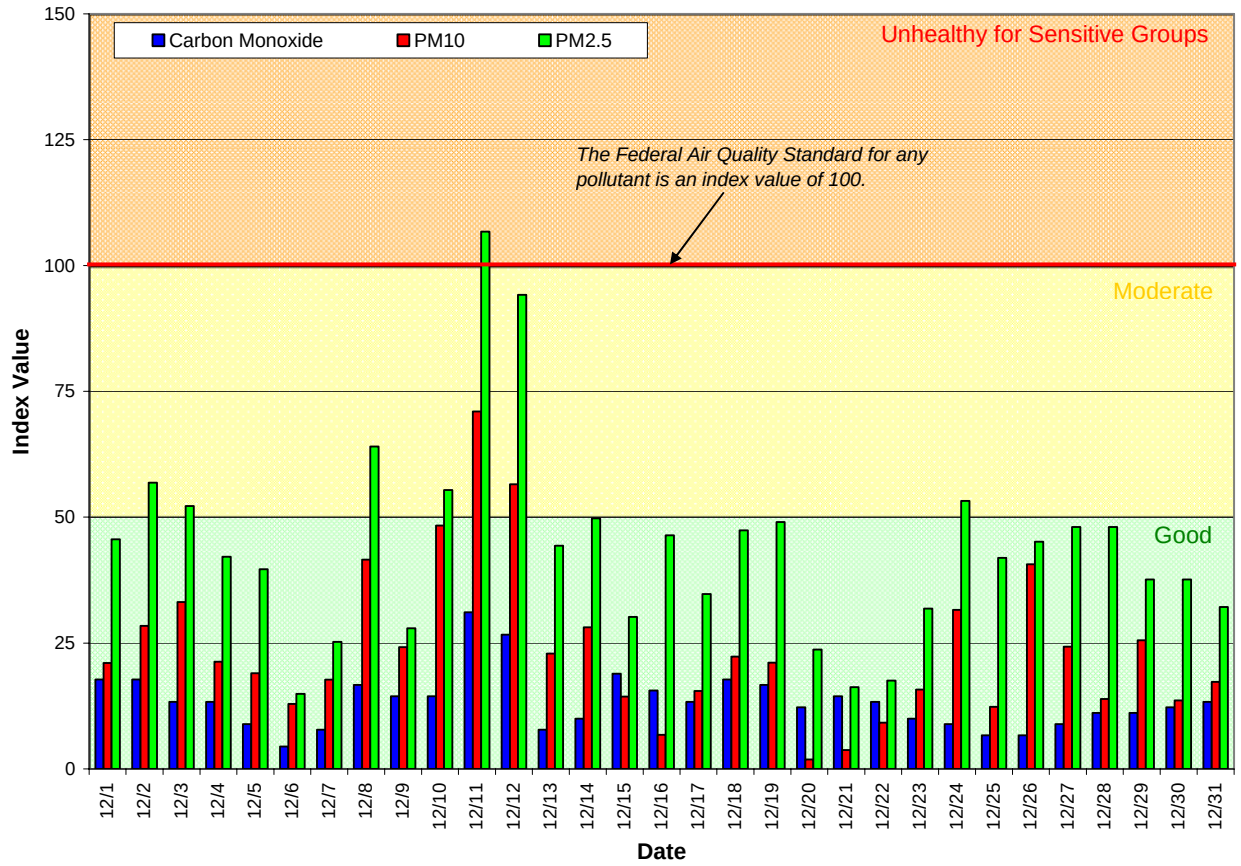
Spokane Regional Clean Air Agency
Air Quality Report - December 2009

Spokane County had mostly good air quality in December, as determined by the Air Quality Index (AQI), but December 10th through 12th was a notable exception (Figure 1). The atmosphere was stagnant during that period under a high pressure ridge and light westerly to west-northwesterly winds (see also Figure 3).

