APPENDIX I.1

AIR QUALITY EMISSIONS CALCULATIONS

AIR QUALITY EMISSIONS CALCULATIONS

This appendix includes tables that show the emissions factors, equipment assumptions, and references used to estimated emissions under the construction phase and the operational phase of the project.

Table I-1 adjusts the emissions estimates for single work crews (for two different construction techniques) shown in Tables I-2 and I-3 based on the expected number of work crews (9 trenching crews and 3 boring crews) and the number of work days per week (six). Table I-1 presents three emissions scenarios in terms of pounds per day and tons per quarter: 1) uncontrolled emissions, 2) emissions with equipment and fuel mitigation measures (also referred to as Tier 1 mitigation), and 3) emissions with implementation of Tier 1 mitigation measures plus Tier 2 mitigation measures. Tier 2 mitigation measures refer to reduced construction activity levels (in terms of lower number of work crews and greater reliance on directional boring).

Table I-2 presents the uncontrolled emissions estimates for a single crew using the street trenching technique and a single crew using the directional boring technique. Table I-2 also shows the assumed equipment mix, average horsepower, load factor, and usage rates for these two different construction techniques. Table I-3 shows the mitigated-case emissions estimates for the two different construction techniques. For Table I-3, the emissions estimates reflect Tier 1 mitigation measures: use of California diesel fuel for all diesel-powered vehicles and use of construction equipment that is properly tuned and maintained in accordance with manufacturer's specifications.

Table I-4 shows the emissions factors and estimates for the four back-up generators that would be used for the Los Angeles Basin Network. Table I-5 shows the emissions factors and estimates for the five back-up generators that would be used for the San Francisco Bay Area Network.

TABLE I-1: METROMEDIA CONSTRUCTION-RELATED EMISSIONS ESTIMATES UNDER UNCONTROLLED, TIER 1 AND TIER 2 MITIGATED CASES

Uncontrolled Emissions Case

Daily Emissions Estimates

			Maximum Construction Day Scenario			
Pollutant	1 Crew Trenching pounds/day	1 Crew Boring pounds/day	9 Crews Trenching pounds/day	3 Crews Boring pounds/day	Total pounds/day	SCAQMD Significance Criteria pounds/day
Carbon Monoxide	21	75	190	224	414	550
Reactive Organic Gases	3	5	27	14	41	75
Nitrogen Oxides	26	16	231	49	**281**	**100**
Sulfur Oxides	2	1	18	4	22	150
Particulate Matter (PM-10)	3	2	23	5	28	150

Quarterly Emissions Estimates

			Maximum Quarterly Construction Scenario			
Pollutant	1 Crew Trenching pounds/day	1 Crew Boring pounds/day	9 Crews Trenching tons/quarter	3 Crews Boring tons/quarter	Total tons/quarter	SCAQMD Significance Criteria tons/quarter
Carbon Monoxide	21	75	7	9	16	24.75
Reactive Organic Gases	3	5	1	1	2	2.5
Nitrogen Oxides	26	16	9	2	**11**	**2.5**
Sulfur Oxides	2	1	1	0	1	6.75
Particulate Matter (PM-10)	3	2	1	0	1	6.75

Assumes six days per week; 13 weeks per quarter.

Tier 1 Mitigated Case (Properly Tuned Equipment and California Diesel Fuel)

NOx Daily Emissions Estimates

			Maximum Construction Day Scenario			
Pollutant	1 Crew Trenching pounds/day	1 Crew Boring pounds/day	9 Crews Trenching pounds/day	3 Crews Boring pounds/day	Total pounds/day	SCAQMD Significance Criteria pounds/day
Nitrogen Oxides	23	15	211	45	**256**	**100**

NOx Quarterly Emissions Estimates

			Maximum Quarterly Construction Scenario			
Pollutant	1 Crew Trenching pounds/day	1 Crew Boring pounds/day	9 Crews Trenching tons/quarter	3 Crews Boring tons/quarter	Total tons/quarter	SCAQMD Significance Criteria tons/quarter
Nitrogen Oxides	23	15	8	2	**10**	**2.5**

