Central Ohio Ozone Pollution: Looking Back at the 2016 Season

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for

Mid-Ohio Regional Planning Commission
Columbus, OH

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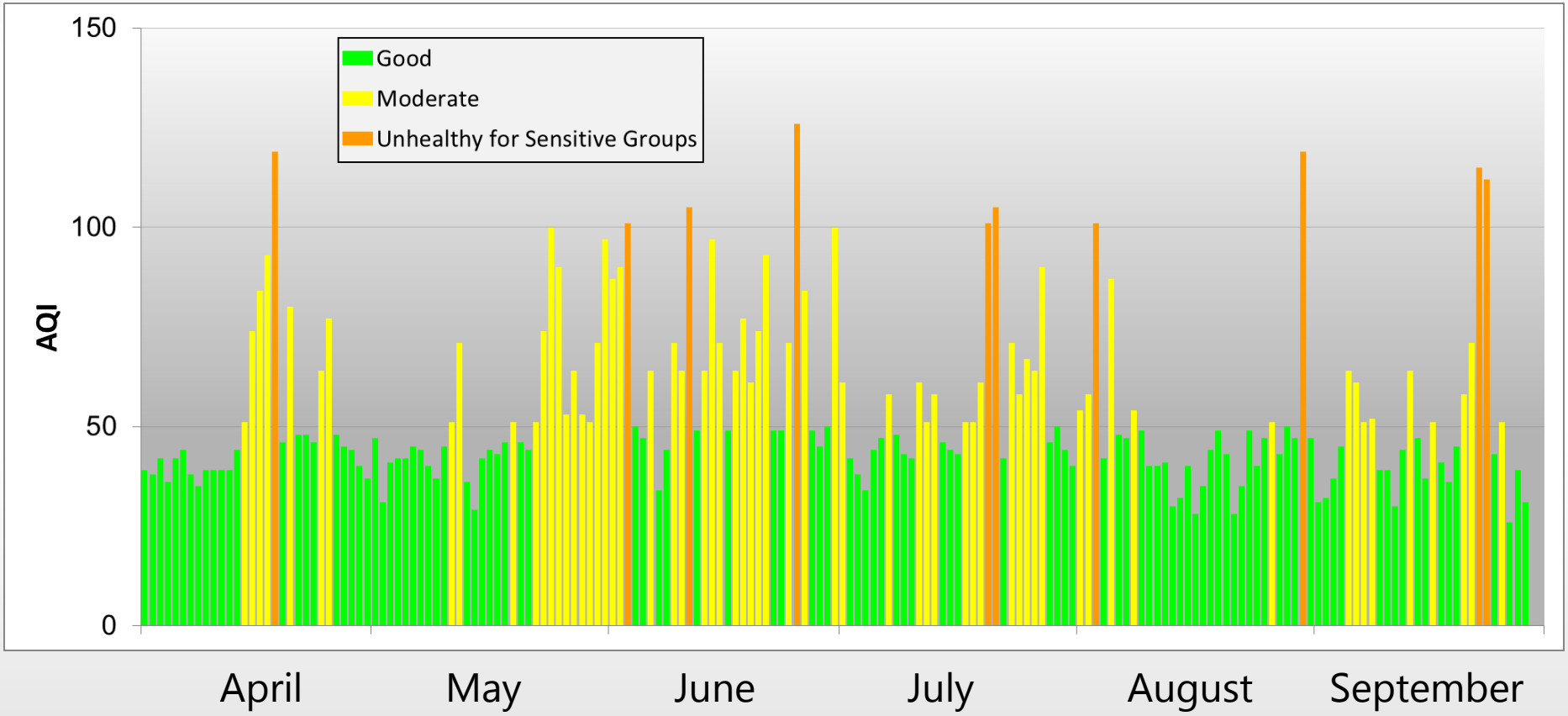
Sonoma Technology, Inc.

Outline

- Air quality summary for central Ohio
- Air quality trends
- Comparisons to other regions
- Impact of the new ozone standard

