

# **APPENDIX E**

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Climate Change Modeling



Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: H:\PROJECTS\Pinole-Hercules WPCP\Project Information\Pinole-Hercules WPCP CorpYard and On-Site Construction.urb924

Project Name: Pinole-Hercules WPCP Construction Emissions - Corporation Yard and On-Site Upgrades

Project Location: Contra Costa County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10 Dust</u>	<u>PM10 Exhaust</u>	<u>PM10</u>	<u>PM2.5 Dust</u>	<u>PM2.5 Exhaust</u>	<u>PM2.5</u>	<u>CO2</u>
2014 TOTALS (tons/year unmitigated)	0.26	2.01	1.23	0.00	0.03	0.09	0.11	0.01	0.08	0.09	307.96
2014 TOTALS (tons/year mitigated)	0.26	2.01	1.23	0.00	0.01	0.09	0.10	0.00	0.08	0.08	307.96
Percent Reduction	0.00	0.00	0.00	0.00	52.66	0.00	11.69	52.64	0.00	3.20	0.00

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10 Dust</u>	<u>PM10 Exhaust</u>	<u>PM10</u>	<u>PM2.5 Dust</u>	<u>PM2.5 Exhaust</u>	<u>PM2.5</u>	<u>CO2</u>
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2014	0.26	2.01	1.23	0.00	0.03	0.09	0.11	0.01	0.08	0.09	307.96
Fine Grading 06/02/2014-06/06/2014	0.01	0.05	0.03	0.00	0.03	0.00	0.03	0.01	0.00	0.01	5.87
Fine Grading Dust	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.01	0.00	0.01	0.00
Fine Grading Off Road Diesel	0.01	0.05	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.62
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26
Building 06/09/2014-12/31/2014	0.25	1.97	1.20	0.00	0.00	0.09	0.09	0.00	0.08	0.08	302.09
Building Off Road Diesel	0.25	1.97	1.20	0.00	0.00	0.09	0.09	0.00	0.08	0.08	302.09
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Phase Assumptions

- Phase: Fine Grading 6/2/2014 - 6/6/2014 - Site preparation for corporation yard
- Total Acres Disturbed: 1.24
- Maximum Daily Acreage Disturbed: 1
- Fugitive Dust Level of Detail: Default
- 10 lbs per acre-day
- On Road Truck Travel (VMT): 0
- Off-Road Equipment:
- 1 Graders (174 hp) operating at a 0.61 load factor for 6 hours per day
- 1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 6 hours per day
- 1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day
- 1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

- Phase: Building Construction 6/9/2014 - 12/31/2014 - On-site upgrades
- Off-Road Equipment:
- 1 Bore/Drill Rigs (291 hp) operating at a 0.75 load factor for 8 hours per day

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1 Excavators (168 hp) operating at a 0.57 load factor for 8 hours per day

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Mitigated

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10 Dust</u>	<u>PM10 Exhaust</u>	<u>PM10</u>	<u>PM2.5 Dust</u>	<u>PM2.5 Exhaust</u>	<u>PM2.5</u>	<u>CO2</u>
2014	0.26	2.01	1.23	0.00	0.01	0.09	0.10	0.00	0.08	0.08	307.96
Fine Grading 06/02/2014-06/06/2014	0.01	0.05	0.03	0.00	0.01	0.00	0.01	0.00	0.00	0.00	5.87
Fine Grading Dust	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Fine Grading Off Road Diesel	0.01	0.05	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.62
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26
Building 06/09/2014-12/31/2014	0.25	1.97	1.20	0.00	0.00	0.09	0.09	0.00	0.08	0.08	302.09
Building Off Road Diesel	0.25	1.97	1.20	0.00	0.00	0.09	0.09	0.00	0.08	0.08	302.09
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 6/2/2014 - 6/6/2014 - Site preparation for corporation yard

For Soil Stabilizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: C:\Documents and Settings\lwg\Desktop\Pinole-Hercules WPCP\Project Information\Pinole-Hercules WPCP Option 2 Construction.urb924