Tier 2 Mitigated Case (Tier 1 Measures plus: Reduced Number of Work Crews and Greater Reliance on Directional Boring)

NOx Daily Emissions Estimates

			Reduced Construction Day Scenario			
Pollutant	1 Crew Trenching pounds/day	1 Crew Boring pounds/day	6 Crews Trenching pounds/day	4 Crews Boring pounds/day	Total pounds/day	SCAQMD Significance Criteria pounds/day
Nitrogen Oxides	23	15	141	60	**200**	**100**

NOx Quarterly Emissions Estimates

			Reduced Quarterly Construction Scenario			
Pollutant	1 Crew Trenching pounds/day	1 Crew Boring pounds/day	6 Crews Trenching tons/quarter	4 Crews Boring tons/quarter	Total tons/quarter	SCAQMD Significance Criteria tons/quarter
Nitrogen Oxides	23	15	5.5	2.3	**7.8**	**2.5**

Reduced Work Crews: 6 trenching, 4 boring.

TABLE I-2: ASSUMED CONSTRUCTION EQUIPMENT MIX AND UNCONTROLLED EMISSIONS ESTIMATES

Construction Equipment--Street Trench Spread Scenario:

	Type	Assumed # of type	Fuel	Average Rated HP	Typical operating load factor	Hours of operation	CO factor grams/hp-hr	HC factor grams/hp-hr	NOx factor grams/hp-hr	SOx factor grams/hp-hr	PM-10 factor grams/hp-hr	CO Emissions lb/day	HC Emissions lb/day	NOx Emissions lb/day	SOx Emissions lb/day	PM-10 Emissions lb/day
Assumed Mix of Equipment:	asphalt paver	1	diesel	80	0.59	3	3.2	0.5	10.4	0.9	0.5	1.0	0.1	3.3	0.3	0.1
	roller	1	diesel	78	0.575	1	3.2	0.9	9.1	0.9	0.5	0.3	0.1	0.9	0.1	0.0
	windrow elevator	1	diesel	80	0.53	1	4.5	0.9	10.9	0.9	0.5	0.4	0.1	1.0	0.1	0.0
	grinder	1	diesel	500	0.53	1	4.5	0.9	10.9	0.9	0.5	2.7	0.5	6.4	0.5	0.3
	backhoe	2	diesel	78	0.465	6	5.0	0.9	10.4	0.9	0.7	4.8	0.9	10.0	0.9	0.7
						# of round-trips	grams/veh-trip	grams/veh-trip	grams/veh-trip	grams/veh-trip	grams/veh-trip					
	haul truck	1	diesel	NA	NA	12	144.3	22.4	124.0	4.0	15.8	3.8	0.6	3.3	0.1	0.4
	automobile	10	gasoline	NA	NA	20	183.3	16.4	19.9	0.3	21.3	8.1	0.7	0.9	0.0	0.9
												21	**3**	**26**	**2**	**3**

Fugitive Dust Sources:

Excavation / Soil Density

Amount of soil removed (tons) = (A x B)/2,000

A = Amount of soil removed (cy) =	66.67	cubic yards	(200 ft x 1.5 ft wide x 6 ft deep)
B = Soil Density (lbs/cy) =	2,528	pounds	
Total =	84.27	tons	

Excavation / Emissions

Emissions (PM-10) for aggregate batch drop (excavate and stockpile/aggregate collected and loaded into haul truck)

AP-42 Emissions Factor (lbs/ton) = n x k x (0.0032)(U/5)^1.3 / (M/2)^1.4

n = number of batch drops	3		
k = particle size multiplier =	0.35	for PM-10	
U = mean wind speed =	7.9	miles per hour	(based on ARB data for LAX)
M = material moisture content =	7.9	percent	
Emissions Factor =	0.0009	lbs/ton	
Emissions Rate (lbs/day) =	**0.0750**	**pounds**	

Construction Equipment--Directional Boring Spread Scenario:

