South Dakota Ambient Air Monitoring Annual Plan 2022

South Dakota
Department of Agriculture and Natural Resources
Air Quality Program

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Executive Summary

The South Dakota Department of Agriculture and Natural Resources (DANR) develops an annual ambient air monitoring network plan which is a review of the ambient air monitoring network each year as required by Title 40 of the Code of Federal Regulation (CFR), Part 58. All areas of the state are in attainment with the Environmental Protection Agency's (EPA's) National Ambient Air Quality Standards (NAAQS).

The annual plan was published on the department's air quality website from 5/26/22 through 6/25/22 to provide for public review and comments for 30 days. No comments were received. The annual plan includes the following major sections:

1. Ambient air monitoring goals, plans and needs are in Sections 3.0 through 5.0, respectively;
2. Proposed modifications to the ambient air monitoring network to meet the changing trends, national requirements, and state needs are in Section 6.0;
3. Sampling frequency waivers are identified in Section 7.0;
4. Purchase replacement plan is in Section 8.0;
5. Evaluation of collected data compared to the National Ambient Air Quality Standards is in Section 9.0;
6. Air pollution trends for each site are in Section 10.0; and
7. Special air quality monitoring is identified in Section 11.0.

The department is planning the following site modifications in 2022:

1. Continue replacing older continuous monitors before they become too expensive to repair and as resources allow;
2. The landowner of the UC #1 site indicated she did not wish to renew the contract; therefore, the contract was terminated in late 2021 and sampling ended in October; and
3. A new monitoring location was set-up in Vermillion and began sampling in 2022.

1.0 INTRODUCTION

The United States Environmental Protection Agency through Title 40 of the Code of Federal Regulation and the Performance Partnership Agreement (PPA) requires the South Dakota Department of Agriculture and Natural Resources to complete an annual ambient air monitoring plan. EPA's requirements for the annual plan are listed in Title 40 of the Code of Federal Regulations §58.10. The plan will cover a review of the ambient air monitoring sites and determine if the network is meeting the monitoring objectives in Title 40 of the Code of Federal Regulations Part 58, Appendixes A, C, D, and E. The plan will identify needed modifications to the network such as the termination or relocation of a monitor, addition of new parameters, or the establishment of new stations. The plan will update compliance concentrations for comparison to the National Ambient Air Quality Standards and to determine trends for each sampling parameter.

The department was required to take public comments on the plan for 30 days prior to submitting the plan to EPA. The department complied with this requirement by posting this document on the department's Air Quality Program website at the following location from 5/26/22 through 6/25/22: https://danr.sd.gov/Environment/AirQuality/default.aspx and no comments were received. DANR will post the finalized Annual Plan for 2022 on our webpage at: https://danr.sd.gov/Environment/AirQuality/AirMonitoring/default.aspx.

2.0 AMBIENT AIR MONITORING NETWORK HISTORY

In 1972, South Dakota developed, and EPA approved a State Implementation Plan (SIP) which included the establishment and operation of an ambient air monitoring network for the state. In 1980, South Dakota submitted a revision to its State Implementation Plan to upgrade the program by establishing a network of State and Local Air Monitoring (SLAMS) stations and Special Purpose Monitoring (SPM) stations.

In the past, EPA has changed the National Ambient Air Quality Standards several times. Currently, EPA has established National Ambient Air Quality Standards for Particulate Matter (PM), Sulfur Dioxide (SO2), Nitrogen Dioxide (NO2), Ozone, Carbon Monoxide (CO), and Lead.

The particulate matter 10 microns in diameter or less (PM_{10}) standard was set in 1987 setting a 24-hour level of 150 micrograms per cubic meter (ug/m3) and an annual standard of 50 micrograms per cubic meter. In 2006, EPA revoked the annual standard leaving only the 24-hour standard. The department began monitoring for PM_{10} in 1987, and for 2021 was monitoring PM_{10} concentrations in Sioux Falls, Brookings, Watertown, Union County, Aberdeen, Badlands National Park, Wind Cave National Park, Black Hawk and Rapid City. The PM_{10} monitoring network represents the most populated and rural areas of the state. South Dakota's ambient air monitoring network for PM_{10} has historically demonstrated attainment with the PM_{10} standards.

The particulate matter 2.5 microns in diameter or less ($PM_{2.5}$) standards for 24-hour and annual levels were set in 1997. EPA revised the $PM_{2.5}$ standard significantly by reducing the 24-hour standard from 65 micrograms per cubic meter to 35 micrograms per cubic meter in 2006. The annual standard was revised from 15 micrograms per cubic meter to 12 micrograms per cubic meter in 2013. The department began monitoring for $PM_{2.5}$ in 1999 and in 2021 was monitoring $PM_{2.5}$ concentrations in Sioux Falls, Brookings, Watertown, Union County, Aberdeen, Pierre, Badlands National Park, Wind Cave National Park, and Rapid City. The $PM_{2.5}$ monitoring network represents the most populated and rural areas of the state. South Dakota's ambient air monitoring network for $PM_{2.5}$ has historically demonstrated attainment with the $PM_{2.5}$ standards.

EPA set the first Sulfur Dioxide standards in 1971. The primary standards were 140 parts per billion for the 24-hour average and 30 parts per billion (ppb) for the annual average. The secondary standard was 500 parts per billion for the 3-hour average. The Sulfur Dioxide standard was revised in 2010 setting a new primary 1-hour standard of 75 parts per billion and revoking the 24-hour and annual standards. The department began monitoring for Sulfur Dioxide in 1974, using bubbler method samplers. All the bubbler method samplers were closed out in the 1980s because of problems with the test method in cold climates and low concentration levels. In 2002, the program began setting up continuous analyzers and in 2021 operated Sulfur Dioxide analyzers in Sioux Falls, Union County, Badlands National Park, and Rapid City. The Sulfur Dioxide monitoring network represents the highest population areas and rural areas of the state. South Dakota's ambient air monitoring network for Sulfur Dioxide has historically demonstrated attainment with the Sulfur Dioxide standards.

The Nitrogen Dioxide standard was established in 1971 setting an annual average standard of 53 parts per billion. In 2010, EPA revised the standard by adding a one-hour standard of 100 parts per billion. The annual standard was retained without any change in concentration level. The department first tested for Nitrogen Dioxide in 1974, using bubbler method samplers. All the bubbler method samplers were closed out in the 1980s because of problems with the test method in cold climates and low concentration levels. The department started testing again for Nitrogen Dioxide in 2003 and in 2021 operated continuous Nitrogen Dioxide monitors in Sioux Falls, Union County, Badlands National Park, and Rapid City. The Nitrogen Dioxide monitoring network represents the most populated and rural areas of the state. South Dakota's ambient air monitoring network for Nitrogen Dioxide has historically demonstrated attainment with the Nitrogen Dioxide standards.

The ozone standard was established in 1979, setting a 1-hour average standard of 0.120 parts per million (ppm). In 1997, the standard was revised setting an 8-hour average of 0.08 parts per million. In 2008, EPA revised the 8-hour average to 0.075 parts per million. In 2015, EPA set the current 8-hour average at 0.070 parts per million. South Dakota's ambient air monitoring network for ozone was established in 1999 and in 2021 monitored concentrations in Sioux Falls, Union County, Brookings, Watertown, Badlands National Park, Wind Cave National Park, and Black Hawk. The ozone monitoring network represents the highest population and three rural areas of the state. South Dakota's ambient air monitoring network for ozone has historically demonstrated attainment with the ozone standards.

The Carbon Monoxide standard was established in 1971. The primary and secondary standards were 35 parts per million for the 1-hour average and 9 parts per million for the 8-hour average. In 1985, the primary standards were retained without revision and the secondary standards were revoked. The department began monitoring for Carbon Monoxide in 2009 as part of collecting air monitoring data to show background levels for the criteria pollutants prior to the anticipated construction of the Hyperion Energy Center. Three years of data was collected, and monitoring was discontinued in 2013 because the proposed project did not go through and the collected sampling values were very low. A second site was added in 2011, at the SD School Site in Sioux Falls as part of the required testing at a National Core (NCore) site. In early 2021, the NCore site was moved to the USD Sioux Falls campus. South Dakota's ambient air monitoring network for Carbon Monoxide has historically demonstrated attainment with the Carbon Monoxide standards.

The lead standard was established in 1978, with a concentration of 1.5 micrograms per cubic meter. Testing was done in the 80's and 90's and results showed compliance with the standard. In 2008, the standard was significantly revised setting a concentration level of 0.15 micrograms per cubic meter. EPA made changes to the air monitoring requirements for lead in 2009 to help determine where states would need to test. The final rule did not require lead monitoring at the National Core site and all sources in South Dakota have emission levels less than 0.5 ton per year. Therefore, testing for lead is not required at this time. South Dakota's ambient air monitoring network for lead has historically demonstrated attainment with the lead standard.

Data collected from the ambient air monitoring network is entered into the federal database called the Air Quality System (AQS). Individuals interested in reviewing the air quality data can go to the EPA website at the following address: https://www.epa.gov/outdoor-air-quality-data

3.0 AIR MONITORING GOALS

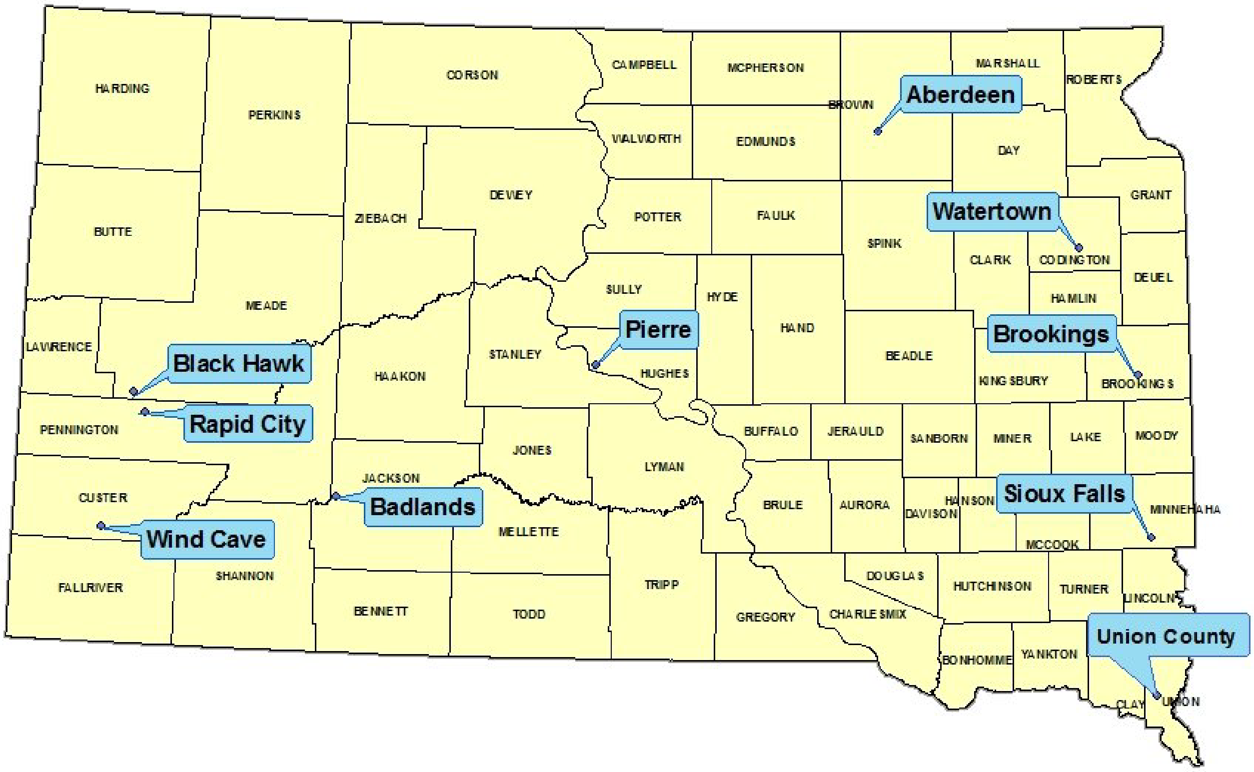
The department's Air Quality Program was established with the primary goal of protecting the health, welfare, and property of South Dakotans from the detrimental effects of air pollution. The Clean Air Act of 1970 and subsequent amendments define air quality standards for various air pollutants necessary to protect the public from injurious pollution concentrations.

In order to attain and maintain the National Ambient Air Quality Standards, the department developed regulations that restrict air pollution from sources, establishes these restrictions in an air quality permit, requires periodic inspections to ensure compliance, and maintains an ambient air monitoring network to provide air quality information and monitor the success of the Air Quality Program. Based on the ambient monitoring concentrations collected throughout the state, the department's Air Quality Program is meeting its goals.

4.0 AIR MONITORING PLAN

In calendar year 2021, the ambient air monitoring network included eleven ambient air monitoring sites run by the department at the beginning of the year. There were two sites in Pierre, and one site in the remaining nine locations. The NCore site in Sioux Falls transitioned from the School for the Deaf location to the USD Sioux Falls campus in early 2021. Figure 4-1 shows a map of the general locations and cities with ambient air monitoring sites in 2021.

Figure 4-1 – South Dakota Air Monitoring Sites



The following types of ambient air monitors and monitoring sites may be operated in South Dakota:

1. State and local air monitoring stations;
2. Special purpose monitors;
3. Prevention of Significant Deterioration (PSD) monitors;
4. Interagency Monitoring of Protected Visual Environments (IMPROVE) sites;
5. Environmental Radiation Network (RadNet) ambient monitoring systems; and
6. National Core multi-pollutant sites.

Ambient air monitoring site files are maintained in the department's Pierre office for the state and local air monitoring stations, special purpose monitoring sites, and the National Core multi-pollutant site. The ambient air monitoring site files are available for public review during normal working hours from 8:00 AM to 5:00 PM each workday. The monitoring site files contain at a minimum the following information for each site:

1. Air Quality System site identification form;
2. Sampling location;
3. Sampling and analysis method;
4. Operating schedule;
5. Monitoring objective and spatial scale;
6. Beginning date of operation; and
7. Site maps.

4.1 State and Local Air Monitoring Stations

A state and local air monitoring station consists of an air monitor for at least one air pollutant parameter selected by the state or local air programs to determine compliance with the National Ambient Air Quality Standards. During 2021, ten of the network's sites were considered a state and local air monitoring station. The sites in the network collected PM_{10} data at nine sites, $PM_{2.5}$ data at nine sites, Sulfur Dioxide and Nitrogen Dioxide at four sites, Ozone at seven sites, and Carbon Monoxide at one site.

4.2 Special Purpose Monitoring

Special Purpose Monitoring is a generic term for all monitors not used to determine compliance with the National Ambient Air Quality Standards and used for special studies. The data is reported to EPA, the equipment uses EPA or non-EPA designated monitoring methods, and the monitoring data is used for special circumstances or needs. At the beginning of 2021, three of the ambient air monitoring network sites operated special purpose monitoring in 2021. The parameters tested by the special purpose monitoring in South Dakota include:

1. Weather stations at the Black Hawk and Sioux Falls sites;
2. PM_{coarse} monitor, Total Reactive Nitrogen (NOy) analyzer, and $PM_{2.5}$ speciation monitors at the Sioux Falls NCore Site; and
3. Radiation monitor operated at the Pierre Quonset Site.

Particulate matter coarse (PM_{coarse}) is particulate matter 10 microns in diameter or less (PM_{10}) minus particulate matter 2.5 microns in diameter or less ($PM_{2.5}$).

4.3 Prevention of Significant Deterioration Monitoring Sites

In 2021, no Prevention of Significant Deterioration air monitoring projects were started or completed.

4.4 Interagency Monitoring of Protected Visual Environments Network

Two Interagency Monitoring of Protected Visual Environments sites are being operated by the National Parks Service in South Dakota. The site locations are at the Badlands and Wind Cave National Parks. Data results for parameters collected by the National Park Service can be requested from the following website: http://views.cira.colostate.edu/fed/

4.5 Environmental Radiation Network

The Environmental Radiation Network site in Pierre is being operated as a part of the national network and is also considered a Special Purpose Monitoring Site. The Pierre Site has been operated since the early 1980s. The state has a limited role in operating the monitor. The state collects the samples and ships the samples to the EPA office of Radiation and Indoor Air. The type of sample collected is airborne particulates and measurements taken are gross beta radiation levels.

The general objectives of the sampling site are to provide a means of estimating ambient levels of radioactive pollutants in our environment, to follow trends in environmental radioactivity levels, and to assess the impact of fallout and other intrusions of radioactive materials. Specifically, the Radiation Network monitors were designed to:

1. Provide a direct assessment of the population's intake of radioactive pollutants due to fallout;
2. Provide data for developing a set of dose computational models for specific sources and a national dose computational model to aggregate all sources and determine total population dose;
3. Monitor pathways for significant population exposure from routine, accidental, and terrorist releases of radioactivity from major sources;
4. Provide data for indicating additional sampling needs or other actions required to ensure public health and environmental quality in the event of a major release of radioactivity to the environment; and
5. Serve as a reference for data comparison with other localized and limited monitoring programs.

The radiation data collected at this site may be reviewed at:
https://www.epa.gov/enviro/radnet-customized-search

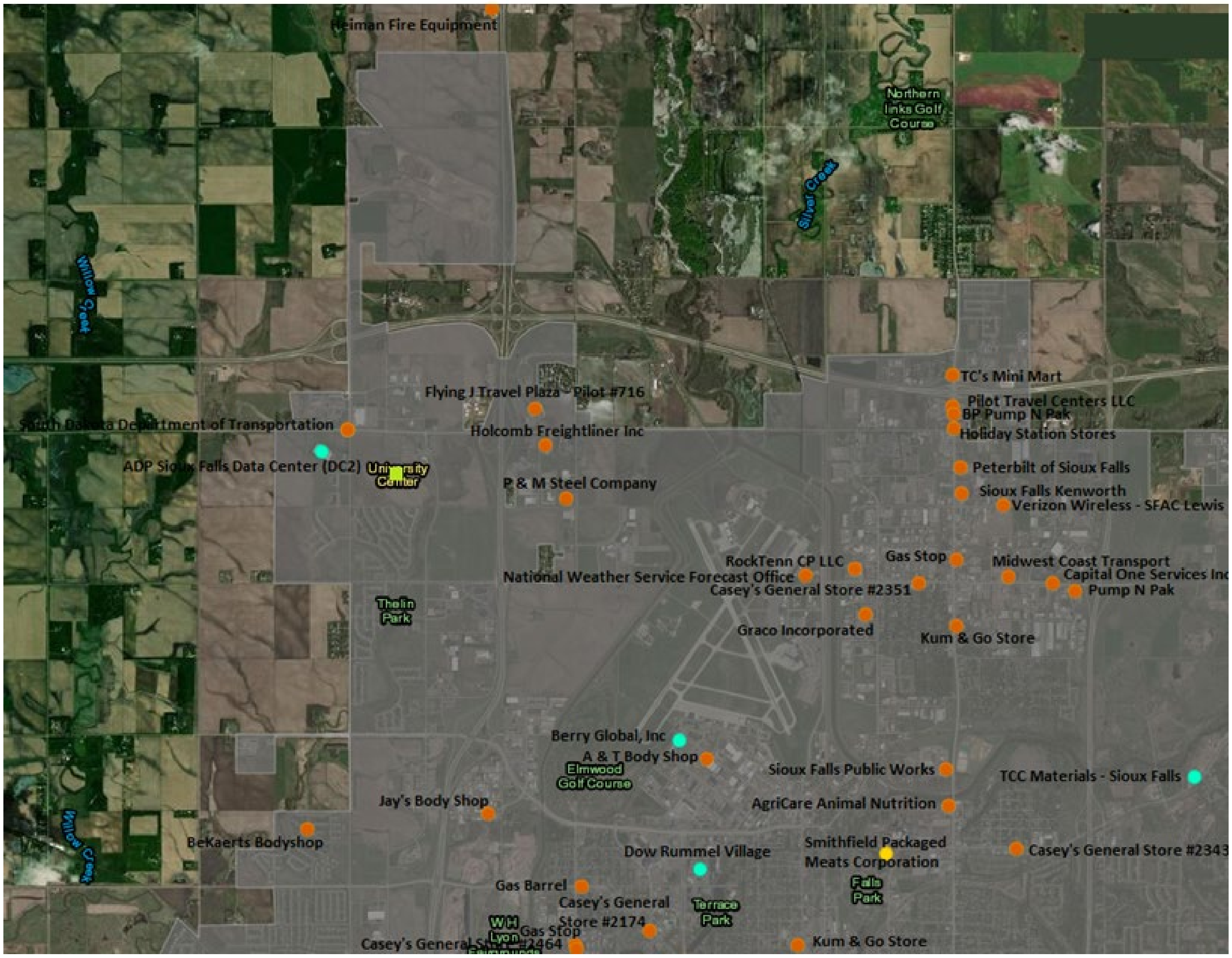
4.6 National Core Multi-Pollutant Site

The National Core multi-pollutant monitoring site will provide data on several pollutants at lower detection levels and replaced the National Air Monitoring Station (NAMS) sites that had existed for several years. Each state's ambient air monitoring network is required to have at least one National Core site. The National Core site addresses the following monitoring objectives:

1. Timely reporting of data to the public through AirNow for air quality forecasting and other public reporting mechanisms;
2. Support development of emission strategies through air quality model evaluation and other observational methods;
3. Accountability of emission strategy progress through tracking long-term trends of criteria and non-criteria pollutants and their precursors;
4. Support long-term health assessments that contribute to ongoing reviews of the National Ambient Air Quality Standards;
5. Compliance through establishing nonattainment/attainment areas by comparison with the National Ambient Air Quality Standards; and
6. Support multiple disciplines of scientific research including public health, atmospheric and ecological.

The National Core site in South Dakota was located on the SD School for the Deaf campus in Sioux Falls, which was identified as the SD School Site (46-099-0008). The property at that location was sold. In early 2021, the NCore site transitioned to a new location on the USD Sioux Falls campus, which is identified at SF USD (46-099-0009). This site meets the location requirements to be in an urban residential area. Sioux Falls was selected as the National Core site for South Dakota because it is the largest city in the state and is one of the state's fastest growing communities. See Figure 4-2 for an aerial view of the city around the SF USD Site (labeled as the University Center with the yellow square symbol).

Figure 4-2 – SF USD Site Area Map



At the beginning of 2011, all required parameters were operating at the SD School Site. The SD School Site collected data for trace level Sulfur Dioxide, nitrogen oxides, all reactive oxides of nitrogen, Carbon Monoxide, ozone, $PM_{2.5}$ continuous and filter based manual monitors, PM_{coarse}, $PM_{2.5}$ speciated, PM_{10} and meteorological parameters of wind speed, wind direction, relative humidity, and ambient temperature. In March through June of 2021, all parameters were moved from the SD School Site to the new SF USD Site. Data for both sites is available in AQS, but this report will only include the data for the new location.

5.0 AMBIENT AIR MONITORING NEEDS AND REQUIREMENTS

5.1 Monitoring State's Largest Population Centers

South Dakota's industrial base and population centers are typical of the northern plains' states. The largest industry in the state is agriculture. Most of the other industries are in several localized areas. The industries in these locations are typically small (less than 50 employees) and generally do not produce large quantities of air pollutants. Most are considered service-oriented businesses or light industrial. The only heavy industrial facilities are the Big Stone Power Plant in Grant County and the quarry area in Rapid City.

The population distribution of the state follows the general industrial distribution. Most of the state's population of 886,667, from the 2020 Census, lives either on the eastern or western third of South Dakota. Since 2020, there has been a small population increase in South Dakota of about 1% according to estimates of 895,376 done in July 2021. The two largest cities in South Dakota are Sioux Falls and Rapid City located in southeastern and western South Dakota, respectively. The remaining population is primarily spread across the eastern third of the state with the remaining portion of the state sparsely populated. See Table 5-1 for a list of the 10 largest cities and Table 5-2 for a list of the 10 largest counties in the state.

