



## 4.0 CLIMATE AND AIR QUALITY

### 4.1 CLIMATE

The climate of Paradise may be characterized as an inland Mediterranean climatic type. This climate has warm to hot summers and mild to cool winters with a distinctive winter precipitation regime. The long, dry summer period is somewhat unique to the Mediterranean climate yet is a feature shared commonly with most of California. The winter period is characterized by the passage of mid-latitude storms moving westward from the North Pacific Ocean and bringing moist, unstable air masses into interior Northern California. The actual number of storm centers of low pressure is quite different from year to year and is the primary determinant of precipitation variability from one year to another.

Since these storm systems are basically passing along the North American Polar Front under the influence of a strong westerly wind movement, their passage during winter is a time of considerable air mass interaction. Cold, dry air may flow southward across Northeastern California both during and immediately after the passage of the storm centers. Additionally, a strong southerly flow brings moist, unstable maritime air into the Paradise region from the Pacific Ocean by way of the San Francisco Bay and the Sacramento River Valley. This unstable air brings periods of overcast conditions accompanied by drizzly weather and cooler temperatures which can last for several days. North-south fluctuations in the mid-latitude and subtropical jet streams have been noted to have some effect upon the trajectories of these storm systems as they pass across Northern California.

Precipitation from these storms increases from west to east, with lower totals in the Sacramento Valley and Western Sierran foothills, to much higher totals at higher elevations on the western side of the summit. Reflective of this pattern, most stations such as Chico and Oroville receive between twenty-five/thirty inches of precipitation annually; stations such as Paradise, Forest Ranch, and Grass Valley receive between forty-five/fifty inches; and upland stations such as DeSabra, Brush Creek, and Strawberry Valley receive between sixty/seventy inches per year. Table 4-1 shows the annual precipitation totals for Paradise at an elevation of 1,750 feet above sea level, and for DeSabra at an elevation of 2,563 feet. The average monthly precipitation varies greatly in Paradise (Table 4-2).

According to the Paradise *Multihazard Disaster Plan*, Paradise can experience a major storm at any time during the rain and snow season. The Town of Paradise has been hard hit by major storms in the past. When snowfall occurs in combination with warmer temperatures, a heavy, wet snow is produced which creates the potential for damage to buildings and other snow related hazards. A major snowstorm in 1990 produced significant damage to both public and private property, as well as citizen casualties and injuries.



In general the winter months are cool, overcast and periodically dominated by moist maritime air masses whose passage across Northern California as storm systems becomes increasingly more unstable. Freezes can occur within Paradise at any time between late October and late April; however, prolonged periods of freezing temperatures are rare. Absolute minimum temperatures of 10.8 F. and 9.0 F. have been recorded during January for Paradise and DeSabra respectively. Snowfall frequently occurs during mid to late winter in Paradise. It usually does not remain on the ground long, often melting within thirty-six hours. The periods of snowfall, snow depth, and low winter temperatures are all climatological features which change rapidly within short distances of Paradise as one moves up or down in elevation.

During the winter months the Cascade-Sierra area is dominated by higher pressure as a consequence of the chilling effect of altitude coupled with a snowpack covering the surface. Cooler air tends to settle into basins and valley bottoms where radiational cooling during the relatively calm, clear winter nights can lead to low temperatures. On other occasions, radiational cooling can lead to the formation of thick fog which tends to blanket the Sierran foothills. The lower winter temperatures are also primarily responsible for the low evaporation rates during November-April, when about twenty-five percent of the annual evaporation of 53.6 inches is spread over half of the year.

The summer months are usually quite dry with less than four percent of the annual precipitation arriving in the five month period of May-September. By mid-summer, the Sacramento Valley is usually occupied by an elongated thermal high pressure ridge due to intense heating of the land surface. The retreat northward of the Polar Front is accompanied by the domination of Northern California by the North Pacific high pressure system. Warm, dry, subsiding air masses then dominate the Paradise region bringing low relative humidities and absolute maximum temperatures such as 115 F. at Oroville, 104 F. at DeSabra, and 110 F. at Paradise. The period of mid-June to late September is coincidentally the peak season of fire hazard in terms of optimal "fire weather" conditions: strong northwesterly winds; low relative humidities; low soil moisture; dry brush, grass and timber; high air temperatures; and suitable ignition conditions and temperature. The summer drought is not alleviated by the sporadic summer convectional thunderstorms which bring sporadic and unreliable amounts of warm season moisture and the danger of lightning-set wildfires to the Paradise region.