	Type	Assumed # of type	Fuel	Average Rated HP	Typical operating load factor	Hours of operation	CO factor grams/hp-hr	HC factor grams/hp-hr	NOx factor grams/hp-hr	SOx factor grams/hp-hr	PM-10 factor grams/hp-hr	CO Emissions lb/day	HC Emissions lb/day	NOx Emissions lb/day	SOx Emissions lb/day	PM-10 Emissions lb/day
Assumed Mix of Equipment:	vacuum trailer	1	gasoline	30	0.56	6	258.8	11.4	5.0	0.2	0.0	57.5	2.5	1.1	0.1	0.0
	drilling machine	1	diesel	70	0.75	8	9.1	1.4	10.9	0.9	0.7	8.4	1.3	10.1	0.8	0.6
	backhoe	1	diesel	78	0.465	4	5.0	0.9	10.4	0.9	0.7	1.6	0.3	3.3	0.3	0.2
	mini-excavator	1	diesel	17.4	0.58	4	5.0	0.5	10.9	0.9	0.7	0.4	0.0	1.0	0.1	0.1
							grams/hr	grams/hr	grams/hr	grams/hr	grams/hr					
	water truck	1	diesel	NA	NA	1	169.3	18.7	82.8	0.0	3.4	0.4	0.0	0.2	0.0	0.0
						# of round-trips	grams/veh-trip	grams/veh-trip	grams/veh-trip	grams/veh-trip	grams/veh-trip					
	automobile	10	gasoline	NA	NA	16	183.3	16.4	19.9	0.3	21.3	6.5	0.6	0.7	0.0	0.8
												75	**5**	**16**	**1**	**2**

Notes: 1) Haul-truck trip length is assumed to be 10 miles round trip @ 25 mph with 15 minute idle-time; emissions based on EMFAC7G, Year 1999, HDDT.

2) 12 haul trips per day are assumed for hauling spoils and delivering fill and materials.

3) Automobile represents construction worker commute trips; based on EMFAC7G, Year 1999, LDA-Catalytic, 75 degrees, 40 mph, 720 minute rest time; 30 miles round-trip.

References: SCAQMD CEQA Handbook Table A9-8 and U.S. EPA, Nonroad Engine and Vehicle Emission Study-Report, November 1991.

TABLE I-3: ASSUMED CONSTRUCTION EQUIPMENT MIX AND MITIGATED EMISSIONS ESTIMATES

Construction Equipment--Street Trench Spread Scenario:

	Type	Assumed # of type	Fuel	Average Rated HP	Typical operating load factor	Hours of operation	CO factor grams/hp-hr	HC factor grams/hp-hr	NOx factor grams/hp-hr	SOx factor grams/hp-hr	PM-10 factor grams/hp-hr	CO Emissions lb/day	HC Emissions lb/day	NOx Emissions lb/day	SOx Emissions lb/day	PM-10 Emissions lb/day
Assumed Mix of Equipment:	asphalt paver	1	diesel	80	0.59	3	3.2	0.5	9.3	0.9	0.5	1.0	0.1	2.9	0.3	0.1
	roller	1	diesel	78	0.575	1	3.2	0.9	8.1	0.9	0.5	0.3	0.1	0.8	0.1	0.0
	windrow elevator	1	diesel	80	0.53	1	4.5	0.9	9.8	0.9	0.5	0.4	0.1	0.9	0.1	0.0
	grinder	1	diesel	500	0.53	1	4.5	0.9	9.8	0.9	0.5	2.7	0.5	5.7	0.5	0.3
	backhoe	2	diesel	78	0.465	6	5.0	0.9	9.3	0.9	0.7	4.8	0.9	9.0	0.9	0.7
						# of round-trips	grams/veh-trip	grams/veh-trip	grams/veh-trip	grams/veh-trip	grams/veh-trip					
	haul truck	1	diesel	NA	NA	12	144.3	22.4	124.0	4.0	15.8	3.8	0.6	3.3	0.1	0.4
	automobile	10	gasoline	NA	NA	20	183.3	16.4	19.9	0.3	21.3	8.1	0.7	0.9	0.0	0.9
												21	**3**	**23**	**2**	**3**