Table 5-1 – 10 Largest Cities in South Dakota 2020

Ranking	City Name	Counties	Population
1	Sioux Falls	Minnehaha/Lincoln	180,927
2	Rapid City	Pennington /Meade	76,541
3	Aberdeen	Brown	28,315
4	Brookings	Brookings	24,479
5	Watertown	Codington	22,249
6	Mitchell	Davison	15,599
7	Yankton	Yankton	14,619
8	Pierre	Hughes	13,908
9	Huron	Beadle	13,289
10	Spearfish	Lawrence	11,702

Table 5-2 – 10 Counties with the Highest Populations 2020

Ranking	Counties	Population
1	Minnehaha	197,214
2	Pennington	109,222
3	Lincoln	65,161
4	Brown	38,301
5	Brookings	34,375
6	Meade	29,852
7	Codington	28,323
8	Lawrence	23,310
9	Yankton	23,310
10	Davison	19,956

Given South Dakota's population distribution, most of the air monitoring efforts of the state have in the past been concentrated in the areas of high population. Within these areas of high population, monitoring sites are chosen that will determine areas of high pollution concentration, determine if the National Ambient Air Quality Standards are being met, identify and attempt to quantify pollutant concentrations emitted by industries, and identify sources that have the potential to release the highest amounts of pollutants. A majority of the air monitoring sites are currently being operated in or near the five largest cities and seven largest counties in the state. However, as EPA continues to lower the National Ambient Air Quality Standards, the department has established some of the monitoring sites in rural areas such as the Wind Cave National Park, Badlands National Park, Union County, and Pierre. These sites are helping to determine long range impacts from other states and countries on South Dakota's rural and urban areas.

5.2 Real Time Data

Air monitoring goals have shifted to the collection of data using continuous air monitoring samplers and providing the data as quickly as possible for the public to use. Continuous samplers provide more data at lower operational cost, which is necessary as EPA continues to expand ambient air monitoring programs for the same amount of funding or less. In many cases, the continuous monitoring can be accessed by phone and uploaded to a website for public use. The public can then use this data to determine if they need to take extra precautions when doing outdoor activities. The real time information is also used to monitor PM_{10} and $PM_{2.5}$ concentrations when high wind dust alerts are forecasted for Rapid City and all parameters during national or international events such as wildfires that impact South Dakota.

The sites reporting data to the department's real time webpage in 2021 were Wind Cave National Park, Badlands National Park, Brookings (Research Farm), Union County (Union County #1), Rapid City (Rapid City Credit Union and Black Hawk), Watertown, Pierre, and Sioux Falls (SD School/SF USD) sites. The data includes hourly concentrations of PM_{10}, $PM_{2.5}$, Sulfur Dioxide, Nitrogen Dioxide, Carbon Monoxide, and ozone. South Dakota's air quality real time website is located at: https://denravweb.sd.gov/AirVision/default.aspx.

In 2021, data uploaded from the $PM_{2.5}$ and PM_{10} monitors and ozone analyzers at Wind Cave National Park, Badlands National Park, Brookings Research Farm, Union County #1, Credit Union, Black Hawk, Watertown, Pierre, and SD School/SF USD sites were reporting hourly data to EPA's AirNow website located at: https://www.airnow.gov/

This data along with other monitoring sites around the nation provides the public and EPA with near real time data to show current air pollution levels and forecast levels for long range transport.

5.3 Class I Areas

With the development of coal bed methane and oil and gas production in North Dakota, Wyoming, Montana and Colorado there is still a need for data in rural and small cities in the western part of the state. In addition, South Dakota has developed a plan to implement the regional haze regulations required by the federal Clean Air Act. The implementation of these regulations will put more importance on air pollution levels in the state's two class I areas of Badlands and Wind Cave National Parks.

Ambient air monitors were placed in these areas in order to determine background levels and the impact of long-range transport of air pollutants like particulate matter and ozone. In addition, continuous data is needed for modeling purposes to help in determining air quality permit requirements. The National Park sites collect data from Interagency Monitoring of Protected Visual Environments monitors for PM_{10}, $PM_{2.5}$, and chemical analysis of the collected particulates. The department collects PM_{10}, $PM_{2.5}$, Sulfur Dioxide, Nitrogen Dioxide, and ozone data at the Badlands Site and PM_{10}, $PM_{2.5}$, and ozone data at the Wind Cave Site.

5.4 Metropolitan Statistical Areas

Title 40 of the Code of Federal Regulations Part 58, Appendix D, contains information used to design an ambient air monitoring network and lists three basic objectives in designing an ambient air monitoring network. The three basic objectives are listed below:

1. Provide air pollution data to the general public in a timely manner. The department accomplishes this objective by providing near real time data on the department's website at: https://denravweb.sd.gov/AirVision/default.aspx.

   The sites reporting data to the department's real time webpage in 2021 were Wind Cave National Park, Badlands National Park, Brookings (Research Farm), Union County (Union County #1), Rapid City (Credit Union and Black Hawk sites), Watertown, Pierre (Airport), and Sioux Falls (SD School/SF USD) sites. Specifically, in the Rapid City area, High Wind Dust Alerts are called when meteorological conditions are forecasted that could cause high PM_{10} concentrations. This information along with a report graphing hourly concentrations recorded during the alert is also provided to the public through the department's website;

2. Support compliance with ambient air quality standards and emissions strategy development. The department accomplishes this objective by locating the sites throughout the state to assess the permit control measures and pollution emission impacts on the state. For example, the Rapid City air monitoring site specifically evaluates the permit control measures and the special measures taken to reduce fugitive dust levels; and

3. Support for air pollution research studies. The department supports research by loading the air quality data into EPA's Air Quality System database site and by supporting local studies when funding is available.

EPA identified in Appendix D the minimum number of air monitoring SLAM sites and requirements for ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead.

5.4.1 Required Ozone Monitoring Sites

The minimum number of required air monitoring sites for ozone is based on the population within a Metropolitan Statistical Area (MSA). There are three Metropolitan Statistical Areas in South Dakota. The Sioux Falls Metropolitan Statistical Area consists of Lincoln, McCook, Minnehaha, and Turner counties. The Rapid City Metropolitan Statistical Area consists of Meade and Pennington counties. Union County in South Dakota is part of the Sioux City Metropolitan Statistical Area which includes Dixon and Dakota counties in Nebraska and Woodbury County in Iowa.

To determine the number of monitoring sites for ozone, the design value is calculated, divided by the standard, and the results multiplied by 100. If the Metropolitan Statistical Area has a design value greater than 85% of the standard one site is required. The required number of sampling sites continues to increase as the population increases. If the highest concentration site in a Metropolitan Statistical Area has a design value less than 85% for ozone, the required number of sites may be one or even zero depending on the design value and population of the Metropolitan Statistical Area.

The typical peak ozone concentrations are expressed in the percentage of the design value (see Table 9-4) of the National Ambient Air Quality Standard for ozone (0.070 parts per million). Table 5-3 shows the population, design values as percent of the National Ambient Air Quality Standards and the minimum number of ozone monitoring site required for the Sioux Falls, Rapid City, and Sioux City Metropolitan Statistical Areas after adding the data for the 2021 sampling year.

Table 5-3 – Minimum Ozone Sites Required

2020 MSA Population	Counties	Sites	AQS ID	Design Values as % of the NAAQS	> 85% Criteria (Yes or No)	Minimum Sites Required
Sioux Falls MSA						
276,730	Minnehaha Lincoln McCook Turner	SF USD	46-099-0009	Ozone 8-hr = (.065/.070)*100 = 93% *	Yes*	1*
Rapid City MSA						
144,382	Pennington Meade	Black Hawk	46-093-0001	Ozone 8-hr = (.063/.070)*100 = 90%	Yes	1

2020 MSA Population	Counties	Sites	AQS ID	Design Values as % of the NAAQS	> 85% Criteria (Yes or No)	Minimum Sites Required
Sioux City MSA						
149,940	Union, SD Dixon, NE Dakota, NE Woodbury, IA	UC #1	46-129-0001	Ozone 8-hr = (.064/.070)*100 = 91% **	Yes**	1**

* This site opened in early 2021, so the minimum sites required is being based on the estimated design value from one partial year.
**This site closed after the third quarter of 2021, so the minimum sites required is being based on the estimated design value for 2 ¾ years.

There are two additional ambient air monitoring requirements in Appendix D for an ozone network. If a Metropolitan Statistical Area is required to have one or more ozone monitors, at least one of the ozone monitoring sites is required to be located at the expected high concentration area for the Metropolitan Statistical Area. The Metropolitan Statistical Areas in South Dakota do not require more than one ozone monitoring site, but the department does locate the ozone monitoring site at the expected high concentration in the area. Ozone monitoring at a SLAMS monitoring site is only required during the ozone season which is the months of March through October in South Dakota. The department operates the ozone monitors all year round because the department has determined through experience that the monitors have less operational problems when operated continuously.

As a result of evaluating the air monitoring site data, based on the design values and populations, an ozone monitoring site is required in the Sioux Falls, Rapid City, and Sioux City Metropolitan Statistical Areas. Although Union County only represents a small percentage of the population of the Sioux City Metropolitan Statistical Area, the department had been operating one ozone monitoring site in Union County. The landowner did not want to continue the contract and the Union County site was closed. Discussions are taking place to see if Iowa or Nebraska would take over the needed monitoring for the Sioux City MSA.

5.4.2 Required PM_{10} Monitoring Sites

The minimum number of PM_{10} monitoring sites is based on the population of the Metropolitan Statistical Area and the PM_{10} concentrations within the Metropolitan Statistical Area. The Rapid City and Sioux City Metropolitan Statistical Areas in South Dakota have a population between 100,000 to 250,000 and the Sioux Falls Metropolitan Statistical Area has a population between 250,000 and 500,000. To determine the number of monitoring sites for PM_{10}, the maximum 24-hour concentration level at a site is divided by the standard (150 micrograms per cubic meter) and the results multiplied by 100. For the size of the Rapid City and Sioux City MSAs, if the percentage is over 120% of the standard, 1-2 sites are required; if the percentage is between 80% and 120% of the standard, 0-1 sites are required; and if the percentage is less than 80%, zero sites are required. For the size of the Sioux Falls MSA, if the percentage is over 120% of the standard, 3-4 sites are required; if the percentage is between 80% and 120% of the standard, 1-2 sites are required; and if the percentage is less than 80%, 0-1 sites are required.

Table 5-4 shows the population, the 24-hour maximum concentration as a percentage of the National Ambient Air Quality Standards, and the minimum site requirements for the Sioux Falls, Rapid City, and Sioux City Metropolitan Statistical Areas in the state.

Table 5-4 – Minimum PM_{10} Sites Required

2020 MSA Population	Counties	Site	AQS ID	PM_{10} Max Concentration as % of the NAAQS	> 80% Criteria (Yes or No)	Minimum Sites Required
Sioux Falls MSA						
276,730	Minnehaha Lincoln McCook Turner	SF USD	46-099-0009	(125/150) (100) 24-hour = 83%	Yes*	1 – 2
Rapid City MSA						
144,382	Pennington Meade	RC Credit Union	46-103-0020	(260/150) (100) 24-hr = 173%	Yes	1-2
		Black Hawk	46-093-0001	(153/150) (100) 24-hr = 102%		
Sioux City MSA						
149,940	Union, SD Dixon, NE Dakota, NE Woodbury, IA	UC #1	46-129-0001	(92/150) (100) 24-hr = 61%	No**	0

* This site opened in early 2021, so the minimum sites required is being based on the maximum value from one partial year.
**This site closed after the third quarter of 2021, so the minimum sites required is being based on the maximum value for ¾ year.

5.4.3 Required $PM_{2.5}$ Monitoring Sites

The minimum number of required air monitoring sites for $PM_{2.5}$ is based on the population within a Metropolitan Statistical Area. As discussed for ozone monitoring sites, there are three Metropolitan Statistical Areas (Sioux Falls, Sioux City, and Rapid City) in South Dakota. All three Metropolitan Statistical Areas have a population from 50,000 to less than 500,000. In addition, each state must monitor for $PM_{2.5}$ at their NCore site.

If the Metropolitan Statistical Area has a design value (see Tables 9-2 and 9-3) greater than 85% of the $PM_{2.5}$ standards and the population is from 50,000 to less than 500,000 people, a minimum of one site is required. If the highest concentration site in a Metropolitan Statistical Area has a design value less than 85%, the minimum required number of sites for the above population range is zero.

Table 5-5 provides the data used to determine the minimum number of $PM_{2.5}$ monitoring sites in each Metropolitan Statistical Area. As a result of evaluating the air monitoring site data, based on the design values and populations, South Dakota is not required to have a monitoring site, but still needs one at the NCore site. The department will still operate a $PM_{2.5}$ monitor in the Rapid City MSA to monitor impacts from local, national, and international events. The landowner did not wish to continue the contract, so the Union County site was closed.

Table 5-5 – Minimum $PM_{2.5}$ Sites Required

2019 MSA Population	Counties	Site	AQS ID	$PM_{2.5}$ Design Values as % of the NAAQS	> 85% Criteria (Yes or No)	Minimum Sites Required
Sioux Falls MSA						
276,730	Minnehaha Lincoln McCook Turner	SF USD	46-099-0009	24-hour = (29/35)*100 = 83%	No*	0
		SF USD	46-099-0009	Annual = (7.1/12)*100 = 59%	No*	0
Rapid City MSA						
144,382	Pennington Meade	RC Credit Union	46-103-0020	24-hr = (22/35)*100 = 63%	No	0
		RC Credit Union	46-103-0020	Annual = (7/12)*100 = 58%	No	0
Sioux City MSA						
149,940	Union, SD Dixon, NE Dakota, NE Woodbury, IA	UC #1	46-129-0001	24-hr = (18/35)*100 = 51%	No**	0
		UC #1	46-129-0001	Annual = (6.8/12)*100 = 57%	No**	0

* This site opened in early 2021, so estimated the design value from one partial year.
**This site closed after the third quarter of 2021, so estimated the design value for 2 ¾ years.

5.4.4 Required Carbon Monoxide Monitoring Sites

The minimum monitoring requirement for Carbon Monoxide is based on core-based statistical areas (CBSA) which are established by the Office of Management and Budget. Core-based statistical areas are Metropolitan Statistical Areas (i.e., 50,000 or more populations).

A minimum of one Carbon Monoxide monitor is required to operate collocated with one required near-road Nitrogen Dioxide monitor in core-based statistical areas with a population greater 1,000,000 or more persons. None of the core-based statistical areas in South Dakota meet the population criteria. Therefore, no Carbon Monoxide monitoring is required under the minimum requirements, but Carbon Monoxide must be measured at the state's NCore site.

5.4.5 Required Nitrogen Dioxide Monitoring Sites

A minimum of one Nitrogen Dioxide monitor is required to operate at a microscale near-road monitoring station and at an expected highest Nitrogen Dioxide concentration representing the neighborhood or larger spatial scales in a core based statistical area with a population level of 1,000,000 or greater. None of the core-based statistical areas in South Dakota meet the population criteria. Therefore, no Nitrogen Dioxide monitoring is required under the minimum requirements, but Nitrogen Dioxide must be measured at the state's NCore site.

5.4.6 Required Sulfur Dioxide Monitoring Sites

Sulfur dioxide has a population-based monitoring requirement for a core-based statistical area (CBSA). The monitoring requirement is based on multiplying the total amount of sulfur dioxide, in tons per year, emitted within the counties in the core-based statistical area by the population within the core-based statistical area. The resulting product is divided by one million, providing the population weighted emissions index (PWEI) for the core-based statistical area.

A micropolitan statistical area is defined as a core-based statistical area with a population of greater than 10,000 but less than 50,000 people. A core-based statistical area with a population of 50,000 people or greater is defined as a metropolitan statistical area. In accordance with 40 CFR Part 58, Appendix D, Section 4.4.2, the state must operate a minimum number of sulfur dioxide monitoring sites, as described below:

- For any core-based statistical area with a calculated PWEI value equal to or greater than 1,000,000, a minimum of three SO2 monitors are required within that CBSA;
- For any CBSA with a calculated PWEI value equal to or greater than 100,000, but less than 1,000,000, a minimum of two SO2 monitors are required within that CBSA; and
- For any CBSA with a calculated PWEI value equal to or greater than 5,000, but less than 100,000, a minimum of one SO2 monitor is required within that CBSA.

Table 5-6 provides the data used for calculating the population weighted emissions index (PWEI) for each core-based statistical area (CBSA) and Micropolitan area in South Dakota. The Sulfur Dioxide emissions were derived from EPA's 2017 National Emission Inventory. None of the PWEI values calculated are greater than 5,000. Therefore, no sulfur dioxide monitoring is required under the minimum requirements. However, in accordance with 40 CFR Part 58, Appendix D, Section 3(b), sulfur dioxide must be measured at the state's NCore site.

Table 5-6 – Population Weighted Emission Index

CBSA	2020 Population	Counties	SO_2 Emissions	PWEI
Metropolitan Areas				
Sioux Falls	276,730	Lincoln, McCook, Minnehaha, and Turner	622 tons per year	172
Sioux City	149,940	Union (SD), Dakota and Dixon (NE), and Woodbury (IA)	9,533 tons per year	1,429
Rapid City	144,382	Meade and Pennington	617 tons per year	89
Micropolitan Areas				
Aberdeen	42,555	Brown and Edmunds	137 tons per year	6
Brookings	34,375	Brookings	161 tons per year	6
Huron	21,158	Beadle	89 tons per year	2
Mitchell	23,417	Davison and Hanson	77 tons per year	2
Pierre	20,913	Hughes and Stanley	32 tons per year	1
Spearfish	25,768	Lawrence	144 tons per year	4
Vermillion	14,967	Clay	14 tons per year	0
Watertown	34,489	Codington and Hamlin	128 tons per year	4
Yankton	23,310	Yankton	81 tons per year	2

5.4.7 <u>Required Lead Monitoring Sites</u>

In 2010, EPA completed a rule change that required source type testing in addition to network testing. The rule originally required lead testing at the National Core Site. The final rule required lead testing at the National Core Site only if the site is in a city with a 500,000 and greater population. The National Core site is in Sioux Falls and the city has a population under 500,000 so no testing is required.

The department is also required to conduct ambient lead monitoring near lead sources which are expected to or have been shown to contribute to a maximum lead concentration in the ambient air in excess of the National Ambient Air Quality Standards. South Dakota is in attainment of the National Ambient Air Quality Standard for lead. At a minimum, there must be one source-orientated monitoring site located to measure the maximum lead concentration in the ambient air resulting from each non-airport lead source which emits 0.50 or more tons per year and from each airport which emits 1.0 or more tons per year based on the most recent National Emission Inventory or other scientifically justifiable methods and data. Based on EPA's 2017 National Emission Inventory, there are no sources that emit 0.50 or more tons per year and no airports that emit 1.0 or more tons per year. Therefore, lead monitoring is not required in South Dakota.

5.5 Additional Monitoring

The department operates the following additional types of monitors to meet the specific network requirements in 40 Code of Federal Regulations Part 58, Appendix D:

1. $PM_{2.5}$ background and transport monitors at the Badlands and Wind Cave sites; and
2. National Core monitoring equipment located in the city of Sioux Falls at the SF USD Site. Each State is required to operate at least one NCore site. The NCore sites must measure, at a minimum, $PM_{2.5}$ particle mass using continuous and integrated/filter-based samplers, speciated $PM_{2.5}$, PM_{coarse} particle mass, ozone, Sulfur Dioxide, Carbon Monoxide, and Nitrogen Oxide/Total Reactive Nitrogen (NO/NO_Y), wind speed, wind direction, relative humidity, and ambient temperature.

Another requirement in Appendix D is providing for a Photochemical Assessment Monitoring Stations (PAMS) which is required in areas classified as serious, severe, or extreme nonattainment for ozone. All areas in South Dakota are attaining the National Ambient Air Quality standard for ozone, so no Photochemical Assessment Monitoring Stations sites are required.

5.6 Future Monitoring

There is currently minimal monitoring being completed in other parts of the state that have small but expanding populations and industries. These areas include the northeastern and the northern Black Hills portions of the state. These areas will continue to be evaluated to determine whether additional monitoring efforts need to be conducted in those areas.

PM_{10}, $PM_{2.5}$ and ozone will be the focus of the ambient air monitoring network as levels of these pollutants have the greatest potential to have concentrations close to the standard as EPA continues to lower the National Ambient Air Quality Standards for these pollutants.

6.0 NETWORK MODIFICATIONS FOR 2022

The department will continue to evaluate the air monitoring network in 2022 to determine if any new sites are needed and/or existing sites need to be modified or closed to meet the needs of South Dakota and or federal requirements.

6.1 New Sites

A new site location in Vermillion, SD was opened at the beginning of 2022.

6.2 Sites Closed

The landowner of the Union County site indicated she did not wish to renew the contract. The contract was terminated and there has been no sampling done at that site since October 2021. There are discussions with Iowa and Nebraska to see if they would conduct the needed monitoring for the Sioux City MSA.

6.3 Modifications

The department will continue to update older continuous style monitors with newer monitors.

7.0 REQUEST FOR WAIVER

There were no sampling frequency waivers requested for the 2021 sampling year.

8.0 EQUIPMENT REPLACEMENT PLAN

8.1 Overview

The department is tasked with sampling the ambient air quality throughout the state of South Dakota to demonstrate compliance with the National Ambient Air Quality Standards, and to do special testing when needs arise or as required by EPA. At the beginning of 2021, there were 11 active sites within South Dakota where either environmental radiation or criteria pollutants were monitored. The monitoring sites were located in the cities of Black Hawk, Rapid City, Pierre, Aberdeen, Watertown, Brookings, Sioux Falls, and Union County, and also located at Badlands National Park and Wind Cave National Park. The monitored pollutants include environmental radiation, particulate matter (PM_{10} and $PM_{2.5}$), Nitrogen Dioxide, Ozone, Carbon Monoxide, and Sulfur Dioxide.

The reliable operation of the monitors requires significant investment in staff time and inventory for upkeep, both of which tend to increase as the monitors age. Monitors should be replaced when they reach an age when cost of upkeep meets or exceeds the cost of new purchase and when funding permits. Monitors also experience catastrophic failures, at which time a determination is made whether replacing core components on an aging instrument is viable. Furthermore, the age of some instruments makes sourcing parts difficult or impossible, as they may no longer be supported by the manufacturer.

8.2 Data Loggers

In 2021, the department operated nine ESC 8832 style data loggers and one newer style 8864 data logger. These data loggers are necessary at each site which has continuous monitoring equipment, in order to provide near real time data to the public. The department also has two spare older style 8816 data loggers and seven newer style 8864 data loggers purchased in early 2022 and residing in our laboratory, but which will replace the older models in the field within the next year. The average age of the ESC 8816 and 8832 style data loggers is approximately 13 years. Table 8-1 provides the department’s list of data loggers in 2021. The program plans on purchasing two more 8864 data loggers in the near future, so one is available for every monitoring site.

Table 8-1 - Data Logger Service Records

No.	Serial #	Model	Purchased	Location
1	5047	8816	<2006	Pierre Lab (spare)
2	4543	8816	<2006	Pierre Lab (spare)

No.	Serial #	Model	Purchased	Location
3	2772	8832	2008	Watertown
4	2771K	8832	2008	Union County/ Vermillion
5	2770K	8832	2008	Rapid City
6	2331K	8832	2008	Sioux Falls (spare)
7	2431	8832	2008	Brookings
8	A3705K	8832	2008	Aberdeen
9	A3119k	8832	2008	Badlands
10	3992K	8832	2011	Pierre
11	4467K	8832	2012	Black Hawk
12	4868	8832	2015	Wind Cave
13	C2718	8864	2020	Sioux Falls
14	C3013	8864	2022	Pierre Lab (spare)
15	C3014	8864	2022	Pierre Lab (spare)
16	C3015	8864	2022	Pierre Lab (spare)
17	C3016	8864	2022	Pierre Lab (spare)
18	C3017	8864	2022	Pierre Lab (spare)
19	C3018	8864	2022	Pierre Lab (spare)
20	C3019	8864	2022	Pierre Lab (spare)

ESC discontinued the 8816 and 8832 models which makes it difficult to purchase replacement parts.

Agilaire LLC, which purchased ESC, is offering various newer data logger versions, one of which is the PC-based 8872 model. The department purchased two ESC 8872 data loggers in federal fiscal year 2017. Shortly after purchasing the ESC 8872 data loggers, the department received reports from other states as well as from Agilaire that the computer-data logger interface is difficult to use. Furthermore, issues with the instruments owned by other entities being hacked was worrisome to the SD Air Quality Program. Therefore, in 2021 the program returned them to Agilaire LLC.

8.3 Manual Particulate Matter Monitors

8.3.1 <u>Partisol Monitors</u>

The department currently has three Thermo Scientific Partisol 2000 manual monitors (see Table 8-2). These Partisol manual monitors are Federal Reference Method (FRM) for $PM_{2.5}$ and PM_{10} monitoring. In 2021, two Partisol 2000 manual monitors were operating in the field, and one was used for spare parts, and stored at the Sioux Falls regional office.

