COLORADO

Air Pollution Control Division

Department of Public Health & Environment

Technical Services Program

2022 Ambient Air Monitoring Network Plan

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COLORADO
AMBIENT AIR MONITORING
NETWORK PLAN

2022

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Glossary of Terms

APCD	Air Pollution Control Division
AQS	Air Quality System (EPA database)
CAMP	Continuous Air Monitoring Program
CBSA	Core-Based Statistical Area
CDPHE	Colorado Department of Public Health and Environment
CFR	Code of Federal Regulations
CMZ	Community Monitoring Zone
CO	Carbon monoxide
CSN	Carbon Speciation Network
EPA	U.S. Environmental Protection Agency
MSA	Metropolitan Statistical Area
NAAQS	National Ambient Air Quality Standards
NATTS	National Air Toxics Trends Stations
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Reactive nitrogen oxides
NO_y	Total reactive nitrogen
NPS	National Park Service
O_3	Ozone
Pb	Lead
$PM_{2.5}$	Particulate matter with an equivalent diameter less than or equal to 2.5 μm
PM_{10}	Particulate matter with an equivalent diameter less than or equal to 10 μm
ppb	Parts per billion (one part in 10^9)
ppm	Parts per million (one part in 10^6)
PMSA	Primary Metropolitan Statistical Area
PSD	Prevention of Significant Deterioration
PWEI	Population Weighted Emissions Index
QA/QC	Quality Assurance/Quality Control
SIP	State Implementation Plan
SLAMS	State or Local Air Monitoring Stations
SO_2	Sulfur dioxide
SPM	Special Purpose Monitor
TSP	Total Suspended Particulates
μg	Microgram (10^{-6} grams)
VOC	Volatile Organic Compound

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Introduction

The Colorado Department of Public Health and Environment (CDPHE), Air Pollution Control Division's (APCD) 2022 Ambient Air Monitoring Network Plan is an examination and evaluation of the APCD's network of air pollution monitoring stations. The Annual Network Plan is required by Title 40, Code of Federal Regulations, Part 58.10(a) and provides the general reasoning for the APCD's ambient air monitoring strategy, the location of each monitor, the highest pollutant concentrations, and the type and frequency of measurements taken at each location. The Network Plan is also a simple accounting of monitoring site changes that have taken place over the past year and changes that are expected for the year ahead. It is due on or before July 1st of each year to the U.S. Environmental Protection Agency (EPA) after a 30-day public comment period.

This plan was made available for public comment from 5/26/2022 to 6/27/2022.

1.1 Overview of the Colorado Air Monitoring Network

The APCD currently conducts air quality and meteorological monitoring operations at 42 locations statewide. Ozone (O_3) and particulate matter (PM) monitors, including those for particulate matter less than 10 μm in diameter (PM_{10}) and particulate matter less than 2.5 μm in diameter ($PM_{2.5}$), are the most abundant and widespread monitors in the network. Currently, there are PM_{10} monitors at 15 separate locations, $PM_{2.5}$ monitors at 16 locations, O_3 monitors at 21 locations, carbon monoxide (CO) monitors at seven locations, nitrogen dioxide (NO_2) monitors at seven locations, and sulfur dioxide (SO_2) monitors at four locations. The APCD also operates 18 meteorological sites statewide for the continuous measurement of wind speed, wind direction, resultant speed, resultant direction, standard deviation of horizontal wind direction, and temperature. Additionally, relative humidity is also monitored at seven of these locations. Total solar radiation is also currently monitored at two sites and precipitation and barometric pressure are monitored at one location.

A majority of the gaseous monitoring conducted by the APCD occurs in the Front Range region, with a particular focus on the Denver Metro area. Three of the O_3 monitoring sites that are located on the Western Slope and have data included in this report are operated and maintained by a third party contractor, Air Resource Specialists (ARS). These are the Rifle, Palisade, and Cortez monitoring sites. ARS keeps the sites in proper working order and performs calibrations, data retrieval, and data validation, while the APCD uploads data to the EPA's Air Quality System (AQS) database and conducts independent audits of the sites for Quality Assurance (QA) purposes.

Within the particulate sampling network, the APCD operates both continuous and filter based sampling methods for $PM_{2.5}$ and PM_{10}. Continuous monitors sample without the need for subsequent filter retrieval and laboratory analysis, which is required for filter based equipment. Thus, these monitors can continuously record concentrations and send the results back to APCD headquarters on a nearly instantaneous basis. Currently, twelve sites are equipped to measure continuous PM_{10} and, of those twelve sites, eight are located at sites also having filter based PM_{10} monitors. Of the 16 $PM_{2.5}$ monitoring sites, 14 measure $PM_{2.5}$ on a continuous basis, 10 of these sites also having filter based samplers.

1.1.1 APCD Monitoring History

The State of Colorado has been monitoring air quality statewide since the mid-1960s when high volume and tape particulate samplers, dustfall buckets, and sulfation candles were the state of the art for defining the magnitude and extent of the very visible air pollution problem. Monitoring for gaseous pollutants (CO, SO_2, NO_2, and O_3) began in 1965 when the federal government established the CAMP monitoring station in downtown Denver at the intersection of 21^{st} Street and Broadway, which was the area that was thought at the time to represent the best site for detecting maximum levels of most of the pollutants of concern. Instruments were primitive by comparison with those of today and were frequently out of service.

Under provisions of the original Federal Clean Air Act of 1970, the Administrator of the U.S. EPA established National Ambient Air Quality Standards (NAAQS) designed to protect the public's health and welfare. Standards were set for total suspended particulates (TSP), CO, SO_2, NO_2, and O_3. In 1972, the first State Implementation Plan (SIP) was submitted to the EPA. It included an air quality surveillance system in accordance with EPA regulations of August 1971. That plan proposed a monitoring network of 100 monitors (particulate and gaseous) statewide. The system established as a result of that plan and subsequent modifications consisted of 106 monitors.

The 1977 Clean Air Act Amendments required States to submit revised SIPs to the EPA by January 1, 1979. The portion of the Colorado SIP pertaining to air monitoring was submitted separately on December 14, 1979, after a comprehensive review, and upon approval by the Colorado Air Quality Control Commission. The 1979 EPA requirements as set forth in 40 CFR 58.20 have resulted in considerable modification to the network. These and subsequent modifications were made to ensure consistency and compliance with Federal monitoring requirements. Station location, probe siting, sampling methodology, QA practices, and data handling procedures are all maintained throughout any changes made to the network.

Historically, 33 of the 42 current APCD monitoring locations have been in operation for 10 or more years, 20 of these sites have been in operation for 20 or more years, and 12 of the monitoring locations have been in operation for more than 30 years. Conversely, 10 of the 42 current monitoring locations have been in operation for less than 10 years.

1.1.2 APCD Monitoring Operations

The APCD attempts to operate all of its monitors for, at least, a full calendar year, beginning sampling operations of new monitors in January and terminating existing monitors in December. Circumstances both in and out of the APCD's control can make that desired schedule difficult to achieve. In addition, the APCD does not own either the land or the buildings where most of the monitors are located, and it is becoming increasingly difficult to get property owner's permission for use due to perceived risk. Building roof remodeling and demolition projects can also lead to a loss of sampling time and access to locations.

When modifications to the State and Local Air Monitoring Station (SLAMS) network are required, the APCD will provide the appropriate modification forms prior to any implementation to EPA Region 8 for their approval. All currently operating SLAMS monitors have been approved by EPA. With the exception of some vegetation issues or tall trees, of which APCD has received waivers from EPA, all sites currently meet the requirements set forth in 40 CFR 58, Appendices A, C, D, and E.

1.1.3 Network Modification Procedures

The APCD develops changes to its monitoring network in several ways. In the past, new monitoring locations have been added as a result of community concerns about air quality. Other monitors have been established as a result of special studies, such as the O_3 monitoring in Aurora, Rifle, Cortez, Palisade, and Black Hawk.

The most common reasons for monitors being removed from the network are that either the land or building is modified, such that the site no longer meets current EPA siting criteria, the property ownership changes, or the area surrounding the monitor is being modified in a way that necessitates a change in the monitoring location. A current example of this is the Tri-County Health Department site, which was relocated to the Birch Street location nearby due to a roofing project and some access issues at the property during 2020. Monitors are also removed from the network after review of the data shows that the levels have dropped to the point where it is no longer necessary to continue monitoring at that

location or if the data obtained from a site is redundant with another monitoring site or if access to the site becomes too restrictive. For example, the Welch site was closed in 2020 and relocated to Evergreen because this monitor was redundant with other ozone monitoring sites in the Denver Metro/North Front Range Region.

Finally, all monitors are reviewed on a regular basis to determine if they are continuing to meet their monitoring objectives. If the population, land use, or vegetation around the monitor has changed significantly since the monitor was established, a more suitable location for the monitor may be examined. An example of this is the O_3 monitor previously located at the Aspen Park monitoring site, which was shut down on September 16, 2019 and relocated to the Black Hawk monitoring station. A detailed scientific evaluation of the present monitoring network configuration can be found in the APCD's 2020 Ambient Air Monitoring Network Assessment.[1]

1.1.4 Description of Monitoring Regions in Colorado

The state has been divided into eight multi-county areas that are generally based on topography and have similar airshed characteristics. These areas are the Central Mountains, Denver Metro/North Front Range, Eastern High Plains, Pikes Peak, San Luis Valley, South Central, Southwestern, and Western Slope regions. Figure 1.1 shows the approximate boundaries of these regions.

A map of APCD air quality monitoring stations is shown in Figure 1.3 and the parameters monitored at each location are given in Table 1.2. Detailed site descriptions can be found in Appendix A.

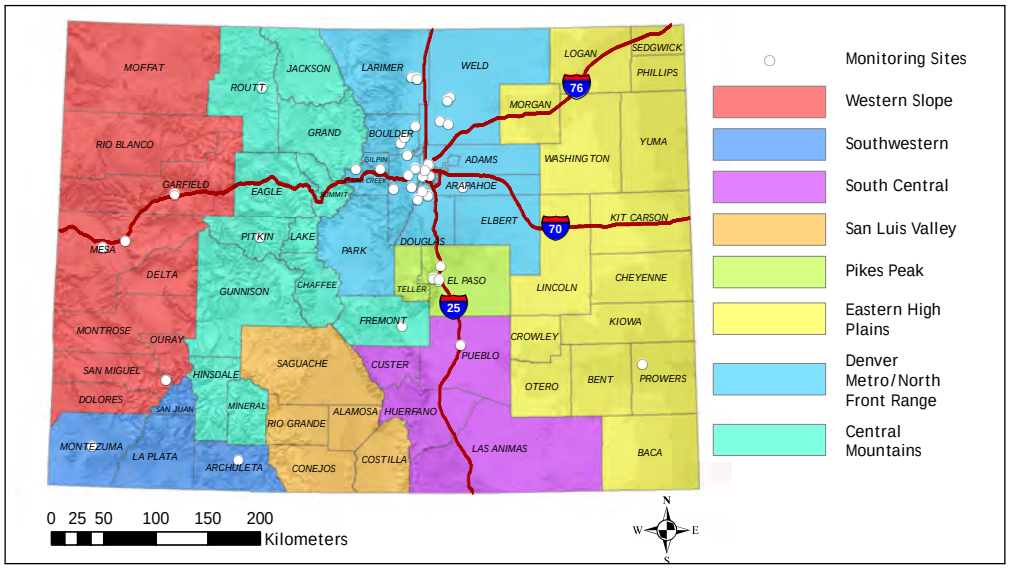


Figure 1.1: Counties and multi-county monitoring regions discussed in this report.

1.1.4.1 Central Mountains Region

The Central Mountains region consists of 12 counties in the central area of the state. The Continental Divide passes through much of this region. Mountains and mountain valleys are the dominant landscape features. Leadville, Steamboat Springs, Cañon City, Salida, Buena Vista, and Aspen represent the larger communities. The population of this region is approximately 242,137, according to the 2020 U.S. Census. Skiing, tourism, ranching, mining, and correctional facilities are the primary industries. The Black Canyon of the Gunnison National Park is located in this region. All of the area complies with federal air quality standards.

The primary monitoring concern in this region is centered around particulate pollution from wood burning and road dust. During 2021, there were three particulate monitoring sites operated by the APCD in the Central Mountains region (Aspen, Steamboat Springs, and Cañon City). APCD does not currently operate any gaseous monitors in this region.

[1] http://www.colorado.gov/airquality/tech_doc_repository.aspx

1.1.4.2 Denver Metro / North Front Range Region

The Denver Metro/North Front Range region includes Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, Elbert, Gilpin, Jefferson, Larimer, Park, and Weld counties. This 13 county region comprises the largest population base in the state of Colorado with approximately 4,016,921 people living in the area, according to the 2020 U.S. Census. This region includes Rocky Mountain National Park and several other wilderness areas.

Since 2002, the region complied with all NAAQS, except for ozone. The area has been exceeding the EPA's current ozone standards since the early 2000s, and in 2007 was formally designated as a "nonattainment" area. This designation was re-affirmed in 2012 when the EPA designated the region as a "marginal" nonattainment area after a more stringent ozone standard was adopted in 2008. The Denver Metro / North Front Range region failed to attain the 2008 ozone standard and was moved up to the next level of classification, a "moderate" area in May of 2016. The EPA released a more stringent eight-hour ozone standard on October 1, 2015. Colorado submitted area designation recommendations for the eight-hour 2015 ozone standard in 2016, based on the data from the 2013-2015 monitoring period. The EPA finalized area designations for the 2015 eight-hour ozone standard of 0.070 ppm (70 ppb) nationwide in April of 2018, designating the Denver Metro/Northern Front Range region as nonattainment with a "marginal" area classification. In January 2020, EPA designated the Denver Metro/Northern Front Range area as a "serious" nonattainment area under the 2008 ozone standard. Due to high ozone levels recorded during July and August 2020, the area may be reclassified as "severe" under the 2008 standard and "moderate" under the 2015 standard.

In the past, the Denver-metropolitan area has violated health-based air quality standards for carbon monoxide and fine particles. In response, RAQC, CAQCC, and the APCD developed, adopted, and implemented air quality improvement plans to reduce each of these pollutants.

For the rest of the Northern Front Range, Fort Collins, Longmont, and Greeley were nonattainment areas for carbon monoxide in the 1980s and early 1990s, but have met the federal standards since 1995. Air quality improvement plans have been implemented for each of these communities.

There are currently 51 air quality and meteorological monitors at 26 individual sites in the Northern Front Range Region. There are six CO monitors, 16 O_3 monitors, seven NO_2 monitors, three SO_2 monitors, as well as six PM_{10} monitors, 13 $PM_{2.5}$ monitors, and 15 meteorological towers. There are also two air toxics monitoring sites, one located at CAMP, and one at Platteville. The CAMP site monitors urban air toxics, while the Platteville site monitors air toxics and ozone precursors in a region of oil and gas development. In addition, there is one site (DESCI) that measures visual range by use of a nephelometer and a transmissometer.

1.1.4.3 Eastern High Plains Region

The Eastern High Plains region encompasses the fifteen counties on the plains of eastern Colorado. The area is semiarid and often windy. The area's population is approximately 133,477, according to the 2020 U.S. Census. Its major population centers have developed around farming, ranching, and trade centers such as Sterling, Fort Morgan, Limon, La Junta, and Lamar. The agricultural base includes both irrigated and dry land farming. With concurrences by EPA on Exceptional Event Reports for high wind dust events submitted by the APCD, all of the Eastern High Plains region complies with federal air quality standards.

Historically, there have been a number of communities in the Eastern High Plains Region that were monitored for particulates and meteorology but not for any of the gaseous pollutants. In the northeast along the I-76 corridor, the communities of Sterling, Brush, and Fort Morgan have been monitored. Along the I-70 corridor, only the community of Limon has been monitored for particulates. Along the US-50/Arkansas River corridor, the Division has monitored for particulates in the communities of La Junta and Rocky Ford. These monitoring sites were all discontinued in the late 1970s through early 1990s after a review showed that the concentrations were well below the standards and trending downward.

There is currently one PM_{10} monitoring site in Lamar. As of 2015, with EPA concurrence, the APCD no longer operates a stand-alone background $PM_{2.5}$ monitoring site, but relies on data from the IMPROVE monitoring network. The IMPROVE monitors are an EPA/National Park Service network that operates in park and wilderness areas, with a focus on monitoring visual air quality (visibility).

1.1.4.4 Pikes Peak Region

The Pikes Peak region includes El Paso and Teller counties. The area has a population of approximately 756,489, according to the 2020 U.S. Census. Eastern El Paso County is rural prairie, while the western part of the region is mountainous. The U.S. Government is the largest employer in the area, and major industries include Fort Carson and the U.S. Air Force Academy in Colorado Springs, which are both military installations. Aerospace and technology are also large employers in the area. All of the area is currently in compliance with federal air quality standards. Two exceedances of the SO_2 standard were observed at the Highway 24 site during 2014-2015; however, these elevated values have not yet resulted in a violation of the NAAQS and SO_2 concentrations have been trending downward at the Highway 24 site since 2016.

Currently, there is one CO monitor, one SO_2 monitor, and two O_3 monitors in the Pikes Peak region, as well as one PM_{10} monitor, one $PM_{2.5}$ monitor, and one meteorological site. Most of these monitors are located in the populous city of Colorado Springs.

1.1.4.5 San Luis Valley Region

Colorado's San Luis Valley region is located in the south central portion of Colorado and is comprised of a broad alpine valley situated between the Sangre de Cristo Mountains on the northeast and the San Juan Mountains of the Continental Divide to the west. The valley is some 114 km wide and 196 km long, extending south into New Mexico. The average elevation is 2290 km. Principal towns include Alamosa, Monte Vista, and Del Norte. The population of this area is approximately 46,150, according to the 2020 U.S. Census. Agriculture and tourism are the primary industries. The valley is semiarid and croplands of potatoes, head lettuce, and barley are typically irrigated. The valley is home to Great Sand Dunes National Park.

There are currently no APCD air monitoring operations active in this region. PM monitoring in the city of Alamosa was discontinued at the end of 2018 due to the low concentrations observed there.

1.1.4.6 South Central Region

The South Central region is comprised of Pueblo, Huerfano, Las Animas, and Custer counties. Its population is approximately 194,758, according to the 2020 U.S. Census. Population centers include Pueblo, Trinidad, and Walsenburg. The region has rolling semiarid plains to the east and is mountainous to the west. All of the area complies with federal air quality standards. In the past the APCD has conducted particulate monitoring in both Walsenburg and Trinidad, but that monitoring was discontinued in 1979 and 1985, respectively, due to low concentrations.

There are currently two particulate monitors (one PM_{10} monitor and one $PM_{2.5}$ monitor) operated in the South Central Region, both at a site located in the city of Pueblo.

1.1.4.7 Southwestern Region

The Southwestern region includes the Four Corners area counties of Montezuma, La Plata, Archuleta, and San Juan. The population of this region is approximately 98,122, according to the 2020 U.S. Census. The landscape includes mountains, plateaus, high valleys, and canyons. Durango and Cortez are the largest towns, while lands of the Southern Ute and Ute Mountain Ute tribes make up large parts of this region. The region is home to Mesa Verde National Park. Tourism and agriculture are the dominant industries, although the oil and gas industry is becoming increasingly important. All of the area complies with federal air quality standards.

There are currently two monitoring stations in the Southwestern region, one O_3 site in Cortez and one PM_{10} site located in Pagosa Springs. PM monitoring in the city of Durango was discontinued at the end of 2018.

1.1.4.8 Western Slope Region

The Western Slope region includes nine counties on the far western border of Colorado. A mix of mountains on the east, and mesas, plateaus, valleys, and canyons to the west form the landscape of this region. Grand Junction is the largest urban area, and other cities include Telluride, Montrose, Delta, Rifle, Glenwood Springs, Meeker, Rangely, and Craig. The population of this region is approximately 325,155, according to the 2020 U.S. Census. Primary industries include ranching, agriculture, mining, energy development, and tourism. Dinosaur and Colorado National Monuments

are located in this region. The Western Slope, along with the Central Mountains, are projected to be the fastest growing areas of Colorado through 2020 with greater than two percent annual population increases, according to the Colorado Department of Local Affairs. All of the area complied with federal air quality standards during 2021.

Currently, there are two ozone monitoring sites and two particulate monitoring sites in the Western Slope region operated by the APCD. The APCD also works with the EPA to monitor air toxics at the Grand Junction - Pitkin site as part of the EPA's National Air Toxics Trends Stations (NATTS) monitoring network.

1.1.5 Statewide Population Statistics

Table 1.1 is a listing of the projected population statistics by county based on the 2020 U.S. Census. Counties have been grouped by Metropolitan Statistical Area (MSA) and by the multi-county monitoring regions described above.

Population growth in Colorado over time is plotted in Figure 1.2, which shows actual population values in each multi-county monitoring region for the period 1970-2020 and U.S. Census Bureau projections for the period 2021-2030.

Table 1.1: Population estimates and projections by county and Metropolitan Statistical Area (MSA).