Fugitive Dust Sources:

Excavation / Soil Density

Amount of soil removed (tons) = (A x B)/2,000

A = Amount of soil removed (cy) =	66.67	cubic yards	(200 ft x 1.5 ft wide x 6 ft deep)
B = Soil Density (lbs/cy) =	2,528	pounds	
Total =	84.27	tons	

Excavation / Emissions

Emissions (PM-10) for aggregate batch drop (excavate and stockpile/aggregate collected and loaded into haul truck)

AP-42 Emissions Factor (lbs/ton) = n x k x (0.0032)(U/5)^1.3 / (M/2)^1.4

n = number of batch drops	3		
k = particle size multiplier =	0.35	for PM-10	
U = mean wind speed =	7.9	miles per hour	(based on ARB data for LAX)
M = material moisture content =	7.9	percent	
Emissions Factor =	0.0009	lbs/ton	
Emissions Rate (lbs/day) =	**0.0750**	**pounds**	

Construction Equipment--Directional Boring Scenario:

	Type	Assumed # of type	Fuel	Average Rated HP	Typical operating load factor	Hours of operation	CO factor grams/hp-hr	HC factor grams/hp-hr	NOx factor grams/hp-hr	SOx factor grams/hp-hr	PM-10 factor grams/hp-hr	CO Emissions lb/day	HC Emissions lb/day	NOx Emissions lb/day	SOx Emissions lb/day	PM-10 Emissions lb/day
Assumed Mix of Equipment:	vacuum trailer	1	gasoline	30	0.56	6	258.8	11.4	5.0	0.2	0.0	57.5	2.5	1.1	0.1	0.0
	drilling machine	1	diesel	70	0.75	8	9.1	1.4	9.8	0.9	0.7	8.4	1.3	9.0	0.8	0.6
	backhoe	1	diesel	78	0.465	4	5.0	0.9	9.3	0.9	0.7	1.6	0.3	3.0	0.3	0.2
	mini-excavator	1	diesel	17.4	0.58	4	5.0	0.5	9.8	0.9	0.7	0.4	0.0	0.9	0.1	0.1
							grams/hr	grams/hr	grams/hr	grams/hr	grams/hr					
	water truck	1	diesel	NA	NA	1	169.3	18.7	82.8	NA	3.4	0.4	0.0	0.2	NA	0.0
						# of round-trips	grams/veh-trip	grams/veh-trip	grams/veh-trip	grams/veh-trip	grams/veh-trip					
	automobile	10	gasoline	NA	NA	16	183.3	16.4	19.9	0.3	21.3	6.5	0.6	0.7	0.0	0.8
												75	**5**	**15**	**1**	**2**

Notes: 1) Haul-truck trip length is assumed to be 10 miles round trip @ 25 mph with 15 minute idle-time; emissions based on EMFAC7G, Year 1999, HDDT.
2) 12 haul trips per day are assumed for hauling spoils and delivering fill and materials.
3) Automobile represents construction worker commute trips; based on EMFAC7G, Year 1999, LDA-Catalytic, 75 degrees, 40 mph, 720 minute rest time; 30 miles round-trip.

References: SCAQMD CEQA Handbook Table A9-8 and U.S. EPA, Nonroad Engine and Vehicle Emission Study-Report, November 1991.

Mitigation: Proper Tuning of off-road diesel equipment (0.05 reduction factor) and use of California Diesel Fuel.

Reference: Air Resources Board, Public Meeting to Consider Approval of California's Emissions Inventory for Off-Road Large Compression-Ignited (CI) Engines (>25 HP), January 2000.