Our oldest partisol monitors are now 12 years old, with expected average longevity of 10-15 years. The department continues to experience a high rate of repair for the older models but does not plan to purchase any new manual monitors since most of the sites that have operated these monitors in the past have been closed. The department does have enough spare parts to keep the one remaining manual monitoring site at Sioux Falls operating, and therefore does not plan on purchasing any new Partisols in the near future.

Table 8-2 – Partisol Service Record

No.	Serial #	Model	Purchased	Location
1	210801007	2000FRM	2010	Sioux Falls
2	210881007	2000FRM	2010	Sioux Falls
3	210851007	2000FRM	2010	Sioux Falls (spare parts)

8.3.2 Speciation $PM_{2.5}$ Monitors

The department currently does speciation monitoring at its National Core site in Sioux Falls. In 2009, the Met One SASS monitor was moved from the Hilltop site to the NCore site. In September 2009, the Interagency Monitoring of Protected Visual Environments URG 3000N sampler was set up to do the carbon sampling. In November 2016, EPA Region 8 gave the department a Met One Super SASS to replace the SASS. The SuperSASS allows four sample cartridges to be loaded enabling the sampler to collect samples every 3rd day with physical loading only required every 6th day. The speciation monitors were moved to the new SF USD site in early 2021. The program doesn't anticipate needing to purchase a new PM2.5 speciation monitor in the near future.

8.4 Continuous Particulate Matter Monitors

The department operates the Met One BAM 1020 continuous particulate monitor. The department has 18 in-field BAM continuous monitors, and five in reserve currently held at either the Brookings site or in the Pierre Lab (See Table 8-3). Advantages to running one monitoring method are data consistency across sites, decreased training time for operators, reduced inventory of spare parts, and higher quality assurance during operational checks.

The oldest monitors are fourteen years old. The department has not had many problems with these monitors but expects to begin having more operational problems as the monitors age. Because this monitor type has been so reliable, the department has been gradually converting all continuous particulate monitoring to this method. The operational life expectancy of this continuous particulate matter (PM) monitor running 24 hours a day 365 days a year is about 15 years, mainly due to detector and hardware board failures. With some major replacement of monitor components, the operational age may be extended.

The department purchased three new MetOne BAM 1020s in early 2022, and does not plan on purchasing any new BAM 1020s anytime in the next year.

Table 8-3 - BAM Service Record

No	Serial #	Purchased	Comments
1	H2949	2008	Brookings
2	H7027	2008	Brookings (spare)
3	H2972	2008	Sioux Falls
4	H7028	2008	Badlands
5	H7236	2008	Badlands
6	H7051	2008	Wind Cave
7	K1801	2010	Sioux Falls
8	M5333	2011	Watertown
9	M12165	2012	Wind Cave
10	T15079	2015	Watertown
11	T15065	2015	Aberdeen
12	T19274	2015	Rapid City
13	U15821	2017	Union County/ Vermillion
14	U15820	2017	Pierre Lab (spare)
15	X12895	2018	Union County/ Vermillion
16	W25139	2018	Black Hawk
17	Y14735	2019	Brookings
18	Y21688	2019	Aberdeen
19	Y14733	2019	Rapid City
20	CN10310	2022	Pierre Lab (spare)
21	CN10311	2022	Pierre Lab (spare)
22	CN10731	2022	Pierre Lab (spare)

8.5 Continuous Gas Analyzers and Calibrators

The gaseous pollutant air monitoring network consists of continuous gas analyzers and calibrators. The department has purchased various pieces of equipment nearly every year over the past decade. The department typically purchases replacement equipment for instruments that are 7–10 years old, although some analyzers, such as ozone, can have a longer lifespan.

8.5.1 Ozone Analyzers

In 2021, the department operated ozone analyzers at seven sites throughout South Dakota. The ozone instruments have been some of the more reliable and durable instruments in the monitoring network. The program also has three spare ozone analyzers. One of the spares is considered a predominantly lab-residing ozone analyzer, used to conduct checks on ozone transfer standards, however it could be placed in the field in case of an emergency (see Table 8-4). The program might consider purchasing a few new ozone analyzers within the next year or two.

Table 8-4 - Ozone Analyzers

No.	Serial #	Purchased	Location
1	0525812377	2005	Sioux Falls
2	0525812377	2005	Union County/ Vermillion
3	0810029426	2008	Badlands
4	1313057856	2013	Wind Cave
5	1427262856	2014	Pierre Lab (spare)
6	1191893442	2019	Watertown
7	1191893443	2019	Pierre Lab (spare)
8	5932	2020	Pierre Lab (spare)
9	12035310150	2020	Brookings
10	12035310149	2020	Black Hawk

8.5.2 Sulfur Dioxide Analyzers

The department operated Sulfur Dioxide analyzers at four sites in South Dakota. The department also had two Sulfur Dioxide backup analyzers for use when a major repair is needed. Two monitors were located in the Pierre lab, one at Sioux Falls, one at Rapid City, one in Union County, and one at Badlands National Park.

The Sulfur Dioxide analyzers have been reliable and seldom need to be sent in for repair. Occasionally a lamp or detector needs to be replaced, which is something the department can do in-house. As with most Thermo Scientific instruments, the department does replace the pumps and installs pump kits on occasion, which is also something the department does in-house. The oldest model is from 2006 (see Table 8-5). The program doesn't anticipate needing to purchase another new SO2 analyzer in the next year or two.

Table 8-5 - Sulfur Dioxide Analyzers

No.	Serial #	Purchased	Location
1	0621217058	2006	Sioux Falls
2	0829531904	2008	Union County/Pierre Lab (spare)
3	0829531903	2008	Pierre Lab (spare)
4	1117348531	2011	Pierre Lab (spare)
5	408	2020	Badlands
6	429	2021	Rapid City

8.5.3 Nitrogen Dioxide Analyzers

The department operated Nitrogen Dioxide analyzers at four sites in South Dakota. The National Core site in Sioux Falls also includes a NOy analyzer in addition to the traditional NOx analyzer. The department had two backup NO2 analyzers, which are all currently housed in our laboratory in Pierre.

Nitrogen Dioxide analyzers have been the most difficult to maintain and operate of the gaseous pollutant analyzers. Replacement parts can be very expensive and if the instrument needs to go back to the factory for repair, the cost can easily reach $2,000 to $3,000. The oldest Nitrogen Dioxide analyzers in our network were purchased in 2011 (see Table 8-6). The program doesn't anticipate needing to purchase another new NO2 analyzer in the next year or two.

Table 8-6 - Nitrogen Dioxide Analyzers

No.	Serial #	Purchased	Location
1	1116748523	2011	Pierre Lab (spare)
2	2411	2015	Sioux Falls
3	298-122	2016	Sioux Falls (NOy)
4	3006	2016	Union County/ Pierre Lab (spare)
5	6557	2020	Rapid City
6	6556	2020	Pierre Lab (spare)
7	6981	2021	Badlands

8.5.4 Carbon Monoxide Analyzers

The department operates just one Carbon Monoxide analyzer at our National Core site in Sioux Falls. The Thermo Scientific Carbon Monoxide analyzer which was the main Carbon Monoxide at the National Core site is now the backup analyzer (see Table 8-7). The department may plan to purchase a new Carbon Monoxide analyzer in 2022 or 2023; although both monitors have historically functioned very well, in the beginning of 2022 the primary analyzer was non-operational for multiple months.

Table 8-7 - Carbon Monoxide Analyzers

No.	Serial #	Purchased	Location
1	0723923521	2007	Sioux Falls (spare)
2	0174	2008	Sioux Falls

8.5.5 Multi-gas & Ozone Calibrators

The department operates either a multi-gas or ozone calibrator at each of the monitoring sites with gas analyzers (see Tables 8-8 and 8-9). The department originally used primarily Thermo Scientific calibrators for weekly checks and quarterly audits. Since then, the department started purchasing Environics 6103 calibrators, which can be used for multi-gas or ozone operation and are much lighter and easier to transport. Both types of calibrators have been very reliable and inexpensive to operate. Historically, the annual calibration of the flow controllers in the 6103 instruments has been the only recurring cost, however, as of 2021 this procedure was conducted in-house. The program doesn't anticipate needing to purchase any new calibrators in the near future.

Table 8-8 - Multi-gas Calibrators

No.	Serial #	Purchased	Location
1	4299	2008	Sioux Falls
2	4290	2008	Badlands
3	4298	2008	Pierre Lab (spare)
4	4562	2009	Union County/Pierre Lab (spare)
5	4561	2009	Pierre Lab (spare)
6	5047	2011	Rapid City
7	5881	2013	Pierre Lab (spare)
8	6223	2014	Pierre Lab (spare)
9	6588	2015	Rapid City Regional Office
10	9089	2021	Pierre Lab (spare)
11	9088	2021	Pierre Lab (spare)

Table 8-9 - Ozone Calibrators

No.	Serial #	Purchased	Location
1	0525812378	2005	Watertown
2	0807328333	2008	Wind Cave
3	0824131746	2008	Black Hawk
4	1191893441	2019	Brookings
5	12035310151	2020	Union County/ Vermillion

8.6 Zero Air Generators

The department operates a zero air generator at each of the monitoring sites that have gas analyzers (see Table 8-10). The zero air generators have been historically inexpensive to operate, with very little operational issues occurring, making them one of the most reliable pieces of equipment we operate. The program doesn't anticipate needing to replace any zero air generators within the next few years.

The program also owns two portable zero air generators in an effort to reduce the amount of effort required to carry large and heavy zero air generators around during audits. However, these zero air generators have not been reliable, especially during NOx audits. We will continue working on solving this issue.

Table 8-10 – Zero Air Generators

No.	Serial #	Purchased	Location
1	3290	2010	Sioux Falls
2	3291	2010	Sioux Falls (spare)
3	4014	2011	Rapid City
4	4013	2011	Pierre Lab (spare)
5	4012	2011	Badlands
6	4619	2013	Union County/ Vermillion
7	4618	2013	Pierre Lab (spare)
8	1305	2018	Brookings
9	1306	2018	Black Hawk
10	1304	2018	Wind Cave
11	172 (portable)	2019	Pierre Lab (spare)
12	173 (portable)	2019	Pierre Lab (spare)
13	1944	2020	Watertown

8.7 Meteorological Stations

The department currently has two meteorological (met) stations at the Black Hawk and Sioux Falls locations. Each meteorological station consists of a temperature sensor, wind direction vane, and anemometer, mounted on a 10-meter tower. The National Core Site also has a relative humidity sensor. The operation of each instrument on the tower is checked every month. The Sioux Falls meteorological station is audited once per quarter even though the audit requirements for a National Core Site is biannually. The Black Hawk met station is audited biannually even though it is only required annually. The program doesn't foresee the need to purchase any completely new meteorology stations indefinitely, though individual components such as anemometers may need to be periodically replaced as needed.

The department's data needs at the other monitoring sites are being met by reliable and available data from the National Weather Service collected from nearby airports.

9.0 COMPLIANCE WITH NATIONAL AMBIENT AIR QUALITY STANDARDS

This section provides a comparison of the collected data to the National Ambient Air Quality Standards. The comparison will determine if an area is attaining the standard. In addition, the comparison will assist in determining if more monitoring stations for certain parameters are needed in an area or an area no longer needs to monitor for a certain parameter or parameters.

9.1 Particulate Matter (PM10)

The PM_{10} National Ambient Air Quality Standard is based on a 24-hour average concentration. The maximum 24-hour average concentration allowed is 150 micrograms per cubic meter. Attainment with the 24-hour standard is demonstrated when there is less than or equal to one expected exceedance per year averaged over three years. A 24-hour average concentration of 154.4 micrograms per cubic meter is the highest level that still attains the 24-hour standard for PM_{10} based on EPA rounding to the nearest 10 micrograms per cubic meter.

In 2021, the statewide PM_{10} monitoring network included nine monitoring locations. All of the sites used continuous samplers providing 1-hour concentrations at the Rapid City Credit Union, SF USD (Sioux Falls), Watertown, Black Hawk Elementary, Brookings Research Farm, Aberdeen, Badlands, Wind Cave, and UC #1 (Union County) sites. Badlands, Wind Cave, and UC #1 sites are rural sites.

Table 9-1 contains a list of the expected exceedance and attainment status for the PM_{10} ambient air monitors throughout the state for calendar years 2019 to 2021.

Table 9-1 – Statewide PM_{10} 24-Hour Concentrations

Site	Expected Exceedance	Attainment Status
Aberdeen Bus Stop	0.0	Yes *
Rapid City Credit Union	2.7	No**
Black Hawk Elementary	0.0	Yes
SF USD	0.0	Yes***
Badlands	0.3	Yes
Brookings Research Farm	0.3	Yes ****
Watertown	0.7	Yes
Wind Cave	0.3	Yes
UC #1	0.0	Yes*****

*There has only been two years of data at the Aberdeen Bus Stop site.
**Thought to be due to exceptional events of high winds and fires. See more information below.
***There has only been a partial year of data at the SF USD site.
****2019 data did not meet 75% completeness criteria.
*****Site closed after third quarter 2021, so design value is based on 2 ¾ years.

During 2021, there were PM_{10} concentrations that exceeded the 24-hour standard at the Credit Union, Badlands, Brooking Research Farm, Wind Cave, and Watertown sites. All of the exceedances were believed to be caused by high winds or fires.

At the Rapid City Credit Union site, there were three high wind events in 2019 and two high wind and three fire related exceedances in 2021. These resulted in an expected exceedance level of 2.7. These events have been flagged in AQS and the department believes they fit under the definition of exceptional events. If needed, the department will develop an exceptional events package for these events and submit it to EPA for concurrence.

Title 40 of the Code of Federal Regulations Part 50.14 allows a State to exclude data showing exceedances or violations of any NAAQS that are directly due to an exceptional event from use in determinations. DANR has flagged the violation days in AQS and if needed will develop exceptional events packages for these events and submit them to EPA for concurrence. Therefore, the department considers all nine sites in South Dakota to be demonstrating attainment of the PM_{10} standard.

9.2 Particulate Matter (PM2.5)

The $PM_{2.5}$ National Ambient Air Quality Standards consist of a 24-hour and an annual standard. The 24-hour standard is 35 micrograms per cubic meter. Attainment of the 24-hour standard is achieved when the maximum 24-hour average concentration, based on the annual 98th percentile averaged over three years (24-hour average design value), is less than or equal to 35 micrograms per cubic meter.

The $PM_{2.5}$ annual standard is 12 micrograms per cubic meter. Attainment is demonstrated when the maximum annual arithmetic mean averaged over three consecutive years (annual design value) is equal to or less than 12 micrograms per cubic meter.

9.2.1 $PM_{2.5}$ 24-Hour Standard

Table 9-2 shows the yearly 98th percentile for calendar years 2019 to 2021 used in the calculation of the 24-hour design value for $PM_{2.5}$, the 2021 24-hour design value, attainment status of each site, and the percent of the standard. The percent of the standard in this case and for the rest of the pollutants is the design value divided by the standard times 100.

In 2021, the highest 24-hour 98th percentile concentration was 29.9 micrograms per cubic meter and was recorded at the Aberdeen Bus Stop Site. The site with the second highest 24-hour 98th percentile concentration in 2021 was at the SF USD Site with 29.1 micrograms per cubic meter. 2021 had many high days due to fires in Canada and the western states.

Table 9-2 – Statewide $PM_{2.5}$ 24-Hour Concentrations

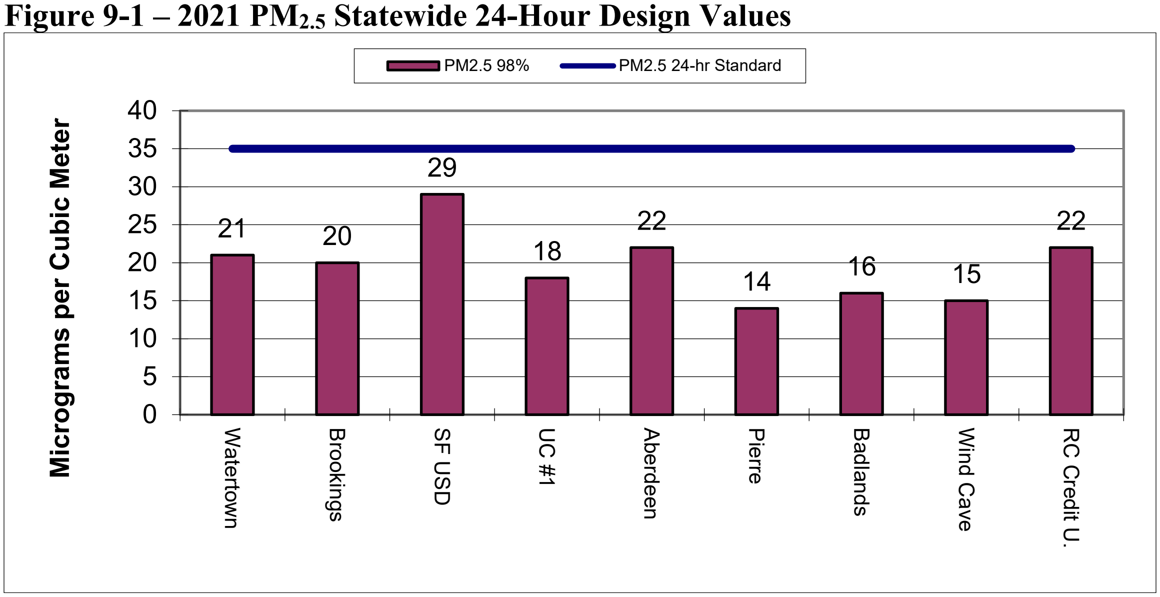
Site	Yearly 98th Percentile	2021 24-hour Design Value	Attainment Status	Percent of the Standard
Aberdeen Bus Stop	2019 – 2020 – 15.0 ug/m^3 2021 – 29.9ug/m^3	22 ug/m^3	Yes*	63%
Rapid City Credit Union	2019 – 15.7 ug/m^3 2020 – 22.7ug/m^3 2021 – 26.5 ug/m^3	22 ug/m^3	Yes	63%
Badlands	2019 – 9.4 ug/m^3 2020 – 16.6 ug/m^3 2021 – 21.9 ug/m^3	16 ug/m^3	Yes	46%
Pierre Airport	2019 – 11.1 ug/m^3 2020 – 12.9 ug/m^3 2021 – 16.8 ug/m^3	14 ug/m^3	Yes	40%

Site	Yearly 98th Percentile	2021 24-hour Design Value	Attainment Status	Percent of the Standard
SF USD	2019 – 2020 – 2021 – 29.1 ug/m^3	29 ug/m^3	Yes**	83%
Brookings Research Farm	2019 – 15.1 ug/m^3 2020 – 15.8 ug/m^3 2021 – 28.5 ug/m^3	20 ug/m^3	Yes	57%
Watertown	2019 – 17.5 ug/m^3 2020 – 16.1 ug/m^3 2021 – 28.7 ug/m^3	21 ug/m^3	Yes	60%
Wind Cave	2019 – 8.2 ug/m^3 2020 – 15.8 ug/m^3 2021 – 21.8 ug/m^3	15 ug/m^3	Yes	43%
UC #1	2019 – 16.5 ug/m^3 2020 – 16.9 ug/m^3 2021 – 20.5 ug/m^3	18 ug/m^3	Yes***	51%

*There has only been two years of data at the Aberdeen Bus Stop Site.
**Only a part of a year at SF USD
***Site closed after third quarter 2021, so design value based on 2 ¾ years.

Figure 9-1 contains a graph of the 24-hour design values for each site. The highest design value for the 24-hour $PM_{2.5}$ standard from 2019 to 2021 was recorded in Sioux Falls at the SF USD site with a concentration of 29 micrograms per cubic meter. This represents 83% of the standard. The Pierre Airport site had the lowest 24-hour design values for $PM_{2.5}$ at 14 micrograms per cubic meter or 40% of the standard. 2021 had many high days due to fires in Canada and the western states. All sites are attaining the 24-hour $PM_{2.5}$ standard.

Figure 9-1 – 2021 $PM_{2.5}$ Statewide 24-Hour Design Values



* Only two years of data at Aberdeen, part of a year at SF USD, and first 3/4 at UC.

9.2.2 $PM_{2.5}$ Annual Standard

Table 9-3 contains a list of the annual averages, 2021 annual design values, attainment status, and percent of the standard for each of the $PM_{2.5}$ sites using the data from 2019 to 2021 in the state. The highest annual average concentration in 2021 was recorded at the Watertown Site at 9.2 micrograms per cubic meter. The Pierre Airport Site had the lowest annual average at 3.8 micrograms per cubic meter in 2021. 2021 had many high days due to fires in Canada and the western states.

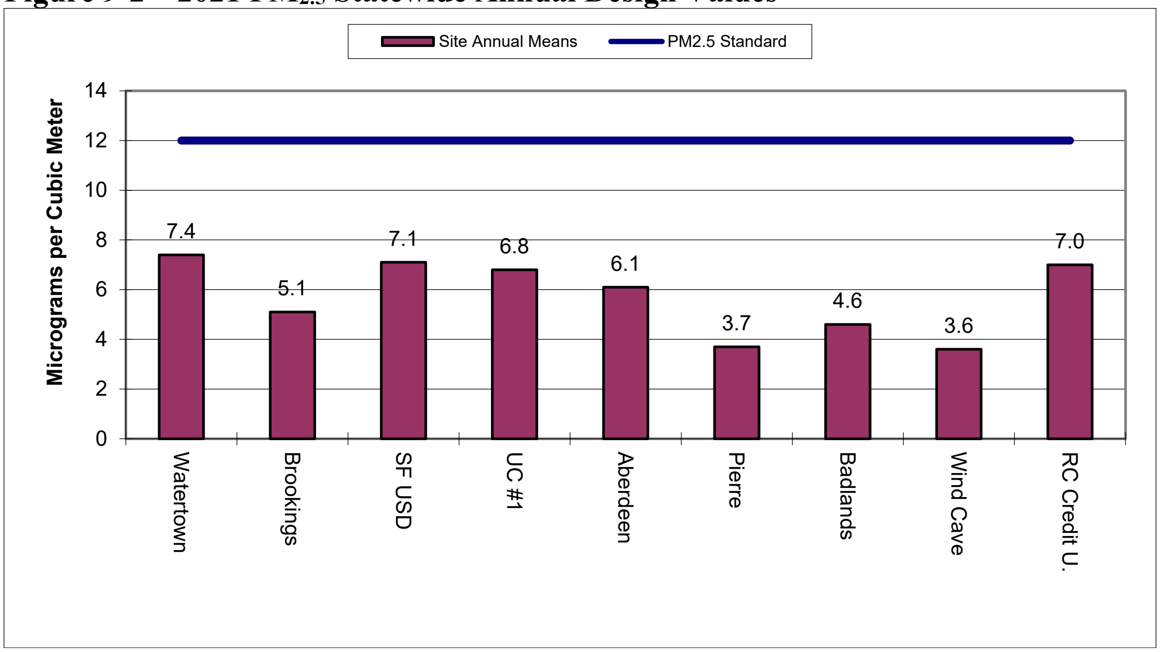
Table 9-3 – Statewide $PM_{2.5}$ Annual Concentrations

Site	Annual Averages	2021 Annual Design Values	Attainment Status	Percent of the Standard
Watertown	2019 – 6.3 ug/m^3 2020 – 6.7 ug/m^3 2021 – 9.2 ug/m^3	7.4 ug/m^3	Yes	62%
Brookings Research Farm	2019 – 4.2 ug/m^3 2020 – 4.4 ug/m^3 2021 – 6.7 ug/m^3	5.1 ug/m^3	Yes	43%
SF USD	2019 – 2020 – 2021 – 7.1 ug/m^{33}	7.1 ug/m^3	Yes*	59%
UC #1	2019 – 5.8 ug/m^3 2020 – 6.1 ug/m^3 2021 – 8.3 ug/m^3	6.8 ug/m^3	Yes**	57%
Aberdeen Bus Stop	2019 – 2020 –5.6 ug/m^3 2021 – 6.7 ug/m^3	6.1 ug/m^3	Yes***	51%
Pierre Airport	2019 – 3.3 ug/m^3 2020 – 4.0 ug/m^3 2021 – 3.8 ug/m^3	3.7 ug/m^3	Yes	31%
Badlands	2019 – 3.7 ug/m^3 2020 – 4.2 ug/m^3 2021 – 5.9 ug/m^3	4.6 ug/m^3	Yes	38%
Wind Cave	2019 – 2.6 ug/m^3 2020 – 3.3 ug/m^3 2021 – 4.8 ug/m^3	3.6 ug/m^3	Yes	30%
Rapid City Credit Union	2019 – 5.9 ug/m^3 2020 – 6.8 ug/m^3 2021 – 8.1 ug/m^3	7.0 ug/m^3	Yes	58%

*Only a part of a year at SF USD
**Site closed after third quarter 2021, so design value based on 2 ¾ years.
***There has only been two years of data at the Aberdeen Bus Stop Site.