Region/MSA/County	Actual Population	Projected Population		Avg. Annual Change (%)	
	2020	*2025*	*2030*	*2020-25*	*2020-30*
COLORADO	***5,813,209***	***6,120,735***	***6,544,591***	***1.1***	***1.3***
CENTRAL MOUNTAINS	**242,137**	**249,943**	**263,801**	**0.6**	**0.9**
Chaffee	20,397	21,099	22,295	0.7	0.9
Eagle	55,390	57,953	61,862	0.9	1.2
Fremont	47,413	47,369	48,246	-0.0	0.2
Grand	15,719	16,545	17,675	1.1	1.2
Gunnison	17,522	17,988	18,703	0.5	0.7
Hinsdale	827	868	914	1.0	1.1
Jackson	1,367	1,307	1,272	-0.9	-0.7
Lake	8,095	8,358	8,799	0.6	0.9
Mineral	764	805	828	1.1	0.8
Pitkin	17,591	17,614	17,909	0.0	0.2
Routt	25,929	27,845	30,882	1.5	1.9
Summit	31,123	32,192	34,416	0.7	1.1
DENVER METRO/NORTH FRONT RANGE	**4,016,921**	**4,242,183**	**4,543,600**	**1.1**	**1.3**
BOULDER	*328,006*	*334,735*	*351,743*	*0.4*	*0.7*
Boulder	328,006	334,735	351,743	0.4	0.7
DENVER-AURORA-LAKEWOOD	*2,996,432*	*3,153,963*	*3,351,783*	*1.1*	*1.2*
Adams	523,709	558,063	612,890	1.3	1.7
Arapahoe	661,363	695,723	733,504	1.0	1.1
Broomfield	71,803	81,029	91,058	2.6	2.7
Clear Creek	9,750	9,971	10,518	0.5	0.8
Denver	735,822	773,264	818,733	1.0	1.1
Douglas	356,811	381,544	408,671	1.4	1.5
Elbert	27,286	31,130	35,970	2.8	3.2
Gilpin	6,185	6,141	6,091	-0.1	-0.2
Jefferson	584,725	597,384	613,270	0.4	0.5
Park	18,978	19,714	21,078	0.8	1.1
FORT COLLINS	*360,937*	*384,222*	*415,248*	*1.3*	*1.5*
Larimer	360,937	384,222	415,248	1.3	1.5
GREELEY	*331,546*	*369,263*	*424,826*	*2.3*	*2.8*
Weld	331,546	369,263	424,826	2.3	2.8
EASTERN HIGH PLAINS	**133,477**	**136,040**	**138,920**	**0.4**	**0.4**
Baca	3,517	3,374	3,235	-0.8	-0.8
Bent	5,368	5,204	5,079	-0.6	-0.5
Cheyenne	1,819	1,813	1,801	-0.1	-0.1
Crowley	6,049	6,131	6,262	0.3	0.4
Kiowa	1,390	1,356	1,304	-0.5	-0.6

Table 1.1: Population estimates and projections by county and Metropolitan Statistical Area (MSA).

Region/MSA/County	Actual Population	Projected Population		Avg. Annual Change (%)	
	2020	*2025*	*2030*	*2020-25*	*2020-30*
Kit Carson	7,131	7,337	7,623	0.6	0.7
Lincoln	5,717	6,093	6,457	1.3	1.3
Logan	22,061	23,249	24,327	1.1	1.0
Morgan	28,900	30,256	31,994	0.9	1.1
Otero	18,151	17,801	17,290	-0.4	-0.5
Phillips	4,248	4,176	4,120	-0.3	-0.3
Prowers	12,084	11,881	11,764	-0.3	-0.3
Sedgwick	2,217	2,234	2,208	0.2	-0.0
Washington	4,721	4,851	4,916	0.6	0.4
Yuma	10,104	10,284	10,540	0.4	0.4
PIKES PEAK	**756,489**	**803,270**	**863,281**	**1.2**	**1.4**
COLORADO SPRINGS	*756,489*	*803,270*	*863,281*	*1.2*	*1.4*
El Paso	731,032	776,678	835,835	1.2	1.4
Teller	25,457	26,592	27,446	0.9	0.8
SAN LOUIS VALLEY	**46,150**	**46,912**	**47,832**	**0.3**	**0.4**
Alamosa	16,223	17,139	18,044	1.1	1.1
Conejos	8,136	8,059	8,113	-0.2	-0.0
Costilla	3,847	3,790	3,744	-0.3	-0.3
Rio Grande	11,138	11,106	11,099	-0.1	-0.0
Saguache	6,806	6,818	6,832	0.0	0.0
SOUTH CENTRAL	**194,758**	**198,081**	**206,613**	**0.3**	**0.6**
Custer	5,053	4,946	5,028	-0.4	-0.0
Huerfano	6,776	6,642	6,538	-0.4	-0.4
Las Animas	14,386	14,110	13,869	-0.4	-0.4
PUEBLO	*168,543*	*172,383*	*181,178*	*0.5*	*0.7*
Pueblo	168,543	172,383	181,178	0.5	0.7
SOUTHWESTERN	**98,122**	**104,556**	**113,027**	**1.3**	**1.5**
Archuleta	14,137	14,856	16,242	1.0	1.5
La Plata	56,970	61,520	66,972	1.6	1.8
Montezuma	26,294	27,461	29,097	0.9	1.1
San Juan	721	719	716	-0.1	-0.1
WESTERN SLOPE	**325,155**	**339,750**	**367,517**	**0.9**	**1.3**
Delta	31,108	31,497	32,952	0.3	0.6
Dolores	2,017	1,934	1,880	-0.8	-0.7
Garfield	60,795	64,517	70,422	1.2	1.6
GRAND JUNCTION	*155,574*	*163,040*	*177,574*	*1.0*	*1.4*
Mesa	155,574	163,040	177,574	1.0	1.4
Moffat	13,181	13,039	13,032	-0.2	-0.1
Montrose	42,999	45,558	50,355	1.2	1.7
Ouray	4,931	5,028	5,204	0.4	0.6
Rio Blanco	6,260	6,176	6,120	-0.3	-0.2
San Miguel	8,290	8,961	9,978	1.6	2.0

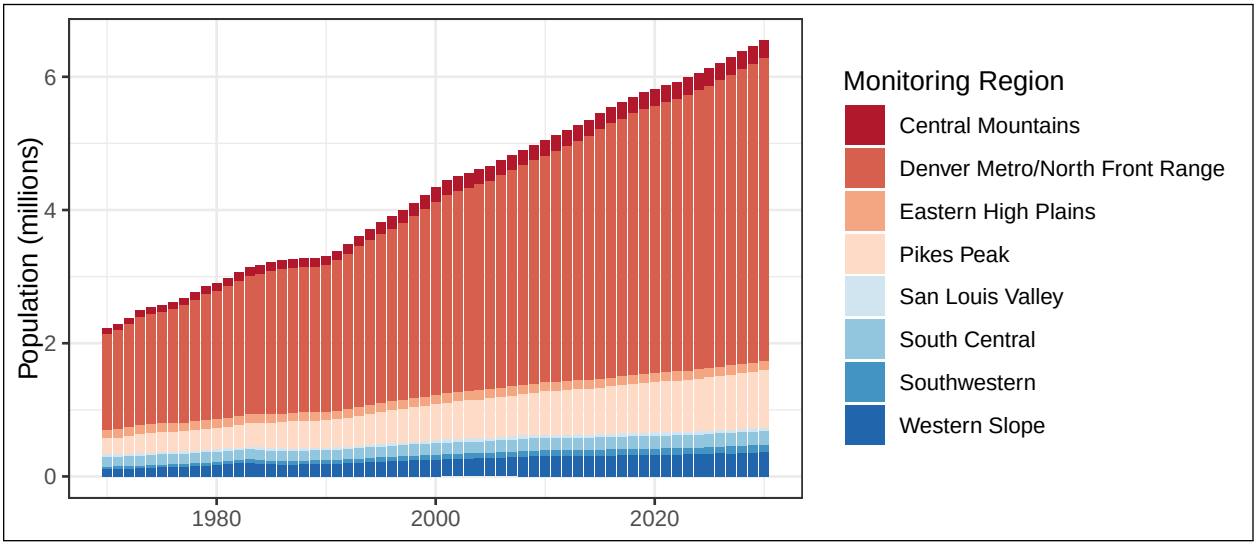


Figure 1.2: Population in Colorado from 1970 to 2030.

1.1.6 Monitoring Site Locations and Parameters Monitored

Table 1.2: Summary of parameters monitored at APCD monitoring sites discussed in this report.

AQS Site Number	Site Name	County	Parameters Monitored						
			O_3	CO	NO_2	SO_2	PM_{10}	$PM_{2.5}$	Met
08-001-0010	Birch Street	Adams					X	X	
08-001-3001	Welby	Adams	X	X	X	X	X		X
08-005-0002	Highlands	Arapahoe	X						X
08-005-0005	Arapaho Community College (ACC)	Arapahoe						X	
08-005-0006	Aurora - East	Arapahoe	X						X
08-007-0001	Pagosa Springs School	Archuleta					X		
08-013-0003	Longmont - Municipal Bldg.	Boulder					X	X	
08-013-0012	Boulder Chamber of Commerce (CC)	Boulder					X	X	
08-013-0014	Boulder Reservoir	Boulder	X						X
08-019-0006	Mines Peak	Clear Creek	X						
08-031-0002	CAMP	Denver	X	X	X	X	X	X	X
08-031-0013	National Jewish Health (NJH)	Denver						X	
08-031-0026	La Casa	Denver	X	X	X	X	X	X	X
08-031-0027	I-25: Denver	Denver		X	X			X	X
08-031-0028	I-25: Globeville	Denver			X			X	X
08-035-0004	Chatfield State Park	Douglas	X					X	X
08-041-0013	U.S. Air Force Academy (USAFA)	El Paso	X						
08-041-0015	Highway 24	El Paso		X		X			X
08-041-0016	Manitou Springs	El Paso	X						
08-041-0017	Colorado College	El Paso					X	X	
08-043-0003	Cañon City - City Hall	Fremont					X		
08-045-0012	Rifle - Health Dept.	Garfield	X						
08-047-0003	Black Hawk	Gilpin	X						X
08-059-0006	Rocky Flats - N.	Jefferson	X		X				X
08-059-0011	NREL	Jefferson	X						
08-059-0014	Evergreen	Jefferson	X						X
08-069-0009	Fort Collins - CSU	Larimer						X	
08-069-0011	Fort Collins - West	Larimer	X						
08-069-1004	Fort Collins - Mason	Larimer	X	X					X
08-077-0017	Grand Junction - Powell Bldg.	Mesa					X	X	
08-077-0018	Grand Junction - Pitkin	Mesa							X
08-077-0020	Palisade Water Treatment	Mesa	X						X
08-083-0006	Cortez - Health Dept.	Montezuma	X						
08-097-0008	Aspen	Pitkin					X		
08-099-0002	Lamar - Municipal Bldg.	Prowers					X		
08-101-0015	Pueblo - Fountain School	Pueblo					X	X	
08-107-0003	Steamboat Springs	Routt					X		
08-113-0004	Telluride	San Miguel					X		
08-123-0006	Greeley - Hospital	Weld						X	
08-123-0008	Platteville - Middle School	Weld						X	
08-123-0009	Greeley - Weld County Tower	Weld	X	X					X
08-123-0013	Platteville Atmospheric Observatory (PAO)	Weld	X		X				X

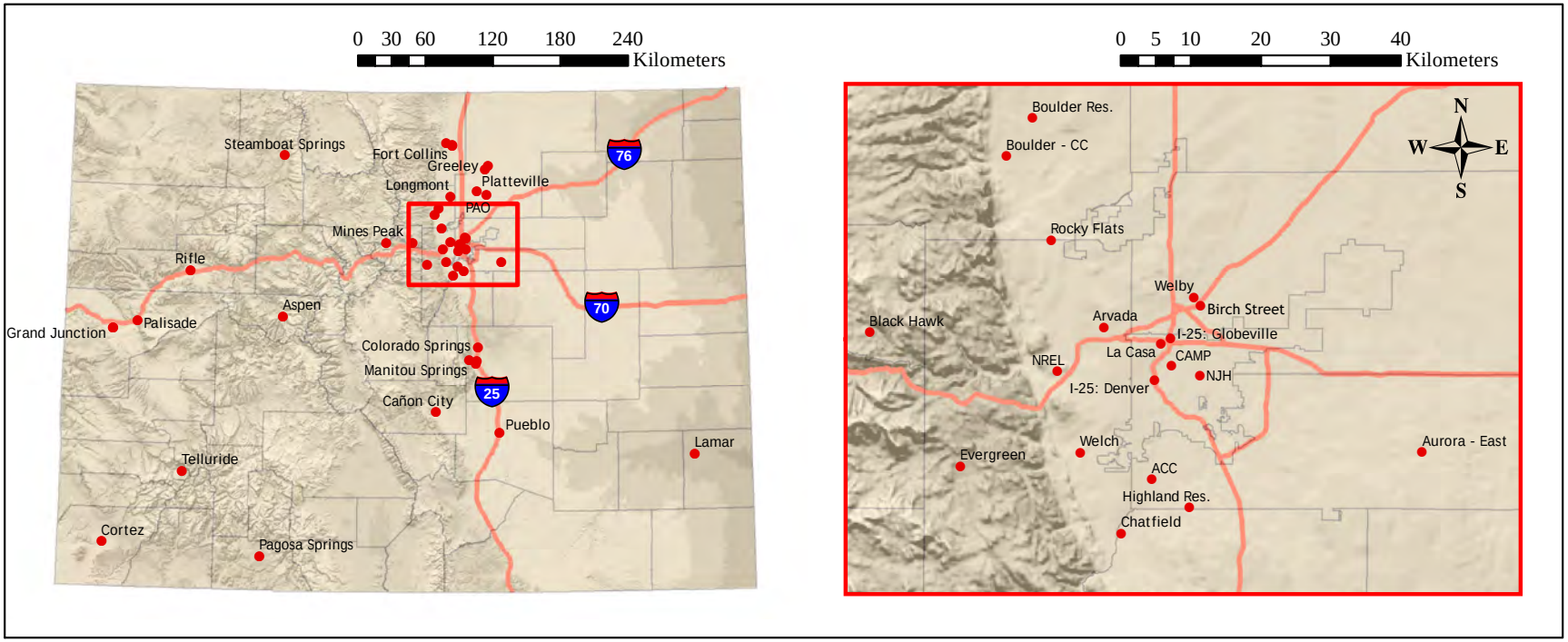


Figure 1.3: Map of Colorado with an inset map of the Denver metropolitan area showing the location of all monitoring sites operated by the APCD and listed in Table 1.2. For the purpose of improving the readability of the map, labels for monitoring sites in Fort Collins, Grand Junction, and Colorado Springs have been combined under a single label. Detailed site information, including AQS identification numbers, site descriptions and histories, addresses and coordinates, monitoring start dates, site elevations, site orientation/scale designations, etc., can be found in Appendix A of this document. The Arvada meteorological monitoring site was closed on 12/31/2021.

2

Carbon Monoxide (CO)

In 2022, the APCD will operate seven CO monitors. Currently, the NAAQS for CO are primary standards, with a concentration level not to exceed 9 parts per million (ppm) in an eight-hour time period or 35 ppm in a one-hour period. There is no secondary standard for CO. CO levels have declined from a statewide maximum eight-hour value of 48.1 ppm in 1973 to a value of 2.0 ppm in 2021. The level of the standard has not been exceeded since 1999. The CO monitors currently operated by the APCD are associated both with State Maintenance Plan requirements and EPA requirements under the Code of Federal Regulations (CFR). However, the EPA has revised the minimum requirements for CO monitoring by requiring CO monitors to be sited near roads in certain urban areas. They are requiring a CO monitor to be located at one near-roadway NO_2 monitoring site. EPA is also specifying that monitors required in metropolitan areas of 2.5 million or more persons are to be operational by January 1, 2015, and that monitors required in Core-Based Statistical Areas (CBSAs) of one million or more persons are required to be operational by January 1, 2017. Currently, a CO monitor is located at the I-25 Denver near roadway NO_2 site to satisfy these requirements.

2.1 Denver Metro/North Front Range Region

The three major urban centers in the North Front Range Region include the greater Denver Metro area, and the Fort Collins and Greeley areas located in Larimer and Weld counties, respectively. Mobile sources are the main contributor to elevated CO in the Front Range region. However, controlled burns,wild fires, and biogenic influences, including oil and gas development, may also contribute to elevated CO levels. Weld County is also located in an area of significant oil and gas development. Table 2.1 lists the first and second maximum one-hour and eight-hour CO concentrations recorded in 2021 for the Denver Metro/North Front Range region.

Table 2.1: Summary of CO values recorded at monitoring stations in the Denver Metro / Northern Front Range region during 2021.

Site Name	County	CO 1-Hour Average (ppm)		CO 8-Hour Average (ppm)	
		1^{st} Max.	2^{nd} Max.	1^{st} Max.	2^{nd} Max.
Welby	Adams	2.0	1.9	1.5	1.4
CAMP	Denver	2.4	2.3	1.8	1.4
La Casa	Denver	1.7	1.7	1.3	1.2
I-25 Denver	Denver	2.6	2.4	2.0	1.8
Fort Collins - Mason	Larimer	1.5	1.4	1.0	1.0
Greeley - County Tower	Weld	0.9	0.9	0.7	0.6

2.2 Pikes Peak Region

The Pikes Peak Region is a very popular tourist area with rapid urban growth. The first and second maximum one-hour and eight-hour CO concentrations recorded in 2021 at the Highway 24 site are shown in Table 2.2.

Table 2.2: Summary of CO values recorded at the Highway 24 (Colorado Springs) station during 2021.

Site Name	County	CO 1-Hour Average (ppm)		CO 8-Hour Average (ppm)	
		1^{st} Max.	2^{nd} Max.	1^{st} Max.	2^{nd} Max.
Highway 24	El Paso	1.9	1.9	1.1	1.1

2.3 Recent and Planned Changes in CO Monitoring

There are no planned changes to the CO network for 2022.

3

Ozone (O_3)

In March 2008, the U.S. EPA promulgated a new level of the NAAQS for O_3 of 0.075 ppm as an annual fourth-highest daily maximum eight-hour concentration, averaged over three years. This made a significant change in the number of O_3 monitors that violated the standard at the time. On October 2015, the EPA again strengthened the NAAQS for ground level ozone to 0.070 ppm (effective December 28^{th}, 2015). The APCD currently operates fourteen sites that have three-year design values (2019-2021) in excess of the current eight-hour O_3 NAAQS standard of 0.070 ppm.These sites are all located in the Front Range region and are: Welby (0.072), Highlands (0.080), Aurora East (0.073), Boulder Reservoir (0.075), CAMP (0.072), La Casa (0.075), Chatfield (0.083), Manitou Springs (0.073), Air Force Academy (0.073), Black Hawk (0.074), Rocky Flats North (0.081), NREL (0.083), Fort Collins West (0.077), and Greeley (0.071).

EPA's monitoring requirements for O_3 include placing a certain number of monitors in areas with high populations. For example, in Metropolitan Statistical Areas (MSAs) with a population greater than ten million people, EPA recommends the placement of at least four monitors in areas with design value concentrations that are greater than or equal to 85% of the O_3 standard. The largest MSA in Colorado is the Denver-Aurora-Lakewood Primary Metropolitan Statistical Area (PMSA). This PMSA includes the counties of Adams, Arapahoe, Broomfield, Clear Creek, Denver, Douglas, Elbert, Gilpin, Jefferson, and Park. There are seven different MSAs in Colorado. Table 3.1 below lists EPA's O_3 monitoring requirements. Each MSA is discussed further in the following subsections.

Table 3.1: EPA's minimum ozone monitoring requirements.

MSA Population	**Most recent 3-year design value concentrations > 85% of any O_3 NAAQS**	**Most recent 3-year design value concentrations < 85% of any O_3 NAAQS**
>10 million	4	2
4 - 10 million	3	1
350,000 - 4 million	2	1
50,000 - 350,000	1	0

3.1 Denver Metro/North Front Range Region

Emissions from industrial facilities and electric utilities, oil and gas development, motor vehicle exhaust, gasoline vapors, and chemical solvents are some of the major sources of NO_x and Volatile Organic Compounds (VOCs) in the atmosphere. In the presence of sunlight, NO_x and VOCs chemically react to form ground level ozone. Table 3.2 lists the first and fourth maximum eight-hour O_3 concentrations recorded in 2021 for the Denver Metro/North Front Range region. Also listed are the current three-year design values for each site with enough data available to calculate them.

In the Denver Metro area, Adams, Arapahoe, Boulder, Denver, Douglas, and Jefferson counties have O_3 monitors.

Table 3.2: Summary of O_3 values recorded at monitoring stations in the Denver Metro / Northern Front Range region during 2021. Sites having three-year NAAQS values in excess of 70 ppb are indicated by asterisks.

Site Name	County	Ozone 8-Hour Average (ppb)		
		1^{st} Max.	4^{th} Max.	3-Year Ave. of 4^{th} Max. 8-Hr
Welby	Adams	82	79	72*
Highlands	Arapahoe	90	84	80*
Aurora East	Arapahoe	82	77	73*
Boulder Reservior	Boulder	89	82	75*
CAMP	Denver	81	77	72*
La Casa	Denver	92	83	75*
Chatfield State Park	Douglas	96	89	83*
Black Hawk	Gilpin	86	82	74*
Rocky Flats - N.	Jefferson	94	87	81*
NREL	Jefferson	94	89	83*
Evergreen	Jefferson	88	79	-
Fort Collins - West	Larimer	88	85	77*
Fort Collins - Mason	Larimer	80	76	69
Greeley - County Tower	Weld	82	76	71*

There are 14 monitors currently in operation in this area. There are two MSAs located in the Metropolitan Denver area. These are the Boulder MSA and the Denver-Aurora-Lakewood MSA, with populations of 328,006 and 2,996,432 respectively, according to the 2020 U.S. Census. Per EPA monitoring requirements, the Boulder MSA falls in the 50,000 to 350,000 population range and the Denver-Aurora-Lakewood MSA falls in the 350,000 to 4,000,000 range. The Boulder MSA therefore requires at least one monitor, and this requirement is satisfied by the monitor at Boulder Reservoir, which became operational in August of 2016. By EPA rules, the Denver-Aurora-Lakewood MSA requires at least two monitors. This requirement is satisfied by the remaining ten monitors that are placed throughout the Denver-Aurora-Lakewood MSA. The monitors located at Chatfield State Park, Rocky Flats - N., and NREL are the highest concentration monitors in the state.