Project Name: Pinole-Hercules WPCP Construction - Option 2

Project Location: Contra Costa County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10 Dust</u>	<u>PM10 Exhaust</u>	<u>PM10</u>	<u>PM2.5 Dust</u>	<u>PM2.5 Exhaust</u>	<u>PM2.5</u>	<u>CO2</u>
2014 TOTALS (tons/year unmitigated)	0.41	3.77	1.87	0.00	0.00	0.15	0.15	0.00	0.14	0.14	565.65

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Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10 Dust</u>	<u>PM10 Exhaust</u>	<u>PM10</u>	<u>PM2.5 Dust</u>	<u>PM2.5 Exhaust</u>	<u>PM2.5</u>	<u>CO2</u>
2014	0.41	3.77	1.87	0.00	0.00	0.15	0.15	0.00	0.14	0.14	565.65
Building 06/02/2014-12/31/2014	0.41	3.77	1.87	0.00	0.00	0.15	0.15	0.00	0.14	0.14	565.65
Building Off Road Diesel	0.41	3.77	1.87	0.00	0.00	0.15	0.15	0.00	0.14	0.14	565.65
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Phase Assumptions

Phase: Building Construction 6/2/2014 - 12/31/2014 - Option 2 on-site upgrades

Off-Road Equipment:

- 1 Bore/Drill Rigs (291 hp) operating at a 0.75 load factor for 8 hours per day
- 1 Excavators (168 hp) operating at a 0.57 load factor for 8 hours per day
- 1 Generator Sets (549 hp) operating at a 0.74 load factor for 8 hours per day
- 1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day
- 1 Rollers (95 hp) operating at a 0.56 load factor for 8 hours per day
- 1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day

**Pinole-Hercules WPCP  
Construction and Operational GHG Summary**

**CONSTRUCTION**

**Option 1**

<b>Activity</b>	<b>CO<sub>2</sub> Emissions (lb/day)</b>	<b>Duration (months)</b>	<b>CO<sub>2</sub> Emissions (MT/yr)</b>
On-Site Upgrades	4,082	30	1,222
Pipeline Installation	2,419	9	217
Corporation Yard	2,349	0.25	6
<b>Total Emissions</b>			<b>1,445</b>

**Option 2**

<b>Activity</b>	<b>CO<sub>2</sub> Emissions (lb/day)</b>	<b>Duration (months)</b>	<b>CO<sub>2</sub> Emissions (MT/yr)</b>
On-Site Upgrades	7,394	9	664

**OPERATION**

<b>Scenario</b>	<b>GHG Emissions (MT CO<sub>2</sub>e/yr)</b>					
	<b>Electricity</b>	<b>Natural Gas</b>	<b>Methane Combustion</b>	<b>Methane Incomplete Combustion</b>	<b>Methane Flare</b>	<b>Total</b>
Existing	926	61	546	43	302	1,878
Option 1	1,084	61	546	43	907	2,640
Option 2	602	41	546	43	302	1,534

Notes: CO<sub>2</sub> = carbon dioxide; lb = pound; MT = metric ton; yr = year; CO<sub>2</sub>e = carbon dioxide equivalent



**Pinole-Hercules WPCP**  
**Electricity and Natural Gas Calculations**  
**Existing Conditions**

**Electricity Consumption**

Total KWh	MWh	Region	Emission Factor (lb CO <sub>2</sub> /MWh)	GWP	Emission Factor (lb CH <sub>4</sub> /MWh)	GWP	Emission Factor (lb N <sub>2</sub> O/MWh)	GWP	Total CO <sub>2</sub> e (Metric Tons/year)
2,806,850	2,807	CALI	724.12	1	0.0302	23	0.0081	296	926

**Natural Gas Consumption**  
**Summer**

Btu/hr	Hr/day	Total Btu Needed	Total NG Used (MMBtu)	Emission Factor (kg CO <sub>2</sub> /MMBtu)	GWP	Emission Factor (kg CH <sub>4</sub> /MMBtu)	GWP	Emission Factor (kg N <sub>2</sub> O/MMBtu)	GWP	Total CO <sub>2</sub> e (Metric Tons/year)
300,000	24	7,200,000	0	53.06	1	0	23	0	296	

