |

* Heater Treater does not currently burn fuel.
** Steam Generators A-2 and A-4 do not currently operate..
PAH w/o – polyaromatic hydrocarbons without individual components.

**Table 6. HAPs Emissions – Project, Maximum Hour, lbs/hour**

| | PAHs-w/ | Xylenes | Form-aldehyde | Benzene | Acet-aldehyde | Ethyl Benzene | Acrolein | Toluene | Hexane | Propy-lene | MEK |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Generator A-1 | 1.96E-05 | 9.66E-04 | 6.03E-04 | 2.84E-04 | 1.52E-04 | 3.38E-04 | 1.32E-04 | 1.30E-03 | 2.26E-04 | 2.60E-02 | |
| Generator A-2 | 1.96E-05 | 9.66E-04 | 6.03E-04 | 2.84E-04 | 1.52E-04 | 3.38E-04 | 1.32E-04 | 1.30E-03 | 2.26E-04 | 2.60E-02 | |
| Generator A-3 | 1.96E-05 | 9.66E-04 | 6.03E-04 | 2.84E-04 | 1.52E-04 | 3.38E-04 | 1.32E-04 | 1.30E-03 | 2.26E-04 | 2.60E-02 | |
| Generator A-4 | 1.96E-05 | 9.66E-04 | 6.03E-04 | 2.84E-04 | 1.52E-04 | 3.38E-04 | 1.32E-04 | 1.30E-03 | 2.26E-04 | 2.60E-02 | |
| Generator A-5 | 1.96E-05 | 9.66E-04 | 6.03E-04 | 2.84E-04 | 1.52E-04 | 3.38E-04 | 1.32E-04 | 1.30E-03 | 2.26E-04 | 2.60E-02 | |
| Generator A-6 | 1.18E-05 | 5.79E-04 | 3.62E-04 | 1.71E-04 | 9.12E-05 | 2.03E-04 | 7.94E-05 | 7.79E-04 | 1.35E-04 | 1.56E-02 | |
| Generator A-7 | 3.33E-05 | 1.64E-03 | 1.03E-03 | 4.83E-04 | 2.58E-04 | 5.75E-04 | 2.25E-04 | 2.21E-03 | 3.83E-04 | 4.42E-02 | |
| Generator A-8 | 3.33E-05 | 1.64E-03 | 1.03E-03 | 4.83E-04 | 2.58E-04 | 5.75E-04 | 2.25E-04 | 2.21E-03 | 3.83E-04 | 4.42E-02 | |
| Generator A-9 | 3.33E-05 | 1.64E-03 | 1.03E-03 | 4.83E-04 | 2.58E-04 | 5.75E-04 | 2.25E-04 | 2.21E-03 | 3.83E-04 | 4.42E-02 | |
| Turbine | | 1.33E-03 | 1.47E-02 | 2.48E-04 | 8.28E-04 | 6.62E-04 | 1.33E-04 | 2.69E-03 | | | |
| Heater, Stack 1 | 1.57E-06 | 1.07E-04 | 6.67E-05 | 3.14E-05 | 1.69E-05 | 3.73E-05 | 1.06E-05 | 1.44E-04 | 2.47E-05 | 2.87E-03 | |
| Heater, Stack 2 | 1.57E-06 | 1.07E-04 | 6.67E-05 | 3.14E-05 | 1.69E-05 | 3.73E-05 | 1.06E-05 | 1.44E-04 | 2.47E-05 | 2.87E-03 | |
| Air Stripper 1 | | 2.92E-04 | | 1.46E-04 | | 7.68E-05 | | 6.51E-05 | | | 5.74E-02 |
| Air Stripper 2 | | 2.92E-04 | | 1.46E-04 | | 7.68E-05 | | 6.51E-05 | | | 5.74E-02 |
| Air Stripper 3 | | 2.92E-04 | | 1.46E-04 | | 7.68E-05 | | 6.51E-05 | | | 5.74E-02 |
| New Wells | | 1.34E-02 | | 6.70E-03 | | | | 3.35E-02 | 2.28E-01 | 6.70E-03 | |
| Existing Fugitives | | 2.03E-04 | | 1.01E-04 | | | | 5.07E-04 | 3.45E-03 | 1.01E-04 | |
| Gas Plant | | 3.25E-04 | | 1.63E-04 | | | | 8.13E-04 | 5.53E-03 | 1.63E-04 | |
| Solvent Use | | 1.36E-03 | | 2.72E-04 | | | | | | | |
| Tanks | | 6.38E-08 | | 1.53E-06 | | 9.89E-08 | | 2.77E-07 | | | |
| Loading Racks | | 1.20E-07 | | 2.87E-06 | | 1.86E-07 | | 5.20E-07 | | | |
| **TOTAL** | **2.13E-04** | **2.80E-02** | **2.13E-02** | **1.10E-02** | **2.49E-03** | **4.59E-03** | **1.57E-03** | **5.19E-02** | **2.39E-01** | **2.91E-01** | **1.72E-01** |

PAH w/ – polyaromatic hydrocarbons with individual components.