Weld County is an area of significant oil and gas development, which potentially contributes to ozone forming compounds or "precursors" in the lower atmosphere. There are two MSAs located in Larimer and Weld counties. These are the Fort Collins MSA and the Greeley MSA, with populations of 360,937 and 331,546 respectively, according to the 2020 U.S. Census. Per EPA monitoring requirements, the Greeley MSA falls in the 50,000 to 350,000 population range and the Fort Collins MSA falls in the 350,000 to 4,000,000 range. The Greeley MSA therefore requires at least one monitor and the Fort Collins MSA requires at least two monitors. These requirements are satisfied by the monitors listed in Table 3.2. The monitor located at the Fort Collins West site is a highest concentration monitor for the Fort Collins MSA, while the Greeley - County Tower monitor serves the same purpose for the Greeley MSA.

Twelve of the O_3 monitors shown in Table 3.2 have three-year design values above the current eight-hour ozone NAAQS of 0.070 ppm (70 ppb): Welby, Highlands, Aurora East, Boulder Reservoir, CAMP, La Casa, Chatfield State Park, Black Hawk, Rocky Flats N., NREL, Fort Collins West, and Greeley - County Tower.

3.2 Pikes Peak Region

The first and fourth maximum eight-hour concentrations recorded in 2021 for each O_3 monitoring site in the Pikes Peak region are listed in Table 3.3 below. Also listed are the three year design values for each site.

The Colorado Springs MSA is the only MSA located in the Pikes Peak region. According to the 2020 U.S. Census, this MSA has a population of 756,489. Per EPA monitoring requirements the Colorado Springs MSA falls in the 350,000 to 4,000,000 range and therefore requires at least two monitors. This requirement is satisfied by the monitors at the U.S. Air Force Academy and at Manitou Springs.

Table 3.3: Summary of O_3 values recorded at monitoring stations in the Pikes Peak region during 2021.

Site Name	County	Ozone 8-Hour Average (ppm)		
		1^{st} Max.	4^{th} Max.	3-Year Ave. of 4^{th} Max.
U.S. Air Force Academy	El Paso	82	75	73*
Manitou Springs	El Paso	82	78	73*

3.3 Western Slope Region

The first and fourth maximum eight-hour O_3 concentrations recorded in 2021 in the Western Slope region are listed in Table 3.4 below.

Table 3.4: Summary of O_3 values recorded at monitoring stations in the Western Slope region during 2021.

Site Name	County	Ozone 8-Hour Average (ppm)		
		1^{st} Max.	4^{th} Max.	3-Year Ave. of 4^{th} Max.
Rifle - Health Dept.	Garfield	72	65	61
Palisade Water Treatment	Mesa	73	68	65

The Grand Junction MSA is the only MSA located on the Western Slope. The Grand Junction MSA includes all of Mesa County and has a population of 155,574 according to the 2020 U.S. Census. Per EPA monitoring requirements, this MSA falls in the 50,000 to 350,000 population range, and thus requires one O_3 monitor. The monitor at the Palisade site satisfies this requirement, as well as the highest concentration monitor requirement.

3.4 Southwestern Region

The first and fourth maximum eight-hour concentrations recorded in 2021 at the Cortez - Health Dept. O_3 monitoring site are listed in Table 3.5 below. This is the only O_3 monitor located in the Southwestern Region.

Table 3.5: Summary of O_3 values recorded at the monitoring station in the Southwest region during 2021.

Site Name	County	Ozone 8-Hour Average (ppm)		
		1^{st} Max.	4^{th} Max.	3-Year Ave. of 4^{th} Max.
Cortez - Health Dept.	Montezuma	71	65	62

3.5 Recent and Planned Changes in O_3 Monitoring

The APCD is planning to commence ozone monitoring in the city of Pueblo. Planning and site selection are underway.

4

Nitrogen Dioxide/Reactive Oxides of Nitrogen (NO_2/NO_y)

Currently, there are seven $NO_2/NO_x/NO_y$ monitoring locations in operation in the Denver Metro/North Front Range Region, three of which are relatively new sites. The Denver CAMP monitor exceeded the annual average NO_2 standard (53 ppb) in 1977 and the Welby monitor has never exceeded the standard. Concentrations have shown a gradual decline over the past 20 years and during the last decade the trend has been nearly flat, averaging between 20 and 30 ppb.

In January 2010, the EPA set a new primary one-hour NO_2 NAAQS that is in addition to the annual standard. The new standard, both primary and secondary, of 100 ppb is based on the three-year average of the 98^{th} percentile of the yearly distribution of daily maximum one-hour concentrations.

The APCD began monitoring for NO_y at the La Casa NCore site in January 2013. NCore sites are part of a national EPA network that monitors multiple pollutants at certain "core" sites around the country. NO_y monitoring is a requirement for an NCore station, but there are no standards for NO_y. The EPA has also established requirements for an NO_2 monitoring network that will include monitors at locations where maximum NO_2 concentrations are expected to occur, including within 50 meters of major roadways, as well as monitors sited to measure the area-wide NO_2 concentrations that occur more broadly across communities. Per these requirements, at least one monitor must be located near a major road in any urban area with a population greater than or equal to 500,000 people. A second monitor is required near another major road in areas with either: (1) population greater than or equal to 2.5 million people, or (2) one or more road segments with an annual average daily traffic count greater than or equal to 250,000 vehicles. A second near roadway site was installed and began NO_2 monitoring in October 2015 at 4905 Acoma St. to satisfy the requirement for a second near-roadway site. In addition to the near roadway monitoring, there must be one monitoring station in each CBSA with a population of one million or more persons to monitor a location of expected highest NO_2 concentrations representing the neighborhood or larger spatial scales. The CAMP site satisfies the requirement for the neighborhood highest representative concentration site.

4.1 Denver Metro/North Front Range Region

The annual mean and 98^{th} percentile one-hour concentrations recorded in 2021 for each NO_2 monitoring site in the Denver Metro/North Front Range region are listed in Table 4.1 below. Also listed are the three year design values for each site. The APCD currently monitors NO_2 only in this region. All of these monitors show values that are well below both the annual average NAAQS of 53 ppb and the one-hour NAAQS of 100 ppb.

The APCD commenced NO_2 monitoring at the Rocky Flats - N. site on 2/1/2019 per PAMS monitoring requirements, so the three-year design value is not currently valid for this site.

4.2 Recent and Planned Changes in NO_2/NO_y Monitoring

There are no planned changes to the NO_2 network for 2022.

Table 4.1: Summary of NO_2 values recorded at monitoring stations in the Denver Metro / Northern Front Range region during 2021.

Site Name	County	NO_2 (ppb)		
		Annual Mean	98^{th} Percentile	3-Year Ave. of 98^{th} Percentile
Welby	Adams	15.4	54.5	58
CAMP	Denver	15.4	62.2	65
La Casa	Denver	15.9	58.6	59
I-25 Denver	Denver	21.3	59.4	64
I-25 Globeville	Denver	26.0	71.1	70
Rocky Flats - N.	Jefferson	2.6	25.2	26
PAO	Weld	5.7	42.2	-

5

Sulfur Dioxide (SO_2)

Currently, there are four SO_2 monitoring locations within the APCD's network. A new one-hour primary standard was finalized in June 2010. To attain that standard, the three-year average of the 99^{th} percentile of daily maximum one-hour averages at each monitor within an area must not exceed 75 ppb. The secondary NAAQS is a three-hour average not to exceed 500 ppb more than once per year. In the past, SO_2 had never approached the level of any of the standards until an SO_2 analyzer was added at the Highway 24 site in Colorado Springs in 2013; this site exceeded the level of the one-hour standard in 2013 on 3/22/13 and 4/16/13 (one-hour concentrations of 99 ppb and 81 ppb, respectively), again on 7/3/2014 (82 ppb), and once again on 3/29/2015 (87 ppb). Each exceedance of the standard was a single occurrence of a concentration above the specified NAAQS concentration and did not take into account the three-year averaging period necessary to determine compliance with the standard. Since the installation in 2013, the Highway 24 site has not had an actual violation of the SO_2 standard when calculating the 99^{th} percentile across the three-year window. The 2013-2015 three-year design value was 56 ppb at this location, which is below the 75 ppb standard level. Examination of wind direction and speed in combination with higher concentrations of SO_2 at the site indicated the Martin Drake Power Plant as one potential source. Working with the APCD, Colorado Springs Utilities (CSU) completed meteorological monitoring at its Martin Drake Power Plant from October 2015 through January 2017. The division coordinated with CSU to conduct SO_2 modeling using this validated on-site meteorological data. CSU submitted modeling that followed an approved Division and EPA modeling protocol. This protocol process included Division and EPA review as well as public comment. Results from this study, which considered a number of different scenarios, demonstrated current compliance with the one-hour SO_2 NAAQS. The APCD also monitors meteorology at the Highway 24 site. The current three-year design value (2019-2021) for the Highway 24 site in Colorado Springs is 9 ppb, well below the 75 ppb standard.

SO_2 monitoring requirements include the need for calculating a Population Weighted Emissions Index (PWEI). This figure is calculated for each MSA by multiplying the population of the MSA by the SO_2 emissions for that MSA and dividing by 1 million. This PWEI value is then used to determine areas in need of SO_2 monitoring. A sum of the most recent emissions data by county give a total for SO_2 emissions of 15,235 tons per year for the Denver PMSA. The calculated PWEI for this region is 37,930 million persons-tons per year. This indicates the need for one SO_2 monitor in the Denver-Aurora-Lakewood MSA according to EPA monitoring requirements.

Using the same calculation for the Colorado Springs MSA, the calculated PWEI is 8,207 million persons-tons per year. Because of the increase in population in Colorado Springs, there is a need for one SO_2 monitor in this MSA. The monitors listed in the sections below meet these requirements.

5.1 Denver Metro/North Front Range Region

The annual mean and 99^{th} percentile one-hour daily maximum concentrations recorded in 2021 for each SO_2 monitoring site in the Denver Metro/North Front Range region are listed in Table 5.1 below. Also listed are the three year design values for each site.

Table 5.1: Summary of SO_2 values recorded at monitoring stations in the Denver Metro/Northern Front Range region during 2021.

Site Name	County	SO_2 (ppb)		
		Annual Mean	99^{th} Percentile	3-Year Ave. of 99^{th} Percentile
Welby	Adams	0.67	6	6
CAMP	Denver	0.42	6	6
La Casa	Denver	0.45	7	7

5.2 Pikes Peak Region

In January of 2013 an SO_2 monitor was added to the Highway 24 monitoring station in Colorado Springs.

Table 5.2: Summary of SO_2 values recorded at the Highway 24 monitoring site in Colorado Springs during 2021.

Site Name	County	SO_2 (ppb)		
		Annual Mean	99^{th} Percentile	3-Year Ave. of 99^{th} Percentile
Highway 24	El Paso	0.83	10	9

5.3 Planned Changes in SO_2 Monitoring

There are no planned changes in 2022 for the SO_2 monitoring network at this time.

6

Particulate Matter (PM)

Sources of suspended particulate matter in ambient air include mobile and stationary sources (i.e., diesel trucks, wood burning stoves, power plants, etc). Several industrial and manufacturing processes also contribute to elevated particulate levels. There are also a variety of agricultural sources of PM including feed lots, grazing, tilling, etc. Suspended particulates in the atmosphere vary widely in their chemical and physical composition. Particulate matter can be directly emitted or can be formed in the atmosphere when gaseous pollutants react to form particles.

Particle size is the factor most directly linked to the health impacts of atmospheric PM. Particles of less than 10 micrometers (μm) in aerodynamic diameter (PM_{10}) are inhalable and thus pose a health threat. Particles less than 2.5 μm in aerodynamic diameter ($PM_{2.5}$) can penetrate deeply into the alveoli, while the smallest particles, such as those less than 0.1 μm in aerodynamic diameter (ultrafine particles), can penetrate all the way into the bloodstream. Exposure to such particles can affect the lungs, the heart, and the cardiovascular system. Particles with diameters between 2.5 μm and 10 μm ($PM_{10\text{-}2.5}$) represent less of a health concern, although they can irritate the eyes, nose, and throat, and cause serious harm due to inflammation in the airways of people with respiratory diseases such as asthma, chronic obstructive pulmonary disease, and pneumonia. Note that PM_{10} encompasses all particles smaller than 10 μm, including the $PM_{2.5}$ and ultrafine fractions.

Currently the APCD operates PM_{10} monitors at 15 different locations. Eleven of these sites use high-volume filter based instruments, four sites use low-volume filter based instruments, and eight sites have continuous monitors collocated with FRM (filter based) instruments. There are two sites with collocated high-volume samplers (CAMP and Longmont), and two sites with collocated low volume PM_{10} samplers (La Casa and Grand Junction - Powell). The PM_{10} NAAQS is a 24-hour average of 150 $\mu g\ m^{-3}$ not to be exceeded more than once per year on average over a three-year period. This average is also based on the monitoring frequency and the percent of valid data collected at a site.

$PM_{2.5}$ concentration values are reported in four different categories of readings by the APCD. Data from instruments sampling according to the Federal Reference Method (FRM) are reported with an 88101 parameter code, data from continuous samplers that reasonably compare to the FRM are reported with the 88500 parameter code, data from continuous samplers that don't compare reasonably to the FRM are reported with the 88501 parameter code, and speciation data is reported with the 88502 parameter code. Currently, there are 16 filter-based $PM_{2.5}$ FRM instruments at 9 sites. Of the 9 sites, six are collocated with a continuous instrument and one is collocated with another filter-based FRM; six sites (National Jewish Hospital, I-25: Globeville, Fort Collins CSU, Grand Junction Powell, Greeley Hospital, Colorado College) have continuous $PM_{2.5}$ but no filter-based FRM. Speciation analysis (laboratory analysis of $PM_{2.5}$ samples to characterize the different components of $PM_{2.5}$ in the atmosphere) is conducted at three sites; La Casa, Platteville, and Birch Street. All three speciation sites are collocated with a low volume filter based FRM.

The annual $PM_{2.5}$ standard of 12 $\mu g\ m^{-3}$ is compared to the three-year average annual mean $PM_{2.5}$ concentration. The 24-hour $PM_{2.5}$ standard of 35 $\mu g\ m^{-3}$ is compared to the three-year average of the annual 98^{th} percentile value.

6.1 Continuous PM Monitoring

All Federal Reference Method (FRM) monitors in the Colorado $PM_{2.5}$ network were in the past compared to the NAAQS. The FRM monitors are all filter based 24-hour composite samplers. Due to advances in continuous particulate monitoring technology, the APCD now uses continuous PM monitors to compare to the $PM_{2.5}$ NAAQS. The GRIMM EDM 180 and the Teledyne T640 have received Federal Equivalent Method (FEM) designation for $PM_{2.5}$ from the EPA. The sites that use these instruments to compare to the $PM_{2.5}$ NAAQS are: National Jewish Health (08-031-0013), I-25 Denver (08-031-0027), I-25 Globeville (08-031-0028), Colorado College (08-041-0017), Fort Collins CSU (08-069-0009), Grand Junction Powell Bldg. (08-077-0017), and Greeley - Hospital (08-123-0006). The APCD replaced the first TEOM at CAMP in April of 2013 with a GRIMM EDM 180. The APCD has determined the GRIMM EDM 180 and the T640 to be a very reliable and cost effective way to monitor ambient continuous particulate concentrations.

The APCD currently employs two (one PM_{10}) TEOM continuous particulate monitors for forecasting and advising the public of air quality alerts. The TEOM 1400ab with 8500 FDMS is a federally equivalent monitor; however frequent monitor problems and APCD concerns regarding equivalency designation have forced the APCD to consider these instruments not suitable for regulatory purposes. The Welby site currently has a TEOM continuous $PM_{2.5}$ monitor that is not intended for comparison with the NAAQS.

6.2 Community Monitoring Zones

Community monitoring zones are an additional method of defining an area for comparison with the $PM_{2.5}$ NAAQS where data from two or more monitoring sites are averaged together for comparison with the standard. Currently, the APCD does not employ this technique anywhere in the state.

The definition of community monitoring zone (CMZ) in 40 CFR Part 58.1 is as follows: “Community monitoring zone (CMZ) means an optional averaging area with established, well defined boundaries, such as county or census block, within a Monitoring Planning Area (MPA) that has relatively uniform concentrations of annual $PM_{2.5}$ as defined by appendix N of part 50 of this chapter. Two or more community oriented SLAMS monitors within a CMZ that meet certain requirements as set forth in appendix N of part 50 of this chapter may be averaged for making comparisons to the annual $PM_{2.5}$ NAAQS.” The CMZ is an optional technique that averages 24-hour $PM_{2.5}$ concentrations from two or more monitors located in the same community.

If the $PM_{2.5}$ monitoring network is changed by the creation/change of a CMZ or changing the location of a violating monitor, then the APCD will ask EPA Region VIII for approval via the current network modification process and then notify the appropriate governments of affected communities. The APCD will also provide the proposed changes to the affected communities and concerned citizens on our website. A public comment period will be open for thirty days prior to the APCD selecting a new site.

6.3 Denver Metro/North Front Range Region

There were no violations of the PM_{10} NAAQS in the Denver Metro/North Front Range region during 2021; however, three sites (Longmont, NJH, and Chatfield State Park) recorded 24-hour $PM_{2.5}$ design values in exceedance of the 24-hour standard of 35 $\mu g\ m^{-3}$. Table 6.1 and Table 6.2 below list the PM_{10} and $PM_{2.5}$ annual averages and design values recorded at each site in this region in 2021. The Birch Street monitor has only been in operation since March 2021, so the design values for this site are not valid for NAAQS comparison.

Table 6.1: Summary of PM_{10} values recorded at monitoring stations in the Denver Metro/Northern Front Range region during 2021.

Site Name	County	PM_{10} ($\mu g\ m^{-3}$)		
		Annual Average	24-Hr Max	3-Year Exceedances
Birch Street	Adams	36.6	104	0
Welby	Adams	38.7	96	0
Longmont	Boulder	22.0	59	0
Boulder Chamber of Comm.	Boulder	21.3	55	0
CAMP	Denver	29.8	64	0
La Casa	Denver	23.7	64	0

Table 6.2: Summary of $PM_{2.5}$ values recorded at monitoring stations in the Denver Metro/Northern Front Range region during 2021. Sites having three-year NAAQS values in excess of 35 $\mu g\ m^{-3}$ are indicated by asterisks.

Site Name	County	$PM_{2.5}$ ($\mu g\ m^{-3}$)		
		Annual Average	Annual 98^{th} Percentile	3-Year Ave. of 98^{th} Percentile
Birch Street	Adams	10.3	29.8	-
Arapaho Comm. College	Arapahoe	7.3	25.4	25
Longmont	Boulder	10.0	54.3	47*
Boulder Chamber of Comm.	Boulder	7.0	24.5	25
CAMP	Denver	8.0	27.1	26
National Jewish Health	Denver	9.7	36.7	33
La Casa	Denver	8.6	28.2	28
I-25 Denver	Denver	8.7	23.4	24
I-25 Globeville	Denver	10.1	30.7	30
Chatfield State Park	Douglas	7.9	41.2	36*
Fort Collins - CSU	Larimer	8.5	29.4	32
Greeley - Hospital	Weld	9.8	31.0	31
Platteville	Weld	7.8	28.0	27

6.4 Eastern High Plains

There were two violations of the PM_{10} NAAQS in the Eastern High Plains region during 2021. The maximum 24-hour concentration of 680 $\mu g\ m^{-3}$ was recorded at the Lamar site on January 15. The second highest 24-hour average PM_{10} concentration recorded at this site in 2021 was 176 $\mu g\ m^{-3}$. Table 6.3 below lists the PM_{10} annual average and design value recorded at the Lamar site in 2021.

Table 6.3: Summary of PM_{10} values recorded at monitoring stations in the Eastern High Plains region during 2021, with proposed exceptional events included.

Site Name	County	PM_{10} ($\mu g\ m^{-3}$)		
		Annual Average	24-Hr Max	3-Year Exceedances
Lamar - Mun. Bldg.	Prowers	26.6	680	2.1

6.5 Pikes Peak Region

There were no violations of the PM_{10} or $PM_{2.5}$ NAAQS in the Pikes Peak region during 2021. Table 6.4 and Table 6.5 below list the PM_{10} and $PM_{2.5}$ annual averages and design values recorded at the Colorado College monitoring site in 2021.

Table 6.4: Summary of PM_{10} values recorded at the Colorado College station during 2021.

Site Name	County	PM_{10} ($\mu g\ m^{-3}$)		
		Annual Average	24-Hr Max	3-Year Exceedances
Colorado College	El Paso	21.2	73	0

Table 6.5: Summary of $PM_{2.5}$ values recorded at the Colorado College station during 2021.

Site Name	County	$PM_{2.5}$ ($\mu g\ m^{-3}$)		
		Annual Average	Annual 98^{th} Percentile	3-Year Ave. of 98^{th} Percentile
Colorado College	El Paso	6.0	20.5	18

6.6 South Central Region

There were no violations of the PM_{10} or $PM_{2.5}$ NAAQS in the South Central region during 2021. Table 6.6 and Table 6.7 below list the PM_{10} and $PM_{2.5}$ annual averages and design values recorded at the Pueblo site in 2021.

Table 6.6: Summary of PM_{10} values recorded at the Pueblo monitoring station during 2021.

Site Name	County	PM_{10} ($\mu g\ m^{-3}$)		
		Annual Average	24-Hr Max	3-Year Exceedances
Pueblo	Pueblo	22.5	81	0

Table 6.7: Summary of $PM_{2.5}$ values recorded at the Pueblo monitoring station during 2021.

Site Name	County	$PM_{2.5}$ ($\mu g\ m^{-3}$)		
		Annual Average	Annual 98^{th} Percentile	3-Year Ave. of 98^{th} Percentile
Pueblo	Pueblo	7.0	20.7	16

6.7 Central Mountain Region

There were no violations of the PM_{10} NAAQS in the Central Mountain region during 2021. Table 6.8 below lists the PM_{10} 2021 annual average and design value recorded at each site in this region. The Cañon City PM_{10} monitor did not meet completeness requirements during 2019-2020 and so does not have a valid three-year design value.