**Winter**

SCF/day	Hr/day	Total Btu Needed	Total NG Used (MMBtu/yr)	Emission Factor (kg CO <sub>2</sub> /MMBtu)	GWP	Emission Factor (kg CH <sub>4</sub> /MMBtu)	GWP	Emission Factor (kg N <sub>2</sub> O/MMBtu)	GWP	Total CO <sub>2</sub> e (Metric Tons/year)
6,000	24	6,174,000	1,142	53.06	1	0	23	0	296	60.77

**Methane Combustion (Incomplete Combustion of Methane)**

Digester Gas (SCF)	Fraction CH <sub>4</sub>	Density of Methane	1-Destruction Efficiency	Metric tons CH <sub>4</sub>	MT CO <sub>2</sub> e
50,000	0.6	662	0.01	2	43

Source: Local Government Operations Protocol Equation 10.1

**Methane Combustion (Combustion)**

Digester Gas (SCF)	MMBtu/day	MMBtu/year	lb CO <sub>2</sub> /MMBtu	CO <sub>2</sub> GWP	Metric tons CO <sub>2</sub>
50,000	30,000,000	10,950	110	1	546

Note: Natural gas emission factor is used as surrogate for methane combustion.

**Methane Flare Emissions**

MMSCF	Fraction Methane	Destruction Efficiency	Capture Efficiency	Metric tons CH <sub>4</sub>	MT CO <sub>2</sub> e
0.01	0.6	0.99	0.75	14	302

Source: Local Government Operations Protocol Equation 9.1

Notes: kWh = kilowatt-hour; MWh = megawatt-hour; CO<sub>2</sub> = carbon dioxide; GWP = global warming potential; CH<sub>4</sub> = methane; N<sub>2</sub>O = nitrous oxide; CO<sub>2</sub>e = carbon dioxide equivalent; SCF = standard cubic feet; Btu = British thermal unit; MMBtu = million British thermal units; kg = kilogram; MMSCF = million standard cubic feet

Pinole-Hercules WPCP  
 Electricity and Natural Gas Calculations  
 Option 1: Pinole-Hercules New Larger Effluent Pipe to Rodeo

**Electricity Consumption**

Total KWh	MWh	Region	Emission Factor (lb CO <sub>2</sub> /MWh)	GWP	Emission Factor (lb CH <sub>4</sub> /MWh)	GWP	Emission Factor (lb N <sub>2</sub> O/MWh)	GWP	Total CO <sub>2</sub> e (Metric Tons/year)
3,285,000	3,285	CALI	724.12	1	0.0302	23	0.0081	296	1,084

**Natural Gas Consumption  
 Summer**

SCF/day	Btu/day	Total MMBtu/summer	Emission Factor (kg CO <sub>2</sub> /MMBtu)	GWP	Emission Factor (kg CH <sub>4</sub> /MMBtu)	GWP	Emission Factor (kg N <sub>2</sub> O/MMBtu)	GWP	Total CO <sub>2</sub> e (Metric Tons/year)
0	0	0	53.06	1	0.0050	23	0.0001	296	0.00

**Winter**

SCF/day	Btu/day	Total MMBtu/winter	Emission Factor (kg CO <sub>2</sub> /MMBtu)	GWP	Emission Factor (kg CH <sub>4</sub> /MMBtu)	GWP	Emission Factor (kg N <sub>2</sub> O/MMBtu)	GWP	Total CO <sub>2</sub> e (Metric Tons/year)
6,000	6,174,000	1,142	53.06	1	0.0050	23	0.0001	296	60.77

**Methane Combustion (Incomplete Combustion of Methane)**

Digester Gas (SCF)	Fraction CH <sub>4</sub>	Density of Methane	1-Destruction Efficiency	Metric tons CH <sub>4</sub>	MT CO <sub>2</sub> e
50,000	0.6	662	0.01	2	43

Source: Local Government Operations Protocol Equation 10.1

**Methane Combustion (Combustion)**

Digester Gas (SCF)	MMBtu/day	MMBtu/year	lb CO <sub>2</sub> /MMBtu	CO <sub>2</sub> GWP	Metric tons CO <sub>2</sub>
50,000	30,000,000	10,950	110	1	546

Note: Natural gas emission factor is used as surrogate for methane combustion.