Figure 9-2 contains a graph of the $PM_{2.5}$ annual average design value for each site. None of sites in the network had a 2021 design value that exceeded the annual $PM_{2.5}$ standard. The highest annual design value occurred at the Watertown site with a level of 7.4 micrograms per cubic meter which is 62% of the annual standard. The lowest $PM_{2.5}$ annual design value occurred at the Wind Cave Site with a concentration of 3.6 micrograms per cubic meter which is 30% of the annual standard. 2021 had many high days due to fires in Canada and the western states.

Figure 9-2 – 2021 $PM_{2.5}$ Statewide Annual Design Values



* Only two years of data at Aberdeen, part of a year at SF USD, and first 3/4 at UC.

9.3 Lead

During the early 1980's, the department conducted lead sampling. The levels detected were well below the National Ambient Air Quality Standards at that time. After passage of the 1990 Clean Air Act Amendments, there were concerns with the way EPA had instructed states in determining if those areas were in attainment of the lead standard. For this reason, a monitoring site was established in April 1992, at the Jaehn's Site in Rapid City to determine compliance with the standard. This site was downwind of GCC Dacotah, which is a cement plant that burns coal and has the potential to emit lead. The results of the analyzed data from the second quarter of 1992 through the first quarter of 1994 showed lead levels well below the National Ambient Air Quality Standards. Due to the low concentrations of lead in Rapid City, the sampling site was terminated at the end of the first quarter in 1994.

EPA changed the lead National Ambient Air Quality Standards on October 15, 2008. The change significantly lowered the lead standard from 1.5 micrograms per cubic meter to 0.15 micrograms per cubic meter based on the annual maximum three-month rolling average. Attainment of the lead National Ambient Air Quality Standards is achieved if the annual maximum three-month rolling average, averaged over a three-year period, is less than or equal to 0.15 micrograms per cubic meter.

The lead sampling in the past and current emissions levels indicates that South Dakota is attaining the new lead standard.

9.4 Ozone

Seven ozone ambient air monitoring sites were operated in 2021. The analyzers were located at SF USD, UC #1, Brookings Research Farm, Watertown, Badlands, Black Hawk, and Wind Cave sites. The National Ambient Air Quality Standard for ozone consists of a daily 8-hour average of 0.070 parts per million. The 8-hour standard is met when the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration is less than or equal to 0.070 parts per million.

The 4th highest concentration for each year, 2021 8-hour design value in parts per million, attainment status, and percent of the standard for each of the sites can be seen in Table 9-4 and the 2021 design value is summarized in Figure 9-3. From 2019 to 2021, the Brookings Research Farm Site had the highest 3-year average ozone concentrations in the state at 0.068 parts per million, which is 97% of the ozone standard. The Badlands site is reporting the lowest ozone design value with 0.057 parts per million or 81% of the standard.

The SD School Site was the highest ozone concentration site in the state since 2010. In 2019, the Brookings Research Farm had the highest readings. There was a noticeable increase in concentrations since the beginning of the year and in the number of high concentrations at Brookings. EPA concurred these readings were out of the ordinary compared to the region. The department received a new ozone analyzer and put it at the Brookings site to do a side by side comparison toward the end of October. The two analyzers tracked very well, but the new analyzer read 6-7 ppb lower. On October 30, 2019, the new analyzer was put into service and the Brooking's readings are more comparable to the other eastern sites. During 2021, there were several fires in Canada and the western states which seemed to have increased the concentrations at several of the sites.

The data collected in the past three years demonstrates that South Dakota is attaining the national ozone standard, but four of the sites were at least 90% of the ozone design value.

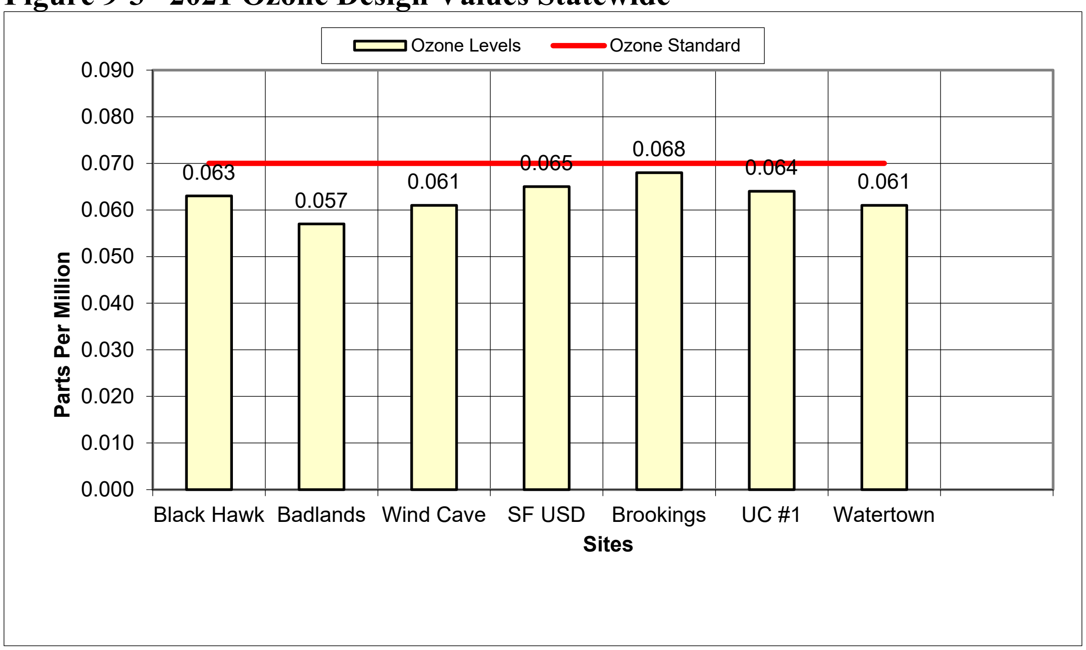
Table 9-4 – Statewide Ozone 4th highest Concentrations

Site	4th Highest Concentration	2021 8-Hour Design Values	Attainment Status	Percent of the Standard
SF USD	2019 – 2020 – 2021 – 0.065 ppm	0.065 ppm	Yes*	93%
Brookings Research Farm	2019 – 0.071 ppm 2020 – 0.064 ppm 2021 – 0.070 ppm	0.068 ppm	Yes	97%

Site	4th Highest Concentration	2021 8-Hour Design Values	Attainment Status	Percent of the Standard
Black Hawk	2019 – 0.055 ppm 2020 – 0.062 ppm 2021 – 0.072 ppm	0.063 ppm	Yes	90%
Badlands	2019 – 0.058 ppm 2020 – 0.061 ppm 2021 – 0.054 ppm	0.057 ppm	Yes	81%
Wind Cave	2019 – 0.057 ppm 2020 – 0.063 ppm 2021 – 0.065 ppm	0.061 ppm	Yes	87%
UC #1	2019 – 0.064 ppm 2020 – 0.063 ppm 2021 – 0.065 ppm	0.064 ppm	Yes**	91%
Watertown	2019 – 2020 – 0.057 ppm 2021 – 0.066 ppm	0.061 ppm	Yes***	87%

*Only a part of a year at SF USD
**Site closed after third quarter 2021, so design value based on 2 ¾ years.
***There has only been two years of data at the Watertown Site.

Figure 9-3– 2021 Ozone Design Values Statewide



* Only two years of data at Watertown, part of a year at SF USD, and first 3/4 at UC.

9.5 Sulfur Dioxide

Four Sulfur Dioxide ambient air monitoring sites were operated in 2021. The analyzers were located at the SF USD, Badlands, Rapid City Credit Union, and UC #1 sites. The 1-hour Sulfur Dioxide standard concentration is 75 parts per billion. The area is attaining the standard when the three-year average of the yearly (99th percentile) of the daily maximum 1-hour average concentrations is less than or equal to 75 parts per billion (1-hour design value). The secondary Sulfur Dioxide standard is based on a 3-hour average concentration of 0.5 parts per million, not to be exceeded more than once per year.

9.5.1 Sulfur Dioxide 1-Hour Standard

Table 9-5 contains the yearly 99th percentile concentration, 1-hour design value, attainment status, and percent of the standard for each site. The Sulfur Dioxide 1-hour design values are based on Sulfur Dioxide data collected in 2019 to 2021. The highest 99th percentile 1-hour levels in 2021 were recorded at the SF USD and Credit Union Sites with 4 parts per billion.

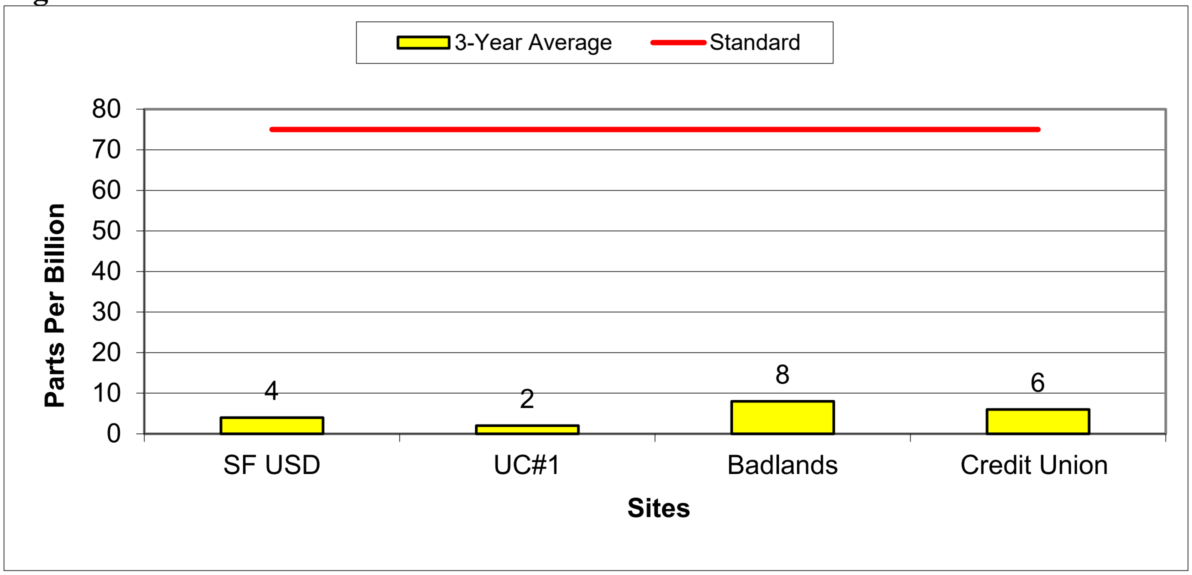
Table 9-5 – 2021 Statewide Sulfur Dioxide 1-hour Design Values

Site	99th Percentile Concentration	1-Hour Design Values	Attainment Status	Percent of the Standard
SF USD	2019 – 2020 – 2021 – 4 ppb	4 ppb	Yes*	5%
Rapid City Credit Union	2019 – 7 ppb 2020 – 8 ppb ** 2021 – 4 ppb	6 ppb	Yes**	8%
Badlands	2019 – 19 ppb 2020 – 1 ppb 2021 – 3 ppb	8 ppb	Yes	11%
UC #1	2019 – 3 ppb 2020 – 2 ppb 2021 – 3 ppb	2 ppb	Yes ***	3%

* Only a part of a year at SF USD
**2020 data at the Credit Union Site did not meet completeness criteria due to multiple machine malfunctions
***Site closed after third quarter 2021, so design value based on 2 ¾ years.

Figure 9-4 shows the three-year average of the yearly 99th percentile or design value for the 1-hour concentration for each of the sites in the network for 2021. All four of the sites recorded concentrations well under the 1-hour standard. The highest 1-hour design value was recorded at the Badlands Site with a concentration of 8 parts per billion which is 11% of the standard. The Union County site had a concentration of 2 parts per billion which is 3% of the standard. The data collected in the past three years demonstrates that South Dakota is attaining the 1-hour Sulfur Dioxide standard.

Figure 9-4– 2021 Sulfur Dioxide 1-Hour Concentrations



*2021 design values for SF USD, UC#1 were based on available data, although they did not have 3 full years.

9.5.2 Sulfur Dioxide 3-Hour Secondary Standard

The EPA Air Quality Systems does not calculate the yearly 3-hour average so a comparison could not be made to the secondary standard for Sulfur Dioxide. South Dakota has very low levels of Sulfur Dioxide at the four monitoring sites. Therefore, the department opted to use the maximum 1-hour concentrations as a comparison for the 3-hour standard for Sulfur Dioxide. The highest 1-hour average concentration was recorded at the Badlands site at 0.015 parts per million which is 3% of the Sulfur Dioxide secondary standard. Since the 1-hour average concentrations are not exceeding the secondary standard, all four sites are attaining the secondary standard for Sulfur Dioxide.

9.6 Nitrogen Dioxide

Beginning in 2010, the standard for Nitrogen Dioxide was revised by adding a 1-hour standard of 100 parts per billion and keeping the annual arithmetic mean standard of 53 parts per billion. Attainment is demonstrated when the 3-year average of 98^{th} percentile daily maximum 1-hour concentration is less than or equal to 100 parts per billion (1-hour design value) and the annual arithmetic mean is less than or equal to 53 parts per billion (annual design value).

There were four Nitrogen Dioxide ambient air monitoring sites operated in 2021. The sampling locations were at the SF USD, Badlands, Rapid City Credit Union, and UC #1 sites.

9.6.1 Nitrogen Dioxide 1-Hour Standard

Table 9-6 contains the 1-hour 98^{th} percentile concentration for each of the last three years, 1-hour design values, attainment status, and percent of the standard for each site. The Rapid City Credit Union Site had the highest 2021 98^{th} percentile 1-hour concentration at 33.4 parts per billion.

The second highest 1-hour concentration for 2021 was recorded at the SF USD Site at 26.5 parts per billion.

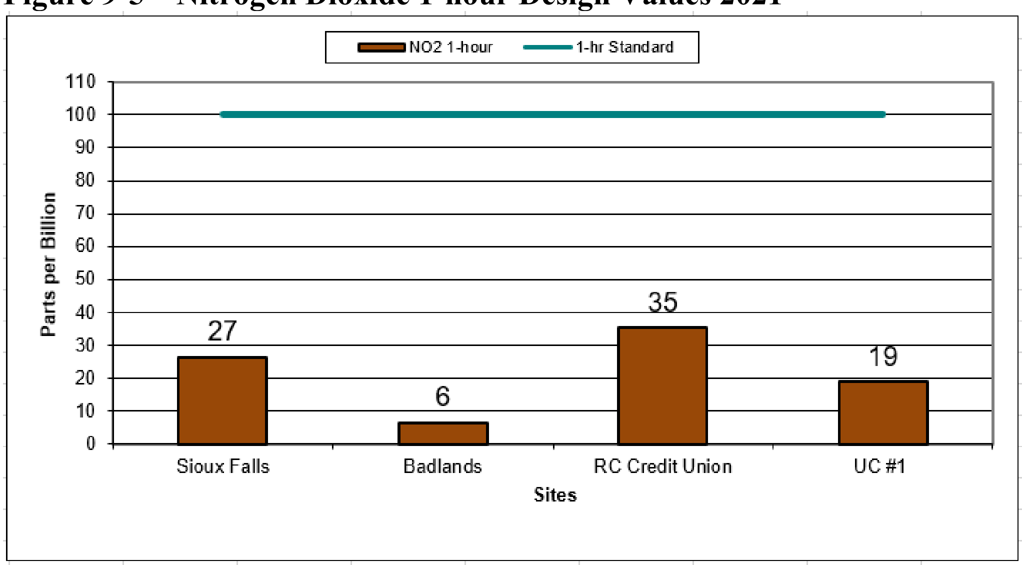
Table 9-6 – Nitrogen Dioxide 1-Hour 98th Percentile Concentrations

Site	98th Percentile Concentration	1-Hour Design Values	Attainment Status	Percent of the Standard
SF USD	2019 – 2020 – 2021 – 26.5 ppb	27 ppb	Yes*	27%
Badlands	2019 – 8.0 ppb 2020 – 3.8 ppb 2021 – 7.6 ppb	6 ppb	Yes	6%
RC Credit Union	2019 – 38.4 ppb 2020 – 33.9 ppb 2021 – 33.4 ppb	35 ppb	Yes**	35%
UC #1	2019 – 11.5 ppb 2020 – 22.4 ppb 2021 – 22.5 ppb	19 ppb	Yes***	19%

* Only a part of a year at SF USD
**2020 data at the Credit Union Site did not meet completeness criteria due to multiple machine malfunctions
***Site closed after third quarter 2021, so design value based on 2 ¾ years.

Figure 9-5 shows the Nitrogen Dioxide 1-hour design values for each of the sites. The Rapid City Credit Union Site had the highest concentration at 35 parts per billion or 35% of the standard. The SD School Site recorded the 2nd highest 1-hour Nitrogen Dioxide design value at 32 parts per billion or 32% of the standard. All sites had concentrations under the 1-hour Nitrogen Dioxide standard and are attaining the standard using data from 2018 to 2020.

Figure 9-5 – Nitrogen Dioxide 1-hour Design Values 2021

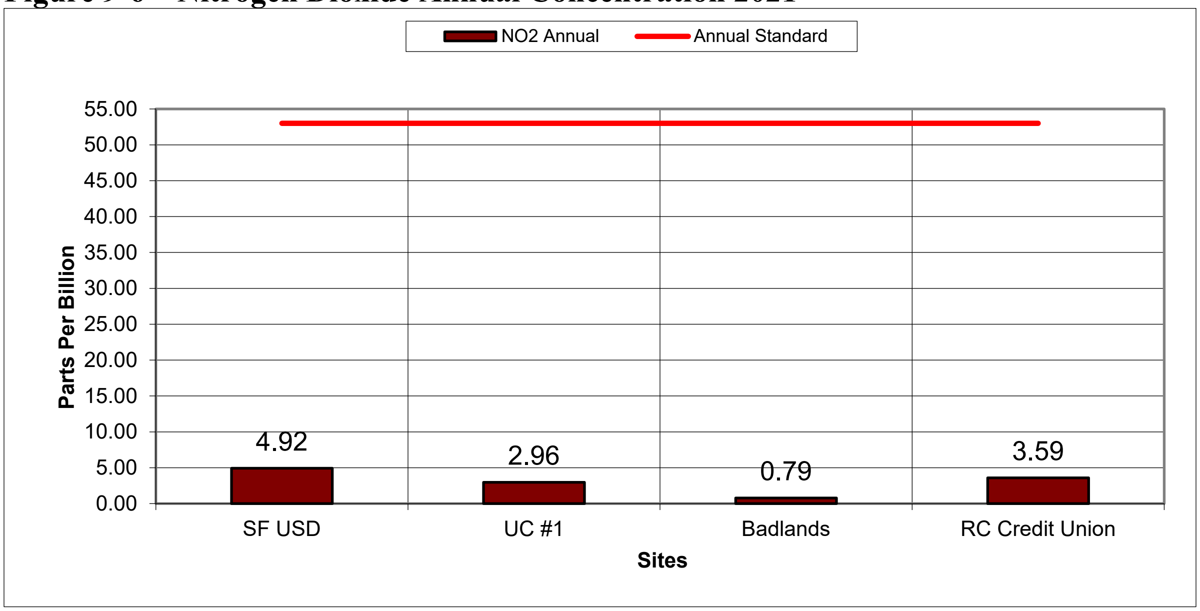


*2021 design values for SF USD, UC#1 were based on available data, although they did not have 3 full years.

9.6.2 Nitrogen Dioxide Annual Standard

Figure 9-6 shows the annual average for the four sites operated in 2021. The highest Nitrogen Dioxide annual average was recorded at the SF USD Site at 4.92 parts per billion. The Badlands Site remained near the detection level for the sampling method. In 2021, all four sites attained the annual standard for Nitrogen Dioxide.

Figure 9-6 – Nitrogen Dioxide Annual Concentration 2021



9.7 Carbon Monoxide

The Carbon Monoxide standard is based on two primary standards in the form of a one-hour and an 8-hour average concentration. The one-hour standard is 35.0 parts per million and is not to be exceeded more than once per year. The highest 1-hour concentration of Carbon Monoxide recorded in 2021 at the SF USD Site was 1.2 part per million. The Carbon Monoxide concentrations are very low. The Carbon Monoxide data shows the area is attaining the 1-hour National Ambient Air Quality Standard.

The other standard is an 8-hour average concentration of 9.0 parts per million, not to be exceeded more than once per year. The highest 8-hour average recorded in 2021 at the SF U SD School Site was 1.1 parts per million. Figure 9-8 shows the Carbon Monoxide maximum 8-hour average concentrations from the SD School Site from 2011 to 2020. The Carbon Monoxide concentrations are very low, and the area is attaining the 8-hour average National Ambient Air Quality Standard.

9.8 2021 High Concentrations Summary

Evaluating high concentration days are important because they affect the design values and need to be considered when evaluating the data results for each year. A conceptual theory on what caused the high concentrations can be formed and further developed in future years. In some cases, if local sources are causing the problem, early actions can be taken to reduce concentration levels and further protect public health from high levels. As EPA revises the national standards lower, information on the cause of the high concentration day needs to be collected soon after the event instead of three years after a standard revision. In some cases, the information may show long range transport or an exceptional event.

The department defined high concentration days as days where the concentration was 90% of or greater than the applicable standard. The evaluation of high concentration days for each parameter is as follows:

1. Ozone $\geq$ 0.063 parts per million, 8-hour average;
2. $PM_{2.5}$ $\geq$ 32 micrograms per cubic meter, 24-hour average;
3. $PM_{2.5}$ $\geq$ 10.8 ug/ m^3, annual average;
4. PM_{10} $\geq$ 135 ug/ m^3, 24-hour average;
5. Nitrogen Dioxide $\geq$ 90.0 parts per billion, 1-hour maximum;
6. Sulfur Dioxide $\geq$ 67.0 parts per billion, 1-hour maximum;
7. Carbon Monoxide $\geq$ 8.1 parts per million, 8-hour average; and
8. Carbon Monoxide $\geq$ 31.5 parts per million 1-hour maximum.

None of the recorded samples at any of the locations throughout the state for $PM_{2.5}$ (annual), Sulfur Dioxide, Nitrogen Dioxide, and Carbon Monoxide (1-hour or 8-hour) had levels that exceeded the high concentration day criteria listed above for these pollutants. Smoke from Canada and western states caused many more high readings in 2021.

9.8.1 $PM_{2.5}$ High Concentration Days

In 2021, there were eleven high concentration days for the 24-hour $PM_{2.5}$ standard throughout South Dakota. The high 24-hour $PM_{2.5}$ readings are shown in Table 9-7. The AirNow Air Quality Index (AQI) and AirNow Tech maps for the day are displayed in Appendix A. The AirNow Air Quality Index maps show the monitoring sites with high concentration days were at Moderate to Unhealthy for Sensitive Groups levels. The AirNow Tech maps show the wind barbs (direction and wind speed), fire locations, and the greyish areas represent smoke plumes.

Table 9-7 – 2021 High 24-Hour $PM_{2.5}$ Readings

No.	Date	Site	Monitor	Concentration (ug/m^3) [1]
1	7/07/2021	Aberdeen	Continuous	32.5
2	7/15/2021	Aberdeen	Continuous	32.3
3	7/29/2021	Brookings	Continuous	**161.1**
		Aberdeen	Continuous	**71.6**
		Watertown	Continuous	**196.6**
		Pierre	Continuous	**35.9**
		Badlands	Continuous	34.7
		Sioux Falls	Continuous	**85.7**
		Union County #1	Continuous	**45.8**
4	7/30/2021	Sioux Falls	Manual A	**114.2**
		Aberdeen	Continuous	**132.7**
		Watertown	Continuous	**97.9**
		Wind Cave	Continuous	**133.8**
		Pierre	Continuous	**193.4**
		Badlands	Continuous	**157.5**
		Sioux Falls	Continuous	**115.5**
		Credit Union	Continuous	**126.3**
		Union County #1	Continuous	**78.1**
5	7/31/2021	Brookings	Continuous	**45.4**
		Aberdeen	Continuous	**68.47**
		Watertown	Continuous	**59.0**
		Wind Cave	Continuous	**44.7**
		Badlands	Continuous	**59.4**
		Sioux Falls	Continuous	**51.8**
		Credit Union	Continuous	**47.1**
		Union County #1	Continuous	**58.2**
6	8/1/2021	Brookings	Continuous	**43.4**
		Aberdeen	Continuous	34.7
		Watertown	Continuous	**38.2**
		Sioux Falls	Continuous	**36.6**
7	8/2/2021	Brookings	Continuous	**43.0**
		Watertown	Continuous	**48.2**
		Sioux Falls	Continuous	**38.5**
8	8/6/2021	Watertown	Continuous	33.3
9	8/10/2021	Credit Union	Continuous	32.7
10	8/16/2021	Wind Cave	Continuous	**37.1**
		Credit Union	Continuous	**41.5**
11	8/17/2021	Credit Union	Continuous	33.8

[1] – Bolded concentrations that are shaded represent $PM_{2.5}$ concentrations that exceeded the 24-hour standard.