The AQI is EPA's color-coded tool for communicating daily air quality to the general public and can be calculated for any of the "criteria" air pollutants regulated under the National Ambient Air Quality Standards (NAAQS), except lead. The criteria aie pollutants include carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), ozone (O_3) and sulfur dioxide (SO_2). Of these, CO, PM_{10}, $PM_{2.5}$ and O_3 are monitored in Spokane County. Ozone is monitored May through September only. The AQI categorizes air quality as "good," "moderate," "unhealthy for sensitive groups," "unhealthy," "very unhealthy" or "hazardous," depending on air pollution levels. See appendices 1 and 2 for descriptions of the NAAQS and AQI, respectively.

Figure 1: Air Quality Index (AQI) values for December 2009



The data used for calculating the AQIs are obtained using automated air pollution monitoring methods that provide "real time" data, which the SRCAA uses in its day-to-day programs, e.g., air quality forecasting and burning curtailment. For measurement of particulate matter concentrations, the SRCAA operates a network of automated particulate matter monitors consisting of Tapered Element Oscillating Microbalances (TEOM) and nephelometers. The Washington State Department of Ecology (Ecology) operates a carbon monoxide monitor near the intersection of 3rd & Washington in downtown Spokane. Daily air quality data for all pollutants and all monitoring stations within Spokane County are provided in tabular form in Appendix 3.

Tables 1 and 2 contain the maximum AQI values for each pollutant for the month and for the year to date. Table 3 summarizes the year to date daily AQIs by category and compares them to last year's AQIs. The 24 hour average $PM_{2.5}$ concentration measured on December 11 using the TEOM at Broadway Elementary School in Spokane Valley was 39.5 $\mu g/m^3$ (AQI=107; unhealthy for sensitive groups), a level exceeding the allowable limit set forth under the NAAQS. However, the monitor is not an EPA-approved federal reference method (FRM) or federal equivalent method (FEM) and it is not quality assured by the Department of Ecology, both of which would be required before it could be used for determining compliance with the NAAQS. The $PM_{2.5}$ concentration at the Spokane Augusta Ave monitoring station, where the $PM_{2.5}$ FRM is located, did not reach levels exceeding the NAAQS on December 11 using the TEOM or on December 12 when the FRM was operating on the EPA-determined monitoring schedule.

Table 1: Maximum AQI values and pollutant concentrations for this reporting period

Pollutant	AQI/Concentration	Location	Date
CO	31/2.8 ppm	3rd & Washington	12/11/09
PM_{10}	30/32 $\mu g/m^3$	Turnbull Wildlife Refuge	12/11/09
$PM_{2.5}$	107/39.5 $\mu g/m^3$	Broadway Ave	12/11/09