The rainfall pattern in Paradise can be characterized as one of seasonal drought. This seasonal drought can be extended to a longer term cyclical drought during periods of lower than average annual precipitation. The long term record shows that wide departures from the mean are uncharacteristic for Paradise. However, a high of ninety-six inches was recorded in 1983 and a low of 18.5 inches was recorded for 1976.

**TABLE 4-1**  
**ANNUAL PRECIPITATION TOTALS**  
**FOR PARADISE AND DE SABLA, 1958-1989**

YEAR	PARADISE <sup>1</sup>	DE SABLA <sup>2</sup>
1958	56.10	80.37
1959	30.73	45.45
1960	51.54	71.66
1961	40.37	52.82
1962	61.14	76.36
1963	48.91	61.99
1964	47.82	69.36
1965	44.63	60.02
1966	45.00	52.22
1967	51.76	66.81
1968	52.59	64.42
1969	76.43	86.26
1970	71.43	90.01
1971	27.61	41.02
1972	41.01	52.29
1973	82.84	106.82
1974	59.11	67.01
1975	50.84	63.31
1976	18.47	22.66
1977	35.09	43.95
1978	63.78	82.53
1979	62.81	75.07
1980	52.54	64.30

YEAR	PARADISE <sup>1</sup>	DE SABLA
1981	71.05	88.39
1982	64.72	78.02
1983	96.14	121.24
1984	39.70	44.56
1985	31.77	37.33
1986	58.98	70.59
1987	58.68	59.94
1988	44.94	46.17
1989	40.12	48.09
<b>AVERAGE ANNUAL PRECIPITATION</b>	52.46	65.34

Source: California Climatological Data, Monthly Summaries, 1958-1989, U. S. Department of Commerce, National Oceanic and Atmospheric Administration.

<sup>1</sup> Paradise Station elevation 1,750 feet above mean sea level

<sup>2</sup> DeSabra Station elevation 2,710 feet above mean sea level

**TABLE 4-2**  
**CLIMATOLOGICAL DATA SUMMARY**  
**PARADISE, CALIFORNIA**

<b>MONTH</b>	<b>AVERAGE TEMPERATURE (FAHRENHEIT)</b>	<b>AVERAGE PRECIPITATION (INCHES)</b>	<b>AVERAGE EVAPORATION (INCHES)</b>
January	43.7	9.3	0.7
February	46.6	15.7	0.8
March	49.7	13.3	3.4
April	52.8	4.8	4.4
May	63.2	0.3	7.0
June	71.9	0.2	8.1
July	75.0	0.3	10.2
August	76.4	0.0	9.1
September	74.9	0.0	5.4
October	65.3	2.7	3.4
November	51.0	2.5	1.1
December	44.0	7.2	0.0
<b>ANNUAL AVERAGE</b>	59.5	56.3	53.6

Source: California Climatological Data, U. S. Department of Commerce, National Oceanic and Atmospheric Administration. As cited in Montgomery, "Water Quality Management Plan for Paradise and Magalia," March 1979.



## 4.2 AIR QUALITY

Paradise lies within the Sacramento Valley Air Basin, which extends from Sacramento and Solano Counties on the south to Shasta County on the north (Figure 4-1). The air basin is generally situated in the northern portion of the Central Valley and is bounded on the west by the Coastal Range, on the north and east by the Cascade-Sierra Nevada and Siskiyou foothills and mountains, and on the south by the San Joaquin Valley Air Basin.

The primary factors affecting air quality in a given area are the quality, type and location of pollutant emissions, the topographic and geographic features of the region, and the prevailing meteorological conditions. An emission rate represents the amount of pollutant released into the atmosphere by a given source over a specified time period. It is generally expressed in units, such as pounds per hour (lb/hr) or tons per year (ton/yr). Local and regional meteorological conditions govern the transport and diffusion of emissions in the atmosphere. Wind speed, wind direction, atmospheric stability, temperature, and the presence or absence of inversions are some of the key factors which affect pollutant dispersion.

The northern Sacramento Valley Air Basin is a natural closed basin, often with poor air circulation and high atmospheric stability. The area is subject to frequent temperature inversions (a layer of cold air capped with a warm air mass), preventing dispersion of pollutants.

The nearest air quality monitoring stations in Butte County are in Chico [carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), nitrogen dioxide (NO<sub>2</sub>), ozone and particulate matter smaller than ten microns in diameter (PM<sub>10</sub>)]. The Butte County Air Pollution Control District designates the Paradise area as a nonattainment area for ozone and as an attainment area for NO<sub>2</sub>, sulfur oxides, lead and sulfates. All other categories are unclassified at this time. The Paradise area has few major stationary sources of air pollutants.