Table 6.8: Summary of PM_{10} values recorded at monitoring stations in the Central Mountains region during 2021.

Site Name	County	PM_{10} ($\mu g\ m^{-3}$)		
		Annual Average	24-Hr Max	3-Year Exceedances
Cañon City	Fremont	17.6	77	0
Aspen	Pitkin	14.8	59	0
Steamboat Springs	Routt	18.4	89	0.3

6.8 Western Slope Region

There were no violations of the PM_{10} or $PM_{2.5}$ NAAQS in the Western Slope region during 2021. Table 6.9 and Table 6.10 below list the PM_{10} and $PM_{2.5}$ annual averages and design values recorded at each site in this region in 2021.

Table 6.9: Summary of PM_{10} values recorded at monitoring sites in the Western Slope region during 2021.

Site Name	County	PM_{10} ($\mu g\ m^{-3}$)		
		Annual Average	24-Hr Max	3-Year Exceedances
Grand Junction - Powell Bldg.	Mesa	20.3	75	0
Telluride	San Miguel	17.8	58	0

Table 6.10: Summary of $PM_{2.5}$ values recorded at the Grand Junction - Powell Bldg. monitoring site during 2021.

Site Name	County	$PM_{2.5}$ ($\mu g\ m^{-3}$)		
		Annual Average	Annual 98^{th} Percentile	3-Year Ave. of 98^{th} Percentile
Grand Junction - Powell Bldg.	Mesa	6.2	18.0	18

6.9 Southwestern Region

There were no violations of the PM_{10} NAAQS in the Southwestern region during 2021. Table 6.11 below lists the PM_{10} annual average and design value recorded at each site in this region in 2021.

Table 6.11: Summary of PM_{10} values recorded at monitoring sites in the Southwest region during 2021.

Site Name	County	PM_{10} ($\mu g\ m^{-3}$)		
		Annual Average	24-Hr Max	3-Year Exceedances
Pagosa Springs School	Archuleta	20.8	64	0

6.10 Planned Changes in PM Monitoring

There are currently no planned changes for the PM monitoring network.

7

Lead

Lead sampling at the La Casa NCore site was discontinued in December 31 of 2015 due to low concentrations. The maximum quarterly lead concentration has generally been less than a tenth of the current 2008 standard. Additionally, Colorado has not recorded an exceedance of the previous lead standard (1.5 $\mu g\ m^{-3}$ averaged over a calendar quarter) since the first quarter of 1980. The 2008 lead standard, which is 0.15 $\mu g\ m^{-3}$ averaged over any three rolling consecutive three-month periods, has not been exceeded using data from 2013 - 2015.

The U.S. EPA calculated emissions for lead at general aviation airports due to piston engine aircraft, which continue to use leaded aviation fuel. According to the EPA, Centennial Airport had the second highest lead emissions of any airport in the country at 1.18 tons per year (tpy) using data from the 2005 National Emissions Inventory (NEI). Since this emissions estimate exceeded the threshold for lead, the APCD located a lead sampling site at the Centennial Airport. This monitoring site was installed in March 2011 and the first sample was collected on April 3, 2011. The Centennial Airport TSP sampler was decommissioned in December of 2014 due to the site meeting its sampling requirements and it regularly showing concentrations well below that of the standard. The 2014 NEI report indicates that lead emissions from the Centennial Airport are approximately 0.77 tpy, which is below the 1 tpy threshold for monitoring and corroborates the decision to discontinue monitoring at this site.

Lead monitoring is required by EPA at one source-oriented SLAMS site located to measure the maximum lead concentration in ambient air resulting from each non-airport lead source which emits 0.50 or more tpy based on either the most recent National Emission Inventory (NEI) or other scientifically justifiable methods and data (such as improved emissions factors or site-specific data) taking into account logistics and the potential for population exposure. Based on the 2014 NEI, there are no non-airport sources in Colorado that are over the 0.5 tpy threshold. There have been questions regarding the U.S. Army Fort Carson facility in Colorado Springs, which has at times reported potential emissions over 0.5 tpy in the Toxics Release Inventory (TRI). It is noted that the 2014 NEI reports 0.029 tpy for Fort Carson and both the 2014 and 2016 TRI report 0 tpy for fugitive and stack air emissions. Based on the APCD inventories, these emissions are actually from their Piñon Canyon training area in Las Animas County. This area is remote with only scattered ranches, approximately 25 miles to the northeast of the town of Trinidad and thus would not warrant monitoring due to a low potential for public exposure.

7.1 Planned Changes in Lead Monitoring

No changes in lead monitoring are planned for 2022. Ambient lead concentrations will still be measured at the $PM_{2.5}$ speciation and IMPROVE sites throughout the state, as well as on the PM_{10} sampler at Grand Junction Powell (08-077-0017) as part of the NATTS project.

8

Meteorological Measurements

Meteorological measurements taken by the APCD consist of wind speed, wind direction, and temperature; six sites are also equipped to measure relative humidity. Two sites also record temperature differential and total solar radiation, and the APCD is presently enhancing the meteorological network with barometric pressure and precipitation measurements at select sites. Sites equipped with meteorological monitoring equipment are indicated in Table 1.2.

8.1 Recent and Planned Changes in Meteorological Monitoring

In 2021 the APCD commenced meteorological monitoring at the Black Hawk site and decommissioned the Arvada site on 12/31. In 2022 the APCD plans to relocate the meterological monitoring at the Fort Collins Mason site to Fort Collins West.

9

PAMS (Photochemical Assessment Monitoring Station) Monitoring

In accordance with the EPA's 2015 revised ozone monitoring rule (80 CFR 65292), the state of Colorado is required to install and operate one Photochemical Assessment Monitoring Station (PAMS) site. The rule states that PAMS monitoring is to occur at all NCore sites from June 1 through August 31 in CBSAs with populations of 1,000,000 or more. The CDPHE operates the NAAQS air monitoring compliance network in Colorado and will be responsible for implementing these new monitoring requirements. Colorado's Rocky Flats PAMS site will measure, at a minimum, volatile organic compounds (VOCs), carbonyls, ozone, total reactive nitrogen (NO_y), nitrogen dioxide (NO_2), mixing layer height, wind speed, wind direction, relative humidity, temperature, atmospheric pressure, precipitation, total solar radiation, and ultraviolet radiation. All measurements will be collected and reported in hourly averages.

Based on 40 CFR part 58, Appendix D, State air monitoring agencies are required to begin making PAMS measurements at their NCore location(s) by June 1, 2019. EPA is to provide the equipment and operational funding in support of PAMS monitoring. To date, the EPA has provided funding for the purchase of an auto-gas chromatograph, ceilometer, and true nitrogen dioxide analyzer. This equipment has been subsequently purchased and installed at the Rocky Flats North air monitoring site. The EPA has announced that funding for additional equipment and operations will not be available in time to begin making PAMS measurements by June 1, 2019. Because of this, the EPA has proposed an extension of the PAMS start date. As a result of this extension, the CDPHE will not begin making PAMS measurements at the Rocky Flats site until June 1, 2023, pending the availability of federal funds for equipment and operations.

10

Quality Assurance

10.1 Continuous Monitors

The Technical Services Program (TSP) staff performs three types of gaseous analyzer performance checks: quality control checks, accuracy audits, and calibrations. The audits and calibrations challenge the analyzer with pollutant gases of known concentration within the range of the analyzer. The APCD Quality Assurance (QA) staff conducts independent accuracy audits on all of the instruments at least twice per year. The EPA's National Performance Audit Program (NPAP) also conducts independent audits on randomly selected sites within the network. The APCD Gaseous and Meteorology Monitoring (GMM) staff conducts quality control checks nominally once every two weeks and calibrations once every calendar quarter. The details and minimum standards for this program are set out in the Code of Federal Regulations (Part 58 Ambient Air Quality Surveillance). The APCD always makes an effort to go above and beyond the minimum requirements. A complete description of these procedures is available in the APCD Quality Assurance Project Plan (QAPP) and the results are available from the APCD or through the national EPA AQS database.

10.2 Particulate Monitors

The audit checks performed on the particulate monitors consist of calibrated flow rate checks, as well as temperature and pressure sensor checks. The precision checks that are made on filter based particulate monitors consist of collocated samplers that operate side-by-side and collect a sample from both samplers once every sixth day. The precision checks for continuous particulate monitors consist of monthly temperature, pressure, leak rate and flow rate verification checks. EPA requires a minimum of 15% of the FRM network to be collocated. By the end of 2021, Colorado maintained 19 filter based particulate monitoring sites (low-volume and high-volume), five of which had collocated instruments (CAMP, Adams County, Longmont, La Casa, and Grand Junction - Powell). The EPA also has a performance evaluation program (PEP), which checks the national network for bias by having a private contractor set up an independent filter based low-volume FRM sampler next to the APCD's $PM_{2.5}$ sampler. All of the samples are then compared to ensure that the data are within federal limits and meet pre-established data quality objectives.

10.3 Meteorological Monitors

Annual calibrations and audits are performed on all APCD meteorological equipment to determine proper alignment and operation of the sensors. The details and minimum standards for this program are set out in the Code of Federal Regulations (Part 58 Ambient Air Quality Surveillance). A complete description of the procedures and the results are available from the APCD or in the APCD QAPP.

11

Summary of Network Changes

Over the past year, several network changes occurred, and during the next year several more changes are planned. The section below summarizes these changes to the monitoring network.

11.1 Completed Changes

- Meteorological monitoring commenced at the Black Hawk site.
- The Arvada meteorological site was closed on 12/31/2021.
- PM_{10} sampling frequency was increased at the Cañon City site from 1-in-6 days to 1-in-3 days on 6/15/2021 and at the Pueblo site from 1-in-3 days to daily starting 7/1/2021.

11.2 Planned Changes

- Meteorological monitoring at Fort Collins Mason will be relocated to Fort Collins West.
- O_3 monitoring will begin at a new site in the city of Pueblo. Site selection is underway.

12

CFR Requirements Summary

This section summarizes the requirements of 40 CFR 58, Appendices A, C, D, and E as they pertain to the CDPHE's ambient air monitoring network, as well as how these specific requirements are being met.

Appendix A of 40 CFR 58 covers the data quality assurance requirements for SLAMS, SPM, and PSD monitors. The requirements state the need for, and frequency of zero, span, and precision processes on the analyzer. It also specifies the auditing requirements for each monitor type. Audits of each particulate analyzer are performed on a quarterly basis and gaseous analyzers are audited twice annually. These results are tracked in a database at the CDPHE and are available upon request. A zero/span or a zero/precision routine is run on each of the gaseous monitoring instruments in the CDPHE's network on a nightly basis. These results are kept "in-house" at the CDPHE and are available on request. Manual quality control checks are performed on all gaseous instruments weekly and the results of these quality control tests are uploaded to EPA's national AQS database.

Appendix C of 40 CFR 58 specifies the criteria pollutant monitoring methods (manual analyzers or automated analyzers) which must be used in SLAMS and NCore stations that are a subset of SLAMS. Monitor types, sampling frequencies, and station descriptions are listed in Appendix A.

Appendix D of 40 CFR 58 specifies the network design criteria for ambient air quality monitoring. It covers monitoring objectives and spatial scales, general monitoring requirements, design criteria for NCore sites, pollutant specific design criteria for SLAMS sites, and design criteria for Photochemical Assessment Monitoring Stations (PAMS). These requirements are addressed in the individual pollutant sections.

Appendix E of 40 CFR 58 contains the specific location criteria applicable to SLAMS, NCore, and PAMS ambient air quality monitoring probes, inlets, and optical paths after the general location has been selected based on the monitoring objectives and spatial scale of representation discussed in Appendix D of 40 CFR 58. Adherence to these specific siting criteria is necessary to ensure the uniform collection of compatible and comparable air quality data. To ensure that all sites in the network meet the appropriate criteria, the CDPHE performs thorough site evaluations every two years. These evaluations include measurements of the probe heights and locations, as well as residence time determinations for each gaseous analytical instrument. The results are tracked in a database at the CDPHE and are available upon request.

APPENDIX A: MONITORING SITE DESCRIPTIONS

This appendix provides detailed information for all monitoring sites considered in this Data Report. **Table A-1** summarizes the locations and monitoring parameters of each site currently in operation, by county, alphabetically. The shaded lines in the table list the site AQS identification numbers, address, site start-up date, elevation, and longitude and latitude coordinates. Beneath each site description the table lists each monitoring parameter in operation at that site, the orientation and spatial scale, which national monitoring network it belongs to, the type of monitor in use, and the sampling frequency. The parameter date is the date when valid data were first collected.

The following abbreviations are used in **Table A-1** below, with orientation (Orient) referring to the monitoring objective and scale referring to the size of the area that concentrations from the monitor represent.

Orientation
P.O. - Population oriented
Back - Background orientation
SPM - Special Purpose Monitor
H.C. - Highest Concentration
POC - Parameter Occurrence Code
SLAMS - State or Local Air Monitoring Stations

Scale (Area Represented)[1]
Micro - Micro-scale (several m – 100 m)
Middle - Middle Scale (100 – 500 m)
Neigh - Neighborhood Scale (0.5 – 4 km)
Urban - Urban Scale (4 – 50 km)
Region - Regional Scale (50 – hundreds of km)

Table A-1. Monitoring Locations and Parameters Monitored

AQS #	*Site Name*	*Address*		*Site Start*	*Elevation (m)*	*Latitude*	*Longitude*
	Parameter	**POC**	**Start**	**Orient/Scale**	**Monitor**	**Type**	**Sample**
Adams							
08 001 0010	*Adams County Birch Street*	*7275 Birch Street*		*Mar-21*	*1,565*	*39.8281*	*-104.93646*
	PM_{10}	1	Mar-21	P.O. Neigh	R&P PARTISOL 2025	SLAMS	1 in 1
	$PM_{2.5}$	2	Mar-21	P.O. Neigh	R&P PARTISOL 2025	SLAMS	1 in 6
	$PM_{2.5}$	3	Mar-21	P.O. Neigh	GRIMM EDM 180	SPM	Continuous
	$PM_{2.5}$ Speciation	5	Mar-21	P.O. Neigh	SASS	Trends Spec.	1 in 6
	$PM_{2.5}$ Carbon	5	Mar-21	P.O. Neigh	URG 3000N	Trends Spec.	1 in 6

[1] "Appendix D to Part 58 – Network Design Criteria for Ambient Air Quality Monitoring," 40 Federal Register 58 (15 January 2015).

AQS #	Site Name	Address		Site Start	Elevation (m)	Latitude	Longitude
	Parameter	**POC**	**Start**	**Orient/Scale**	**Monitor**	**Type**	**Sample**
08 001 3001	*Welby*	*3174 E. 78th Ave.*		*Jul-73*	*1,554*	*39.838119*	*-104.94984*
	CO (Trace)	1	Jul-73	P.O. Neigh	THERMO 48i-TLE	SLAMS	Continuous
	SO_2	2	Jul-73	P.O. Neigh	TAPI 100E	SLAMS	Continuous
	NO/NO_x	2	Jan-76	P.O. Urban	TAPI 200UP	SPM	Continuous
	NO_2	1	Jan-76	P.O. Urban	TAPI 200EU	SLAMS	Continuous
	O_3	2	Jul-73	P.O. Neigh	TAPI 400E	SLAMS	Continuous
	WS/WD/Temp	1	Jan-75	P.O. Neigh	MET-ONE	SPM	Continuous
	PM_{10}	1	Feb-92	P.O. Neigh	SA/GMW 1200	SLAMS	1 in 6
	PM_{10}	3	Jun-90	P.O. Neigh	TEOM 1400AB	SLAMS	Continuous
Arapahoe							
08 005 0002	*Highland Reservoir*	*8100 S. University Blvd*		*Jun-78*	*1,747*	*39.567887*	*-104.957193*
	O_3	1	Jun-78	P.O. Neigh	TAPI 400E	SLAMS	Continuous
	WS/WD/Temp	1	Jul-78	P.O. Neigh	MET-ONE	SPM	Continuous
08 005 0005	*Arapahoe Community College (ACC)*	*6190 S. Santa Fe Dr.*		*Dec-98*	*1,636*	*39.604399*	*-105.019526*
	$PM_{2.5}$	1	Mar-99	P.O. Neigh	R&P PARTISOL 2025	SLAMS	1 in 3
08 005 0006	*Aurora - East*	*36001 E. Quincy Ave.*		*Apr-11*	*1,552*	*39.63854*	*-104.56913*
	O_3	1	Apr-09	P.O. Region	TAPI 400E	SLAMS	Continuous
	WS/WD/Temp	1	Jun-09	P.O. Neigh	MET-ONE	SPM	Continuous
Archuleta							
08 007 0001	*Pagosa Springs School*	*309 Lewis St.*		*Aug-75*	*2,165*	*37.26842*	*-107.009659*
	PM_{10}	3	Sep-90	P.O. Neigh	SA/GMW 1200	SLAMS	1 in 1

AQS #	Site Name	Address		Site Start	Elevation (m)	Latitude	Longitude
	Parameter	POC	Start	Orient/Scale	Monitor	Type	Sample
Boulder							
08 013 0003	*Longmont - Municipal Bldg.*	*350 Kimbark St.*		*Jun-85*	*1,520*	*40.164576*	*-105.100856*
	PM_{10}	2	Sep-85	P.O. Neigh	SA/GMW 1200	SLAMS	1 in 6
	PM_{10} Collocated	2	Sep-14	P.O. Micro	SA/GMW 1200	SLAMS	1 in 6
	$PM_{2.5}$	1	Jan-99	P.O. Neigh	R&P PARTISOL 2025	SLAMS	1 in 3
	$PM_{2.5}$	3	Nov-05	P.O. Neigh	TEOM 1400AB	SPM	Continuous
08 013 0012	*Boulder Chamber of Commerce*	*2440 Pearl St.*		*Dec-94*	*1,619*	*40.021097*	*-105.263382*
	PM_{10}	1	Oct-94	P.O. Neigh	SA/GMW 1200	SLAMS	1 in 6
	$PM_{2.5}$	1	Jan-99	P.O. Middle	R&P PARTISOL 2025	SLAMS	1 in 3
08 013 0014	*Boulder Reservoir*	*5565 N. 51st*		*Sep-16*	*1,586*	*40.070016*	*-105.220238*
	O_3	1	Sep-16	H.C. Urban	TAPI 400E	SLAMS	Continuous
	WS/WD/Temp/RH	1	Sep-16	H.C. Urban	RM YOUNG	SPM	Continuous
08 013 1001	*Boulder - CU Athens*	*2102 Athens St.*		*Dec-80*	*1,622*	*40.012969*	*-105.264212*
	$PM_{2.5}$	3	Feb-04	P.O. Neigh	TEOM FDMS	SPM	Continuous

AQS #	Site Name	Address		Site Start	Elevation (m)	Latitude	Longitude
	Parameter	**POC**	**Start**	**Orient/Scale**	**Monitor**	**Type**	**Sample**
Denver							
08 031 0002	*CAMP*	*2105 Broadway*		*Jan-65*	*1,593*	*39.751184*	*-104.987625*
	CO (Trace)	2	Jan-71	P.O. Micro	THERMO 48i-TLE	SLAMS	Continuous
	SO_2	1	Jan-67	P.O. Neigh	TAPI 100E	SLAMS	Continuous
	O_3	6	Mar-12	P.O. Neigh	TAPI 400E	SLAMS	Continuous
	NO/NO_x	1	Jan-73	Other	TAPI 200EU	Other	Continuous
	NO_2	1	Jan-73	P.O. Neigh	TAPI 200EU	SLAMS	Continuous
	WS/WD/Temp	1	Jan-65	P.O. Neigh	MET-ONE	SPM	Continuous
	PM_{10}	1	Aug-86	P.O. Micro	SA/GMW 1200	SLAMS	1 in 6
	PM_{10} Collocated	2	Dec-87	P.O. Micro	SA/GMW 1200	SLAMS	1 in 6
	PM_{10}	3	Apr-13	P.O. Micro	GRIMM EDM 180	SLAMS	Continuous
	$PM_{2.5}$	1	Jan-99	P.O. Micro	R&P PARTISOL 2025	SLAMS	1 in 1
	$PM_{2.5}$ Collocated	2	Sep-01	P.O. Micro	R&P PARTISOL 2025	SLAMS	1 in 6
	$PM_{2.5}$	3	Apr-13	P.O. Micro	GRIMM EDM 180	SPM	Continuous
08 031 0013	*National Jewish Health*	*14th Ave. & Albion St.*		*Jan-83*	*1,620*	*39.738578*	*-104.939925*
	$PM_{2.5}$	3	Oct-03	P.O. Neigh	TAPI T640	SPM	Continuous
	PM_{10}	3	Mar-18	P.O. Neigh	TAPI T640	SPM	Continuous
08 031 0016	*DESCI*	*1901 E. 13th Ave.*		*Dec-90*	*1,623*	*39.7357*	*-104.9582*
	Transmissometer	1	Dec-89	Other	OPTEC LPV-3	SPM	Continuous
	Nephelometer	1	Dec-00	Other	OPTEC NGN-2	SPM	Continuous
	Relative Humidity	1	Dec-89	Other	RM YOUNG	SPM	Continuous

