Climate Change and Air Quality Analysis of the 2019 Summer Ozone Season



Finding the ways that work

Overview

1. Ozone Basics

- Ground-level ozone formation and health effects
- The linkage between climate and air quality
- 2. Nonattainment, Exceedances, Air Quality Index
 - Ozone nonattainment areas
 - 2019 summer ozone exceedances
 - Air Quality Index
- 3. Ozone Monitoring Data

Ground-Level Ozone

- Ozone forms through the interaction of heat, sunlight, volatile organic compounds, and nitrogen oxides (NOx).
- The most common sources of ozone-producing pollutants (NOx and VOCs) include vehicles, power plants, and industrial facilities, including oil and gas pollution.
- Ground-level ozone can seriously impact human health. A 2018 analysis by EDF found that ozone significantly increases the risk of:
 - Respiratory disease: reduced lung function, increased hospital admissions and emergency department visits for asthma and respiratory infections and possibly increasing rates of asthma development. School-aged children are particularly vulnerable.
 - Cardiovascular disease: specifically increased rates of strokes. There is also accumulating evidence supporting ozone's effects on cardiac arrhythmia in persons with preexisting heart disease.
 - Mortality due to short-term exposure to ozone. Studies reviewed indicate that ozone is responsible for ~5000 deaths per year in the US. New studies are adding to the evidence that long-term exposure to ozone also increases rates of mortality.



Source: EPA Ground-level Ozone Basics

Climate Change Impacts on Air Quality

- July 2019 was the hottest on record for the globe.
- The Fourth National Climate Assessment states with "high confidence" that climate change will increase ozone levels and negatively impact air quality over most of the United States.
- Hot, sunny days and stagnant weather conditions can contribute to higher concentrations of ozone and particulate matter (PM).
- Wildfires, which are growing more frequent, release ozone precursors and are a major source of PM.
- According to the American Lung Association in its "State of the Air" 2019 report, reviewing data from 2015-2017, Americans are "experiencing worsened ozone and particle pollution due to warmer temperatures and increased wildfires."



Change in Ozone Concentration (parts per billion

EPA Air Quality Standards

- EPA establishes national air quality standards for 6 "criteria" air pollutants: carbon monoxide, lead, ground-level ozone, nitrogen dioxide, particulate matter, and sulfur dioxide. These standards are set by the EPA based on numerous health studies showing adverse effects from exposure to these pollutants.
- States are required to measure and report air quality data for each of these pollutants. EPA then designates areas as meeting or failing to meet the standards (known as NAAQS).
- Attainment designations are based on 3-years of monitoring data.

Display:

 A "Design Value" is a statistic that describes the air quality status of a given location relative to the level of the NAAQS.



8-Hour Ozone (2015) Designated Area Design Values

Nonattainment and Maintenance Areas
 O Nonattainment Areas
 O Maintenance Areas

Data is current as of July 31, 2019

8-Hour Ozone (2015) Notes Design Values in ppm. "Current Design Values" are current as of the posted Green Book date. Check the Air Quality Design Value site for design value updates.

Click underlined column heading to change report order	Design Values at the Time of Designation						
<u>Area Name</u>	<u>Design</u> Values	Design Monitoring		Current Status	<u>Current</u> <u>Classification</u> or at Redesignation	2010	
click area name for state/county list	values	Itars	<u>Determin.¹</u>	Jacus	click for classif. history	- opulation	
Allegan County, MI	0.075	2014-2016	No	Nonattainment	Marginal	46,615	
Amador County, CA	0.073	2014-2016	No	Nonattainment	Marginal	38,091	
Atlanta, GA	0.075	2014-2016	No	Nonattainment	Marginal	3,669,376	
Baltimore, MD	0.073	2014-2016	No	Nonattainment	Marginal	2,662,691	
Berrien County, MI	0.074	2014-2016	No	Nonattainment	Marginal	156,813	
Butte County, CA	0.075	2014-2016	No	Nonattainment	Marginal	220,000	

Source: www3.epa.gov/airquality/greenbook/jdtc.html

Exceedance vs Nonattainment

Exceedance

- A maximum 8-hour ozone concentration at one monitoring station greater than 70 part per billion (2015 ozone NAAQS)
- An exceedance may indicate elevated pollution levels but does not necessarily mean that the area will be designated nonattainment. Nonattainment designations are based on three years of data.
- Ozone exceedances are most common on hot summer days and during heavy traffic periods.