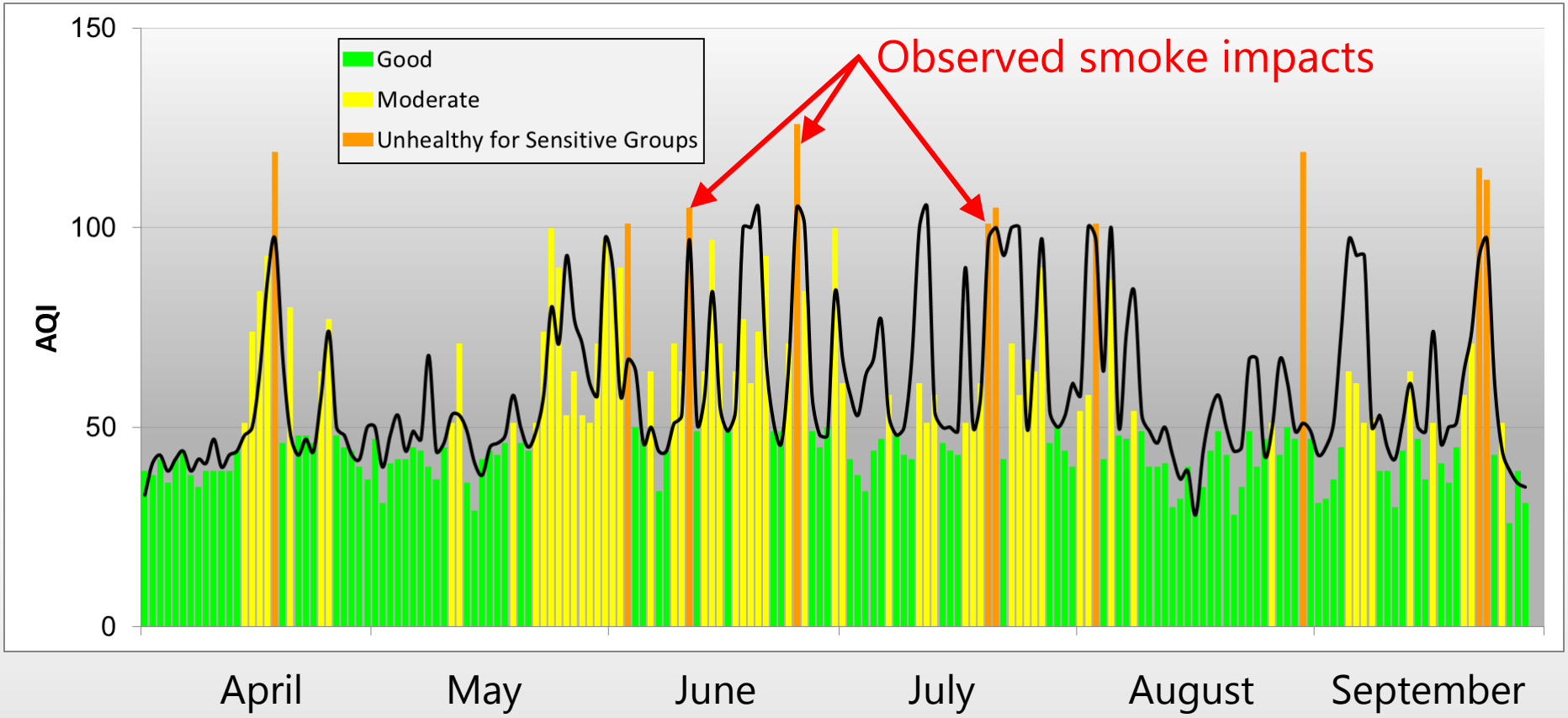
Summary of AQI Levels

Daily maximum AQI levels, Summer 2016

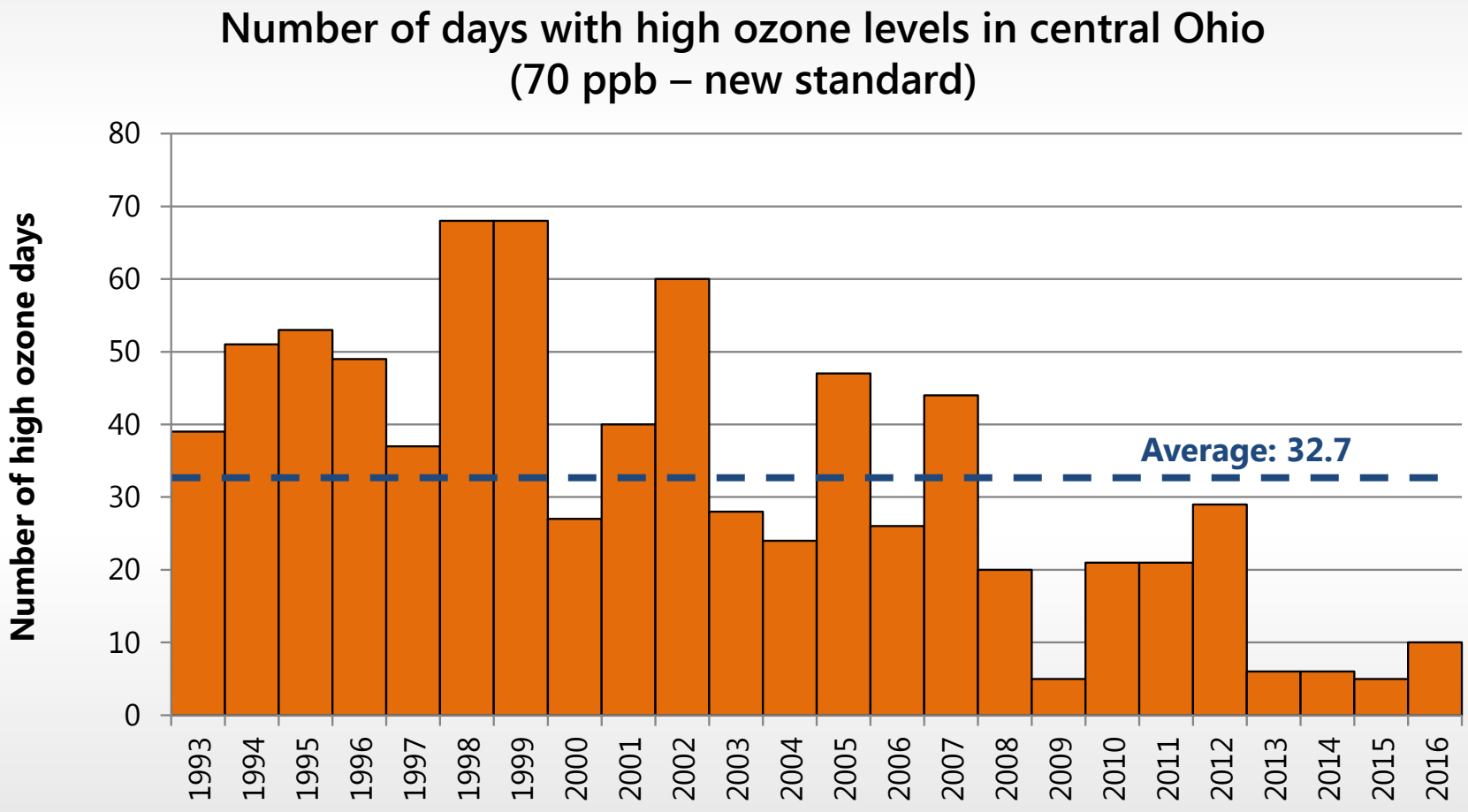


Summary of AQI Levels

Daily maximum AQI levels, Summer 2016

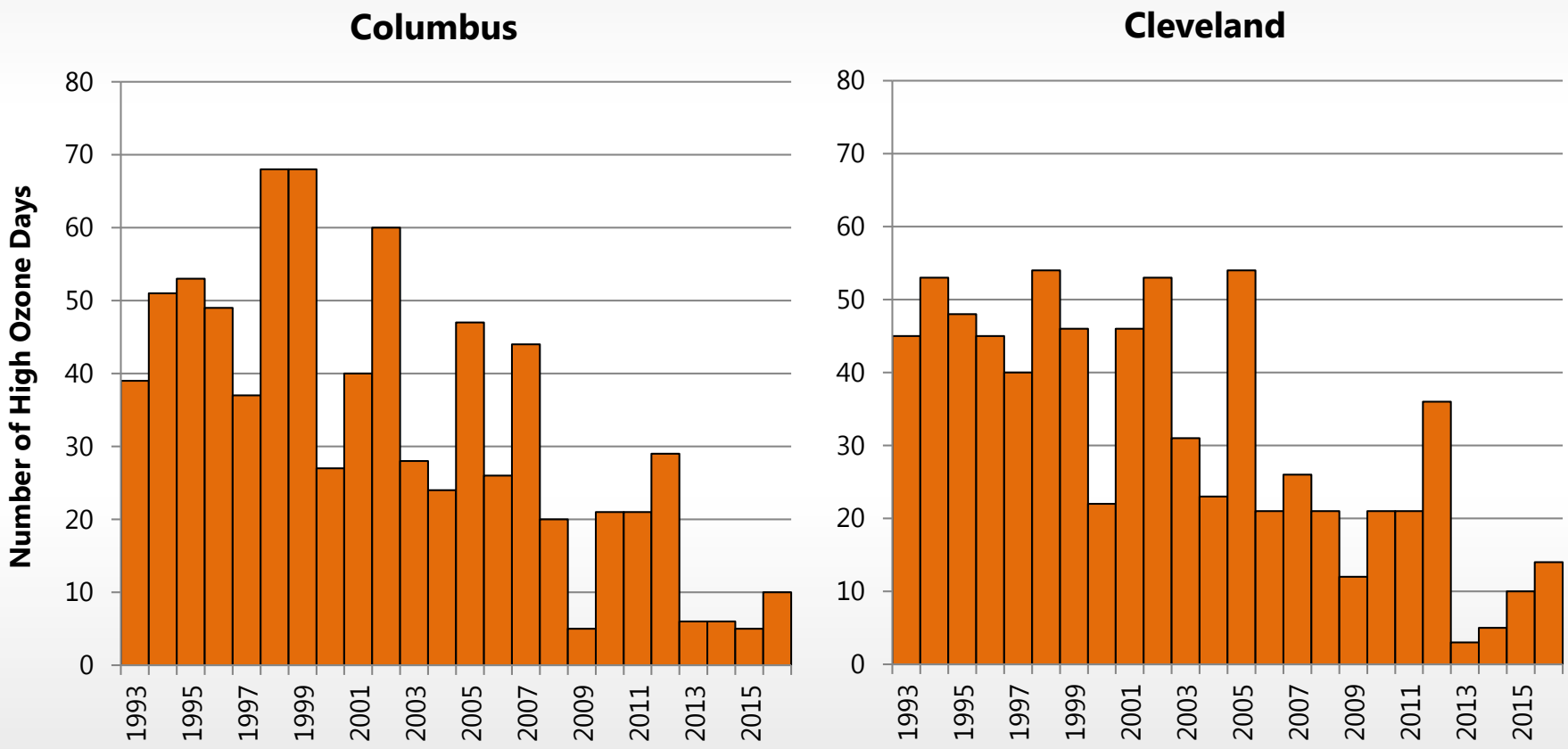


Past Trends: Improving Air Quality

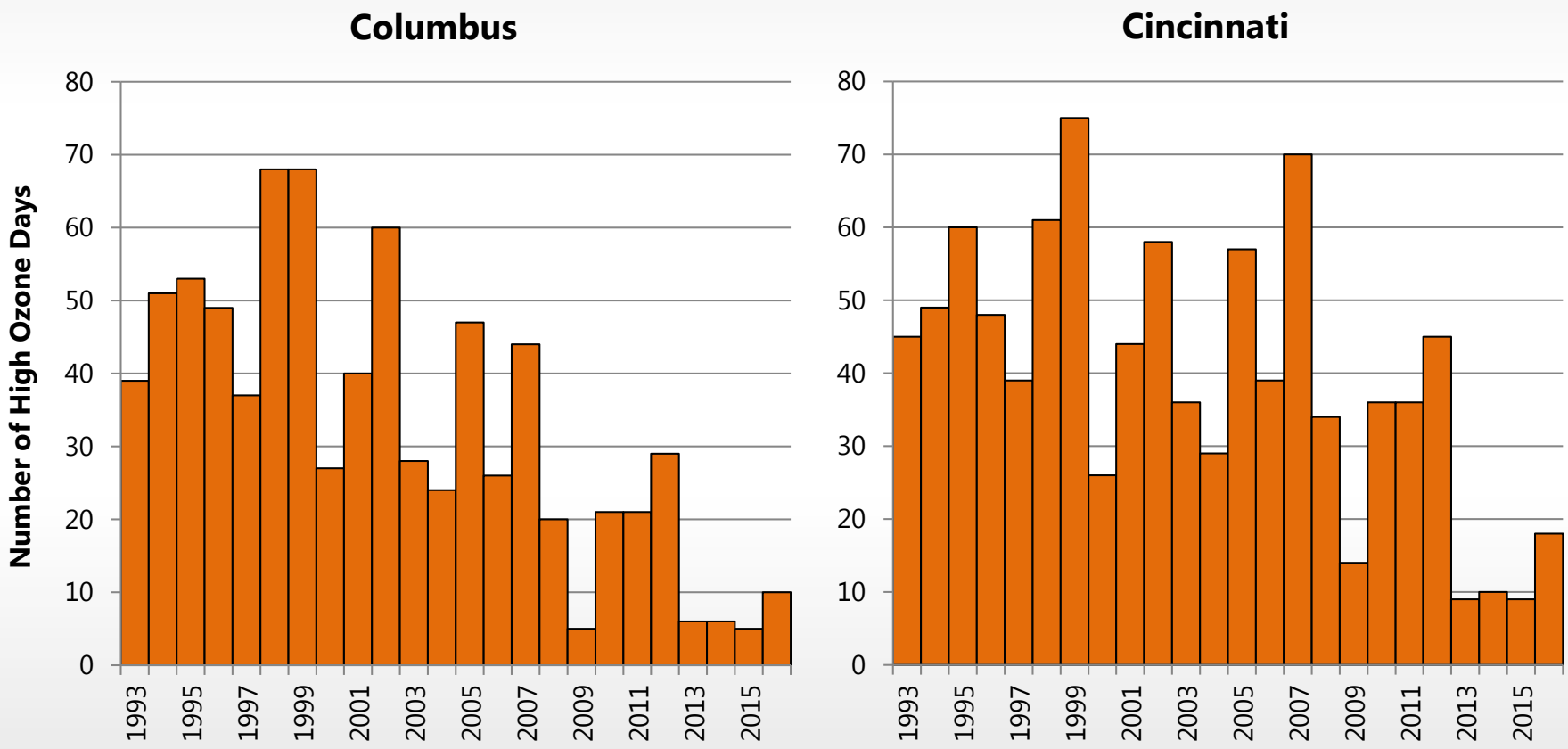


Annual variability but a steady improvement in number of high ozone days.