Table 2: Maximum AQI values and pollutant concentrations this year to date

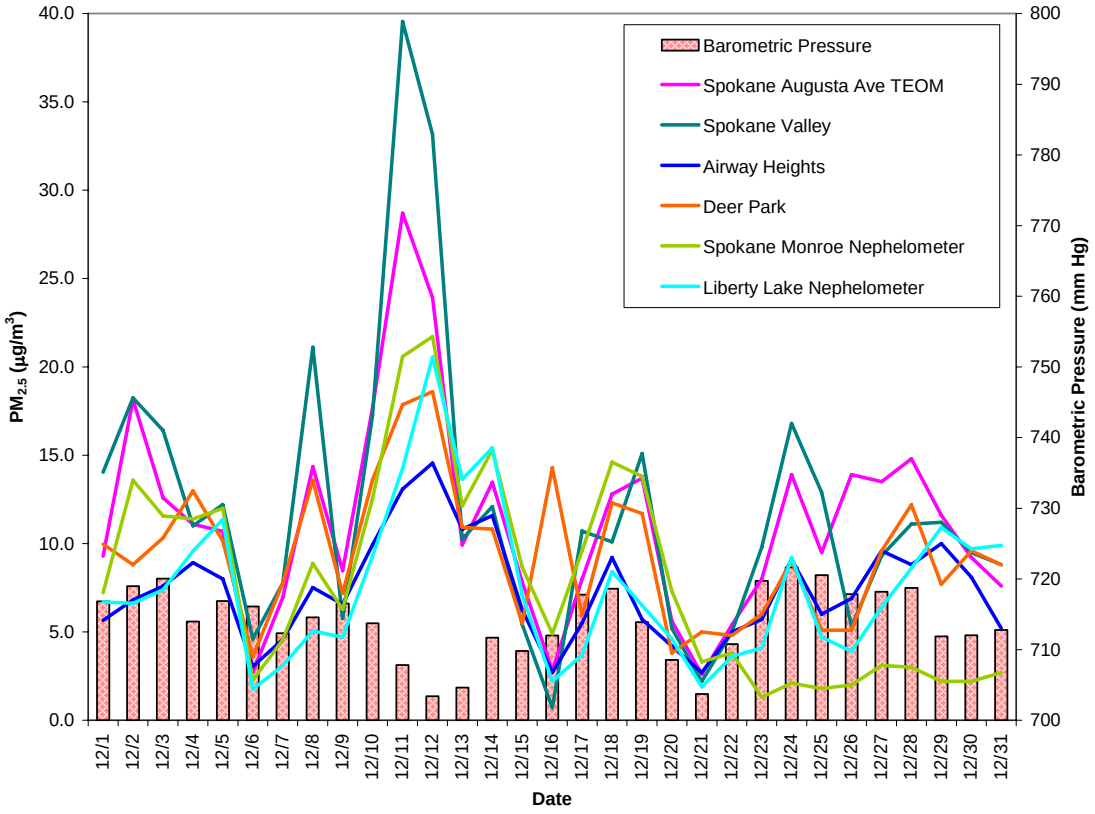
Pollutant	AQI/Concentration	Location	Date
CO	33/3 ppm	3rd & Washington	4/1/09
PM_{10}	68/90 $\mu g/m^3$	Turnbull Wildlife Refuge	9/3/09
$PM_{2.5}$	113/43 $\mu g/m^3$	Airway Heights	7/4/09
O_3	78/0.068 ppm	Greenbluff	7/22/09

Table 3: AQI summary as of December 31, 2009

Category	Number of Days This Year	Last Year to Date
Good (0-50)	324	309
Moderate (51-100)	39	56
Unhealthy for Sensitive Groups (101-150)	2	1
Unhealthy (151-200)	0	0
Very Unhealthy (201-300)	0	0
Hazardous (>300)	0	0

