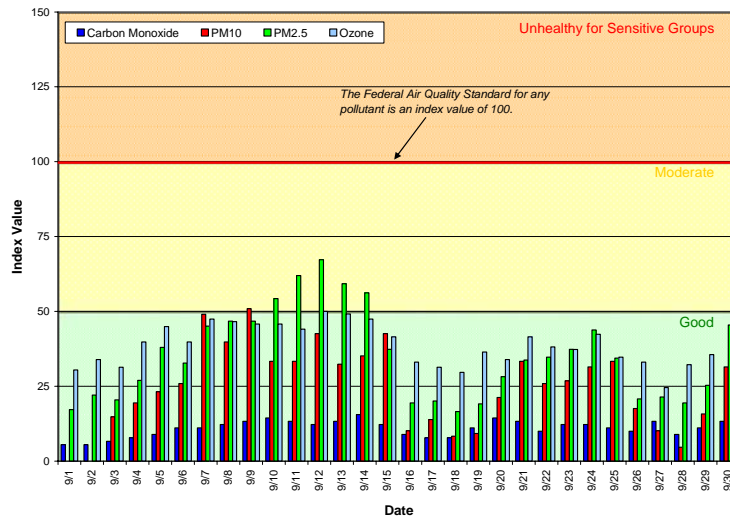


Spokane Regional Clean Air Agency Air Quality Report - September 2011

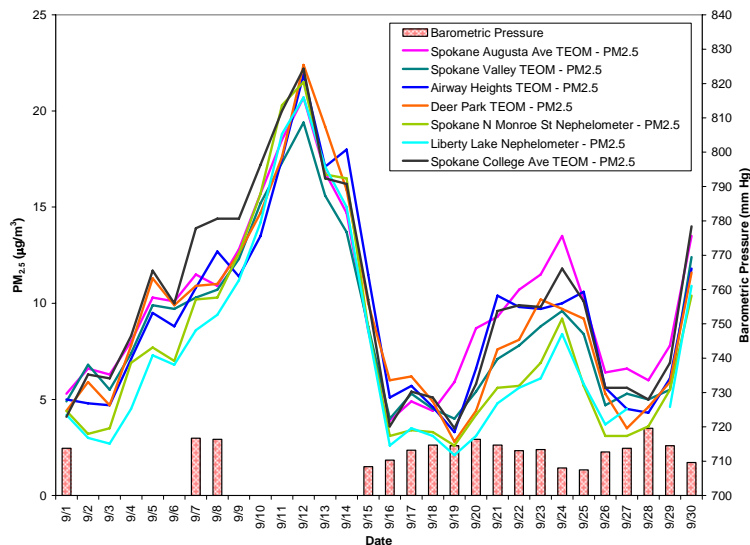
An atmospheric high pressure ridge brought exceptionally warm, sunny and dry weather, light winds and marginal to poor ventilation to the Spokane region from September 7th until the 15th. These conditions, combined with the intrusion of wildfire smoke into the area, pushed ground-level ozone (O₃) and fine particulate matter (PM_{2.5}) concentrations into the moderate or near-moderate range of the Air Quality Index (AQI; Figure 1). A cold front moved through the region on the 15th, bringing breezy conditions, improved ventilation and better air quality. Morning and mid-day vehicular traffic on gravel roads near the background particulate matter (PM₁₀) monitoring station at Turnbull National Wildlife Refuge caused sharp spikes in the data around expected commute times, resulting in artificially high PM₁₀ readings, especially on the 7th, 8th and 9th. Carbon monoxide (CO) remained in the good AQI range. See Appendix 1 of this report for information about federal air quality standards or Appendix 2 for a description of the AQI.

Figure 1: Air Quality Index (AQI) values for September 2011



The PM_{2.5} data used to determine the AQI and for other day-to-day operations are obtained using a network of automated particulate matter monitors consisting of Tapered Element Oscillating Microbalances (TEOM) and nephelometers. Daily mass concentrations of PM_{2.5} monitored in September throughout the network are shown in figure 2. The barometric pressure data are obtained at Spokane Augusta Ave using the TEOM 1405-DF, which malfunctioned the first half of the month.