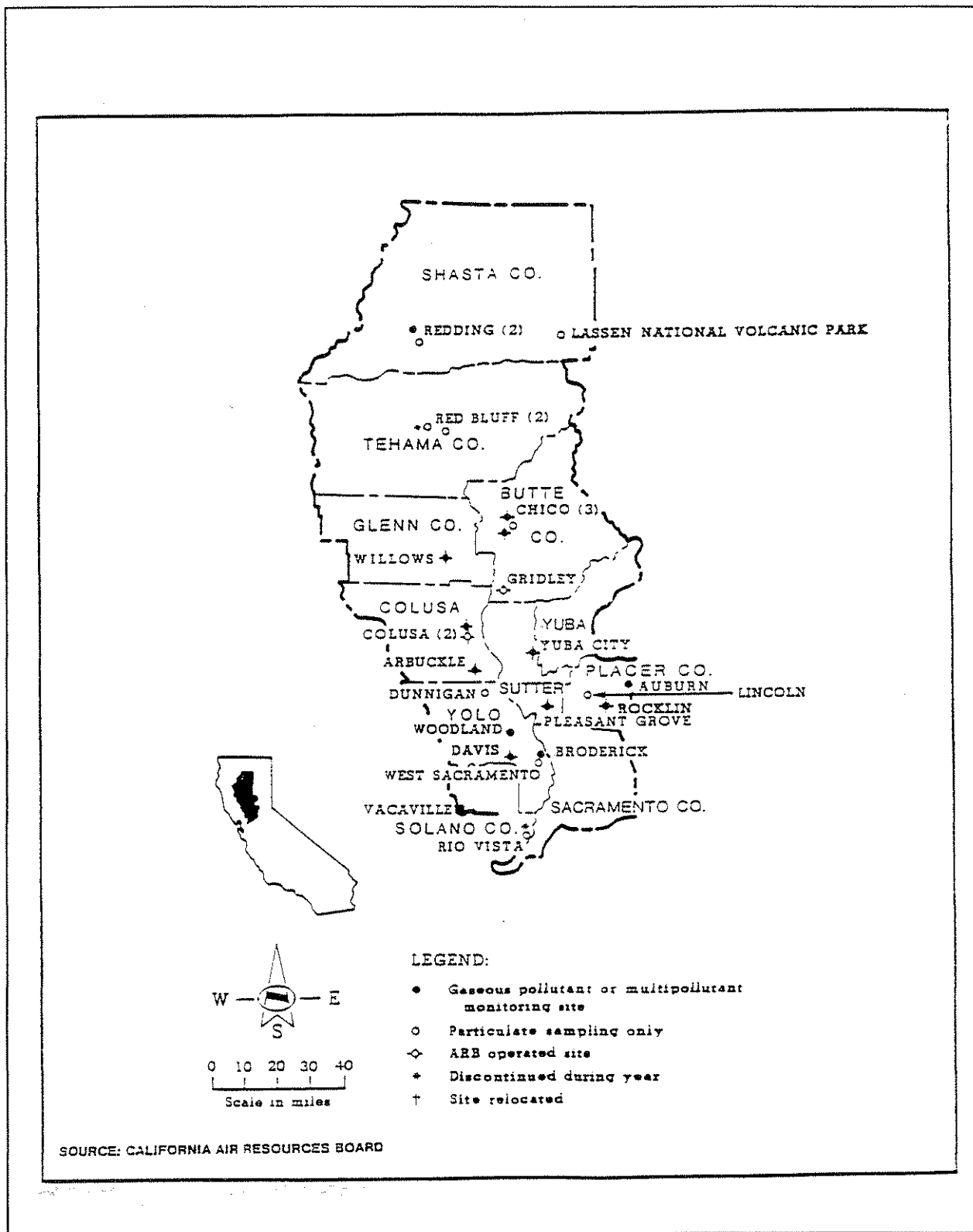
Relative to other nonattainment areas of California, emissions inventories for Butte County show low to moderate emissions of total organic gases and nitrogen dioxide. The burning of agricultural wastes and application of pesticides and herbicides on the valley floor result in hydrocarbon emissions. Agricultural activity is also a significant source of suspended particulates. Vehicular traffic emissions are the major source of CO and the primary constituent of ozone. Motor vehicles comprise the major emission source category generated within the community.

A summary of data from the BCAPCD monitoring stations from 1980 through 1989 pertaining to local pollutant monitoring and the relationship of measured pollutants in the local environment to California and the national ambient air quality standards is contained in Tables 4-3 through 4-6. However, this data should not necessarily be interpreted as having direct applicability to the Paradise area, as Paradise is above the valley floor in the foothills.