**Table 6 (cont.). HAPs Emissions – Project, Maximum Hour, lbs/hour**

| | Naphtha-lene | Chloro-benzene | Ammonia, NH3 | Cyclo-hexane | H2S | Methanol | PAHs-w/o | Propylene Oxide | 1,3-Butadiene |
|---|---|---|---|---|---|---|---|---|---|
| Generator A-1 | | | | | | | | | |
| Generator A-2 | | | | | | | | | |
| Generator A-3 | | | | | | | | | |
| Generator A-4 | | | | | | | | | |
| Generator A-5 | | | | | | | | | |
| Generator A-6 | | | | | | | | | |
| Generator A-7 | | | | | | | | | |
| Generator A-8 | | | | | | | | | |
| Generator A-9 | | | | | | | | | |
| Turbine | 2.69E-05 | | | | | | 4.55E-05 | 6.00E-04 | 8.90E-06 |
| Heater, Stack 1 | | | | | | | | | |
| Heater, Stack 2 | | | | | | | | | |
| Air Stripper 1 | 9.14E-04 | 2.14E-04 | 1.46E+00 | | | | | | |
| Air Stripper 2 | 9.14E-04 | 2.14E-04 | 1.46E+00 | | | | | | |
| Air Stripper 3 | 9.14E-04 | 2.14E-04 | 1.46E+00 | | | | | | |
| New Wells | | | | 6.70E-03 | 1.81E-01 | | | | |
| Existing Fugitives | | | | 1.01E-04 | 2.73E-03 | | | | |
| Gas Plant | | | | 1.63E-04 | 4.39E-03 | | | | |
| Solvent Use | | | | | | 5.48E-04 | | | |
| Tanks | | | | | 9.42E-04 | | | | |
| Loading Racks | | | | | 1.77E-03 | | | | |
| **TOTAL** | **2.77E-03** | **6.42E-04** | **4.37E+00** | **6.96E-03** | **1.90E-01** | **5.48E-04** | **4.55E-05** | **6.00E-04** | **8.90E-06** |

PAH w/o – polyaromatic hydrocarbons without individual components.

## Table 7. HAPs Emissions – Project, Annual, lbs/year

| | PAHs-w/ | Xylenes | Form-aldehyde | Benzene | Acet-aldehyde | Ethyl Benzene | Acrolein | Toluene | Hexane | Propy-lene | MEK |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Generator A-1 | 1.72E-01 | 8.46E+00 | 5.28E+00 | 2.49E+00 | 1.33E+00 | 2.96E+00 | 1.16E+00 | 1.14E+01 | 1.98E+00 | 2.28E+02 | |
| Generator A-2 | 1.72E-01 | 8.46E+00 | 5.28E+00 | 2.49E+00 | 1.33E+00 | 2.96E+00 | 1.16E+00 | 1.14E+01 | 1.98E+00 | 2.28E+02 | |
| Generator A-3 | 1.72E-01 | 8.46E+00 | 5.28E+00 | 2.49E+00 | 1.33E+00 | 2.96E+00 | 1.16E+00 | 1.14E+01 | 1.98E+00 | 2.28E+02 | |
| Generator A-4 | 1.72E-01 | 8.46E+00 | 5.28E+00 | 2.49E+00 | 1.33E+00 | 2.96E+00 | 1.16E+00 | 1.14E+01 | 1.98E+00 | 2.28E+02 | |
| Generator A-5 | 1.72E-01 | 8.46E+00 | 5.28E+00 | 2.49E+00 | 1.33E+00 | 2.96E+00 | 1.16E+00 | 1.14E+01 | 1.98E+00 | 2.28E+02 | |
| Generator A-6 | 1.03E-01 | 5.08E+00 | 3.17E+00 | 1.49E+00 | 7.99E-01 | 1.78E+00 | 6.96E-01 | 6.83E+00 | 1.19E+00 | 1.37E+02 | |
| Generator A-7 | 2.92E-01 | 1.44E+01 | 8.98E+00 | 4.23E+00 | 2.26E+00 | 5.04E+00 | 1.97E+00 | 1.93E+01 | 3.36E+00 | 3.87E+02 | |
| Generator A-8 | 2.92E-01 | 1.44E+01 | 8.98E+00 | 4.23E+00 | 2.26E+00 | 5.04E+00 | 1.97E+00 | 1.93E+01 | 3.36E+00 | 3.87E+02 | |
| Generator A-9 | 2.92E-01 | 1.44E+01 | 8.98E+00 | 4.23E+00 | 2.26E+00 | 5.04E+00 | 1.97E+00 | 1.93E+01 | 3.36E+00 | 3.87E+02 | |
| Turbine | | 1.16E+01 | 1.29E+02 | 2.18E+00 | 7.25E+00 | 5.80E+00 | 1.16E+00 | 2.36E+01 | | | |
| Heater, Stack 1 | 1.37E-02 | 9.34E-01 | 5.84E-01 | 2.75E-01 | 1.48E-01 | 3.26E-01 | 9.28E-02 | 1.26E+00 | 2.16E-01 | 2.51E+01 | |
| Heater, Stack 2 | 1.37E-02 | 9.34E-01 | 5.84E-01 | 2.75E-01 | 1.48E-01 | 3.26E-01 | 9.28E-02 | 1.26E+00 | 2.16E-01 | 2.51E+01 | |
| Air Stripper 1 | | 2.56E+00 | | 1.28E+00 | | 6.73E-01 | | 5.71E-01 | | | 5.02E+02 |
| Air Stripper 2 | | 2.56E+00 | | 1.28E+00 | | 6.73E-01 | | 5.71E-01 | | | 5.02E+02 |
| Air Stripper 3 | | 2.56E+00 | | 1.28E+00 | | 6.73E-01 | | 5.71E-01 | | | 5.02E+02 |
| New Wells | | 1.17E+02 | | 5.87E+01 | | | | 2.93E+02 | 1.99E+03 | 5.87E+01 | |
| Existing Fugitives | | 1.78E+00 | | 8.88E-01 | | | | 4.44E+00 | 3.02E+01 | 8.88E-01 | |
| Gas Plant | | 2.85E+00 | | 1.43E+00 | | | | 7.13E+00 | 4.85E+01 | 1.43E+00 | |
| Solvent Use | | 1.19E+01 | | 2.38E+00 | | | | | | | |
| Tanks | | 5.59E-04 | | 1.34E-02 | | 8.66E-04 | | 2.43E-03 | | | |
| Loading Racks | | 1.05E-03 | | 2.51E-02 | | 1.63E-03 | | 4.56E-03 | | | |
| **TOTAL** | **1.87E+00** | **2.46E+02** | **1.86E+02** | **9.66E+01** | **2.18E+01** | **4.02E+01** | **1.38E+01** | **4.55E+02** | **2.10E+03** | **2.55E+03** | **1.51E+03** |