9.8.2 <u>PM_{10} High Concentration Days</u>

During 2021, there were nine high concentration days for PM_{10} in South Dakota. The high concentration days are shown in Table 9-8. The AirNow Air Quality Index (AQI) and AirNow Tech map are displayed in Appendix B.

The first two exceedances listed were believed to be caused by high winds and the remaining eight were believed to be fire influenced. The department considers all nine sites in South Dakota to be demonstrating attainment of the PM_{10} 24-hour standard.

Table 9-8 - 2021 High 24-Hour PM_{10} Readings

No.	Date	Site	Monitor	Concentration (ug/m^3) [1]
1	1/14/2021	Credit Union	Continuous	**260**
2	3/29/2021	Watertown	Continuous	143
3	5/21/2021	Credit Union	Continuous	**156**
4	5/29/2021	Credit Union	Continuous	140
5	7/12/2021	Credit Union	Continuous	140
6	7/28/2021	Credit Union	Continuous	**156**
7	7/29/2021	Brookings	Continuous	**184**
		Watertown	Continuous	**219**
8	7/30/2021	Aberdeen	Continuous	145
		Wind Cave	Continuous	**155**
		Badlands	Continuous	**190**
		Black Hawk	Continuous	**153**
		Credit Union	Continuous	**168**
9	9/23/2021	Credit Union	Continuous	**156**

[1] – Bolded concentrations that are shaded represent PM_{10} concentrations that exceeded the 24-hour standard.

9.8.3 <u>Ozone High Concentration Days</u>

During 2020, there were 44 8-hour average high concentration days for ozone. The 44 days occurred mainly from June through August, primarily at the Brookings and Black Hawk sites. In the east, Brookings had 15 high reading days, Watertown had 10 high reading days, Sioux Falls had 5 high reading days, and the Union County site had 5 high reading days. For the western sites, Wind Cave had 7 high reading days and Black Hawk had 25 high reading days. See table 9-9 for the high readings. In 2021, there were several fires in Canada and the western states that appear to have contributed to the number of high ozone readings.

Table 9-9 - 2021 High 8-Hour Average Ozone Readings

No.	Date	Site	Concentration (ppm) [1]
1	5/15/2021	Brookings	0.066
2	6/2/2021	Brookings	0.067
		Sioux Falls	0.063
3	6/3/2021	Brookings	0.063
		Watertown	0.066
4	6/4/2021	Brookings	0.063
5	6/5/2021	Brookings	0.065
		Watertown	0.065
		Sioux Falls	0.065
6	6/7/2021	Brookings	0.066
7	6/10/2021	Brookings	**0.070**
		Watertown	0.063
8	6/13/2021	Brookings	**0.073**
		Watertown	0.068
		Union County #1	0.066
9	6/14/2021	Brookings	**0.073**
		Watertown	0.068
10	6/15/2021	Union County #1	0.065
11	6/16/2021	Brookings	0.069
		Watertown	0.066
		Sioux Falls	**0.070**
		Union County #1	**0.075**
12	6/17/2021	Union County #1	0.069
13	6/18/2021	Brookings	0.064
		Sioux Falls	0.065
14	6/23/2021	Brookings	**0.074**
		Sioux Falls	0.068
		Union County #1	0.063
15	6/29/2021	Brookings	0.066
16	6/30/2021	Brookings	0.063
17	7/2/2021	Watertown	0.065
18	7/4/2021	Watertown	0.064
19	7/8/2021	Black Hawk	0.065
20	7/9/2021	Black Hawk	0.063
21	7/10/2021	Black Hawk	0.064
22	7/11/2021	Black Hawk	0.064
23	7/12/2021	Black Hawk	0.064
24	7/15/2021	Black hawk	0.063
25	7/18/2021	Wind Cave	0.064
26	7/19/2021	Black Hawk	**0.070**
27	7/20/2021	Black Hawk	0.063
28	7/22/2021	Black Hawk	0.064
29	7/24/2021	Wind Cave	0.065

		Black Hawk	**0.072**
30	7/25/2021	Wind Cave	0.066
		Black Hawk	**0.071**
31	7/26/2021	Wind Cave	0.064
		Black Hawk	**0.071**
32	7/27/2021	Watertown	**0.072**
		Wind Cave	0.066
		Black Hawk	**0.074**
33	7/28/2021	Brookings	0.069
		Watertown	0.064
		Wind Cave	0.065
		Black Hawk	**0.072**
34	7/30/2021	Black Hawk	0.068
35	7/31/2021	Wind Cave	0.066
		Black Hawk	0.069
36	8/3/2021	Black Hawk	0.064
37	8/4/2021	Black Hawk	0.063
38	8/5/2021	Black Hawk	0.066
39	8/7/2021	Black Hawk	0.063
40	8/8/2021	Black Hawk	0.063
41	8/16/2021	Black Hawk	**0.075**
42	8/17/2021	Black Hawk	0.069
43	8/22/2021	Black Hawk	**0.072**
44	8/23/2021	Black Hawk	0.066

[1] – Bolded concentrations that are shaded represent ozone concentrations that exceeded the 8-hour average ozone standard.

The AirNow Air Quality Index (AQI) and AirNow Tech maps for each day are displayed in Appendix C. Of the 67 high concentrations, 15 exceeded the 8-hour average standard of 0.070 parts per million. The highest two concentrations occurred at the Union County site and Black Hawk site, with an 8-hour average of 0.075 parts per million on June 16, 2021, and August 16, 2021, respectively.

In many of the cases, the AirNow Tech maps show local fires or smoke plumes from fires in other areas may have influenced the ozone concentrations in South Dakota. Out of the 44 high concentration days, there were 13 instances that caused a violation of the 8-hour average ozone standard.

10.0 AIR MONITORING SITE TRENDS

This section will evaluate each air monitoring site in the network, determine if the site should be continued, and examine trends for each pollutant. Through this evaluation a determination is made if site goals are being met and if each testing parameter is needed at the site. This section also has site specific information tables including Air Quality System ID #, location, operation, data use, sampling schedule, monitoring objectives, spatial scale, and sampling and analytical methods required as part of the annual plan requirements in Title 40 of the Code of Federal Regulations Part 58.

10.1 Credit Union Site

The Rapid City area had one monitoring site collecting data in 2021. The high concentration site for PM_{10} was located at the Rapid City Credit Union Site and a continuous PM_{10} monitor was used to determine compliance with the National Ambient Air Quality Standards. In addition, Sulfur Dioxide, Nitrogen Dioxide, and $PM_{2.5}$ analyzers were operated to determine current concentration levels.

In cooperation with Rapid City, Pennington County, and local industry, the department is implementing a Natural Events Action Plan for the Rapid City area. Part of this plan is to alert the public of the potential of high dust levels caused by high winds and to advise the public of precautions to take during the high wind events. Under this plan high wind dust alerts are called by the National Weather Service when the following forecast conditions occur:

1. Hourly wind speeds exceed 20 miles per hour;
2. Peak wind gusts are greater than 40 miles per hour; and
3. Five consecutive days of 0.02 inches or less of precipitation each day excluding dry snow.

During 2021, 17 high wind dust alert days were called for the Rapid City area. One of the alert days exceeded the PM_{10} 24-hour standard. That date was 1/14/21, with a $PM_{2.5}$ concentration of 260.6 micrograms per cubic meter. The Natural Events Action Plan for the Rapid City area is working to maintain PM_{10} concentrations below the National Ambient Air Quality Standards during the high wind events on most days but still concentrations can exceed the standard.

An attainment designation was requested for PM_{10} and was approved by EPA for the Rapid City area in 2006. An attainment designation for the 24-hour $PM_{2.5}$ standard was requested for the Rapid City area in 2008 and for the annual $PM_{2.5}$ standard in 2014. EPA designated Pennington and Meade Counties as attainment/unclassifiable for 24-hour standard in 2010 and the annual standard in 2015.

The Rapid City Credit Union Site is located on a lot next to Fire Station #3 building. The Rapid City Credit Union Site replaced the Fire Station #3 Site in October 2003 and is the high PM_{10} concentration location for Rapid City. The Rapid City Credit Union Site is located just south of the quarry area and is centrally located in relation to the quarry facilities. Figure 10-1 contains a picture of the monitoring site looking in a northwest direction towards the quarry area. The goal of this site is to determine if the Rapid City area is attaining the PM_{10}, $PM_{2.5}$, Sulfur Dioxide, and Nitrogen Dioxide standards and population exposure. The department was informed that this property has been sold, but at this time the site can remain.

Figure 10-1 — Rapid City Credit Union Site

Continuous Met One BAM PM_{10} and $PM_{2.5}$ particulate monitors and Thermo Sulfur Dioxide and Nitrogen Dioxide monitors were operated at this site in 2020. The continuous particulate matter monitors provide hourly concentrations on an everyday sampling schedule. The hourly readings from the continuous PM_{10} monitor are used to investigate high concentration days for Rapid City and to compare concentrations to the PM_{10} National Ambient Air Quality Standards. A continuous $PM_{2.5}$ monitor is used to supply hourly data for investigation of high concentration days and to compare to the $PM_{2.5}$ standards. In 2011, continuous Sulfur Dioxide and Nitrogen Dioxide analyzers were added to the Rapid City Credit Union Site to provide data on population exposure and source oriented testing near the facilities in the quarry area. Table 10-1 contains details on the monitoring site specific to the requirements in 40 Code of Federal Regulations Part 58.

Table 10-1 – Rapid City Credit Union Site Specifics

Parameter	Information
Site Name	Rapid City Credit Union
AQS ID Number	46-103-0020
Street Address	106 Kinney Ave.
Geographic Coordinates	UTM Zone 13, NAD 83, E 638,199.75, N 4,882,811.92
MSA	Rapid City
PM_{10}	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0798-122
Operating Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population

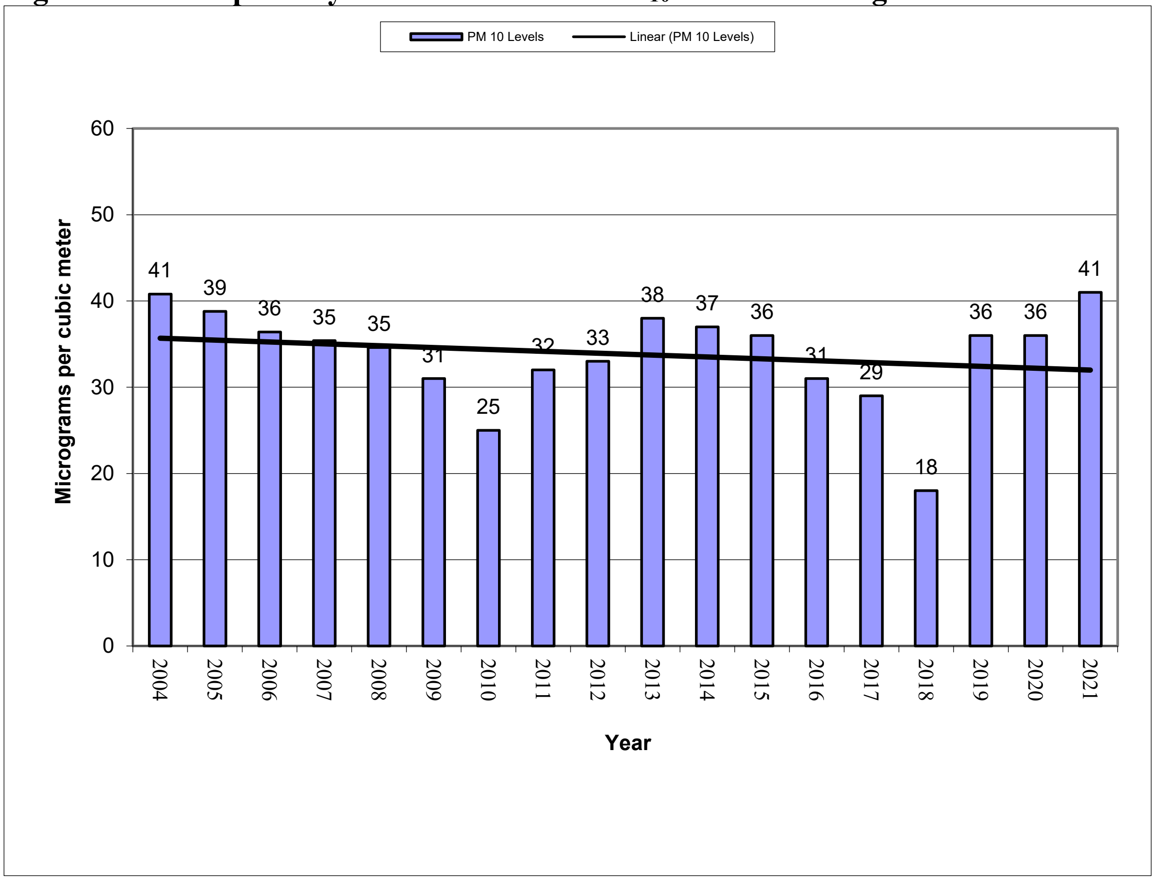
Parameter	Information
Sampling Method	Met One BAM-1020
Analysis Methods	Beta Attenuation
Data Use	SLAMS (Comparison to the NAAQS) and Real-Time Data
$PM_{2.5}$ (Continuous)	
Sampler Type	Federal Equivalent Method EQPM-0308-170
Operating Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration
Sampling Method	Met One BAM-1020
Analysis Methods	Beta Attenuation
Data Use	SLAMS (Comparison to the NAAQS) Real-Time Data
SO_2	**(Continuous)**
Sampler Type	Federal Equivalent Method EQSA-0486-060
Operation Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration
Sampling Method	Instrumental Thermo 43i
Analysis Method	Pulsed Fluorescent
Data Use	SLAMS (Comparison to the NAAQS) and Real-Time Data
NO_2	**(Continuous)**
Sampler Type	Federal Reference Method RFNA-1194-099
Operation Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration
Sampling Method	Teledyne T200
Analysis Method	Chemiluminescence
Data Use	SLAMS (Comparison to the NAAQS) and Real-Time Data

10.1.1 Credit Union Site PM_{10} Data

The Rapid City Credit Union Site began operation in October of 2003. Only three months of data was collected in 2003, so 2004 is the first complete sampling year. Figure 10-2 shows a graph of the annual average PM_{10} concentration.

The PM_{10} annual average concentration trend shows a declining level each year from 2004 to 2010. In 2011, average concentration levels increased back to the level in 2009 and increased through 2013. Since 2013, average concentration levels had declined until 2019. In 2021, concentrations rose again. Testing for PM_{10} concentrations is a priority for this site, since the Rapid City Library Site was closed at the end of 2019 and the parameter will be continued.

Figure 10-2 – Rapid City Credit Union Site PM_{10} Annual Averages



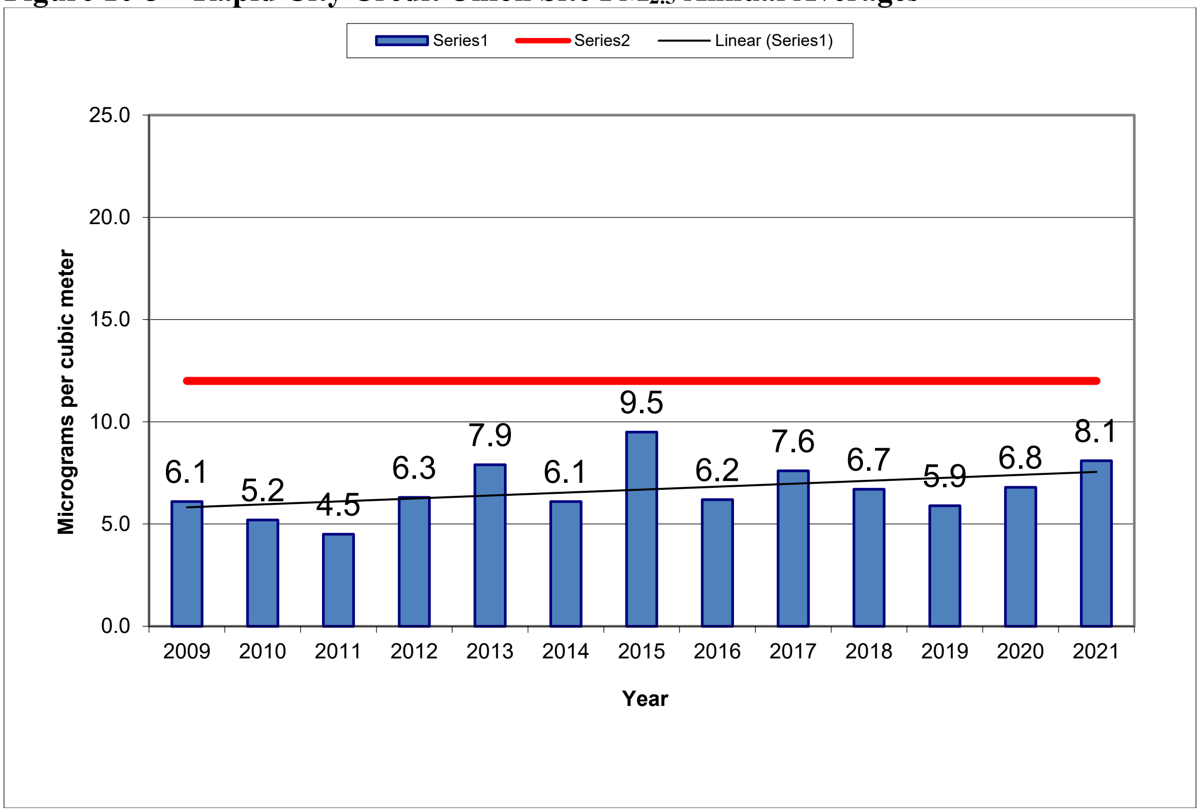
10.1.2 Credit Union Site $PM_{2.5}$ Data

The testing for $PM_{2.5}$ parameter using the manual method began at this site in October 2003 and completed the first full year of testing in 2004. In 2009, a continuous method $PM_{2.5}$ monitor was added to the site as a special purpose monitor. Because the continuous monitor was a new method, EPA allowed the operation of the monitor as a special purpose method for up to three years before the data from the monitor was required to be compared to the $PM_{2.5}$ standard. By the end of 2011, the continuous monitor had operated for three years and the Met One continuous $PM_{2.5}$ monitor received the federal equivalent method number. Data was similar between the methods of $PM_{2.5}$ monitoring, so as a cost savings measure the manual $PM_{2.5}$ monitor was removed, and the continuous monitor became the state and local air monitoring stations monitor providing more valid data at a lower cost per year of operation.

Figure 10-3 shows the annual average for each sampling year since 2009 when the continuous monitor was setup. The annual average concentrations have varied through the years. In 2011, $PM_{2.5}$ annual concentrations reached its lowest level with a concentration of 4.5 micrograms per cubic meter. The highest annual average for $PM_{2.5}$ at this site was 9.5 micrograms per cubic meter in 2015. Smoke from wildfires in Canada and Pacific Northwest states had a large impact on the $PM_{2.5}$ annual average concentration in 2015, 2017, 2018, and 2021.

The parameter of $PM_{2.5}$ will be continued at this site using the continuous monitor to determine compliance with the National Ambient Air Quality Standards and to determine any change in concentration levels.

Figure 10-3 – Rapid City Credit Union Site $PM_{2.5}$ Annual Averages

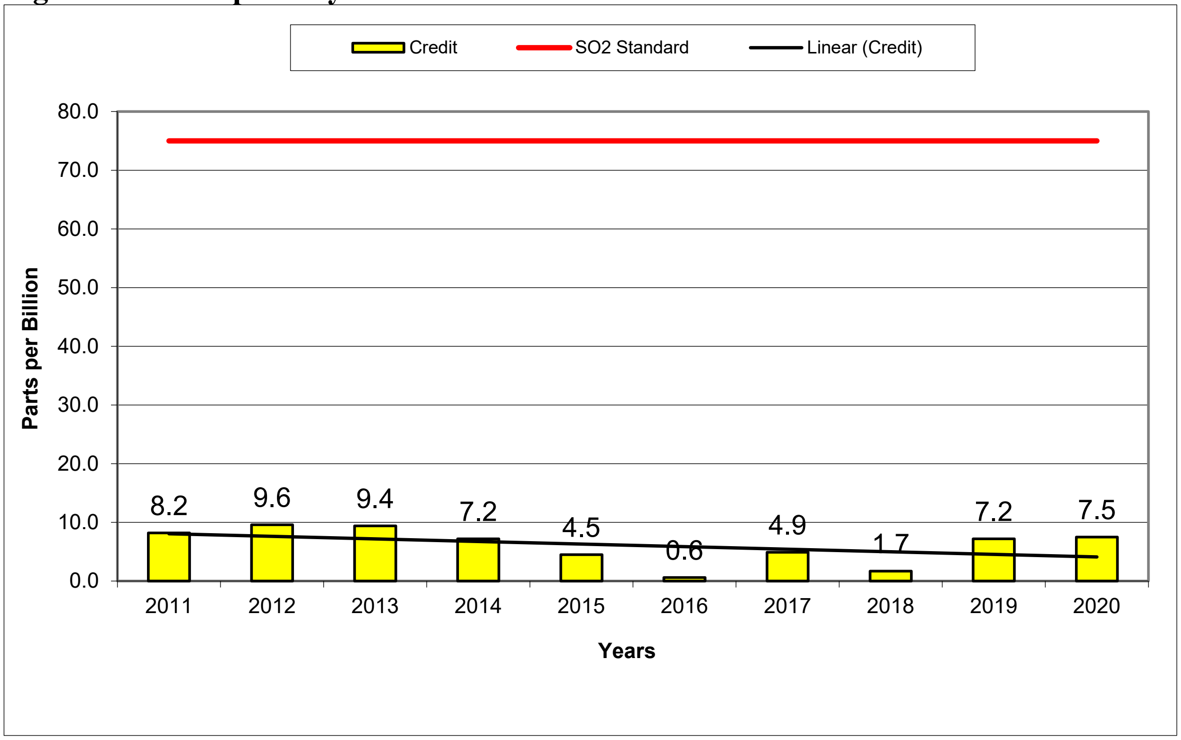


10.1.3 Credit Union Site Sulfur Dioxide Data

Testing for Sulfur Dioxide started at the beginning of 2011 for this site. Some testing for the parameters was done in the 1990s but that data was old and there was need for the collection of new data. The annual standard for Sulfur Dioxide was dropped when the standard was revised so the 1-hour, daily maximum, 99 percentile concentrations will be used to track trends.

See Figure 10-4 for the 1-hour daily maximum concentration of Sulfur Dioxide recorded at the Rapid City Credit Union Site. The concentration level is low. Trends indicate a decreasing Sulfur Dioxide concentration level for this site. Testing for Sulfur Dioxide will continue at this site.

