CHAPTER 3

EXISTING SETTING

Introduction
Air Quality
Water Resources
Transportation / Circulation
Public Services
Solid / Hazardous Waste
Energy / Mineral Resources
Hazards

INTRODUCTION

In order to determine the significance of the impacts associated with a proposed project, it is necessary to evaluate the project's impacts against the backdrop of the environment as it exists at the time the NOP/IS is published. The CEQA Guidelines defines "environment" as "the physical conditions that exist within the area which will be affected by a proposed project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historical or aesthetic significance" (CEQA Guidelines §15360; see also Public Resources Code §21060.5). Furthermore, a CEQA document must include a description of the physical environment in the vicinity of the project, as it exists at the time the notice of preparation is published, from both a local and regional perspective (CEQA Guidelines §15125). Therefore, the "environment" or "existing setting" against which a project's impacts are compared consists of the immediate, contemporaneous physical conditions at and around the project site (Remy, et al; 1996).

The following sections set forth the existing setting for each environmental topic analyzed in this report, i.e., air quality, water resources, transportation/circulation, public services, solid/hazardous waste, energy/mineral resources, and hazards. In Chapter 4, potential adverse impacts from these identified environmental areas are then compared to the existing setting to determined whether the effects of the implementation of the proposed fleet vehicle rules are significant.

AIR QUALITY

It is the responsibility of the SCAQMD to ensure that state and federal ambient air quality standards are achieved and maintained. Health-based air quality standards have been established by California and the federal government for the following criteria air pollutants: ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), particulate matter less than 10 microns (PM10), sulfur dioxide (SO_2) and lead. These standards were established to protect sensitive receptors with a margin of safety from adverse health impacts due to exposure to air pollution. The California standards are more stringent than the federal standards and in the case of PM10 and SO_2, far more stringent. California has also established standards for sulfate, visibility, hydrogen sulfide, and vinyl chloride. The state and national ambient air quality standards for each of these pollutants and their effects on health are summarized in Table 3-1.

The SCAQMD monitors levels of various criteria pollutants at 33 monitoring stations. In 1998, the area within the SCAQMD's jurisdiction exceeded the federal standards for ozone, carbon monoxide, or PM10 on a total of 97 days. In 1998, the annual maximum concentrations of ozone and CO in the district exceeded both federal and state standards in some or all areas. For PM10, only the state standard was exceeded in some or all areas with in the district. In 1998, no areas of the Basin exceeded standards for NO_x, SO_2, lead, or sulfate. Currently, the district is in attainment with the ambient air quality standards for lead and SO_2 and NO_2. The 1998 air quality data from SCAQMD's monitoring stations are presented in Table 3-2.

Ozone

Unlike primary criteria pollutants that are emitted directly from an emissions source, ozone is a secondary pollutant. It is formed in the atmosphere through a photochemical reaction of VOC, NOx, oxygen, and other hydrocarbon materials with sunlight.

Ozone is a deep lung irritant, causing the passages to become inflamed and swollen. Exposure to ozone produces alterations in respiration, the most characteristic of which is shallow, rapid breathing and a decrease in pulmonary performance. Ozone reduces the respiratory system's ability to fight infection and to remove foreign particles. People who suffer from respiratory diseases such as asthma, emphysema, and chronic bronchitis are more sensitive to ozone's effects. In severe cases, ozone is capable of causing death from pulmonary edema. Early studies suggested that long-term exposure to ozone results in adverse effects on morphology and function of the lung and acceleration of lung-tumor formation and aging. Ozone exposure also increases the sensitivity of the lung to bronchoconstrictive agents such as histamine, acetylcholine, and allergens.

The national ozone ambient air quality standard is exceeded far more frequently in the SCAQMD's jurisdiction than any other area in the United States[1]. In the past few years, ozone air quality has been the cleanest on record in terms of maximum concentration and number of days exceeding the standards and episode levels. Maximum 1-hour average and 8-hour average ozone concentrations in 1998 (0.24 ppm and 0.21 ppm) were 200 percent and 263 percent of the federal 1-hour and 8-hour standards, respectively. Ozone concentrations exceeded the 1-hour state standard at all but two monitored locations in 1998.

The 1-hour federal ozone standard was exceeded a number of days in different areas of the Basin in 1998. The number of days exceeding the federal standard varies widely between different areas of the Basin. The standard was exceeded most frequently in the Basin's inland valleys in an area extending from the East San Gabriel Valley eastward to the Riverside-San Bernardino area and into the adjacent mountains. The Central San Bernardino Valley recorded the greatest number of exceedances of the national ozone standard (57 days).

[1] It should be noted that in 1999 Houston, Texas exceeded the federal ozone standards on several occasions and reported the highest ozone concentration in the nation.

TABLE 3-1

Federal and State Ambient Air Quality Standards

	STATE STANDARD	FEDERAL PRIMARY STANDARD	MOST RELEVANT EFFECTS
AIR POLLUTANT	CONCENTRATION/ AVERAGING TIME	CONCENTRATION/ AVERAGING TIME	
Ozone	0.09 ppm, 1-hr. avg. >	0.12 ppm, 1-hr avg.>	(a) Short-term exposures: (1) Pulmonary function decrements and localized lung edema in humans and animals (2) Risk to public health implied by alterations in pulmonary morphology and host defense in animals; (b) Long-term exposures: Risk to public health implied by altered connective tissue metabolism and altered pulmonary morphology in animals after long-term exposures and pulmonary function decrements in chronically exposed humans; (c) Vegetation damage; (d) Property damage
Carbon Monoxide	9.0 ppm, 8-hr avg. > 20 ppm, 1-hr avg. >	9 ppm, 8-hr avg.> 35 ppm, 1-hr avg.>	(a) Aggravation of angina pectoris and other aspects of coronary heart disease; (b) Decreased exercise tolerance in persons with peripheral vascular disease and lung disease; (c) Impairment of central nervous system functions; (d) Possible increased risk to fetuses
Nitrogen Dioxide	0.25 ppm, 1-hr avg. >	0.053 ppm, ann. avg.>	(a) Potential to aggravate chronic respiratory disease and respiratory symptoms in sensitive groups; (b) Risk to public health implied by pulmonary and extra-pulmonary biochemical and cellular changes and pulmonary structural changes; (c) Contribution to atmospheric discoloration
Sulfur Dioxide	0.04 ppm, 24-hr avg.> 0.25 ppm, 1-hr. avg. >	0.03 ppm, ann. avg.> 0.14 ppm, 24-hr avg.>	(a) Bronchoconstriction accompanied by symptoms which may include wheezing, shortness of breath and chest tightness, during exercise or physical activity in persons with asthma
Suspended Particulate Matter (PM10)	30 $\mu g/m^3$, ann. geometric mean > 50 $\mu g/m^3$, 24-hr average>	50 $\mu g/m^3$, annual arithmetic mean > 150 $\mu g/m^3$, 24-hr avg.>	(a) Excess deaths from short-term exposures and exacerbation of symptoms in sensitive patients with respiratory disease; (b) Excess seasonal declines in pulmonary function, especially in children
Sulfates	25 $\mu g/m^3$, 24-hr avg. >=		(a) Decrease in ventilatory function; (b) Aggravation of asthmatic symptoms; (c) Aggravation of cardio-pulmonary disease; (d) Vegetation damage; (e) Degradation of visibility; (f) Property damage
Lead	1.5 $\mu g/m^3$, 30-day avg. >=	1.5 $\mu g/m^3$, calendar quarter>	(a) Increased body burden; (b) Impairment of blood formation and nerve conduction
Visibility-Reducing Particles	In sufficient amount to reduce the visual range to less than 10 miles at relative humidity less than 70%, 8-hour average (10am - 6pm)		Visibility impairment on days when relative humidity is less than 70 percent

TABLE 3-2

1998 South Coast Air Quality Management District Air Quality Data

Carbon Monoxide								
						No. Days Standard Exceeded[a)] Federal	State	
Source/ Receptor Area No.	Location of Air Monitoring Station	No. Days of Data	Max. Conc. in ppm 1-hour	Max. Conc. in ppm 8-hour		≤9.5 ppm 8-hr.	>9.0 ppm 8-hr.	> 20 ppm 1-hr
LOS ANGELES COUNTY								
1	Central LA	364	8	6.1		0	0	0
2	NW Coast LA Co	358	7	4.5		0	0	0
3	SW Coast LA Co	363	11	9.4		0	1	0
4	S Coast LA Co	353	8	6.6		0	0	0
6	W Sn Fernan V	365	11	9.3		0	1	0
7	E Sn Fernan V	365	8	7.5		0	0	0
8	W Sn Gabrl V	348	8	6.3		0	0	0
9	E Sn Gabrl V1	359	6	3.9		0	0	0
9	E Sn Gabrl V2	--	--	--		--	--	--
10	Pomona/Wln	325	10	7.3		0	0	0
11	S Sn Gabrl V	357	17	13.4		10	11	0
12	S Cent LA Co 1	151*	18*	13.5*		8*	9*	0*
12	S Cent LA Co 2	151*	18*	13.5*		8*	9*	0*
13	Sta Clarita V	350	8	3.4		0	0	0
ORANGE COUNTY								
16	N Orange Co	365	15	6.1		0	0	0
17	Cent Orange Co	348	8	5.3		0	0	0
18	N Coast Orange	358	9	7.0		0	0	0
19	Saddleback V	319*	6*	3.1*		0*	0*	0*
RIVERSIDE COUNTY								
22	Norco/Corona	--	--	--		--	--	--
23	Metro Riv Co 1	342	5	4.6		0	0	0
23	Metro Riv Co 2	365	6	4.6		0	0	0
24	Perris Valley	--	--	--		--	--	--
25	Lake Elsinore	--	--	--		--	--	--
29	Banning/San Gor	--	--	--		--	--	--
29	Banning Airport	--	--	--		--	--	--
30	Coachella V1**	363	3	1.6		0	0	0
30	Coachella V2**	--	--	--	--	--	--	--
SAN BERNARDINO COUNTY								
32	NW SB V	--	--	--	--	--	--	--
33	SW SB V	--	--	--	--	--	--	--
34	Cent SB V 1	--	--	--	--	--	--	--
34	Cent SB V 2	360	6	4.6	0	0	0	0
35	E SB V	--	--	--	--	--	--	--
37	Cent SB Mtns	--	--	--	--	--	--	--

ABBREVIATIONS USED IN THE AREA NAMES: LA = Los Angeles, SB = San Bernardino, N = North, S = South, W = West, E = East, V = Valley, P = Pass, Cent = Central

ppm - Parts per million parts of air, by volume.
-- - Pollutant not monitored.
* - Less than 12 full months of data. May not be representative.
** - Salton Sea Air Basin
a) - The federal 1-hour standard (1-hour average CO > 35 ppm) was not exceeded.

TABLE 3-2 (CONTINUED)

1998 South Coast Air Quality Management District Air Quality Data

Ozone

Source/ Receptor Area No.	Location of Air Monitoring Station	No. Days of Data	Conc. in ppm 1-hour	Max. Conc. in ppm 8-hour	Max High Conc.> . ppm 8-hour	No. Days Standard Exceeded: Federal: Fourth 12 ppm 1-hr.	Federal: > .08 ppm 8-hr.	State: > .09 ppm 1-hour
LOS ANGELES COUNTY								
1	Central LA	362	0.15	0.11	0.096	5	9	17
2	NW Coast LA Co	365	0.13	0.08	0.070	1	0	7
3	SW Coast LA Co	363	0.09	0.07	0.064	0	0	0
4	S Coast LA Co	361	0.12	0.08	0.065	0	0	2
6	W Sn Fernan V	365	0.16	0.12	0.100	7	13	23
7	E Sn Fernan V	355	0.18	0.13	0.101	7	14	34
8	W Sn Gabrl V	349	0.17	0.14	0.118	14	17	31
9	E Sn Gabrl V1	352	0.20	0.15	0.126	19	23	43
9	E Sn Gabrl V2	352	0.22	0.17	0.143	28	38	61
10	Pomona/Wln V1	365	0.18	0.13	0.120	18	21	41
11	S Sn Gabrl V	364	0.18	0.12	0.103	10	13	31
12	S Cent LA Co 1	361	0.09	0.06	0.051	0	0	0
12	S Cent LA Co 2	160*	9.13*	0.10*	0.085*	1*	4*	7*
13	Sta Clarita V	352	0.18	0.15	0.128	16	35	38
ORANGE COUNTY								
16	N Orange Co	365	0.18	0.11	0.094	5	4	16
17	Cent Orange Co	365	0.14	0.11	0.088	2	4	10
18	N Coast Orange	361	0.12	0.08	0.076	0	0	5
19	Saddleback V	355	0.16	0.11	0.083	2	3	15
RIVERSIDE COUNTY								
22	Norco/Corona	--	--	--	--	--	--	--
23	Metro Riv Co 1	361	0.20	0.17	0.136	32	57	70
23	Metro Riv Co 2	--	--	--	--	--	--	--
24	Perris Valley	365	0.15	0.13	0.115	8	28	38
25	Lake Elsinore	358	0.17	0.14	0.129	22	44	52
29	Banning/San G P	181*	0.12*	0.10*	0.084*	0*	3*	4*
29	Banning Airport	357	0.17	0.14	0.124	25	52	67
30	Coachella V 1**	361	0.17	0.14	0.109	8	38	40
30	Coachella V 2**	364	0.13	0.12	0.098	2	16	16
SAN BERNARDINO COUNTY								
32	NW SB V	364	0.21	0.17	0.138	30	40	60
33	SW SB V	--	--	--	--	--	--	--
34	Cent SB V 1	362	0.20	0.17	0.133	32	43	60
34	Cent SB V 2	353	0.21	0.18	0.145	39	50	65
35	E SB V	365	0.22	0.19	0.149	43	60	76
37	Cent SB Mtns	364	0.24	0.21	0.190	57	97	97

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ppm - Parts per million parts of air, by volume.
-- - Pollutant not monitored.
* - Less than 12 full months of data. May not be representative.
** - Salton Sea Air Basin.

TABLE 3-2 (CONTINUED)

1998 South Coast Air Quality Management District Air Quality Data

Nitrogen Dioxide					
				Average Compared to Federal Standard[b)]	No. Days Std. Exc'd State
Source/ Receptor Area No.	Location of Air Monitoring Station	No. Days of Data	Max. Conc. in ppm 1-hour	AAM in ppm	> .25 ppm 1-hour
LOS ANGELES COUNTY					
1	Central LA	362	0.17	0.0398	0
2	NW Coast LA Co	351	0.13	0.0270	0
3	SW Coast LA Co	333	0.15	0.0295	0
4	S Coast LA Co	349	0.16	0.0339	0
6	W Sn Fernan V	359	0.14	0.0266	0
7	E Sn Fernan V	365	0.14	0.0416	0
8	W Sn Gabrl V	349	0.16	0.0351	0
9	E Sn Gabrl V 1	353	0.14	0.0364	0
9	E Sn Gabrl V 2	353	0.13	0.0276	0
10	Pomona/Wln V	363	0.15	0.0433	0
11	S Sn Gabrl V	358	0.14	0.0369	0
12	S Cent LA Co 1	357	0.26	0.0393	0
12	S Cent LA Co 2	--	--	--	--
13	Sta Clarita V	--	--	--	--
ORANGE COUNTY					
16	N Orange Co	361	0.13	0.0344	0
17	Cent Orange Co	362	0.13	0.0336	0
18	N Coast Orange Co	365	0.12	0.0200	0
19	Saddleback V	--	--	--	--
RIVERSIDE COUNTY					
22	Norco/Corona	--	--	--	--
23	Metro Riv Co 1	321*	0.10*	0.0225*	0*
23	Metro Riv Co 2	--	--	--	--
24	Perris Valley	--	--	--	--
25	Lake Elsinore	358	0.09	0.0174	0
29	Banning/San Gor P	--	--	--	--
29	Banning Airport	359	0.26	0.0215	1
30	Coachella V 1**	347	0.07	0.0170	0
30	Coachella V 2**	--	--	--	--
SAN BERNARDINO COUNTY					
32	NW SB V	349	0.14	0.0359	0
33	SW SB V	--	--	--	--
34	Cent SB V 1	365	0.15	0.0362	0
34	Cent SB V 2	355	0.11	0.0339	0
35	E SB V	--	--	--	--
37	Cent SB Mtns	--	--	--	--

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ppm - Parts per million parts of air, by volume.
AAM - Annual arithmetic mean.
-- - Pollutant not monitored.
* - Less than 12 full months of data. May not be representative.
** - Salton Sea Air Basin.
b) - The federal standard is annual arithmetic mean NO^2 greater than 0.0534 ppm. No location exceeded this standard.

TABLE 3-2 (CONTINUED)

1998 South Coast Air Quality Management District Air Quality Data

Sulfur Dioxide

Source/ Receptor Area No.	Location of Air Monitoring Station	No. Days of Data	Max. Conc. in ppm 1-hour[c)]	Max. Conc. in ppm 24-hour[c)]	Average Compared to Federal Standard[d)] AAM in ppm
LOS ANGELES COUNTY					
1	Central LA	364	0.14	0.010	0.0008
2	NW Coast LA Co	--	--	--	--
3	SW Coast LA Co	359	0.03	0.014	0.0039
4	S Coast LA Co	363	0.08	0.013	0.0018
6	W Sn Fernan V	--	--	--	--
7	E Sn Fernan V	365	0.01	0.009	0.0002
8	W Sn Gabrl V	--	--	--	--
9	E Sn Gabrl V 1	--	--	--	--
9	E Sn Gabrl V 2	--	--	--	--
10	Pomona/Wln V	--	--	--	--
11	S Sn Gabrl V	--	--	--	--
12	S Cent LA Co 1	--	--	--	--
12	S Cent LA Co 2	--	--	--	--
13	Sta Clarita V	--	--	--	--
ORANGE COUNTY					
16	N Orange Co	--	--	--	--
17	Cent Orange Co	--	--	--	--
18	N Coast Orange	358	0.02	0.008	0.0004
19	Saddleback V	--	--	--	--
RIVERSIDE COUNTY					
22	Norco/Corona	--	--	--	--
23	Metro Riv Co 1	361	0.03	0.010	0.0011
23	Metro Riv Co 2	--	--	--	--
24	Perris Valley	--	--	--	--
25	Lake Elsinore	--	--	--	--
29	Banning/San Gor P	--	--	--	--
29	Banning Airport	--	--	--	--
30	Coachella V 1**	--	--	--	--
30	Coachella V 2**	--	--	--	--
SAN BERNARDINO COUNTY					
32	NW SB V	--	--	--	--
33	SW SB V	--	--	--	--
34	Cent SB V 1	294*	0.02*	0.010*	0.0007
34	Cent SB V 2	--	--	--	--
35	E SB V	--	--	--	--
37	Cent SB Mtns	--	--	--	----

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ppm - Parts per million parts of air, by volume.AAM - Annual arithmetic mean.

* - Less than 12 full months of data. May not be representative.** - Salton Sea Air Basin.

c) - The state standards are 1-hour average > 0.25 ppm and 24-hour average >0.04 ppm. No location exceeded state standards.

d) - The federal standard is annual arithmetic mean SO_2 greater than 80 µg/m^3 (0.03 ppm). No location exceeded this standard. The other federal standards (3-hour average > 0.50 ppm, and 24-hour average > 0.14 ppm) were not exceeded either

TABLE 3-2 (CONTINUED)

1998 South Coast Air Quality Management District Air Quality Data

Suspended Particulates PM10[e)]							
				No. (%) Samples Exceeding Standard		Annual Averages[g)]	
Source/ Receptor Area No.	Location of Air Monitoring Station	No. Days of Data	Max. Conc. in µg/m³ 24-hour	Federal >150 µg/m³ 24-hour	State >50 µg/m³ 24-hour	AAM Conc. µg/m³	AGM Conc. µg/m³
LOS ANGELES COUNTY							
1	Central LA	59	80	0	10(19.9)	37.4	34.2
2	NW Coast LA Co	--	--	--	--	--	--
3	SW Coast LA Co	59	66	0	7(11.9)	32.7	30.3
4	S Coast LA Co	59	69	0	6(10.2)	32.3	29.2
6	W Sn Fernan V	--	--	--	--	--	--
7	E Sn Fernan V	59	75	0	9(15.3)	36.0	32.8
8	W Sn Gabrl V	--	--	--	--	--	--
9	E Sn Gabrl V 1	57	87	0	16(28.1)	40.6	35.7
9	E Sn Gabrl V 2	--	--	--	--	--	--
10	Pomona/Wln V	--	--	--	--	--	--
11	S Sn Gabrl V	--	--	--	--	--	--
12	S Cent LA Co 1	--	--	--	--	--	--
12	S Cent LA Co 2	--	--	--	--	--	--
13	Sta Clarita V	55*	60*	0*	3(5.5)*	30.0*	27.3*
ORANGE COUNTY							
16	N Orange Co	--	--	--	--	--	--
17	Cent Orange Co	61	81	0	12(19.7)	35.9	33.0
18	N Coast Orange	--	--	--	--	--	--
19	Saddleback V	59	70	0*	6(10.2)	30.6	28.0
RIVERSIDE COUNTY							
22	Norco/Corona	57	93	0	23(40.4)	46.7	41.0
23	Metro Riv Co 1	78	116	0	42(53.8)	56.2	48.7
23	Metro Riv Co 2	--	--	--	--	--	--
24	Perris Valley	53*	98*	0*	14(26.4)*	38.1*	33.3*
25	Lake Elsinore	--	--	--	--	--	--
29	Banning/San Gor P	55*	76*	0*	5(9.1)*	27.9*	23.9
29	Banning Airport	52*	62*	0*	2(3.8)*	27.0*	23.5*
30	Coachella V 1**	58	72	0	3(5.2)	26.4	23.8
30	Coachella V 2**	80[j)]	114[j)]	0[j)]	32(40.0)[j)]	48.1[j)]	43.8[j)]
SAN BERNARDINO COUNTY							
32	NW SB V	--	--	--	--	--	--
33	SW SB V	59	92	0	20(33.9)	46.5	40.2
34	Cent SB V 1	60	101	0	28(46.7)	50.2	43.3
34	Cent SB V 2	58	114	0	22(37.9)	46.3	39.3
35	E SB V	60	97	0	19(31.7)	40.5	33.9
37	Cent SB Mtns	58	45	0	0	24.5	21.2

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µg/m³ - Micrograms per cubic meter of air.
AAM - Annual arithmetic mean. AGM - Annual geometric mean.
-- - Pollutant not monitored.
* - Less than 12 full months of data. May not be representative.
** - Salton Sea Air Basin.
e) - PM10 samples were collected every 6 days using the size-selective inlet high volume sampler with quartz filter media
g) - Federal PM10 standard is AAM > 50 µg/m³; state standard is AGM > 30 µg/m³
j) - The data for the sample collected on a high-wind-day (158 µg/m³ on 6/16/98) was excluded according to the U.S. EPA's Natural Events Policy

TABLE 3-2 (CONTINUED)

1998 South Coast Air Quality Management District Air Quality Data

Particulates TSP[f)]				
			Annual Averages	
Source/ Receptor Area No.	Location of Air Monitoring Station	No. Days of Data	Max. Conc. in $\mu g/m^3$ 24-hour	AAM Conc. $\mu g/m^3$
LOS ANGELES COUNTY				
1	Central LA	64	126	61.7
2	NW Coast LA Co	55*	91*	45.4*
3	SW Coast LA Co	60	94	55.5
4	S Coast LA Co	61	101	52.2
6	W Sn Fernan V	--	--	--
7	E Sn Fernan V	--	--	--
8	W Sn Gabrl V	58	87	46.1
9	E Sn Gabrl V 1	46*	167*	74.8*
9	E Sn Gabrl V 2	--	--	--
10	Pomona/Wln V	--	--	--
11	S Sn Gabrl V	60	140	76.3
12	S Cent LA Co 1	60	158	77.7
12	S Cent LA Co 2	--	--	--
13	Sta Clarita V	--	--	--
ORANGE COUNTY				
16	N Orange Co	--	--	--
17	Cent Orange Co	--	--	--
18	N Coast Orange	--	--	--
19	Saddleback V	--	--	--
RIVERSIDE COUNTY				
22	Norco/Corona	--	--	--
23	Metro Riv Co 1	56	216	98.5
23	Metro Riv Co 2	62	138	71.7
24	Perris Valley	--	--	--
25	Lake Elsinore	--	--	--
29	Banning/San Gor P	--	--	--
29	Banning Airport	--	--	--
30	Coachella V 1**	--	--	--
30	Coachella V 2**	--	--	--
SAN BERNARDINO COUNTY				
32	NW SB V	62	132	67.0
33	SW SB V	--	--	--
34	Cent SB V 1	62	175	89.6
34	Cent SB V 2	60	278	84.8
35	E SB V	--	--	--
37	Cent SB Mtns	--	--	--

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$\mu g/m^3$ - Micrograms per cubic meter of air.
AAM - Annual arithmetic mean. AGM - Annual geometric mean.
-- - Pollutant not monitored.
* - Less than 12 full months of data. May not be representative.
** - Salton Sea Air Basin.
f) - Total suspended particulates, lead, and sulfate were determined from samples collected every 6 days by the high volume sampler method, on glass fiber filter media. Federal TSP standard superseded by PM10 standard, July 1, 1987.
i) - Includes make-up sampling days.