PAH w/ – polyaromatic hydrocarbons with individual components.

**Table 7 (cont.). HAPs Emissions – Project, Annual, lbs/year**

| | Naphtha-lene | Chloro-benzene | NH3 | Cyclo-hexane | H2S | Methanol | PAHs-w/o | Propylene Oxide | 1,3-Butadiene |
|---|---|---|---|---|---|---|---|---|---|
| Generator A-1 | | | | | | | | | |
| Generator A-2 | | | | | | | | | |
| Generator A-3 | | | | | | | | | |
| Generator A-4 | | | | | | | | | |
| Generator A-5 | | | | | | | | | |
| Generator A-6 | | | | | | | | | |
| Generator A-7 | | | | | | | | | |
| Generator A-8 | | | | | | | | | |
| Generator A-9 | | | | | | | | | |
| Turbine | 2.36E-01 | | | | | | 3.99E-01 | 5.26E+00 | 7.80E-02 |
| Heater, Stack 1 | | | | | | | | | |
| Heater, Stack 2 | | | | | | | | | |
| Air Stripper 1 | 8.01E+00 | 1.87E+00 | 1.28E+04 | | | | | | |
| Air Stripper 2 | 8.01E+00 | 1.87E+00 | 1.28E+04 | | | | | | |
| Air Stripper 3 | 8.01E+00 | 1.87E+00 | 1.28E+04 | | | | | | |
| New Wells | | | | 5.87E+01 | 1.58E+03 | | | | |
| Existing Fugitives | | | | 8.88E-01 | 2.39E+01 | | | | |
| Gas Plant | | | | 1.43E+00 | 3.84E+01 | | | | |
| Solvent Use | | | | | | 4.80E+00 | | | |
| Tanks | | | | | 8.26E+00 | | | | |
| Loading Racks | | | | | 1.55E+01 | | | | |
| **TOTAL** | **2.43E+01** | **5.62E+00** | **3.83E+04** | **6.10E+01** | **1.67E+03** | **4.80E+00** | **3.99E-01** | **5.26E+00** | **7.80E-02** |

PAH w/o – polyaromatic hydrocarbons without individual components.

## 5. *Analysis*

The 70-years (adult resident) exposure duration with the Derived (Adjusted) Method was used to determine cancer risk. The Derived (OEHHA) Method was used to determine the chronic hazard index. Coordinates are given in UTM NAD 83.

Inhalation and other RELs and cancer potency factors for each substance that are integral to the HARP v 1.3 software were used to evaluate potential cancer and non-cancer risks.