Figure 2: PM_{2.5} multi-station time series for September 2011



The September daily air quality data for all monitoring stations in the Spokane region are provided in Appendix 3. Current and historical air quality data can be obtained electronically from Ecology via their air monitoring data website, <https://fortress.wa.gov/ecy/enwiwa/Default.htm>. Ecology’s site can also be accessed through the SRCAA’s webpage, http://spokanecleanair.org/air_quality.asp. Select the link, “State Wide Air Monitoring Data.” The Washington Air Quality Advisory (WAQA) on Ecology’s webpage is similar to the AQI, which the SRCAA uses, but shows higher index values (increased health effects) at lower measured air pollution concentrations than the AQI.

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.

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

Pollutant	AQI/Concentration	Location	Date
CO	16/1.4 ppm (8 hour)	Spokane, 3 rd & Washington	9/14
O ₃	50/0.059 ppm (8 hour)	Spokane, Greenbluff	9/12
PM ₁₀	51/55 µg/m ³	Cheney, Turnbull NWR	9/9
PM _{2.5}	67/22.4 µg/m ³	Deer Park, A Street	9/12

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

Pollutant	AQI/Concentration	Location	Date
CO	23/2.1 ppm (8 hour)	Spokane, 3 rd & Washington	1/12
O ₃	56/0.061 ppm (8 hour)	Spokane, Greenbluff	8/13
PM ₁₀	67/88 µg/m ³	Spokane, Augusta & Fiske	8/29
PM _{2.5}	98/34.5 µg/m ³	Spokane Valley, E. Broadway	1/1

Table 3: AQI summary as of September 30, 2011

Category	Number of Days This Year	Last Year to Date
Good (0-50)	252	249
Moderate (51-100)	21	22
Unhealthy for Sensitive Groups (101-150)	0	2
Unhealthy (151-200)	0	0
Very Unhealthy (201-300)	0	0
Hazardous (>300)	0	0

Fine particulate matter (PM_{2.5}) concentrations increased with light easterly (E) to northeasterly (NE) winds (Figures 3 and 4). Weather systems brought stronger southerly (S) to southwesterly (SW) winds and promoted better air quality.

Figure 3: The wind rose depicts the variation of hourly average wind speed (mph) with the direction from which the wind was blowing in September.