Nonattainment

- Monitors record ozone concentrations over an 8-hour period
- Attainment/Nonattainment status is based on the 3-year average of the 4th highest daily concentrations
- Nonattainment classifications range from "Marginal" to "Extreme"

Classification	Design Value (ppm)
Extreme	0.163+
Severe-17	0.111 to 0.162
Severe-15	0.105 to 0.110
Serious	0.093 to 0.104
Moderate	0.081 to 0.092
Marginal	0.071 to 0.080

Nonattainment

As of July 31, 2019, EPA has designated 51 nonattainment areas under the 2015 8-hour Ozone NAAQS, in the following states, including the District of Columbia:

Arizona	Kentucky	New York	
California	Maryland	Ohio	
Colorado	Michigan	Pennsylvania	
Connecticut	Missouri	Texas	
Delaware	Nevada	Utah	
Georgia	New Jersey	Virginia	
Illinois	New Mexico	Wisconsin	
Indiana			



US Ozone Nonattainment Areas Source: EPA Green Book GIS Download

States Experiencing Exceedances in 2019

248 Counties in 40 States and the District of Columbia have had at least one measurement over 70 ppb in 2019 (exceedance):

Alabama	Illinois	Minnesota
Arizona	Indiana	Mississippi
Arkansas	Iowa	Missouri
California	Kansas	Nevada
Colorado	Kentucky	New Hampshire
Connecticut	Louisiana	New Jersey
Delaware	Maine	New Mexico
District of Columbia	Maryland	New York
Florida	Massachusetts	North Carolina
Georgia	Michigan	Ohio

Oklahoma Pennsylvania Rhode Island South Carolina South Dakota Tennessee Texas Utah Virginia Wisconsin Wyoming



US Counties experiencing one or more exceedances in 2019 Source: EPA Outdoor Air Quality Data

National Parks Experiencing Ozone Exceedances



Monitors in National Parks have recorded 87 ozone exceedances in 2019, including National Parks in Arizona, California, Indiana, Maine, Nevada, New Mexico, and Texas.

Haze in Joshua Tree National Park, view from Belle Mountain Looking Southeast Source: National Park Service Air Webcams. Accessed 8-26-2019

								4th Highest 8-hour
Monitoring Site	Apr	Мау	June	July	Aug*	Total	Max8hr	Measurement
Cadillac Mountain	0	0	0	1		1	72	61
Biology Building	0	0	0	4		4	82	72
State Monitor	0	0	0	3		3	75	67
Park Village	0	0	2	1		3	72	69
Water Treatment Plant	0	0	1	0		1	74	68
Black Rock	2	1	14	10		26	88	80
Kelso Mountains	2	1	6	5		14	75	73
South Entrance	0	0	1	0		1	74	66
East	0	0	0	1		1	71	64
Ash Mountain	0	0	13	19		23	83	78
	Monitoring Site Cadillac Mountain Biology Building State Monitor Park Village Water Treatment Plant Black Rock Kelso Mountains South Entrance East Ash Mountain	Monitoring SiteAprCadillac Mountain0Biology Building0State Monitor0Park Village0Water Treatment Plant0Black Rock2Kelso Mountains2South Entrance0East0Ash Mountain0	Monitoring SiteAprMayCadillac Mountain00Biology Building00State Monitor00Park Village00Water Treatment Plant00Black Rock21Kelso Mountains21South Entrance00East00Ash Mountain00	Monitoring SiteAprMayJuneCadillac Mountain000Biology Building000State Monitor000Park Village002Water Treatment Plant001Black Rock2114Kelso Mountains216South Entrance001East003Ash Mountain0013	Monitoring SiteAprMayJuneJulyCadillac Mountain0001Biology Building0004State Monitor0003Park Village0021Water Treatment Plant0010Black Rock211410Kelso Mountains2165South Entrance0010East001319	Monitoring Site Apr May June July Aug* Cadillac Mountain 0 0 0 1 Biology Building 0 0 0 4 State Monitor 0 0 0 3 Park Village 0 0 2 1 Water Treatment Plant 0 0 1 0 Black Rock 2 1 14 10 Kelso Mountains 2 1 6 5 South Entrance 0 0 1 0 Ash Mountain 0 0 13 19	Monitoring Site Apr May June July Aug* Total Cadillac Mountain 0 0 0 1 1 Biology Building 0 0 0 4 4 State Monitor 0 0 0 3 3 Park Village 0 0 2 1 3 Water Treatment Plant 0 0 1 0 1 Black Rock 2 1 14 10 26 Kelso Mountains 2 1 6 5 14 South Entrance 0 0 1 0 1 East 0 0 13 19 23	Monitoring Site Apr May June July Aug* Total Max8hr Cadillac Mountain 0 0 0 1 1 72 Biology Building 0 0 0 4 42 82 State Monitor 0 0 0 3 3 75 Park Village 0 0 2 1 3 72 Water Treatment Plant 0 0 1 0 1 74 Black Rock 2 1 14 10 26 88 Kelso Mountains 2 1 6 5 14 75 South Entrance 0 0 1 0 1 74 East 0 0 1 1 1 74 Ash Mountain 0 0 1 3 75

Year-to-Date Ozone Exceedances

Based on preliminary monitoring data, there have been over 2,500 8-hour maximum ozone readings over 70 ppb recorded in 2019 and approximately 185 million people have been exposed to at least one exceedance. The following table shows the 25 Combined Statistical Areas and Counties with the most reported exceedances and their respective populations.