AQS #	Site Name	Address		Site Start	Elevation (m)	Latitude	Longitude
	Parameter	**POC**	**Start**	**Orient/Scale**	**Monitor**	**Type**	**Sample**
08 031 0026	*La Casa*	*4587 Navajo St.*		*Oct-13*	*1,594*	*39.779429*	*-105.005174*
	CO (Trace)	1	Oct-12	P.O. Neigh	THERMO 48i-TLE	NCore	Continuous
	SO_2 (Trace)	1	Oct-12	P.O. Neigh	TAPI 100EU	NCore	Continuous
	NO_Y	1	Oct-12	P.O. Neigh	TAPI 200EU	NCore	Continuous
	CAPS NO_2	1	Jul-14	P.O. Neigh	TAPI 500U	NCore	Continuous
	O_3	1	Oct-12	Neigh/Urban	TAPI 400E	NCore	Continuous
	WS/WD/Temp	1	Oct-12	P.O. Neigh	MET-ONE	NCore	Continuous
	Relative Humidity	1	Oct-12	P.O. Neigh	MET-ONE	NCore	Continuous
	Total Solar Radiation	1	Apr-18	P.O. Neigh	KIPP & ZONEN	NCore	Continuous
	Temp (Lower)	2	Oct-12	P.O. Neigh	MET-ONE	NCore	Continuous
	PM_{10}	1	Oct-12	P.O. Neigh	R&P PARTISOL 2025	SLAMS	1 in 3
	PM_{10} Collocated	2	Oct-12	P.O. Neigh	R&P PARTISOL 2025	SLAMS	1 in 6
	PM_{10}	3	Feb-14	P.O. Neigh	GRIMM EDM 180	SLAMS	Continuous
	$PM_{2.5}$	1	Oct-12	P.O. Neigh	R&P PARTISOL 2025	NCore	1 in 3
	$PM_{2.5}$	3	Feb-14	P.O. Neigh	GRIMM EDM 180	SLAMS	Continuous
	$PM_{2.5}$ Speciation	5	Oct-12	P.O. Neigh	SASS	Supplem. Speciation	1 in 3
	$PM_{2.5}$ Carbon	5	Oct-12	P.O. Neigh	URG 3000N	Supplem. Speciation	1 in 3

AQS #	Site Name	Address		Site Start	Elevation (m)	Latitude	Longitude
	Parameter	**POC**	**Start**	**Orient/Scale**	**Monitor**	**Type**	**Sample**
08 031 0027	*I-25: Denver*	*971 W. Yuma Street*		*Jun-13*	*1,586*	*39.732146*	*-105.015317*
	CO (Trace)	1	Jun-13	Near Road	THERMO 48i-TLE	SLAMS	Continuous
	NO_2	1	Jun-13	Near Road	TAPI 200E	SLAMS	Continuous
	NO/NO_x	1	Jun-13	Near Road	TAPI 200E	SPM	Continuous
	WS/WD/Temp	1	Jun-13	Near Road	MET-ONE	SPM	Continuous
	PM_{10}	3	Dec-13	Near Road	GRIMM EDM 180	SLAMS	Continuous
	$PM_{2.5}$	1	Jan-14	Near Road	R&P PARTISOL 2025	SLAMS	1 in 6
	$PM_{2.5}$	3	Dec-13	Near Road	GRIMM EDM 180	SLAMS	Continuous
	$PM_{2.5}$ Carbon	5	Oct-13	Near Road	API 633	SPM	Continuous
08 031 0028	*I-25: Globeville*	*4905 Acoma Street*		*10/1/2015*	*1,587*	*39.785823*	*-104.988857*
	NO_2	1	10/1/2015	Near Road	TAPI 200E	SLAMS	Continuous
	NO/NO_x	1	10/1/2015	Near Road	TAPI 200E	SPM	Continuous
	WS/WD/Temp/RH	1	10/1/2015	Near Road	RM YOUNG	SPM	Continuous
	PM_{10}	3	10/1/2015	Near Road	GRIMM EDM 180	SLAMS	Continuous
	$PM_{2.5}$	3	10/1/2015	Near Road	GRIMM EDM 180	SLAMS	Continuous
Douglas							
08 035 0004	*Chatfield State Park*	*11500 N. Roxborough Pk. Rd*		*Apr-04*	*1,676*	*39.534488*	*-105.070358*
	O_3	1	May-05	H.C. Urban	TAPI 400E	SLAMS	Continuous
	WS/WD/Temp	1	Apr-04	P.O. Neigh	MET-ONE	SPM	Continuous
	$PM_{2.5}$	1	Jul-05	P.O. Neigh	R&P PARTISOL 2025	SPM	1 in 3
	$PM_{2.5}$	3	May-04	P.O. Neigh	TAPI T640	SPM	Continuous
	PM_{10}	3	Jun-17	P.O. Neigh	TAPI T640	SPM	Continuous

AQS #	Site Name	Address		Site Start	Elevation (m)	Latitude	Longitude
	Parameter	POC	Start	Orient/Scale	Monitor	Type	Sample
El Paso							
08 041 0013	*U. S. Air Force Academy*	*USAFA Rd. 640*		*May-96*	*1,971*	*39.958341*	*-104.817215*
	O_3	1	Jun-96	H.C. Urban	TAPI 400E	SLAMS	Continuous
08 041 0015	*Highway 24*	*690 W. Hwy. 24*		*Nov-98*	*1,824*	*39.830895*	*-104.839243*
	CO (Trace)	1	Nov-98	P.O. Micro	THERMO 48i-TLE	SLAMS	Continuous
	SO_2	1	Jan-13	P.O. Micro	TAPI 100EU	SLAMS	Continuous
	WS/WD/Temp	1	Aug-14	P.O. Micro	RM YOUNG	SPM	Continuous
	Relative Humidity	1	Aug-14	P.O. Micro	RM YOUNG	SPM	Continuous
08 041 0016	*Manitou Springs*	*101 Banks Pl.*		*Apr-04*	*1,955*	*38.853097*	*-104.901289*
	O_3	1	Apr-04	H.C. Neigh	TAPI 400E	SLAMS	Continuous
08 041 0017	*Colorado College*	*130 W. Cache La Poudre*		*Dec-07*	*1,832*	*38.848014*	*-104.828564*
	PM_{10}	1	Dec-07	P.O. Neigh	R&P PARTISOL 2025	SLAMS	1 in 6
	PM_{10}	3	Jun-16	P.O. Neigh	GRIMM EDM 180	SLAMS	Continuous
	$PM_{2.5}$	3	Dec-07	P.O. Neigh	GRIMM EDM 180	SLAMS	Continuous
Fremont							
08 043 0003	*Cañon City - City Hall*	*128 Main St.*		*Oct-04*	*1,626*	*38.43829*	*-105.24504*
	PM_{10}	1	Oct-04	P.O. Neigh	SA/GMW 1200	SLAMS	1 in 3
Garfield							
08 045 0012	*Rifle - Health Dept.*	*195 W. 14th Ave.*		*Jun-08*	*1,629*	*39.54182*	*-107.784125*
	O_3	1	Jun-08	P.O. Neigh	TAPI 400E	SLAMS	Continuous
Gilpin							
08 047 0003	*Black Hawk*	*831 Miners Mesa Rd.*		*Jul-19*	*2,635*	*39.79251*	*-105.49133*
	O_3	1	Jul-19	P.O. Neigh	TAPI 400E	SLAMS	Continuous

AQS #	Site Name	Address		Site Start	Elevation (m)	Latitude	Longitude
	Parameter	POC	Start	Orient/Scale	Monitor	Type	Sample
Jefferson							
08 059 0002	*Arvada*	*9101 W. 57th Ave.*		*Jan-73*	*1,640*	*39.800333*	*-105.099973*
	WS/WD/Temp	1	Jan-75	P.O. Neigh	MET-ONE	SPM	Continuous
08 059 0006	*Rocky Flats - N.*	*16600 W. Hwy. 128*		*Jun-92*	*1,802*	*39.912799*	*-105.188587*
	NO_Y	1	Oct-12	P.O. Neigh	TAPI 200EU	PAMS	Continuous
	CAPS NO_2	1	Jul-14	P.O. Neigh	TAPI 500U	PAMS	Continuous
	O_3	1	Sep-92	H.C. Urban	TAPI 400E	PAMS	Continuous
	WS/WD/Temp	1	Sep-92	P.O. Neigh	MET-ONE	PAMS	Continuous
08 059 0011	*NREL*	*2054 Quaker St.*		*Jun-94*	*1,832*	*39.743724*	*-105.177989*
	O_3	1	Jun-94	H.C. Urban	TAPI 400E	SLAMS	Continuous
08 059 0014	*Evergreen*	*5124 S. Hatch Dr.*		*Sept-20*	*2225*	*39.62047*	*-105.3382*
	O_3	1	Apr-11	P.O. Neigh	TAPI 400E	SLAMS	Continuous
	WS/WD/Temp	1	Jun-11	P.O. Neigh	RM YOUNG	SPM	Continuous
Larimer							
08 069 0009	*Fort Collins - CSU*	*251 Edison Dr.*		*Dec-98*	*1,524*	*40.571288*	*-105.079693*
	PM_{10}	1	Jul-99	P.O. Neigh	SA/GMW 1200	SLAMS	1 in 3
	PM_{10}	3	Jun-15	P.O. Neigh	GRIMM EDM 180	SPM	Continuous
	$PM_{2.5}$	3	Jun-15	P.O. Neigh	GRIMM EDM 180	SPM	Continuous
08 069 0011	*Fort Collins - West*	*3416 La Porte Ave.*		*May-06*	*1,571*	*40.592543*	*-105.141122*
	O_3	1	May-06	H.C. Urban	TAPI 400E	SLAMS	Continuous
08 069 1004	*Fort Collins - Mason*	*708 S. Mason St.*		*Dec-80*	*1,524*	*40.57747*	*-105.07892*
	CO (Trace)	1	Dec-80	P.O. Neigh	THERMO 48i-TLE	SLAMS	Continuous
	O_3	1	Dec-80	P.O. Neigh	TAPI 400E	SLAMS	Continuous
	WS/WD/Temp	1	Jan-81	P.O. Neigh	MET-ONE	SPM	Continuous

AQS #	Site Name	Address		Site Start	Elevation (m)	Latitude	Longitude
	Parameter	POC	Start	Orient/Scale	Monitor	Type	Sample
Mesa							
08 077 0017	*Grand Junction - Powell Bldg.*	*650 South Ave.*		*Feb-02*	*1,398*	*39.063798*	*-108.561173*
	PM_{10} & NATTS Metals	3	Jan-05	P.O. Neigh	R&P PARTISOL 2025	SLAMS	1 in 3
	PM_{10} Collocated & NATTS	4	Mar-05	P.O. Neigh	R&P PARTISOL 2025	SLAMS	1 in 6
	PM_{10}	3	Jan-14	P.O. Neigh	GRIMM EDM 180	SPM	Continuous
	$PM_{2.5}$	3	Jan-14	P.O. Neigh	GRIMM EDM 180	SPM	Continuous
08 077 0018	*Grand Junction - Pitkin*	*645 1/4 Pitkin Ave.*		*Jan-04*	*1,398*	*39.064289*	*-108.56155*
	WS/WD/Temp	1	Jan-04	P.O. Neigh	MET-ONE	SPM	Continuous
	Relative Humidity	1	Jan-04	P.O. Neigh	RM YOUNG	SPM	Continuous
08 077 0020	*Palisade Water Treatment*	*Rapid Creek Rd.*		*May-08*	*1,512*	*39.130575*	*-108.313853*
	O_3	1	Apr-08	P.O. Urban	TAPI 400E	SLAMS	Continuous
	WS/WD/Temp	1	Apr-08	P.O. Neigh	RM YOUNG	SPM	Continuous
Montezuma							
08 083 0006	*Cortez - Health Dept.*	*106 W. North St.*		*Jun-06*	*1,890*	*37.350054*	*-108.592337*
	O_3	1	Jun-08	P.O. Urban	TAPI 400E	SLAMS	Continuous
Montrose							
Pitkin							
08 097 0006	*Aspen*	*215 N. Garmisch St.*		*Jan-15*	*2,408*	*39.192958*	*-106.823257*
	PM_{10}	1	Feb-15	P.O. Neigh	SA/GMW 1200	SLAMS	1 in 3
Prowers							
08 099 0002	*Lamar - Municipal Bldg.*	*104 E. Parmenter St.*		*Dec-76*	*1,107*	*38.084688*	*-102.618641*
	PM_{10}	2	Mar-87	P.O. Neigh	SA/GMW 1200	SLAMS	1 in 1

AQS #	Site Name	Address		Site Start	Elevation (m)	Latitude	Longitude
	Parameter	POC	Start	Orient/Scale	Monitor	Type	Sample
Pueblo							
08 101 0015	*Pueblo - Fountain School*	*925 N. Glendale Ave.*		*Jun-11*	*1,433*	*38.276099*	*-104.597613*
	PM_{10}	1	Apr-11	P.O. Neigh	SA/GMW 1200	SLAMS	1 in 1
	$PM_{2.5}$	1	Apr-11	P.O. Neigh	R&P PARTISOL 2025	SLAMS	1 in 1
Routt							
08 107 0003	*Steamboat Springs*	*136 6th St.*		*Sep-75*	*2,054*	*40.485201*	*-106.831625*
	PM_{10}	2	Mar-87	P.O. Neigh	SA/GMW 1200	SLAMS	1 in 1
San Miguel							
08 113 0004	*Telluride*	*333 W. Colorado Ave.*		*Mar-90*	*2,684*	*37.937872*	*-107.813061*
	PM_{10}	1	Mar-90	P.O. Neigh	SA/GMW 1200	SLAMS	1 in 3
Weld							
08 123 0006	*Greeley - Hospital*	*1516 Hospital Rd.*		*Apr-67*	*1,441*	*40.414877*	*-104.70693*
	PM_{10}	2	Mar-87	P.O. Neigh	GRIMM EDM 180	SPM	Continuous
	$PM_{2.5}$	3	Feb-99	P.O. Neigh	GRIMM EDM 180	SPM	Continuous
08 123 0008	*Platteville - Middle School*	*1004 Main St.*		*Dec-98*	*1,469*	*40.209387*	*-104.82405*
	$PM_{2.5}$	1	Aug-99	P.O. Region	R&P PARTISOL 2025	SLAMS	1 in 3
	$PM_{2.5}$ Speciation	5	Aug-99	P.O. Region	SASS	Spec. Trends	1 in 6
	$PM_{2.5}$ Carbon	5	Apr-11	P.O. Neigh	URG 3000N	Spec. Trends	1 in 6
08 123 0009	*Greeley - County Tower*	*3101 35th Ave.*		*Jun-02*	*1,484*	*40.386368*	*-104.73744*
	O_3	1	Jun-02	H.C. Neigh	TAPI 400E	SLAMS	Continuous
	WS/WD/Temp	1	Feb-12	P.O. Neigh	MET-ONE	SPM	Continuous
	CO (Trace)	1	Apr-16	P.O. Neigh	THERMO 48i-TLE	SLAMS	Continuous

AQS #	Site Name	Address		Site Start	Elevation (m)	Latitude	Longitude
	Parameter	POC	Start	Orient/Scale	Monitor	Type	Sample
08 123 0009	*Plattville Atmospheric Obsevatory (PAO)*	*17065 County Rd 28*		*Jun-20*	*1,523*	*40.18161*	*-104.72614*
	O_3	1	Jun-20	P.O. Urban	TAPI 400	SLAMS	Continuous
	WS/WD/Temp/RH	1	Jun-20	P.O. Urban	RM YOUNG	SPM	Continuous
	NO/NO_x	2	Jan-76	P.O. Urban	TAPI 200UP	SPM	Continuous
	NO_2	1	Jan-76	P.O. Urban	TAPI 200UP	SLAMS	Continuous

Adams County Birch Street, 7275 Birch Street (08 001 0010):

The Adams County Birch Street site began operation on 03/01/2021 and is in a predominantly residential area with a large commercial and industrial district. It is located north of the Denver Central Business District (CBD) near the Platte River Valley, downstream from the Denver urban air mass. There are three schools in the immediate vicinity, an elementary school to the south, a middle school to the north, and a high school to the southeast. There is a large industrial area to the south and east, and gravel pits about a kilometer to the west and northwest.

This is a replacement site for the Tri County Health Dept. - Commerce City (08-001-0008) site which was dismantled due to a roofing project on the building.

PM_{10} and $PM_{2.5}$ monitoring began in August of 2016. There is a collocated $PM_{2.5}$ FRM along with a continuous $PM_{2.5}$ GRIMM EDM dust monitor, a filter based low volume PM_{10} monitor, a trends speciation monitor, and a $PM_{2.5}$ carbon monitor all in operation.

Welby, 3174 E. 78th Avenue (08 001 3001):

Located 8 miles north-northeast of the Denver Central Business District (CBD) on the bank of the South Platte River, this site is ideally located to measure nighttime drainage of the air mass from the Denver metropolitan area and the thermally driven, daytime upriver flows. The monitoring shows that high CO levels are associated with winds from the south-southwest. While this is the direction of five of the six major sources in the area, it is also the direction of the primary drainage winds along the South Platte River. This monitor is in the SLAMS network, and is population oriented for a neighborhood scale.

CO monitoring began in 1973 and continued through the spring of 1980. Monitoring was stopped from the spring of 1980 until October 1986 when it began again as a special study. Welby has not recorded an exceedance of either the one-hour or eight-hour CO standard since January 1988. In the last few years, its primary value has been as an indicator of changes in the air quality index (AQI).

O_3 monitoring began at Welby in July of 1973. The Welby monitor has not recorded an exceedance of the old one-hour O_3 standard since 1998. However, the trend in the 3-year average of the 4th maximum eight-hour average has been increasing since 2002.

The Welby NO_2 monitor began operation in July 1976. The site's location provides an indication of possible exceedance events before they hit the Denver-Metro area. The site serves as a good drainage location, but it may be a target for deletion or relocation farther down the South Platte River Valley from Denver due to growth in trees that are not allowed

to be removed.

The Welby SO_2 monitor began operation in July of 1973.

PM_{10} monitoring began at Welby in June and July of 1990 with a high volume PM_{10} monitor and a PM_{10} continuous TEOM monitor. Meteorological monitoring began in January of 1975.

Highland Reservoir, 8100 S. University Boulevard (08 005 0002):

The Highlands site began operation in June of 1978. It was intended to be a background location. However, with urban growth and the construction of C-470, it has become a long-term trend site that monitors changes in the air quality of the area. It is currently believed to be near the southern edge of the high urban O_3 concentrations although it may not be in the area of maximum concentrations. This is a population oriented neighborhood scale SLAMS monitor.

Meteorological monitoring began in July of 1978.

In September of 2010 the site and meteorological tower were relocated to the east by approximately 30 meters to allow for the construction of an emergency generator system. This emergency generator system is located approximately 20 meters northwest of the new site location. The Highlands monitoring site had to be shut down from approximately Oct. of 2013 to Sept. of 2015 due to major construction activities on the property. The site is currently back up and monitoring for ozone and meteorological parameters.

Arapahoe Community College (ACC), 6190 S. Santa Fe Drive (08 005 0005):

The ACC site is located in south suburban metropolitan Denver. It is located on the south side of the Arapahoe Community College in a distant parking lot. The site is near the bottom of the Platte River Valley along Santa Fe Drive (Hwy. 85) in the city of Littleton. It is also near the city of Englewood. There is a large residential area located to the east across the railroad and Light Rail tracks. The $PM_{2.5}$ monitor is located on a mobile shelter in the rarely used South parking lot. Located at 6190 S. Santa Fe Drive, this small trailer is close to the Platte River and the monitor has excellent 360^0 exposure. Based on the topography and meteorology of the area ACC is in an area where $PM_{2.5}$ emissions may collect. This location may capture high concentrations during periods of upslope flow and temperature inversion in the valley. However, since it is further south in a more sparsely populated area, the concentrations are usually not as high as other Denver locations.

Winds are predominately out of the south-southwest and south, with secondary winds out of the north and north-northeast (upslope). Observed distances and traffic estimates easily fall into the neighborhood scale in accordance with federal guidelines found in the 40 CFR, Part 58, Appendix D. The site meets all other neighborhood scale criteria, making the monitor a population oriented neighborhood scale SLAMS monitor on a 1 in 3 day sample schedule.

Aurora – East, 36001 Quincy Ave (08 005 0006):

The Aurora East site began operation in June 2009. It is intended to act as a regional site and aid in the determination of the eastern most extent of the high urban O_3 concentrations. It is located along the eastern edge of the former Lowry bombing range, on a flat, grassy plains area. This site is currently outside of the rapid urban growth area taking place around Aurora Reservoir. This was a special purpose monitor (SPM) for a regional scale, and became a SLAMS monitor in 2013.

Pagosa Springs School, 309 Lewis Street (08 007 0001):

The Pagosa Springs site was located on the roof of the Town Hall from April 24, 2000 through May 2001. When the Town Hall building was planned to be demolished, the PM_{10} monitor was relocated to the Pagosa Springs Middle School and the first sample was collected on June 7, 2001.

The Pagosa Springs School site is located next to Highway 160 near the center of town. Pagosa Springs is a small town spread over a large area. The San Juan River runs through the south side of town. The town sits in a small bowl like

setting with hills all around. A small commercial strip area along Highway 160 and single-family homes surrounds this location. It is representative of residential neighborhood exposure. Pagosa Springs was a PM_{10} nonattainment area and a SIP was implemented for this area. PM_{10} concentrations were exceeded a few times in the late 1990s.

Winds for this area predominantly blow from the north, with secondary winds from the north-northwest and the south. The predominant wind directions closely follow the valley topography in this rugged terrain. McCabe Creek, which is very near the meteorological station that was on the Town Hall building, runs north-south through this area. However, the highest wind gusts come from the west and southwest during regional dust storms. This is a population oriented neighborhood scale SLAMS monitor on a daily sampling schedule.

Longmont – Municipal Bldg., 350 Kimbark Street (08 013 0003):

The town of Longmont is a growing, medium sized Front Range community. Longmont is located between the Denver/Boulder Metro-area and Fort Collins. Longmont is both suburban and rural in nature. The town of Longmont is located approximately 30 miles north of Denver along the St. Vrain Creek and is about six miles east of the foothills. Longmont is partly a bedroom community for the Denver-Boulder area. The elevation is 4978 feet. The Front Range peaks rise to an elevation of 14,000 feet just to the west of Longmont. In general, the area experiences low relative humidity, light precipitation and abundant sunshine.