TABLE 3-2 (CONTINUED)

1998 South Coast Air Quality Management District Air Quality Data

Lead f)					
				Quarters/Months Exceeding Standard h)	
Source/ Receptor Area No.	Location of Air Monitoring Station	Max. Mo. Conc. µg/m^3	Max. Qtrly. Conc. µg/m^3	Federal >1.5 µg/m^3 Qtrly. Avg.	State >=1.5 µg/m^3 Mo. Avg.
LOS ANGELES COUNTY					
1	Central LA	.0.06	0.04	0	0
2	NW Coast LA Co	--	--	--	--
3	SW Coast LA Co	0.06	0.04	0	0
4	S Coast LA Co	0.07	0.04	0	0
6	W SN Fernan V	--	--	--	--
7	E Sn Fernan V	--	--	--	--
8	W Sn Gabrl V	--	--	--	--
9	E Sn Gabrl V 1	--	--	--	--
9	E Sn Gabrl V 2	--	--	--	--
10	Pomona/Wln V	--	--	--	--
11	S Sn Gabrl V	0.07	0.05	0	0
12	S Cent LA Co 1	0.04	0.04	0	0
12	S Cent LA Co 2	--		--	--
13	Sta Clarita V	--	--	--	--
ORANGE COUNTY					
16	N Orange Co	--	--	--	--
17	Cent Orange Co	--	--	--	--
18	N Coast Orange	--	--	--	--
19	Saddleback V	--	--	--	--
RIVERSIDE COUNTY					
22	Norco/Corona	--	--	--	--
23	Metro Riv Co 1	0.08	0.04	0	0
23	Metro Riv Co 2	0.10	0.05	0	0
24	Perris Valley	--	--	--	--
25	Lake Elsinore	--	--	--	--
29	Banning/San Gor P	--	--	--	--
29	Banning Airport	--	--	--	--
30	Coachella V 1**	--	--	--	--
30	Coachella V 2**	--	--	--	--
SAN BERNARDINO COUNTY					
32	NW SB V	0.05	0.04	0	0
33	SW SB V	--	--	--	--
34	Cent SB V 1	--	--	--	--
34	Cent SB V 2	0.05	0.03	0	0
35	E SB V	--	--	--	--
37	Cent SB Mtns	--	--	--	--

ABBREVIATIONS USED IN THE AREA NAMES: LA = Los Angeles, SB = San Bernardino, N = North, S = South, W = West, E = East, V = Valley, P = Pass, Cent = Central

µg/m^3 - Micrograms per cubic meter of air.-- - Pollutant not monitored.

* - Less than 12 full months of data. May not be representative.

** - Salton Sea or Mojave Desert Air Basin.

f) - Total suspended particulates, lead, and sulfate were determined from samples collected every 6 days by the high lume sampler method, on glass fiber filter media. Federal TSP standard superseded by M10 standard, July 1, 1987.

h) - Special monitoring immediately downwind of stationary sources of lead was carried out at several locations in 1998. The maximum monthly average concentration was 1.24 µg/m^3 and the maximum quarterly average concentration was 0.75 µg/m^3 , both recorded in Area 5, Southeast Los Angeles County.

TABLE 3-2 (CONCLUDED)

1998 South Coast Air Quality Management District Air Quality Data

Source/ Receptor Area No.	Location of Air Monitoring Station	Sulfate[f)] Max. Conc. in µg/m^3 24-hour	No. (%) Samples Exceeding Standard State >=25 µg/m^3 24-hour
LOS ANGELES COUNTY			
1	Central LA	10.6	0
2	NW Coast LA Co	11.2*	0*
3	SW Coast LA Co	13.5	0
4	S Coast LA Co	14.5	0
6	W Sn Fernan V	--	--
7	E Sn Fernan V	--	--
8	W Sn Gabrl V	9.2	0
9	E Sn Gabrl V 1	10.2*	0*
9	E Sn Gabrl V 2	--	--
10	Pomona/Wln V	--	--
11	S Sn Gabrl V	12.0	0
12	S Cent LA Co 1	12.0	0
12	S Cent LA Co 2	--	--
13	Sta Clarita V	--	--
ORANGE COUNTY			
16	N Orange Co	--	--
17	Cent Orange Co	--	--
18	N Coast Orange	--	--
19	Saddleback V	--	--
RIVERSIDE COUNTY			
22	Norco/Corona	--	--
23	Metro Riv Co 1	10.1	0
23	Metro Riv Co 2	12.8	0
24	Perris Valley	--	--
25	Lake Elsinore	--	--
29	Banning/San Gor P	--	--
29	Banning Airport	--	--
30	Coachella V 1**	--	--
30	Coachella V 2**	--	--
SAN BERNARDINO COUNTY			
32	NW SB V	10.5	0
33	SW SB V	--	--
34	Cent SB V 1	10.1	0
34	Cent SB V 2	11.5	0
35	E SB V	--	--
37	Cent SB Mtns	--	--

ABBREVIATIONS USED IN THE AREA NAMES: LA = Los Angeles, SB = San Bernardino, N = North, S = South, W = West, E = East, V = Valley, P = Pass, Cent = Central

µg/m^3 - Micrograms per cubic meter of air.
-- - Pollutant not monitored.
* - Less than 12 full months of data. May not be representative.
** - Salton Sea Air Basin.
f) - Total suspended particulates, lead, and sulfate were determined from samples collected every 6 days by the high volume sampler method, on glass fiber filter media. Federal TSP standard superseded by PM10 standard, July 1, 1987.

In 1997, the USEPA promulgated a new national ambient air quality standard for ozone. However, a recent court decision has ordered that the USEPA cannot enforce the new standard until USEPA provides adequate justification for the new standard. USEPA is in the process of appealing the decision. Meanwhile, CARB and local air districts continue to collect technical information in order to prepare for an eventual SIP to reduce unhealthful levels of ozone in areas violating the new federal standard. California has previously developed a SIP for the current ozone standard.

Carbon Monoxide

CO is a colorless, odorless gas formed by the incomplete combustion of fuels. CO competes with oxygen, often replacing it in the blood, thus reducing the blood's ability to transport oxygen to vital organs in the body. The ambient air quality standard for carbon monoxide is intended to protect persons whose medical condition already compromises their circulatory systems' ability to deliver oxygen. These medical conditions include certain heart ailments, chronic lung diseases, and anemia. Persons with these conditions have reduced exercise capacity even when exposed to relatively low levels of CO. Fetuses are at risk because their blood has an even greater affinity to bind with CO. Smokers are also at risk from ambient CO levels because smoking increases the background level of CO in their blood.

CO was monitored at 21 locations in the district in 1998. The national and state 8-hour CO standards were exceeded at two and four locations, respectively. The highest 8-hour average CO concentration of the year (13.5 ppm) was 179 percent of the federal standard. Source/Receptor Area No. 12, South Central Los Angeles County, reported by far the greatest number of the exceedances of the federal and state CO standards (10 and 11 days, respectively) in 1998.

Nitrogen Dioxide

NO_2 is a brownish gas that is formed in the atmosphere through a rapid reaction of the colorless gas nitric oxide (NO) with atmospheric oxygen. NO and NO_2 are collectively referred to as NO_x. NO_2 can cause health effects in sensitive population groups such as children and people with chronic lung diseases. It can cause respiratory irritation and constriction of the airways, making breathing more difficult. Asthmatics are especially sensitive to these effects. People with asthma and chronic bronchitis may also experience headaches, wheezing and chest tightness at high ambient levels of NO_2. NO_2 is suspected to reduce resistance to infection, especially in young children.

By 1991, exceedances of the federal standard were limited to one location in Los Angeles County. The Basin was the only area in the United States classified as nonattainment for the federal NO_2 standard under the 1990 Clean Air Act Amendments. No location in the area of SCAQMD's jurisdiction has exceeded the federal standard since 1992 and the South Coast

Air Basin was designated attainment for the national standard in 1998. The state NO_2 standard has been met each year since 1994. In 1998, the maximum annual arithmetic mean (0.0433ppm) was 81 percent of the federal standard (the federal standard is annual arithmetic mean NO_2 greater than 0.0534 ppm.). The more stringent state standard was exceeded on one day, with a maximum 1-hour average NO_2concentration (0.26 ppm) which was 104 percent of the state standard (0.25 ppm). In 1998, the South Coast Air Basin was redesignated to attainment of the federal NO_2 ambient air quality standard. Despite declining NO_x emissions over the last decade, further NO_x emissions reductions are necessary because NO_x emissions are PM10 and ozone precursors.

Particulate Matter (PM10)

PM10 is defined as suspended particulate matter 10 microns or less in diameter and includes a complex mixture of man-made and natural substances including sulfates, nitrates, metals, elemental carbon, sea salt, soil, organics and other materials. PM10 may have adverse health impacts because these microscopic particles are able to penetrate deeply into the respiratory system. In some cases, the particulates themselves may cause actual damage to the alveoli of the lungs or they may contain adsorbed substances that are injurious. Children can experience a decline in lung function and an increase in respiratory symptoms from PM10 exposure. People with influenza, chronic respiratory disease and cardiovascular disease can be at risk of aggravated illness from exposure to fine particles. Increases in death rates have been statistically linked to corresponding increases in PM10 levels.

In 1998, PM10 was monitored at 20 locations in the district. There were no exceedances of the federal 24-hour standard (150 $\mu g/m^3$), while the state 24-hour standard (50 $\mu g/m^3$) was exceeded at all 20 locations. The federal standard (annual arithmetic mean greater than 50 $\mu g/m^3$) was exceeded in two locations, and the state standard (annual geometric mean greater than 30 $\mu g/m^3$) was exceeded at 13 locations.

In 1997, the USEPA promulgated a new national ambient air quality standard for PM2.5, particulate matter 2.5 microns or less in diameter. The PM2.5 standard complements existing national and state ambient air quality standards that target the full range of inhalable PM10. However, a recent court decision has ordered that the USEPA cannot enforce the new standard until USEPA provides adequate justification for the new standard. USEPA is in the process of appealing the decision. Meanwhile, CARB and local air districts continue to collect technical information in order to prepare for an eventual SIP to reduce unhealthful levels of PM2.5 in areas violating the new federal standard. California has previously developed a SIP for the current PM10 standard.

Sulfur Dioxide

SO_2 is a colorless, pungent gas formed primarily by the combustion of sulfur-containing fossil fuels. Health effects include acute respiratory symptoms and difficulty in breathing for children. Though SO_2 concentrations have been reduced to levels well below state and federal standards, further reductions in emissions of SO_2 are needed to comply with standards for other pollutants (sulfate and PM10).

Lead

Lead concentrations once exceeded the state and national ambient air quality standards by a wide margin, but have not exceeded state or federal standards at any regular monitoring station since 1982. Though special monitoring sites immediately downwind of lead sources recorded very localized violations of the state standard in 1994, no violations were recorded at these stations since that time.

Sulfates

Sulfates are a group of chemical compounds containing the sulfate group, which is a sulfur atom with four oxygen atoms attached. Though not exceeded in 1993, 1996, 1997, and 1998 the state sulfate standard was exceeded at three locations in 1994 and one location in 1995. There are no federal air quality standards for sulfate.

Visibility

Since deterioration of visibility is one of the most obvious manifestations of air pollution and plays a major role in the public's perception of air quality, the state of California has adopted a standard for visibility or visual range. Until 1989, the standard was based on visibility estimates made by human observers. The standard was changed to require measurement of visual range using instruments that measure light scattering and absorption by suspended particles. It has been determined that the calibration of the instruments used to measure visibility was faulty, and no reliable data are available for 1998.

Volatile Organic Compounds

It should be noted that there are no state or national ambient air quality standards for VOCs because they are not classified as criteria pollutants. VOCs are regulated, however, because reduction in VOC emissions reduces the rate of photochemical reactions that contribute to the formation of ozone. They are also transformed into organic aerosols in the atmosphere, contributing to higher PM10 and lower visibility levels.

Although health-based standards have not been established for VOCs, health effects can occur from exposures to high concentrations of VOCs because of interference with oxygen uptake. In general, ambient VOC concentrations in the atmosphere are suspected to cause coughing, sneezing, headaches, weakness, laryngitis, and bronchitis, even at low concentrations. Some hydrocarbon components classified as VOC emissions are thought or known to be hazardous. Benzene, for example, one hydrocarbon component of VOC emissions, is known to be a human carcinogen.

Non-Criteria Pollutant Emissions

Although the SCAQMD's primary mandate is attaining the State and National Ambient Air Quality Standards for criteria pollutants within the district, SCAQMD also has a general responsibility pursuant to the Health and Safety Code, §41700, to control emissions of air contaminants and prevent endangerment to public health. As a result, over the last few years the SCAQMD has regulated pollutants other than criteria pollutants such as TACs, greenhouse gases, and stratospheric ozone depleting compounds. The SCAQMD has developed a number of rules to control non-criteria pollutants from both new and existing stationary sources. These rules originated through state directives, CAA requirements, or the SCAQMD rulemaking process. Table 3-3 presents the estimated toxic emissions for selected compounds by source category.

TABLE 3-3

1998 Annual Average Daily Toxic Emissions for the South Coast Air Basin (lbs/day)

Pollutant	On-Road	Off-Road	Point	AB2588	Area	Total
Acetaldehyde[a]	5485.8	5770.3	33.9	57.1	189.1	11536.2
Acetone[b]	4945.8	4824.7	3543.5	531.4	23447.4	37292.8
Benzene	21945.5	6533.4	217.7	266.8	2495.4	31458.8
Butadiene [1,3]	4033.8	1566.1	6.7	2.0	151.3	5759.9
Carbon tetrachloride	0.0	0.0	8.8	1.8	0.0	10.6
Chloroform	0.0	0.0	0.0	35.5	0.0	35.5
Dichloroethane [1,1]	0.0	0.0	0.0	0.1	0.0	0.1
Dioxane [1,4]	0.0	0.0	0.0	105.0	0.0	105.0
Ethylene dibromide	0.0	0.0	0.0	0.2	0.0	0.2
Ethylene dichloride	0.0	0.0	4.9	17.6	0.0	22.5
Ethylene oxide	0.0	0.0	58.1	12.3	454.1	524.4
Formaldehyde*	16664.9	16499.3	521.6	674.7	1107.5	35468.0
Methyl ethyl ketone*	905.1	906.9	3240.2	385.9	14535.4	19973.5
Methylene chloride	0.0	0.0	1378.6	1673.6	9421.7	12473.9
MTBE	58428.9	2679.2	40.5	434.4	5473.7	67056.7
p-Dichlorobenzene	0.0	0.0	0.0	4.5	3735.6	3740.1
Perchloroethylene	0.0	0.0	4622.0	2249.1	22813.1	29684.2
Propylene oxide	0.0	0.0	0.0	22.3	0.0	22.3
Styrene	1114.8	287.1	447.0	3836.7	21.4	5707.0
Toluene	63187.6	11085.9	5689.6	3682.4	52246.7	135892.2
Trichloroethylene	0.0	0.0	1.1	58.0	2550.3	2609.3
Vinyl chloride	0.0	0.0	0.0	4.3	0.0	4.3

TABLE 3-3 (CONTINUED)

1998 Annual Average Daily Toxic Emissions for the South Coast Air Basin (lbs/day)

Pollutant	On-Road	Off-Road	Point	AB2588	Area	Total
Arsenic	0.1	0.3	2.7	0.7	21.4	25.2
Cadmium	1.6	1.5	0.5	0.7	27.5	31.8
Chromium	2.4	2.3	3.9	2.2	302.2	313.0
Diesel particulate	23906.3	22386.3	0.0	5.4	815.3	47113.4
Elemental carbon[c]	27572.1	6690.3	702.8	0.0	16770.5	51735.7
Hexavalent chromium	0.4	0.4	0.3	1.0	0.1	2.2
Lead	0.7	0.9	1.9	24.5	1016.3	1044.3
Nickel	2.5	2.2	2.9	21.6	85.6	114.9
Organic carbon	16426.2	15381.8	0.0	0.0	108612.1	140420.2
Selenium	0.1	0.1	3.0	5.7	2.6	11.6
Silicon[b]	68.6	67.6	167.2	0.0	248614.0	248917.4

Source: Final Report MATES II Study, SCAQMD (March, 2000).

[a] Primarily emitted emissions. These materials are also formed in the atmosphere as a result of photochemical reactions.

[b] Acetone and silicon are not toxic compounds. Their emissions are included here because they were measured in the sampling program and were subsequently modeled for the purpose of model evaluation.

[c] Includes elemental carbon from all sources (including diesel particulate).

Health Effects from Toxic Air Contaminants

Cancer Risk

When "carcinogenic risk" is discussed, it typically refers to the increased probability that an individual exposed to an average air concentration of a chemical will develop cancer when exposed over 70 years. Cancer risks are often expressed on a per-million basis for comparative purposes. As an example, a cancer risk of 100 in a million at a location means that the individuals staying at that location for 70 years have a 100 in a million chance of contracting cancer.

Health statistics show that one in four people will contract cancer over their lifetime, or 250,000 in a million, from all causes, including diet, genetic factors and lifestyle choices.

One of the primary health risks of concern due to exposure to TACs is the risk of contracting cancer. The carcinogenic potential of TACs is a particular public health concern because it is currently believed by many scientists that there is no "safe" level of exposure to carcinogens. Any exposure to a carcinogen poses some risk of causing cancer. It is currently estimated that about one in four deaths in the United States is attributable to cancer. About two percent of cancer deaths in the United States may be attributable to environmental pollution (Doll and Peto, 1981).

Noncancer Health Risks

It is only relatively recently that regulatory agencies have begun to address TACs that are associated with health effects other than cancer (e.g., birth defects, reproductive problems, genetic mutations, etc.). A preliminary study by USEPA found that exposures to TACs have a significant potential to cause adverse noncancer health impacts (USEPA, 1990). The study found that of 150 chemicals for which health data and quantitative exposure data were available, about half exceeded relative exposure levels (RELs) at numerous sites throughout the country. The study also found that exposure to chemical mixtures may result in adverse noncancer health risks that might not be predicted if only the impacts of individual pollutants are considered.

Unlike carcinogens, for most noncarcinogens it is believed that there is a threshold level of exposure to the compound below which it will not pose a health risk. The CalEPA and OEHHA develop RELs for TACs that are health-conservative estimates of the levels of exposure at or below which health effects are not expected. The noncancer health risk due to exposure to a TAC is assessed by comparing the estimated level of exposure to the REL. The comparison is expressed as the ratio of the estimated exposure level to the REL, called the hazard index (HI).

A "cancer burden" typically refers to the number of excess cancer cases expected in the exposed population. If 10,000 people live at that location, then the cancer burden for this population will be <u>one</u> (the population multiplied by the cancer risk). This means that one of the 10,000 people staying at the location for 70 years is estimated to contract cancer.

Multiple Air Toxics Exposure Study II (MATES II) Study

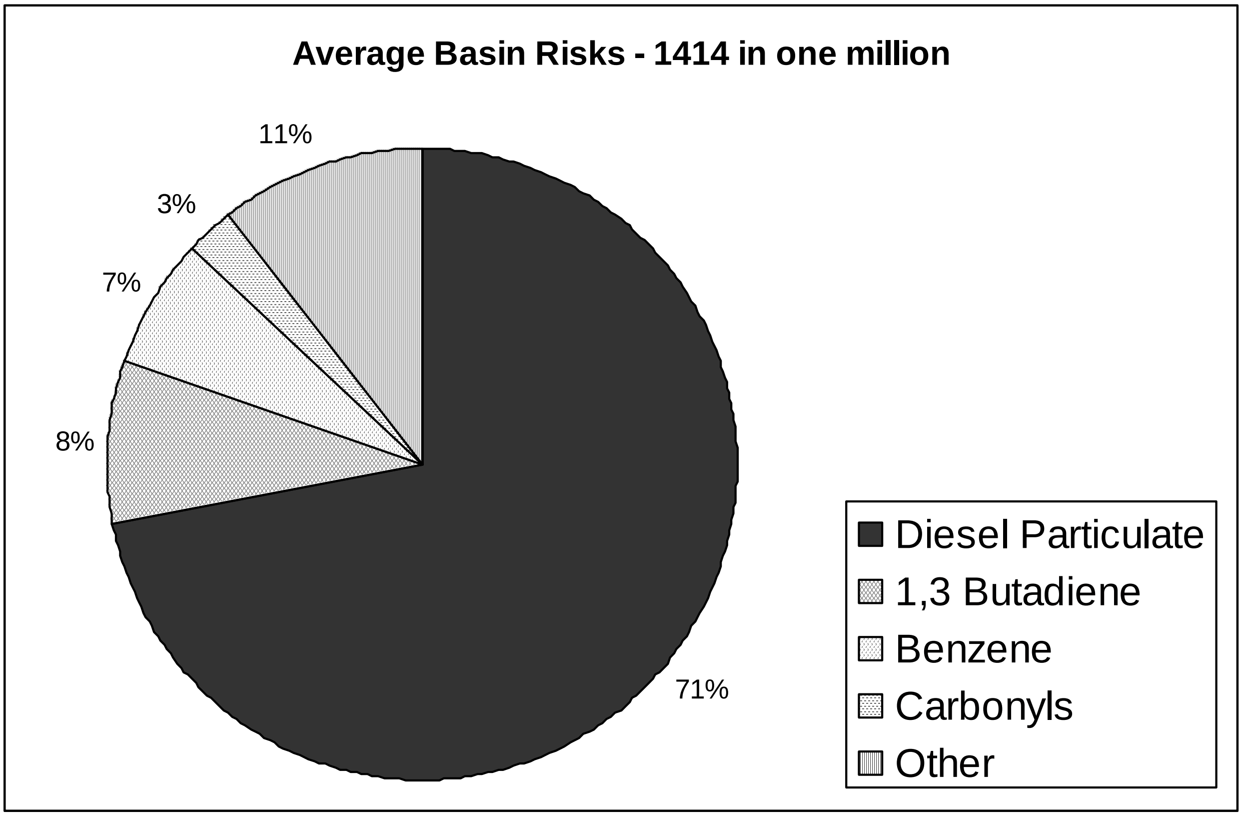
The MATES II study, which is the most comprehensive study of urban toxic air pollution ever undertaken, shows that motor vehicles and other mobile sources of air pollution are the predominant source of cancer-causing air pollutants in the Southland. The SCAQMD's Governing Board directed staff to undertake the MATES II study as part of the agency's environmental justice initiatives (e.g., EJ Initiative #7) adopted in late 1997. A panel of scientists from universities, an environmental group, businesses and other government agencies helped design and guide the study. The study was aimed at determining the cancer risk from toxic air pollution throughout the area by monitoring toxics continually for one year at 10 fixed-monitoring sites. Another goal was to determine if there were any sites where concentrations of industry were causing a disproportionate cancer burden on surrounding communities. To do so, the SCAQMD monitored toxic pollutants at 14 sites for one month each with three mobile monitors. Although no such sites were identified, models show that elevated levels can occur very close to facilities emitting toxic pollutants. Monitoring platforms were placed in or near residential areas adjacent to clusters of facilities.

In the MATES II study, SCAQMD monitored more than 30 toxic air pollutants at 24 sites (10 fixed and 14 temporary) over a one-year period in the spring of 1999. The SCAQMD collected more than 4,500 air samples and together with the California Air Resources Board performed more than 45,000 separate laboratory analyses of these samples. A similar study known as MATES I was conducted in 1986 and 1987. In each study, SCAQMD calculated cancer risk assuming 70 years of continuous exposure to monitored levels of pollutants.

The MATES II study found that the average carcinogenic risk in the Basin is about 1,400 in one million (1400 x 10-6). Mobile sources (e.g., cars, trucks, trains, ships, aircraft, etc.) represent the greatest contributors. As shown in Figure 3-1, about 70 percent of all risk is attributed to diesel particulate emissions; about 20 percent to other toxics associated with mobile sources (including benzene, butadiene, and formaldehyde); about 10 percent of all risk is attributed to stationary sources (which include industries and other certain businesses such as dry cleaners and chrome plating operations.)

FIGURE 3-1

Major Pollutants Contributing To Cancer Risk[2]
In The South Coast Air Basin



When including diesel particulates risks in the South Coast Air Basin range from a low of about 1120 in one million at Anaheim and Long Beach, to a high of about 1740 in one million. Those sites with the highest measured risk levels, Huntington Park, Pico Rivera, Los Angeles, and Burbank, are indicative of the urban core area surrounding Downtown Los Angeles. Diesel particulate, 1,3 butadiene, and benzene (all mobile source related) contribute 87 to 91 percent of the risk.

Table 3-4 presents the model estimated average risk modeled at ten monitoring sites. For comparison purposes to the monitored values an eight-site average is provided also (there were no measured elemental carbon at Compton or Wilmington). The overall average of the ten locations is about 1200 in one million (1200 x 10^{-6}) compared to the network average value of 1400 in one million (1400 x 10^{-6}) based on measured concentrations.

[2] Based on the average of the pollutant concentrations measured at the fixed monitoring sites.

TABLE 3-4

Comparison Of The Network Averaged Modeled Risk To Measured Risk
At The Ten MATES-II Sites

Site	Benzene	1,3 Butadiene	Other	Diesel	Total
Anaheim	119	87	161	963	1330
Burbank	93	62	164	842	1161
Compton	96	65	147	994	1302
Fontana	48	19	120	752	939
Huntington Park	88	61	179	867	1195
Downtown L.A.	94	65	170	1176	1505
Long Beach	88	58	138	920	1204
Pico Rivera	77	43	142	869	1131
Rubidoux	57	26	107	797	987
Wilmington	81	46	222	1182	1531
Modeled Average	**84**	**53**	**155**	**938**	**1228**
Modeled Average*	**83**	**53**	**147**	**898**	**1182**
Monitored Average*	**92**	**118**	**187**	**1017**	**1414**

Source: *Final Report MATES II Study*, SCAQMD March, 2000).

* Eight monitoring site average excluding Wilmington and Compton where elemental carbon was not measured.

Table 3-5 shows the risk for the four counties in the South Coast Air Basin. The average risk levels range from 619 to about 1048 in one million (619 to 1048 x 10^{-6}) with an overall Basin average of about 981 in one million (981 x 10^{-6}). As seen from Table 3-5, Los Angeles County has the highest risk levels followed by Orange and San Bernardino counties. The lowest average risk is estimated in Riverside County.