Combined Staistical Area	Population	Exceedances	State	County	Population	Exceedances
Los Angeles-Long Beach, CA	18,764,814	1075	California	San Bernardino	2,171,603	524
Fresno-Madera, CA	1,152,072	101	California	Riverside	2,450,758	338
New York-Newark, NY-NJ-CT-PA	23,522,861	90	California	Los Angeles	10,105,518	202
Houston-The Woodlands, TX	7,197,883	82	California	Kern	896,764	168
San Jose-San Francisco-Oakland, CA	8,841,475	59	Arizona	Maricopa	4,410,824	117
El Paso-Las Cruces, TX-NM	1,063,075	56	California	Tulare	465,861	95
Washington-Baltimore-Arlington, DC-MD-VA-WV-PA	9,797,063	50	California	Fresno	994,400	80
Denver-Aurora, CO	3,572,798	45	Texas	Harris	4,698,619	63
Dallas-Fort Worth, TX-OK	7,994,303	43	Connecticut	Fairfield	943,823	34
Chicago-Naperville, IL-IN-WI	9,866,910	40	New Mexico	Dona Ana	217,522	33
Philadelphia-Reading-Camden, PA-NJ-DE-MD	7,204,035	40	Utah	Uintah	35,438	28
Sacramento-Roseville, CA	2,619,754	35	Colorado	Jefferson	580,233	25
St. Louis-St. Charles-Farmington, MO-IL	2,909,777	33	Texas	El Paso	840,758	23
Salt Lake City-Provo-Orem, UT	2,606,548	26	Utah	Duchesne	19,964	20
Hartford-West Hartford, CT	1,473,084	19	Utah	Salt Lake	1,152,633	19
Cincinnati-Wilmington-Maysville, OH-KY-IN	2,249,416	18	Illinois	Cook	5,180,493	18
AtlantaAthens-Clarke CountySandy Springs, GA	6,630,231	15	California	Stanislaus	549,815	18
Cleveland-Akron-Canton, OH	3,483,297	15	California	San Diego	3,343,364	17
Charlotte-Concord, NC-SC	2,728,933	13	Connecticut	New Haven	857,620	16
Milwaukee-Racine-Waukesha, WI	2,049,391	10	Texas	Tarrant	2,084,931	15
Birmingham-Hoover-Talladega, AL	1,366,283	8	New York	Suffolk	1,481,093	15
Las Vegas-Henderson, NV-AZ	2,486,543	7	California	Placer	393,149	15
Boston-Worcester-Providence, MA-RI-NH-CT	8,285,407	6	California	Imperial	181,827	' 15
Orlando-Deltona-Daytona Beach, FL	3,361,321	6	New Mexico	Eddy	57,900	14
Louisville/Jefferson CountyElizabethtownMadison, KY-IN	1,528,738	6	Arizona	Pinal	447,138	13
Totals	142,756,01	2 1,898		Totals	44,562,048	1,925

*Arranged by Number of Exceedances

**North Port-Sarasota, FL, South Bend-Elkhart-Mishawaka, IN-MI, and Toledo-Port Clinton, OH CSAs also reported 2 Exceedances in 2019

Year-to-Date Ozone Exceedances

The following table shows the 25 most populous Combined Statistical Areas and Counties and the number of exceedances occurring within each, based on preliminary monitoring data.