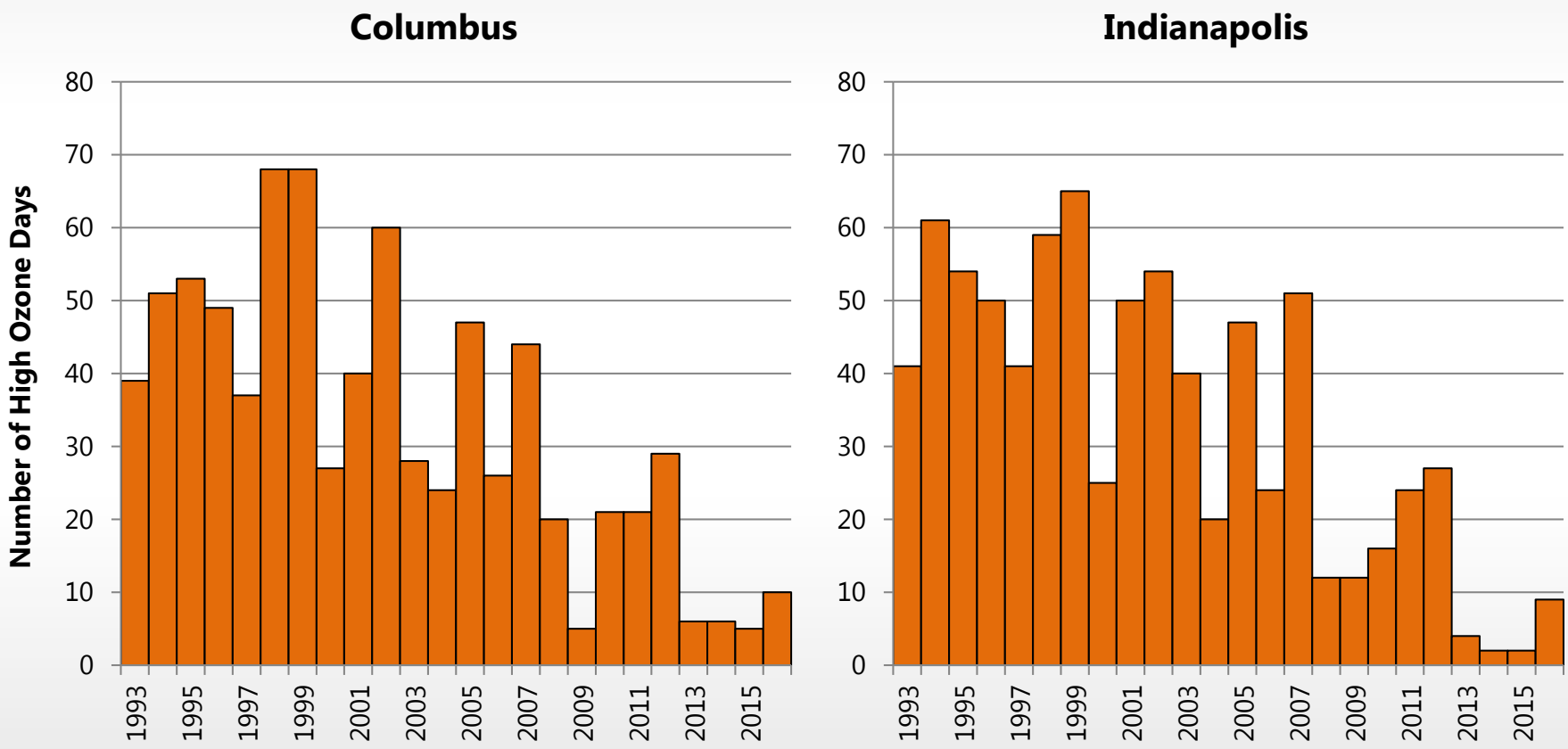
Comparing Air Quality



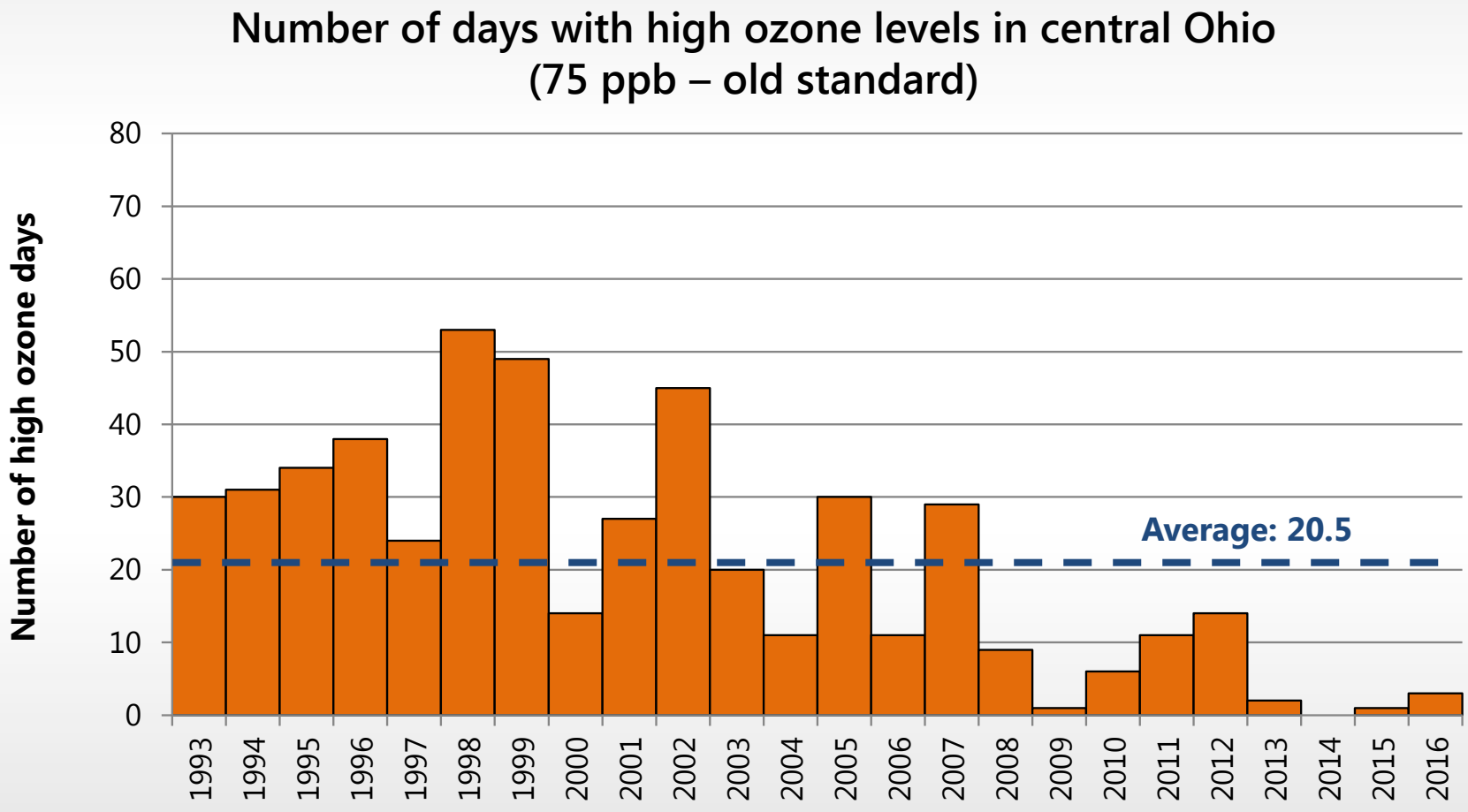
Comparing Air Quality



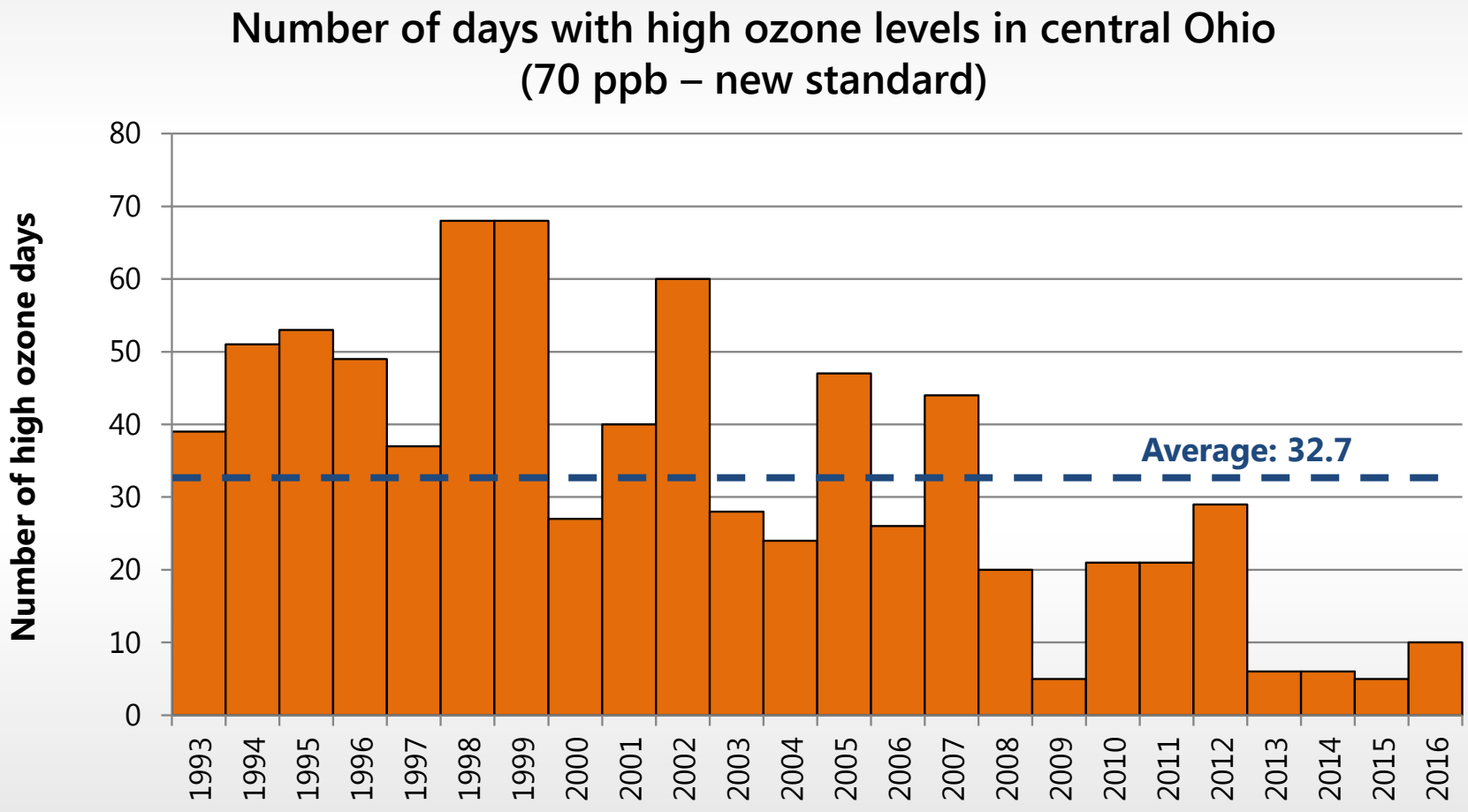
Comparing Air Quality



Impacts of the New Ozone Standard



Impacts of the New Ozone Standard



2016: High Ozone Days Using 75 ppb (Old Standard): 3 Days

April						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

May						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

June						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

July						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

August						
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

September						
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

2016: High Ozone Days Using 70 ppb (New Standard): 10 Days

April						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

May						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

June						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

