

APPENDIX 4.2

Air Quality

URBEMIS2007 Operational Emissions

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\glu\My Documents\aqLBNL\CRT\CRT Operational Emissions.urb9

Project Name: LBNL CRT Project

Project Location: Alameda County

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

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
TOTALS (lbs/day, unmitigated)	0.83	0.78	2.19	0.00	0.01	910.01
TOTALS (lbs/day, mitigated)	0.82	0.62	2.06	0.00	0.01	728.57
Percent Reduction	1.20	20.51	5.94	0.00	0.00	19.94

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
TOTALS (lbs/day, unmitigated)	2.89	2.48	23.50	0.02	3.44	1,973.85

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
TOTALS (lbs/day, unmitigated)	3.72	3.26	25.69	0.02	3.45	2,883.86

Both Area and Operational Mitigation must be turned on to get a combined mitigated total.

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

<u>Source</u>	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
Natural Gas	0.05	0.76	0.64	0.00	0.00	907.20
Hearth - No Summer Emissions						
Landscape	0.12	0.02	1.55	0.00	0.01	2.81
Consumer Products	0.00					
Architectural Coatings	0.66					
TOTALS (lbs/day, unmitigated)	0.83	0.78	2.19	0.00	0.01	910.01

Area Source Mitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Mitigated

<u>Source</u>	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
Natural Gas	0.04	0.60	0.51	0.00	0.00	725.76
Hearth - No Summer Emissions						
Landscape	0.12	0.02	1.55	0.00	0.01	2.81
Consumer Products	0.00					
Architectural Coatings	0.66					
TOTALS (lbs/day, mitigated)	0.82	0.62	2.06	0.00	0.01	728.57

Area Source Changes to Defaults

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

<u>Source</u>	<u>ROG</u>	<u>NOX</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
CRT Building	2.89	2.48	23.50	0.02	3.44	1,973.85
TOTALS (lbs/day, unmitigated)	2.89	2.48	23.50	0.02	3.44	1,973.85

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 85 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
CRT Building		1.89	1000 sq ft	113.40	214.33	1,990.02
					214.33	1,990.02

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	54.4	1.3	98.3	0.4
Light Truck < 3750 lbs	12.4	2.4	95.2	2.4
Light Truck 3751-5750 lbs	19.7	0.5	99.5	0.0
Med Truck 5751-8500 lbs	6.3	0.0	98.4	1.6
Lite-Heavy Truck 8501-10,000 lbs	0.8	0.0	75.0	25.0
Lite-Heavy Truck 10,001-14,000 lbs	0.6	0.0	50.0	50.0
Med-Heavy Truck 14,001-33,000 lbs	1.3	0.0	15.4	84.6
Heavy-Heavy Truck 33,001-60,000 lbs	0.8	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.9	69.0	31.0	0.0
School Bus	0.0	0.0	0.0	0.0
Motor Home	0.6	0.0	83.3	16.7

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commuter	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
CRT Building				90.0	5.0	5.0

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\glu\My Documents\aqLBNL\CRT\CRT Operational Emissions.urb9

Project Name: LBNL CRT Project

Project Location: Alameda County

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

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
TOTALS (lbs/day, unmitigated)	0.71	0.76	0.64	0.00	0.00	907.20
TOTALS (lbs/day, mitigated)	0.70	0.60	0.51	0.00	0.00	725.76
Percent Reduction	1.41	21.05	20.31	0.00	0.00	20.00

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
TOTALS (lbs/day, unmitigated)	2.03	3.64	24.46	0.02	3.44	1,716.73

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
TOTALS (lbs/day, unmitigated)	2.74	4.40	25.10	0.02	3.44	2,623.93

Both Area and Operational Mitigation must be turned on to get a combined mitigated total.

Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

<u>Source</u>	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
Natural Gas	0.05	0.76	0.64	0.00	0.00	907.20
Hearth	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions						
Consumer Products	0.00					
Architectural Coatings	0.66					
TOTALS (lbs/day, unmitigated)	0.71	0.76	0.64	0.00	0.00	907.20

Area Source Mitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Mitigated

<u>Source</u>	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
Natural Gas	0.04	0.60	0.51	0.00	0.00	725.76
Hearth	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions						
Consumer Products	0.00					
Architectural Coatings	0.66					
TOTALS (lbs/day, mitigated)	0.70	0.60	0.51	0.00	0.00	725.76

Area Source Changes to Defaults

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

<u>Source</u>	<u>ROG</u>	<u>NOX</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
CRT Building	2.03	3.64	24.46	0.02	3.44	1,716.73
TOTALS (lbs/day, unmitigated)	2.03	3.64	24.46	0.02	3.44	1,716.73

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 40 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
CRT Building		1.89	1000 sq ft	113.40	214.33	1,990.02
					214.33	1,990.02

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	54.4	1.3	98.3	0.4
Light Truck < 3750 lbs	12.4	2.4	95.2	2.4
Light Truck 3751-5750 lbs	19.7	0.5	99.5	0.0
Med Truck 5751-8500 lbs	6.3	0.0	98.4	1.6
Lite-Heavy Truck 8501-10,000 lbs	0.8	0.0	75.0	25.0
Lite-Heavy Truck 10,001-14,000 lbs	0.6	0.0	50.0	50.0
Med-Heavy Truck 14,001-33,000 lbs	1.3	0.0	15.4	84.6
Heavy-Heavy Truck 33,001-60,000 lbs	0.8	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.9	69.0	31.0	0.0
School Bus	0.0	0.0	0.0	0.0
Motor Home	0.6	0.0	83.3	16.7

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
CRT Building				90.0	5.0	5.0

Combined Annual Emissions Reports (Tons/Year)

File Name: C:\Documents and Settings\glu\My Documents\aqLBNL\CRT\CRT Operational Emissions.urb9

Project Name: LBNL CRT Project

Project Location: Alameda County

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

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
TOTALS (tons/year, unmitigated)	0.14	0.14	0.26	0.00	0.00	165.81
TOTALS (tons/year, mitigated)	0.14	0.11	0.23	0.00	0.00	132.70
Percent Reduction	0.00	21.43	11.54	0.00	0.00	19.97

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
TOTALS (tons/year, unmitigated)	0.48	0.52	4.35	0.00	0.63	344.59

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
TOTALS (tons/year, unmitigated)	0.62	0.66	4.61	0.00	0.63	510.40

Both Area and Operational Mitigation must be turned on to get a combined mitigated total.

Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

<u>Source</u>	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
Natural Gas	0.01	0.14	0.12	0.00	0.00	165.56
Hearth	0.00	0.00	0.00	0.00	0.00	0.00
Landscape	0.01	0.00	0.14	0.00	0.00	0.25
Consumer Products	0.00					
Architectural Coatings	0.12					
TOTALS (tons/year, unmitigated)	0.14	0.14	0.26	0.00	0.00	165.81

Area Source Mitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Annual Tons Per Year, Mitigated

<u>Source</u>	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
Natural Gas	0.01	0.11	0.09	0.00	0.00	132.45
Hearth	0.00	0.00	0.00	0.00	0.00	0.00
Landscape	0.01	0.00	0.14	0.00	0.00	0.25
Consumer Products	0.00					
Architectural Coatings	0.12					
TOTALS (tons/year, mitigated)	0.14	0.11	0.23	0.00	0.00	132.70

Area Source Changes to Defaults

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

<u>Source</u>	<u>ROG</u>	<u>NOX</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>CO2</u>
CRT Building	0.48	0.52	4.35	0.00	0.63	344.59
TOTALS (tons/year, unmitigated)	0.48	0.52	4.35	0.00	0.63	344.59

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Season: Annual

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
CRT Building		1.89	1000 sq ft	113.40	214.33	1,990.02
					214.33	1,990.02

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	54.4	1.3	98.3	0.4
Light Truck < 3750 lbs	12.4	2.4	95.2	2.4
Light Truck 3751-5750 lbs	19.7	0.5	99.5	0.0
Med Truck 5751-8500 lbs	6.3	0.0	98.4	1.6
Lite-Heavy Truck 8501-10,000 lbs	0.8	0.0	75.0	25.0
Lite-Heavy Truck 10,001-14,000 lbs	0.6	0.0	50.0	50.0
Med-Heavy Truck 14,001-33,000 lbs	1.3	0.0	15.4	84.6
Heavy-Heavy Truck 33,001-60,000 lbs	0.8	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.9	69.0	31.0	0.0
School Bus	0.0	0.0	0.0	0.0
Motor Home	0.6	0.0	83.3	16.7