The station began operations in 1985 with the installation of PM_{10} followed by $PM_{2.5}$ monitors in 1999.

Longmont's predominant wind direction is from the north through the west due to winds draining from the St. Vrain Creek Canyon. The PM_{10} site is near the center of the city near both commercial and residential areas. This location provides the best available monitoring for population exposure to particulate matter. The distance and traffic estimate for the controlling street easily falls into the neighborhood scale in accordance with federal guidelines found in 40 CFR, Part 58, and Appendix D. This is a population oriented neighborhood scale SLAMS monitor on a 1 in 6 day sample schedule. In September of 2014 APCD installed a collocated sampler at the site to meet EPA PM_{10} high volume collocation requirements.

Boulder Chamber of Commerce, 2440 Pearl Street (08 013 0012):

The city of Boulder is located on the eastern edge of the Rocky Mountain foothills. Most of the city sits on rolling plains. The Boulder $PM_{2.5}$ site is approximately 7,000 feet east of the base of the Front Range foothills and about 50 feet south of a small branch of Boulder Creek, the major creek that runs through Boulder.

PM_{10} monitoring began at this site in December of 1994, while the $PM_{2.5}$ monitoring did not begin until January of 1999.

The predominant wind direction at the APCD's closest meteorological site (Rocky Flats – North) is from the west with secondary maximum frequencies from the west-northwest and west-southwest. The distance and traffic estimate for Pearl Street and Folsom Street falls into the middle scale, but the site has been justified to represent a neighborhood scale site in accordance with federal guidelines found in 40 CFR, Part 58 and Appendix D. This is a population oriented neighborhood scale SLAMS monitoring site on a 1 in 6 day sample schedule.

Boulder Reservoir, 5545 Reservoir Road (08 013 0014):

The city of Boulder is located about 30 miles to the northwest of Denver. The Boulder Reservoir is a 700 acre multi-use recreation and water storage facility owned and managed by the city of Boulder. It is operated as a water supply by the Northern Colorado Water Conservancy District. The Reservoir is located about 5.5 miles to the North East of the city of Boulder. This site is a replacement site for the South Boulder Creek site which was shut down January 1st, 2016 due to large trees that had grown over the years that could not be removed, making the site no longer meet siting criteria.

The Boulder Reservoir is a highest concentration oriented urban scale SLAMS monitor. The site monitors for ozone and meteorological parameters and has been sampling since September of 2016.

Boulder – CU - Athens, 2102 Athens Street (08 013 1001):

The Boulder - CU site is located at the edge of a low usage parking lot to the immediate north of the site and south of the University of Colorado football practice fields. This location provides a good neighborhood representation for particulates. The site houses a continuous TEOM particulate monitor inside the shelter. The site began operation in November 2004. A dome is erected each fall over the practice field and remains inflated until early spring when it is removed for the summer months.

CAMP, 2105 Broadway (08 031 0002):

The City and County of Denver is located approximately 30 miles east of the foothills of the Rocky Mountains. Denver sits in a basin, and the terrain of the city is characterized as gently rolling hills, with the Platte River running from southwest to northeast, just west of the downtown area. The CAMP site is located in downtown Denver.

CO monitoring began in February 1965 as a part of the Federal Continuous Air Monitoring Program. It was established as a maximum concentration (micro-scale), population-oriented monitor. The CAMP site measures the exposure of the people who work or reside in the central business district (CBD). Its location in a high traffic street canyon causes this site to record most of the high pollution episodes in the metro area. The street canyon effect at CAMP results in variable wind directions for high CO levels and as a result wind direction is less relevant to high concentrations than wind speed. Wind speeds less than 1 mph, especially up-valley, combined with temperature inversions trap the pollution in the area. The CO monitor was updated to a Thermo 48iTLE trace level monitor in April 2017 to better characterize lower level concentrations seen in recent years.

Sampling for all parameters at the site was discontinued from June of 1999 to July of 2000 for the construction of a new building.

The NO_2 monitor began operation in January 1973 at this location.

The SO_2 monitor began operation in January 1967.

O_3 monitoring began originally in 1972 and has been intermittently monitored through January 2008. The current O_3 monitor began operation in February 2012.

The PM_{10} monitoring began in 1986 with the installation of collocated monitors, and was furthered by the addition of a continuous monitor in 1988.

The $PM_{2.5}$ monitoring began in 1999 with a sequential filter based FRM monitor. A continuous TEOM FEM $PM_{2.5}$ monitor was installed in February of 2001 and an FDMS was installed on the instrument November 1, 2003. In April 2013, the TEOM/FDMS was replaced with a GRIMM EDM 180 continuous monitor, which concurrently measures both PM_{10} and $PM_{2.5}$.

Meteorological monitoring began at this site in January of 1965.

National Jewish Health, 14th Avenue & Albion Street (08 031 0013):

This site is located three miles east of the Denver CBD, close to a very busy intersection (Colorado Boulevard and Colfax Avenue). The current site began operations in 1982. Two previous sites were located just west of the current location. The first operated for only a few months before it was moved to a new site in the corner of the laboratory building at the corner of Colorado Boulevard and Colfax Avenue. Data from this continuous TEOM particulate monitor is not compared with the NAAQS. It is used for short term forecasting and public notifications. The monitor here is a population oriented middle scale special project monitor.

DESCI:

A visibility site was installed in Denver in late 1990 using a long-path transmissometer. Visibility in the downtown area is monitored using a receiver located near Cheesman Park at 1901 E. 13th Avenue, and a transmitter located on the roof of the Federal Building at 1929 Stout Street. Renovations at the Federal Building forced the transmissometer to temporarily move to 1255 19th Street in 2010, and quality control measurements showed no meaningful difference between old and new locations. This instrument directly measures light extinction, which is proportional to the ability of atmospheric

particles and gases to attenuate image-forming light as it travels from an object to an observer. The station also monitors relative humidity in order to resolve low visibility because of fog or rain.

La Casa, 4587 Navajo Street (08 031 0026):

The La Casa site was established in January of 2013 as a replacement for the Denver Municipal Animal Shelter (DMAS) site when a land use change forced the relocation of the site. The La Casa location has been established as the NCore site for the Denver Metropolitan area. In late 2012 the DMAS site was decommissioned and moved to the La Casa site in northwest Denver and includes a trace gas/precursor-level CO analyzer, and a NOy analyzer, in addition to the trace level SO_2, O_3, meteorology, and particulate monitors are located here. La Casa has been certified in 2013 as an NCore-compliant site by the EPA. The site represents a population oriented neighborhood scale monitoring area.

The trace level SO_2, CO, and NOy analyzers began operation in January 2013.

The meteorological monitoring began at La Casa in January 2013.

PM_{10} monitoring began at La Casa in January 2013. Currently, there is a pair of collocated low volume PM_{10} samplers, and a Lo-Vol $PM_{2.5}$ on the shelter roof. The Lo-vol PM_{10} concentrations are very useful as they are used in conjunction with the $PM_{2.5}$ measurements to calculate $PM_{10-2.5}$ or coarse PM.

$PM_{2.5}$ monitoring began at La Casa in January 2013 with an FRM filter-based monitor, a continuous TEOM/FDMS FEM instrument, a supplemental $PM_{2.5}$ speciation monitor, and a carbon speciation monitor. In early 2015, the TEOM/FDMS was replaced with a GRIMM EDM 180 continuous monitor, which concurrently measures both PM_{10} and $PM_{2.5}$.

PM_{10}/lead monitoring began in January 2013. Lead monitoring at La Casa was discontinued December 31st, 2015 due to extremely low concentrations measured at the site. EPA has removed the lead monitoring requirement from all NCore sites due to the low concentrations measured throughout the country. Ambient lead concentrations will still be measured at the $PM_{2.5}$ speciation and IMPROVE sites throughout the state, as well as on the PM_{10} sampler at Grand Junction Powell (08 077 0017) as part of the National Air Toxics Trends Stations project.

I-25 Denver, 913 Yuma Street (08 031 0027):

The I-25 Denver site is an EPA-required near roadway NO_2 monitoring site. It was established in June 2013. It is measuring $NO/NO_2/NO_x$ by chemiluminescence. Trace level CO, Teledyne API Model 633 Black Carbon Aethalometer, $PM_{2.5}$ with a filter based sequential FRM on a 1 and 6 day schedule, continuous PM_{10} & $PM_{2.5}$ (with a GRIMM EDM 180), and meteorological parameters are also measured here.

I-25 Globeville, 4905 Acoma Street (08 031 0028):

The I-25 Globeville site is a second EPA-required near roadway NO_2 monitoring site. It was established Oct. 1st, 2015. It is measuring $NO/NO_2/NO_x$ by chemiluminescence. The site is also equipped with sensors to measure meteorological parameters and continuous PM_{10} and $PM_{2.5}$ with a GRIMM EDM 180 instrument.

Chatfield State Park, 11500 N. Roxborough Park Road (08 035 0004):

The Chatfield State Park location was established as the result of the 1993 Summer O_3 Study. The original permanent site was located at the campground office. This site was later relocated on the south side of Chatfield State Park at the park offices. This location was selected over the Corps of Engineers Visitor Center across the reservoir because it was more removed from the influence of traffic along C-470. Located in the South Platte River drainage, this location is well suited for monitoring southwesterly O_3 formation in the Denver metro area.

$PM_{2.5}$ monitoring began at this site in 2004 with the installation of a continuous monitor, and was furthered by the addition of an FRM sequential filter based monitor in 2005. Meteorological monitoring began in April of 2004.

Colorado Springs, USAFA Road 640 (08 041 0013):

The United States Air Force Academy site was installed as a replacement maximum concentration O_3 monitor for the Chestnut Street (08 041 0012) site. Modeling in the Colorado Springs area indicates that high O_3 concentrations should generally be found along either the Monument Creek drainage to the north of the Colorado Springs central business district (CBD), or to a lesser extent along the Fountain Creek drainage to the west of the CBD. The decision was made to locate this site near the Monument Creek drainage, approximately 9 miles north of the CBD. This location is near the south entrance of the Air Force Academy but away from any roads. This is a population oriented urban scale SLAMS monitor.

Colorado Springs Hwy-24, 690 W. Highway 24 (08 041 0015):

The Highway 24 site is located just to the west of I-25 and just to the east of the intersection of U.S. Highway 24 and 8th Street, approximately 0.8 miles to the west of the Colorado Springs CBD. Commencing operation in November 1998, this site is a replacement for the Tejon Street (08 041 0004) CO monitor. The site is located in the Fountain Creek drainage and is in one of the busiest traffic areas of Colorado Springs. Additionally, traffic is prone to back-up along Highway 24 due to a traffic light at 8th Street. Thus, this site is well suited for the SLAMS network to monitor maximum concentrations of CO in the area both from automotive sources and also from nearby industry, which includes a power plant. It also provides a micro-scale setting for the Colorado Springs area, which has not been possible in the past.

In January of 2013 an SO_2 monitor was added to Highway 24 to meet monitoring criteria for an increased population found during the 2010 census. To supplement SO_2 monitoring at the site, APCD added an RM Young meteorological tower in August of 2014, which also includes an RH sensor.

Manitou Springs, 101 Banks Place (08 041 0016):

The Manitou Springs ozone site is located 4 miles west of Colorado Springs. It was established because of concern that the high concentration urban O_3 area was traveling farther up the Fountain Creek drainage and the current monitoring network was not adequate. The Manitou Springs monitor began operations in April 2004. It is located in the foothills above Colorado Springs in the back of the city maintenance facility. It has not recorded any levels greater than the current standard. This is a population-oriented neighborhood scale SLAMS monitor.

Colorado College, 130 W. Cache la Poudre Street (08 041 0017):

The Colorado College monitoring site was established in January, 2007 after the revised particulate regulations required that Colorado Springs have a continuous $PM_{2.5}$ monitor. The APCD elected to collocate the new $PM_{2.5}$ monitor with the corresponding filter-based monitors from the RBD site at the Colorado College location, which included an FRM $PM_{2.5}$ monitor and added a low volume FEM PM_{10} monitor in November, 2007. The continuous monitor began operation in April of 2008. In the summer of 2016 the filter based $PM_{2.5}$ FRM instrument was removed and the GRIMM EDM 180 was designated as the primary sampler used to compare to the $PM_{2.5}$ NAAQS. Currently there is also a low volume filter-based PM_{10} sampler operated on a 1 in 6 day schedule at the site.

The nearest representative meteorological site is located at the Highway 24 monitoring site. Wind flows at the Colorado College site are affected by its proximity to Fountain Creek, so light drainage winds will follow the creek in a north/south direction. The three monitoring sites here are population-oriented neighborhood scale monitors on the SLAMS network (PM_{10} and $PM_{2.5}$).

Cañon City - City Hall, 128 Main Street (08 043 0003):

Cañon City is located 39 miles west of Pueblo. Particulate monitoring began on January 2, 1969 with the operation of a TSP monitor located on the roof of the courthouse building at 7th Avenue and Macon Street. The Macon Street site was relocated to the top of the City Hall building in October of 2004.

The Cañon City PM_{10} site began operation in December 1987. On May 6, 1988, the Macon Street monitor recorded a

PM_{10} concentration of 172 μg/m^3. This is the only exceedance of either the 24-hour or annual NAAQS since PM_{10} monitoring was established at Cañon City. This is a population oriented neighborhood scale SLAMS monitor on a 1 in 6 day sample schedule.

Rifle – Health Dept., 195 14th Ave (08 045 0012):

The Rifle Health site is located at the Garfield County Health Department building. The site is approximately 1 kilometer to the north of the downtown area and next to the Garfield County fairgrounds. The site is uphill from the downtown area. A small residential area is to the north and a commercial area to the east. This site was established to measure O_3 in Rifle, which is the largest population center in the oil and gas impacted area of the Grand Valley. Monitoring commenced in June 2008. This is a SLAMS site with a neighborhood scale.

Black Hawk, 195 14th Ave (08 047 0003):

The Black Hawk Site was selected to replace the Aspen Park Site that no longer met EPA siting requirements for tree obstruction. The Black Hawk site was chosen because it was found, during a recent Front Range ozone study, to have elevated ozone concentrations as compared to the other sites in the study. The Black Hawk monitoring location sits at an elevation of 2,633 meters and has been in operation since July of 2019.

Arvada, 9101 57th Avenue (08 059 0002):

The city of Arvada is located 15 miles west-northwest of the Denver central business district (CBD). The Arvada site began operation before 1973. It is located to the northwest of the Denver CBD near the western end of the diurnal midday wind flow of the high concentration urban O_3 area. As a result, when conditions are proper for daylong O_3 production, this site has received some of the highest levels in the city. In the early and mid-1990s, these wind patterns caused Arvada to have the most exceedances in the metro area. In the 5-Year Network Assessment Plan the Arvada site was deemed to be redundant. The last valid O_3 sample was taken 12/31/2011, and the instrument was removed shortly after that. Meteorological monitoring began in 1975 and continues today.

Welch, 12400 W. Highway 285 (08 059 0005):

The APCD conducted a short-term O_3 study on the grounds of Chatfield High School from June 14, 1989 until September 28, 1989. The Chatfield High School location was chosen because it sits on a ridge southwest of the Denver CBD. Wind pattern studies showed a potential for elevated O_3 levels in the area on mid to late afternoon summer days. There were no exceedances of the NAAQS recorded at the Chatfield High School site, but the levels were frequently higher than those recorded at the other monitoring sites south of the metro area.

One finding of the study was the need for a new, permanent site further north of the Chatfield High School location. As with most Denver locations, the predominant wind pattern is north/south. The southern flow occurs during the upslope, daytime warming period. The northern flow occurs during late afternoon and nighttime when drainage is caused by cooling and settling. The major drainages of Bear Creek and Turkey Creek were selected as target downwind transport corridors. These are the first major topographical features north of the Chatfield High School site. A point midway between the valley floor (Englewood site) and the foothill's hogback ridge was modeled to be the best estimate of the maximum downwind daytime transport area. These criteria were used to evaluate available locations. The Welch site best met these conditions. This site is located off State Highway 285 between Kipling Street and C-470. This is a population oriented urban scale SLAMS monitor.

Rocky Flats North, 16600 W. Highway 128 (08 059 0006):

The Rocky Flats - N site is located north-northeast of the former plant on the south side of Colorado Highway 128, approximately 1¼ miles to the west of Indiana Street. The site began operation in June of 1992 with the installation of an O_3 monitor and meteorological monitors as a part of the first phase of the APCD's monitoring effort around the Rocky Flats Environmental Technology Site.

O_3 monitoring began as a part of the Summer 1993 Ozone Study. The monitor recorded some of the highest O_3 levels of any of the sites during that study. Therefore, it was included as a regular part of the APCD O_3 monitoring network. The Rocky Flats – N monitor frequently exceeds the current standard. This is a highest concentration-oriented urban scale SLAMS monitor.

NREL Solar Radiation Research Laboratory, 2054 Quaker Street (08 059 0011):

The National Renewable Energy Laboratory (NREL) site is located on the south rim of South Table Mountain, near Golden, and was part of the Summer 1993 Ozone Study. Based on the elevated concentrations found at this location during the study, it was made a permanent monitoring site in 1994. This site typically records some of the higher eight-hour O_3 concentrations in the Denver area. It frequently exceeds the current standard.

Evergreen, 5124 S. Hatch Dr. (08 059 0014):

The Evergreen Site was selected to replace the Welch Site that was closed due to its redundancy with other ozone monitoring sites in the Denver Metro/North Front Range Region. The Evergreen location was selected because it expanded ozone monitoring into a populous area in the western foothills south of the I-70 corridor, an unmonitored area where special studies have indicated potentially elevated ozone concentrations. The Evergreen monitoring location sits at an elevation of 2,225 meters and has been in operation since September of 2020.

Fort Collins – CSU – Edison, 251 Edison Street (08 069 0009):

Fort Collins does not have the population to require a particulate monitor under Federal regulations. However, it is one of the largest cities along the Front Range. In the summer of 2016 APCD removed the filter based FRM $PM_{2.5}$ sampler and designated the GRIMM EDM 180 continuous particulate monitor as the primary method for $PM_{2.5}$ NAAQS comparisons. Currently there are filter based high volume PM_{10} neighborhood scale SLAMS monitors on a 1 in 3 day schedule and a continuous GRIMM EDM 180 that measures PM_{10} and $PM_{2.5}$ operated at the site.

Fort Collins - West, 3416 W. La Porte Avenue (08 069 0011):

The Fort Collins-West ozone monitor began operation in May of 2006. The location was established based on modeling and to satisfy permit conditions for a major source in the Fort Collins area. The levels recorded for the first season of operation showed consistently higher concentrations than the 708 S. Mason Street monitor. This is a highest concentration oriented urban scale SLAMS monitor.

Fort Collins- Mason, 708 S. Mason Street (08 069 1004):

The 708 S. Mason Street site began operation in December 1980 and is located one block west of College Avenue in the Central Business District. The one-hour CO standard of 35 ppm as a one-hour average has only been exceeded on December 1, 1983, at 4:00 P.M. and again at 5:00 P.M. The values reported were 43.9 ppm and 43.2 ppm respectively. The eight-hour standard of 9 ppm was exceeded one or more times a year from 1980 through 1989. The last exceedances were in 1991 on January 31 and December 6 when values of 9.8 ppm and 10.0 ppm respectively were recorded.

Fort Collins does not have the population to require a CO monitor under Federal regulation. However, it is one of the largest cities along the Front Range and was declared in nonattainment for CO in the mid-1970s after exceeding the eight-hour standard in both 1974 and 1975. In May of 2016 the CO monitor was upgraded to a Thermo 48i-TLE trace level instrument. The current level of monitoring is in part a function of the resulting CO State Maintenance Plan (SMP) for the area. It is a population oriented neighborhood scale SLAMS monitor.

O_3 monitoring began in 1980, and continues today.

Meteorological monitoring began at the site January 1st, 1981. In March 2012 the meteorological tower was relocated from a freestanding tower on the west side of the shelter to a shelter mounted tower on the south side of the shelter due to the Mason Street Redevelopment Project.

Grand Junction - Powell, 650 South Avenue (08 077 0017):

Grand Junction is the largest city on the western slope. It is located in the broad valley of the Colorado River. The monitors are on county owned buildings in the south side of the city. This site is on the southern end of the central business district and close to the industrial area along the train tracks. It is about a half a mile north of the river and about a quarter mile east of the railroad yard. In the summer of 2016 the primary filter based FRM was removed and the GRIMM EDM 180 continuous particulate monitor was designated as the primary to compare to the $PM_{2.5}$ NAAQS. Currently the GRIMM monitors for continuous $PM_{2.5}$ and PM_{10} and there are also two low volume filter based collocated PM_{10} monitors operated at the site on a 1 in 3 day and 1 in 6 day sample schedule.

Grand Junction - Pitkin, 645¼ Pitkin Avenue (08 077 0018):

Meteorological monitors were installed in 2004, and include wind speed, wind direction, and temperature sensors. The meteorological tower was outfitted January 5th, 2015 with RM Young meteorological sensors, including a RH sensor. This site is also part of the National Air Toxics Trends Station Network. This network is a national EPA project to assess levels of urban air toxics around the country. EPA requires that the site include a carbon monoxide monitor, as an indication of automobile traffic in the area.

Palisade Water Treatment, Rapid Creek Rd (08 077 0020):

The Palisade site is located at the Palisade Water Treatment Plant. The site is 4 km to the east-northeast of downtown Palisade, just into the De Beque Canyon area. The site is remote from any significant population and was established to measure maximum concentrations of O_3 that may result from summertime up-flow conditions into a topographical trap. Ozone and meteorological monitoring commenced in May 2008. This is an urban scale special purpose monitor.