July						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

August						
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7	8	9	10	11	12	13
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21	22	23	24	25	26	27
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September						
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

Impacts of the New Ozone Standard on Forecasting

- Historical conditions for ozone Alert Days
  - Calm winds/light transport from the southwest (<10 mph)
  - Strong upper-level ridge of high pressure
  - Sunny skies, temperatures above 84°F
- New conditions for ozone Alert Days
  - Light-to-moderate winds (up to 15 mph)
  - Partly-to-mostly-sunny skies, temperatures above 80°F
- STI periodically updates forecast rules and models to assist with forecasting.

Contact

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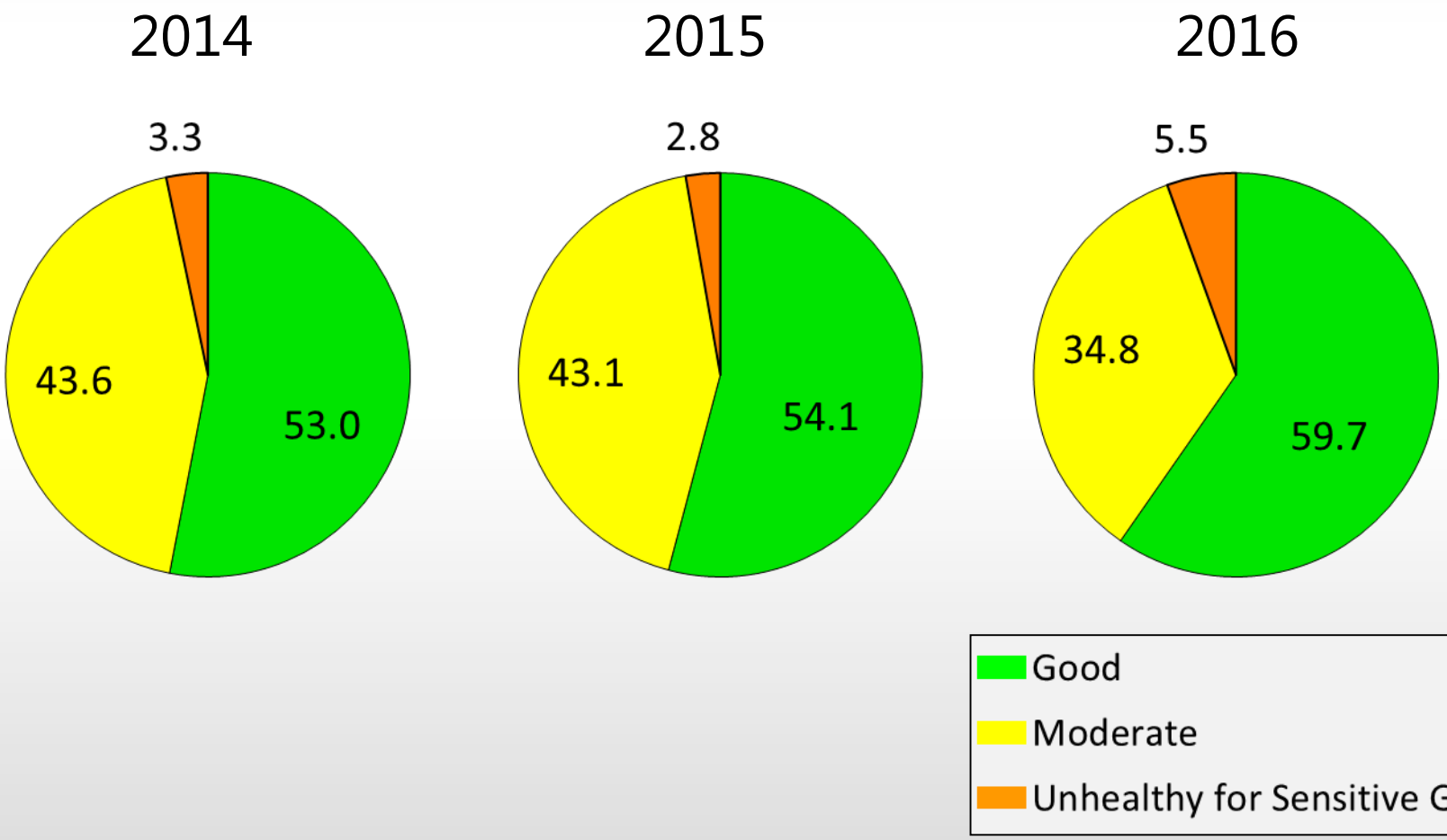
Supplemental Slides