TABLE 3-5

South Coast Air Basin Modeled Estimated Risk

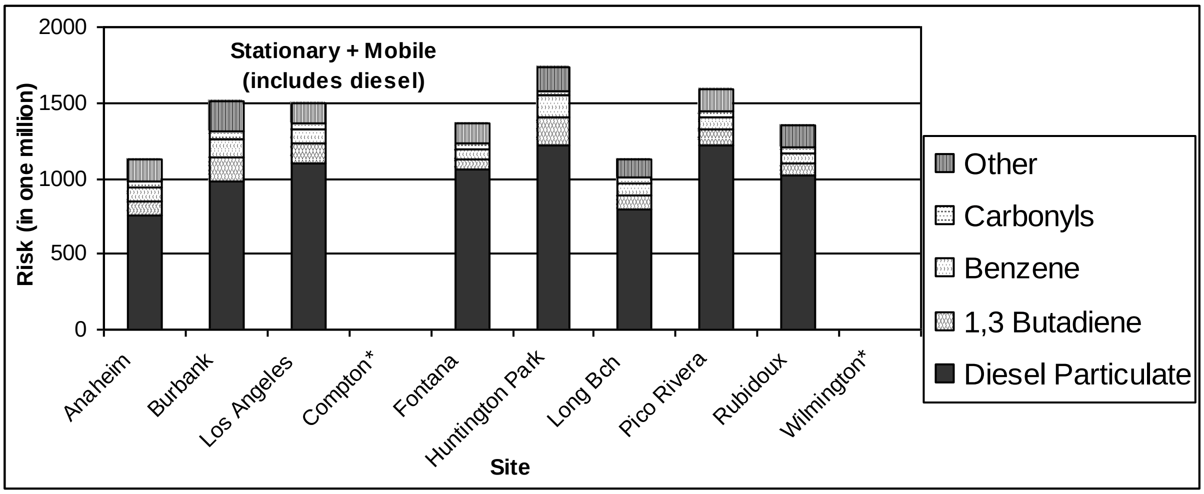
County	Population	Average Risk (per million)
Los Angeles County	9,305,726	1048
Orange County	2,579,974	940
Riverside County	1,249,554	619
San Bernardino County	1,269,919	926
Basin Average	14,404,993	981

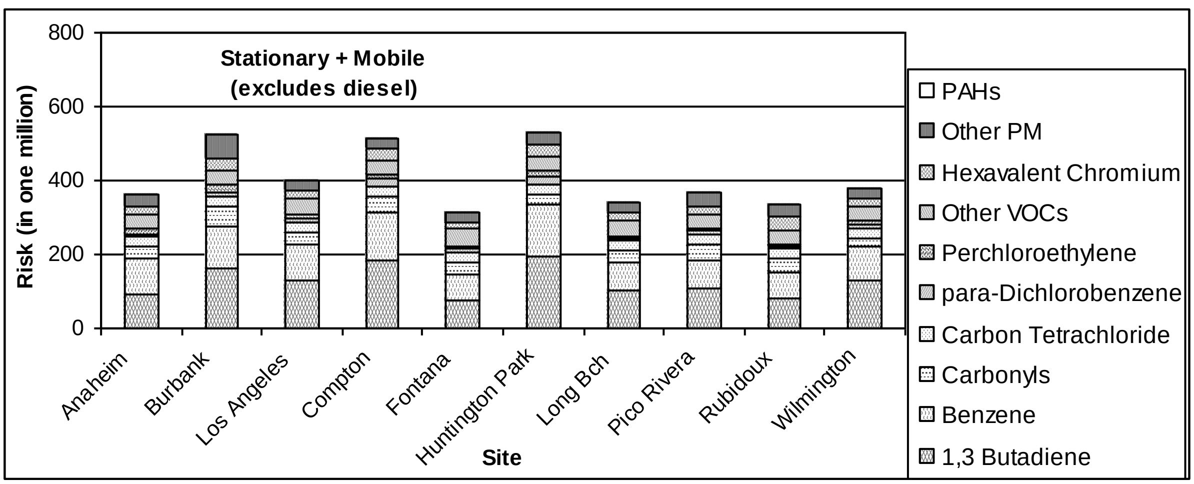
Source: *Final Report MATES II Study*, SCAQMD (March, 2000).

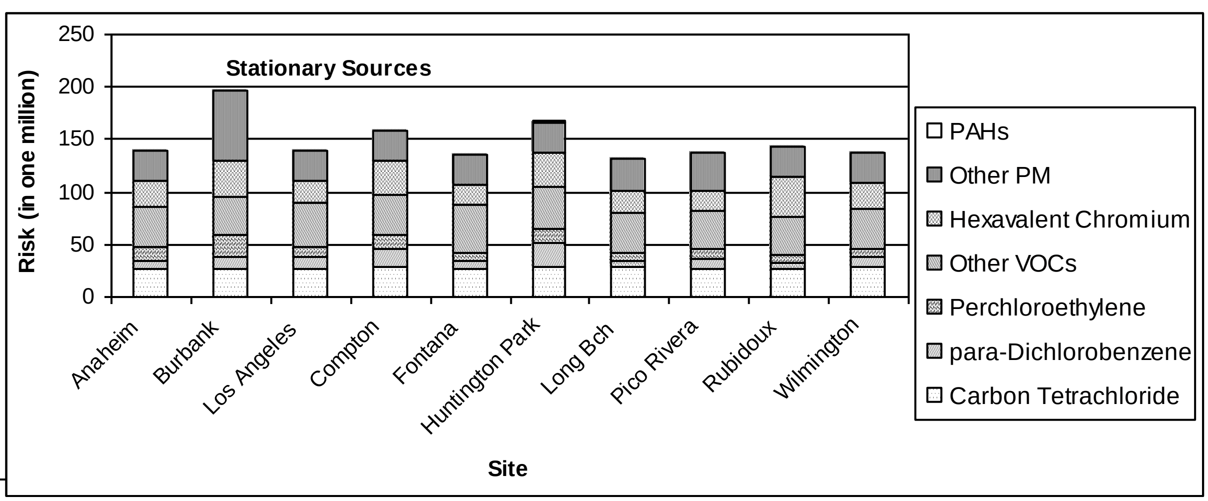
As shown in Figure 3-2 (top), on the next page, the carcinogenic risk of 1,400 per million (1400 x 10^{-6}) is based on an average range from about 1,120 in a million (1120 x 10^{-6}) to about 1,740 in a million (1740 x 10^{-6}) among the ten sites. The sites with the greatest risk levels were in the south-central and east-central portions of Los Angeles County. At these locations, the dominance of mobile sources is even greater than at other sites. The sites with the lowest risk levels were mostly in the other three counties.

FIGURE 3-2

Cancer Risks At The MATES-II Fixed Sites[3]
Risks Are Shown For All Sources Including Diesel Particulates (Top Figure),
All Sources Excluding Diesel Particulates (Middle Figure), And Stationary Sources (Bottom Figure)





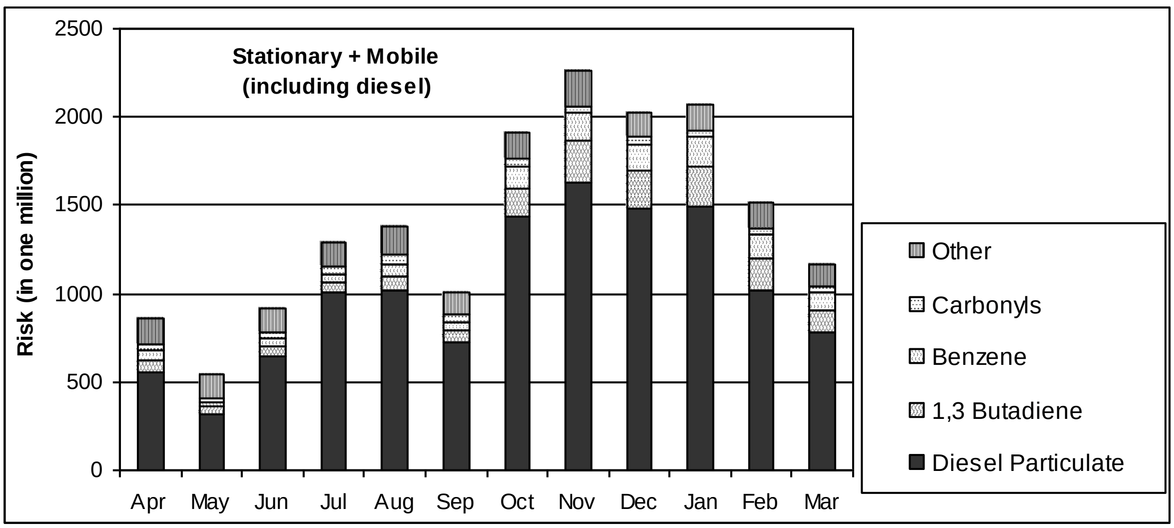


[3] No elemental carbon measured at these sites.

The MATES II Study also revealed that there are strong seasonal variations to the levels of toxic air contaminants, primarily with those pollutants associated with mobile sources. As shown in Figure 3-3, elemental carbon (a surrogate for diesel particulates), benzene, and butadiene – all have seasonal peaks in the late fall and winter months. Lowest levels are observed during the spring and summer months.

FIGURE 3-3

Monthly Variation In Cancer Risks For All Sources
Including Diesel Particulates (Top Figure) And For Stationary Sources (Bottom Figure)



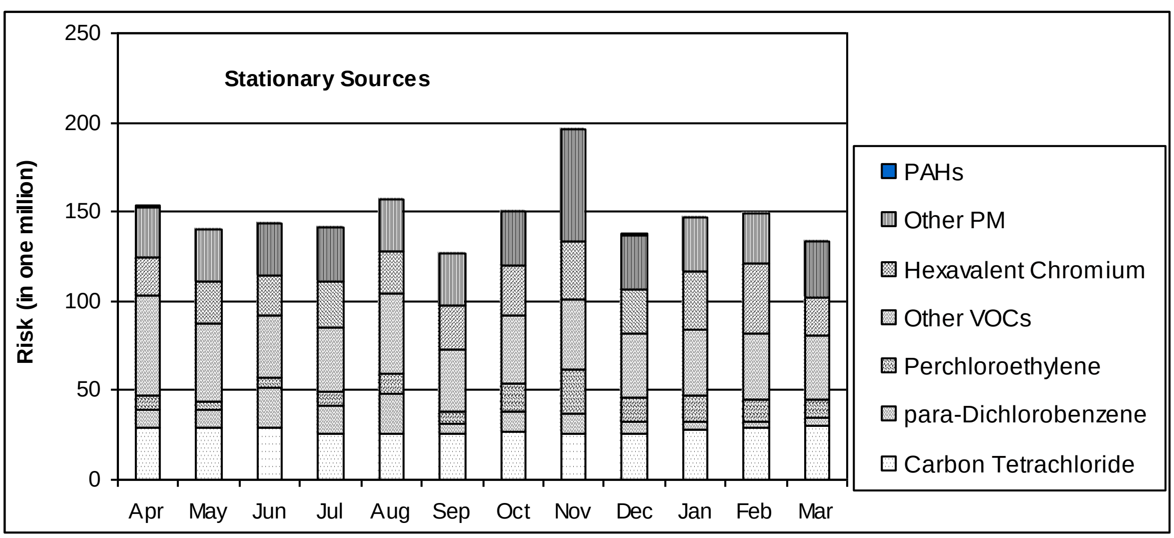


Figure 3-4 shows the model estimated risk at each grid cell for all modeled compounds. In addition to the total model estimated risk, Figure 3-5 shows the risk estimated excluding diesel sources. The cumulative risk averaged over the four counties of the South Coast Air Basin is about 980 in one million (980 x 10^{-6}) when diesel sources are included and about 260 in one million (260 x 10^{-6}) when diesel sources are excluded.

FIGURE 3-4

Model Estimated Risk For The Basin
(Number In A Million, All Sources)

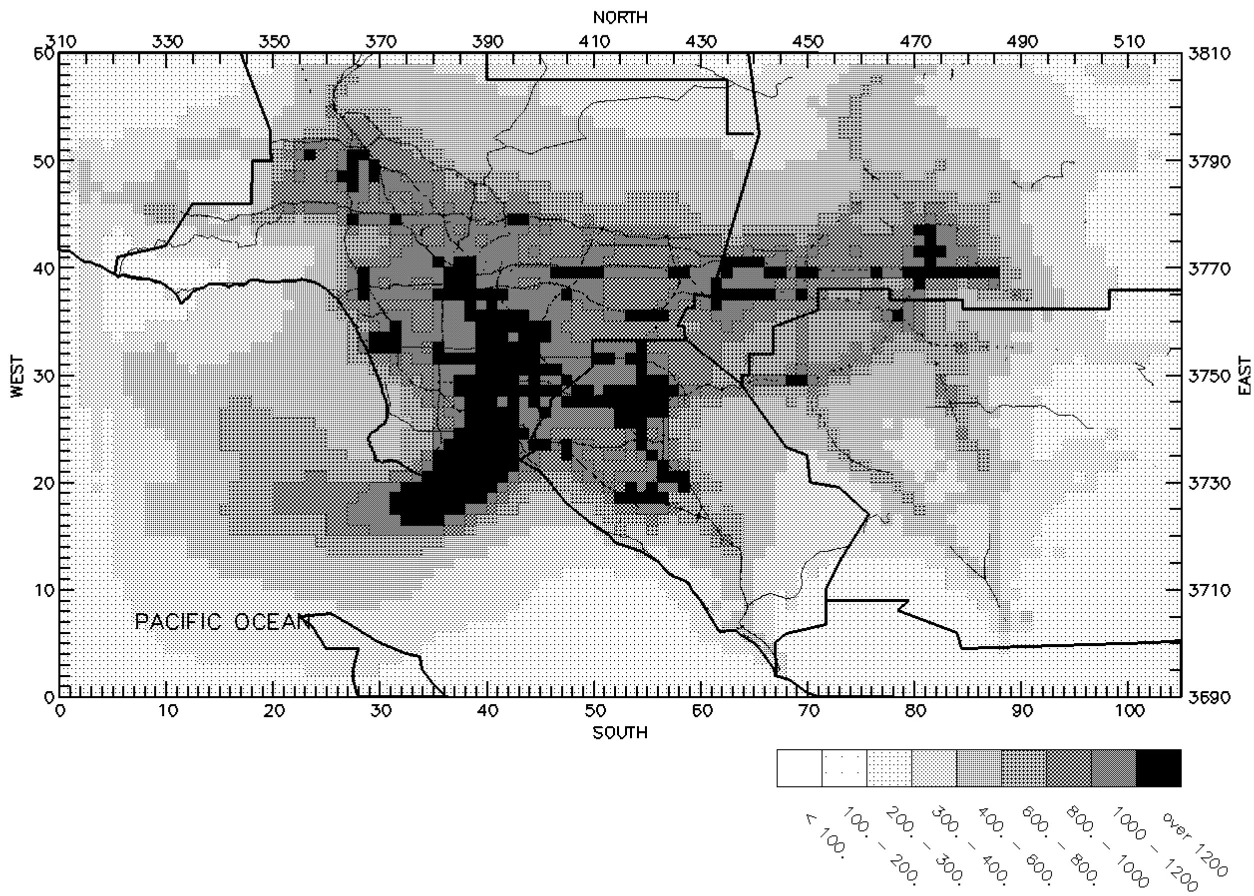
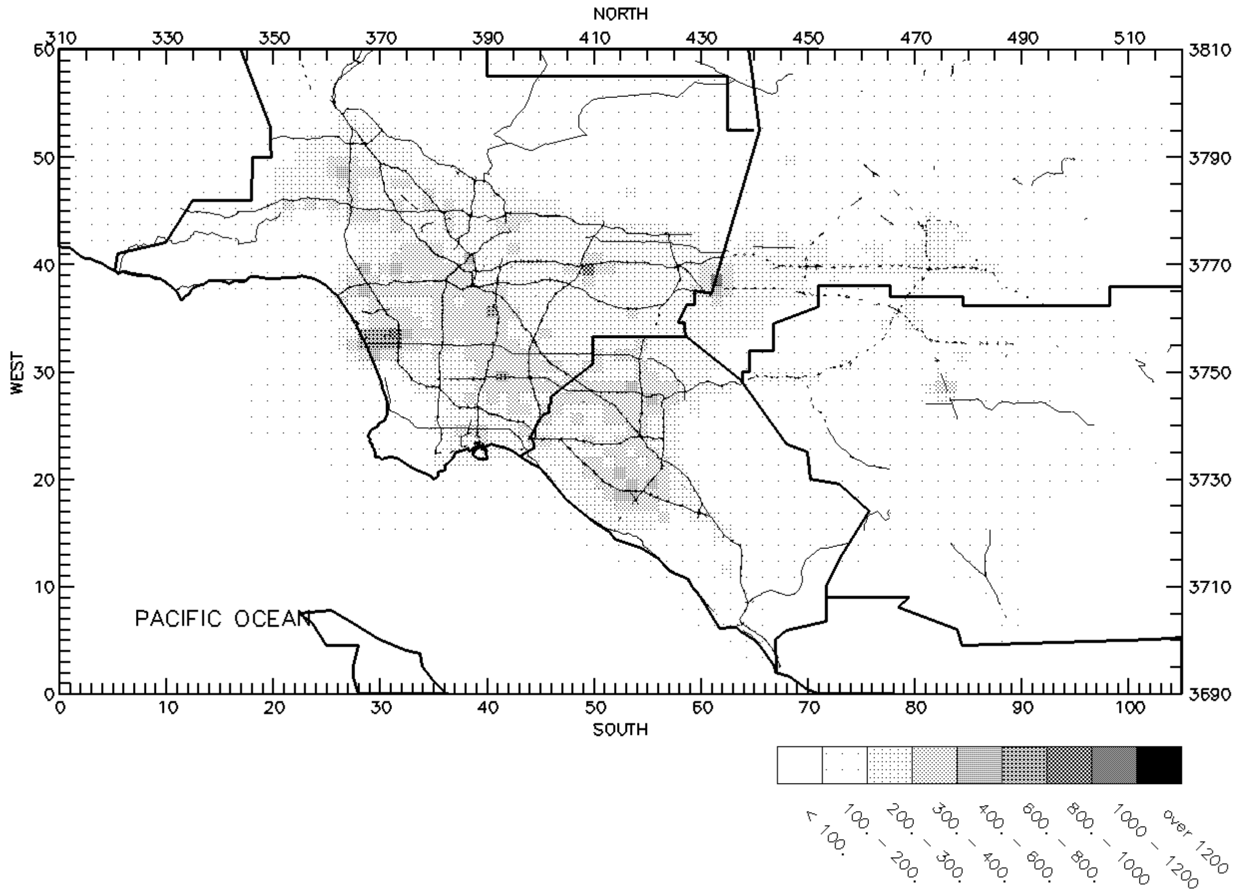


FIGURE 3-5

Model Estimated Risk For The Basin (Without Diesel Sources)



Gas Research Institute (GRI) Study

According to a 1999 GRI Study, the risk of lung cancer based on CARB's estimated unit risk factor of 3 x 10^{-4} from exposure of 1.8 micro-gram per cubic meter[4] of diesel exposure over a lifetime can be calculated at 540 cases per million people (GRI, 1999a). When accounting for the noncancer risks of PM2.5, the lifetime risk of premature death due to estimated diesel concentrations in California comes to comes to 4,250 cases per million, or one in 235 (GRI, 1999a).

[4] CARB estimated annual diesel exposure for Californians in the year 2000.

Diesel Exhaust Emissions From Stationary Diesel Internal Combustion Engines (ICEs)

Diesel exhaust entered the AB 1807 process in October 1989 and has undergone an extensive evaluation because of its potential cancer and non-cancer health effects and widespread exposure. CARB and the OEHHA evaluated diesel exhaust for potential identification as a TAC. On April 22, 1998, the Scientific Review Panel formally reviewed and approved listing of particulate emissions from diesel-fueled internal combustion engines as a TAC.

Emissions from diesel-fueled engines are mainly composed of particulate matter and gases, which contain potential cancer-causing substances. Emissions from diesel ICEs currently include over 40 substances that are listed by the USEPA as hazardous air pollutants and the CARB as TACs. CARB is in the process of developing several guidance documents related to regulating diesel emissions as a TAC. These guidance documents are expected to be released in the fall of 2000.

WATER RESOURCES

Water Demand

Existing Water Sources and Uses

Local water districts are the primary water purveyors in the SCAQMD's jurisdiction. These water districts receive some of their water supply from surface and groundwater resources within their respective jurisdictions, with any shortfall made up from supplemental water purveyors. In some cases, 100 percent of a local water district's water supply may come from supplemental sources. The main sources of surface water used by local water districts within the District are the Colorado, Santa Ana, and Santa Clara rivers. The primary groundwater sources used by local water districts are as follows:

- Los Angeles County: Raymond, San Fernando, and San Gabriel Water Basins.
- San Bernardino and Riverside counties: Upper Santa Ana Valley Water Basin.
- Riverside County: Coachella Valley Water Basin.
- Orange County: Coastal Plain Water Basin.

The major supplemental water importer in the district is the Southern California Metropolitan Water District (MWD), which is made up of 12 member agencies, 14 member cities, and one County Water Authority.

Water Consumption

Estimating total water use in the district is difficult because the boundaries of supplemental water purveyors' service areas bear little relation to the boundaries of the SCAQMD and there are dozens of individual water retailers within the district.

Total water demand within the district was approximately 4.22 million-acre feet (MAF)[5] or about 1.4 trillion gallons in fiscal year 1995 (July 1994 through June 1995). About two-thirds of that demand occurred in the service area of the Metropolitan Water District of Southern California (MWD). The MWD's service area includes southern Los Angeles County, including the San Gabriel and San Fernando valleys, all of Orange County, the western portion of Riverside county, and the Chino Basin in southwestern San Bernardino County. The MWD supplied 1.54 MAF and the LADWP supplied 0.36 MAF in the fiscal year 1995 (MWD, 1996). The remaining water was drawn from local water sources by local water districts within the MWD service area. About 89 percent of water consumed in the MWD region goes to urban uses with the rest going to agriculture (Rodrigo, 1996). Sixty-six percent of urban water use occurs in the residential sector, with another 17 percent in the commercial and six percent in the industrial sectors. Remaining water uses include public entities, fire fighting, industrial and manufacturing processes.

Smaller water purveyors supply water to the northern and eastern areas of the SCAQMD's jurisdiction. Table 3-6 shows water demand by water purveyor.

TABLE 3-6

1994/1995 Water Demand

WATER DISTRICT	1994/1995 WATER DEMAND (MAF)
Metropolitan Water District Service Area:	
MWD	1.54
Los Angeles Aqueducts	0.36
Local Supplies	1.83
Local Supplies:	
Coachella Valley Water District	0.73
Palo Verde Irrigation District	0.90
San Bernardino Valley Municipal	0.30
Antelope Valley/East Kern Water Agency	0.10
Desert Water Agency	0.037
Castaic Lake Water Agency	0.016
Palmdale Water Agency	0.018
San Gorgonio Pass Water Agency	0.018
Crestline/Lake Arrowhead Water Agency	0.002
Little Rock Creek Irrigation District	0.002

Source: MWD, 1996

[5] One acre foot (AF) is equivalent to 325,800 gallons.

Most of the outlying regions of the SCAQMD's jurisdiction are heavily dependent on local surface and groundwater resources as major sources of supply for both domestic and agricultural uses. Supplemental supplies are also available in some areas through California State Water Project (SWP) contractors. The largest water supply source in this subregion is the Colorado River.

Past population growth and agricultural development in the outlying regions have resulted in groundwater pumping beyond safe yield levels. The Antelope Valley Basin (north Los Angeles County), Mojave Basin (San Bernardino County), and the Coachella Valley Basin (Riverside County) are all in overdraft condition.

Local Water Supplies

Local surface water sources and groundwater basins provide about one-third of the water supply in the SCAQMD's jurisdiction (SCAG, 1993d). The largest surface water sources in the region are the Colorado, the Santa Ana, and the Santa Clara river systems. Major groundwater basins in the region include the Central, Raymond, San Fernando, and San Gabriel basins (Los Angeles County); the Upper Santa Ana Valley Basin system (San Bernardino and Riverside Counties); the Coastal Plain Basin (Orange County); and the Coachella Valley Basin (Riverside County).

Local water resources are fully developed and are expected to remain relatively stable in the future on a region wide basis. However, local water supplies may decline in certain localized areas and increase in others. Several groundwater basins in the region are threatened by overdraft conditions, increasing levels of salinity, and contamination by toxics or other pollutants. Local supplies may also be reduced by conversion of agricultural land to urban development, thereby reducing the land surface available for groundwater recharge. Increasing demand for groundwater may also be limited by water quality, since levels of salinity in sources currently used for irrigation could be unacceptably high for domestic use without treatment.

Imported Water Supplies

Several major conveyance systems bring water to the urbanized portion of the region from: northern California via the SWP; the Sierra Nevada via the Los Angeles Aqueduct; and the Colorado River via the Colorado River Aqueduct. The All-American/Coachella Canals deliver agricultural irrigation water from the Colorado River to the Coachella Valley. The continued availability of water from these sources is uncertain at current levels. The yield of the SWP system is expected to decrease in the future as water use in areas of origin increases, Central Valley Project (CVP) contractual obligations increase, and users with prior rights to northern California water supplies begin to exercise those rights (SCAG, 1987). The following subsections detail some of the major sources of water supplied to the area within the jurisdiction of the SCAQMD.

State Water Project

The SWP supplied 0.57 MAF to the MWD in 1995 (Muir, 1996). Contractors in the MWD service area hold contracts for 1.86 MAF. California's total apportionment of SWP water is 4.23 MAF per year, with a dependable supply of about 2.1 MAF. If additional water supplies are not secured, SWP contractors in the region will face increasing risks of water supply deficiencies during dry years. Efforts to increase dependable yields through the SWP have included a Coordinated Operation Agreement between the State and the U.S. Bureau of Reclamation, completion of additional pumping capacity in the San Francisco Bay Delta, and development of additional off-stream storage facilities. If these efforts are successful, annual net use of SWP may increase by 0.8 MAF by 2010.

Los Angeles Aqueduct

The Los Angeles Aqueduct provided about 0.17 MAF of water in 1992 (RWQCB, 1993). Recent court decisions (September, 1994) have required that minimum stream flows be established in four of the streams feeding Mono Lake so that fish and water fowl habitats can be restored and protected (Frink, 1996). In addition, California courts have ruled that the average lake surface elevation of Mono Lake be restored to 6,392 feet above mean sea level. To comply with these rulings, the City of Los Angeles anticipates it will have to ultimately reduce diversion of Mono Lake water by as much as 60,000 AF per year.