Combined Staistical Area	Population	Exceedances	State	County	Population	Exceedances
New York-Newark, NY-NJ-CT-PA	23,522,861	90	California	Los Angeles	10,105,518	202
Los Angeles-Long Beach, CA	18,764,814	1075	Illinois	Cook	5,180,493	18
Chicago-Naperville, IL-IN-WI	9,866,910	40	Texas	Harris	4,698,619	63
Washington-Baltimore-Arlington, DC-MD-VA-WV-PA	9,797,063	50	Arizona	Maricopa	4,410,824	117
San Jose-San Francisco-Oakland, CA	8,841,475	59	California	San Diego	3,343,364	17
Boston-Worcester-Providence, MA-RI-NH-CT	8,285,407	6	California	Orange	3,185,968	7
Dallas-Fort Worth, TX-OK	7,994,303	43	Florida	Miami-Dade	2,761,581	1
Philadelphia-Reading-Camden, PA-NJ-DE-MD	7,204,035	40	Texas	Dallas	2,637,772	4
Houston-The Woodlands, TX	7,197,883	82	New York	Kings	2,582,830	0
Miami-Fort Lauderdale-Port St. Lucie, FL	6,879,772	1	California	Riverside	2,450,758	338
AtlantaAthens-Clarke CountySandy Springs, GA	6,630,231	15	New York	Queens	2,278,906	6 4
Detroit-Warren-Ann Arbor, MI	5,353,002	4	Washington	King	2,233,163	0
Seattle-Tacoma, WA	4,853,364	0	Nevada	Clark	2,231,647	7
Minneapolis-St. Paul, MN-WI	3,977,790	1	California	San Bernardino	2,171,603	524
Denver-Aurora, CO	3,572,798	45	Texas	Tarrant	2,084,931	15
Cleveland-Akron-Canton, OH	3,483,297	15	Texas	Bexar	1,986,049	5
Orlando-Deltona-Daytona Beach, FL	3,361,321	6	Florida	Broward	1,951,260	0
Portland-Vancouver-Salem, OR-WA	3,239,335	0	California	Santa Clara	1,937,570	7
St. Louis-St. Charles-Farmington, MO-IL	2,909,777	33	Michigan	Wayne	1,753,893	0
Charlotte-Concord, NC-SC	2,728,933	13	California	Alameda	1,666,753	12
Sacramento-Roseville, CA	2,619,754	35	New York	New York	1,628,701	2
Pittsburgh-New Castle-Weirton, PA-OH-WV	2,612,492	0	Massachusetts	Middlesex	1,614,714	0
Salt Lake City-Provo-Orem, UT	2,606,548	26	Pennsylvania	Philadelphia	1,584,138	11
Columbus-Marion-Zanesville, OH	2,509,850	1	California	Sacramento	1,540,975	10
Kansas City-Overland Park-Kansas City, MO-KS	2,487,053	0	Florida	Palm Beach	1,485,941	0
Totals	161,300,06	B 1,680		Totals	69,507,971	1,364

*Arranged by Population

Ozone and AQI

- The EPA's Air Quality Index (Airnow.gov) is a tool that helps the public quickly learn when air quality is likely to reach unhealthy levels. These forecasts, shared online and through local TV stations, radio programs, and newspapers, help individuals reduce their exposure by altering the type and location of their physical activity.
- AQI Levels are generated for groundlevel ozone, PM, sulfur dioxide, and nitrogen dioxide.
- There are also AQI levels scaled specifically to ground-level ozone concentrations (see table to the right).

Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0 to 50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51 to 100	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	101 to 150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151 to 200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201 to 300	Health alert: everyone may experience more serious health effects.
Hazardous	301 to 500	Health warnings of emergency conditions. The entire population is more likely to be affected.

8-hour Ozone Concentration	Air Quality Index Levels
0 - 54 ppb	Good (Green)
55 - 70 ppb	Moderate (Yellow)
71 - 85 ppb	Unhealthy for Sensitive Groups (Orange)
86 - 105 ppb	Unhealthy (Red)
106 - 200 ppb	Very Unhealthy (Purple)
>200 ppb	 Hazardous (Maroon)

Ozone monitor readings by month and category (Moderate to Hazardous)



 Exceedance readings increase significantly from May to June, and remain elevated during the summer months



On July 12, 2019, temperatures reached 101° in Riverside and San Bernardino Counties. The South Coast Air Quality Management District issued an Ozone Advisory from 7/11-7/16



Source: EPA Air Quality Data

14



Source: EPA Air Quality Data

On June 9, 2019, the high temperature in Houston was 102°. 10 monitoring stations registered ozone concentrations above 70 ppb. Of those, 4 readings exceeded 88 ppb, in the "unhealthy" AQI zone.



Ozone Measurements on June 9, 2019

CT-NJ-NY



Source: EPA Air Quality Data

On July 18, 2019, the National Weather Service issued an 'Excessive Heat Warning' for most of the Northeast, including all of New Jersey, Connecticut, and New York City. Heat index values reached 110°. 4 ozone measurements in Connecticut reached the "unhealthy zone", while 9 registered "unhealthy for sensitive groups. No monitors in the region achieved "good" AQI on this day.



Ozone Measurements on June 29, 2019

DC-MD-VA



Source: EPA Air Quality Data

On July 28, 2019, the Metropolitan Washington Council of Governments issued an air quality alert for high levels of ozone. High temperatures in the northern Virginia, D.C., and Maryland areas were in the mid-90s for 4 consecutive days.



Ozone Measurements on June 29, 2019

Noes on Data Quality

Data Quality Assurance

AQS data, as it becomes available, replaces any AirNow data. The AirNow data are not fully verified and validated through the quality assurance procedures monitoring organizations use to officially submit and certify data on the EPA AQS (Air Quality System) and, therefore, cannot be used to formulate or support regulation, guidance or any other Agency decision or position.

Last Full Data Update: September 3, 2019