Summary of Observed AQI Levels

Percent of days in each AQI category, April–September



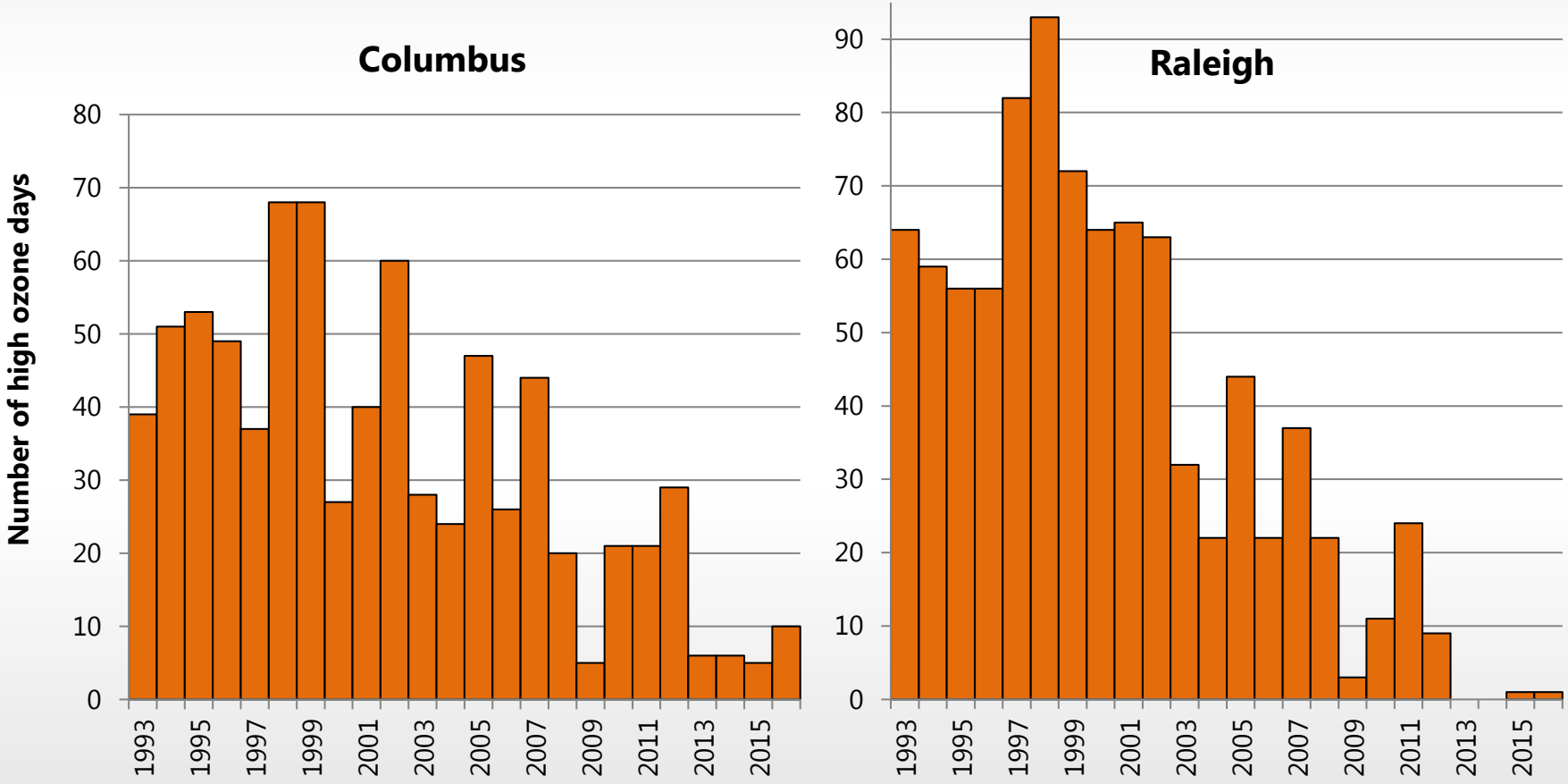
Our Background

- STI provides air quality and meteorological services to clients around the world
- Based in Petaluma, CA, with around 60 employees
- Business areas include
  - Meteorology and forecasting
  - Air quality monitoring, modeling, and data analysis
  - Fire and forest ecology
  - Software development
  - Near-road air quality monitoring and transportation analysis

High-Ozone Days Are Less Frequent

- Annual variability due to weather conditions does not explain the overall downward trend in high-ozone days
- Reductions in pollution emissions have led to this downward trend
  - Vehicle fleet turnover
  - Emission controls on power plants and industries
  - Cleaner-burning gasoline
  - Fluctuation in the economy

Comparing Air Quality



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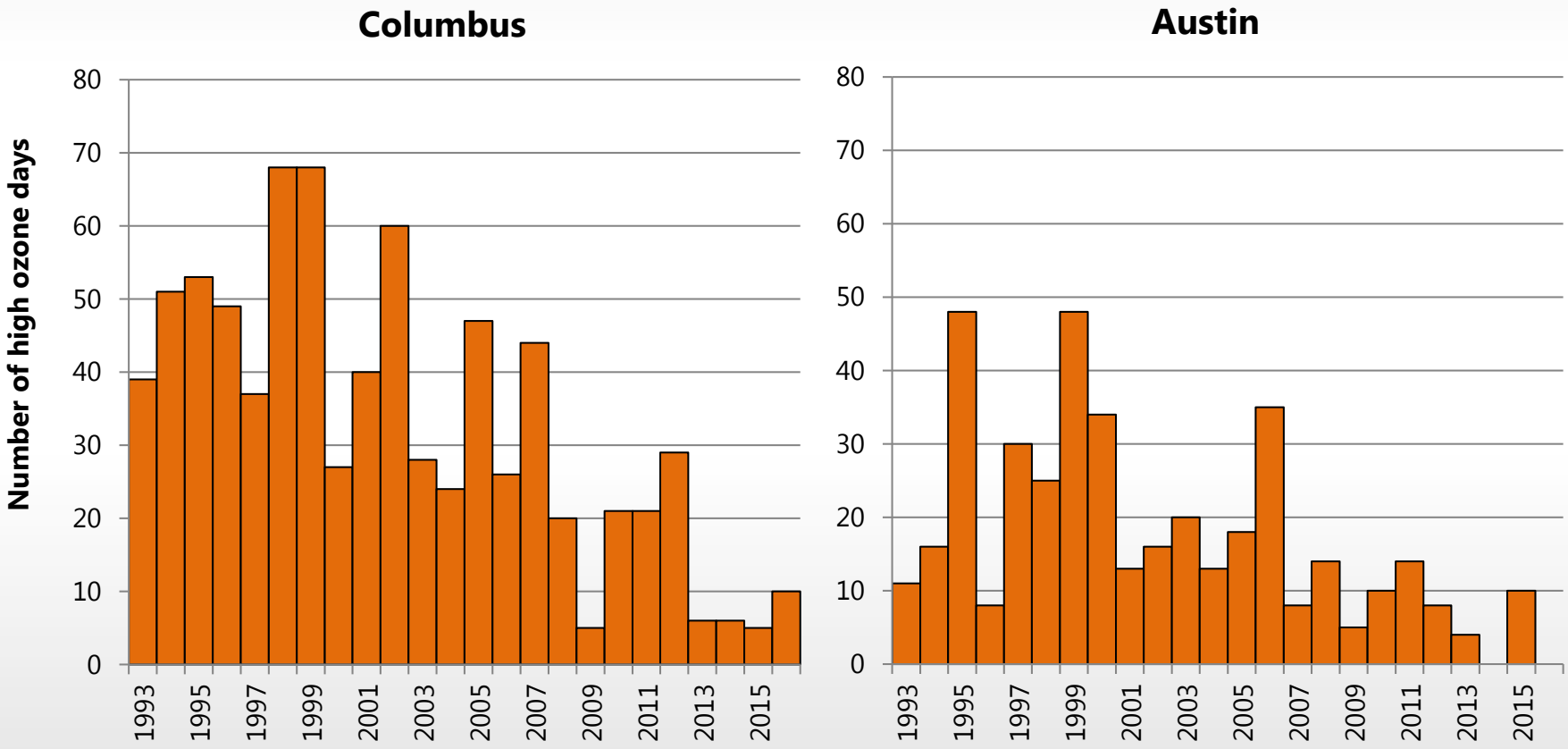