The California Clean Air Act (AB 2595, 1988) requires that each air pollution control district that is nonattainment for state ambient air quality standards for ozone or carbon monoxide prepare and submit an



attainment plan. Each plan must include a wide range of control measures which, for most areas, include transportation control measures (programs or measures with the objective of reducing vehicle trip generation and vehicle miles traveled), designed to reduce overall emissions by a net five percent per year from 1987 levels. Butte County is coordinating with other northern Sacramento Valley counties in this planning effort. Refer to Section 16.4 for a more complete discussion of this plan.



**SACRAMENTO VALLEY AIR BASIN**

**FIGURE 4-1**



**TABLE 4-3**  
**MAXIMUM HOURLY CONCENTRATIONS FOR OZONE <sup>1</sup>**  
**(ppm<sup>2</sup>)**

MONTH	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
January	.03	.04	.06	.05	.05	.04	NA <sup>6</sup>	.05	.06	.07	.04
February	.04	.04	.05	.04	.06	.05	.06	.06	.06	.07	.06
March	.07	.05	.04	.04	.06	.05	.07	.07	.08	.05	.08
April	.06	.08	.09	.07	.05	.07	.08	.09	.07	.10 <sup>3</sup>	.08
May	.07	.07	.08	.07	.09	.07	.09	.08	.09	.07	.08
June	.09	.10 <sup>3</sup>	.08	.07	.07	.10 <sup>3</sup>	.08	.11 <sup>3</sup>	.09	.08	.08
July	.10 <sup>3</sup>	.09	.08	.08	.08	.10 <sup>3</sup>	.11 <sup>3</sup>	.09	.10 <sup>3</sup>	.10 <sup>3</sup>	NA
August	.09	.07	.09	.08	.08	.09	.09	.10 <sup>3</sup>	.10 <sup>3</sup>	.09	NA
September	.10 <sup>3</sup>	.08	.08	.07	.08	.08	.09	.10 <sup>3</sup>	.09	.09	NA
October	.11 <sup>3</sup>	.08	.08	.08	.07	.09	.10 <sup>3</sup>	.09	.10 <sup>3</sup>	.10 <sup>3</sup>	NA
November	.06	.04	.03	.04	.05	.07	.07	.05	.06	.06	NA
December	.07	.05	.06	.04	.05	.05	.04	.04	.06	.06	NA

**STANDARDS**

California .10  
 1<sup>o</sup> National<sup>4</sup> .12  
 2<sup>o</sup> National<sup>5</sup> .12

**Footnotes:**

- <sup>1</sup> Manzanita Street, Chico, Monitoring Station
- <sup>2</sup> Parts per million
- <sup>3</sup> Denotes a violation of the California Ambient Air Quality Standard
- <sup>4</sup> National Primary Standards are the ambient Standard levels of pollutants necessary to protect the public health.
- <sup>5</sup> National Secondary Standards are the ambient levels pollutants necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
- <sup>6</sup> Data not available

Source: Summary of Air Quality Monitoring, Butte County 1980-1989, Butte County APCD; California Air Resources Board, California Air Quality Data, April 1989 - June 1990.

**TABLE 4-4**  
**MAXIMUM HOURLY CONCENTRATIONS FOR**  
**CARBON MONOXIDE<sup>1</sup>**  
**(ppm<sup>7</sup>)**

MONTH	1980 <sup>2</sup>	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
January	16	12	12	10	15	15	11	11	12	12	10
February	9	8	9	11	10	15	12	12	6	6	9
March	6	7	4	NA	5	5	7	6	6	6	6
April	5	4	5	5	5	6	5	6	6	5	4
May	3	5	6	4	5	5	4	4	4	5	5
June	3	4	4	3	3	4	NA	3	3	4	3
July	3	4	4	5	4	5	NA	5	5	4	NA
August	4	6	7	5	7	5	NA	8	8	5	NA
September	7	7	8	9	8	5	12	9	9	7	NA
October	NA <sup>3</sup>	10	10	11	10	9	12	15	15	12	NA
November	NA	15	11	8	12	15	11	9	9	15	NA
December	NA	17	10	14	15	20 <sup>6</sup>	9	17	17	12	NA