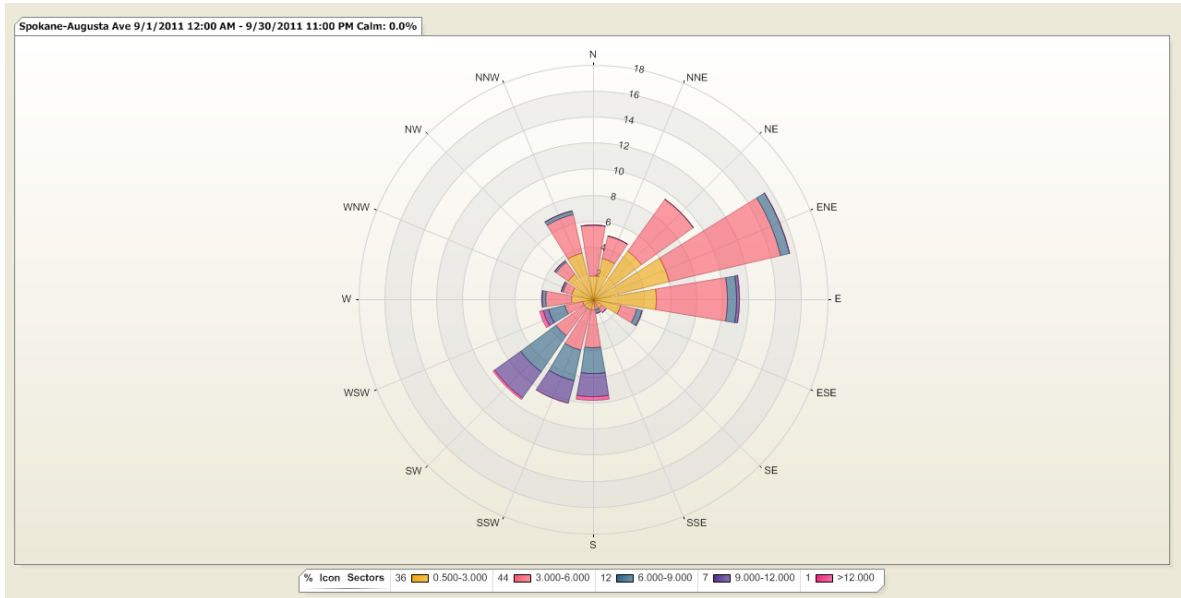
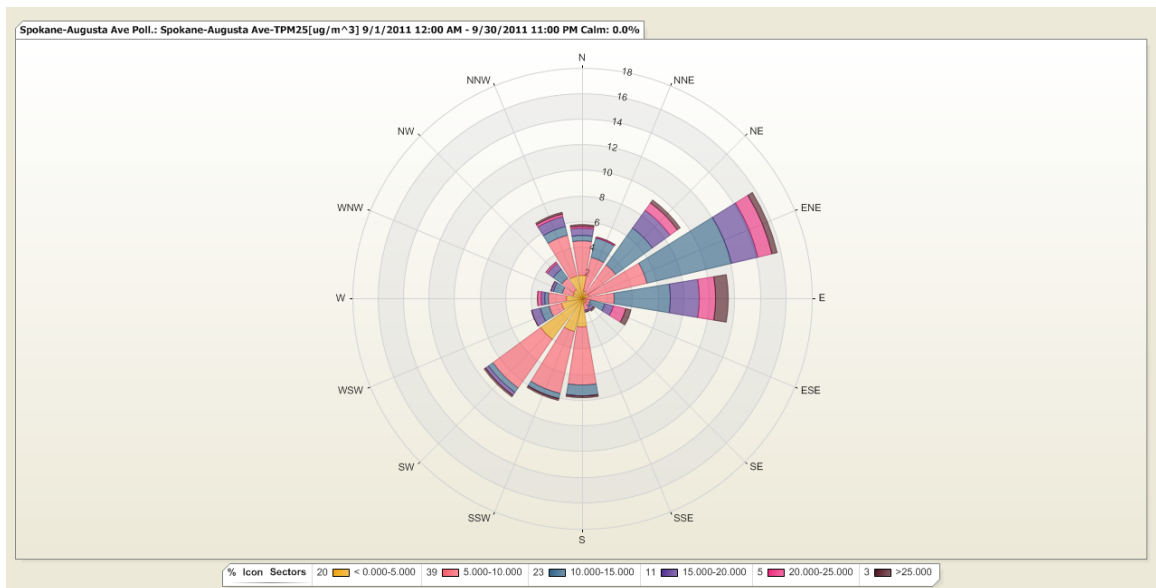


Figure 4: The PM_{2.5} pollution rose depicts the variation of hourly average PM_{2.5} (µg/m³) with the direction from which the wind was blowing in September.



Ground-level ozone (O_3), a component of smog, is formed when nitrogen oxides and volatile organic compounds chemically react in the presence of sunlight. It is measured in units of parts per million (ppm) in ambient air. Ozone is a strong oxidizer and can damage lung tissue, thereby impairing respiratory function. The main sources of ozone precursors are motor vehicle emissions and refueling, gasoline storage and transport, paints, solvents and industry. Ground-level ozone concentrations remained within the good range of the AQI throughout the month, but reached near-moderate levels under hot, sunny and stagnant conditions from September 7th until the 15th (AQI-Good: 0-50 index value or 0-0.059 ppm; Figure 5). Ozone precursor gases (nitrogen oxides and hydrocarbons) monitored at the Spokane Augusta Ave station remained low through the month (Figure 6). The variation of ozone concentrations with precursor gases and meteorological conditions on an hourly basis is shown in Figure 7.