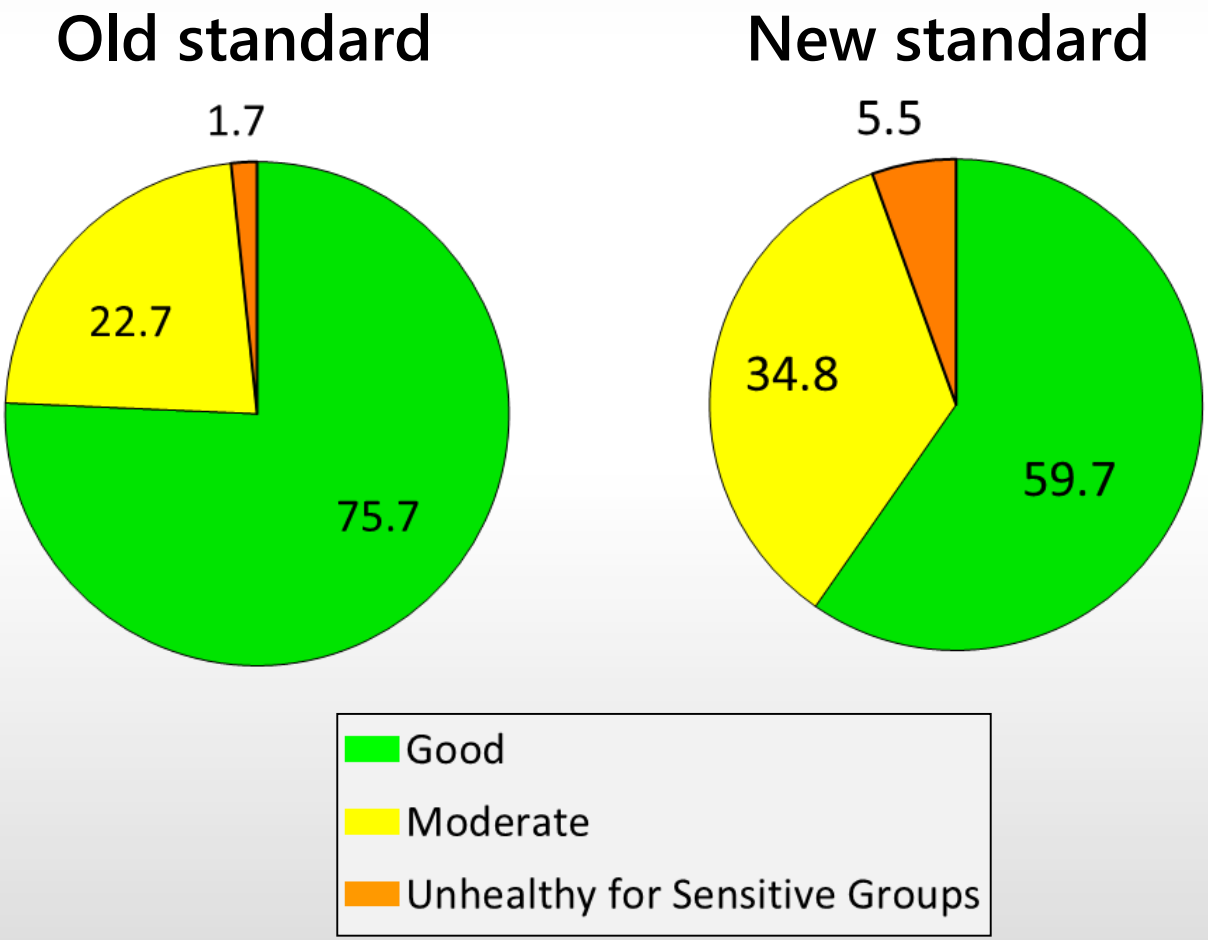
New Ozone Standard

- A new ozone standard of 70 ppb went into effect at the end of 2015.
- Five of the six AQI cut-points were lowered, in coordination with the more stringent ozone standard.

AQI Category	Old Concentration Range (ppb)	New Concentration Range (ppb)
Good	0 – 59	0 – 54
Moderate	60-75	55-70
Unhealthy for Sensitive Groups	76-95	71-85
Unhealthy	96-115	86-105
Very Unhealthy	116-200	106-200
Hazardous	201-300	201+

Impacts of the New Ozone Standard

Percent of days in each AQI category, 2016



2014: High Ozone Days Using 75 ppb (Old Standard): 0 Days

April						
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

May						
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4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

June						
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15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

July						
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6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

August						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

September						
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

2014: High Ozone Days Using 70 ppb (New Standard): 6 Days

April						
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

May						
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

June						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

July						
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

August						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

September						
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

2015: High Ozone Days Using 75 ppb (Old Standard): 0 Days

April						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

May						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

June						
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7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
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July						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

August						
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

September						
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
21	28	29	30			

2015: High Ozone Days Using 70 ppb (New Standard): 5 Days

April						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

May						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

June						
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

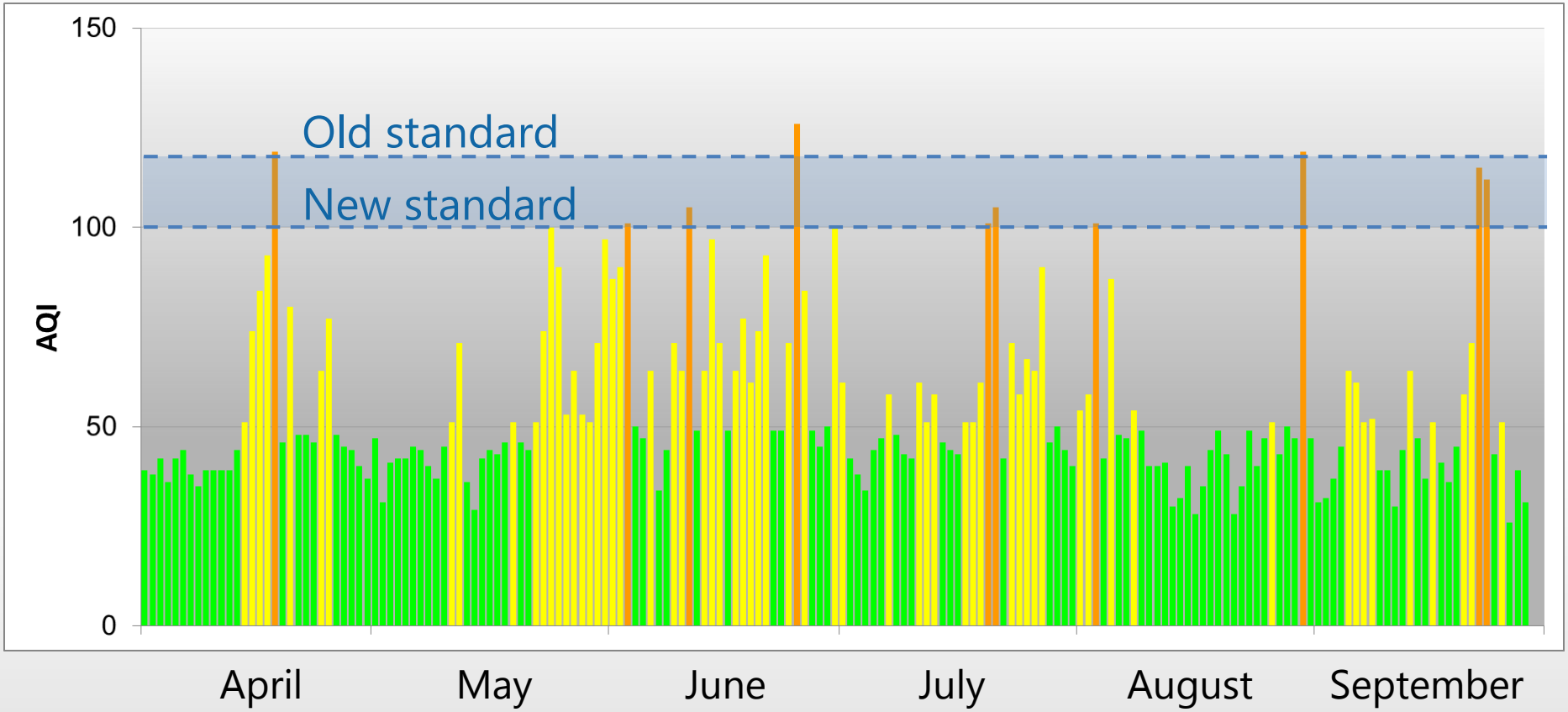
July						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

August						
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

September						
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
21	28	29	30			