**STANDARDS**

California 20  
1° National<sup>4</sup> 35  
2° National<sup>5</sup> 35

**Footnotes:**

- <sup>1</sup> Salem Street, Chico, Monitoring station (except 1980)
- <sup>2</sup> California State University, Chico Monitoring Station
- <sup>3</sup> Data not available
- <sup>4</sup> National Primary Standards are the ambient Standard levels of pollutants necessary to protect the public health.
- <sup>5</sup> National Secondary Standards are the ambient levels of pollutants necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
- <sup>6</sup> Denotes a violation of the California Ambient Air Quality Standard
- <sup>7</sup> Parts per million

Source: Ibid

**TABLE 4-5**  
**TWENTY-FOUR HOUR MAXIMUM CONCENTRATIONS FOR**  
**PM-10<sup>1</sup>**  
**(ug/m<sup>3</sup>)<sup>2</sup>**

MONTH	1985	1986	1987	1988	1989 <sup>5</sup>	1990 <sup>6</sup>
January	NA <sup>7</sup>	71 <sup>3</sup>	88 <sup>3</sup>	69 <sup>3</sup>	82 <sup>3</sup>	68 <sup>3</sup>
February	NA	23	43	73 <sup>3</sup>	46	49
March	NA	32	54 <sup>3</sup>	28	19	33
April	NA	26	56 <sup>3</sup>	25	36	46
May	NA	28	47	26	25	40
June	NA	48	49	46	54 <sup>3</sup>	28
July	NA	34	48	40	35	NA
August	NA	47	69 <sup>3</sup>	46	35	NA
September	NA	68 <sup>3</sup>	74 <sup>3</sup>	58 <sup>3</sup>	53 <sup>3</sup>	NA
October	35	79 <sup>3</sup>	60 <sup>3</sup>	58 <sup>3</sup>	53 <sup>3</sup>	NA
November	77 <sup>3</sup>	80 <sup>3</sup>	68 <sup>3</sup>	37	81 <sup>3</sup>	NA
December	76 <sup>3</sup>	68 <sup>3</sup>	29	100 <sup>3</sup>	90 <sup>3</sup>	NA

**STANDARDS**

California        50  
 1<sup>o</sup> National<sup>4</sup>    150  
 2<sup>o</sup> National<sup>5</sup>    150

**Footnotes:**

- <sup>1</sup> California State University, Chico, monitoring station except November 1989-June 1990.
- <sup>2</sup> Micrograms per cubic meter
- <sup>3</sup> Denotes a violation of the California Ambient Air Quality Standard.
- <sup>4</sup> National Primary Standards are the ambient Standard levels of pollutants necessary to protect the public health.
- <sup>5</sup> National Secondary Standards are the ambient levels of pollutants necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
- <sup>6</sup> Chico - Salem Street monitoring station, November 1989 - June 1990.
- <sup>7</sup> Data not available.

Source: Ibid

**TABLE 4-6**  
**MAXIMUM HOURLY CONCENTRATIONS FOR**  
**NITROGEN DIOXIDE<sup>1</sup>**  
 (ppm<sup>2</sup>)

MONTH	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
January	NA <sup>3</sup>	.06	.06	.04	.06	.06	.05	.23	.05	.06	.05
February	.06	.05	.06	.04	.06	.06	.05	.07	.06	.06	.05
March	.05	.05	.05	.04	.07	.04	.05	.06	.05	.05	.05
April	.05	.05	.05	.05	.04	.05	.05	.04	.05	.04	.05
May	.06	NA	.07	.04	.05	.05	.06	.05	.05	.04	.05
June	.05	NA	.05	.05	.08	.04	.05	.05	.04	.04	.04
July	.05	.05	.05	.06	.05	.04	.05	.05	.06	.05	NA
August	.05	.04	.06	.05	.05	.05	.08	.07	.06	.06	NA
September	.07	.05	.08	.11	.07	.04	.05	.08	.07	.08	NA
October	NA	.06	.06	.07	.05	.08	.07	.09	.10	.07	NA
November	.07	.06	.04	.05	.05	.07	.08	.06	.05	.07	NA
December	.10	.05	NA	.04	.16	.07	.08	.07	.06	.07	NA

**STANDARDS**

California .25  
 1<sup>st</sup> National<sup>4</sup> NA  
 2<sup>nd</sup> National<sup>5</sup> NA

**Footnotes:**

- <sup>1</sup> Manzanita Street, Chico, Monitoring Station
- <sup>2</sup> Parts per million
- <sup>3</sup> Denotes a violation of the California Ambient Air Quality Standard.
- <sup>4</sup> National Primary Standards are the ambient Standard levels of pollutants necessary to protect the public health.
- <sup>5</sup> National Secondary Standards are the ambient levels of pollutants necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
- <sup>6</sup> Data not available.

Source: Ibid