Figure 5: Eight hour maximum ozone concentrations for the Spokane region in September. Daily maximum temperatures are also shown. Daily maximum temperature can be used as a surrogate for solar radiation (ozone is formed through a photochemical reaction) for determining potential ozone maximum concentrations. The threshold for the moderate category for the AQI for ozone is 0.06 ppm averaged over eight hours. An ozone measurement above 0.075 ppm, averaged over eight hours, is the threshold value for the federal ozone standard. It is not a violation of the standard to exceed this level on a given day because determination of attainment status is based on averaging data over a period of years. See Appendix 1 for more detailed information about attainment of federal air quality standards.

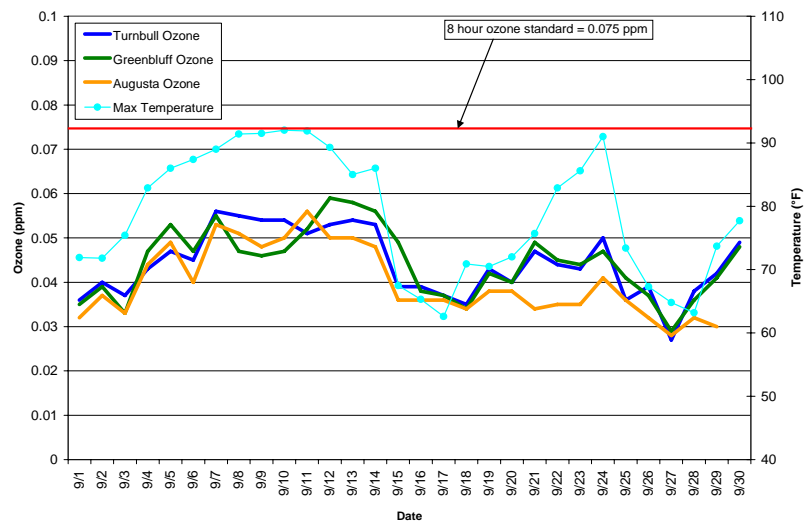


Figure 6: One hour maximum concentrations of nitrogen oxides and hydrocarbons for Spokane Augusta Ave monitoring station in September. The federal standard daily 1-hour maximum for nitrogen dioxide (NO_2) is 100 ppb. The NAAQS does not set limits on the other air pollutants shown here.