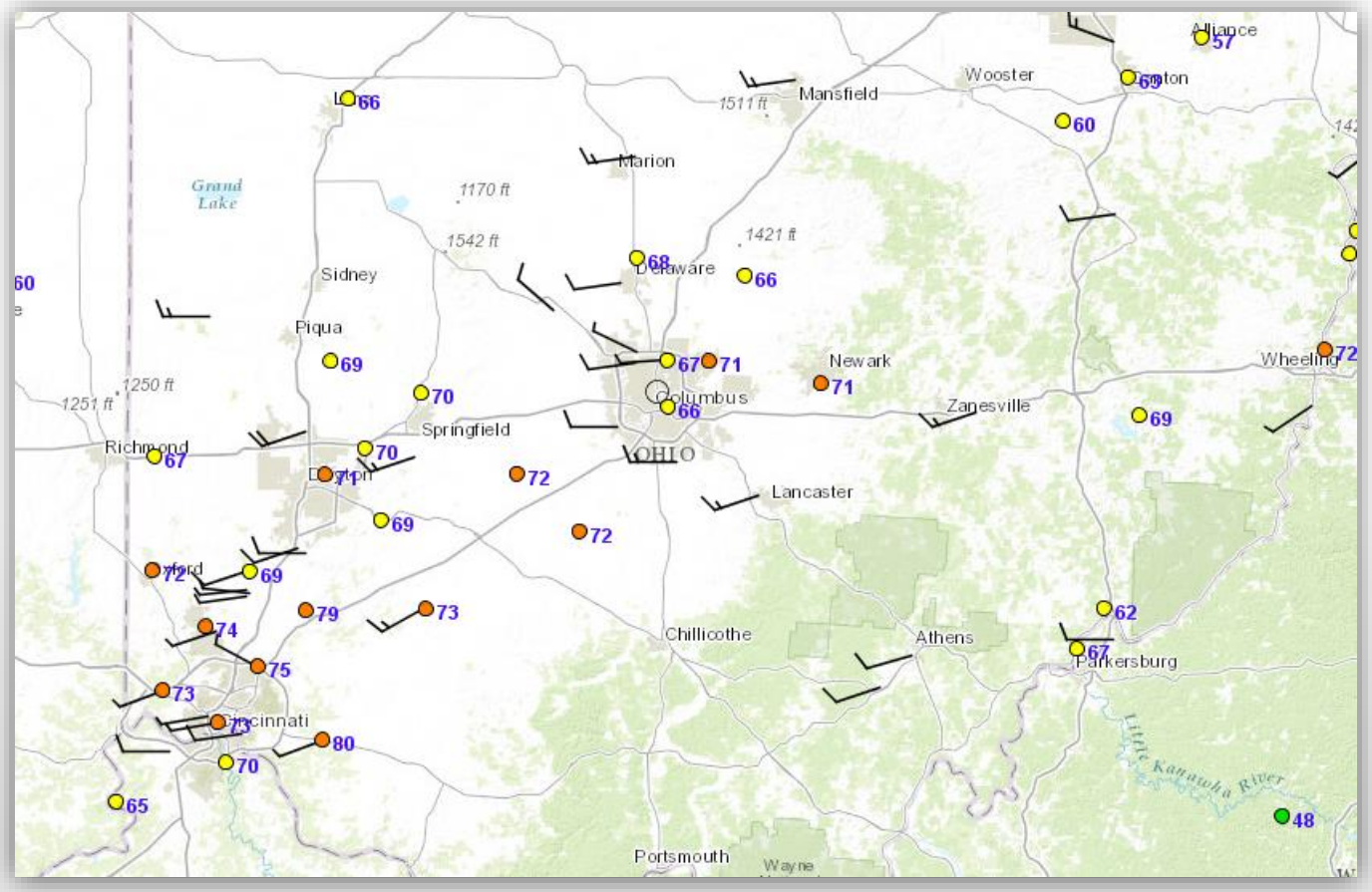
The "New Alert" Days

Daily maximum AQI levels, Summer 2016



Case Study: High Ozone Day with New Standard

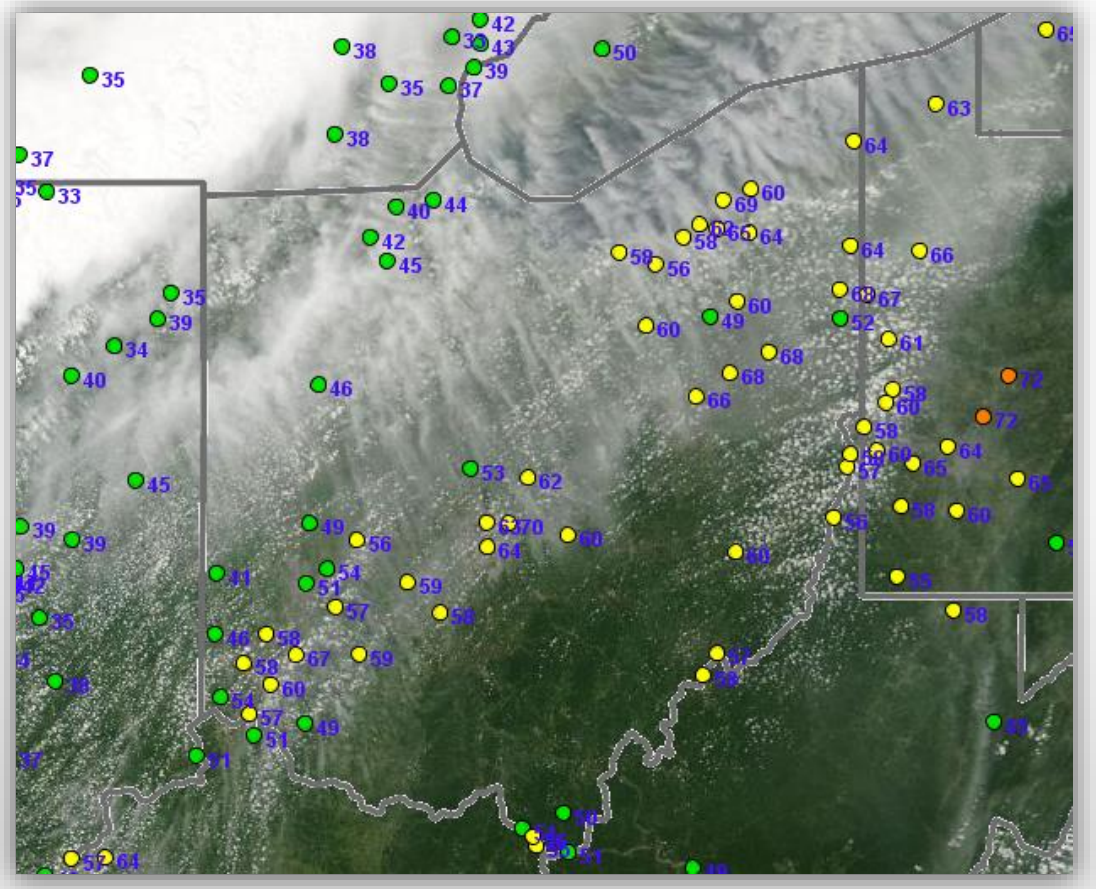
June 11, 2016 (8-hour max ozone: 72 ppb)



8-hour ozone concentrations and hourly winds reported at 1:00 p.m.

Case Study: High Ozone Day with New Standard

July 21, 2016 (8-hour max ozone: 72 ppb)

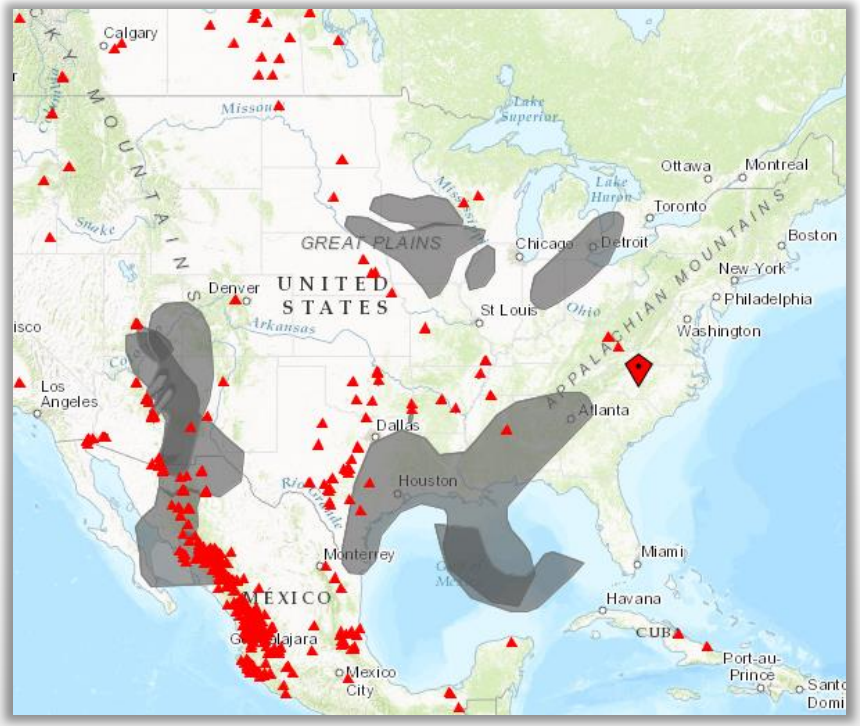


8-hour ozone concentrations and cloud cover reported at 2:00 p.m.