Figure 10-4 – Rapid City Credit Union Site Sulfur Dioxide 99th Percentile 1-hour Averages

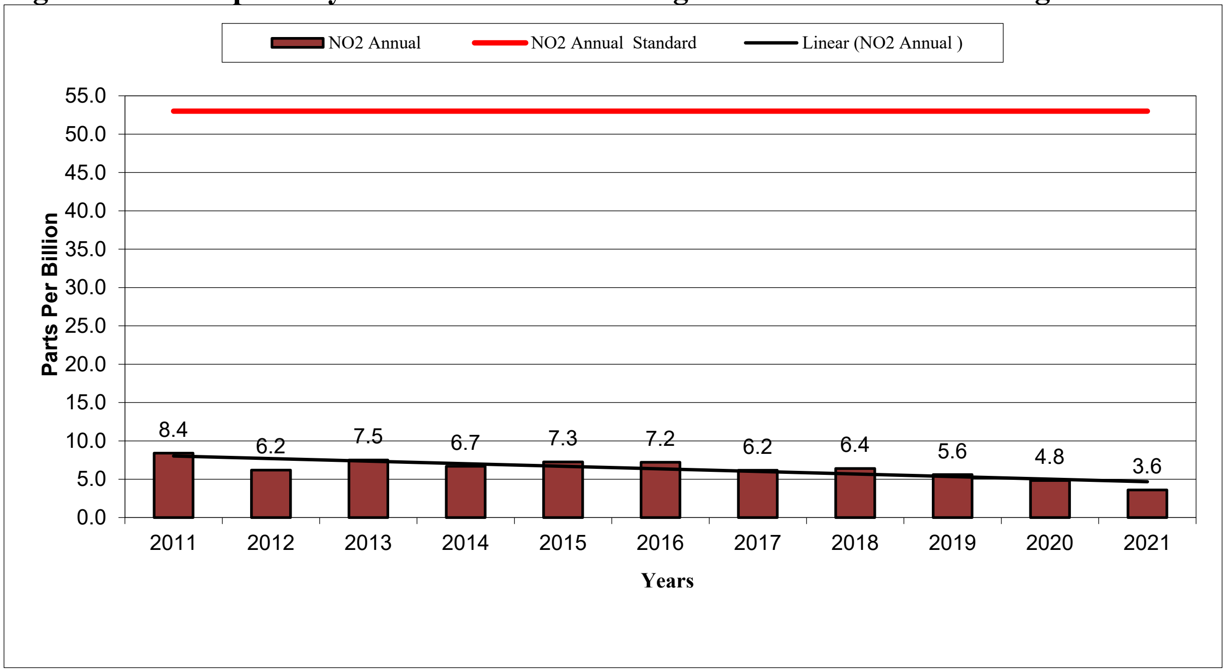


10.1.4 <u>Credit Union Site Nitrogen Dioxide Data</u>

Testing for Nitrogen Dioxide started at the beginning of 2011 for this site. Some testing for the parameter was completed in the 1990s but that data was old and there was a need for the collection of new data. The Nitrogen Dioxide standard includes a 1-hour and annual average concentration so the annual average will be represented to track trends.

See Figure 10-5 for concentrations of Nitrogen Dioxide at the Rapid City Credit Union Site. The concentrations are low. The trend line shows a slightly declining concentration level for the annual average. Testing for Nitrogen Dioxide will continue at this site to further define the pollution level trend for this site.

Figure 10-5 – Rapid City Credit Union Site Nitrogen Dioxide Annual Averages



10.2 Black Hawk Site

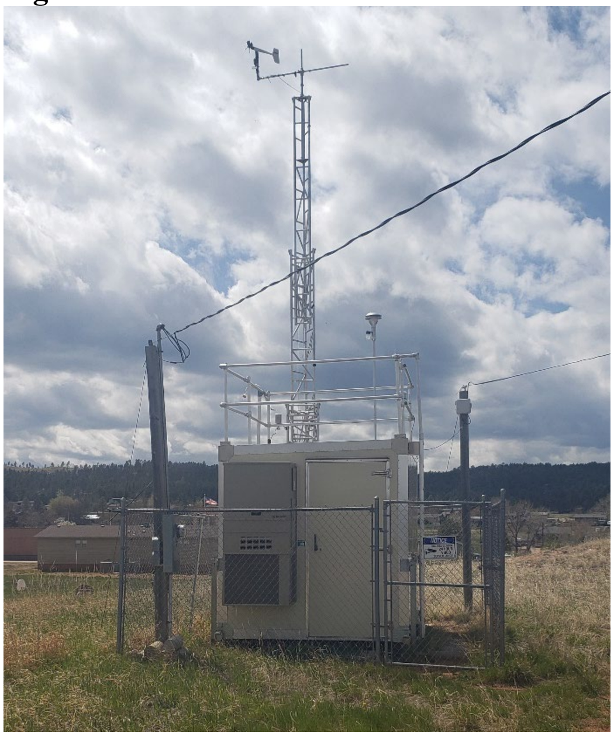
Black Hawk is a small town located just north of Rapid City in Meade County north of the quarry area. Black Hawk is not an incorporated city but is a growing subdivision and is part of the Rapid City Metropolitan Statistical Area.

The Black Hawk Site was setup in the fall of 2000. The site is located on a small hill east of the Black Hawk Elementary School. PM_{10} and $PM_{2.5}$ monitors were located on a sampling shelter until October 2003 when the sampling shelter was moved to the Rapid City Credit Union Site. The monitors were then located on scaffolding within a fenced area until the fall of 2006 when a shelter was added back to the site. At the end of 2004, the $PM_{2.5}$ monitors were removed because concentrations were the lowest in the area and the potential for concentrations over the National Ambient Air Quality Standards were very low. In 2007, the ozone analyzer was moved from Rapid City Credit Union Site to the Black Hawk Site to determine ozone concentrations outside of the modeled one microgram Nitrogen Dioxide influence area from air quality sources in western Rapid City. See Figure 10-6 for a current picture of the site looking to the northwest.

The land use around the site is mainly residential with a few service type businesses. There are no obstructions around the monitoring site. The limestone quarry industries are located to the south and southeast of the Black Hawk Site and are expanding to ore bodies located closer to this site.

The current goal of the Black Hawk Site is to determine urban background concentrations for PM_{10} coming into the Rapid City area from the north and determine compliance with the ozone National Ambient Air Quality Standards in the Rapid City Metropolitan Statistical Area.

Figure 10-6 – Black Hawk Site



The site's spatial scale is neighborhood for PM_{10} and ozone sampling. The objectives of the PM_{10} sampling are high concentration, population, and source impact. The objectives of the ozone sampling are high concentration and population. The goals are being met. Table 10-2 contains details on the monitoring site specific to the requirements in Title 40 of the Code of Federal Regulations Part 58.

Table 10-2 – Black Hawk Site Specifics

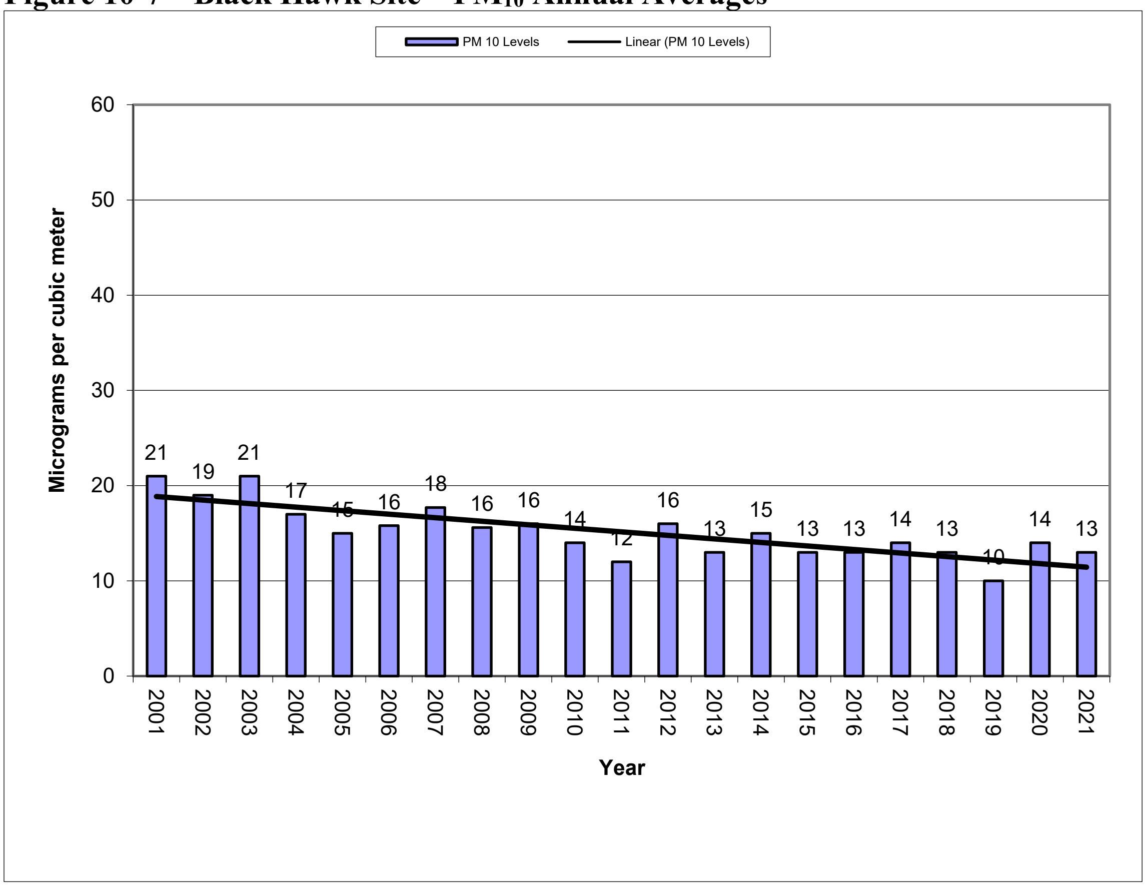
Parameter	Information
Site Name	Black Hawk Elementary
AQS ID Number	46-093-0001
Street Address	7108 Seeaire Street
Geographic Coordinates	UTM Zone 13, NAD 83, E 634,683.07 N 4,890,309.65
MSA	Rapid City
PM_{10}	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-1102-150
Operating Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	Population, Urban Background
Sampling Method	T A Series FH 62 C14 Continuous
Analysis Methods	Gravimetric
Data Use	SLAMS (Comparison to the NAAQS)

Parameter	Information
Ozone	**(Continuous)**
Sampler Type	Federal Equivalent Method EQOA-0880-047
Operating Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration
Sampling Method	Instrumental Thermo 49i
Analysis Methods	Ultraviolet
Data Use	SLAMS (Comparison to the NAAQS) and Real-time Data

10.2.1 Black Hawk Site PM_{10} Data

Figure 10-7 contains a graph showing the PM_{10} annual averages for the Black Hawk Site. The first three years of PM_{10} concentration levels remained about the same. In 2004, the annual average dropped four micrograms per cubic meter. The highest annual average was 21 micrograms per cubic meter recorded in both 2001 and 2003. The lowest level of 10 micrograms per cubic meter was recorded in 2019. The overall trend shows a decrease in concentration. Plans are to continue to test for PM_{10} at this location.

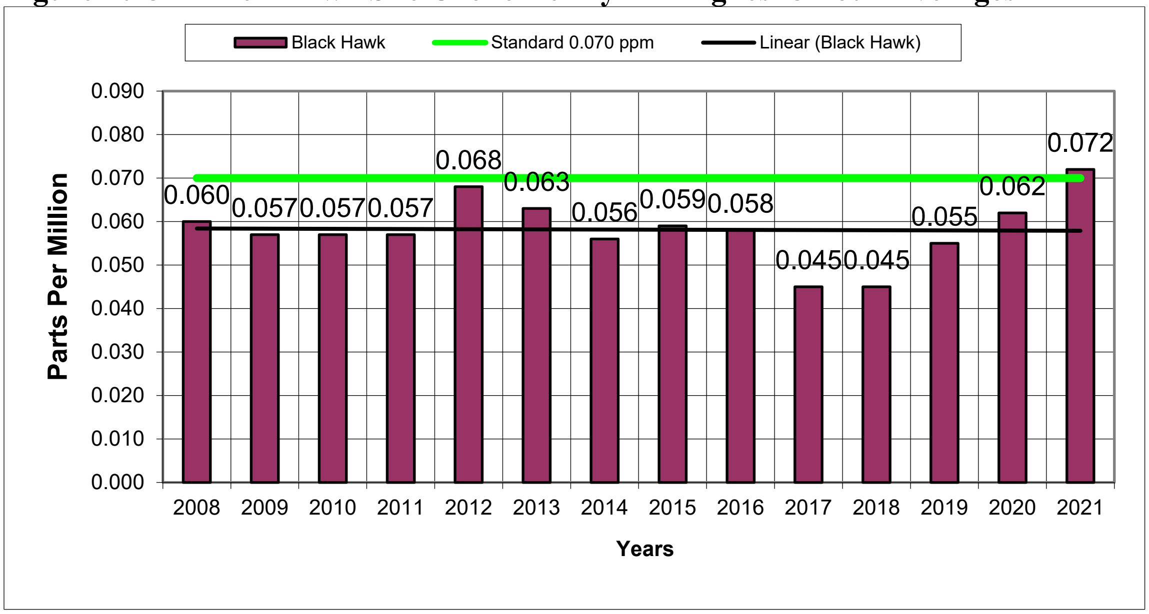
Figure 10-7 – Black Hawk Site – PM_{10} Annual Averages



10.2.2 Black Hawk Site Ozone Data

The 2021 sampling year is the 14th ozone season at the Black Hawk Site (see Figure 10-8). In the first year of testing (2008), the site recorded the second highest ozone level in the state. In 2012, the ozone levels were up statewide by 4 parts per billion and significantly at this site at 11 parts per billion. In 2021, ozone levels increased for a third year. The overall trends show a steady ozone concentration level. Plans are to continue to test for ozone at this location.

Figure 10-8 – Black Hawk Site Ozone Yearly 4th Highest 8-hour Averages



10.3 Badlands Site

The Badlands National Park is one of two Class I areas in South Dakota designated for visibility protection under the Clean Air Act. The Badlands area is a large national park that attracts more than two million visitors each year. The Badlands area is a dry semi-desert area with short prairie grass and beautiful sandstone cliff vistas.

The Badlands Site was established in 2000, with manual monitors for particulate matter. Continuous monitors for particulate matter and gaseous air pollutants have been added over the years. Currently, the Badlands Site continuously monitors for PM_{10}, $PM_{2.5}$, Sulfur Dioxide, Nitrogen Dioxide, and ozone. The site is in the southeast part of the park near the visitor center. Figure 10-9 shows a current picture of the Badlands Site.

Figure 10-9 –Badlands Site

The Badlands Site is located next to the Interagency Monitoring of Protected Visual Environments site operated by the National Park Service. The Interagency Monitoring of Protected Visual Environments data is used to determine what types of sources are impacting the visibility of the national parks in South Dakota. The goal of having a state and local air monitoring station site next to the Interagency Monitoring of Protected Visual Environments site is to determine air pollution background levels and to see if pollution trends show long range transport of air pollution into the state. Table 10-3 contains details on the monitoring site specific to the requirements in Title 40 of the Code of Federal Regulations Part 58.

Table 10-3 – Badlands Site Specifics

Parameter	Information
Site Name	Badlands
AQS ID Number	46-071-0001
Street Address	25216 Ben Reifel Road, Interior, South Dakota 57750
Geographic Coordinates	UTM Zone 14, NAD 83, E 263,173.81 N 4,847,799.95
MSA	None
PM_{10}	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0798-122
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport

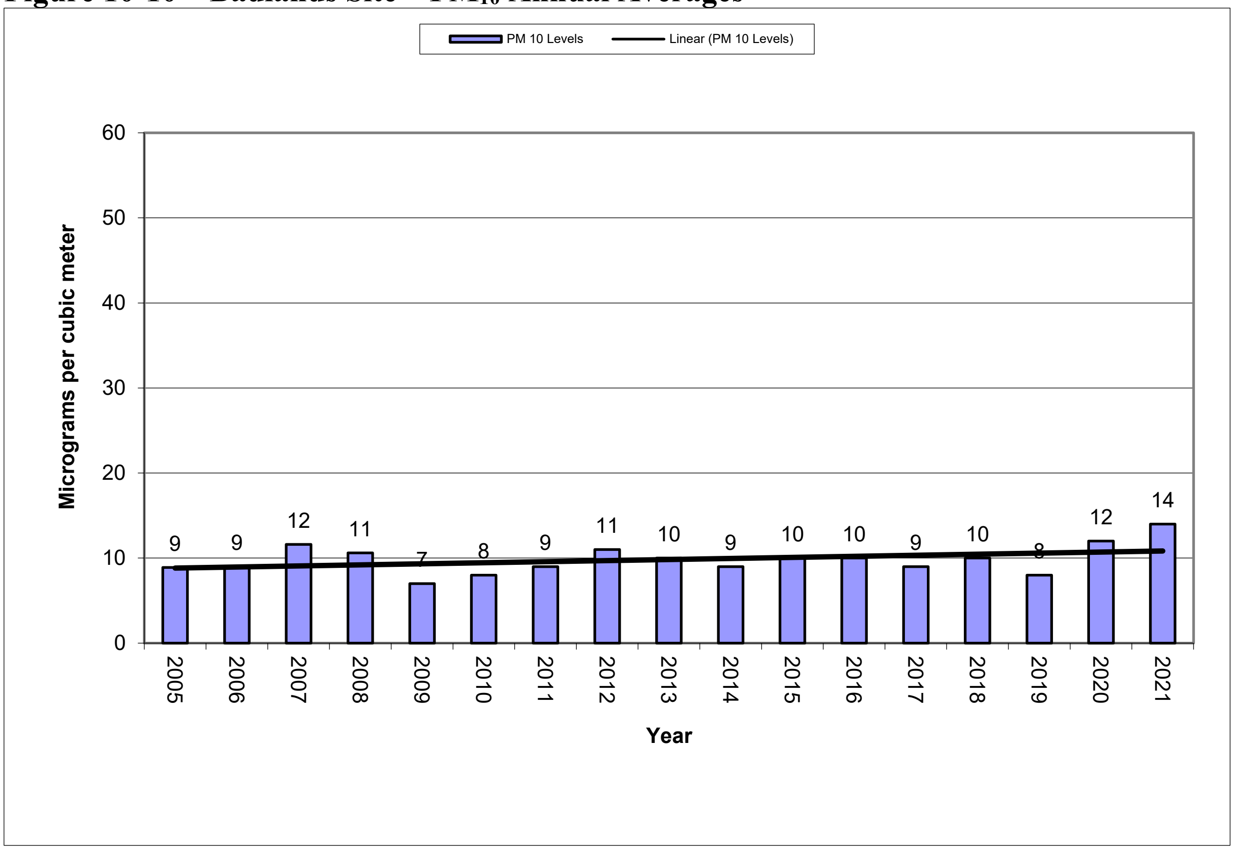
Parameter	Information
Sampling Method	Met One BAM - 1020
Analysis Method	Beta Attenuation
Data Use	SLAMS (Comparison to the NAAQS) Real-time Data
$PM_{2.5}$	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0308-170
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Met One BAM-1020 w/$PM_{2.5}$ VSCC
Analysis Method	Beta Attenuation
Data Use	Real-time Data and SLAMS (Comparison to the NAAQS)
SO_2	**(Continuous)**
Sampler Type	Federal Equivalent Method EQSA-0495-100
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Teledyne T100U
Analysis Methods	UV Fluorescence
Data Use	SLAMS (Comparison to the NAAQS) Real-time Data
NO_2	**(Continuous)**
Sampler Type	Federal Reference Method RFNA-1194-099
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Teledyne T200
Analysis Method	Chemiluminescence
Data Use	SLAMS (Comparison to the NAAQS) Real-time Data
Ozone	**(Continuous)**
Sampler Type	Federal Equivalent Method EQOA-0992-087
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Teledyne T400
Analysis Method	Ultraviolet
Data Use	SLAMS (Comparison to the NAAQS) and Real-time Data

10.3.1 Badlands Site – PM_{10} Data

PM_{10} data has been collected at this site since 2000. The PM_{10} manual monitors were operated on an every sixth day schedule from 2000 through 2004. As of 2005, continuous monitoring methods have been employed.

Figure 10-10 contains a graph of the annual averages for the Badlands Site since the continuous monitor was installed. The annual average concentration over the last 17 years varied only slightly overall. The highest annual average concentration of 14 micrograms per cubic meter was recorded in 2021. The lowest annual average concentration of 7 micrograms per cubic meter was recorded in 2009. The PM_{10} concentrations recorded at this site are some of the lowest levels in the state and represent background levels for the western half of the state. This parameter is meeting the goals for testing at this site and will be continued.

Figure 10-10 – Badlands Site – PM_{10} Annual Averages

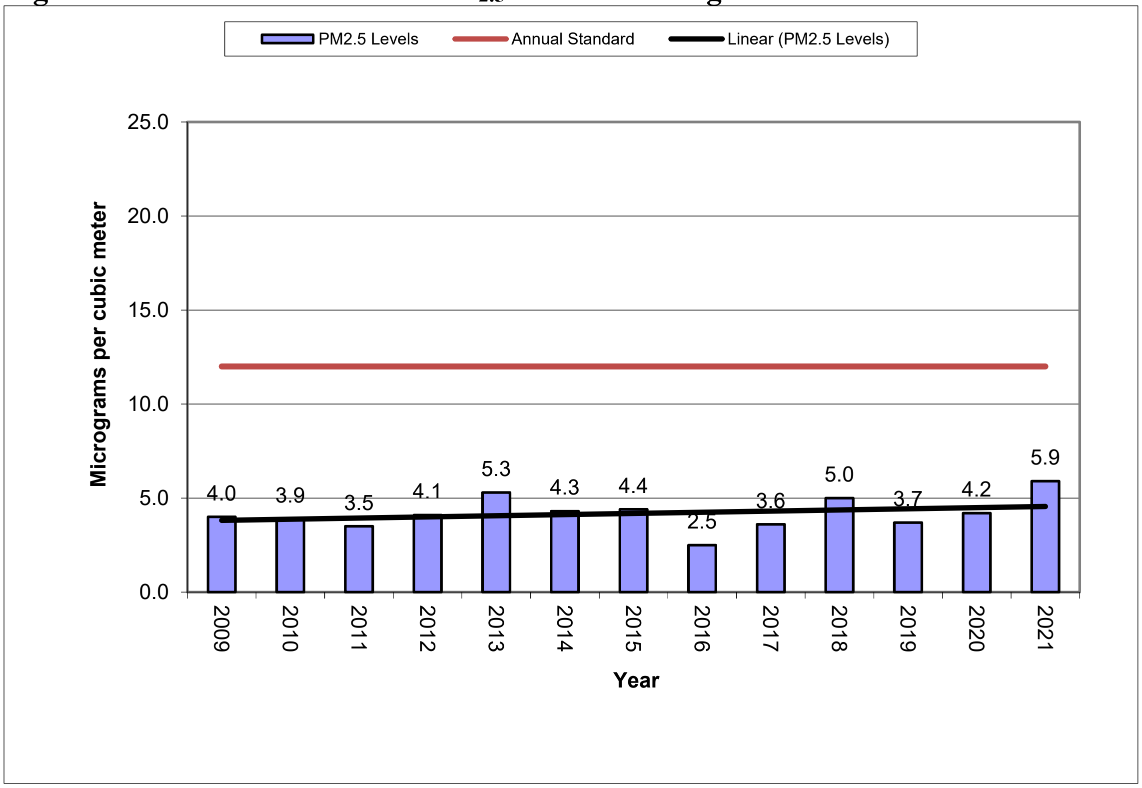


10.3.2 Badlands Site – $PM_{2.5}$ Data

The $PM_{2.5}$ manual monitors ran on an every third day schedule from 2001 to 2008. Beginning in 2009, the continuous Met One BAM-1020 Federal Equivalent Method replaced the manual RAAS 100 and the sampling schedule went to every day providing hourly and 24-hour average concentrations.

Figure 10-11 contains a graph of the annual averages for the continuous monitoring data. The annual averages for the Badlands Site show a concentration range with a high of 5.9 micrograms per cubic meter in 2021 and a low of 2.5 micrograms per cubic meter in 2016. Like the annual PM_{10} concentrations, $PM_{2.5}$ concentrations at this site have varied slightly over the years and are the lowest in the state. $PM_{2.5}$ concentrations at the Badlands Site represent background levels for western South Dakota. This parameter is meeting the goals for testing at this site and will be continued.