Dermal, mother's milk and soil injection pathways were enabled in addition to inhalation.

Facility Boundary Receptors have been spaced at 25 meters. Grid Receptors have been spaced at 50 meters. Sensitive receptors were obtained by studying the aerials of the area, the details are given in Table 8.

## 6. *Results*

The resulting health risk factors are below the respective significance thresholds: 10 in a million (1.00E-05) for cancer risk, and 1.00 for both chronic and acute HIs.

**Table 8. Sensitive Receptors and Project Health Risks**

| Sensitive Receptor * | UTM E, m | UTM N, m | Cancer Risk, threshold = 1.00E-05 | Chronic HI, threshold = 1.00E-00 | Acute HI, threshold = 1.00E-00 |
|---|---|---|---|---|---|
| **Residence 1** | **717452** | **3897482** | **3.94E-07** | **3.12E-02** | **7.29E-02** |
| Residence 2 | 717518 | 3897983 | 2.87E-07 | 2.12E-02 | 3.69E-02 |
| Residence 3 | 717016 | 3897908 | 3.01E-07 | 2.19E-02 | 4.10E-02 |
| **Residence 4** | **717064** | **3897548** | **7.01E-07** | **4.23E-02** | **6.57E-02** |
| **Residence 5** | **715958** | **3897651** | **8.00E-07** | **3.62E-02** | **4.84E-02** |
| Residence 6 | 715825 | 3897756 | 6.88E-07 | 3.12E-02 | 4.09E-02 |
| Residence 7 | 713478 | 3895541 | 1.80E-07 | 9.97E-03 | 1.61E-02 |
| Residence 8 | 715381 | 3892772 | 3.13E-07 | 1.31E-02 | 1.74E-02 |
| Residence 9 | 717882 | 3893858 | 4.82E-07 | 1.83E-02 | 2.87E-02 |
| Residence 10 | 717934 | 3893937 | 4.92E-07 | 1.86E-02 | 2.90E-02 |
| Residence 11 | 718061 | 3893871 | 4.87E-07 | 1.85E-02 | 2.86E-02 |
| Residence 12 | 718055 | 3894069 | 5.03E-07 | 1.89E-02 | 2.97E-02 |
| Residence 13 | 717858 | 3896363 | 4.08E-07 | 2.97E-02 | 6.48E-02 |
| School | 715166 | 3891752 | 1.84E-07 | 1.05E-02 | 1.48E-02 |

* The highlighted receptors have the highest risks.

The health risk analysis results – cancer risk and hazard indices (HIs) isopleths – are plotted on the area maps, and can be seen on the Figures in Appendix A[1].

Proposed Project Point of Maximum Impact (PMI) offsite receptors are shown on the maps in Appendix A. These are also summarized in Table 9.

[1] The Isopleths do not seem to surround the emission sources because of the way the terrain interacts with the screening meteorology parameters.

The potentially affected sensitive receptors are identified on the maps. The resulting cancer and non-cancer risk factors are provided in Table 8; the receptors with the highest risk are highlighted in bold font.

**Table 9. Point of Maximum Impact Offsite Receptors and Project Health Risks**

| Receptor with HARP grid No.* | UTM E, m | UTM N, m | Cancer Risk, threshold = 1.00E-05 | Chronic HI, threshold = 1.00E-00 | Acute HI, threshold = 1.00E-00 |
|---|---|---|---|---|---|
| **#599** | 715773 | 3896249 | 1.49E-06 | 7.81E-02 | 1.20E-01 |
| **#876** | 717073 | 3895449 | 2.06E-06 | 9.13E-02 | 2.32E-01 |
| **#683** | 717573 | 3896049 | 1.91E-06 | 6.22E-02 | 1.15E-01 |

* The grid point numbers are generated by HARP. Please see Appendix A Figures for the locations of the PMI grid points.

## *7. Reporting*

Attached to this report are the following electronic files with HARP input and output:

- ISC workbook file (filename.ISC);
- ISC input file generated by HARP when ISC is run (filename.INP);
- ISC output file generated by HARP when ISC in run (filename.OUT);
- ISC binary output file; holds $\chi$/Q for data for each hour (filename.BIN);
- List of error messages generated by ISC (filename.ERR);
- Sources receptor file; contains list of sources and receptors for the ISC run; generated by HARP when you set up ISC (filename.SRC);
- Point estimate risk values generated by HARP; this file is updated automatically each time you perform one of the point estimate risk analysis functions (filename.RSK);
- Average and maximum $\chi$/Q values for each source-receptor combination; generated by ISC (filename.XOQ);
- Plot file generated by ISC (filename.PLT);
- Site-specific parameters used for all receptor risk modeling (filename.SIT);
- Map file used to overlay facility and receptors (filename.DEB).

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