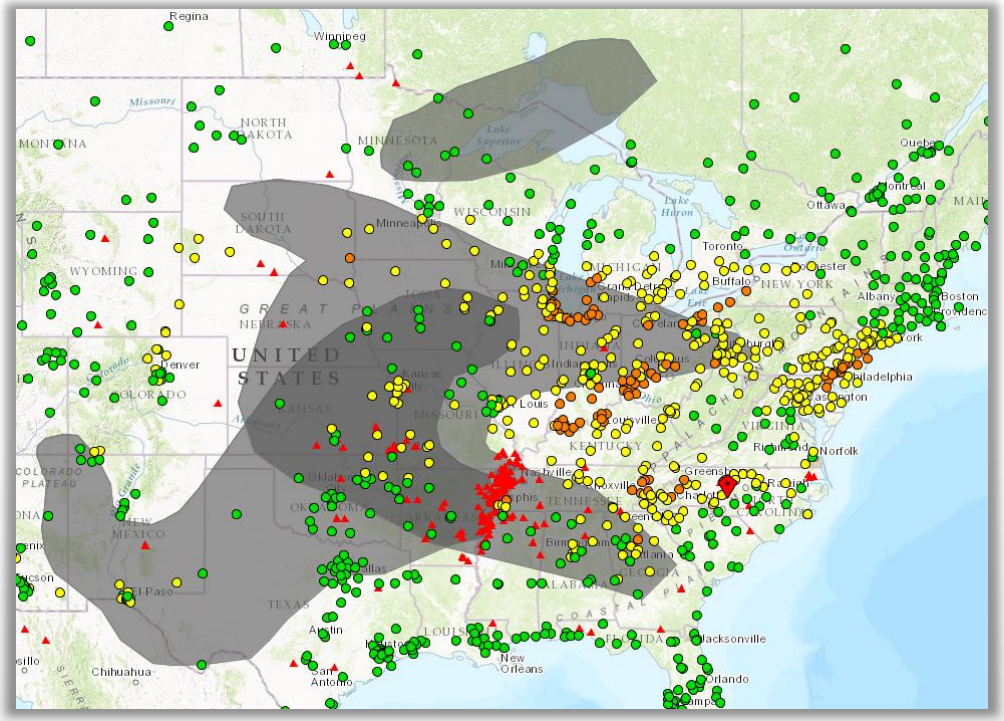
Example: Smoke Impacts on an Alert Day

Fire and smoke detections

June 6, 2016

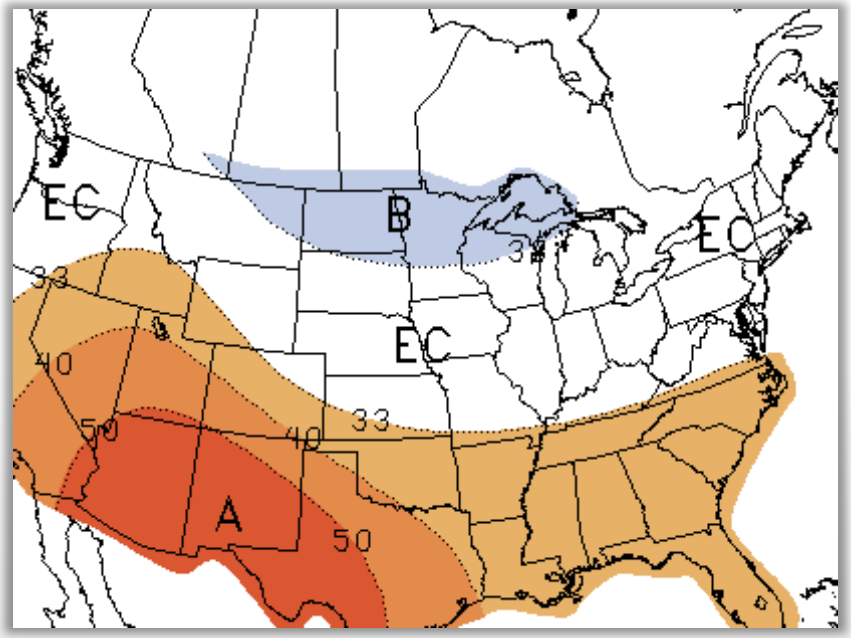


June 11, 2016

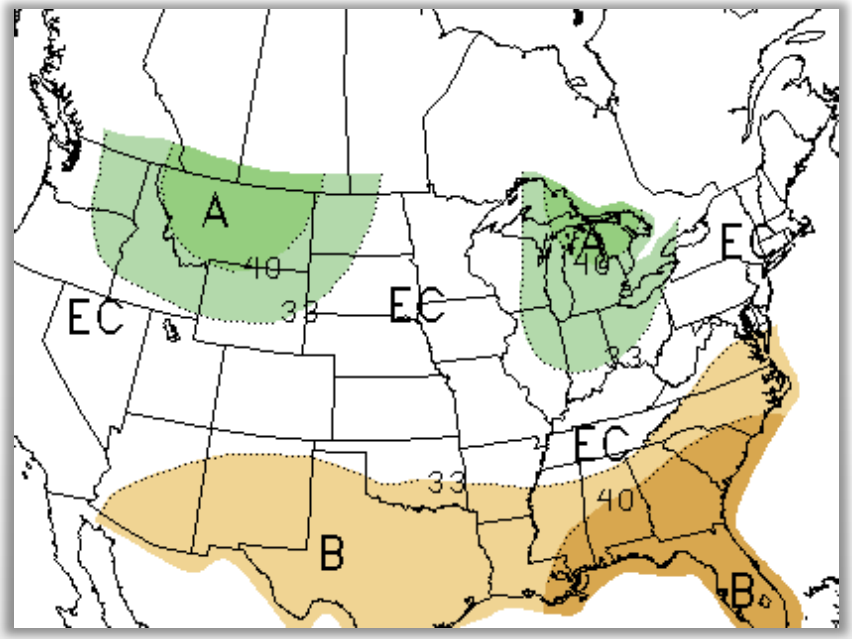


Air Quality Forecasting: Outlook for Winter 2016-2017

Temperature anomaly

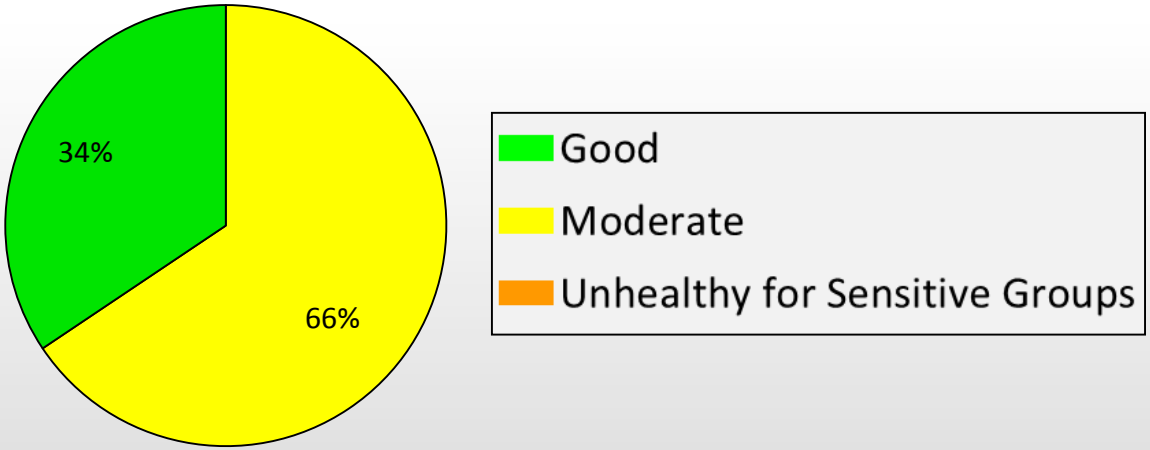


Precipitation anomaly



December–February predicted anomalies, from http://www.cpc.ncep.noaa.gov/

Air Quality Forecasting: Outlook for Winter 2016-2017

- Near-normal temperatures, slightly-above-normal precipitation
- More frequent storms, better-than-normal air quality (lower $PM_{2.5}$ concentrations)

Historical $PM_{2.5}$ distribution, November-March