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commuter	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
CRT Building				90.0	5.0	5.0

Stationary Source and Greenhouse Gas Emissions

LBNL CRT Stationary Emissions

Criteria Pollutants

Source	lbs/day				
	ROG	NOx	CO	SOx	PM10
Emergency Generator	0.78	2.33	2.02	0.00	0.01
Cogeneration Engines	31.12	14.52	20.75	0.39	4.15
Cooling Towers (With Emergency Generator)	—	—	—	—	2.36
Cooling Towers (With Cogeneration)	—	—	—	—	4.24
Total with Emergency Generator	0.78	2.33	2.02	0.00	2.37
Total with Cogeneration	31.12	14.52	20.75	0.39	8.39

Greenhouse Gases

Source	metric tons/yr CO ₂ E
Emergency Generator	9.21
Cogeneration Engines	14,908
Cooling Towers	—

**LBNL CRT Facility
Cogeneration Engines**

Number of Units 2 engines
 Total Output 2.78 MW
 Rating per Engine 1,389 KW
 1,961 HP
 Operating Hours 24 hr/day
 365 day/yr
 8,760 hr/yr

	ROG	NOx	CO	SOx	PM10	Greenhouse Gases		
						CO ₂	CH ₄	CO ₂ E
gm/HP-hr (BACT)	0.15	0.15	0.60	—	0.02			
gm/HP-hr (proposed)	0.15	0.07	0.10	0.0019	—	350.4	4.0	434.0
lb/hr	1.30	0.61	0.86	0.02	0.17	3,029	34	3,752
lb/day	31.12	14.52	20.75	0.39	4.15	72,696	826	90,043
lb/yr	11,359.51	5,301.11	7,573.01	143.89	1,514.60	26,533,900	301,522	32,865,854
metric tons/yr						12,036	137	14,908

Notes:

1. Engine ratings based on specifications for GE Jenbacher J420 cogeneration engine.
2. BACT levels based on BAAQMD BACT Guideline for Spark Ignition, Natural Gas IC Engines and ARB Guidance for Permitting of Electrical Generation Technologies, July 2002.
3. Emission factors for NOx, CO, and ROG based on specifications from the emission control equipment manufacturer.
4. Emission factors for SOx, CO2, and CH4 are based AP-42, Chapter 3.2, Table 3.2-2, and 7,022 Btu/hp-hr fuel input rating.

**LBNL CRT Project
Emergency Generator**

Rating 250 KW
 353 HP
 Operating Hours 1.0 hr/day
 50 hr/yr

	ROG	NOx	CO	SOx	PM10	CO ₂
gm/HP-hr	1.0	3.0	2.6	0.005	0.01	521.64
lb/hr	0.78	2.33	2.02	0.00	0.01	405.95
lb/day	0.78	2.33	2.02	0.00	0.01	405.95
lb/yr	38.91	116.73	101.17	0.19	0.39	20,297.50
metric tons/yr						9.21

Notes:

1. Emission factors (except SOx and PM10) based on EPA/CARB emission standards for 2010 MY engines rated at \geq 300 HP and $<$ 600 HP.
2. Emission Factor for SOx is based on 15 ppm (0.0015%) S and fuel usage of 0.4 lb/HP-hr.
3. Emission Factor for PM10 is based on CARB ATCM for compression-ignition engines (assumes DPM filter).
4. Emission factor for CO₂ is based AP-42, Chapter 3.3, Table 3.3.-1.

**LBNL CRT Project
Cooling Towers
Daily Emissions**

Cogeneration Option

High Flow Rate	1465 Gallons per Minute
Maximum Drift	0.005% Percent
Water Density	8.34 Pounds per gallon
	9 Cooling Towers
	24 hr/day

	PM10
TDS ppm	536
lb/hr	0.18
lb/day	4.24

Note:

1. Total dissolved solids (TDS) is based on a maximum electrical conductivity of 800 micromhos per centimeter, which is a TDS of approximately 536 ppm.

Emergency Generator Option

High Flow Rate	1465 Gallons per Minute
Maximum Drift	0.005% Percent
Water Density	8.34 Pounds per gallon
	5 Cooling Towers
	24 hr/day

	PM10
TDS ppm	536
lb/hr	0.10
lb/day	2.36

Note:

1. Total dissolved solids (TDS) is based on a maximum electrical conductivity of 800 micromhos per centimeter, which is a TDS of approximately 536 ppm.