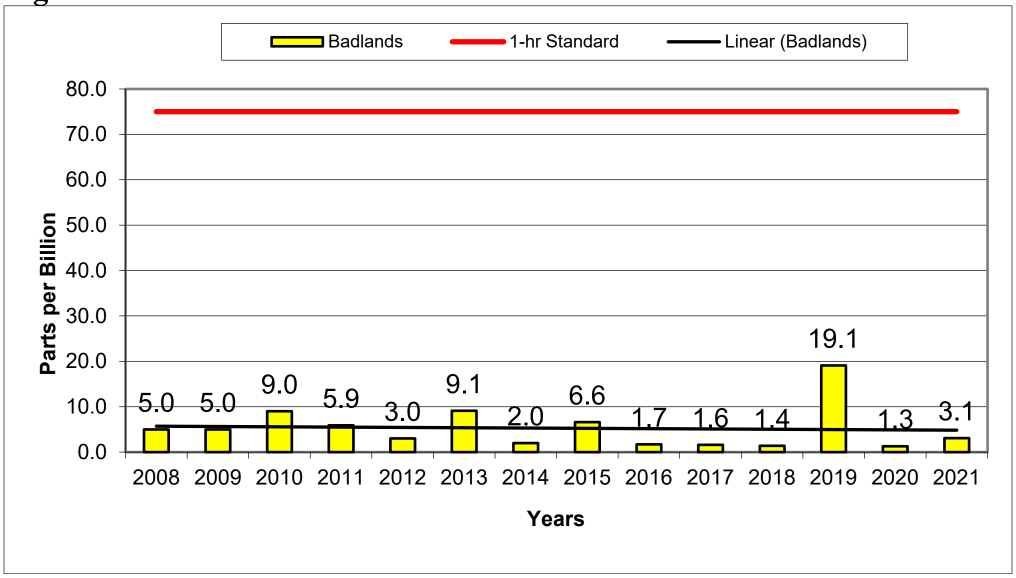
Figure 10-11 – Badlands Site – $PM_{2.5}$ Annual Averages



10.3.3 Badlands Site – Sulfur Dioxide Data

The first year of testing at the Badlands Site for Sulfur Dioxide occurred in 2005. As expected, concentrations for Sulfur Dioxide are very low. In 2019, the annual 99th percentile Sulfur Dioxide concentration was the highest recorded in the history of the site at 19.1 parts per billion. See Figure 10-12 to view a graph of the annual 99th percentile concentrations for Sulfur Dioxide. The linear trend line shows steady concentrations, but levels are very low and indicate minimal concentrations of Sulfur Dioxide. This parameter is meeting the goals for testing at this site and will be continued.

Figure 10-12 – Badlands Site – Sulfur Dioxide 99th Percentile 1-hour Average



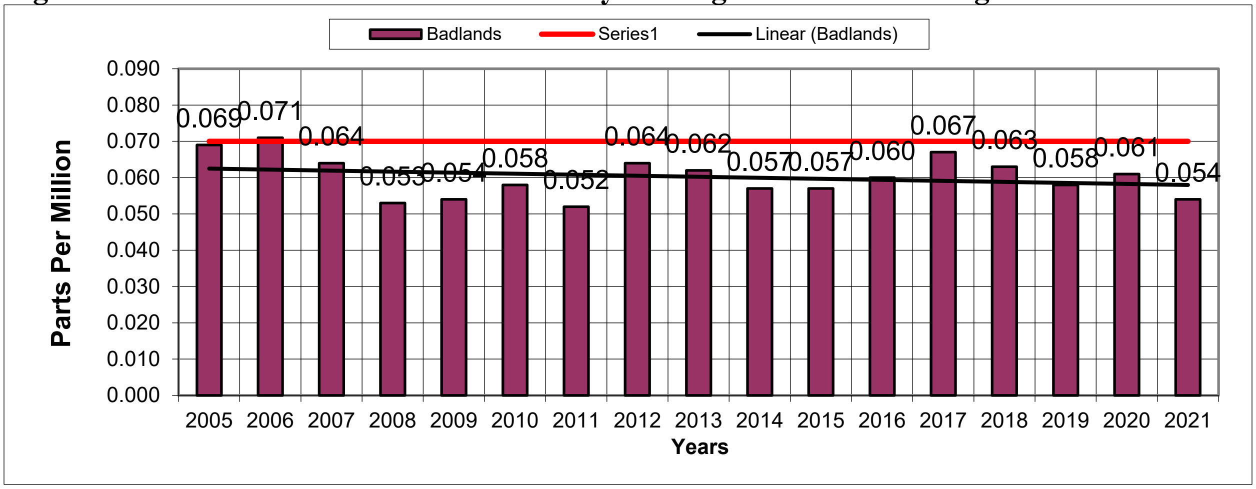
10.3.4 <u>Badlands Site Ozone Data</u>

The first year of testing at the Badlands Site for ozone was in 2005, with equipment being operated by the National Park Service. The department completed quarterly audits of the ozone analyzer so data could be compared to the National Ambient Air Quality Standards. At the beginning of 2008 sampling year, the department took over the operation of the ozone analyzer.

Concentrations of ozone at this site have varied up and down over the sixteen years of testing. The yearly 4th highest 8-hour average ranged from a high of 0.071 parts per million in 2006 to a low of 0.052 parts per million in 2011. Currently it appears the ozone concentrations are on a slight decline. See Figure 10-13 to view a graph of the yearly 4th highest 8-hour average.

This parameter will continue to be a priority at this location because of past concentration levels at a site representing a rural area in western South Dakota and the testing is meeting the needs to continue the sampling effort.

Figure 10-13 – Badlands Site – Ozone Yearly 4th Highest 8-hour Averages

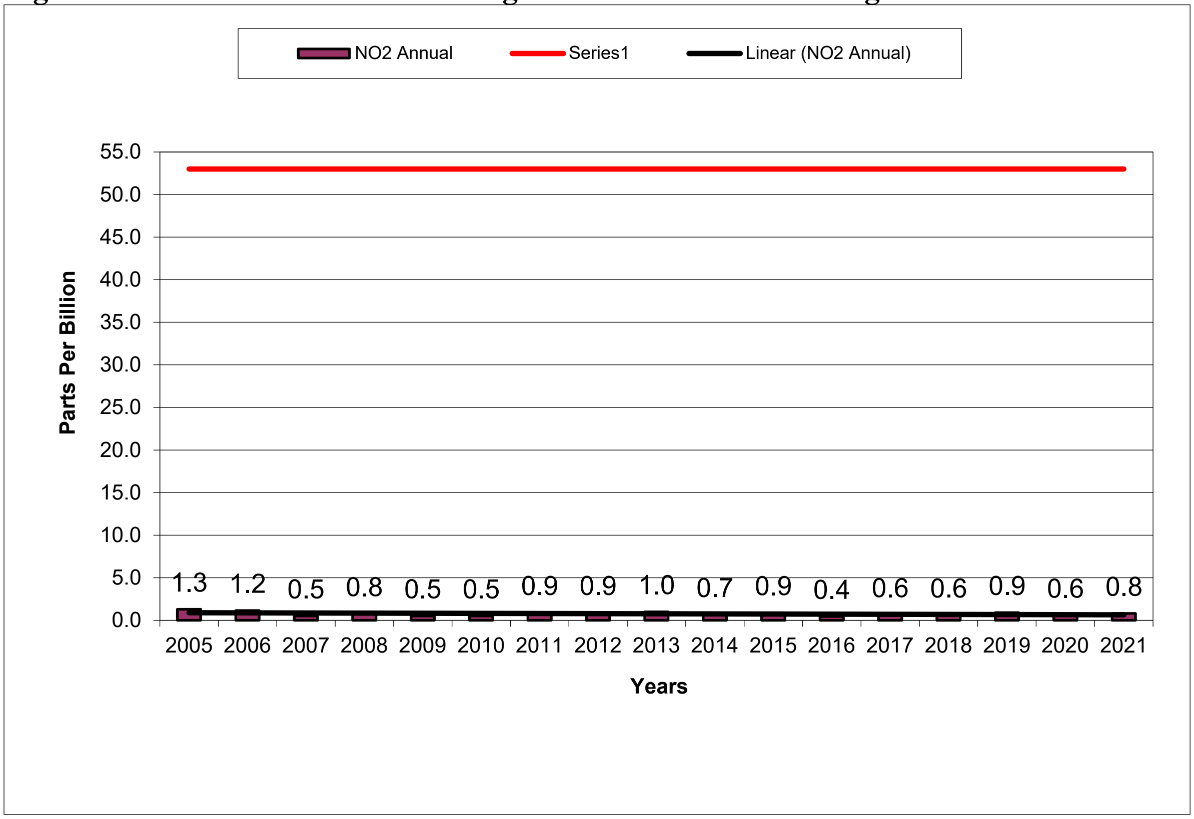


10.3.5 Badlands Site – Nitrogen Dioxide Data

The first year of testing at the Badlands Site for Nitrogen Dioxide occurred in 2005. As expected, concentrations for Nitrogen Dioxide are very low and represent background levels. Many hourly concentrations are at the detection limit of the analyzer at 1.0 part per billion. The calculated annual average levels for all 17 years are close to the detection level for Nitrogen Dioxide.

See Figure 10-14 to view a graph of the annual average concentrations. The linear trends line shows a slightly declining concentration level. This parameter will continue at this location providing background concentration levels for western South Dakota.

Figure 10-14 – Badlands Site – Nitrogen Dioxide Annual Averages



10.4 Wind Cave Site

The Wind Cave National Park is one of two Class I areas in South Dakota designated for visibility protection under the Clean Air Act. The Wind Cave area is a large national park located in the southern Black Hills of South Dakota.

The Wind Cave Site was established in 2005, with manual monitors for $PM_{2.5}$ and continuous monitors for $PM_{2.5}$, PM_{10}, Sulfur Dioxide, Nitrogen Dioxide, and ozone. At the end of 2010, the manual $PM_{2.5}$ monitors were removed from the site leaving only the continuous $PM_{2.5}$ monitor for this parameter. Currently, the Wind Cave Site continuously monitors for PM_{10}, $PM_{2.5}$, and ozone. The site is located a short distance west of the visitor center. Figure 10-15 shows a current picture of the Wind Cave Site.

Figure 10-15 – Wind Cave Site

The monitoring equipment at the Wind Cave Site is in a sampling shelter next to the Interagency Monitoring of Protected Visual Environments site operated by the National Park Service. The Interagency Monitoring of Protected Visual Environments data will be used to determine what types of sources are impacting the visibility of the national parks in South Dakota. The purpose of having a State and Local Air Monitoring Stations site next to the Interagency Monitoring of Protected Visual Environments site is to determine air pollution background levels, and to see if pollution trends show long range transport of air pollution from outside of the state. Table 10-4 contains details on the monitoring site specific to the requirements in Title 40 of the Code of Federal Regulations Part 58.

Table 10-4 – Wind Cave Site Specifics

Parameter	Information
Site Name	Wind Cave
AQS ID Number	46-033-0132
Street Address	290 Elk Mountain Camp Road, Hot Springs, South Dakota
Geographic Coordinates	UTM Zone 13, NAD 83, E 622,471.56 N 4,823,856.93
MSA	Rapid City
PM_{10}	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0798-122
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Met One BAM - 1020

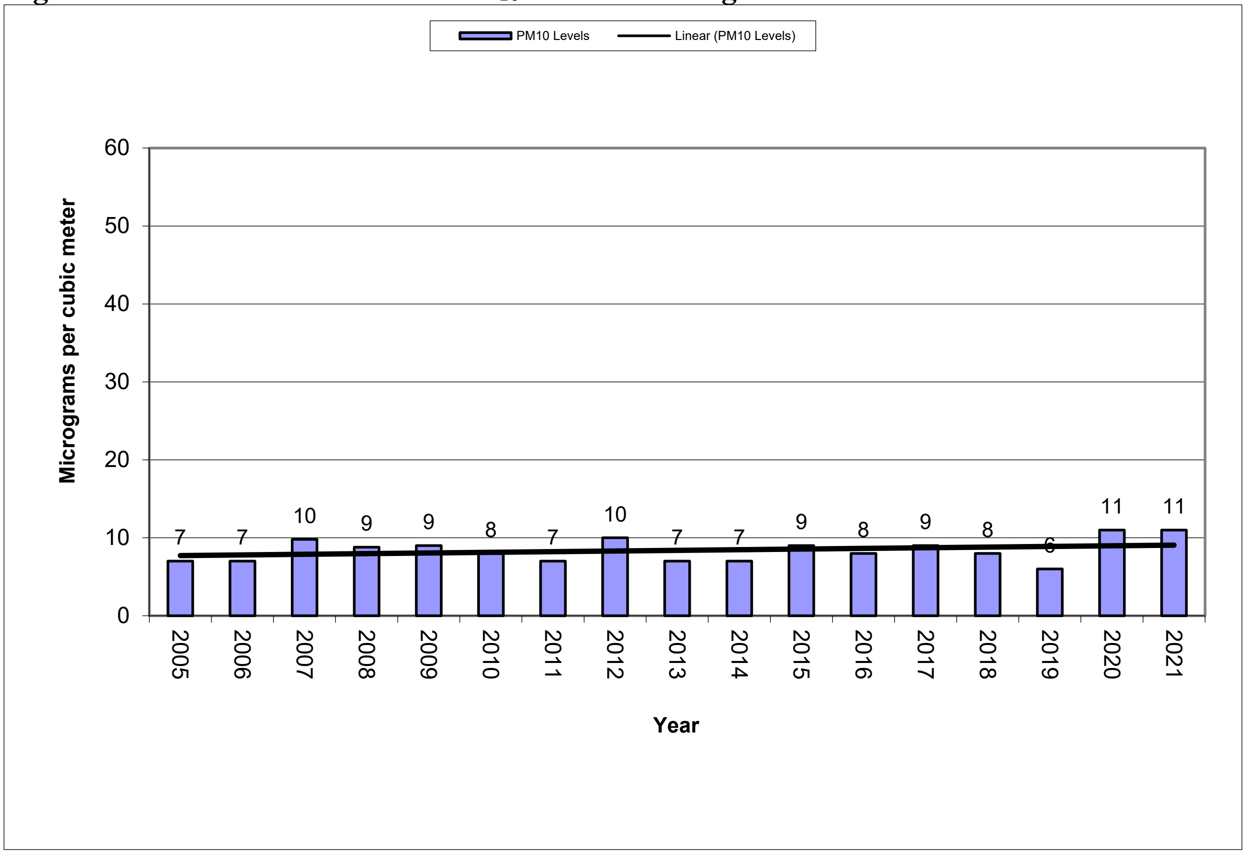
Parameter	Information
Analysis Method	Beta Attenuation
Data Use	SLAMS (Comparison to the NAAQS) Real-time Data
$PM_{2.5}$	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0308-170
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Met One BAM-1020 FEM
Analysis Method	Beta Attenuation
Data Use	Real-time Data and SPMs
Ozone	**(Continuous)**
Sampler Type	Federal Equivalent Method EQOA-0880-047
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Instrumental Thermo 49i
Analysis Method	Ultra Violet
Data Use	SLAMS (Comparison to the NAAQS) Real-time Data

10.4.1 Wind Cave Site PM_{10} Data

The PM_{10} concentrations at this site are one of the lowest in the state and are similar in concentrations as the Badlands Site. The Wind Cave Site is the most remote site in the state and a site that has no influence from industry and agriculture activities near the location. Figure 10-16 contains a graph showing the annual average PM_{10} concentrations.

The 2019 PM_{10} concentrations were the lowest they have been at the site. In 2020, the concentrations were the highest they have been at the site. The trend line indicates slight increase in concentration levels over the 17 years of testing. The concentrations ranged from 6 to 11 micrograms per cubic meter and are very low representing background levels in western South Dakota. This parameter is meeting the goals of background, visibility protection, long range transport, and will be continued.

Figure 10-16 - Wind Cave Site – PM_{10} Annual Averages

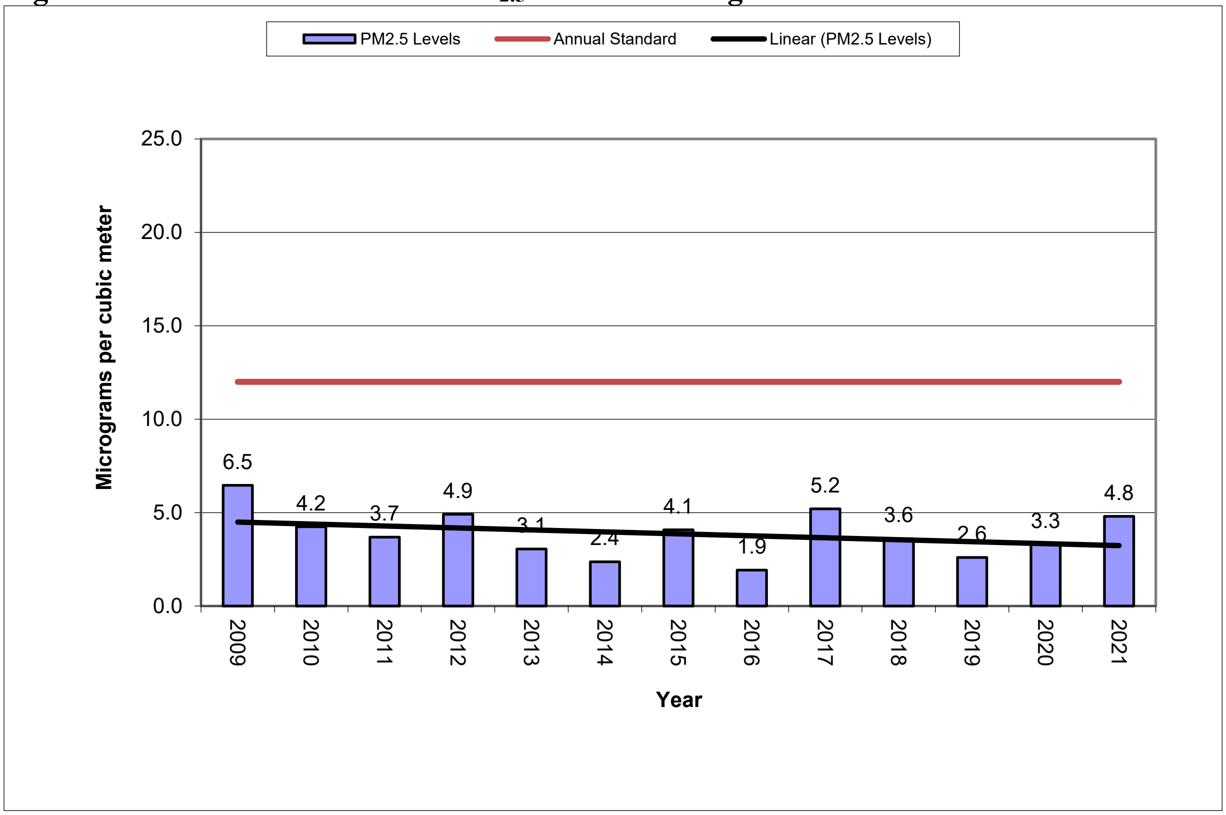


10.4.2 Wind Cave Site $PM_{2.5}$ Data

The $PM_{2.5}$ concentrations are like the levels recorded at the Badlands Site and are some of the lowest in the state. Figure 10-17 contains a graph showing the annual average $PM_{2.5}$ concentration levels.

The $PM_{2.5}$ annual average concentrations range from 6.5 micrograms per cubic meter in 2009 to 1.9 micrograms per cubic meter in 2016. Concentrations were up slightly for this site for the second year in a row. This parameter is meeting the goals of background, visibility protection, and long-range transport and will be continued.

Figure 10-17 - Wind Cave Site – $PM_{2.5}$ Annual Averages

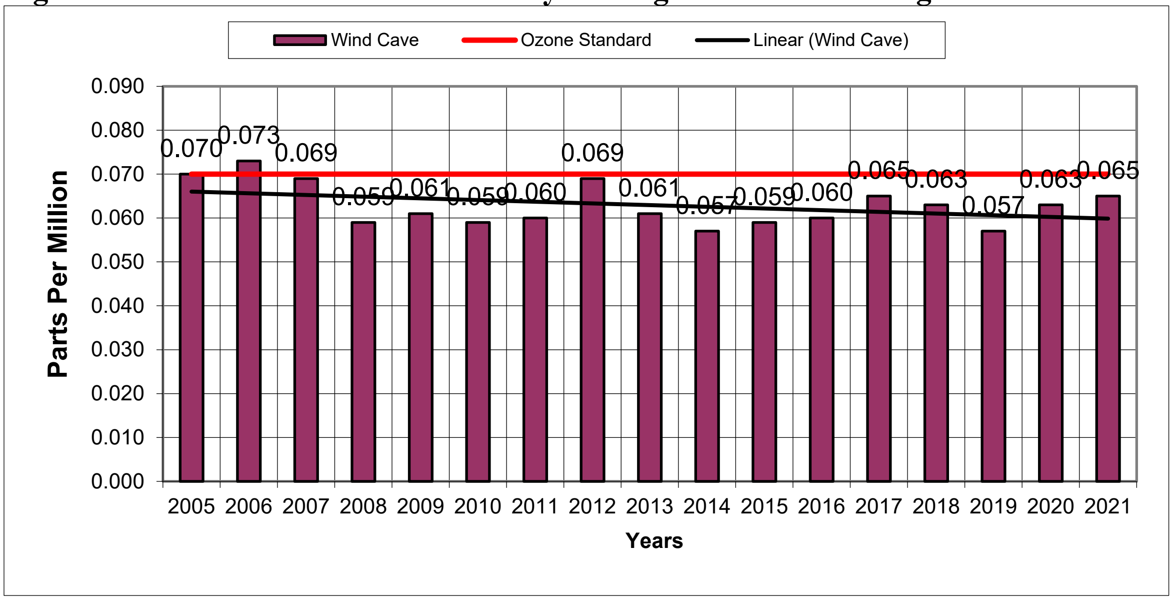


10.4.3 Wind Cave Site Ozone Data

Figure 10-18 contains a graph of the ozone 8-hour concentrations for the Wind Cave Site since 2005. The Wind Cave Site had the highest reported yearly 4th highest 8-hour ozone level in the state at 0.073 parts per million recorded in 2006. Ozone levels began to fall in 2007, in 2008 through 2011 the ozone concentrations leveled out. In 2012, Wind Cave ozone levels jumped back up to the approximate levels recorded when the department first started monitoring for ozone. However, in 2013 through 2016 the ozone concentrations dropped and leveled out similar to what occurred in 2008 through 2011. During 2017, there was an increase in concentration levels. During the next two years the levels had decreased and now have increased again for two years. The overall trend at the site shows a decrease in concentration.

Testing for ozone is meeting the needs of the monitoring network by detecting transport pollution levels for this area of the state. Therefore, this parameter will be continued.

Figure 10-18 – Wind Cave Ozone Yearly 4th Highest 8-hour Averages



10.5 SF USD Site - Sioux Falls Area

Sioux Falls is the largest city in the state. It is located in the southeast corner of the state. The SD School site property had been sold and a new monitoring location was needed. In early 2021, monitoring transitioned from the SD School Site to the new SF USD Site. The SD School Site replaced the SF Hilltop Site on January 1, 2008. The site was the National Core site for the state and monitored for PM_{10}, $PM_{2.5}$, ozone, Carbon Monoxide, Sulfur Dioxide, and Nitrogen Dioxide. In addition, special purpose parameters were sampled including PM_{coarse}, speciation $PM_{2.5}$ and Total Reactive Nitrogen. The same instruments were set up at the new site. This is a very busy monitoring site collecting more than 140,000 data points per year all loaded to the EPA national database. Figure 10-19 shows a picture of the new SF USD Site.

Figure 10-19 – SF USD Site

The SF USD Site is located in the northwest part of the city. The site is west of I-29. The site is located on USD's Sioux Falls campus. Table 10-5 contains details on the monitoring site specific to the requirements in Title 40 of the Code of Federal Regulations Part 58. In addition to the parameters listed in Table 10-5, a $PM_{2.5}$ speciation monitor is operated at an every 3rd day sampling schedule. A complete year of sampling was not done at the new site due to the timing of the move.