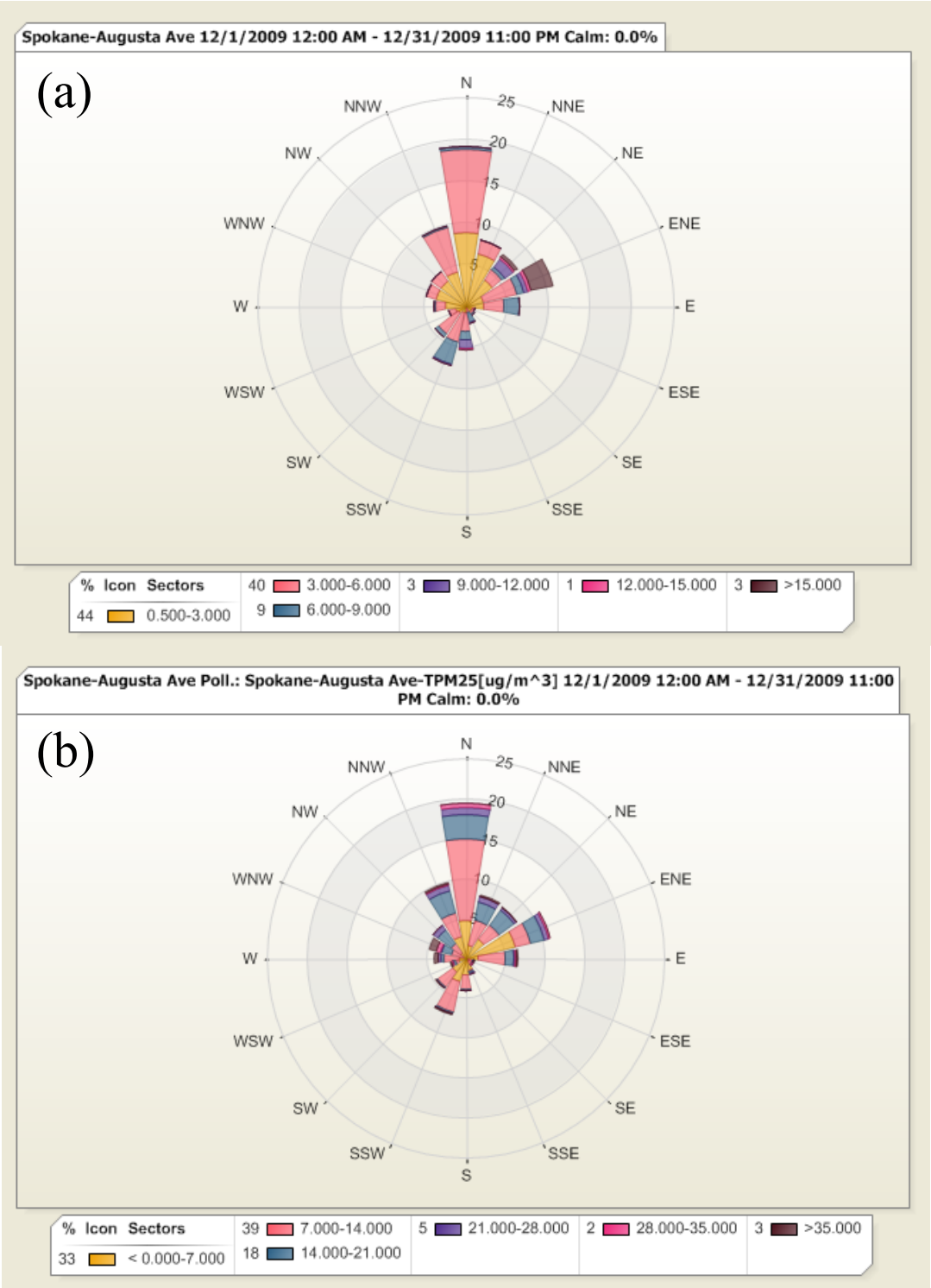
Figure 2 shows the 24 hour average $PM_{2.5}$ mass concentrations across the monitoring network as they changed through the month of December. The highest $PM_{2.5}$ concentrations were measured at the monitoring station at Broadway Elementary School in Spokane Valley, followed by the station at the SRCAA office on Augusta Avenue in Spokane.

Figure 2: $PM_{2.5}$ multi-station time series for December 2009



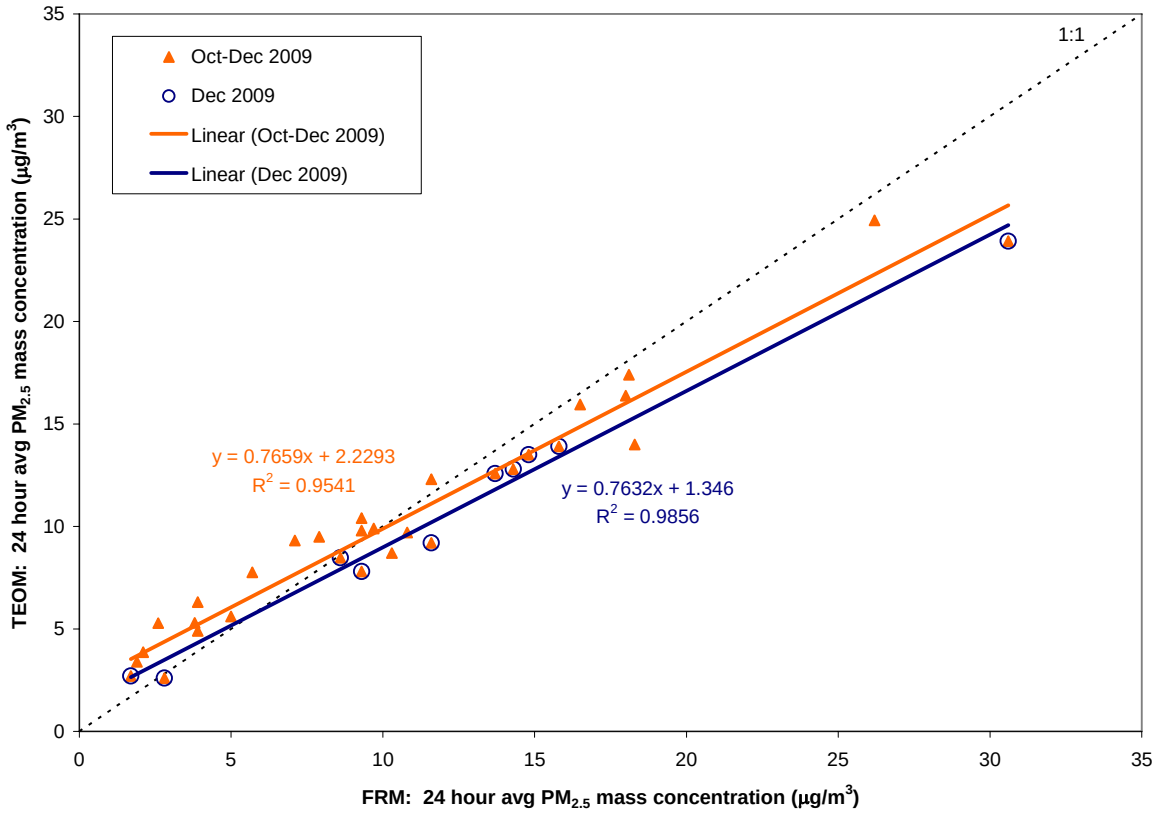
Light northerly winds were most common during December (Figure 3a) and the highest $PM_{2.5}$ comcentrations for the month occurred during a period with light winds from westerly and west-northwesterly directions (Figure 3b).