TABLE I-4: METROMEDIA GENERATOR-RELATED EMISSIONS ESTIMATES ASSOCIATED WITH LOS ANGELES BASIN NETWORK

Operational-Phase Emissions Estimates

Pollutant	Emission Factors in grams per brake horsepower-hour /a/	Estimated Hourly Emissions in grams at 80 HP /b/	Estimated Hourly Emissions in pounds one generator	Estimated Daily Emissions in pounds on day of weekly tests /c/ assuming 4 generators	SCAQMD Recommended Significance Criteria in pounds per day	Estimated Annual Emissions in tons (weekly tests) 4 generators	Estimated Annual Emissions in tons (max usage) 4 generators
Carbon Monoxide	8.50	680	1.5	6	550	0.16	0.60
Reactive Organic Gases	1.00	80	0.2	1	55	0.02	0.07
Nitrogen Oxides	6.90	552	1.2	5	55	0.13	0.49
Sulfur Dioxide	0.93	74	0.2	1	150	0.02	0.07
Particulate Matter (PM-10)	0.38	30	0.1	0	150	0.01	0.03

a/ SCAQMD BACT requirement for all but sulfur dioxide, which is based on U.S. EPA, AP-42, Section 3.3, October 1996.
b/ The proposed back-up generator would generate 60 Kilowatts (kW), equivalent to 80 horsepower.
c/ Operation of the proposed generator would typically include hourly tests once per week for a total annual usage of 52 hours per year.
d/ Annual hours of operation for each individual generator would be limited to 200.

South Coast Air Basin Emissions Inventory

Pollutant	South Coast Air Basin Year 1996 tons per year	Project as % of South Coast at 52 hours/year	Project as % of South Coast at 200 hours/year
Reactive Organic Gases	401,500	0.000005%	0.00002%
Nitrogen Oxides	401,500	0.000032%	0.00012%
Particulate Matter (PM-10)	160,600	0.000004%	0.00002%

Source: Air Resources Board, Emission Inventory 1996, October 1998.

TABLE I-5: METROMEDIA GENERATOR-RELATED EMISSIONS ESTIMATES RELATED TO SAN FRANCISCO BAY AREA NETWORK

Operational-Phase Emissions Estimates

Pollutant	U.S. EPA Emission Factors in pounds per horsepower-hour /a/	Emissions Factors Converted to kilograms per kilowatt-hour	Estimated Emissions in pounds per hour at 60 kW for one generator /c/	Estimated Emissions in pounds per day on day of weekly test assuming 4 generators	BAAQMD Recommended Significance Criteria pounds per day	Estimated Emissions in pounds per year at assuming 4 generators Expected Usage /d/	Estimated Emissions in pounds per year at assuming 4 generators Maximum Usage /d/	Estimated Emissions Converted to tons per year Expected Usage	Estimated Emissions Converted to tons per year Maximum Usage	BAAQMD Recommended Significance Criteria tons per year
Carbon Monoxide	0.0067	0.0041	0.5	2	NA	112	322	0.1	0.2	NA
Total Organic Compounds /b/	0.0025	0.0015	0.2	1	80	42	121	0.0	0.1	15
Nitrogen Oxides	0.0310	0.0188	2.5	10	80	519	1,496	0.3	0.7	15
Sulfur Dioxide	0.0021	0.0012	0.2	1	NA	34	99	0.0	0.0	NA
Particulate Matter (PM-10)	0.0022	0.0013	0.2	1	80	37	106	0.0	0.1	15

a/ U.S. EPA, AP-42, Section 3.3, October 1996.
b/ Total Organic Compounds (TOC) are assumed to equal Reactive Organic Gases (ROG).
c/ The proposed back-up generator would generate 60 Kilowatts (kW); there would be a total of four such generators.
d/ Operation of any given proposed generator would not be expected to exceed 150 hours per year; actual usage is expected to be 52 hours per year.

San Francisco Bay Area Air Basin Emissions Inventory

Pollutant	Year 1996 tons per year	Project as % of Bay Area Expected Usage	Project as % of Bay Area Maximum Usage
Reactive Organic Gases	178,850	0.000012%	0.00003%
Nitrogen Oxides	197,100	0.00013%	0.0004%
Particulate Matter (PM-10)	58,400	0.00003%	0.0001%

Source: Air Resources Board, Emissions Inventory 1996, October 1998.