**LBNL CRT Project
Cooling Towers
Annual Emissions**

Cogeneration Option

High Flow Rate	735 Gallons per Minute
Maximum Drift	0.005% Percent
Water Density	8.34 Pounds per gallon
	9 Cooling Towers
	24 hr/day
	90 day/yr (5 towers)
	365 day/yr (4 towers)

	PM10
TDS ppm	536
lb/yr	451.8

Note:

1. Total dissolved solids (TDS) is based on a maximum electrical conductivity of 800 micromhos per centimeter, which is a TDS of approximately 536 ppm.
2. Cooling towers for building cooling are assumed to operate up to 90 days per year. Cooling towers for cogeneration are assumed to operate 365 days per year.

Emergency Generator Option

High Flow Rate	735 Gallons per Minute
Maximum Drift	0.005% Percent
Water Density	8.34 Pounds per gallon
	5 Cooling Towers
	24 hr/day
	90 day/yr

	PM10
TDS ppm	536
lb/yr	106.5

Note:

1. Total dissolved solids (TDS) is based on a maximum electrical conductivity of 800 micromhos per centimeter, which is a TDS of approximately 536 ppm.
2. Cooling towers for building cooling are assumed to operate up to 90 days per year.

**CRT Facility
Greenhouse Gas Emissions from Motor Vehicles**

Source	Annual CO ₂ Emissions (tons/yr) ¹	Annual CO ₂ E Emissions (metric tons/yr) ^{2,3}
Proposed Land Uses	344.2	328.6

1. Estimated emissions from URBEMIS2007
2. CO₂ emissions are assumed to be 95% of GHG emissions on a CO₂ equivalent basis. (U.S. EPA, "Emission Facts - Greenhouse Gas Emissions from a Typical Passenger Vehicle", Office of Transportation and Air Quality, EPA420-F-05-004, February 2005)
3. 1 metric ton = 1.102 tons

**CRT Facility
Greenhouse Gas Emissions from Area Sources**

GHG	Emission Factor (lb/10 ⁶ scf) ¹	GWP	% CO ₂ E
CO ₂	120,000	1	99.4%
N ₂ O	2.2	310	0.6%
CH ₄	2.3	21	0.0%
CO ₂ E	120,730		

Proposed Land Uses	Annual CO ₂ (tons/yr) ²	Annual CO ₂ E (metric tons/yr) ³
Proposed Land Uses	203.2	185.5

1. U.S. EPA. AP-42 Chapter 1.4 Natural Gas Combustion. July 1998.
2. Estimated emissions from URBEMIS2007
3. 1 metric ton = 1.102 tons

CRT CO Hotspots Analysis

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title: LBNL CRT Project
 Intersection: Centennial Dr and Grizzly Pk Blvd
 Analysis Condition: Cumulative with Project
 Nearest Air Monitoring Station measuring CO: 822 Alice Street Oakland, CA 94607
 Background 1-hour CO Concentration (ppm): 6.8
 Background 8-hour CO Concentration (ppm): 4.2
 Persistence Factor: 0.7
 Analysis Year: 2025

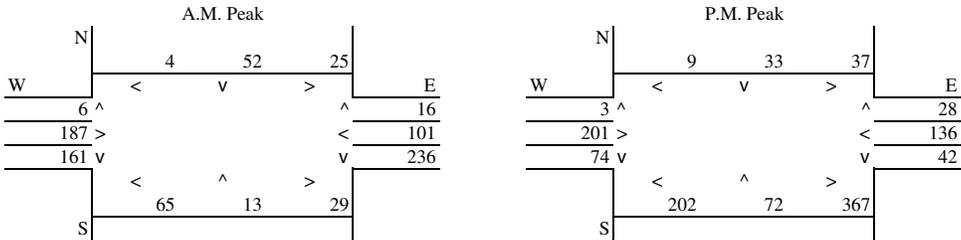
	Roadway Type	No. of Lanes	Approach/Departure Speed	
			A.M.	P.M.
North-South Roadway: Centennial Drive	AT GRADE	2	5	5
East-West Roadway: Grizzly Peak Boulevard	AT GRADE	2	5	5

EMFAC2007 COMPOSITE EMISSION FACTORS FOR CO

Air Basin: San Francisco Bay Area County: All
 Assumes lowest mean wintertime temperature of 40 degrees F and 30% humidity.