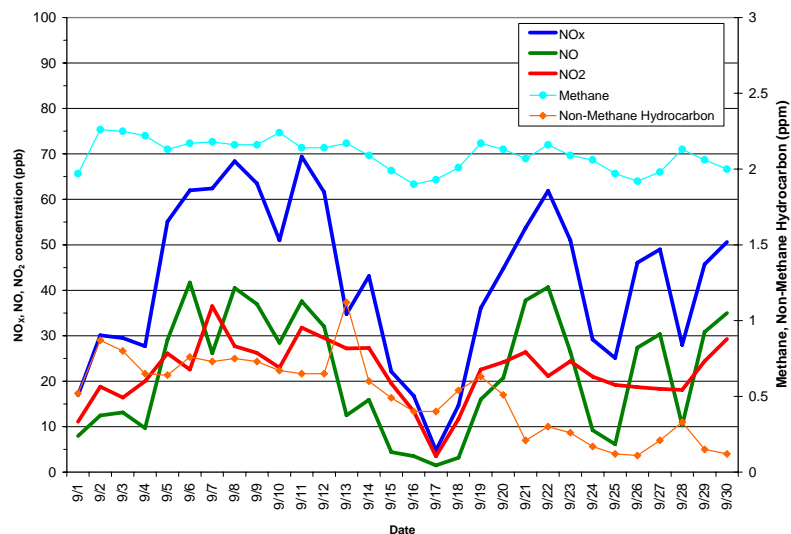
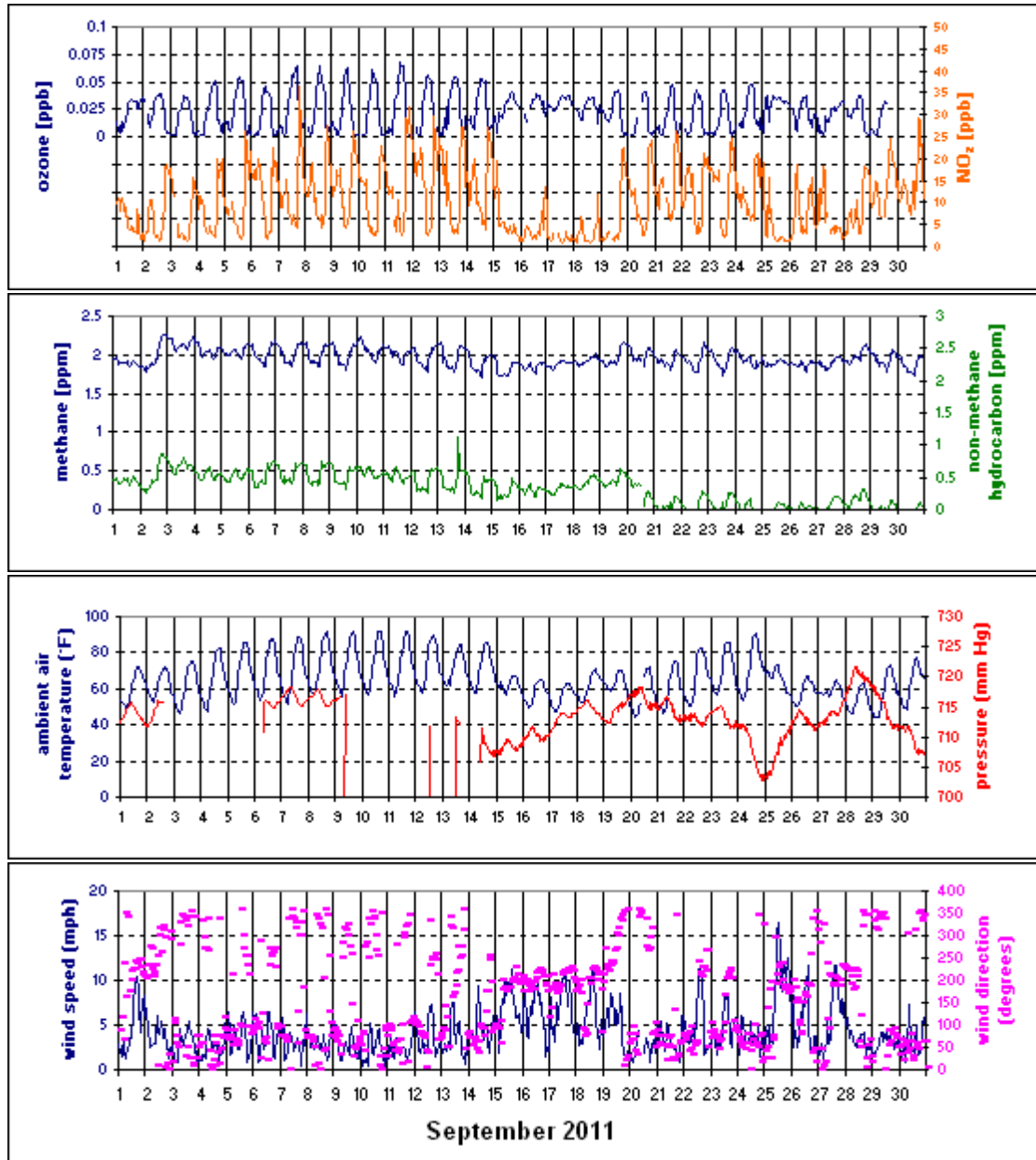


Figure 7: Variation of ground-level ozone concentration measured at the Spokane Augusta & Fiske monitoring station with nitrogen dioxide (NO₂), methane and non-methane hydrocarbons, ambient air temperature and pressure, and wind speed and direction. All data are one hour averages measured at the Spokane Augusta & Fiske monitoring station in September 2011 and separated in these charts by day of month.