Figure 3: The wind rose (a) and $PM_{2.5}$ pollution rose (b) summarize the percentage of time during the month of December that wind speed and $PM_{2.5}$, respectively, varied with wind direction. The charts are derived from hourly-averaged data.



The Augusta monitoring station contains both automated and manual methods for monitoring $PM_{2.5}$. The manually-operated Federal Reference Method (FRM) is the "gold-standard" for measurement of the 24-hour average particulate matter concentration and meets the requirements for demonstrating attainment of federal air quality standards. The accuracy of the TEOM sample data can be verified by comparison with co-located FRM data. The correlation coefficient (R^2) for the $PM_{2.5}$ TEOM and FRM data was 0.99 for the month of December and 0.95 for the three month period ending December 31 (Figure 5). The TEOM-generated $PM_{2.5}$ data were higher than the FRM data when $PM_{2.5}$ concentrations were above about 13 µg/m^3.

Figure 5: Comparison between Augusta Ave $PM_{2.5}$ TEOM and FRM data for December 2009. The combined September, October and December data are shown in orange. Blue circles and trend line represent the data for December only.



Appendix 1 – National Ambient Air Quality Standards

The Clean Air Act requires EPA to set National Ambient Air Quality Standards (NAAQS) for six common air pollutants, carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), ground-level ozone (O_3) and sulfur dioxide (SO_2; Table A-1). These are known as "criteria" pollutants because the US EPA established regulatory limits to concentrations in ambient air using human health or environmentally based criteria. Carbon monoxide, particulate matter and ozone are monitored in Spokane County by the Spokane Regional Clean Air Agency (SRCAA) and the Washington State Department of Ecology (Ecology).

Table A-1: National Ambient Air Quality Standards

Pollutant	Primary Standards		Secondary Standards	
	Level	Averaging Time	Level	Averaging Time
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour [1]	None	
	35 ppm (40 mg/m^3)	1-hour [1]		
Lead	0.15 µg/m^3 [2]	Rolling 3-Month Average	Same as Primary	
	1.5 µg/m^3	Quarterly Average	Same as Primary	
Nitrogen Dioxide	0.053 ppm (100 µg/m^3)	Annual (Arithmetic Mean)	Same as Primary	
Particulate Matter (PM_{10})	150 µg/m^3	24-hour [3]	Same as Primary	
Particulate Matter ($PM_{2.5}$)	15.0 µg/m^3	Annual [4] (Arithmetic Mean)	Same as Primary	
	35 µg/m^3	24-hour [5]	Same as Primary	
Ozone	0.075 ppm (2008 std)	8-hour [6]	Same as Primary	
	0.08 ppm (1997 std)	8-hour [7]	Same as Primary	
	0.12 ppm	1-hour [8] (Applies only in limited areas)	Same as Primary	
Sulfur Dioxide	0.03 ppm	Annual (Arithmetic Mean)	0.5 ppm (1300 µg/m^3)	3-hour [1]
	0.14 ppm	24-hour [1]		

[1] Not to be exceeded more than once per year.