Year	Average Speed (miles per hour)									
	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES



Representative Traffic Volumes (Vehicles per Hour)

N-S Road	556	N-S Road	790
E-W Road	594	E-W Road	811
Primary Road =	E-W Road	Primary Road =	E-W Road

ROADWAY CO CONTRIBUTIONS

Roadway	Reference CO Concentrations			*	Traffic Volume	*	Emission Factor	÷	
	0 Feet	25 Feet	50 Feet						
A.M. Peak Hour									
N-S Road	3.7	2.7	2.2	*	556	*	2.14	÷	100,000
E-W Road	14.0	7.6	5.7	*	594	*	2.14	÷	100,000
P.M. Peak Hour									
N-S Road	3.7	2.7	2.2	*	790	*	2.14	÷	100,000
E-W Road	14.0	7.6	5.7	*	811	*	2.14	÷	100,000

TOTAL CO CONCENTRATIONS (ppm)

	A.M. Peak Hour	P.M. Peak Hour	8-Hour
0 Feet from Roadway Edge	7.0	7.1	4.4
25 Feet from Roadway Edge	6.9	6.9	4.3
50 Feet from Roadway Edge	6.8	6.9	4.3

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title: LBNL CRT Project
 Intersection: Gayley Ave-La Loma Ave and Hearst Ave
 Analysis Condition: Cumulative with Project
 Nearest Air Monitoring Station measuring CO: 822 Alice Street Oakland, CA 94607
 Background 1-hour CO Concentration (ppm): 6.8
 Background 8-hour CO Concentration (ppm): 4.2
 Persistence Factor: 0.7
 Analysis Year: 2025

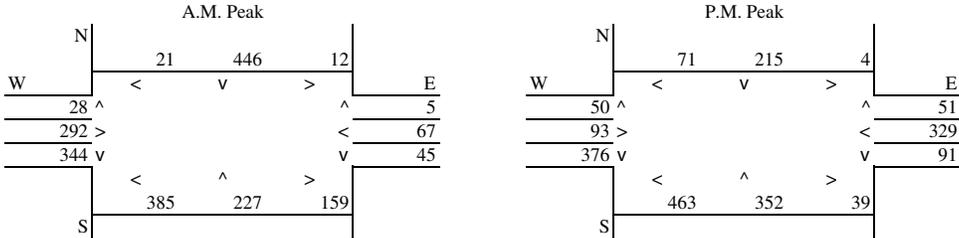
	Roadway Type	No. of Lanes	Approach/Departure Speed	
			A.M.	P.M.
North-South Roadway: Gayley Avenue/La Loma Avenue	AT GRADE	2	5	5
East-West Roadway: Hearst Avenue	AT GRADE	2	5	5

EMFAC2002 COMPOSITE EMISSION FACTORS FOR CO

Air Basin: San Francisco Bay Area County: All
 Assumes lowest mean wintertime temperature of 40 degrees F and 30% humidity.

Year	Average Speed (miles per hour)									
	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES



Representative Traffic Volumes (Vehicles per Hour)

N-S Road	1,606	N-S Road	1,536
E-W Road	1,137	E-W Road	1,382
Primary Road =	N-S Road	Primary Road =	N-S Road

ROADWAY CO CONTRIBUTIONS

Roadway	Reference CO Concentrations			Traffic Volume	Emission Factor
	0 Feet	25 Feet	50 Feet		
A.M. Peak Hour					
N-S Road	14.0	7.6	5.7	* 1,606	* 2.14 ÷ 100,000
E-W Road	3.7	2.7	2.2	* 1,137	* 2.14 ÷ 100,000
P.M. Peak Hour					
N-S Road	14.0	7.6	5.7	* 1,536	* 2.14 ÷ 100,000
E-W Road	3.7	2.7	2.2	* 1,382	* 2.14 ÷ 100,000

TOTAL CO CONCENTRATIONS (ppm)

	A.M. Peak Hour	P.M. Peak Hour	8-Hour
0 Feet from Roadway Edge	7.3	7.3	4.6
25 Feet from Roadway Edge	7.1	7.1	4.4
50 Feet from Roadway Edge	7.0	7.0	4.4