Colorado River Aqueduct

Currently, California's basic apportionment of Colorado River water is 4.4 MAF. However, due to above-normal runoff in the Colorado River Basin, and the states of Arizona and Nevada not taking their full apportionment, California has received an average of 4.8 MAF per year in recent years (SCAG, 1993).

With the Central Arizona Project operational and therefore diverting Colorado River water, the supply of Colorado River water available to MWD can be reduced from 1.212 MAF to 0.62 MAF per year, even with completion of a cooperative water conservation program with the Imperial Irrigation District. MWD staff has conservatively projected future supply at 0.62 MAF per year from existing programs and facilities and is considering programs to increase its dependable Colorado River supplies (Schempp, 1996).

Water Quality

Effluent Standards

California has an extensive regulatory program to control water pollution. The most important statute affecting water quality issues is the Porter-Cologne Act, which gives the State Water Resources Control Board (SWRCB) and the nine RWQCBs broad powers to protect surface and groundwater supplies in California, regulate waste disposal, and require cleanup of hazardous conditions (California Water Code §§13000 - 13999.16). In particular, the SWRCB establishes water-related policies and approves water quality control plans, which are implemented and enforced by the RWQCBs. Five RWQCBs have jurisdiction over areas within the boundaries of the SCAQMD. These Regional Boards include: Los Angeles, Lahontan, Colorado River Basin, Santa Ana, and San Diego.

It is the responsibility of each regional board to prepare water quality control plans to protect surface and groundwater supplies within its region. These plans must identify important regional water resources and their beneficial uses, such as domestic, navigational, agricultural, industrial, and recreational; establish water quality objectives, limits or levels of water constituents or characteristics established for beneficial uses and to prevent nuisances; and present an implementation program necessary to achieve those water quality objectives. These plans also contain technical information for determining waste discharge requirements and taking enforcement actions. The plans are typically reviewed and updated every three years (California Water Code §13241).

California dischargers of waste, which "could affect the quality of the waters of the state," are required to file a report of waste discharge with the appropriate regional water board (California Water Code §13260). The report is essentially a permit application and must contain information required by the RWQCB. After receipt of a discharge report, the RWQCB will issue "waste discharge requirements" analogous to a permit with conditions prescribing the allowable nature of the proposed discharge (California Water Code §§13263, 13377, and 13378).

National Pollution Discharge Elimination System Requirements

Most discharges into state waters are regulated by the National Pollution Discharge Elimination System (NPDES), a regulatory program under the federal Clean Water Act. The NPDES is supervised by USEPA, but administered by SWRCB. NPDES requirements apply to discharges of pollutants into navigable waters from a point source, discharges of dredged or fill material into navigable waters, and the disposal of sewage sludge that could result in pollutants entering navigable waters. California has received USEPA approval of its NPDES program.

Pursuant to California's NPDES program, any waste discharger subject to the NPDES program must obtain an NPDES permit from the appropriate RWQCB. The permits typically include criteria and water quality objectives for a wide range of constituents. The NPDES program is self-monitoring, requiring periodic effluent sampling. Permit compliance is assessed monthly by the local RWQCB and any NPDES violations are then categorized and reported to USEPA on a quarterly basis.

USEPA has also published regulations that require certain industries, cities and counties to obtain NPDES permits for stormwater discharges (55 Fed. Reg., 1990). The new regulations set forth permit application requirements for classes of stormwater discharges specifically identified in the federal Clean Water Act. The regulated stormwater discharges include those associated with industrial activity and from municipal storm sewer systems serving a population of 100,000 or more.

Discharges to Publicly Owned Treatment Works (POTWs)

Water discharges to a public sewage system (referred to generically as a POTW), rather than directly to the environment, are not subject to the NPDES discharge requirements. Instead, such discharges are subject to federal pretreatment requirements under 307(b) and (c) of the Clean Water Act (33 U.S.C. §1317(b)-(c)). Though these pretreatment standards are enforced directly by USEPA, they are implemented by local sanitation districts (Monahan et al., 1993). The discharger, however, has the responsibility to ensure that the waste stream complies with the pretreatment requirements of the local system. Any facility using air pollution control equipment affecting water quality must receive a permit to operate from the local sanitation district. In cases where facilities modify their equipment or install air pollution controls that generate or alter existing wastewater streams, owner/operators must notify the local sanitation district and request that their existing permit be reviewed and modified.

In order to ensure compliance with wastewater pretreatment regulations, local sanitation districts, such as the County Sanitation Districts of Los Angeles County, sample and analyze the wastewater streams from facilities approximately two to four times per year (Lum, 1989). Persons who violate the state's water quality laws are subject to a wide array of enforcement provisions.

In 1990, USEPA revised and extended existing regulations to further regulate hazardous waste dischargers and require effluent testing by POTWs. To comply with revised permit limits, POTWs may alter their operations or impose more stringent local limits on industrial user discharges of hazardous wastes (Monahan, et al., 1993). POTWs in California are operated by sanitation districts that adopt ordinances establishing a permit system and fee structure. There are 47 agencies providing wastewater treatment within the SCAQMD’s jurisdiction, the largest three being the County Sanitation Districts of Los Angeles County, Los Angeles City Sanitation District, and the Orange County Sanitation District. These three agencies account for 71 percent of influent wastewater in the District (SCAG, 1993). Table 3-7 identifies the total daily flow and capacity of POTWs located within the SCAQMD’s jurisdiction.

TABLE 3-7

Total Average Daily Flow And Capacity
For District POTWs

REGION	COUNTY NAME	AVERAGE DAILY FLOW (MILLION GAL/DAY)	CAPACITY (MILLION GAL/DAY)
4	Los Angeles	701.8378	870.5035
8	Orange	275.7	251.5
9	Orange	35.6142	49.306
7	Riverside	12.207	52.31
8	Riverside	60.728	83.45
9	Riverside	3.8	6
6	San Bernardino	4.83	23.057
7	San Bernardino	19.5211	8.82
8	San Bernardino	94.6701	111.16
Total		**1208.9082**	**1456.1065**

Source: CARB, 1999

There are a variety of advanced chemical and physical treatment techniques and equipment that remove chemical contaminants from waste streams. Depending upon the characteristics of the contaminants in the wastewater stream, it may be necessary for the wastewater to undergo a series of treatment processes. Table 3-8 identifies some examples of wastewater treatment methodologies and the appropriate sequence in the wastewater treatment process in which they would occur.

TABLE 3-8

Examples Of Wastewater Treatment Methods

INITIAL TREATMENT	INTERMEDIATE TREATMENT	ADVANCED TREATMENT
Sedimentation	Trickling Filters	Carbon Adsorption
Neutralization	Activated Sludge	Ion Exchange
Chemical Coagulation	(aerobic bacteria)	Air Stripping
Precipitation	Chemical Oxidation	Reverse Osmosis
	(chlorination & ozonation)	Electrodialysis

Source: Lippmann and Schlesinger, 1979; Vembu, 1994.

Subregional Water Quality

The following subsections consider the quality of surface and groundwater sources that lie within the coastal subregion and the outlying subregion. Water quality of the major water basins in each subregion is discussed for both surface and groundwater sources.

Coastal Subregion Water Quality

The Los Angeles River Basin area is located in southern Los Angeles County and is drained by the Los Angeles River, San Gabriel River, and Malibu Creek (RWQCB, 1993).

- Surface water quality of the Los Angeles River system has minor problems that are attributable to high pH, nitrate/nitrite, chlorine levels, and low dissolved oxygen. The Los Angeles River drainage basin includes large recreation and wildlife habitat areas in the San Fernando Valley. Urban runoff and illegal dumping are the major sources of water quality problems in this river system.

- Minor water quality problems caused by urban runoff and point source discharges have occurred in urbanized portions of the San Gabriel River drainage system, but water quality is good in the source areas of the San Gabriel Mountains.

- Malibu Creek and its tributaries are an intermittent stream system that drains a portion of the western Santa Monica Mountains. This drainage area has high total dissolved solids (TDS) levels and, in general, water quality has declined as a result of wastewater discharge into the creek. Non-point source pollutants of concern include excess nutrients, sediment and bacteria.

Groundwater sources of the Los Angeles River Basin include the Los Angeles Coastal Plain, San Fernando Valley, and San Gabriel Valley Basins (RWQCB, 1993).

- Water quality in the Los Angeles Coastal Plain Basin is generally good, although saltwater intrusion has been a problem along the coast. This problem is currently being addressed by the Los Angeles County Flood Control District through the Dominguez Gap Barrier project. The purpose of the project is to create a fresh water pressure ridge to prevent further landward movement of seawater.

- Hydrocarbons from industry, and nitrates from subsurface sewage disposal and past agricultural activities are the primary pollutants in much of the groundwater throughout the San Gabriel and San Fernando Valley Groundwater Basins. Pollution has shut down at least 20 percent of municipal groundwater production capacity in both basins. The California Department of Toxic Substances Control has designated large areas of these basins as high priority Hazardous Substances Cleanup sites. The USEPA has designated both areas as Superfund sites. Both the RWQCB and USEPA are overseeing investigations to further define the extent of pollution, identify the responsible parties and begin remediation.

Santa Ana River Basin

The Santa Ana River Basin area is located in Orange County and the western (non-desert) portion of San Bernardino and Riverside counties. Improper operation of individual sewage storage or treatment systems in the upper Santa Ana River area has degraded surface water quality. High Total Dissolved Solids (TDS) and nutrient levels have affected lower portions of the river due to low quality rising groundwater, urban runoff, and nonpoint agricultural pollution. Lakes in the area receive water from the State Water Project and Colorado River and have fair to good water quality.

Primary groundwater basins in the Santa Ana River Basin include Orange County Coastal Plain, Upper Santa Ana River Valley, San Jacinto, Elsinore, and San Juan Creek. Groundwater quality is generally good in this area. Some deterioration has occurred due to recharge by Colorado River water, percolation of irrigation wastewater, overdrafting, seawater intrusion, and mineralization. Water quality has been compromised further by municipal, industrial, and agricultural waste disposal. Saltwater intrusion problems have been somewhat alleviated by injection of water into wells of the Talbert Gap Barrier Project and increased use of Colorado River water by southern Orange County.

Outlying Subregion Water Quality

Santa Clara River Basin

The Santa Clara River Basin area is located in Ventura County and northern Los Angeles county and is drained by the Santa Clara River, which empties into the Pacific Ocean near the city of Oxnard. Surface water sources are provided mainly by reservoirs in the area, which are in turn supplied by water from the SWP and the Los Angeles Aqueduct. These water sources provide water that is generally of high quality. Tributary creeks typically possess good water quality except during low flows. Water quality in the Santa Clara River is relatively poor and further degrades downstream when groundwaters rise, resulting in high TDS levels, irrigation return flows, and other contaminants. Threats to water quality include increasing urban development in floodplain areas, which require flood control measures. These measures result in increased flows and erosion and loss of habitat (RWQCB, 1993).

Nine groundwater basins are located in the Santa Clara River Basin. Groundwater quality is generally good in the upper Santa Clara River Basin (Los Angeles County) but worsens near the Los Angeles County-Ventura County line. High TDS concentrations are common in the Santa Clara River Valley area.

Desert Basins

The desert subregion includes most of San Bernardino County, eastern Riverside County, and Imperial county. Few water quality problems exist in this area with the exception of the Salton Sea vicinity, which has high and increasing salinity as a result of irrigation return flows, increasing salinity of Colorado River water, and inadequately treated municipal discharges (particularly from sources in Mexico) (Coachella Valley Water District, 1993).

Groundwater quality problems in the South Lahontan Basin, located in desert subregion portions of Los Angeles and San Bernardino counties, include overdrafting and pollution from mining and sewage wastes. West Colorado River Basin has increasingly high salinity near the Colorado River. Local groundwater supplies along the Colorado River are also poor where they are affected by saline river water, failing septic tanks and leachfield systems, and irrigation return flows.

TRANSPORTATION / CIRCULATION

Many agencies share authority for transportation planning and operations in the district. These agencies include SCAG, the county transportation authorities, local government transportation departments, and Caltrans, as well as the SCAQMD. For the purposes of the AQMP, however, the SCAQMD and SCAG share the responsibility for developing transportation measures to achieve air quality objectives.

SCAG, as the federally designated Metropolitan Planning Organization for a major portion of Southern California, SCAG is required to adopt and periodically update a long-range transportation plan for the area of its jurisdiction (Title 23 U.S.C. §134(g)(1)). SCAG also is required, under §65080 of the California Government Code, to prepare a regional transportation plan (RTP) for the area. These subsections also specify that actions by transportation agencies must be consistent with an adopted RTP that conforms with air quality requirements in order to obtain federal and state funding.

By law, the 1998 RTP must meet federal and state air quality (conformity) requirements. Failure to meet these standards will result in a loss of transportation funding from these sources. Failure to meet these standards also results in serious health risks. In the South Coast Air Basin, the RTP is required to reduce the amount of VOC emissions by approximately 15 tons per day and NOx emissions by 16 tons a day.

The transportation system utilized in the SCAQMD's jurisdiction is a multi-faceted and multi-modal system for moving people and goods. It includes an extensive network of freeways, highways and roads; public transit; air and sea routes; and non-motorized modes of travel (walking and biking). The routes of travel to move people and goods are briefly summarized below. Please consult SCAG's 1998 RTP for further detail.

Freeways, Highways, and Arterials

There are almost 8,000 miles of freeway and high-occupancy vehicle (HOV) lanes linking the region. Additionally, there are 27,500 lane miles of arterials and highways. These roadways are an integral part of the transportation system, often acting as alternative routes to freeway driving (SCAG, 1993).

According to SCAG annual surveys conducted for the past ten years, the commute patterns have remained relatively constant. Approximately 80 percent of survey respondents indicate they drive alone to work, while 5 percent use transit. The percent of commuters who carpool to work has remained at approximately 15 to 16 percent since 1991. The 1998 SCAG *State of the Commute* survey indicates that the average travel distance to work is 16.1 miles (one way), and the average travel time to work is 32 minutes, while the average travel time home is 37 minutes. Bus riders commute an average distance of 13.6 miles. Men are more likely than women to drive alone to work on a regular basis (79 percent vs. 76 percent), while younger commuters are more likely to use alternatives to driving alone than older commuters (32 percent of respondents under 30 years of age compared to only 14 percent of those 50 years of age or older). Comparing the commute across county lines, the 1998 survey shows Los Angeles County has the lowest drive-alone rate and Orange County has the highest. Residents in San Bernardino and Riverside counties spend the most time commuting and travel the farthest (SCAG, 1999a).

Most of the transit operators in the region have experienced an increase in ridership in recent years. The total passenger trips for large transit operators in the region increased by over 6 percent between 1996 and 1997, to 552 million. However, the 1997 ridership remains over 40 million below the 1985 total, the year the Southern California Rapid Transit District (the predecessor of the Los Angeles County Metropolitan Transit Authority) discontinued the 50 cents fare. In Los Angeles County, the urban rail line registered a ridership in excess of 34 million passengers in 1997. However, any further expansion of heavy rail in Los Angeles County is doubtful because of the financing constraints as a result of Proposition A approved in November 1998. Metrolink, the commuter express train system which connects commuters living and working in Southern California, including San Diego County, has seen a steady increase ridership since it became operational in 1992. The daily ridership totaled 2,300 in 1992 and had grown to 27,000 by 1998 (SCAG, 1999b).

The public transit system includes local shuttles, public bus operations, rail rapid transit, commuter rail services, and interregional passenger rail service. Transit service is provided by approximately 17 separate public agencies, with nine of these providing 98 percent of the existing public bus transit service. Local service is supplemented by municipal lines and shuttle services and additional regional service is provided by private bus companies (SCAG, 1999b).

In the field of advanced transportation technologies, the region is concentrating on intelligent transportation systems, smart shuttles, alternative fuel vehicles: electric and natural gas, and telecommunications. There is over $1 billion worth of electronics deployed within the region's transportation infrastructure. The advanced transportation management centers are using information collected to increase average vehicle speeds and to provide swifter incident detection and clearance and decrease incident duration, travel time, and emissions. The system wide implementation of smart traffic signals in Los Angeles County has reduced by 41 percent the number of vehicle stops and reduced by 14 percent emissions caused by starts and stops. In Orange County, the use of satellite vehicle tracking is expected to cut police response by 25 percent. In Riverside County, advanced public transit system technologies and applications are being deployed to improve transit system performance, reliability, and use (SCAG, 1999b).

CARB Estimated Vehicle Population

California's transportation system is vital to the state's economy, but gasoline- and diesel-fueled cars, buses, and trucks are also our greatest source of air pollution. As oil prices have dropped throughout the world, as the number of registered vehicles has increased and because workers often live farther away from their workplace, Californians are driving more today than ever before (CEC, 1999d). Table 3-9 shows CARB's projected number of vehicles that will be in use in the SCAQMD's jurisdiction as well as statewide.

TABLE 3-9

Projected Number of Vehicles
Operated In The SCAQMD's Jurisdiction And Statewide

Vehicle Type	**Year**					
	2000		**2005**		**2010**	
	SCAQMD	**State**	**SCAQMD**	**State**	**SCAQMD**	**State**
Light Duty Automobiles						
Non-Cat[a]	211,434	513,141	76,225	195,495	6,244	30,215
Cat	6,768,832	15,934,044	7,311,137	17,271,932	7,776,961	18,429,910
Diesel	41,585	97,892	22,000	51,975	12,380	29,336
Total	7,021,851	16,545,077	7,409,362	17,519,402	7,795,585	18,489,461
Light Duty Trucks < 6,000 lbs						
Non-Cat	14,994	39,308	-	-	-	-
Cat	2,653,882	6,956,410	2,960,608	7,766,396	3,274,035	8,595,826
Diesel	20,027	52,493	10,315	27,059	2,376	6,237
Total	2,688,903	7,048,211	2,970,923	7,793,455	3,276,411	8,602,063
Medium Duty Trucks > 6,001 < 14,000 lbs[b]						
Non-Cat	33,036	84,626	17,479	44,706	4,444	11,365
Cat	530,969	1,385,045	670,347	1,749,638	782,489	2,043,455
Diesel	89,943	230,531	115,284	295,382	133,862	342,909
Total	653,948	1,700,202	803,110	2,089,726	920,795	2,397,729

TABLE 3-9 (CONTINUED)

Projected Number of Vehicles
Operated In The SCAQMD's Jurisdiction And Statewide

Vehicle Type	**Year**					
	2000		**2005**		**2010**	
	SCAQMD	**State**	**SCAQMD**	**State**	**SCAQMD**	**State**
Heavy Duty Trucks						
Non-Cat	9,233	23,609	3,406	8,704	1,379	3,532
Cat	11,582	29,609	15,205	38,873	18,368	46,953
Diesel	137,189	351,631	150,402	385,365	166,858	427,430
Total	158,004	404,849	169,013	432,942	186,605	477,915
Urban Diesel Buses	3,076	6,361	3,188	6,618	3,300	6,877
Motorcycles	204,667	572,913	205,483	575,195	206,298	577,475
All Vehicles	**10,730,449**	**26,277,613**	**11,561,079**	**28,417,338**	**12,388,994**	**30,551,520**

Source: MVEI7G Run for the South Coast Air Basin and Statewide (CARB, June 1998). See Emission Tonnages South Coast Sir Basin and Statewide at http://www.arb.ca.gov/msei/msei.htm.

[a] Cat = Catalytic Converter

[b] Medium duty trucks includes light heavy duty trucks.

Rail

The railroad network includes an extensive system of private railroads and several publicly-owned freight lines. The Southern California Regional Rail Authority operates commuter rail systems in the SCAQMD's jurisdiction. Additionally, Amtrak provides inter-city service, principally between San Diego and San Luis Obispo.

The SCAG region is served by two main line freight railroads--the Burlington Northern Santa Fe (BNSF) and the Union Pacific Railroad (UP). These freight railroads connect Southern California with other U.S. regions, Mexico and Canada via their connections with other railroads. They also provide freight rail service within the SCAQMD's jurisdiction. In 1995, these railroads moved more than 91 million tons of cargo into and out of Southern California (SCAG, 1993).

The SCAG region is also served by three short line or switching railroads: Harbor Belt Railroad, owned by BNSF and UP; Los Angeles Junction Railway Company, owned by BNSF; and Ventura County Railway, owned by Greenbrier. These freight railroads perform specific local functions, and serve as feeder lines to the trunk line railroads for moving goods to and from Southern California (SCAG, 1993).

The two main line freight railroads maintain major facilities in the SCAG region: Intermodal facilities in Commerce (BNSF), San Bernardino (BNSF), City of Industry (UP), Los Angeles (UP) and Long Beach (UP). Major classification yards in Barstow (BNSF), East Los Angeles (UP) and West Colton (UP), and Rail-truck transload and warehousing facilities in Bakersfield, Glendale, Fontana, Pomona, Los Angeles, Long Beach, Wilmington and Commerce (SCAQ, 1993).

Maritime

The region's ports support significant international and interregional freight movement and tourist travel The region is served by three major deep water port facilities: The Port of Los Angeles and The Port of Long Beach in Los Angeles County, and the Port of Hueneme in Ventura County. The ports of Long Beach and Los Angeles are full-service ports with facilities for containers, autos, and various bulk cargoes The Port of Long Beach, the largest in the United States, handled 3.07 million twenty-foot-container equivalent units (TEUs) of freight in 1996. The Port of Los Angeles, the second largest in the United States, handled 2.6million TEUs of freight in 1996. Port Hueneme handles significant traffic in agricultural exports and automobile imports (SCAG, 1999b).

Air Travel

The airport system consists of commercial and general aviation airport facilities serving passenger, freight, business, and recreational needs. There are 67 commercial and general aviation airports serving the region, making this system one of the largest and most heavily utilized in the nation and in the world. Los Angeles International Airport (LAX) is the region's largest facility for passengers and cargo. Three of the newest regional airport facilities are recently converted military air facilities. Norton Air Force Base is now San Bernardino International Airport, March Air Force Base is now March Airport, and George Air Force Base is now Southern California International Airport. The region's three largest airports are nearing capacity (John Wayne due to legal constraints rather than physical capacity). The region's planners and policy makers are acutely aware of this approaching problem. Major expansion plans for LAX and Burbank are under discussion, and a new international facility is anticipated for the El Toro Marine Base facility (SCAG, 1999b).

Air travel is increasing even more rapidly than auto travel. Air passenger traffic in the region's six largest airports doubled between 1977 and 1994. The current rate of growth is slower - there was a 2.3 percent increase between 1996 and 1997 - but the number of passengers is expected to reach 170 million by the year 2020. It is anticipated that the region will reach its 100 million capacity around the year 2000 (SCAG, 1999b).

Air cargo in the six largest airports in the region reached one million tons per year in 1983. By 1994, there were more than two million tons of cargo handled by these airports. That number jumped to over 2.6 million tons in 1997. Increased air port capacity is essential for continued economic growth (SCAG, 1999b).

PUBLIC SERVICES

Public services offered and available within the SCAQMD' jurisdiction are extensive and numerous although statistical data specific to the SCAQMD are not available. Information concerning public services was obtained from references that outlined data by county or by the SCAG Region. The SCAG region comprises Ventura and Imperial counties, and the desert portions of Los Angeles, San Bernardino and Riverside Counties in addition to the four-county area comprising the Basin. Statistical information will therefore be provided for the four-county area or by SCAG region. The following public service areas are discussed in this section.

- Schools;
- Law Enforcement; and
- Fire Protection;

Schools

Southern California, containing 44 percent of California's population, has 50 percent of her elementary-secondary students, 44 percent of the community college students, 38 percent of the state university (CSU) students and 37 percent of those enrolled in the University of California (UC). There are 200 school districts, 44 community colleges in 27 districts, eight California State University campuses (including the new Channel Islands campus in Ventura County), and three University of California campuses. There is also a large and vigorous sector of private education. Almost 11 percent (336,000) of the region's K-12 students attend 2,210 private schools. Statewide, there are some 300 independent colleges and universities that enroll 218,000 students, and another 2,100 private post-secondary training and certificate programs that enroll another 300,000 students. The great majority of these programs are in Southern California, according to a 1992 study of the Bureau of Private Post-Secondary Education (SCAG, 1999b).

As the largest region in the nation's largest state, Southern California's enrollment trends dominate. Over the last decade, the region's public school population grew rapidly (20 percent), as did the private school population, which increased 14 percent. Students who are classified as white declined from 40 to 30 percent of the total, while those classified as Hispanic increased from 41 to 51 percent. Concurrently, the proportion of students with limited English proficiency grew from 19 to 30 percent, primarily due to immigration, most of which has been from Mexico and Central America. While K-12 enrollments have grown rapidly, higher education enrollments, reflecting the state's budgetary predicament grew much more slowly. This has resulted in greater competition for university slots. In 1997, the region's community colleges enrolled 636,000 students; the California State University's seven campuses enrolled 99,000; and the University of California's three campuses enrolled 63,000. Although California's fiscal situation is improving, slow enrollment growth is likely to continue over the next few years, limiting the numbers who will be able to take advantage of higher education (SCAG, 1999b).

Law Enforcement

As of 1990, there were approximately 55,471 law enforcement officers employed within the SCAG Region, yielding a ratio of one police officer and/or sheriff per 263 civilians (SCAG, 1993). Most cities in the district maintain their own police departments, although some cities may contract with county sheriffs departments or nearby larger cities for police services. Unincorporated areas receive police protection from county sheriff departments. The California Highway Patrol (CHP) provides law enforcement services on state and interstate highways. The CHP also provides back-up services, along with county sheriff departments, on federal lands such as national forests and Bureau of Land Management land. State rangers protect state park and recreation areas.

Many of the police and sheriff departments have begun programs to improve efficiencies in delivering protection services and increase involvement in policing. These programs have included drug and crime prevention programs and education, job training and community activities for youth and adults. Police departments have also begun to place a greater reliance upon communities to provide needed support services, such as neighborhood watch programs. Some law enforcement agencies have established a goal of increasing their efficiency in delivering protection services and utilization of existing facilities through consolidation of services, better use of underutilized facilities, and redefinition of service district boundaries and use of new technologies.