Cortez, 106 W. North St (08 083 0006):

The Cortez site is located in downtown Cortez at the Montezuma County Health Department building. Cortez is the largest population center in Montezuma County in the southwest corner of Colorado.

The O_3 monitor was established to address community concerns of possible high O_3 from oil and gas and power plant emissions in the area. Many of these sources are in New Mexico. Ozone monitoring commenced in May 2008 and the first $PM_{2.5}$ filter was sampled June 20th, 2008. $PM_{2.5}$ monitoring was discontinued at the site in July of 2015 due to the site completing sampling requirements and the site returning low $PM_{2.5}$ concentrations. This site is an urban scale SLAMS monitor.

Aspen Yellow Brick School, 215 North Garmisch (08 097 0008):

Aspen is at the upper end of a steep mountain valley. Aspen does not have an interstate highway running through it. Aspen was classified as nonattainment for PM_{10}, but it is now under an attainment/maintenance plan. The valley is more restricted at the lower end, and thus forms a tighter trap for pollutants. The transient population due to winter skiing and summer mountain activities greatly increases the population and traffic during these seasons. There is also a large down valley population that commutes to work each day from as far away as the Glenwood Springs area, which is 41 miles to the northeast. There is currently a high volume filter based PM_{10} monitor and a continuous $PM_{10}/PM_{2.5}$ GRIMM EDM 180 monitor operated at this site.

The population oriented neighborhood scale SLAMS high volume PM_{10} monitor is operating on a 1 in 3 sample schedule.

Lamar Municipal Building, 104 Parmenter Street (08 099 0002):

The Lamar Municipal site was established in January of 1996 as a more population oriented location than the Power Plant. The Power Plant site was located on the northern edge of town (until it was decommissioned in 2012) while the Municipal site is near the center of the town. Both sites have recorded exceedances of the 24-hour standard of 150 $\mu g/m^3$, and both sites regularly record values above $100\mu g/m^3$ as a 24-hour average. The Power Station site in Lamar has been shut down, because it did not meet siting criteria. The Lamar Municipal Building location houses population oriented neighborhood scale SLAMS high-volume PM_{10} monitors on a daily sample schedule.

Pueblo Fountain School, 925 N. Glendale Ave (08 101 0015):

Pueblo is the third largest city in the state, not counting communities that are part of Metropolitan Denver. Pueblo is principally characterized by rolling plains and moderate slopes with elevations ranging from 4,474 feet to 4,814 feet (1,364 to 1,467 m). The Rocky Mountain Front Range is about 25 miles (40 km) west and the sight of Pikes Peak is easily visible on a clear day.

Meteorologically, Pueblo can be described as having mild weather with an average of about 300 days of sunshine per year. Generally, wind blows up valley from the southeast during the day and down valley from the west at night. Pueblo experiences average wind speed ranges from 7 miles per hour in the fall and early winter to 11 miles per hour in the spring.

This site was formerly located on the roof of the Public Works Building at 211 E. D St., in a relatively flat area found two blocks northeast of the Arkansas River. At the end of June in 2011 the Public Works site was shut down and moved to the Magnet School site as the construction of a new multi-story building caused a major change in the flow dynamics of the site. The new site began operations in 2011. The distance and traffic estimate for the surrounding streets falls into the middle scale in accordance with federal guidelines found in 40 CFR, Part 58, and Appendix D.

Steamboat Springs, 136 6th Street (08 107 0003):

Like other ski towns, Steamboat Springs has problems with wintertime inversions, high traffic density, wood smoke, and street sand. These problems are exacerbated by temperature inversions that trap the pollution in the valleys.

The first site began operation in Steamboat Springs in June 1985 at 929 Lincoln Avenue. It was moved to the current location in October 1986. The 136 6th Street location not only provides a good indication of population exposure, since it is more centrally located, but it has better accessibility than the previous location. This site monitors for PM_{10} with high volume filter based sampling. This is a population oriented neighborhood scale SLAMS monitor on a daily sample schedule.

Telluride, 333 W. Colorado Avenue (08 117 0002):

Telluride is a high mountain ski town in a narrow box end valley. The San Miguel River runs through the south end of town, which is only about ½ mile wide from north to south. The topography of this mountain valley regime creates temperature inversions that can last for several days during the winter. Temperature inversions can trap air pollution close to the ground. Telluride sits in a valley that trends mainly east to west, which can trap air pollutants more effectively since the prevailing winds in this latitude are westerly and the San Miguel River Valley is closed off on the east end. This is a population oriented neighborhood scale SLAMS monitor on a 1 in 3 day sample schedule.

Greeley Hospital, 1516 Hospital Road (08 123 0006):

The Greeley PM_{10} and $PM_{2.5}$ monitors are on the roof of a hospital office building at 1516 Hospital Road. In the summer of 2016 the filter Based FRM was removed from the site and the GRIMM EDM 180 continuous particulate monitor was designated as the primary monitor for NAAQS comparisons. The site currently has Hi Volume filter based PM_{10} monitors

on a 1 in 3 day sample schedule and a continuous GRIMM instrument that measures $PM_{2.5}$ and $PM_{10.}$ This is a population-oriented neighborhood scale SLAMS site. Greeley Central High School is located immediately to the east of the monitoring site. Overall, this is in an area of mixed residential and commercial development that makes it a good population-exposure, neighborhood scale monitor. The distance and traffic estimate for the most controlling street easily falls into the neighborhood scale in accordance with federal guidelines found in 40 CFR, Part 58.

Winds in this area are primarily out of the northwest, with dominant wind speeds less than 5 mph. Secondary winds are from the north, north-northwest and east-southeast, with the most frequent wind speeds also being less than 5 mph. The most recent available wind data for this station is for the period December 1986 to November 1987. Predominant residential growth patterns are to the west and north with large industrial growth expected to the west. There are two feedlots located about 11 miles east of the town. There was a closer feedlot on the east edge of town, but it was shut down in early 1999, after the town of Greeley purchased the land in 1997.

Platteville, 1004 Main Street (08 123 0008):

Platteville is located immediately west of Highway 85 along the Platte River valley bottom approximately five miles east of I-25, at an elevation of 4,825 feet. The area is characterized by relatively flat terrain and is located about one mile east of the South Platte. The National Oceanic and Atmospheric Administration operated the Prototype Regional Observational Forecasting System Mesonet network of meteorological monitors from the early 1990s through the mid-1990s in the northern Colorado Front Range area. Based on this data, the area around Platteville is one of the last places in the wintertime that the cold pool of air that is formed by temperature inversions will burn off. This is due to solar heating. The upslope/down slope Platte River Valley drainage and wind flows between Denver and Greeley make Platteville a good place to monitor $PM_{2.5}$. These characteristics also make it an ideal location for chemical speciation sampling, which began at the end of 2001 and is currently still monitoring.

The Platteville site is located at 1004 Main Street at the South Valley Middle School, located on the south side of town on Main Street. The school is a one-story building and it has a roof hatch from a locked interior room providing easy access to its large flat roof. There is a 2-story gym attached to the building approximately 28 meters to the Northwest of the monitor. The location of the Platteville monitor falls into the regional transport scale in accordance with federal guidelines found in 40 CFR, Part 58, and Appendix D. There are three monitors here. Two are population-oriented regional scale monitors, one of which is on the SLAMS network and the other is for supplemental speciation. The $PM_{2.5}$ filter based FRM SLAMS monitor is operating on a 1 in 3 day sample schedule, while the speciation monitor is operating on a 1 in 6 day schedule. The remaining monitor is a population oriented neighborhood scale supplemental speciation monitor on a 1 in 6 day sample schedule.

Greeley, Weld County Tower, 3101 35th Avenue (08 123 0009):

The Weld County Tower O_3 monitor began operation in June 2002. The site was established after the 811 15th Street building was sold and was scheduled for conversion to other uses. The Weld County Tower site has generally recorded levels greater than the old site. This is a population-oriented neighborhood scale SLAMS monitor. The Greeley West Annex carbon monoxide monitoring site was dismantled in June of 2015 and moved to the Weld County Tower site. Carbon Monoxide monitoring began at the Weld County Tower site in April of 2015 with a Thermo 48C monitor. The CO monitor at Weld County Tower was upgraded from a Thermo 48C to a Thermo 48iTLE trace level analyzer on April 28th, 2016.

Meteorological monitoring began in February of 2012.

Plattville Atmospheric Obsevatory (PAO), 17065 County Rd 28 (08 123 0013):

The APCD commenced ozone, nitrogen dioxide, and meteorological monitoring at NOAA PAO facility near Platteville, CO on June 12, 2020. The PAO air monitoring site was installed to obtain nitrogen dioxide data in the Denver-Julesberg Basin. The location and need for this site was identified in the 2017 Western Air Quality Study Monitoring Network Assessment, where a key finding was the recommendation for nitrogen dioxide monitoring in the underserved/unmonitored Denver-Julesberg Basin.

Appendix B - Public Comments and Responses

This appendix includes information regarding the required public comment period, comments received and APCD responses.

Per 40 CFR 58.10, a 30-day public comment period is required before submitting the Annual Network Plan to EPA. APCD posted notice of this Annual Network Plan on May 26, 2022 on the APCD website at: https://www.colorado.gov/pacific/cdphe/air-division-public-comment and https://www.colorado.gov/airquality/tech_doc_repository.aspx. The public comment period was open through June 27, 2022.

The APCD received two sets of comments on this Annual Network Plan during the public comment period. The APCD appreciates the time and effort taken to develop these comments. The comments are presented below along with the APCD's responses.

Public Comments Received and APCD Responses:

Commenter #1:

Dea APCD,

I am writing to give comments on the 2022 Air Monitoring Network Plan.

1. I urge the APCD to make the monitoring plan more accessible for communities. This monitoring plan was not clearly organized nor made readable, which is a barrier to communities to be able to offer detailed comments. I recommend that the APCD work on making this plan more accessible if it truly wants community input. This could include plain language summaries, more maps and figures, more information in the tables, etc.

2. It is not clear how many of the current PM monitors (PM10 and 2.5) are continuous vs TEOM. I urge the state to switch over to continuous so that we are not still using monitoring at low frequencies (every 3 or 6 days) because it misses important pollution events.

3. I encourage the state to use community monitoring zones and low cost distributed pollution censors to fill in spatial gaps in the network. Right now there still are places that don't have access to information (especially PM10) because of the density of monitors. It would be helpful to include why the APCD did not establish any community monitoring zones.

4. What happened to the Canyon City PM10 monitor that did not allow it to meet the "completeness requirement"? What is that requirement, is the issue being fixed, and what does that mean about the air quality data collected?

5. How is this reporting of exceedances impacted by Exceptional Events? Is the data reported here represent total exceedances after data was removed or does it represent unmanipulated data? This is important and BOTH data should be reported (measured levels and altered counts after exceptional events excluded). Excluded data only disappears from the counts, not from the air quality exposures experienced by communities.

6. Reissue monitors to La Junta and Rocky Ford and clarify "Along the US-50/Arkansas River corridor, the Division has monitored for particulates in the communities of La Junta and Rocky Ford. These monitoring sites were all discontinued in the late 1970s through early 1990s after a review showed that the concentrations were well below the standards and trending downward." Is this because PM levels dropped or because Exceptional Event designations

increased? We need to know what the air quality threats communities are experiencing, and whether or not it is "exceptional" doesn't change if it is harmful or dangerous for those breathing in the particulate matter.

7. Every monitoring plan should include a map of the network and the proposed monitoring network for each of the NAAQS. The map showing all monitoring sites isn't helpful because they monitor for different things and it makes it hard to understand the patterns being proposed for different pollutants/indicators.

8. Wildfire smoke is not described at all in this plan. The state has mobile monitors for this, right? It would be great to include how the mobile monitors would be deployed during wildfire (or dust) events, how many there are, what type of monitors they are. All of this information should be available in the monitoring plan for people to understand this critical issue (and mobile monitors are part of a monitoring plan).

Thank you for consideration of these comments and I hope to receive a response or feedback about how this is used or your consideration of my requests (as is best practices when soliciting community feedback on plans). I am happy to provide more details on my comments as well.

Thank you,

Katie

Katie Clifford, Ph.D. (she/hers)

Western Water Assessment & Department of Geography

University of Colorado, Boulder

APCD Responses to Commenter #1

1. The APCD strives to make the Network Plan as readable and informative as possible, while not necessarily duplicating the information available in other reports (Annual Data Report, 5-Year Network Assessment, etc.). We agree that the Network Plan could be more accessible if communities were better informed of its publication. In future years we intend to announce the 30-day comment period more widely to address this issue.

2. The type of instrumentation used at each monitoring site is detailed in Appendix A. The state continues to explore opportunities to expand our continuous PM monitoring activities.

3. We agree that low cost sensors are useful for determining spatial variability and zones of maximum concentration. The APCD has used low cost sensors for various purposes in the past and will continue to develop experience and expertise in this area; however, this effort is beyond the scope of the Network Plan, which is focused on regulatory criteria pollutant monitoring conducted using federally approved methods.

4. The data completeness requirement for PM10 is 85%. The Canon City PM10 monitor did not meet this requirement during 2020 because COVID-19 restrictions had prevented access to the building from March 8, 2020 to April 30, 2020; therefore, this PM10 monitor does not have a valid three-year design value (all three consecutive years need to meet the completeness requirement for the design value to be comparable to the NAAQS).

5. All potential Exceptional Events are included in this report. Exceptional Event approvals take quite a long time to develop and justify and are never considered forgone conclusions. This also applies to the other air quality documents available on the APCD website. Exceptional Event reports and approvals can be found at the same address (https://www.colorado.gov/airquality/tech_doc_repository.aspx).

6. All of the exceedances of the PM10 NAAQS that have ever been measured by the APCD in the Eastern High Plains region have occurred in the city of Lamar. There are two monitors here that are highly impacted by wind-blown dust (104 E. PARMENTER ST. and 100 N. 2ND AVE.). No other APCD monitor in this region has ever exceeded the NAAQS for PM10, nor have there been any Exceptional Event proposals in this region other than those for Lamar.

7. Detailed monitoring network maps are available in other reports (e.g., Annual Data Report, 5-Year Network Assessment) and are not detailed here.

8. The APCD uses low cost Canary and Purple Air sensors for several different purposes. Currently a large number of the Purple Air sensors have been deployed to public health agencies around the state to aid those folks in providing air quality data to local residents. There are also several of these sensors that can be deployed in the event of a wildfire or a potentially high-impact prescribed fire. However, these activities are beyond the scope of the Network Plan, which is focused on regulatory criteria pollutant monitoring conducted using federally approved methods.

Commenter #2:

When I moved to Lakewood from Denver in 2015 I discovered there's a whole lot of wood burning on the west side of town. Big lots, mature trees, downed limbs from storms, and no recreational wood burning restrictions in Jefferson County cities (unlike in Denver) = incessant wood burning year-round. Already aware of the ozone issues on the west side, I wanted to know how the particulate air pollution here compared to Denver, so I started looking for that information and was shocked to find out that the state does not monitor PM2.5 in Jefferson County. The only PM2.5 data for Jeffco I could find came from the PurpleAir map showing citizen owned sensors.

Since I wanted to compare PM2.5 levels on the east side (where PM2.5 IS monitored by the state) to PM2.5 levels on the west side, I located the PurpleAir sensors east of Sheridan Blvd that were closest to state PM2.5 monitors. Then I identified sensors west of Sheridan in Lakewood/Wheat Ridge/Arvada and Jefferson County and began to collect data from all of these sensors.

For several months, I collected the 24 hour average readings from west side and east side sensors every day. Then I averaged the daily readings for each sensor for each month. I have data for September, October, November, and December 2021 and January, February and March of 2022. By early April, a family emergency kept me from continuing with the data collection.

Initially, it appeared that the highest PM2.5 readings were coming from the state monitor at National Jewish, so the majority of the PurpleAir sensors I followed on the east side were in the neighborhood around National Jewish. I also added sensors in the vicinity of Globeville, CAMP, 45th and Navajo, and Adam-Birch monitors. I tried to use the same sensors for the duration, but some of the sensors in each group (west side and east side) would go offline and stop sending data, or new sensors would appear in good locations, so I would periodically replace sensors. I started followed the Metro Lofts PurpleAir sensor but then decided to eliminate it since I had added other east side sensors closer to CDPHE monitors.

There are many more PurpleAir sensors operating now than when I first started my data collection, and some of the sensors from which my data were collected are no longer operational. Where it is not obvious by the name where the sensor is located:

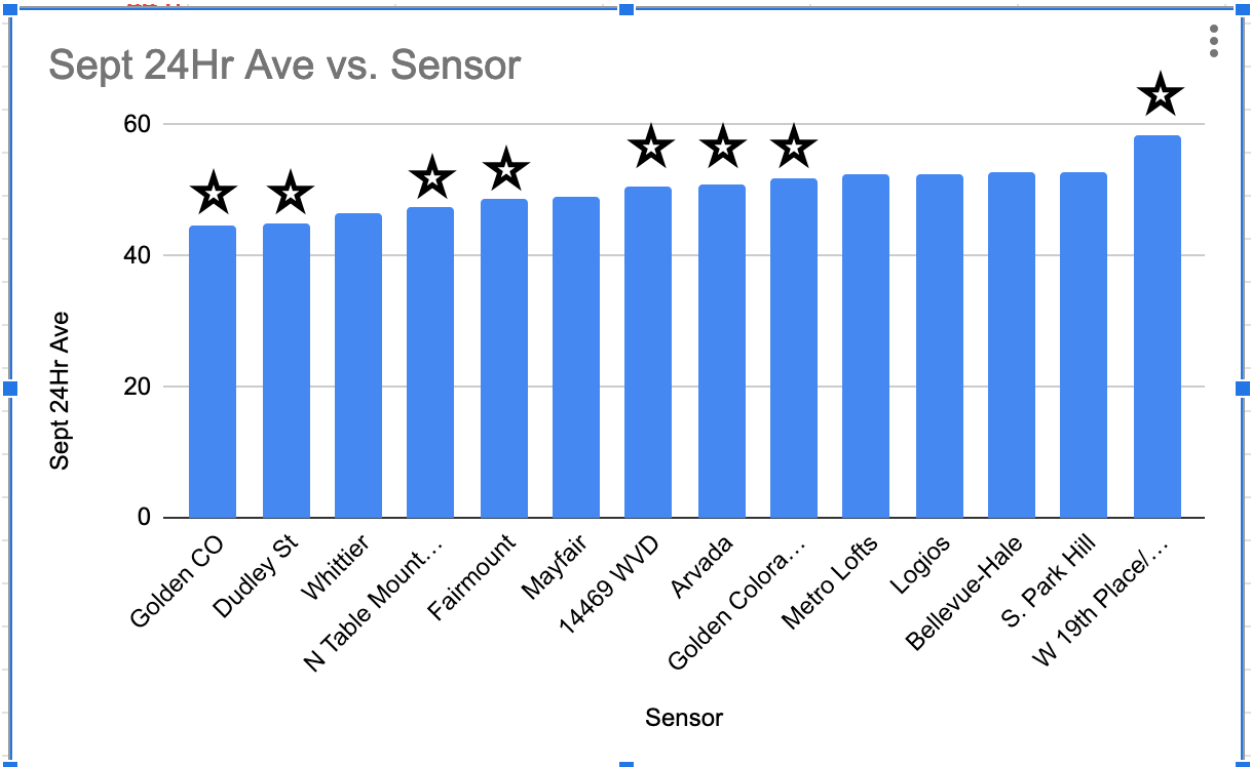
West Side Purple Air Sensor Locations
14469 WVD sensor is located on Green Mountain in Lakewood
Arrakis is also near Green Mountain
Dudley St is in Lakewood near Dudley St and W. 20th Ave near Morse Park
Fairmount is east of N. Table Mountain near W 50th Ave and McIntyre St
Fruitdale is in Wheat Ridge near W 44th Ave and Oak St
Lumberg is Lumberg Elementary in Edgewater near W 20th Ave and Pierce
Quaker Acres is in the vicinity of Quaker St and W 75th Place up near Arvada/Leyden
W. 19th Place and Applewood is near Youngfield and W 20th Avenue in Jeffco