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 (NO₂), particulate matter (PM₁₀ and PM_{2.5}), ground-level ozone (O₃) and sulfur dioxide (SO₂; 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	53 ppb ⁽³⁾	Annual (Arithmetic Average)	Same as Primary	
	100 ppb	1-hour ⁽⁴⁾	None	
Particulate Matter (PM₁₀)	150 µg/m ³	24-hour ⁽⁵⁾	Same as Primary	
Particulate Matter (PM_{2.5})	15.0 µg/m ³	Annual ⁽⁶⁾ (Arithmetic Average)	Same as Primary	
	35 µg/m ³	24-hour ⁽⁷⁾	Same as Primary	
Ozone	0.075 ppm (2008 std)	8-hour ⁽⁸⁾	Same as Primary	
	0.08 ppm (1997 std)	8-hour ⁽⁹⁾	Same as Primary	
	0.12 ppm	1-hour ⁽¹⁰⁾	Same as Primary	
Sulfur Dioxide	0.03 ppm	Annual (Arithmetic Average)	0.5 ppm	3-hour ⁽¹⁾
	0.14 ppm	24-hour ⁽¹⁾		
	75 ppb ⁽¹¹⁾	1-hour	None	

⁽¹⁾ Not to be exceeded more than once per year.

⁽²⁾ Final rule signed October 15, 2008.

⁽³⁾ The official level of the annual NO₂ standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard

⁽⁴⁾ To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb (effective January 22, 2010).

⁽⁵⁾ Not to be exceeded more than once per year on average over 3 years.

⁽⁶⁾ 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/m³.

⁽⁷⁾ 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/m³ (effective December 17, 2006).

⁽⁸⁾ 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)

⁽⁹⁾ (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.

(c) EPA is in the process of reconsidering these standards (set in March 2008).

⁽¹⁰⁾ (a) EPA revoked the [1-hour ozone standard](#) in all areas, although some areas have continuing obligations under that standard (“anti-backsliding”).

(b) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is ≤ 1.

⁽¹¹⁾ (a) Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.

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 AQI in 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.

¹Areas 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.

²8-hour O₃ values do not define higher AQI values (≥ 301). AQI values of 301 or greater are calculated with 1-hour O₃ concentrations.

³There is no AQI for 1-hour O₃ concentrations below the Unhealthy for Sensitive Groups level.

Appendix 3

Table A-3: Summary air quality data for September for air monitoring stations in Spokane County. The carbon monoxide and ozone 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 ($\mu\text{g}/\text{m}^3$). The TEOM 1405-DF malfunctioned during the first half of the month, resulting in missing data.