In an effort to increase law enforcement officers available to provide protection services, some law enforcement agencies are replacing officers in administrative functions with civilian personnel. In addition, Congress has passed the new crime bill which is expected to provide among other things, additional funding for more law enforcement officers.

Fire Protection

Fire protection consists of fire fighting, paramedical care, fire detection and building and fire code inspection. In addition, fire departments are usually the first agency to respond to an emergency release of hazardous materials. City and county fire departments generally provide these services with some cities contracting with the county for services. The U.S. Forest Service provides fire protection on all national forest lands while the California

Department of Forestry has jurisdiction over wildland fire protection in various unincorporated areas of Riverside and San Bernardino counties. The Los Angeles County Department of Forestry serves the northeastern area of Los Angeles County. Approximately 17,924 personnel (one employee per 765 civilians) were employed in fire protection within the four county area, as of June 1993 (SCAG, 1993).

Average response times vary from 4.35 to 15 minutes for emergency medical service and from 2.52 to 15 minutes for structure incidence fires (SCAG, 1993). Times vary according to a variety of factors, such as size of area covered, distance from station, time of day, and road congestion. Within the district, response times are often longer in rural areas than in suburban and urban areas.

SOLID / HAZARDOUS WASTE

Solid Waste

Solid waste consists of residential wastes (trash and garbage produced by households), construction wastes, commercial and industrial wastes, home appliances and abandoned vehicles, and sludge residues (waste remaining at the end of the sewage treatment process). California Code of Regulations (CCR) Title 14, Division 7 includes the state standards for the management of facilities that handle and/or dispose of solid waste. CCR Title 14, Division 7 is administered by the California Integrated Waste Management Board (CIWMB) and the designated Local Enforcement Agency (LEA). The designated LEA for each County is the County Department of Environmental Health. CCR Title 14, Division 7 establishes general standards to provide required levels of performance for facilities that handle and/or dispose of solid waste. Other requirements in CCR Title 14 include operational plans, closure plans, and postclosure monitoring and maintenance plans. This regulation covers various solid waste facilities including, but not limited to: landfills, materials recovery facilities (MRFs) and transfer stations and composting facilities.

The district's four-county region is permitted to accept over 111,198 tons of municipal solid waste (MSW) each day. Solid wastes consist of residential wastes (trash and garbage produced by households), construction wastes, commercial and industrial wastes, home appliances and abandoned vehicles, and sludge residues (waste remaining at the end of the sewage treatment process).

A total of 39 Class III active landfills and two transformation facilities are located within the district with a total capacity of 111,198 tons per day. Los Angeles County has 14 active landfills with a permitted capacity of over 58,000 tons per day. San Bernardino County has nine public and private landfills within the district’s boundaries with a combined permitted capacity of 11,783 tons per day. Riverside County has 12 active sanitary landfills with a total capacity of 14,707 tons per day. Each of these landfills is located within the unincorporated area of the county and is classified as Class III. Orange County currently has four active Class III landfills with a permitted capacity of over 25,000 tons per day.

Hazardous Waste

Hazardous materials are substances with certain physical properties that could pose a substantial present or future hazard to human health or the environment when improperly handled, disposed, or otherwise managed. As defined in CCR title 22, Division 4.5, Chapter 11, Article 3, hazardous materials are grouped into the following four categories based on their properties: toxic (causes human health effects), ignitable (has the ability to burn), corrosive (causes severe burns or damage to materials) and reactive (causes explosions or generates toxic gases). A hazardous waste is any hazardous material that is discarded, abandoned, or to be recycled. The criteria that render a material hazardous also make a waste hazardous (Health and Safety Code, § 25151). If improperly handled, hazardous materials and wastes can result in public health hazards if released to the soil or groundwater or through airborne releases in vapors, fumes, or dust.

Hazardous materials as defined in 40 CFR 261.20 and California Title 22 Article 9 (including listed substances, 40 CFR 261.30) are disposed of in Class I landfills. California has enacted strict legislation for regulating Class I landfills (California Health and Safety Code §§25209 - 25209.7). For example, the treatment zone of a Class I landfill must not extend more than five feet below the initial surface and the base of the zone must be a minimum of five feet above the highest anticipated elevation of underlying groundwater (California Health and Safety Code §25209.1(h)). The Health and Safety Codes also require Class I landfills to be equipped with liners, a leachate collection and removal system, and a groundwater monitoring system (California Health and Safety Code §25209.2(a)). Such systems must meet the requirements of the California Department of Toxic Substances Control (DTSC) and the California Water Resources Control Board (California Health and Safety Code §25209.5). Hazardous waste storage and transportation regulations are discussed below.

Currently, the area within the SCAQMD's jurisdiction does not have any Class I landfills approved to accept hazardous wastes. Currently, there are three Class I landfills located in California. Chemical Waste Management Corporation in Kettleman City is a treatment, storage, and disposal facility that has a permitted capacity of 10 million cubic yards. At current disposal rates, this capacity would last for approximately 20 years (Hashemian, 1999). Safety-Kleen Corporation has a Class I facility in Buttonwillow, Kern County, with a permitted capacity of 10.7 million cubic yards (not yet constructed). The current remaining capacity is 0.3 million cubic yards. At current disposal rates, this capacity would last for approximately seven years. In addition, treatment services and landfill disposal are available from the Safety-Kleen facility located in Westmorland, Imperial County, with a permitted capacity of 2.6 million cubic yards (not yet constructed) and a current remaining capacity of 0.2 million cubic yards, which is estimated to last for approximately five years (Hashemian, 1999).

In addition, hazardous waste can also be transported to permitted facilities outside of California. The nearest out-of-state landfills are U.S. Ecology, Inc., located in Beatty, Nevada; USPCI, Inc., in Murray, Utah; and Envirosafe Services of Idaho, Inc.; in Mountain Home, Idaho. Incineration is provided at the following out-of-state facilities: Aptus, located in Aragonite, Utah and Coffeyville, Kansas; Rollins Environmental Services, Inc., located in Deer Park, Texas and Baton Rouge, Louisiana; Chemical Waste Management, Inc., in Port Arthur, Texas; and Waste Research & Reclamation Co., Eau Claire, Wisconsin (Kirby, 1996).

ENERGY / MINERAL RESOURCES

Electricity

California's energy market has undergone dramatic changes since the beginning of 1998. In March 1998, the newly restructured electricity market, which allows customers of investor owned utilities to procure from a multitude of new providers those energy services (generation, billing, metering) previously only provided by the utilities, commenced operations. This structural change is the end result of a three-year regulatory and legislative review of the electricity market, culminating with the passage of California Assembly Bill 1890 (AB 1890) in September 1996. Additionally, under AB 1890 electricity services (i.e., traditional generation, transmission, and distribution) are frozen at rates that were in effect June 10, 1996. The collection of the competitive transition charge and the rate freeze will continue through March 2002, or until stranded costs have been fully recovered. These changes will clearly have implications for many California energy consumers, who can now shop for the best combination of electricity prices and services from utility and non-utility providers. These recent changes to the electricity market have raised considerable uncertainty about whether and how energy consumption patterns will change in the future (CEC, 1998a).

California is the second largest consumer of electricity in the United States, Texas being the largest. Statewide electricity consumption reached 246,225 gigawatt hours (GWh) in 1997, the second consecutive year that electricity demand grew in excess of 2.9 percent compared to the previous year. In 1997, the residential and commercial sectors accounted for almost two-thirds of all electricity consumed in the state. With little change to the sector shares anticipated during the next ten years, overall growth will continue to be dominated by the residential and commercial sectors even though growth in the remaining sectors is expected. Statewide energy consumption is expected to increase by 1.8 percent per year from 246,225 GWh in 1997 to 291,473 GWh in 2007 (CEC, 1998a)

The varying economic and demographic conditions across counties throughout the state cause significant differences in electricity consumption patterns. For example, the nine largest counties in California accounted for 69 percent of all electricity consumed in the state in 1997. Seven of the 58 counties in the state each consumed at least 10,000 GWh of electricity, with Los Angeles County being the largest by far. Los Angeles County accounts for about one-fourth of statewide electricity consumption. Orange and Santa Clara Counties, driven by energy-intensive high technology industries, are the second and third largest county electricity consumers in the state.

In the SCAQMD's jurisdiction, there are a variety of commercial, residential, and industrial end-users of electricity. Electricity is transmitted to end-users through an extensive electricity distribution system. Electricity distribution is provided for the Southern California service area by Southern California Edison (SCE)[6], the LADWP and the municipal utilities of Burbank, Glendale, and Pasadena (BGP). The LADWP and BGP planning areas are located entirely within the boundaries of the SCAQMD, while SCE's territory extends above the northern borders of Los Angeles County and San Bernardino County to include Ventura, Inyo, Mono and portions of Kings and Kern counties. Although the SCE planning area is large, most of the electricity transmitted by SCE is to areas within the SCAQMD's jurisdiction.

Annual energy demand is the total amount of electricity consumed in a year. Table 3-10 presents the CEC's electricity consumption forecasts by sector for the SCE, LADWP, and BGP planning areas within the SCAQMD's jurisdiction. Annual electricity use is the total amount of electricity consumed in the district in a year. Peak demand is the highest instantaneous need during the year. The forecast accounts for growth in electric vehicles, although they represent a relatively minor impact on electricity consumption.

TABLE 3-10

Electricity Consumption By Sector (GWh) [a]

Sector	Year			
	2000	**2003**	**2007**	**2015**
Residential				
SCE	25,941	26,968	28,550	31,808
LADWP	7,022	7,157	7,384	7,618
BGP	884	900	927	965
Total	33,847	35,025	36,861	40,391
Commercial				
SCE	30,757	33,601	34,901	40,129
LADWP	11,237	12,125	12,330	14,110
BGP	1,993	2,177	2,195	2,475
Total	43,987	47,903	49,426	56,714

[6] The SCE planning area includes the cities of Anaheim, Anza, Asuza, Banning, Colton, Riverside, and Vernon and the Metropolitan and Southern California Water Districts. A planning area denotes a geographic region of an electric investor-owned utility in which there resides municipal utilities and/or irrigation districts. An electric service area denotes a geographic area for which a single utility provides electric distribution services.

TABLE 3-10 (CONTINUED)

Electricity Consumption By Sector (GWh) [a]

Sector	**Year**			
	2000	**2003**	**2007**	**2015**
TCU				
SCE	5,131	5,378	5,643	6,737
LADWP	1,394	1,438	1,509	1,723
BGP	87	89	93	89
Total	6,612	6,905	7,245	8,549
Street Lighting				
SCE	667	694	733	815
LADWP	293	294	296	299
BGP	20	21	21	18
Total	980	1,009	1,050	1,132
Assembly				
SCE	15,877	17,239	19,708	24,580
LADWP	2,259	2,419	2,720	3,335
BGP	235	254	290	374
Total	18,371	19,912	22,718	28,289
Process				
SCE	5,113	5,478	6,186	8,114
LADWP	1,299	1,360	1,497	1,719
BGP	5	5	6	10
Total	6,417	6,843	7,689	9,843
Mining				
SCE	2,437	2,400	2,390	2,269
LADWP	322	322	329	204
BGP	49	50	55	73
Total	2,808	2,772	2,774	2,546
Agriculture				
SCE	5,472	5,683	5,915	6,600
LADWP	174	182	193	204
BGP	31	31	31	33
Total	5,677	5,896	6,139	6,837
Electric Vehicles (EVs)[b]	147	667	1,555	2,347
Total	**118,846**	**126,932**	**135,457**	**156,648**

Source: *1998 Baseline Energy Outlook*, CEC (August 1998)

[a] Historical data through 1997.

[b] Estimates taken from Case B of the On-Road & Rail Transportation Energy Demand Forecasts for California (CEC, April 1999). In this low growth case, electric and natural gas vehicles begin to be substituted for gasoline LDVs, and new vehicle fuel efficiency is assumed to improve. In particular, Case *B* assumes that the sales of new EVs increase beginning in 1999 until ten percent of new light-duty vehicle sales are electric by 2003; this penetration level is assumed to remain constant through 2015.

At least as important as forecasts of electricity consumption are forecasts of peak demand. Peak demand, expressed in megawatts (MW), measures the highest instantaneous consumption of electricity integrated over an hour of time during a calendar year. Peak demand estimates are important in the evaluation of system reliability, determination of points of congestion along the electric system grid, and identification of potential areas where additional transmission, distribution, and generation facilities may be needed. California's electricity demand typically peaks on a typically day in August between the hours of 3 and 5 p.m. It is usually driven by the larger-populated areas, which have the widest variation in temperatures, namely most of the SCE service territory and the Central Valley (e.g., San Joaquin and Sacramento Valleys). The SCE's peak occurred at 3 p.m., and the Sacramento Municipal Utility District's (SMUD) at 5 p.m. The peaks for LADWP and BGP occurred one hour later (CEC, 1998a).

Coincident peak demand estimates for the state are expected to increase 1.7 percent per year, slightly slower than electricity consumption, from 46,505 MW in 1997 to 54,566 MW in 2007. Table 3-11 presents the CEC's coincident peak demand forecasts by sector for the SCE, LADWP, and BGP planning areas within the SCAQMD's jurisdiction (CEC, 1998a).

TABLE 3-11

Electric End-Use Coincident Peak Demand By Sector (MW)[a]

Sector	Year			
	2000	2003	2,007	2,015
Residential Base				
SCE	3,024	3,147	3,334	3,741
LADWP	759	775	801	840
BGP	96	98	101	105
Total	3,879	4,020	4,236	4,686
Commercial Base				
SCE	4,358	4,765	4,945	5,798
LADWP	1,650	1,784	1,814	2,052
BGP	290	317	319	363
Total	6,298	6,866	7,078	8,213
Process				
SCE	705	754	850	584
LADWP	159	167	184	212
BGP	1	1	1	1
Total	865	922	1,035	797
Assembly				
SCE	2,436	2,641	3,016	3,835
LADWP	406	434	487	592
BGP	38	42	48	60
Total	2,880	3,117	3,551	4,487

TABLE 3-11 (CONTINUED)

Electric End-Use Coincident Peak Demand By Sector (MW)[a]

Sector	Year			
	2000	**2003**	**2,007**	**2,015**
Mining				
SCE	358	353	353	349
LADWP	61	62	64	67
BGP	11	11	12	14
Total	430	426	429	430
Agriculture				
SCE	781	812	845	946
LADWP	11	12	13	15
BGP	2	2	2	2
Total	794	826	860	963
TCU & Street Lighting				
SCE	838	877	920	1,035
LADWP	232	239	251	276
BGP	15	15	16	18
Total	1,085	1,131	1,187	1,329
EVs[b]	11	51	120	181
Total Base	16,242	17,359	18,496	21,086
Residential Weather				
SCE	2,793	2,922	3,115	3,556
LADWP	633	633	639	641
BGP	135	136	138	141
Total	3,561	3,691	3,892	4,338
Commercial Weather				
SCE	3,008	3,242	3,331	3,779
LADWP	1,100	1,162	1,170	1,269
BGP	205	219	220	243
Total	4,313	4,623	4,721	5,291
Total Weather	7,874	8,314	8,613	9,629
Grand Total	24,116	25,673	27,109	30,715

Source: *1998 Baseline Energy Outlook*, CEC (August 1998)

[a] Historical data through 1997.

[b] Estimates obtained by converting the EV GWh forecasts in Table 3-10 to MWs.

To determine whether there is sufficient electricity capacity in California to meet the anticipated electricity demand the CEC conducts various computer simulations (e.g., forecasts) based on historical electricity demand and supply. In the most recent forecast entitled 1996 Electricity Report (ER 96), the CEC compares the need identified in its demand forecast with likely future supplies[7]. The CEC divides electricity supplies available or potentially available during forecast years into four categories:

- "Existing" supply resources;
- "Committed" supply resources (e.g., projects that have already received regulatory approval, including committed demand side management (DSM));
- "Uncommitted" supply resources consisting mainly of about 3,000 MW of spot market; and
- "Uncommitted" DSM (e.g., savings from DSM programs that do not yet exist or that have not yet received regulatory funding approval, but that appear to be viable and cost-effective).

Table 3-12 presents the CEC's forcasted capacity balances adjusted for 1998 forcasted peak demands for each individual service provider in the SCAQMD's jurisdiction. Table 3-13 presents the total capacity balances for all service providers in the SCAQMD's jurisdiction.

TABLE 3-12

Individual Capacity Balances For The SCAQMD's Jurisdiction (MW)[a]

	Year			
	2000	**2003**	**2007**	**2015**
SCE Service Area				
Peak Demand[b]	18,301	19,513	20,709	24,087
Exports Requiring Reserves	210	110	-	-
Reserve Requirements	2,901	3,017	3,131	3,035
Exports Not Requiring Reserves	-	-	-	-
Capacity Requirements[c]	21,412	22,640	23,840	27,122
Existing and Committed Resources	20,693	20,714	20,546	18,186
(Deficit)	(719)	(1,926)	(3,294)	(8,936)
Uncommitted DSM[d]	2,669	2,846	3,426	5,103
Uncommitted Generation Resources	588	588	588	588
Total Uncommitted Resources	3,257	3,434	4,014	5,691
Surplus/Deficit	2,538	1,508	720	(3,245)

[7] The Demand Forecast measures demand at the point of consumption. In order to provide the amount of needed power in the places where it is consumed, power plants must actually generate more power, because a small amount of power (a few percent) is lost as it flows over transmission lines. In order to ensure service at all times, available power plant capacity must exceed expected demand; some excess is needed to cover unexpected surges in demand and power plant and transmission line outages. The amount of excess, expressed as a percent of total demand, is called the "reserve margin."

TABLE 3-12 (CONTINUED)

Individual Capacity Balances For The SCAQMD's Jurisdiction (MW)[a]

	Year			
	2000	**2003**	**2007**	**2015**
LADWP Service Area				
Peak Demand	5,011	5,268	5,423	5,958
Exports Requiring Reserves	92	41	41	41
Reserve Requirements	1,171	1,193	1,237	1,312
Exports Not Requiring Reserves	-	-	-	-
Capacity Requirements	6,274	6,502	6,701	7,311
Existing and Committed Resources	7,682	7,694	7,699	7,598
Deficit	1,408	1,192	998	287
Uncommitted DSM	46	69	90	121
Uncommitted Generation Resources	-	-	-	-
Total Uncommitted Resources	46	69	90	121
Surplus	1,454	1,261	1,088	408
GBP Service Area				
Capacity Requirements	793	841	857	948
Existing and Committed Resources	1,141	1,141	1,141	1,080
Surplus	348	300	284	132
Uncommitted DSM	-	-	-	-
Uncommitted Generation Resources	-	-	-	-
Total Uncommitted Resources	-	-	-	-
Surplus	348	300	284	132
Southern California Public Power[d]				
Existing and Committed Resources	1,117	1,134	991	722
Uncommitted DSM	-	-	-	-
Uncommitted Generation Resources	-	-	-	-
Total Uncommitted Resources	-	-	-	-

Source: *1996 Electricity Report*, CEC (November 1997)

[a] Estimates based on Business as Usual Scenario.

[b] Peak demand estimates for SCE, LADWP, and GBP are obtained from Table 3-11.

[c] Capacity requirements represents the amount of power plant capacity needed to meet loads with adequate reserves. California utilities have some contracts to sell power out-of-state. That amount is not included in the demand forecast, which includes only in-state demand, but it must be accounted for in needed power plant capacity.

[d] Part of SCE's Planning Area, which includes Cities of Anaheim, Azusa, Banning, Colton, Riverside, and Vernon.

As shown in Table 3-13, the adjusted forecasted in-SCAQMD capacity requirements are expected to adequately supply total annual energy demand for the forecasted baseline years. However, it should be noted that the CEC's ER 96 showed apparent capacity deficits in the state beginning soon after the turn of the century. According to the CEC, for several reasons, the "deficits" should not be interpreted to mean that significant power plant building should begin soon, or that government or other entities need to take immediate action to ensure adequate supplies. Supplies substantially exceed demand today, and it will take several years before demand and supply converge. Moreover, the CEC's assessment of future supplies is quite conservative. In particular, the ER 96 did not include capacity from the potential construction of new power plants beyond those already permitted (CEC, 1997a)

TABLE 3-13

Total Capacity Balances For The SCAQMD's Jurisdiction (MW)

	Year			
	2000	**2003**	**2007**	**2015**
EVs	11	51	120	181
Capacity Requirements	28,479	29,983	31,398	35,381
Total Capacity Requirements	28,490	30,034	31,518	35,562
Existing and Committed Resources	30,633	30,683	30,377	27,586
Surplus/Deficit	2,143	649	(1,141)	(7,976)
Uncommitted DSM	2,715	2,915	3,516	5,224
Uncommitted Generation Resources	3,257	3,434	4,014	5,691
Total Uncommitted Resources	5,972	6,349	7,530	10,915
Surplus	8,115	6,998	6,389	2,939

The capacity of the electric generation units (including gas turbines regulated under Rule 1134) permitted to operate in the district by SCE, LADWP, BGP, is shown in Table 3-14. Most of this capacity is used to maintain a base load in the district to prevent voltage drops that could cause brown-outs. Some of the capacity is dedicated to providing peak demand during the hot summer months and colder winter months. The amount of in-basin capacity used at any time depends on various factors such as energy mix, cost of imported power, spot market price, time of year, peak demand, etc.

TABLE 3-14

In-Basin Electricity Capacity (MW)[a]

SOURCE	**CAPACITY**
SCE	7,244
LADWP	3,219
BGP	460
Rule 1134 Gas Turbines[b]	1,774
TOTAL	**12,697**

[a] With the exception of SCE, electric capacity associated with Rule 1110.2 ICEs are not included.

[b] Source: RECLAIM Emission Factor Analysis

In particular, most of SCE's planning area needs come from sources outside the SCAQMD's jurisdiction. Approximately one-third of the SCE's total system requirements come sources outside of California. On average about 20 to 25 percent of the SCE's in-district capacity is used to meet base load requirements. The remaining system requirements, comes from in-state sources outside the SCAQMD's jurisdiction.

For LADWP, the allocation of electric generation resources to meet its system requirement is considerably different than SCE. Approximately 70 percent of LADWP's planning area needs are met by out-of-state resources, with another 25 percent coming from within the SCAQMD's jurisdiction. Because LADWP has been historically dependent on power purchases from outside California, less than five percent of total requirements are met from in-state resources outside the South Coast Air Basin.

The SCAQMD's current electricity supply comes from natural gas, petroleum, coal, hydroelectric, biomass, geothermal, fuel cell, wind, solar, and nuclear sources. The primary energy supplying resource is fossil fuel, including natural gas, petroleum, and coal. Most out-of-state coal and nuclear resources that supply electricity to the SCAQMD are located in Nevada, Arizona, New Mexico, and Utah. Electric service providers within the SCAQMD's jurisdiction also purchase coal and hydropower from the Pacific Northwest.

Natural Gas

Similar to its electricity consumption ranking, California is the second largest consumer of natural gas in the nation, ranking behind Texas (CEC 1998a). In 1997, California consumed more than 20,000 million therms (e.g., 5.5 billion cubic feet (BCF) per day), with about 35 percent of that amount used to generate electricity. Statewide natural gas consumption (i.e., without electric generation) is expected to increase by one percent per year from 12,978 million therms in 1997 to 14,235 million therms in 2007. Furthermore, the CEC estimates that natural gas demand in California will exceed seven BCF by 2019 (CEC 1999b). The industrial sector, primarily the process-related industries, is responsible for the bulk of the anticipated increase in gas demand. Residential customers comprise the largest consuming group of natural gas, accounting for nearly 40 percent of total end-use consumption.

The varying economic and demographic conditions across counties throughout the state cause significant differences in natural gas consumption patterns. For example, five counties in total consumed 7,528 million therms in 1997, accounting for 58 percent of statewide natural gas end-use consumption. Los Angeles was the largest natural gas consuming county, comprising nearly one-third of statewide end-use consumption, 4,300 million therms in 1997. Heavy chemical and petroleum refining industries placed Contra Costa County second in natural gas consumption, followed by Orange and Kern Counties (CEC 1999b)

The specific uses for natural gas can be broken down into sectors. For example, the residential sector uses natural gas primarily for water and space heating equipment. In addition to use for water and space heating equipment, commercial facilities such as office buildings, grocery stores, schools, hotels and motels, hospitals, and restaurants use natural gas for space heating and cooling, refrigeration and food preparation. Industrial processes consume natural gas in a variety of processes including water heating and steam generation, drying and curing processes, metal melting, heat treatment and general space heating, as well as cogeneration. Because of its clean burning characteristics, natural gas-powered technology is considered to be BACT for most combustion sources in the district and, therefore, it is required by the SCAQMD to be the primary fuel for most combustion sources. The transportation sector is beginning to use compressed natural gas (CNG) as an alternative clean motor vehicle fuel. In the utility electric generation sector, natural gas is used as the primary combustion fuel in power generating equipment such as utility boilers and gas turbines. Table 3-15 provides the CEC's projections of natural gas consumption by sector for the SCAQMD's jurisdiction.

TABLE 3-15

Southern California Gas Service Territory
Natural Gas End-Use Consumption By Sector (Millions Therms)[a]

Sector	**Year**			
	2000	**2003**	**2007**	**2015**
Residential	2,518	2,548	2,611	2,761
Commercial	896	951	1,019	1,257
TCU	77	79	81	79
Assembly	691	710	731	819
Process	1,146	1,184	1,228	1,631
Mining	2,196	2,137	2,060	1,910
Agriculture	58	59	59	54
Natural Gas Vehicles (NGVs)[b]	25	46	48	52
Total	**7,607**	**7,714**	**7,837**	**8,562**
TCF[c]	0.72	0.73	0.75	0.82

Source: *1998 Baseline Energy Outlook*, CEC (August 1998)

a Historical data through 1997.

b Estimates taken from Case B of the On-Road & Rail Transportation Energy Demand Forecasts for California (CEC, April 1999). In this low growth case, electric and natural gas vehicles begin to be substituted for gasoline low duty vehicles (LDVs), and new vehicle fuel efficiency is assumed to improve. Additionally, four dedicated compressed natural gas (CNG) and two bi-fuel (CNG and gasoline) classes are included, and new LDV fuel economy (for both conventional and alternative fuel vehicles) is assumed to grow between 1997 and 2015 ranges from 15 to 28 percent, depending on the vehicle class.

c TCF = trillion cubic feet. These figures are estimated by converting therms to cubic feet (cf) assuming one therm equals 100,000 British thermal units (BTUs) and the heating value of natural gas is 1050 BTUs per cf.