[2] Final rule signed October 15, 2008.

[3] Not to be exceeded more than once per year on average over 3 years.

[4] To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m^3.

[5] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population oriented monitor within an area must not exceed 35 µg/m^3 (effective December 17, 2006).

[6] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm. (Effective May 27, 2008)

[7] (a) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
(b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.

[8] (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is $\leq$ 1.

(b) As of June 15, 2005 EPA revoked the 1-hour ozone standard in all areas except the 8-hour ozone nonattainment Early Action Compact (EAC) Areas.

Appendix 2 – Air Quality Index

The Air Quality Index (AQI) is EPA's color-coded tool for communicating daily air quality to the public and can be calculated for any of the criteria pollutants except lead, provided monitoring data are available. An index value above 100 indicates that the concentration of a criteria pollutant exceeded the limit established in the NAAQS. Categories of the AQI are "good" (green, 0-50), "moderate" (yellow, 51-100), "unhealthy for sensitive groups" (orange, 101-150), "unhealthy" (red, 151-200), "very unhealthy" (purple, 201-300) and "hazardous" (maroon, 301-500; Table A-2).

Table A-2: Air pollutant breakpoints for the Air Quality Index.

Air Quality Index Levels of Health Concern	Color Code	Index Numerical Value	Breakpoints					Health Effects
			O_3 (ppm) 8-hour	O_3 (ppm) 1-hour[1]	$PM_{2.5}$ (µg/m^3) 24-hour	PM_{10} (µg/m^3) 24-hour	CO (ppm) 8-hour	
Good	Green	0-50	0.000-0.059	[3]	0.0-15.4	0-54	0.0-4.4	Air quality is considered satisfactory and air pollution poses little or no risk.
Moderate	Yellow	51-100	0.060-0.075	[3]	15.5-35.4	55-154	4.5-9.4	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	Orange	101-150	0.076-0.095	0.125-0.164	35.5-65.4	155-254	9.5-12.4	People especially sensitive to air pollution may experience health effects. The general public is not likely to be affected. An AQIin this category or above indicates that air pollution exceeds levels acceptable under federal air quality standards.
Unhealthy	Red	151-200	0.096-0.115	0.165-0.204	65.5-150.4	255-354	12.5-15.4	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	Purple	201-300	0.116-0.374	0.205-0.404	150.5-250.4	355-424	15.5-30.4	Health alert: everyone may experience more serious health effects.
Hazardous	Maroon	>300	[2]	0.405+	250.5+	425+	30.5+	Health warnings of emergency conditions. The entire population is more likely to be affected.

[1]Areas are generally required to report the AQI based on 8-hour ozone values. However, there are a small number of areas where an AQI based on 1-hour ozone values would be more precautionary. In these cases, in addition to calculating the 8-hour ozone index value, the 1-hour ozone index value may be calculated, and the maximum of the two values reported.

[2]8-hour O_3 values do not define higher AQI values (≥ 301). AQI values of 301 or greater are calculated with 1-hour O_3 concentrations.

[3]There is no AQI for 1-hour O_3 concentrations below the Unhealthy for Sensitive Groups level.

Appendix 3

Table A-3: Summary air quality data for December from all of the analyzers operated in Spokane County. The CO data are 8-hour maximums in parts per million (ppm) and the PM data are 24-hour averages in micrograms per cubic meter of air (μg/m^3). The Monroe & College $PM_{2.5}$ TEOM data are missing because of problems with the data telemetry system.