Date	CO 3rd & Washington (8 hour max, ppm)	O ₃ Greenbluff (8 hour max, ppm)	O ₃ Turnbull (8 hour max, ppm)	O ₃ Augusta & Fiske (8 hour max, ppm)	PM _{2.5} Augusta & Fiske TEOM ($\mu\text{g}/\text{m}^3$)	PM _{2.5} Augusta & Fiske TEOM 1405-DF ($\mu\text{g}/\text{m}^3$)	PM _{2.5} College Ave TEOM ($\mu\text{g}/\text{m}^3$)	PM _{2.5} Deer Park TEOM ($\mu\text{g}/\text{m}^3$)	PM _{2.5} Spokane Valley TEOM ($\mu\text{g}/\text{m}^3$)	PM _{2.5} Airway Heights TEOM ($\mu\text{g}/\text{m}^3$)	PM _{2.5} Monroe & Wellesley nephelometer ($\mu\text{g}/\text{m}^3$)	PM _{2.5} Liberty Lake nephelometer ($\mu\text{g}/\text{m}^3$)	PM _{coarse} Augusta & Fiske TEOM 1405-DF ($\mu\text{g}/\text{m}^3$)	PM ₁₀ Augusta & Fiske TEOM 1405-DF ($\mu\text{g}/\text{m}^3$)	PM ₁₀ Turnbull NWR TEOM ($\mu\text{g}/\text{m}^3$)
9/1	0.5	0.035	0.036	0.032	5.3	4.3	4.1	4.4	4.9	5.0	4.4	4.2	16	20	
9/2	0.5	0.039	0.040	0.037	6.6		6.3	5.9	6.8	4.8	3.2	3.0			14
9/3	0.6	0.033	0.037	0.033	6.3		6.1	4.7	5.5	4.7	3.5	2.7			16
9/4	0.7	0.047	0.043	0.044	8.0		8.3	7.8	7.4	7.1	6.9	4.5			21
9/5	0.8	0.053	0.047	0.049	10.3		11.7	11.3	9.9	9.5	7.7	7.3			25
9/6	1.0	0.047	0.045	0.040	10.1		10.0	9.9	9.7	8.8	7.0	6.8			28
9/7	1.0	0.055	0.056	0.053	11.5	9.1	13.9	10.9	10.3	10.8	10.2	8.6	18	27	53
9/8	1.1	0.047	0.055	0.051	10.9	8.2	14.4	11.0	10.7	12.7	10.3	9.4	16	25	43
9/9	1.2	0.046	0.054	0.048	12.8		14.4	12.6	12.3	11.4	12.6	11.2			55
9/10	1.3	0.047	0.054	0.050	15.7		17.2	14.7	15.2	13.5	15.7	14.2			36
9/11	1.2	0.052	0.051	0.056	18.5		20.0	17.6	17.3	17.5	20.3	18.8			36
9/12	1.1	0.059	0.053	0.050	20.7		22.2	22.4	19.4	21.9	21.5	20.7			46
9/13	1.2	0.058	0.054	0.050	16.8		16.5	19.2	15.6	17.1	16.7	17.1			35
9/14	1.4	0.056	0.053	0.048	14.7		16.2	15.9	13.7	18.0	16.5	15.0			38
9/15	1.1	0.049	0.039	0.036	8.6	8.1	10.2	10.0	8.8	11.5	8.7	8.6	34	42	46
9/16	0.8	0.038	0.039	0.036	3.9	3.5	3.6	6.0	4.0	5.1	3.1	2.6	12	15	11
9/17	0.7	0.037	0.037	0.036	4.9	3.2	5.4	6.2	5.3	5.7	3.4	3.5	12	15	15
9/18	0.7	0.034	0.035	0.034	4.4	3.0	5.1	4.9	4.5	4.6	3.3	3.1	6	8	9
9/19	1.0	0.042	0.043	0.038	5.9	2.8	3.5	2.8	4.0	3.3	2.6	2.1	8	10	10
9/20	1.3	0.040	0.040	0.038	8.7	5.2	5.8	4.4	5.4	6.6	4.2	3.1	12	17	23
9/21	1.2	0.049	0.047	0.034	9.3	5.7	9.6	7.6	7.1	10.4	5.6	4.8	16	22	36
9/22	0.9	0.045	0.044	0.035	10.7	6.0	9.9	8.1	7.8	9.8	5.7	5.6	22	28	28
9/23	1.1	0.044	0.043	0.035	11.5	7.5	9.8	10.2	8.8	9.7	6.9	6.1	22	29	29
9/24	1.1	0.047	0.050	0.041	13.5	8.7	11.8	9.7	9.6	10.0	9.2	8.4	15	24	34
9/25	1.0	0.041	0.036	0.036	10.2	5.4	10.1	9.2	8.4	10.6	5.7	5.8	41	46	36
9/26	0.9	0.037	0.039	0.032	6.4	3.5	5.6	5.3	4.7	5.6	3.1	3.7	13	16	19
9/27	1.2	0.029	0.027	0.028	6.6	4.5	5.6	3.5	5.3	4.5	3.1	4.5	8	12	11
9/28	0.8	0.036	0.038	0.032	6.0	4.2	5.0	4.6	5.0	4.3	3.6		6	10	5
9/29	1.0	0.041	0.042	0.030	7.8	6.0	6.9	5.9	5.5	6.1	5.5	4.6	8	14	17
9/30	1.2	0.048	0.049		13.5	10.0	14.0	11.6	12.4	11.8	10.4	10.9	18	28	34
AVG	1.0	0.044	0.044	0.040	10.0	5.7	10.1	9.3	8.8	9.4	8.0	7.6	16	22	28
MAX	1.4	0.059	0.056	0.056	20.7	10.0	22.2	22.4	19.4	21.9	21.5	20.7	41	46	55