Although natural gas (consisting primarily of methane) can be synthetically produced, current supplies are obtained primarily from naturally occurring accumulations within the earth. The CEC indicates that natural gas supplies to California will remain plentiful for the next several decades. The total resource base (gas recoverable with today's technology) for the lower 48 states is estimated to be about 975 TCF, enough to continue current production levels for more than 50 years. Technology enhancements will continue to enlarge the resource base; however, production capacity increases remain less certain. Despite this concern, production from lower 48 states is expected to increase from 17.1 TCF in the 1994 base year to 25.9 TCF in 2019. The Gulf Coast and Rocky Mountain supply regions account for most of the increase during the next two decades. Alberta continues to provide the bulk of Canadian production. Canadian exports to the United States are projected to rise to 3.9 TCF in 2014 and remain at that level thereafter (CEC, 1999b).

Four producing regions supply California with natural gas. Three of them -- the Southwest US, the Rocky Mountains, and Canada -- provide approximately 85 percent of all gas used in California. The remainder is produced inside California. The total supply to meet California consumption is expected to increase from 5.9 BCF per day in the 1994 base year to 7.8 BCF per day by 2019 (CEC, 1999b). Table 3-16 shows the CEC's projections of natural gas supply to California through 2015. Table 3-16 also provides estimates of the natural gas supply available to the SCG service territory.

TABLE 3-16

California Natural Gas Supply Sources Base Case Production (TCF)

Supplier By Producing Region	**Year**			
	2000	**2003**	**2007**	**2015**
California	0.27	0.32	0.34	0.38
Southwest	1.04	1.14	1.20	1.27
Rocky Mountains	0.26	0.28	0.30	0.34
Canada	0.56	0.59	0.66	0.77
Total Supply for California	**2.13**	**2.34**	**2.51**	**2.76**
Total Supply to SCG Service Territory[a]	1.19	1.31	1.40	1.54

Source: *1999 Fuels Report*, CEC (July 1999)

[a] Estimates based on the assumption that the SCG service territory accounts for 56 percent of statewide gas consumption.

According to the CEC, no significant changes are anticipated in the market shares of natural gas supplies from the four supply regions shown in Table 3-16 over the forecast horizon. Southwest supplies will continue to dominate, holding approximately half of the market. Canadian producers will supply another quarter of the market with the remainder split between Rocky Mountain and California suppliers (CEC, 1999b).

Despite the fact that excess interstate pipeline capacity now exists, additional pipeline capacity is expected to be needed at the California border during the next two decades. The CEC estimates a need for additional delivery capacity from the Rocky Mountains in 2004 and Canada in 2009. Additional delivery capacity at Wheeler Ridge, located south of Bakersfield, will also be needed by 2009 to accommodate additional flows from these regions. No additional delivery capacity will be needed from the Southwest; however, the expansion of the pipelines moving San Juan Basin gas in the Four Corners area, to California will be needed by 2004. Additional capacity will be needed on the SCG system at Toprock by 2009 to receive increasing supplies from the Southwest. Toprock is located at the California/Arizona border near Needles, California (CEC, 1999b).

Liquid Petroleum Fuels

Liquid petroleum fuels include fuel oil, gasoline, and diesel fuel. The majority of stationary source combustion equipment in the district uses natural gas as the primary combustion fuel. Some types of stationary combustion equipment such as boilers, heaters, and internal combustion equipment may use fuel oil as a backup during natural gas curtailments or in emergency situations. Gasoline and diesel fuels are consumed primarily as a transportation fuel in all vehicle classes.

Fuel oil, gasoline, and diesel are by-products from the processing of crude oil. According to refinery submittals to the CEC in 1998, about 84 percent of the crude oil feedstock for California's sophisticated refining industry comes from either in-State, much of it heavy and sulfuric, or from Alaska, mostly moderate in weight and sulfur. The remainder of California's oil comes from a wide variety of foreign regions, such as Latin America, Southeast Asia, and the Middle East.

The crude oil supply outlook for California remains one of declining in-State and Alaska supplies leading to increasing dependence on foreign oil sources. In the short-term, California may see annual production declines greater than 0.8 percent. Several factors support this expectation. Royalty rates have been reduced on California heavy crude oil production from federal leases. The construction of a new oil pipeline is also now complete, increasing the capacity to transport more in-State oil from Bakersfield to refineries in Los Angeles. Furthermore, a West Coast technology information center now offers information to many small producers, to help extend the life of marginal oil wells (CEC, 1999b).

According to the CEC's *1999 Fuels Report*, in the long-term, CEC expects continuing, gradual California production declines as world oil prices remain flat. As shown in Table 3-17, CEC's staff's estimate of when foreign oil imports are expected to exceed California's supply from Alaska is 2006. The estimate for foreign oil to exceed in-State supply is 2012. Furthermore, the estimate of when foreign oil supplies could exceed the halfway mark in California's total oil supply picture is 2016.

As indicated by Table 3-17, the CEC projects that California's crude oil demand will be met by a combination of in-State, Alaska, and foreign supplies for all forecasted years. Accordingly, these supplies will be sufficient to meet California's fuel demands for all forecasted years (CEC, 1999b).

TABLE 3-17

California Crude Oil Supply Possibilities (Millions of Barrels)

		Domestic Supply		Foreign Supply
Year	**Crude Oil Demand @ 1% annual growth**	**California 1% decline rate**	**Alaska Half of 1998 ADNR[a] forecast**	**Baseline 1% CA decline and 1998 ADNR forecast**
1999	657.5	341.2[b]	232.9	83.5
2000	664.1	338.0	231.8	94.3
2003	684.2	328.7	233.6	121.9
2006	705.0	319.7	**188.2**	**197.1**
2007	712.0	316.8	174.7	220.6
2012	748.3	**301.3**	129.4	**317.7**
2015	771.0	292.3	105.5	373.2

Source: 1999 Fuels Report, CEC (July 1999)
[a] ADNR = Alaska Department of Natural Resources
[b] The 1999 increase in domestic supply reflects use of Pacific Oil Pipeline.

Petroleum Fuels Consumption By Stationary Sources

Table 3-18 provides a baseline forecast for petroleum consumption by stationary sources (e.g., non-vehicle). This table includes projected growth in petroleum requirements for four different petroleum consuming sectors: residential, commercial, industrial, and utility electric generation (UEG). Table 3-18 reflects that, apart from catastrophic circumstances such as earthquakes or infrequent gas curtailments, UEGs are not projected to burn petroleum (fuel oil) more often than once in a given 10-year span. This is primarily the result of stringent provisions regarding combustion of petroleum products contained in SCAQMD Rule 1134 - Emissions of Oxides of Nitrogen from Stationary Gas Turbines, SCAQMD Rule 1135 - Emissions of Oxides of Nitrogen from Electric Power Generating Systems, and Regulation XX - RECLAIM.

TABLE 3-18

Projected Petroleum Demand for Stationary Sources (Million Gallons per Year)

		Year	
Sector	**1996[a]**	**2000**	**2010**
Residential	2	2	2
Commercial	16	15	15
Industrial	104	125	131
UEG[a]	1	0	0
TOTAL	**122**	**142**	**148**

Source: *1991 AQMP* (SCAQMD, 1991)
[a] Interpreted by JBS Energy
[b] UEG = Utility Electric Generation

Total stationary source petroleum consumption is expected to increase approximately 16 percent over 1991 levels by the year 2010. Commercial and industrial sectors show a seven to 19 percent increase in petroleum consumption over the same time period. As shown in

Table 3-18, UEG petroleum consumption is expected to be zero under normal circumstances, as it is burned by utilities in the SCAQMD's jurisdiction only when natural gas supplies are curtailed. Current projections regarding petroleum product use are substantially reduced from earlier projections because of increased natural gas capacity within the SCAQMD's jurisdiction.

Gasoline and Diesel Fuels for Transportation

California is the third largest consumer of gasoline in the world. It is surpassed only by the rest of the United States and the former Soviet Union. In 1997, Californians used more than 14 billion gallons of gasoline a year and another two billion gallons of diesel fuel. California is a major producer of gasoline products. A total of 15 refineries currently operate in the state and produce the vast majority of gasoline used in California. They are located in three regions: the eastern San Francisco Bay Area, the Bakersfield area and southern Los Angeles County. In general, the Bay Area refineries supply gasoline for Northern California, while the Bakersfield and Los Angeles County refineries supply Southern California. The oil industry typically has moved gasoline between the two halves of the state, as well as exported gasoline from California to other states and the world market. Much of the fuel produced at California refineries is transported via pipeline to bulk terminals in outlying areas. The fuel is then transferred to tank trucks, which bring the gasoline to service stations (CEC, 1999b).

According to CEC's *On-Road & Rail Transportation Energy Demand Forecasts for California* (April 1999), forecasts for California show on-road gasoline demand increasing from 13.1 billion gallons in 1997 to 14.4 billion gallons by 2015. Diesel use is forecast to increase from 2.5 billion gallons in 1997 to 3.3 billion gallons by 2015. On a per capita basis, annual gasoline demand is projected to decline from 408 gallons in 1997 to 370 gallons in 2015 (CEC, 1999a). Table 3-19 provides the CEC's gasoline and diesel demand forecasts for the Los Angeles region. The reader is also referred to Table 3-20 below for projected Statewide gasoline and diesel demand figures.

TABLE 3-19

Projected Gasoline And Diesel Fuel Demand For Transportation In The Los Angeles Region[a]
(Million Gallons Per Year)[b]

	Year			
Fuel Type	**2000**	**2003**	**2007**	**2015**
Gasoline[c]	6,469	6,529	6,638	6,839
Diesel[d]	1,086	1,141	1,242	1,379

Source: *On-Road & Rail Transportation Energy Demand Forecasts for California* (CEC, April 1999)

[a] The Los Angeles Region includes the Counties of Imperial, Los Angels, Orange, Riverside, San Bernardino, and Ventura.

[b] Estimates taken from Case B forecasts, which include transit and light-duty vehicle demand; assumes the ZEV requirements are met and that natural gas autos gain significantly increased acceptance in California.

[c] Gasoline demand projections include freight, transit, and light-duty vehicle use.

[d] Diesel projections include freight and transit use, and roughly 10 percent of demand is for rail diesel.

Alternative Clean Transportation Fuels

The transportation sector contributes large amounts of air pollutants in California. Tailpipe and evaporative emissions contribute to the formation of ozone. Tailpipe emissions also add to carbon dioxide emissions from fossil fuel combustion. Through dependence on one fuel the state economy is vulnerable to petroleum price increases which pose an energy security risk. Reducing this risk can be achieved by developing alternative fuel vehicle technologies that offer choices for the driving public (CEC, 1997b).

Expected increases in population and personal vehicle use will lead to higher fuel consumption and emissions. These environmental concerns and possible energy security risks pose significant challenges for policy makers and opportunities for those involved in research, development, demonstration and commercialization activities tied to the introduction of alternative transportation fuels (e.g., clean fuels) and other strategies to diversify fuel consumption.

There are two basic approaches to the commercialization of clean fuels: (1) reformulating conventional petroleum-based fuels by lowering the content of air pollution precursors and toxic compounds (such as aromatics, benzene, sulfur, particulates); and (2) substituting inherently cleaner-burning alternative fuels such as methanol, ethanol, natural gas (e.g., compressed natural gas (CNG) and liquefied natural gas (LNG)), propane/butane (e.g., liquefied petroleum gas (LPG)), and electricity. Since September 1989, several oil companies have unveiled “environmentally enhanced” gasoline (e.g., reformulated gasoline). Beginning in 1996, reformulated gasoline produced to meet stringent air quality standards set by the federal Clean Air Act and CARB has lowered vehicle exhaust Statewide. Ford, Chrysler, and several foreign vehicle manufacturers have developed electric, CNG, methanol, and other clean-fueled vehicles. Numerous public and private programs are underway to test and promote more widespread use of alternative clean fueled vehicles including buses (SCAQMD, 1994). However, the current market for AFVs is principally motor vehicle fleets operated by federal, state and local agencies; electric and natural gas utilities; and commercial businesses.

According to CEC’s Transportation Technology Status Report (December 1997), the introduction of alternative fuels into California's transportation energy sector continues at a gradual pace due to a variety of market and regulatory uncertainties. As of 1997, CEC estimates that approximately 15,000 M85 (85 percent methanol and 15 percent gasoline) flexible fuel vehicles (FFVs), 4,000 CNG vehicles, 30,000 LPG vehicles, and 800 EVs were in use in the state[8]. Collectively, these AFVs amount to only a small fraction of California's

[8] These estimates include both LDVs and HDVs. It should be noted that CARB estimates that there are approximately 1,100 LPG vehicles, 7,200 CNG vehicles, and 11,500 M85 vehicles in use in California that have been certified to meet California’s LEV standards. See Staff Report: Initial Statement of Reasons – Proposed Amendments to the Clean Fuels Regulations Regarding Clean Fuel Outlets, (CARB, June 1999).

total 26 million vehicles (year 2000 estimate) in use. Table 3-20, shows CEC's projected Statewide AFV and Los Angeles Region estimates for the next 15 years. The Los Angeles Region includes the Counties of Imperial, Los Angels, Orange, Riverside, San Bernardino, and Ventura

TABLE 3-20

Projected Total Stock Of Light-Duty Vehicles (LDV)And Medium And Heavy Duty Trucks (MHDT) For Los Angeles Region And Statewide (Thousands)[a,b]

Region	Year					
	2000	**2003**	**2005**	**2007**	**2010**	**2015**
State						
LDV Total	**23,484**	**24,447**	**25,233**	**26,023**	**27,096**	**28,819**
Gasoline	22,310	23,225	23,971	24,722	25,741	27,378
EV[b]	939	978	1,009	1,041	1,084	1,153
CNG[c]	235	244	252	260	271	288
MHDT Total	**297**	**299**	**310**	**315**	**327**	**344**
Diesel[d]	282	284	295	299	311	327
EV[e]	3	3	3	3	3	3
CNG[f]	12	12	12	13	13	14
Total Statewide AFVs	1,189	1,237	1,277	1,317	1,371	1,458
Los Angeles[g]						
LDV Total	10,827	11,236	11,571	11,891	12,340	13,065
Gasoline	10,286	10,674	10,992	11,296	11,723	12,412
EV	433	449	463	476	494	523
CNG	108	112	116	119	123	131
MHDT Total	129	130	135	137	142	150
Diesel	123	124	128	130	135	143
EV	1	1	1	1	1	2
CNG	5	5	5	5	6	6

TABLE 3-20 (CONTINUED)

Projected Total Stock Of Light-Duty Vehicles (LDV) And Medium And Heavy Duty Trucks (MHDT) For Los Angeles Region And Statewide (Thousands)[a,b]

Region	Year					
	2000	2003	2005	2007	2010	2015
Total Los Angeles AFVs	548	568	585	601	624	661

Source: *On-Road & Rail Transportation Energy Demand Forecasts for California* (CEC, April 1999). See Tables A-8 and A-9.

[a] CEC's vehicle population projections differ slightly from CARB's projections as shown in Table 3-9. The difference appears to be in CEC's MDHT projections. However, CEC's projection for the Los Angeles Region is on par with CARB's projections for the South Coast Air Basin.

[b] According to the CEC, while sales of electric vehicles are assumed to be sufficient, to meet the CARB's Zero Emission Vehicle mandates, sales of natural gas vehicles are forecast to be lower than in previous forecasts, and methanol vehicles, unlike past forecasts, are not assumed to reach a significant percentage of sales. Thus, the existing methanol FFV population (15,000 in 1997) will decrease in future years. The most likely scenario is that methanol FFVs will be replaced by either EVs or CNG vehicles.

[c] Assumed for LDV population that four percent of total vehicles would be EVs.

[d] Assumed for LDV population that only one percent of total vehicles would be CNG vehicles. It is also assumed that CNG includes LPG and LNG vehicles

[e] Assumed MDHT vehicles would predominately use diesel.

[f] Assumed for MDHT population that only one percent of total vehicles would be EVs.

[g] Assumed for MDHT population that four percent of total vehicles would be CNG vehicles.

[h] Used same EV and CNG vehicle population percentages as Statewide estimates. See notes c through e.

The current forecast is much lower than previous CEC forecasts that indicated 5.8 million AFVs by 2005. The current forecast reflects changes that have occurred over the past five years: the price for methanol staying higher than gasoline, reduced numbers of refueling stations for alternative fuels, and fewer choices of AFV makes and models. In addition, the forecast assumes that all currently planned and adopted rules and regulations, and current vehicle manufacturers' plans will be in effect.

As mentioned earlier, AFVs are vehicles that run on fuels other than petroleum products. They have been with us in one form or another for more than one-hundred years. Only recently, however, have they become more commonplace. In California, the following are considered alternative clean fuels:

- Alcohol fuels such as methanol (methyl alcohol), denatured ethanol (ethyl alcohol) and other alcohols, in pure from (called "neat" alcohols) or in mixtures of 85 percent by volume (and mixed with up to 15 percent unleaded regular gasoline – M85 and E85) or more;
- CNG;
- LNG;
- LPG;

- Electricity;
- Hydrogen; and
- Fuel Cells

These fuels are discussed separately in more detail below. Table 3-21 lists CEC's projections of statewide transportation demand including alternative clean fuels. See Tables 3-13, 3-15, and 3-19 above for the projected transportation fuel demands in the SCAQMD's jurisdiction.

TABLE 3-21

Transportation Fuel Demand Forecast for California (Millions of Fuel-Specific Units)

		Year			
Fuel	**Units**	**2000**	**2005**	**2010**	**2015**
Gasoline	Gallons	13,500	13,800	14,100	14,400
Diesel	Gallons	2,600	2,900	3,200	3,300
CNG	Therms	33	47	53	58
Electric	kWh	652	2,647	4,329	5,189

Source: 1999 Fuels Report, CEC (July 1999)

Despite anticipated increases in vehicles and vehicle miles traveled, the CEC anticipates as shown in Table 3-21, that the total gasoline demand in California is expected to remain relatively constant due to increases in alternative fuel use, fuel economy increases primarily from technology advances, and switching from gasoline to diesel for movement of goods. However, while sales of electric vehicles are assumed to be sufficient, to meet the CARB's Zero Emission Vehicle mandates, sales of natural gas vehicles are forecast to be lower than in previous forecasts, and methanol vehicles, unlike past forecasts, are not assumed to reach a significant percentage of sales (CEC, 1999b). Thus, the current us of methanol as a fuel will decrease in future years from present levels. The most likely scenario will be that either EVs or CNG vehicles will replace methanol FFVs.

Methanol

Currently, methanol is used in private and government fleets throughout the SCAQMD's jurisdiction in passenger vehicles. Methanol is also being used in heavy-duty vehicles such as school and transit buses and tractor-trailer rigs. Methanol ("wood," methyl alcohol or M100 – CH_3OH) is a clean-burning liquid fuel. M100, 100 percent methanol, has a colorless invisible flame. Adding a hydrocarbon results in a flame that can be seen (CEC, 1999d). M100 vehicles also have trouble starting in cold weather and adding a hydrocarbon eliminates this problem. The most common use of methanol is as a mixture of 85 percent methanol and 15 percent gasoline known as M85. M85 is cleaner burning than pure gasoline, with good performance characteristics. M85 can also be used in FFVs without the need for a dual fuel system. FFVs were unveiled in 1986 when auto companies pioneered a sensor that could detect the percentage amount of alcohol or gasoline in a fuel mixture. The sensor sends a signal to an engine computer to adjust the timing and fuel injection depending on the fuel mix.

Methanol can be produced from a variety of sources including natural gas, coal, wood, biomass, cellulose and methane from waste decomposition. For the foreseeable future, remote natural gas resources offer the most likely source of methanol production. Chemical methanol production with conventional technologies uses a two-step process. First, feedstock natural gas is converted to a synthesis gas consisting of hydrogen, carbon oxides, steam, and unconverted natural gas. Next, the synthesis gas is fed through a methanol synthesis loop, for further processing. The loop ends with distillation columns to purify the crude methanol (CEC, 1999d).

According to the CEC, there is a growing concern that the worldwide methanol supply industry is not seriously pursuing the potential for a direct methanol motor fuel market. While vast potential to produce methanol is well documented, existing and planned world methanol production capacity of roughly 10 billion gallons per year, all based on natural gas as the feedstock, could supply only a tiny fraction of the motor fuel market. Supply development from alternative resources, such as coal and biomass, is not currently in evidence. Various factors, including prevailing low petroleum prices, corporate mergers and reorganizations, previous overly optimistic fuel market expectations that led to excess production capacity, and the decline in auto industry methanol vehicle offerings may all be contributing to the apparent backing away from motor fuel market development by the methanol industry. A particularly notable setback was the termination of plans that one large methanol producer had announced to begin setting up a network of methanol fueling stations throughout the U.S. Recent efforts by the CEC to maintain industry participation and support for California’s fledgling methanol fueling station network have also become increasingly difficult. In general, the industry does not appear to be taking the types of steps that would assure adequate methanol supply and distribution for the sustained growth of the motor fuel market (CEC, 1997b)

Currently, the methanol that is used in California’s methanol demonstration programs is produced in Canada and on the U.S. Gulf Coast from natural gas. It has been supplied by a number of companies including: Beaumont Methanol Corporation, Enron Petrochemicals Company, Hoescht Celanese Chemical Group, Intermountain Chemical Inc., Methanex Corporation, and Novacor Chemical USA. Methanex is the current supplier of an annual total of more than 20 million gallons of methanol for the state’s fuel methanol reserve (CEC, 1999d).

The methanol stock that is supplied to California currently arrives by rail tank cars to storage areas in Northern and Southern California. From these areas, it is mixed with unleaded regular gasoline and transported to retail network participants (EEA, 1987). Typically methanol is unloaded into a dedicated storage tank at a terminal facility. At the terminal, methanol is blended with a hydrocarbon such as unleaded conventional fuel (gasoline) to make M85. The M85 is then delivered to retail distribution outlets by a dedicated truck fleet.

If methanol use within the SCAQMD's jurisdiction were to increase substantially, rail tank car transportation could possibly be augmented or replaced by methanol dedicated pipelines. However, this is not anticipated due to the forcasted future decline in the use of methanol as an alternative clean-fuel.

Unfortunately, the infrastructure for delivering methanol fuel to the consumer is quite limited. In California, most of fueling facilities capable of providing M85 have been established as part of a demonstration project of the CEC, in cooperation with gasoline refiners. The program was intended to encourage the development of a fueling infrastructure for flexible fuel vehicles capable of using M85. At its peak in 1996-1997, the program reached a high of 54 public fueling facilities (CARB, 1999a). However, currently this number has declined to 38 public fueling facilities, as the use of M85 facilities has decreased. Neither the conventional (petroleum) fuel supply industry, the methanol industry, nor other private or public entities appear prepared to undertake the development of an adequate refueling infrastructure to support unlimited travel with methanol vehicles. The limited fuel volumes being pumped at most of the existing methanol stations, due largely to predominant use of gasoline in much of the on-road FFV fleet, does not make for a viable commercial proposition that would attract private investment capital for additional stations (CEC, 1997b)

Table 3-22 shows the total number of M85 fueling facilities in California and the SCAQMD by type. It is expected that the number of public fueling facilities will be further reduced as a result of automobile manufacturers moving away from M85 as an alternative fuel for FFVs.

TABLE 3-22

M85 Fueling Facilities by Outlet Type

Region	Public	Limited Public	Private	Total
Statewide	38	0	25	63[a]
SCAQMD[b]	--	16	--	16

Source: Initial Statement of Reasons – Proposed Amendments to the Clean Fuels Regulations Regarding Clean Fuel Outlets, (CARB, June 1999)

[a] The Alternative Fuels Data Center estimates that there are approximately 36 total methanol refueling sites in California. See http://www.afdc.nrel.gov.

[b] SCAQMD staff estimate.

While the use of M85 is decreasing, the use of pure methanol (M100) as a future fuel for fuel cell powered vehicles is very possible (CARB, 1999a). It is unclear at this time if the existing M85 fueling infrastructure could be converted to supply pure methanol to future fuel cell powered vehicles, or if these vehicles will require a new infrastructure to be developed.

It should be noted that according to CARB there is currently no fueling infrastructure for E85 in California. It is unclear when an E85 fueling infrastructure will be developed. Since current and anticipated E85 vehicles are flexible fuel, there may be little incentive to run them on E85 (CARB, 1999a).

Compressed Natural Gas (CNG)

CNG is a highly compressed from of the same fuel used in residential households for cooking and heating. It is a combustible, gaseous mixture of simple hydrocarbon compounds, usually found in deep underground reservoirs formed by porous rock. Natural gas is a fossil fuel and can be found by itself or in association with crude oil or hydrocarbon condensates – gases that liquefy at normal atmospheric pressures and closely resemble mineral spirits. Natural gas is primarily composed of methane (CH_4), with minor amounts of ethane (C_2H_6), propane (C_3H_8), butane (C_4H_{10}), and pentane (C_5H_{12}) (CEC, 1999d).

CNG is a clean alternative fuel with a diversity of applications, including energy to provide heat, generate electricity, serve other industrial operations, and fuel motor vehicles. Gasoline vehicles have been converted to run on natural gas for many years. However, it has only been in the last ten years that automobile manufacturers have begun offering factory-produced CNG-powered vehicles. Some vehicles, called dual-fuel vehicles, can operate on either natural gas or gasoline at the flip of a switch.

Of all the liquid or gaseous fuels ready for commercial transportation use, CNG and LNG offer the largest reductions in emissions (next to electric) compared to gasoline. The use of CNG in vehicles fulfills the objectives of the Federal Energy Policy Act, Federal Clean Air Act, and CARB's LEV and ULEV standards.

Table 3-21 above contains current and future baseline forecasts for CNG demand from mobile sources through the year 2015. For refueling, there are currently over 200 CNG fueling facilities in California (CARB, 1999a). Most CNG fueling facilities are private or government owned and do not offer unrestricted access to the general public. Table 3-23 shows the total number of CNG fueling facilities in California and the SCAQMD by type.