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title: LBNL CRT Project
 Intersection: Gayley Ave and Stadium Rim Wy
 Analysis Condition: Cumulative with Project
 Nearest Air Monitoring Station measuring CO: 822 Alice Street Oakland, CA 94607
 Background 1-hour CO Concentration (ppm): 6.8
 Background 8-hour CO Concentration (ppm): 4.2
 Persistence Factor: 0.7
 Analysis Year: 2025

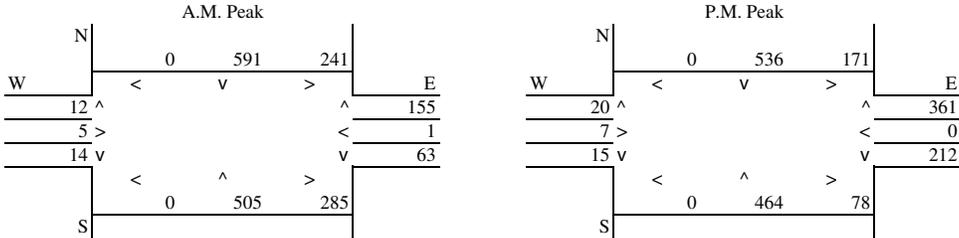
	Roadway Type	No. of Lanes	Approach/Departure Speed	
			A.M.	P.M.
North-South Roadway: Gayley Avenue	AT GRADE	2	5	5
East-West Roadway: Stadium Rim Way	AT GRADE	2	5	5

EMFAC2002 COMPOSITE EMISSION FACTORS FOR CO

Air Basin: San Francisco Bay Area County: All
 Assumes lowest mean wintertime temperature of 40 degrees F and 30% humidity.

Year	Average Speed (miles per hour)									
	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES



Representative Traffic Volumes (Vehicles per Hour)

N-S Road	1,504	N-S Road	1,552
E-W Road	750	E-W Road	829
Primary Road =	N-S Road	Primary Road =	N-S Road

ROADWAY CO CONTRIBUTIONS

Roadway	Reference CO Concentrations			*	Traffic Volume	*	Emission Factor	÷	
	0 Feet	25 Feet	50 Feet						
A.M. Peak Hour									
N-S Road	14.0	7.6	5.7	*	1,504	*	2.14	÷	100,000
E-W Road	3.7	2.7	2.2	*	750	*	2.14	÷	100,000
P.M. Peak Hour									
N-S Road	14.0	7.6	5.7	*	1,552	*	2.14	÷	100,000
E-W Road	3.7	2.7	2.2	*	829	*	2.14	÷	100,000

TOTAL CO CONCENTRATIONS (ppm)

	A.M. Peak Hour	P.M. Peak Hour	8-Hour
0 Feet from Roadway Edge	7.3	7.3	4.6
25 Feet from Roadway Edge	7.0	7.1	4.4
50 Feet from Roadway Edge	7.0	7.0	4.4

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title: LBNL CRT Project
 Intersection: Piedmont Ave and Bancroft Wy
 Analysis Condition: Cumulative with Project
 Nearest Air Monitoring Station measuring CO: 822 Alice Street Oakland, CA 94607
 Background 1-hour CO Concentration (ppm): 6.8
 Background 8-hour CO Concentration (ppm): 4.2
 Persistence Factor: 0.7
 Analysis Year: 2025

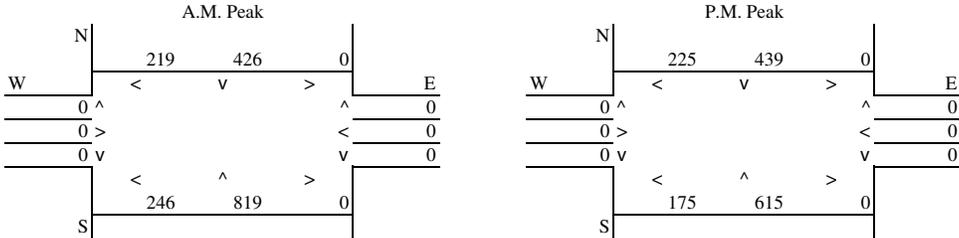
	Roadway Type	No. of Lanes	Approach/Departure Speed	
			A.M.	P.M.
North-South Roadway: Piedmont Avenue	AT GRADE	2	5	5
East-West Roadway: Bancroft Way	AT GRADE	0	5	5

EMFAC2007 COMPOSITE EMISSION FACTORS FOR CO

Air Basin: San Francisco Bay Area County: All
 Assumes lowest mean wintertime temperature of 40 degrees F and 30% humidity.