**Methane Flare Emissions**

MMSCF	Fraction Methane	Destruction Efficiency	Capture Efficiency	Metric tons CH <sub>4</sub>	MT CO <sub>2</sub> e
0.03	0.6	0.99	0.75	43	907

Source: Local Government Operations Protocol Equation 9.1

Notes: kWh = kilowatt-hour; MWh = megawatt-hour; CO<sub>2</sub> = carbon dioxide; GWP = global warming potential; CH<sub>4</sub> = methane; N<sub>2</sub>O = nitrous oxide; CO<sub>2</sub>e = carbon dioxide equivalent; SCF = standard cubic feet; Btu = British thermal unit; MMBtu = million British thermal units; kg = kilogram; MMSCF = million standard cubic feet

Pinole-Hercules WPCP  
 Electricity and Natural Gas Calculations  
 Option 2: Pinole Only Flows at Existing Plant

Electricity Consumption

Total KWh	MWh	Region	Emission Factor (lb CO <sub>2</sub> /MWh)	GWP	Emission Factor (lb CH <sub>4</sub> /MWh)	GWP	Emission Factor (lb N <sub>2</sub> O/MWh)	GWP	Total CO <sub>2</sub> e (Metric Tons/year)
1,825,000	1,825	CALI	724.12	1	0.0302	23	0.0081	296	602

Natural Gas Consumption  
 Summer

SCF/day	Btu/day	Total MMBtu/sumer	Emission Factor (kg CO <sub>2</sub> /MMBtu)	GWP	Emission Factor (kg CH <sub>4</sub> /MMBtu)	GWP	Emission Factor (kg N <sub>2</sub> O/MMBtu)	GWP	Total CO <sub>2</sub> e (Metric Tons/year)
0	0	0	53.06	1	0.0050	23	0.0001	296	0.00

Winter

SCF/day	Btu/day	Total MMBtu/winter	Emission Factor (kg CO <sub>2</sub> /MMBtu)	GWP	Emission Factor (kg CH <sub>4</sub> /MMBtu)	GWP	Emission Factor (kg N <sub>2</sub> O/MMBtu)	GWP	Total CO <sub>2</sub> e (Metric Tons/year)
4,000	4,116,000	761	53.06	1	0.0050	23	0.0001	296	40.51

Methane Combustion (Incomplete Combustion of Methane)

Digester Gas (SCF)	Fraction CH <sub>4</sub>	Density of Methane	1-Destruction Efficiency	Metric tons CH <sub>4</sub>	MT CO <sub>2</sub> e
50,000	0.6	662	0.01	2	43

Source: Local Government Operations Protocol Equation 10.1

Methane Combustion (Combustion)

Digester Gas (SCF)	MMBtu/day	MMBtu/year	lb CO <sub>2</sub> /MMBtu	CO <sub>2</sub> GWP	Metric tons CO <sub>2</sub>
50,000	30,000,000	10,950	110	1	546

Note: Natural gas emission factor is used as surrogate for methane combustion.

Methane Flare Emissions

MMSCF	Fraction Methane	Destruction Efficiency	Capture Efficiency	Metric tons CH <sub>4</sub>	MT CO <sub>2</sub> e
0.01	0.6	0.99	0.75	14	302

Source: Local Government Operations Protocol Equation 9.1

Notes: kWh = kilowatt-hour; MWh = megawatt-hour; CO<sub>2</sub> = carbon dioxide; GWP = global warming potential; CH<sub>4</sub> = methane; N<sub>2</sub>O = nitrous oxide; CO<sub>2</sub>e = carbon dioxide equivalent; SCF = standard cubic feet; Btu = British thermal unit; MMBtu = million British thermal units; kg = kilogram; MMSCF = million standard cubic feet