TABLE 3-23

CNG Fueling Facilities by Outlet Type

Region	Public	Limited Public	Private	Government	Total
Statewide	7	109	93	--	209[a]
SCAQMD[b]	6	37	19	12	74

Source: Initial Statement of Reasons – Proposed Amendments to the Clean Fuels Regulations Regarding Clean Fuel Outlets, (CARB, June 1999)

[a] The Alternative Fuels Data Center estimates that there are approximately 207 total CNG refueling sites in California. See http://www.afdc.nrel.gov.

[b] SCAQMD staff estimate.

California's extensive network of natural gas pipelines can deliver the fuel directly to many sites where compressors are installed by the local utility, including individual homes. Two types of fueling systems are available for commercial use: a "quick fill" system that fuels a vehicles in five minutes (similar in time to fueling a vehicle with gasoline), or a "slow fill" system that can fuel an entire fleet overnight (CEC, 1999d). However, over 90 percent of the CNG fueling facilities in California are fast fill which can fuel a vehicle in just a few minutes

(CARB, 1999a). Slow-fill fueling facilities tend to be older and can only supply a limited number of vehicles. Also used, are small portable fueling systems (fuel makers) that can fuel a vehicle over an extended time (about 8 hours). These are often used by individuals who own a single vehicle and want the convenience of fueling at their home or business location.

Refueling CNG requires high-pressure compressors to compress the gas into storage vessels (tanks) from the low pressure local distribution lines. Because they are under high pressure, CNG vehicle storage tanks are typically made out of aluminum or steel with about ½ inch fiberglass overwrap to achieve burst pressures of approximately three times the normal working pressure in a cylindrical shape vessel. Natural gas is compressed at pressures 3000 and 3600 pounds per square inch to increase stored energy density to achieve a greater driving range. A standard CNG tank is 10 inches in diameter, 36 inches long, and weighs approximately 55 pounds.

Liquefied Natural Gas (LNG)

LNG is natural gas that has been liquefied for easy storage or transport. Natural gas is turned into a liquid by extreme cooling to minus 327.2 degrees Fahrenheit. LNG is almost pure methane, and because it is a liquid, has an energy storage density much closer to gasoline than CNG. The requirements of keeping the liquid very cold, however, and its volatility make its applications more limited for transportation purposes (CEC, 1999d).

LNG fueling requires use of lower pressure but highly insulated fuel storage vessels, which maintain the necessary low temperature to store natural gas in the liquid state. LNG allows significantly greater energy storage density than CNG, providing longer driving range between refueling and/or requiring less on-board fuel storage capacity. However, current LNG storage vessels require some venting of fuel to relieve pressure build-up when vehicles are not operated for a period of time. For heavy-duty vehicles, which are typically used on a daily basis, and where refueling range and payload capacity are important considerations, LNG's higher energy storage density appears to offer a significant advantage over CNG.

The Alternative Fuels Data Center estimates that there are approximately nine total LNG refueling sites in California (see http://www.afdc.nrel.gov). SCAQMD staff estimates that there are approximately six public and four private LNG refueling sites in the SCAQMD's jurisdiction.

Liquefied Petroleum Gas (LPG)

LPG consists primarily of propane (C_3H_8), which has a higher octane rating than conventional gasoline, thus burning cleaner compared to gasoline or diesel. Propane is a gas in its natural state. It turns to liquid under moderate pressure and is stored in vehicle fuel tanks as such. When propane is drawn from the tank, it reverts back to vapor before it is burned in the engine.

LPG (e.g., propane, butane, etc.) is derived primarily from either the lighter hydrocarbon fractions produced during petroleum refining, as a natural function of separating the fractions of crude oil, or is extracted from the heavier parts of natural gas. Nationwide, most LPG is derived from natural gas production; however, statewide, most LPG is derived from crude oil refining. In California, more than sixty percent of LPG is produced from crude oil refining, while the remaining forty percent is provided by natural gas production.

LPG is used for commercial/industrial applications, recreational use, and as motor vehicle fuel. However, in California it is used primarily as a home heating and cooking fuel. As a motor vehicle fuel, propane has been used as an alternative to gasoline, especially in fleets, and many other vehicles, such as fork lift trucks, mobile sources in factories and warehouses, etc., for approximately 50 years. The American Petroleum Institute reports that approximately 10 percent of the propane sold in California is to transportation markets – some 65 million gallons annually (CEC, 1995).

Because the amount of LPG used in motor vehicle applications is small (e.g., 10 percent of total LPG use), most LPG fueling facilities are not designed solely for dispensing LPG into motor vehicles. Currently, there are more than 275 LPG fueling facilities in California (CARB, 1999a). Table 3-24 shows the total number of LPG fueling facilities in California by type. Most of these facilities have public access, although access may be limited and the customer may be required to call ahead to arrange use. Fleets with propane vehicles typically have motor fuel arrangements with propane suppliers for on-site refueling installations or access to designated supplier-operated stations.

TABLE 3-24

LPG Fueling Facilities by Outlet Type

Public	Limited Public	Private	Unknown	Total
107	116	0	55	278[a]

Source: Initial Statement of Reasons – Proposed Amendments to the Clean Fuels Regulations Regarding Clean Fuel Outlets, (CARB, June 1999)

[a] The Alternative Fuels Data Center estimates that there are approximately 517 total LPG refueling sites in California. See http://www.afdc.nrel.gov.

Infrastructure requirements for LPG fueling are minimal. LPG distribution networks in place are capable of scale modifications if there is significant increased demand for LPG (CEC, 1999d). LPG storage and dispensing facilities are typically located at fleet refueling centers, and usually use above-ground tanks. This distribution system is capable of supplying LPG to both industrial and transportation users. LPG is typically stored under low pressure (approximately 160 psig) in liquid from.

Electricity

There are a number of electrically powered vehicles (EVs) in use by the public, government, and utility services today. They are intended to spur on the vehicle market as mandated by California's ZEV program.

The ZEV program was approved by CARB in September 1990 as part of the LEV regulations. These regulations required the seven largest auto manufacturers to produce ZEVs beginning with model year 1998. Specifically, in model years 1998 through 2000, two percent of the seven largest auto manufacturers' new vehicle fleet were required to be ZEVs and this percentage was to increase to five percent in model years 2001 and 2002 and ten percent in model years 2003 and beyond. The ten percent requirement in model years 2003 and beyond applied to the intermediate volume auto manufacturers as well.

In March 1996, CARB modified its LEV regulations. The requirement for ten percent ZEVs in model years 2003 and beyond was maintained. However, in place of the requirement for ZEVs in model years 1998 through 2002, ARB entered into Memoranda of Agreement (MOAs) with the seven largest auto manufacturers affected by the regulations. These MOAs included commitments from the auto manufacturers to:

- offset the emission benefits lost due to the elimination of the ZEV requirements in model years 1998 to 2002 through a national low-emission vehicle program or other program that would provide equivalent air quality benefits;
- continue investment in ZEV and battery research and development and place specified numbers of advanced battery-powered ZEVs in marketplace demonstration programs (up to 3,750 vehicles total);
- participate in a market-based ZEV launch by offering ZEVs to consumers in accordance with market demand; and
- provide annual and biennial reporting requirements.

The auto manufacturers are making progress towards meeting their MOA commitments. Once the ZEV program, as modified in March 1996, is implemented, it will provide direct exhaust, fuel evaporative and fuel marketing emission reductions of 14 tons per day of NOx and VOCs in the SCAQMD's jurisdiction in 2010 (CARB, 1999b)

As shown in table 3-14 above, transportation electricity use in the SCAQMD's jurisdiction is forecasted to increase from around 11 GWh in 1997 to over 181 GWh in by 2015. Based on CEC's *ER 96* projections, there should be sufficient capacity to meet the incremental electrical demand associated with the use of EVs in the SCAQMD's jurisdiction (see Table 3-13 above). It is assumed that most EV recharging will occur off-peak. Assuming EV demand is managed, only about 4.5 percent of EV charging will occur on-peak (during the afternoon and early evening).

The performance and quality of today's EVs is directly related to the progress made in battery technology. The placement of advanced battery-powered EVs has provided an unprecedented amount of technical information regarding battery performance and reliability. CARB staff has evaluated information from four of the most promising advanced battery technologies, nickel-metal-hydride (NiMH), sodium-nickel-chloride (NaNiCl), lithium-ion (Li-Ion), and lithium polymer (Li-Poly). Of the four technologies evaluated, NiMH and NaNiCl could be available in production quantities (>10,000 per year) by 2003. Li-Ion could be near to achieving production quantities by 2003 if development hurdles are resolved soon. The decision about whether or not to go into full production of Li-Poly batteries will likely be made by 2003 (CARB, 1998a).

Additionally, since battery powered EVs are the only technology currently capable of meeting the 2003 requirement of ten percent ZEVs, significant work is being done to increase the range (specific energy) and reduce the cost while maintaining or improving performance capabilities. It will be vital to achieve lower cost if ZEVs are to proliferate in the marketplace. As these technologies are proven and production volumes increase, cost is expected to be reduced.

"Fueling," or more appropriately recharging, lead-acid, NiMH, NaNiCl, Li-Ion, or Li-Poly batteries for EVs would require separate 40 ampere, 220 volt service and a special recharger outlet, which is similar to the electrical outlets used for clothes dryers. The reason for such a powerful device is that it will reduce recharging time to an acceptable level – about five to six hours for today's batteries. The faster the recharging requirements, the more powerful the electrical service and devices have to be. Obviously, electric power has wide distribution, and recharging systems for home or commercial use are quite feasible. Currently, EVs require between six and eight hours to charge the batteries. Typically recharging of the EVs is expected to occur in the evening, during "off-peak" hours between 11 p.m. and 8 a.m. Off peak power has the lowest cost, thus recharging during this time period would produce favorable electricity prices and lower overall electricity costs (CARB, 1998a)

Electricity for EV charging can be made available anywhere there is electric service, a suitable charger and adaptable plug-in. As of July 1998, CARB estimates that there are currently well over 500 EV recharging stations throughout California. The Alternative Fuels Data Center estimates that there are approximately 335 total electric recharging sites in California (see http://www.afdc.nrel.gov). SCAQMD staff estimates that there are approximately 280 EV recharging sites in the SCAQMD's jurisdiction.

The EV power train consists of basically the battery pack, electric motor, and controller (to modulate power to the motor). On some vehicles, the motor can be reversed into a generator to recharge the batteries during braking (regenerative braking). Most EVs utilize a direct current (DC) system – basically the same system that operates toy cars, but on a powerful scale. Prototype vehicles designed to use an alternating current (AC) system, the same type of power used in homes, are being tested. AC-powered vehicles are lighter, more efficient, and will most likely be less expensive to produce than comparable DC-powered vehicles. Special considerations are also being made concerning optional equipment needs such as air conditioning, heating, power steering, and so forth, that utilize additional power.

Hydrogen

Other alternative fuels such as hydrogen may hold promise for future use. Hydrogen is the most abundant element in the universe, but is rarely found in its uncombined from on the earth. When combusted (oxidized) it creates only water vapor as a by-product ($4H + O_2 = 2H_20$). When burned in an internal combustion engine, however, combustion also produces small amounts of nitrogen oxides and small amounts of unburned hydrocarbons and carbon monoxide because of engine lubricants. The exhaust is free from carbon dioxide (CEC, 1999d)

Hydrogen is normally a gas and can be compressed and stored in cylinders. It can also be kept as a liquid, but the gas only turns liquid at temperatures of minus 423.2 degrees Fahrenheit (below zero). Today, hydrogen is mostly obtained by cracking hydrocarbon fuels, but it can be produced by electrolysis of water (using electricity to split water into hydrogen and oxygen) and photolysis (chemical decomposition).

The main problem with hydrogen is bulk storage required for fuel tanks. For an equivalent energy content of gasoline, liquid hydrogen and the required refrigeration system requires six to eight times more storage space than gasoline and compressed hydrogen gas requires six to ten times more storage space.

Although hydrogen has a higher energy content than gasoline or diesel fuel, high production costs and low density have prevented its use as a transportation fuel in all but test programs. It maybe several more years before hydrogen is a truly viable transportation fuel and then perhaps only in fuel-cell-powered vehicles.

Fuel Cells

By chemically combining – rather than burning – hydrogen and oxygen, a fuel cell creates electricity and water vapor as by-products. Types of fuel cells include alkaline, phosphoric acid, Proton Exchange Membrane, also called “solid polymer,” Molten Carbonate, Solid Oxide, and other fuel cells. The fuel cell power system involves three basic steps. First, methanol, natural gas, gasoline, or another fuel containing hydrogen reacts with steam or is reformed to produce hydrogen. This hydrogen is then electrochemically combined with oxygen in the fuel cell. Since the methanol or natural gas fuel is not burned, there is little or no pollution from the generation of electricity (CEC, 1999d)

Fuel cells operate like a battery. Hydrogen and air are fed to the anode and cathode, respectively, of each cell. These cells are stacked to make up the fuel cell stack. As the hydrogen diffuses through the anode, electrons are stripped off, creating direct current electricity. This electricity can be used directly in a DC electric motor or can be converted to alternating current.

Today's fuel cells are too bulky and costly for most transportation uses, but promising new concepts are under development that would shrink both their size and price tag. Currently, The SCAQMD has a stationary phosphoric acid fuel cell producing electricity for its headquarters in Diamond Bar, California.

In the future, fuel cells may replace storage batteries as the power source for EVs. Fuel cells are electrochemical devices that oxidize hydrogen and produce electricity and water. They are more than twice as efficient as internal combustion engines and produce no regulated emissions. Because hydrogen cannot presently be stored very efficiently, fuel cell systems usually include a reformer that converts a stored hydrogen-rich fuel such as methanol into hydrogen. Such liquid fuels will provide fuel cell EVs with a range equivalent to gasoline and diesel-fueled vehicles. Fuel-cell vehicles may be commercially available in the next ten years.

Clean Diesel

CARB Diesel

All diesel fuel sold in California must meet pollution-cutting specifications established by CARB. These specifications ensure that California diesel fuel is the cleanest-burning diesel in the United States. CARB's diesel-fuel regulations were adopted in 1988 and took effect in 1993.

According to CARB, California diesel fuel produces significantly lower emissions than conventional diesel fuel used in California prior to 1993. The switch from conventional to California diesel resulted in the following emission reductions from diesel-powered vehicles and equipment:

- An 82 percent reduction in SOx;
- A 25 percent reduction in PM;
- A seven percent reduction in NOx; and
- Reduction in emissions of several toxic substances, including benzene and polynuclear aromatic hydrocarbons (PAHs).

California's diesel-fuel regulation contains two principal requirements:

- The fuel's sulfur content is capped at 0.05 percent (e.g., 500 ppm), about one-fifth the level of pre-1993 diesel fuel; and
- The fuel's aromatic hydrocarbon content is capped at 10 percent, about one-third the level of pre-1993 diesel fuel.

The use of California Diesel alone is not sufficient to put diesel-fueled engines on par with alternative clean-fueled vehicles from an air quality perspective. Thus, research into other clean burning diesel formulations has proliferated. Three of the most promising low emissions diesel formulations are discussed below. However, it should be noted that before these low emission diesel fuels have the same or lower emissions as alternative clean-fuels they must be used in tandem with other emissions control strategies. These developing emissions control strategies will be further addressed in Chapter 4 of this Final PEA.

Biodiesel

Biodiesel is the generic name for a variety of diesel fuel alternatives based on methyl esters of vegetable oil or fats. Biodiesel fits under the category of a renewable fuel because it is made from agricultural feedstocks such as soybean or grapeseed. Other possible feedstocks for biodiesel include bio-oils from corn, cottonseed, peanut, sunflower, canola, and rendered tallow (animal fat) (CEC, 1999d)

Biodeisel is made by a catalytic chemical process called transesterfication, using an alcohol (such as methanol) and a catalyst. Methanol is mixed with sodium hydroxide and then with soybean oil, letting the glycerine that is formed settle. This process forms fatty esters, which are then separated into two phases, which allows easy removal of glycerol in the first phase. The remaining alcohol/ester mixture called methyl soyate is then separated, and the excess alcohol is recycled. The esters are sent to the clean-up or purification processes which consists of water washing, vacuum drying, and filtration.

The final fuel closely resembles conventional diesel fuel, with higher cetane number (a number that rates its starting ability and antiknock properties). Energy content, viscosity and phase changes are similar to petroleum-based diesel fuel. The fuel is typically blended with 20 percent low-sulfur diesel fuel.

The fuel is essentially sulfur free, emits significantly less smoke, hydrocarbons, and carbon monoxide. NOx emissions are similar to or slightly higher when compared to diesel. Biodiesel has a high flash point and has very low toxicity if digested. It is also biodegradable.

The biggest drawback of biodiesel is cost. Before biodiesel can be a major fuel for vehicle use in the United States, the price needs to become much more competitive with diesel. Other drawbacks are that vehicle fuel lines and other components that would come in contact with the fuel would have to be changed because biodiesel can dissolve some rubber. The fuel also clouds and stops flowing at higher temperatures than diesel, so fuel-heating systems or blends with diesel fuel would be needed in lower temperature climates (CEC, 1999d).

Synthetic Diesel

Synthetic diesel fuel is a diesel fuel synthesized from natural gas. It may also be blended with conventional petroleum diesel fuels. Synthetic diesel fuel offers a new opportunity to use alternative fuels in diesel engines without compromising fuel efficiency, increasing capital outlay, impacting infrastructure, or refueling cost. Its superior fuel quality, cost, and ease of distribution could contribute two to three million barrels per day, or two to three percent of world-wide refinery output by 2005 (CEC, 1999d).

Natural gas, cleaner and as plentiful as oil, is four times more expensive to transport than oil. An option for reducing transportation cost is to convert natural gas to a liquid through a Fischer-Tropsch technology. Fischer-Tropsch is a gas-to-liquid (GTL) process that can produce a high-quality synthetic diesel fuel from coal, natural gas, and biomass resources. The middle distillate produced from this process can be blended with ordinary diesel.

GTL diesel produced in this unconventional way has extremely low sulfur, aromatics, and toxics compounds. GTL fuel can be blended with non-complying diesel fuel to make a cleaner diesel fuel complying with stringent CARB diesel fuel standards.

Further commercialization of this fuel improves the prospects of new engines meeting the national 2004 heavy-duty diesel engine standard. In the near-term, this fuel may also play a role improving existing diesel vehicles exhaust emissions and reducing toxic emissions.

Since November 1997, ARCO (now BP Amoco), Exxon, Chevron, and Texaco (now Equilon) have announced plans to build pilot plants to produce synthetically-derived diesel fuel through an improved Fisher-Tropsch GTL process. This fuel is sometimes referred to as a middle distillate synthesis (MDS). Tosco and Paramount Petroleum have sold blends of Shell's MDS in California. In 1993, Shell Malaysia claimed to have the world's first fully operational commercial middle distillate synthesis plant at Bintulu. Using natural gas feedstock, it produces 470,000 tons a year of middle distillates and paraffins for the international market.

California's stringent diesel fuel specifications are compelling the petroleum industry to revisit the new, improved Fisher-Tropsch process to competitively produce aromatic and sulfur complying diesel fuel. Synthetic diesel fuel appears to be the most economical fuel product from the GTL process, compared to producing other fuels such as gasoline or methanol. The GTL process needs low-cost natural gas, less than $1 per million BTUs, to be competitive with traditional diesel fuel (CEC, 1999d)

Green Diesel[9]

While ultra-low emission fuels are being developed, improvements to current systems to make them much cleaner are also being developed. One of the simplest ways is to use green diesel as opposed to ordinary diesel. Green diesel is basically a modified diesel fuel with a higher cetane rating[10], lower sulfur, nitrogen, and aromatics content. All of which contribute to lower emissions while improving performance. The lower the sulfur content the greater the benefit in reducing air pollution and toxic emissions, according to studies and air quality

[9] Green diesel is also referred to in the context of a combination of ultra low-sulfur diesel and aftertreatment technology.
[10] Green diesel's cetane ratings are comparable to octane ratings for gasoline.

regulators, because low sulfur content enables catalytic exhaust after-treatment on diesel engines.

Recently, ARCO (now BP Amoco) announced that it will begin offering a cleaner burning diesel fuel (e.g., green diesel), well in advance of anticipated CARB regulatory requirements, aimed specifically at helping reduce soot emissions from urban municipal fleets in Southern California. According to a press release dated December 12, 1999, BP Amoco's new ultra low sulfur diesel fuel will be available immediately, upon request, to operators of urban municipal fleets that have been retrofitted with catalytic exhaust control technology.

BP Amoco's new fuel will have a maximum sulfur content of 15 parts per million (ppm), while the sulfur content of diesel fuel currently used in California (CARB diesel) is almost 10-times greater at an average of 120 ppm, with a maximum sulfur level of 500 ppm. Diesel fuel with an average sulfur content level of 340 ppm, and a maximum of 500 ppm, is used in other parts of the country.

BP Amoco's new low sulfur fuel, which will be manufactured exclusively for Southern California at the company's Los Angeles Refinery in Carson, which hopes to ultimately make their low sulfur diesel available to all urban fleet customers, not just municipal fleets. BP Amoco currently supplies about 20 percent of the state's 220,000-barrel daily production of diesel through its distributors[11], and intends to produce and distribute its new low sulfur diesel fuel at competitive prices.

Tosco, the second largest refiner in California, has also recently indicated that it can also produce significant quantities of low sulfur diesel with a maximum sulfur content of 15 ppm to help transit agencies comply with CARB's proposed Urban Bus Rule. Tosco may be able to supply ultra low sulfur diesel as early as 2002 if needed by transit agencies to meet retrofitting requirements of CARB's proposed Urban Bus Rule.

HAZARDS

Hazardous Materials Management Planning

State law requires detailed planning to ensure that hazardous materials are properly handled, used, stored, and disposed of to prevent or mitigate injury to health or the environment in the event that such materials are accidentally released. These requirements are enforced by the California Office of Emergency Services (OES). Federal laws, such as the Emergency Planning and Community-Right-to-Know Act of 1986 (also known as Title III of the Superfund Amendments and Reauthorization Act or SARA) impose similar requirements.

[11] Recently, in various public forums, a BP Amoco representative has stated that BP Amoco's Carson Refinery has the current capacity to produce approximately a 1,000,000 gallons of low sulfur diesel per day.

Hazardous Materials Transportation

The DOT has the regulatory responsibility for the safe transportation of hazardous materials between states and to foreign countries. The DOT regulations govern all means of transportation, except for those packages shipped by mail. Hazardous materials sent by U.S. mail are covered by the U.S. Postal Service (USPS) regulations. The DOT regulations are contained in the Code of Federal Regulations, Title 49 (49 CFR); USPS regulations are in 39 CFR.

Common carriers are licensed by the CHP, pursuant to the California Vehicle Code, §32000, et seq. This section requires licensing of every motor (common) carrier who transports, for a fee, in excess of 500 pounds of hazardous materials at one time and every carrier, if not for hire, which carries more than 1,000 pounds of hazardous material of the type requiring placards. Common carriers conduct a large portion of their business in the delivery of hazardous materials.

Under RCRA, the USEPA sets standards for transporters of hazardous waste. In addition, the State of California regulates the transportation of hazardous waste originating or passing through the state; state regulations are contained in CCR, Title 13. Hazardous waste must be regularly removed from generating sites by licensed hazardous waste transporters. Transported materials must be accompanied by hazardous waste manifests.

Two state agencies have primary responsibility for enforcing federal and state regulations and responding to hazardous materials transportation emergencies: the California Highway Patrol (CHP) and the California Department of Transportation (Caltrans).

The CHP enforces hazardous materials and hazardous waste labeling and packing regulations that prevent leakage and spills of material in transit and provide detailed information to cleanup crews in the event of an accident. Vehicle and equipment inspection, shipment preparation, container identification, and shipping documentation are all part of the responsibility of the CHP. The CHP conducts regular inspections of licensed transporters to assure regulatory compliance. Caltrans has emergency chemical spill identification teams at 72 locations throughout the state.

Hazardous Material Worker Safety Requirements

The California Occupational Safety and Health Administration (Cal/OSHA) and the Federal Occupational Safety and Health Administration (Fed/OSHA) are the agencies responsible for assuring worker safety in the handling and use of chemicals in the workplace. In California, Cal/OSHA assumes primary responsibility for developing and enforcing workplace safety regulations.

Under the authority of the Occupational Safety and Health Act of 1970, Fed/OSHA has adopted numerous regulations pertaining to worker safety (contained in 29 CFR – Labor). These regulations set standards for safe workplaces and work practices, including the reporting of accidents and occupational injuries. Some OSHA regulations contain standards relating to hazardous materials handling, including workplace conditions, employee protection requirements, first aid, and fire protection, as well as material handling and storage. Because California has a federally-approved OSHA program, it is required to adopt regulations that are at least as stringent as those found in 29 CFR.

Cal/OSHA regulations concerning the use of hazardous materials in the workplace (which are detailed in CCR, Title 8) include requirements for employee safety training, availability of safety equipment, accident and illness prevention programs, hazardous substance exposure warnings, and emergency action and fire prevention plan preparation. Cal/OSHA enforces hazard communication program regulations, which contain training and information requirements, including procedures for identifying and labeling hazardous substances. The hazard communication program also requires that Material Safety Data Sheets (MSDS) be available to employees and that employee information and training programs be documented. These regulations also require preparation of emergency action plans (escape and evacuation procedures, rescue and medical duties, alarm systems, and emergency evacuation training).

Both federal and state laws include special provisions for hazard communication to employees in research laboratories, including training in chemical work practices. The training must include instruction in methods for the safe handling of hazardous materials, an explanation of MSDS, use of emergency response equipment and supplies, and an explanation of the building emergency response plan and procedures.

Chemical safety information must also be available at the workplace. More detailed training and monitoring is required for the use of carcinogens, ethylene oxide, lead, asbestos, and certain other chemicals listed in 29 CFR. Emergency equipment and supplies, such as fire extinguishers, safety showers, and eye washes, must also be kept in accessible places. Compliance with these regulations reduces the risk of accidents, worker health effects, and emissions.