Year	Average Speed (miles per hour)									
	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES



Representative Traffic Volumes (Vehicles per Hour)

N-S Road	1,491	N-S Road	1,279
E-W Road	465	E-W Road	400
Primary Road =	N-S Road	Primary Road =	N-S Road

ROADWAY CO CONTRIBUTIONS

Roadway	Reference CO Concentrations			*	Traffic Volume	*	Emission Factor	÷	
	0 Feet	25 Feet	50 Feet						
A.M. Peak Hour									
N-S Road	14.0	7.6	5.7	*	1,491	*	2.14	÷	100,000
E-W Road	0.0	0.0	0.0	*	465	*	2.14	÷	100,000
P.M. Peak Hour									
N-S Road	14.0	7.6	5.7	*	1,279	*	2.14	÷	100,000
E-W Road	0.0	0.0	0.0	*	400	*	2.14	÷	100,000

TOTAL CO CONCENTRATIONS (ppm)

	A.M. Peak Hour	P.M. Peak Hour	8-Hour
0 Feet from Roadway Edge	7.2	7.1	4.5
25 Feet from Roadway Edge	7.0	7.0	4.4
50 Feet from Roadway Edge	6.9	6.9	4.3

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title: LBNL CRT Project
 Intersection: Piedmont Ave and Durant Avenue
 Analysis Condition: Cumulative with Project
 Nearest Air Monitoring Station measuring CO: 822 Alice Street Oakland, CA 94607
 Background 1-hour CO Concentration (ppm): 6.8
 Background 8-hour CO Concentration (ppm): 4.2
 Persistence Factor: 0.7
 Analysis Year: 2025

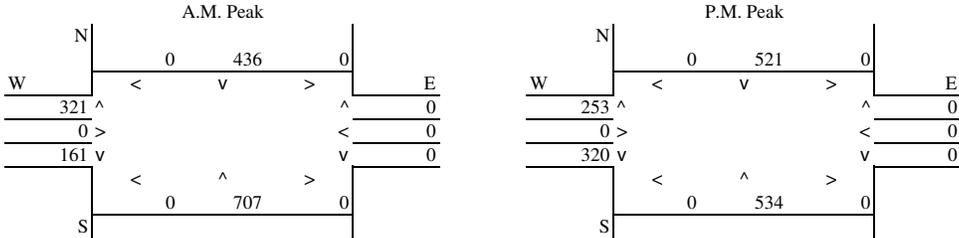
	Roadway Type	No. of Lanes	Approach/Departure Speed	
			A.M.	P.M.
North-South Roadway: Piedmont Avenue	AT GRADE	2	5	5
East-West Roadway: Durant Avenue	AT GRADE	0	5	5

EMFAC2007 COMPOSITE EMISSION FACTORS FOR CO

Air Basin: San Francisco Bay Area County: All
 Assumes lowest mean wintertime temperature of 40 degrees F and 30% humidity.

Year	Average Speed (miles per hour)									
	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES



Representative Traffic Volumes (Vehicles per Hour)

N-S Road	1,464	N-S Road	1,375
E-W Road	482	E-W Road	573
Primary Road =	N-S Road	Primary Road =	N-S Road

ROADWAY CO CONTRIBUTIONS

Roadway	Reference CO Concentrations			Traffic Volume	Emission Factor
	0 Feet	25 Feet	50 Feet		
A.M. Peak Hour					
N-S Road	14.0	7.6	5.7	* 1,464	* 2.14 ÷ 100,000
E-W Road	0.0	0.0	0.0	* 482	* 2.14 ÷ 100,000
P.M. Peak Hour					
N-S Road	14.0	7.6	5.7	* 1,375	* 2.14 ÷ 100,000
E-W Road	0.0	0.0	0.0	* 573	* 2.14 ÷ 100,000

TOTAL CO CONCENTRATIONS (ppm)

	A.M. Peak Hour	P.M. Peak Hour	8-Hour
0 Feet from Roadway Edge	7.2	7.2	4.5
25 Feet from Roadway Edge	7.0	7.0	4.4
50 Feet from Roadway Edge	6.9	6.9	4.3