Date	CO 3rd & Washington (ppm)	PM10 Augusta & Fiske FRM (μg/m3)	PM2.5 Augusta & Fiske FRM (μg/m3)	PM2.5 Augusta & Fiske TEOM (μg/m3)	PM2.5 Monroe & Wellesley nephelometer (μg/m3)	PM2.5 Deer Park TEOM (μg/m3)	PM2.5 Spokane Valley TEOM (μg/m3)	PM2.5 Airway Heights TEOM (μg/m3)	PM10 Turnbull Wildlife Refuge TEOM (μg/m3)	PM10 Turnbull Wildlife Refuge FRM (μg/m3)	PM2.5 Turnbull Wildlife Refuge FRM (μg/m3)	PM10 Liberty Lake (μg/m3)	PM10-2.5 Liberty Lake (μg/m3)	PM2.5 Liberty Lake (μg/m3)	PM2.5 Liberty Lake nephelometer (μg/m3)
12/1	1.6			9.3	7.2	10.0	14.0	5.7	5						6.7
12/2	1.6			18.1	13.6	8.8	18.3	6.8	11						6.6
12/3	1.2	32	14	12.6	11.6	10.3	16.4	7.6	10	12	5.1	17.8	11.0	6.9	7.4
12/4	1.2			11.1	11.4	13.0	11.0	8.9	9						9.6
12/5	0.8			10.7	12.0	10.2	12.2	8.0	9						11.4
12/6	0.4		2	2.7	2.3	3.6	4.6	3.0	5						1.8
12/7	0.7			6.9	4.5	7.8	7.8	4.6	15						3.1
12/8	1.5			14.4	8.9	13.6	21.1	7.5	24						5.1
12/9	1.3	25	9	8.5	6.3	7.2	5.8	6.6	9	10	3.6	11.6	7.2	4.4	4.7
12/10	1.3			17.7	12.5	13.6	17.3	9.9	17						9.3
12/11	2.8			28.7	20.6	17.9	39.5	13.1	32						14.3
12/12	2.4		31	23.9	21.7	18.6	33.2	14.6	27						20.5
12/13	0.7			9.9	12.1	10.9	10.3	10.8	13						13.7
12/14	0.9			13.5	15.3	10.8	12.1	11.6	15						15.4
12/15	1.7	14	9	7.8	8.7	5.5	5.4	6.2	2	1	1.1	9.8	3.9	5.9	7.1
12/16	1.4			2.8	4.9	14.3	0.7	2.7	3						2.2
12/17	1.2			8	9.6	5.9	10.7	5.5	4						3.7
12/18	1.6		14	12.8	14.6	12.3	10.1	9.2	3						8.4
12/19	1.5			13.7	13.8	11.7	15.1	5.7	4						6.5
12/20	1.1			5.6	7.3	3.8	5.2	4.2	2						4.6
12/21	1.3	5	3	2.6	3.3	5.0	2.2	2.7	2	3	1.5	4.0	2.7	1.3	1.9
12/22	1.2			5.4	3.8	4.8	5.0	5.0	4						3.6
12/23	0.9			8	1.3	6.0	9.8	5.7	4						4.1
12/24	0.8		16	13.9	2.1	9.0	16.8	9.1	8						9.2
12/25	0.6			9.5	1.8	5.1	12.9	6.0	7						4.7
12/26	0.6			13.9	2.0	5.1	5.3	6.9	6						3.9
12/27	0.8	28	15	13.5	3.1	9.6	9.3	9.6	7	8	4.0	9.1	4.1	5.0	6.4
12/28	1.0			14.8	3.0	12.2	11.1	8.8	15						8.6
12/29	1.0			11.6	2.2	7.7	11.2	10.0	9						10.9
12/30	1.1		12	9.2	2.2	9.6	9.5	8.1	6						9.7
12/31	1.2			7.6	2.7	8.8	8.8	5.2	2						9.9
AVG	1.2	21	13	11.2	7.9	9.4	12.0	7.4	9	7	3.1	10.5	5.8	4.7	7.6
MAX	2.8	32	31	28.7	21.7	18.6	39.5	14.6	32	12	5.1	17.8	11.0	6.9	20.5