The National Fire Code (NFC), Standard 45 (published by the National Fire Protection Association) contains standards for laboratories using chemicals, which are not requirements, but are generally employed by organizations in order to protect workers. These standards provide basic protection of life and property in laboratory work areas through prevention and control of fires and explosions, and also serve to protect personnel from exposure to non-fire health hazards.

While NFC Standard 45 is regarded as a nationally recognized standard, the California Fire Code (24 CCR) contains state standards for the use and storage of hazardous materials and special standards for buildings where hazardous materials are found. Some of these regulations consist of amendments to NFC Standard 45. State Fire Code regulations require emergency pre-fire plans to include training programs in first aid, the use of fire equipment, and methods of evacuation.

Hazardous Waste Handling Requirements

The passage of RCRA in 1976 created a major new federal hazardous waste regulatory program that is administered by the USEPA. Under RCRA, U.S. EPA regulates the generation, transportation, treatment, storage, and disposal of hazardous waste.

RCRA was amended in 1984 by the Hazardous and Solid Waste Act (HSWA), which affirmed and extended the concept of regulating hazardous wastes from generation through disposal. HSWA specifically prohibits the use of certain techniques for the disposal of some hazardous wastes.

Under RCRA, individual states may implement their own hazardous waste programs in lieu of RCRA as long as the state program is at least as stringent as the federal RCRA requirements. U.S. EPA approved California's program to implement federal regulations as of August 1, 1992.

The California Environmental Protection Agency Department of Toxic Substance Control (DTSC) administers the Hazardous Waste Control Law (HWCL). Under HWCL, DTSC has adopted extensive regulations governing the generation, transportation, and disposal of hazardous wastes. HWCL differs little from RCRA; both laws impose "cradle to grave" regulatory systems for handling hazardous wastes in a manner that protects human health and the environment. Regulations implementing HWCL are generally more stringent than regulations implementing RCRA.

Regulations implementing HWCL list over 780 hazardous chemicals as well as nearly 30 more common materials that may be hazardous. HWCL regulations establish criteria for identifying, packaging and labeling hazardous wastes. They prescribe management practices for hazardous wastes; establish permit requirements for hazardous waste treatment, storage, disposal and transportation; and identify hazardous wastes that cannot be disposed of in landfills.

Under both RCRA and HWCL, hazardous waste manifests must be retained by the generator for a minimum of three years. Hazardous waste manifests list a description of the waste, its intended destination and regulatory information about the waste. A copy of each manifest must be filed with DTSC. The generator must match copies of hazardous waste manifests with certification notices from the treatment, disposal, or recycling facility.

Emergency Response to Hazardous Materials and Wastes Incidents

Pursuant to the Emergency Services Act, the State has developed an Emergency Response Plan to coordinate emergency services provided by federal, state, and local government agencies and private persons. Response to hazardous materials incidents is one part of this plan. The Plan is administered by OES, which coordinates the responses of other agencies including U.S. EPA, CHP, Department of Fish and Game, Regional Water Quality Control Board (RWQCB), and local fire departments (California Government Code §8550).

In addition, pursuant to the Hazardous Materials Release Response Plans and Inventory Law of 1985 (the Business Plan Law), local agencies are required to develop "area plans" for response to releases of hazardous materials and wastes. These emergency response plans depend to a large extent on the business plans submitted by persons who handle hazardous materials. An area plan must include pre-emergency planning of procedures for emergency response, notification and coordination of affected government agencies and responsible parties, training, and follow-up.

Hazardous Materials Incidents

The California Hazardous Materials Incident Reporting System (CHMIRS) is a post-incident reporting system to collect data on incidents involving the accidental release of hazardous materials. During 1998, the counties of Orange, Riverside, San Bernardino and Los Angeles reported a total of 1,726 hazardous material releases, while the statewide total was 5,811 (Table 3-25). The breakdown is as follows: 940 releases in Los Angeles County, 222 releases in Orange County, 306 releases in Riverside County, and 258 in San Bernardino County.

TABLE 3-25

Reported Hazardous Materials Incidents – 1998 (All Materials)

Location	Reported Incidents	% of Reported Four-County Incidents
Los Angeles	940	54
Orange	222	13
Riverside	306	18
San Bernardino	258	15
Total	**1,726**	**100**
California Total	5,811	

Source: Office of Emergency Services

Alternative Clean-Fuels

The proposed fleet vehicle rules require the phased conversion of fleet vehicles from current utilization of petroleum products such as gasoline and diesel to cleaner burning fuels (e.g., methanol, CNG, LNG, LPG, electric power, etc.). Conversion to these clean fuels or electric power reduces air pollution but introduces operational changes with different hazards than those associated with gasoline or diesel. Table 3-26 provides a brief comparison of the various chemical characteristics of gasoline, diesel, and clean fuels.

TABLE 3-26

Fuel Characteristics Comparison[a]

Characteristic	Gasoline[a]	Diesel	Methanol	Ethanol	CNG	LNG	LPG
Net Or Lower Heating Value[b]	113,000 BTU / Gallon (liquid)[c]	130,800 BTU / Gallon (liquid)[c]	57,000 BTU / Gallon (liquid) 65,500 BTU / Gal. M85[c] (liquid)	75,000 BTU / Gallon (liquid) 81,870[d] BTU / Gal. E85[c] (liquid)	92,800 BTU / Gallon (liquid)[c]	72,900 BTU / Gallon (liquid)[c]	83,000 BTU / Gallon (liquid)[c]
Ratio[e]	1.00[c]	0.73[c]	2.00 1.68[c]	1.48[d] 1.31[c]	1.28[c]	1.55[c]	1.36[c]
Toxic To Skin	Moderate	Moderate	Moderate To High	Slight	No	No	No
Toxic To Lungs	Moderate	Moderate	Moderate	Slight	No	No	No
Specific Gravity[f]	3.4	>4.0	1.11	1.59	0.55 (Lighter)	0.55 (Lighter)	1.52
Auto-Ignition Temperature[g], °F	500	500	793	867	1200	1200	920
Lower Flammability Limit[h], %	1.0	0.5	5.5	3.3	5.3	5.3	2.0
Upper Flammability Limit[h], %	7.6	4.1	44.0	19.0	15.0	15.0	9.5
Luminous Flame	Yes	Yes	No	Faint	Yes	Yes	Yes
Source / Feedstock	Petroleum	Petroleum	Natural Gas, Other Hydro-Carbons	Grain, Biomass	Natural Gas	Natural Gas	Petroleum, Natural Gas

Source: *Natural Gas Vehicle Quick Reference Fuel Guide*, http://www.naturalfuels.com/quick_ref_fuel_guide.htm

[a] Unleaded Regular Gasoline ($C_8H_{15\text{-}18}$)

[b] Energy Available For Power. Lower heating value: Gross heating value (total heat obtained from combustion of fuel) minus the latent heat of vaporization of the water vapor formed by the combustion of the hydrogen in the fuel.

[c] See CEC's 1999 Fuels Report (July 1999), Table 4-1

[d] See *A General Introduction to Alternative Fuel Vehicles*, http://www.energy.ca.gov/afvs/vehicles.htm .

[e] Gallons required for same mileage as gasoline.

[f] Lighter or heavier than air (air=1.00).

[g] Temperature required for spontaneous ignition.

[h] Limits of flammability, % volume in air.

The following subsections taken predominately from CEC's *Resource Guide: Infrastructure for Alternative Fuel Vehicles* (June 1995) contain a brief synopsis of the existing hazards associated with alternative clean-fueled vehicles. The Hazards section in Chapter 4 discusses in detail the hazards impacts associated with the use of clean fuels or electric power due to the implementation or the proposed fleet vehicle rules and related amendments.

Methanol and Ethanol

Fueling Characteristics & Options

Fueling with methanol is comparable to fueling with gasoline and takes about the same amount of time. The nozzle for fueling with methanol is identical to the gasoline nozzle. To prevent misfueling, special "lock- out" procedures are programmed into the electronic point-of-sale methanol dispensers

Building, Fire & Electrical Codes

Existing building and fire codes have included specific regulations governing the storage, handling and dispensing of flammable liquids, including fuels. Alcohol fuels (methanol and ethanol) are covered by these regulations and the governing codes do not appear to be a barrier to developing a fueling infrastructure.

Some limited revisions to standard engineering and construction practices at fueling stations are required to accommodate characteristics such as the high solvency and corrosion potential of methanol and (to a lesser degree) ethanol fuels. The methanol industry and the original equipment manufacturers are the most likely parties for obtaining revisions to engineering and materials standards.

Methanol and ethanol storage tanks are subject to somewhat different regulatory treatment than gasoline tanks. The regulations do require that methanol be stored underground in double walled tanks, whereas gasoline storage is allowed in single walled tanks equipped with leak detection equipment and other safety features.

For ethanol, above ground storage tanks need to be identified with a placard showing the contents as "CDA-20, Fuel Grade Ethanol-Poison." Fill lids of underground storage tanks should be identified with color coding such as yellow, white with black diagonal lines or yellow with a black cross in order to prevent misfueling of bulk storage tanks. Fill lids for methanol underground storage tanks should be blue color coded and have a standard methanol logo to prevent misfueling. All product lines should be dedicated to ethanol and identified by the proper color coding.

According to the National Fire Protection Association (NFPA), the electrical specifications for methanol and ethanol are the same as those for gasoline. American National Standards Institute (ANSI)/NFPA 30: Flammable and Combustible Liquids Code and ANSI/NFPA 30A: Automotive and Marine Service Station Code cover this issue. Gasoline, methanol and ethanol fueling facilities are required to have explosion-proof electrical dispensing equipment.

Health and Safety Considerations

The same precautions used with gasoline must be taken when using M85. Like gasoline, M85 should not be ingested as it can be fatal, and persons should not attempt to siphon methanol from a tank. If M85 is splashed on the skin, it should be washed off immediately. Clothes should be changed and laundered as soon as possible if M85 is spilled on them. Drivers should avoid breathing the fumes or getting methanol on the skin.

Although methanol has been safely used on a commercial basis for many years, regulators and consumers should be aware of the potential health impacts from acute exposure to methanol. The symptoms from acute exposure may occur in three stages:

- Headache, giddiness, nausea, gastric pain, coldness or muscle weakness
- A period of 10 to 15 hours when no symptoms are felt
- Visual and central nervous system effects such as failing eyesight, nausea, dizziness, headache and respiratory distress

It should be noted that pure methanol does not accumulate in the body with repeated low exposures and is not carcinogenic.

Methanol, like gasoline, is more flammable than diesel fuel. For that reason, all ignition sources must be kept away from methanol fuel. Ethanol is a flammable liquid that should be handled with the same safety precautions as gasoline and methanol.

Putting an alcohol-gasoline mix in a conventional storage tank can cause the tank to leak. Alcohol fuels should be stored in methanol compatible tanks to protect fuel quality and prevent tank leakage.

Emergency Response Training for Local Officials

Training of safety personnel on the appropriate procedures to use in fighting methanol fires and responding to fuel spills is important for public safety, as it is for all fuels. Alcohol-resistant foams are needed to quickly and effectively control large alcohol fires. Properly trained safety personnel will be able to effectively use the well-known techniques and materials for fire suppression and clean-up, including the use of alcohol-resistant foams and dispersal and dilution techniques. Also essential is training on distinguishing an alcohol-fueled fire.

The low daytime flame luminosity for pure fuel methanol (M100 or 100 percent methanol) has prompted concerns about injuries from an "invisible" flame. This issue has been successfully resolved by the use of M85.

The following methods may be used to extinguish methanol fires. They are presented in their order of preference. Extinguishers are appropriate for small fires. Larger fires require notification of the fire department.

- **Dry powder extinguishers –** ABC-rated dry chemical extinguishers have been found to be the most effective against methanol fires.

- **Halon extinguishers –** Halon fire extinguishers are also effective against methanol fires. Although not as effective as the ABC-rated dry-chemical extinguishers, halon has the advantage of not leaving a residue. It should be noted that halon is destructive to the upper ozone layer.

- **CO2 (carbon dioxide) extinguishers –** CO2 extinguishers may be used on methanol fires. However, because CO2 extinguishers have a limited range, they are less effective and more difficult to use.

- **ARF foam extinguishers –** For larger fires, alcohol resistant foam is appropriate. Methanol will destroy non- ARF foam

- **Water –** Since methanol and water will mix, methanol can be extinguished with water. However, methanol will still burn with mixtures of up to 5 parts water per 1 part methanol. Nearby materials, equipment, and containers can be cooled with streams of water. If water is used, a water-fog-type nozzle is required. Straight streams of water will tend to spread the flames.

Spilled methanol will form flammable vapors. Like gasoline vapors, methanol vapors may travel to an ignition source or may accumulate in low spots. Methanol spills should be cleaned up using authorized spill control procedures.

Unlike methanol, ethanol burns with a luminous flame. With respect to flammability, ethanol is somewhat less flammable than methanol, but it can be explosive in a tank vapor space. It has a slightly lower ignition temperature than does methanol.

CNG/LNG

Fueling Characteristics & Options

Natural gas fueling facilities generally consist of one or more gas compressors, compressed gas storage tanks, and gas dispensing equipment. Natural gas can be dispensed by either "fast-fill" or "slow-fill" systems at both public and private access stations. Fast-fill systems can fuel a vehicle in about the same time as a conventional liquid-fuel dispenser. These systems compress and store the gas until needed.

Slow-fill or time-fill systems compress the natural gas and dispense it directly into NGVs, eliminating the need for storage vessels. These systems require six to eight hours to fuel an

NGV and are commonly used by fleets with vehicles that return to a central location and park overnight. The number of vehicles that can be fueled from a time- fill station depends on the size of the compressor, the gas storage capacity of the vehicles, and the desired fill time. NGVs can also be fueled at residential sites with small compressor appliances. The appliance fills the vehicle with gas at a rate that is about the equivalent of one gallon of gasoline per hour.

Two common alternatives for distributing natural gas to fleets are mobile fueling trucks and tube trailers. Mobile fueling trucks fill directly from the pipeline using an on-board compressor dispensing the gas either directly into vehicles or into stationary storage vessels for subsequent time- or fast-fill into vehicles. Tube trailers are filled with CNG at a natural gas fueling station and then driven to other locations for dispensing fuel. Tube trailers can also fast-fill vehicles using a small compressor to increase gas pressure.

Building, Fire and Electrical Codes

The design, construction and operating approval process for installing a natural gas fueling facility varies from city to city. Local code enforcers base their approval decisions on their local codes, which are modeled after state and national codes. Codes of interest for natural gas stations include fire, electrical and plumbing codes as well as Cal/OSHA's "Unfired Pressure Vessel Article".

Fire marshals use the State Fire Code or their local fire codes in reviewing fueling facilities. Such codes are based on the Uniform Fire Code (UFC). The UFC obtains input from NFPA regarding the establishment of various fire codes. In particular to NGVs, the NFPA has established NFPA 52: Compressed Natural Gas Vehicular Fuel Systems, which is the American National Standards Institute (ANSI) approved standard that applies to the design and installation of CNG engine fuel systems on all vehicles and the installation and operation of their fueling systems. Additional standards related to natural gas fueling include:

- ANSI/NGV1: CNG Fueling Connection Devices
- 2-90: American Gas Association Requirements (AGA) for Fuel System Components for NGVs
- 3-91: AGA Requirements for Natural Gas Compressors for Use in CNG Dispensing Stations
- 2-92: AGA Requirements for CNG Dispensing Equipment for Vehicles
- 1-93: AGA Requirements for Hoses for NGVs and Fuel Dispensers
- 2-93: AGA Requirements of Manually Operated Valves for High-Pressure Natural Gas

- 3-93: AGA Requirements of Gas Operated Valves for High-Pressure Natural Gas
- 4-93: AGA Requirements for Priority and Sequencing Equipment for NGV Fueling
- 9-93: American Gas Association Requirements for Breakaway Devices for CNG Vehicle Fuel Dispensers and Fueling Hoses
- 8-5-92: AGA's NGV Dispensing Station Inspection Report (Draft #2)

Health and Safety Considerations

Natural gas is non-toxic. It can, however, cause asphyxiation if enough oxygen is displaced. Natural gas is lighter than air. Because of this, if natural gas were to be released or accidentally leaked, it would rapidly disperse. In addition to this, before the gas can actually ignite, it would have to mix with 6 to 16 percent air, which is unlikely. Odorants used in CNG allow its detection before the lower flammability limit has been reached.

Since many fleet operators fuel indoors, some concerns have been raised because natural gas can build up in enclosed areas. Appropriately designed safety features, such as ceiling-level ventilation systems actuated by methane detectors, can prevent natural gas buildup.

The quality of a natural gas fuel system installation is an important safety issue. Reputable system installers now appear to be moving toward standardization and documentation of installations. The installer should provide a documentation package for a given installation that shows component placement and fuel-line routing. Particular attention should be paid to the high-pressure regulator; it should be mounted in a protected position, preferably on the firewall.

Emergency Response Training for Local Officials

Emergency response issues for natural gas comes under the broader category of flammable compressed gases. NGVs require labeling so that emergency personnel are aware of the existence of CNG on-board vehicles.

LPG

Fueling Characteristics & Options

LPG vehicle fueling stations can be operated directly by LPG supply companies, while many more are operated by traditional gasoline station owners. Most propane users have received training from a propane supplier to self-fuel their vehicles with the procedure generally controlled via a cardlock system. Propane dispensing is as fast as gasoline dispensing because the fuel is handled in a liquid state. Typical pumping time for a vehicle with a 60-gallon tank is three to five minutes. Propane refueling equipment looks similar to other liquid fuel systems and is fully compatible with cardlock fueling systems.

Most refueling systems employ 500 to 1,000 gallon storage tanks, but storage of up to 30,000 gallons is not uncommon. LPG is typically stored in above-ground tanks, but the industry is beginning to use underground tanks. Choice of storage capacity is influenced by local zoning ordinances and codes, with smaller capacity tanks being used in more congested commercial areas and larger tanks being used in less congested industrial sites.

Building, Fire & Electrical Codes

Standards for LPG installations were first introduced in the 1930s. Since that time, standards and codes covering such facilities have been refined to increase safety and to reflect advances in the technology. The American Society for Testing and Materials, the NFPA, and the California Department of Transportation standards require tanks designed for transportation use be equipped with stop-fill devices and over-pressure relief valves. Fueling systems are not required to have a fire protection system, but a fire extinguisher must be located within 10 feet, and an emergency shut-off switch within a zone of 25 to 75 feet from the dispenser.

NFPA publishes a model code known as Pamphlet #58. It is the basis of standards for the Uniform Fire Code and is updated on a three-year cycle. Recent legislation adopted by the State of California has caused Cal/OSHA to accept the use of NFPA 58, and it is developing minor additions to that code in preparation for its use. In addition, NFPA 58 has won the endorsement of the California Public Utilities Commission Pipeline Safety Office, the CHP, and the State Fire Marshal's Office.

NFPA 58 is the most complete code of its kind detailing all facets and safety requirements for the installation of propane systems for refueling and installation of equipment on vehicles.

Health & Safety Considerations

LPG is a non-toxic gas. High LPG concentrations reduce oxygen levels that may cause asphyxiation, with early symptoms of dizziness. No harmful long-term effects have been reported from exposure to propane vapors. An odorant added to LPG generally enables its detection at concentrations that are below the lower flammability limit and substantially below the concentrations needed for asphyxiation.

LPG is not a cryogen and liquid temperatures of the fuel at tank pressure remain at ambient levels. However, the rapid evaporation of the fuel at atmospheric pressures can, if spilled, cause damage to skin. To avoid direct propane contact to the skin, it is recommended that gloves be used during the refueling process.

Propane has a narrow range of flammability compared to the other transportation fuels. The fuel will only burn within a fuel-to-air ration between 2.2 percent and 9.6 percent. Propane will rapidly dissipate beyond its flammability range in the open atmosphere. It is important that garages housing gaseous fueled vehicles be properly ventilated. LPG fuel leaks can pose a significant explosion hazard relative to gasoline in enclosed garages. All forms of combustion within these enclosed spaces should be eliminated.

Emergency Response Training for Local Officials

Propane dispensing systems and vehicles powered by the fuel are subject to various labeling requirements of NFPA 704 so that emergency response teams may know what product they are dealing with. Dispensing systems are required to be marked with the four-color National Fire Rating System label and are enforced by the local fire agency. The Black Diamond identification label on the back lower right corner of all propane powered vehicles is enforced by the California Highway Patrol. Information regarding labeling requirements can be obtained from the State Fire Marshal, the CHP, the Pressure Vessel Unit of Cal/OSHA, and/or local fire agencies.

Electricity

Charging Characteristics & Options

EVs are expected to be recharged primarily at private home base locations, such as residential or company garages. The availability of public charging facilities for full or partial recharges away from the home base-referred to as “opportunity charging”-will help build consumer confidence and increase the use of EVs. Likely locations for opportunity charging include parking facilities at shopping centers, the workplace, park-and-ride lots, and airports. Fleet or commercial users may also need access to public charging facilities away from their home base.

The National Electric Vehicle Infrastructure Working Council (IWC) worked to standardize energy levels for EV charging. Three levels of charging have been agreed upon:

- **Level 1**: Charging that can be done from a standard, grounded 120-volt, 3- pronged outlet available at all homes
- **Level 2**: Charging at home or public stations functioning at 240-volt/40-amp service with special consumer features to make it easy and convenient to plug in and charge EVs at home or at an EV charging station on a daily basis
- **Level 3**: A high-powered charging technology currently under development that will provide a charge in 5 to 10 minutes, making it analogous to filling the tank of an internal combustion engine at a local gasoline station

Of the three charging levels established, Level 2, a 240-volt/40-amp circuit, is expected to be the consumers’ preference at both private and public facilities. Operating at a rate up to five times faster than Level 1, Level 2 will meet the typical driver’s daily needs in three to five hours of charging – at home, work or public charging facilities. Level 3 is not expected to become the preferred recharging system due to concerns that it may occur during the peak hours for electricity use. Charging during peak hours will be discouraged through pricing mechanisms.

The EV industry is developing two different kinds of systems to charge vehicles. One system, conductive charging, uses standard plug technology. The other, inductive charging, allows AC power to pass magnetically from the power source to the vehicle.

Building, Fire & Electrical Codes

EV charging facilities must meet existing electrical, fire and building codes. As a result, in 1995, The California Energy Commission formed the Building Codes Working Group (BCWG) with CARB, the California Building Officials, the California Electric Transportation Coalition, California utilities, General Motors, and Hughes Power Systems. The BCWG was formed to address issues associated with installation of EV chargers, especially related to building codes, electrical codes and training of permitting and inspection personnel.

The BCWG developed revisions to the California Building Standards to allow for safe installation of electric vehicle charging systems. The Building Code changes, effective in 1996, did the following:

- defined EV charging equipment;
- added safety requirements;
- clarified the definition of refueling and
- added ventilation requirements.

The BCWG developed an informational brochure for building officials, contractors and consumers. The brochure Building Standards for Electric Vehicle Charging Systems; California code of Regulations Title 24 (January 1998) provides information about permitting and inspection requirements, cites appropriate building and electric codes, and gives phone numbers for agencies that can provide further information.

Following adoption of new California code revisions, a training program was developed for building officials, which covered the following:

- The new Building Code and Electric Code provisions governing EVs;
- Plan check and inspection techniques for the new regulation;
- An overview of current and emerging EV technologies including automotive, batteries and charging equipment;
- An opportunity to see and drive current production vehicles; and

- Hands-on experience with charging system equipment.

In an effort to provide a national standard for building code requirements related to EV charging systems, the BCWG focused much of its efforts in 1997 on preparing modifications to the National Electric Code. Changes suggested by the BCWG were forwarded to the National Infrastructure Working Council for approval and submittal to the National Electric Code governing organization. Additionally, through this national effort, EV charging and supply equipment have been designed with safety as the primary concern. Using advanced technology to overcome safety concerns, industry has developed safe EV supply equipment that is durable and convenient to use. Safety requirements have been incorporated into various standards including equipment standards with the Society of Automotive Engineers (SAE) and Underwriters Laboratory, and safety standards with NFPA, the National Electric Codes (NEC), and California Building Codes.

The NEC and California Building Codes require four main safety devices and constructional features to address shock hazards and battery offgassing concerns. The codes require only approved or listed equipment be used for charging electric vehicles.

The 1996 NEC was a proactive attempt to develop codes for equipment that was new, not readily available, nor widely disseminated yet. After evaluating consumer preferences, building department practical experience permitting installations, and changes or enhancements in EV supply equipment design, the 1999 NEC clarifies areas of the original code to make the process easier and more understandable for building officials, installers and consumers.

Health & Safety Considerations

The EV industry is addressing a number of safety issues to ensure consumer safety. As with conventional vehicles, EVs should have full Federal Motor Vehicle Safety Standards certification (or meet all of the safety standards of conventional vehicles). Batteries will usually be enclosed and away from the passenger compartment of the vehicle to address concerns about the possible presence of flammable, toxic, or corrosive materials. There is also a chance of acid leakage with flooded lead-acid batteries. Acid damage can be avoided by periodically checking batteries for leakage. Original equipment manufactured EVs are expected to use advanced lead-acid batteries or newer batteries such as nickel metal hydride. Advanced lead-acid batteries use a paste or gel rather than a liquid acid, and are sealed, further making them less likely to spill.

Hydrogen, a non-toxic but explosive gas, is emitted from some types of batteries during charging. Since hydrogen is lighter than air, it will dissipate rapidly if charging takes place outside or in well-ventilated garages. EV building codes will ensure adequate ventilation.

Emergency Response Training for Local Officials

Ford, General Motors, and Chrysler have jointly developed a video to inform fire rescue personnel of the safety precautions to be aware of when dealing with an EV. To the extent that small manufacturers develop vehicles, they will also need to keep fire officials informed regarding the attributes of their vehicles.

The CEC is working with the California State Fire Marshal, the utility companies, and other state agencies to develop a training program for emergency response personnel. The program will institutionalize training for firefighters and other emergency personnel on procedures for safely handling an EV in an emergency situation.