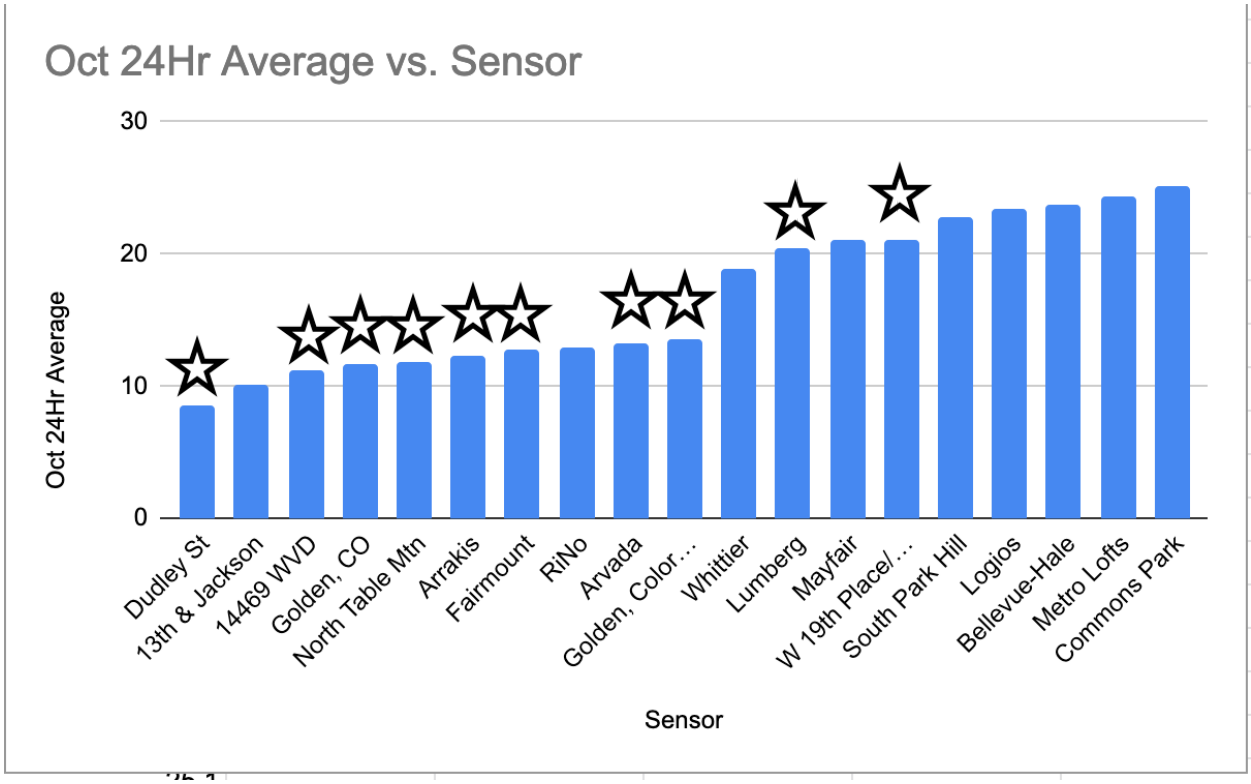
East Side PurpleAir Sensor Locations

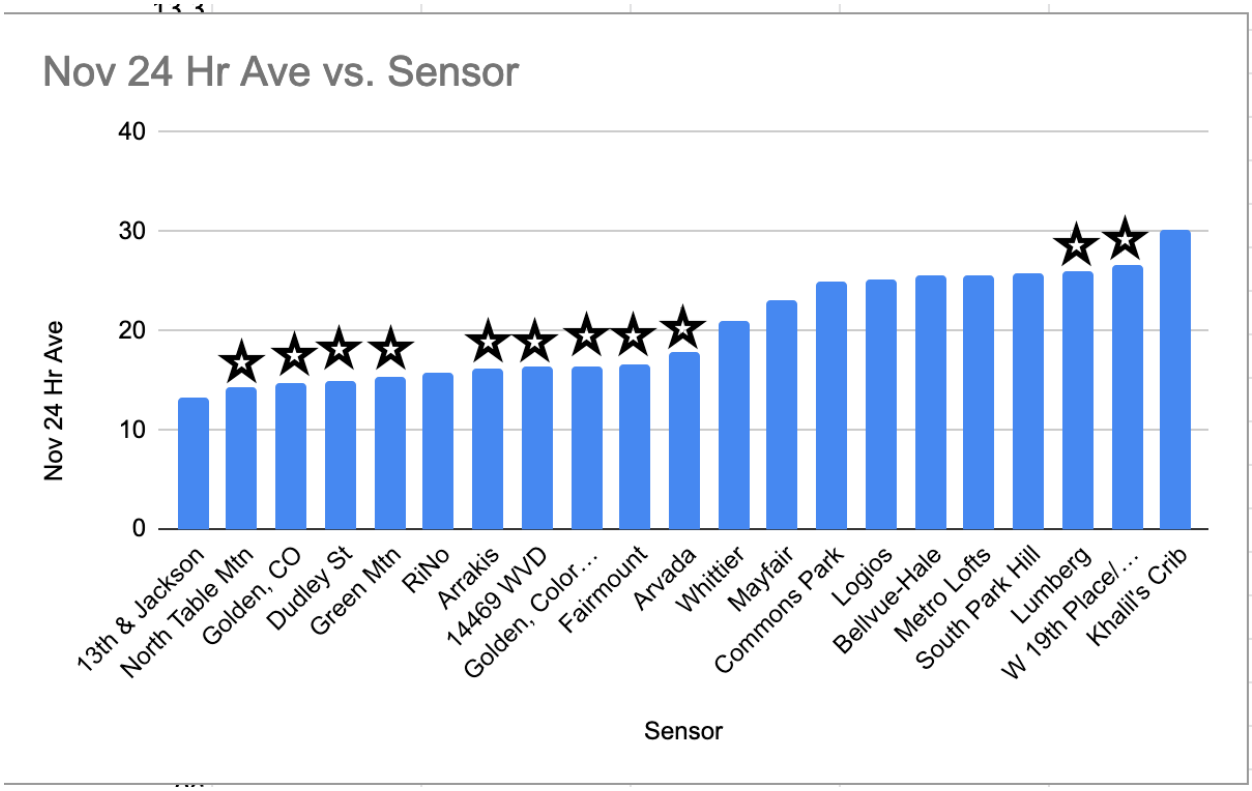
Bellevue-Hale, Logios By the Mtns, S. Park Hill, 13th and Jackson are or were all near National Jewish Hospital
Boulder Air 1 and Boulder Air 6 are/were near Adams-Birch
High Downtown is in vicinity of CAMP monitor
Khalil's Crib was the closest sensor to Globeville for a while but it went offline too much to be useful.
Rino near Globeville and 45th and Navajo
Whittier near the CAMP and 45th and Navajo monitors
50th & Sherman was near Globeville monitor

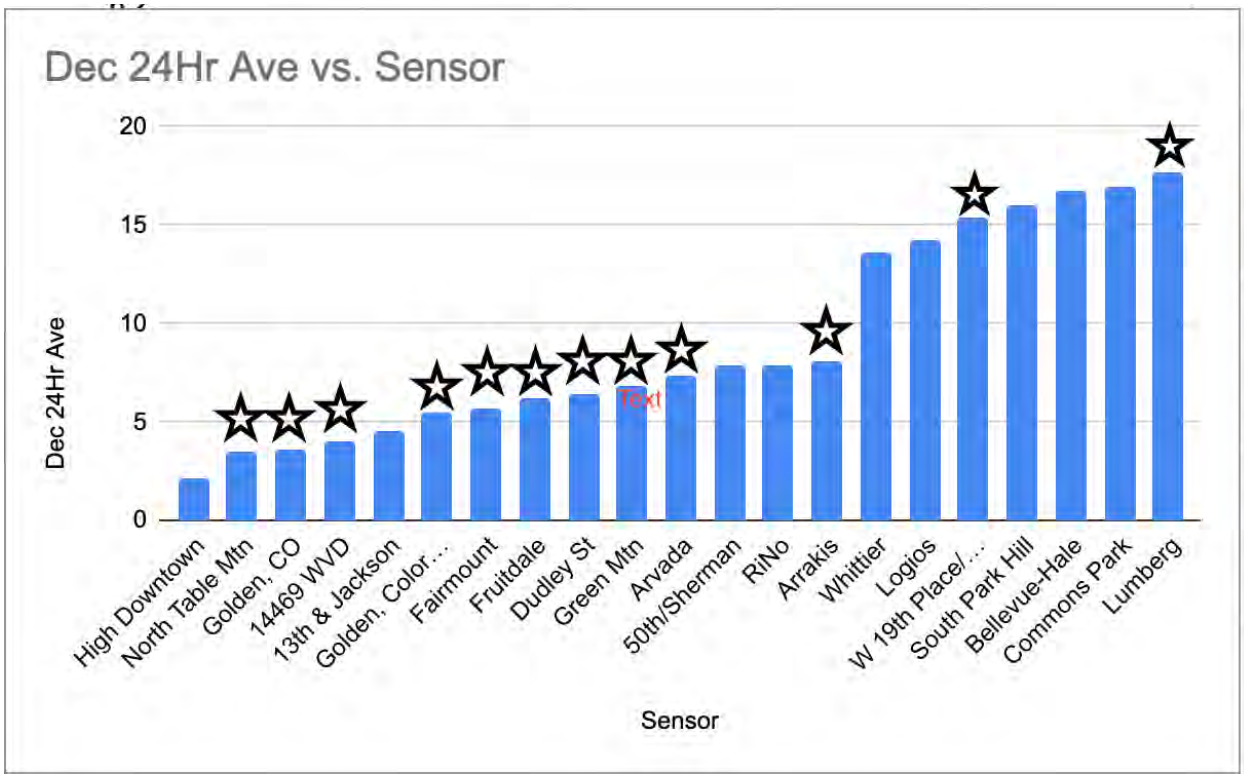
Results:
The data shows the 24hr average PM2.5 reading for the sensor for the month. A star symbol over the bar indicates data from a 'west side' sensor. Bars without stars show data from 'east side' sensors.

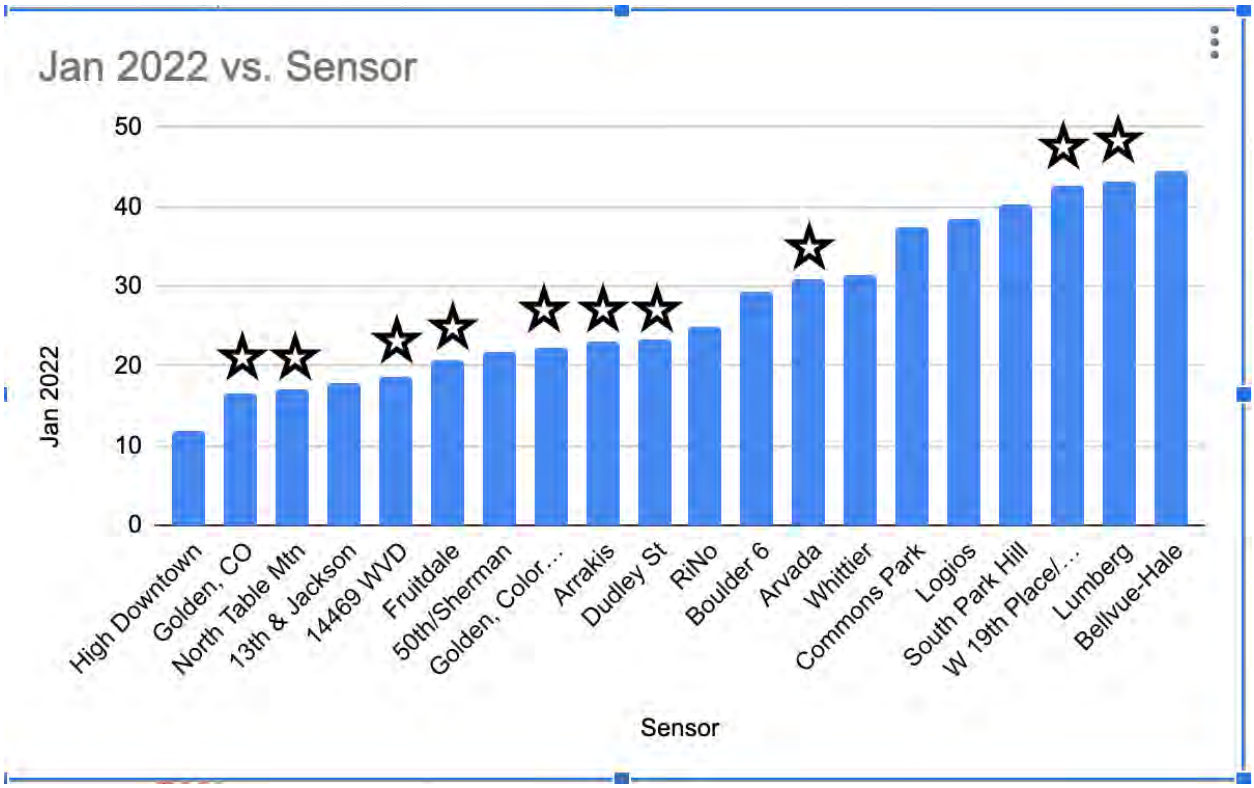
In September 2021, there was not a huge difference from east to west, but the highest reading came from West 19th Avenue and Applewood near Youngfield/Colfax on the west side.

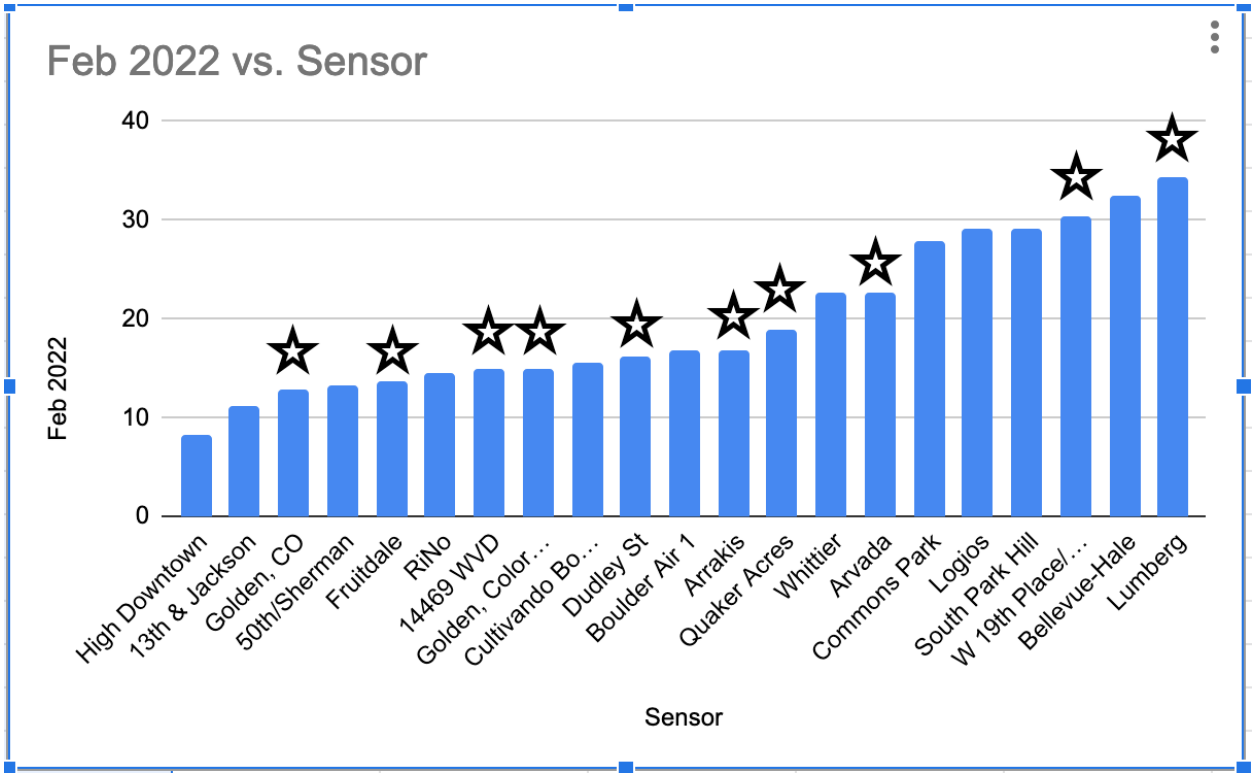


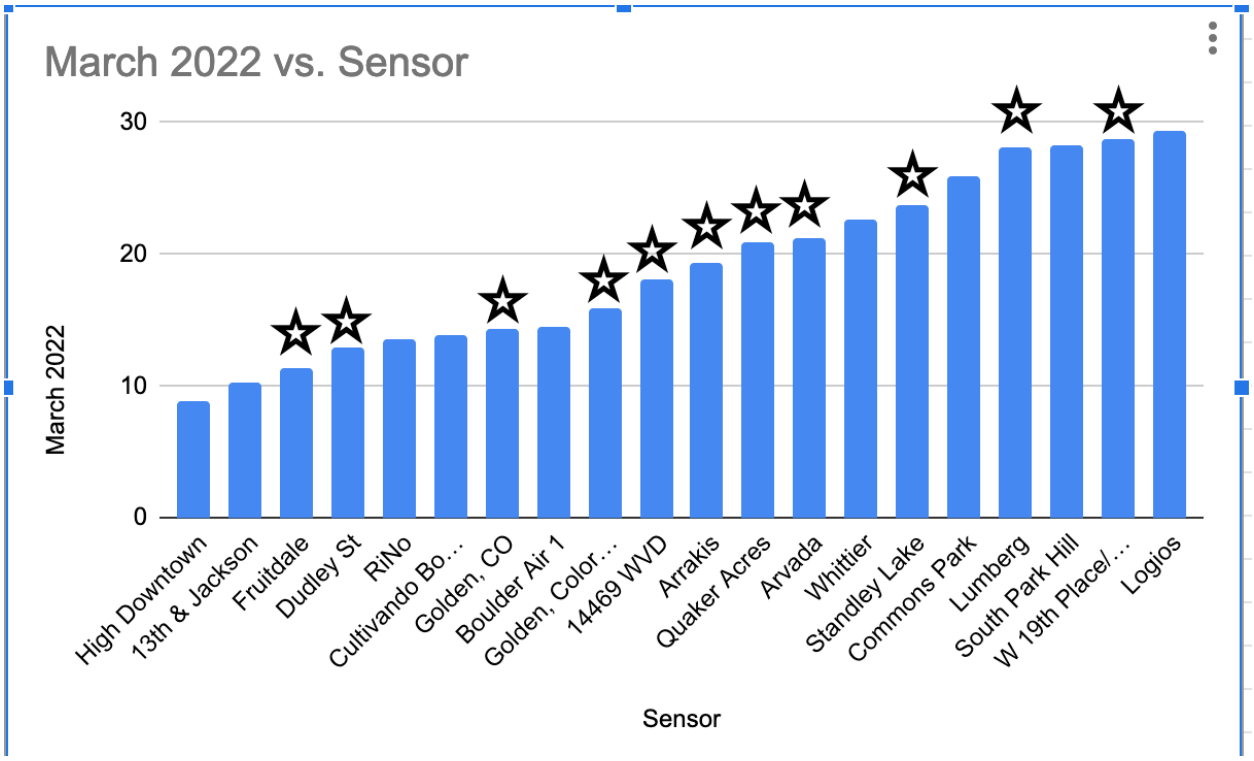

Oct 24Hr Average vs. Sensor
Oct 24Hr Average
30
20
10
0
Dudley St
13th & Jackson
14469 WVD
Golden, CO
North Table Mtn
Arrakis
Fairmount
RiNo
Arvada
Golden, Color…
Whittier
Lumberg
Mayfair
W 19th Place/…
South Park Hill
Logios
Bellvue-Hale
Metro Lofts
Commons Park
Sensor


Nov 24 Hr Ave vs. Sensor
Nov 24 Hr Ave
40
30
20
10
0
13th & Jackson
North Table Mtn
Golden, CO
Dudley St
Green Mtn
RiNo
Arrakis
14469 WVD
Golden, Color…
Fairmount
Arvada
Whittier
Mayfair
Commons Park
Logios
Bellvue-Hale
Metro Lofts
South Park Hill
Lumberg
W 19th Place/…
Khalil's Crib
Sensor


Dec 24Hr Ave vs. Sensor
Dec 24Hr Ave
20
15
10
5
0
High Downtown
North Table Mtn
Golden, CO
14469 WVD
13th & Jackson
Golden, Color…
Fairmount
Fruitdale
Dudley St
Green Mtn
Arvada
50th/Sherman
RiNo
Arrakis
Whittier
Logios
W 19th Place/…
South Park Hill
Bellevue-Hale
Commons Park
Lumberg
Sensor


Jan 2022 vs. Sensor
Jan 2022
50
40
30
20
10
0
High Downtown
Golden, CO
North Table Mtn
13th & Jackson
14469 WVD
Fruitdale
50th/Sherman
Golden, Color…
Arrakis
Dudley St
RiNo
Boulder 6
Arvada
Whittier
Commons Park
Logios
South Park Hill
W 19th Place/…
Lumberg
Bellvue-Hale
Sensor


Feb 2022 vs. Sensor
40
30
20
10
0
Feb 2022
High Downtown
13th & Jackson
Golden, CO
50th/Sherman
Fruitdale
RiNo
14469 WVD
Golden, Color…
Cultivando Bo…
Dudley St
Boulder Air 1
Arrakis
Quaker Acres
Whittier
Arvada
Commons Park
Logios
South Park Hill
W 19th Place/…
Bellevue-Hale
Lumberg
Sensor


March 2022 vs. Sensor
30
20
10
0
March 2022
High Downtown
13th & Jackson
Fruitdale
Dudley St
RiNo
Cultivando Bo…
Golden, CO
Boulder Air 1
Golden, Color…
14469 WVD
Arrakis
Quaker Acres
Arvada
Whittier
Standley Lake
Commons Park
Lumberg
South Park Hill
W 19th Place/…
Logios
Sensor

What do these graphs tell us? In a nutshell, there is quite a bit of variability from month to month, and some of the sensors on the 'West Side' have monthly averages every bit as high as sensors operating closest to where CDPHE currently has PM2.5 monitors located.

So the question is, why are there so many PM2.5 monitors east of I-25, and ZERO west of Sheridan Ave? Yes, ozone is of great concern on the west side, but that does not explain the total lack of monitoring of PM2.5 in Jefferson County. The data would support moving at least ONE of the several PM2.5 monitors to Jefferson County. The high PurpleAir readings from Applewood, near the Applewood shopping center and I-70, suggests that somewhere near that shopping center would be a good place for a PM2.5 monitor. Similarly, Lumberg Elementary, being a public school, seems like an ideal place, given that the sensor there records some of the highest PM2.5 levels of ANY of the sensors, east or west.

What is our air quality, REALLY, over here in Jefferson County? We'll only know if we measure BOTH ozone AND PM2.5.

Sincerely,
Rita Berberian
1900 Dudley St
Lakewood, CO 80215

APCD Responses to Commenter #2:

Thanks for your comments. PM2.5 monitoring tends to be concentrated around I-25 and the Platte River valley, as these are areas with the highest anticipated concentrations. However, it is true that the APCD has never conducted PM2.5 monitoring in Jefferson county and this should be explored in the future, potentially by adding a PM2.5 monitor to one of the existing ozone sites, given the availability of resources to do so.