Table 10-5 – SD School Site Specifics

Parameter	Information
Site Name	SF USD
AQS ID Number	46-099-0009
Street Address	4801 N Career Ave, Sioux Falls, SD
Geographic Coordinates	UTM Zone 14, NAD 83, Lat 43.599010 Long -96.783310
MSA	Sioux Falls
PM_{10}	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0798-122
Operating Schedule	Every Daily/Hourly
Scale Representation	Neighborhood

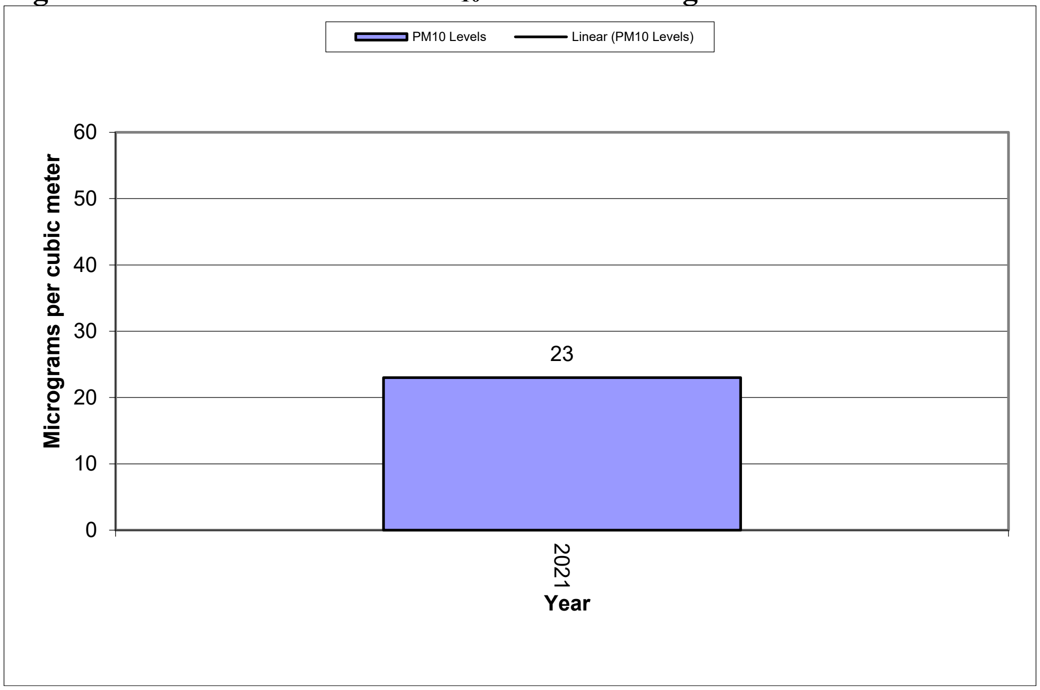
Parameter	Information
Monitoring Objective	Population and High Concentration
Sampling Method	Met One BAM-1020
Analysis Methods	beta attenuation
Data Use	SLAMS (Comparison to the NAAQS)
$PM_{2.5}$	**(Manual)**
Sampler Type	Federal Reference Method RFPS-0498-117
Operating Schedule	Every 3rd Day
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration
Sampling Method	Partisol 2000 w/VSCC
Analysis Methods	Gravimetric
Data Use	SLAMS (Comparison to the NAAQS)
$PM_{10-2.5}$ (Continuous)	
Sampler Type	Federal Equivalent Method EQPM-0709-185
Operating Schedule	Every Daily/Hourly
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration
Sampling Method	Met One BAM-1020
Analysis Methods	beta attenuation
Data Use	SLAMS (Comparison to the NAAQS)
$PM_{2.5}$ (Continuous)	
Sampler Type	Federal Equivalent Method EQPM-0308-170
Operating Schedule	Every Daily/Hourly
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration
Sampling Method	Met One BAM-1020
Analysis Methods	beta attenuation
Data Use	SLAMS (Comparison to the NAAQS)
Ozone (Continuous)	
Sampler Type	Federal Equivalent Method EQOA-0992-087
Operating Schedule	Hourly
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	Teledyne T400
Analysis Methods	Ultraviolet
Data Use	SLAMS (Comparison to the NAAQS), Real-time Data
NO_2 (Continuous)	
Sampler Type	Federal Reference Method RFNA-1194-099
Operating Schedule	Hourly
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	Teledyne API's T200
Analysis Methods	Chemiluminescence detection
Data Use	SLAMS (Comparison to the NAAQS), Real-time Data

Parameter	Information
NO_y (Continuous)	
Sampler Type	None
Operating Schedule	Hourly
Scale Representation	Neighborhood
Monitoring Objective	Population
Sampling Method	Teledyne API's T200U
Analysis Methods	Chemiluminescence NO-Dif-NO_y
Data Use	SPMs
SO_2 (Continuous)	
Sampler Type	Federal Equivalent Method EQSA-0486-060
Operating Schedule	Hourly
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	Instrumental Thermo 43i TLE
Analysis Methods	Pulsed Fluorescence
Data Use	SLAMS (Comparison to the NAAQS), Real-time Data
CO (Continuous)	
Sampler Type	Federal Reference Method RFCA-1093-093
Operating Schedule	Hourly
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	Teledyne API 300EU
Analysis Methods	Gas/Filter/Correlation
Data Use	SLAMS (Comparison to the NAAQS), Real-time Data

10.5.1 SF USD Site PM_{10} Data

The annual average at the SF USD Site for the partial year of 2021 was 23 micrograms per cubic meter (see figure 10-20). A trend line will be added after three completed years of data are recorded. This parameter is meeting the goals of high concentration and population and will be continued.

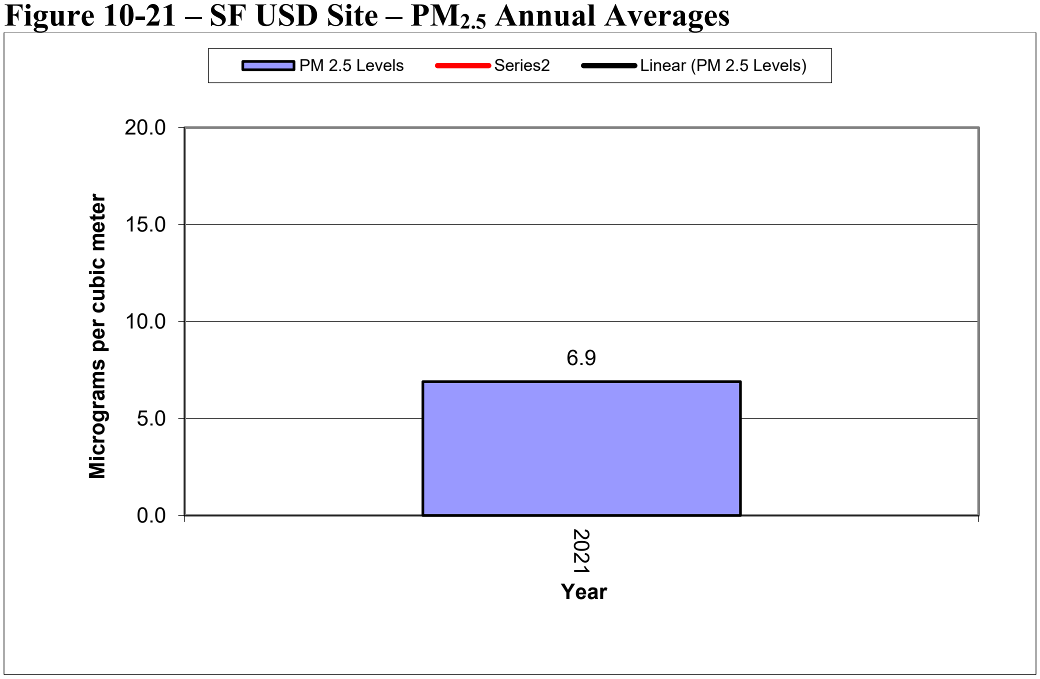
Figure 10-20 – SF USD Site – PM_{10} Annual Averages



10.5.2 SF USD Site – $PM_{2.5}$ Data

The annual average at the SF USD Site for the partial year of 2021 was 6.9 micrograms per cubic meter (see figure 10-21). A trend line will be added after three completed years of data are recorded. This parameter is meeting the goals of high concentration and population and will be continued.

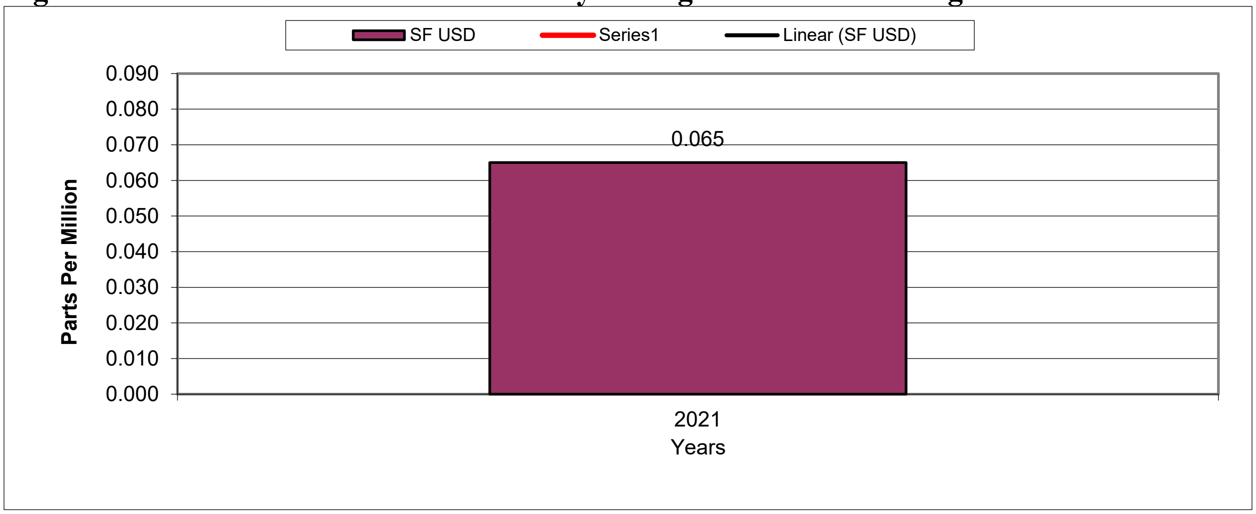
Figure 10-21 – SF USD Site – $PM_{2.5}$ Annual Averages



10.5.3 SF USD Site Ozone Data

The 2021 4th highest 8-hour average ozone concentration recorded at this site was 0.065 parts per million see Figure 10-22). A trend line will be added after three completed years of data are recorded. This parameter is meeting the goals of high concentration and population testing and will be continued at this site.

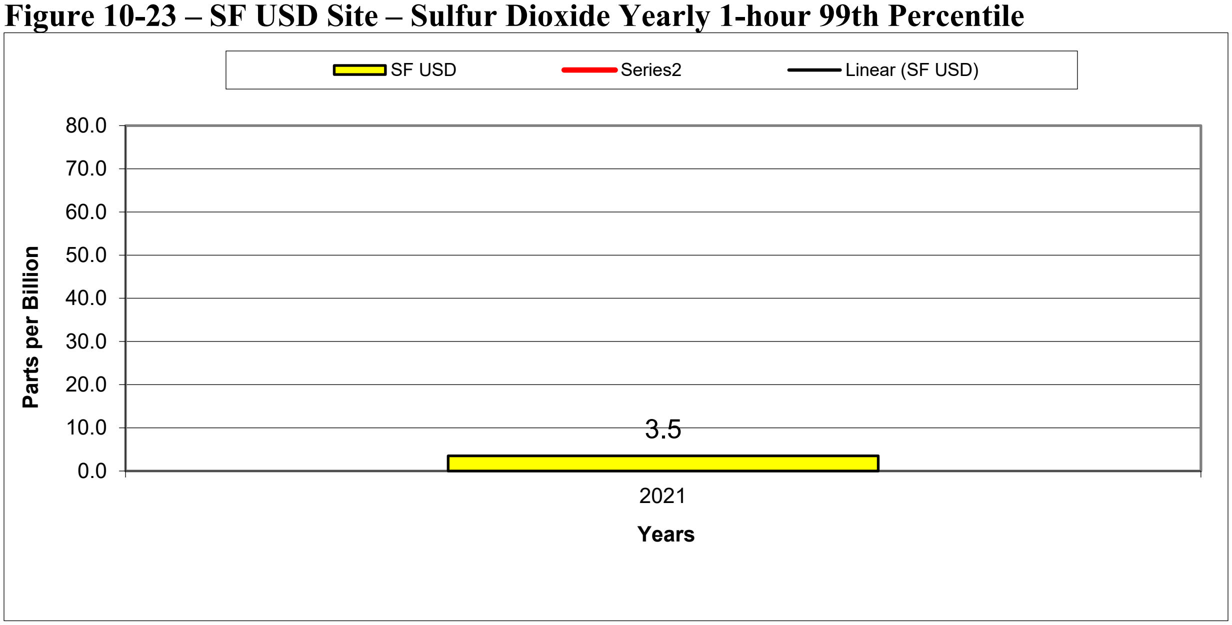
Figure 10-22 – SF USD Site - Ozone Yearly 4th Highest 8-Hour Averages



10.5.4 SF USD Site Sulfur Dioxide Data

The 2021 1-hour 99th percentile reading at this site was 2.3 parts per billion (see Figure 10-23). A trend line will be added after three completed years of data are recorded. This parameter is meeting the goals of high concentration and population testing and will be continued at this site.

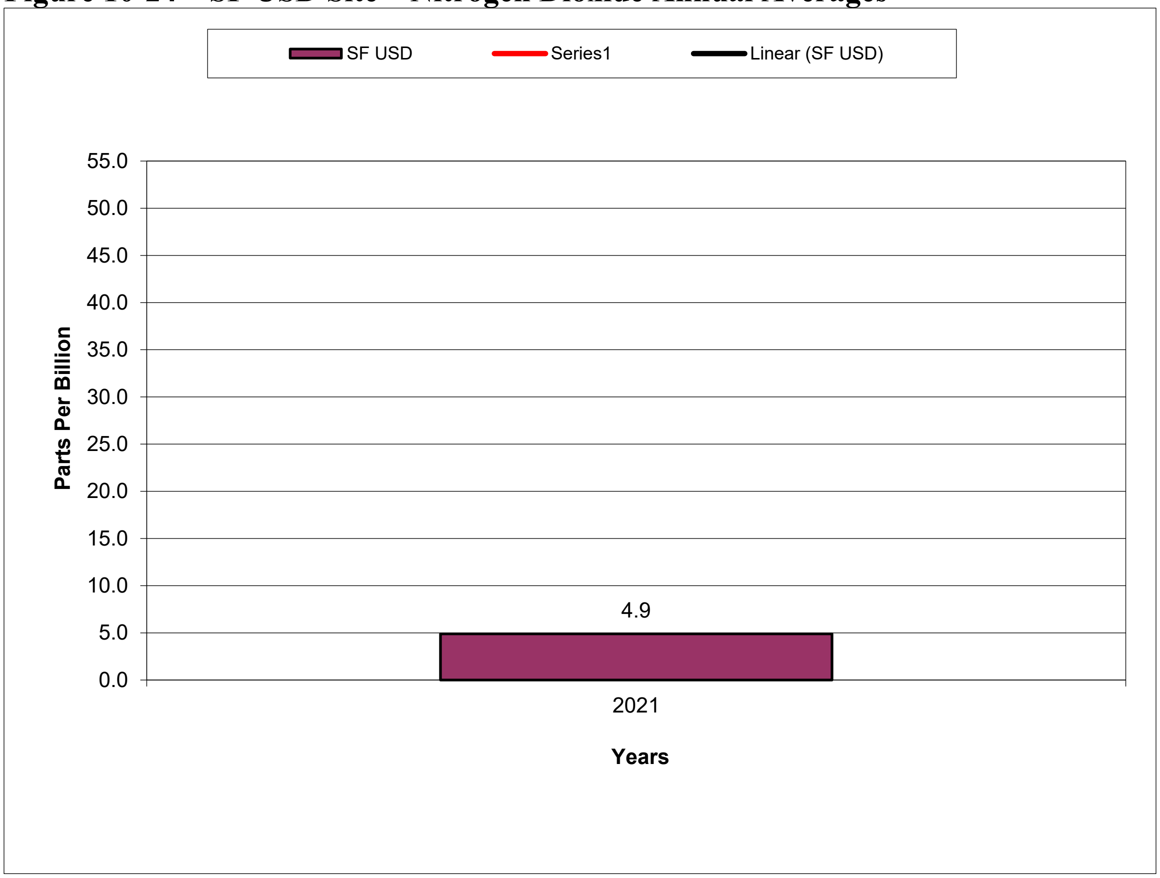
Figure 10-23 – SF USD Site – Sulfur Dioxide Yearly 1-hour 99th Percentile



10.5.5 SF USD Nitrogen Dioxide Data

The 2021 annual average reading at this site was 4.9 parts per billion (see Figure 10-24). A trend line will be added after three completed years of data are recorded. This parameter is meeting the goals of high concentration and population testing and will be continued at this site.

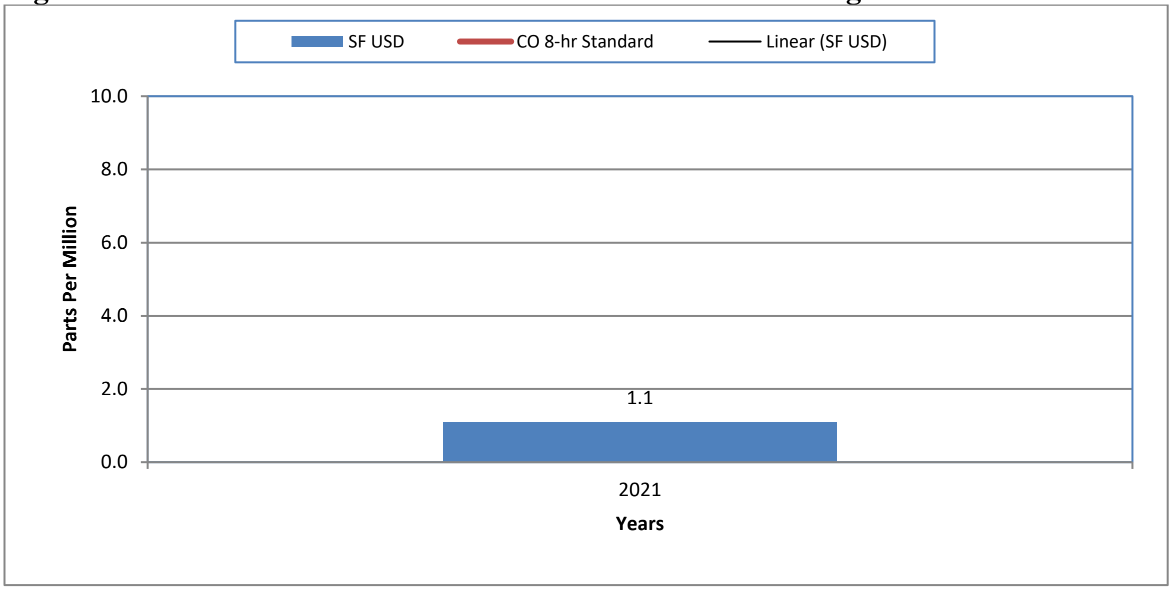
Figure 10-24 – SF USD Site – Nitrogen Dioxide Annual Averages



10.5.6 SD USD Site Carbon Monoxide Data

The department operates just one Carbon Monoxide analyzer and it is located at our National Core site in Sioux Falls. A Carbon Monoxide analyzer was located at Union County #1 for a few years but has since been shut down. The SD School Site began testing for Carbon Monoxide in 2011 and was moved to the SD USD site in early 2021. The Carbon Monoxide analyzer provides hourly concentration levels. The 8-hour average at the site in 2021 was 1.1 parts per million (see figure 10-25). A trend line will be added once three complete years of data have been recorded. This parameter is meeting the goals of high concentration and population and will be continued.

Figure 10-25 – SF USD Site – Carbon Monoxide 8-hour averages



10.6 Aberdeen Bus Stop Site

In 2021, one sampling site was operated in the city of Aberdeen at the Bus Stop Site. The Fire Station #1 Site was established in 2000 as part of the implementation of the $PM_{2.5}$ air monitoring network. The parameters tested at the site included manual PM_{10} and $PM_{2.5}$. In 2020, the Fire Station #1 site was replaced by the Bus Stop site. The new site includes continuous PM_{10} and $PM_{2.5}$. The monitoring site is on the western side of the city. The area around the site has service type businesses and residential area around it. It is a couple blocks North of Highway 12. See Figure 10-26 for a picture of the monitoring site.

Figure 10-26 – Aberdeen's Bus Stop Site

Table 10-6 contains details on the monitoring site specific to the requirements in Title 40 of the Code of Federal Regulations Part 58.

Table 10-6 – Aberdeen Bus Stop Site Specifics

Parameter	Information
Site Name	Aberdeen Bus Stop
AQS ID Number	46-013-0004
Street Address	250 N 4th St, Aberdeen, SD 57401
Geographic Coordinates	Lat/Long: 45°28’06.86” N, 98°29’38.51” W
MSA	None
PM_{10}	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0798-122
Operating Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	Met One BAM 1020
Analysis Methods	Beta Attenuation
Data Use	SLAMS (Comparison to the NAAQS)
$PM_{2.5}$	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0308-170
Operating Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	Met One BAM 1020
Analysis Methods	Beta Attenuation
Data Use	SLAMS (Comparison to the NAAQS)

10.6.1 Aberdeen Bus Stop Site PM_{10} Data

The Aberdeen Bus Stop site was opened in 2020 with a continuous monitor. The old fire station site ran manual monitors. The PM_{10} annual average for the site was 21 micrograms per cubic meter in 2020 and 23 micrograms per cubic meter in 2021. A graph will be added once three years of data is collected.

10.6.2 Aberdeen Bus Stop Site $PM_{2.5}$ Data

The Aberdeen Bus Stop site was opened in 2020 with a continuous monitor. The old fire station site ran manual monitors. The $PM_{2.5}$ annual average for the site was 5.6 micrograms per cubic meter in 2020 and 6.7 micrograms per cubic meter in 2021. A graph will be added once three years of data is collected.

10.7 Brookings Research Farm Site

The Research Farm Site was setup in 2008 and is located at the Soil Conservation Farm northwest of the city of Brookings. An older site located at the City Hall building in the center of Brookings was discontinued at the end of 2014.

The Research Farm Site was set up in cooperation with the 3M Company in Brookings and Valero Renewable Fuels Company near the city of Aurora. The sampling for ozone was a requirement of the Prevention of Significant Deterioration permits for both facilities. The department operated the site and provided data to the facilities. The 3M Company completed their air monitoring report using the data for 2008. Valero Renewable Fuels Company decided not to complete the facility upgrade under its Prevention of Significant Deterioration permit and did not request any data from the Research Farm Site. Ozone data collected between 2008 and 2010 was added as a state and local air monitoring stations site to the National Database in 2010 and the site was continued, adding continuous PM_{10} and $PM_{2.5}$ in 2015.

The initial goals of the monitoring site were the evaluation of impacts to the ozone concentrations from modification at the 3M Company and Valero Renewable Fuels Company. The current goals are to collect ozone data downwind of a small city for comparison to the National Ambient Air Quality Standards and determine particulate matter data for a rural area in eastern South Dakota. Figure 10-27 shows a current picture of the monitoring site.

Figure 10-27 –Research Farm Site

Table 10-7 contains details on the monitoring site specific to the requirements in Title 40 of the Code of Federal Regulations Part 58.

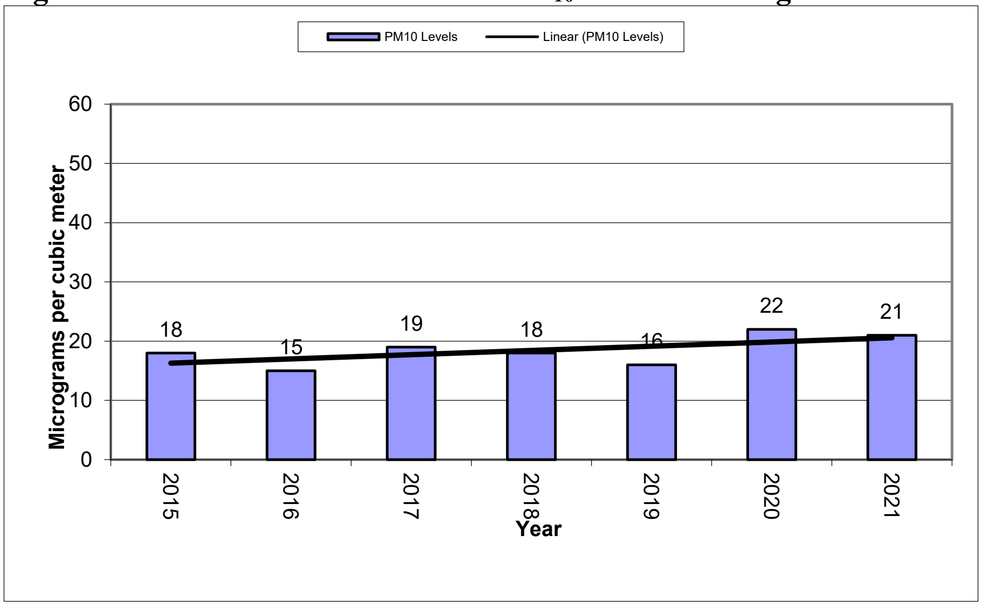
Table 10-7 –Research Farm Site Specifics

Parameter	Information
Site Name	Brookings Research Farm
AQS ID Number	46-011-0003
Street Address	3714 Western Ave.
Geographic Coordinates	UTM Zone 14, NAD 83, E 674766.316 N 4912930.911
MSA	None
Ozone	**(Continuous)**
Sampler Type	Federal Equivalent Method EQOA-0880-047
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	High Concentration, Population, and Background
Sampling Method	Thermo 49i
Analysis Methods	Ultraviolet
Data Use	SLAMS (Comparison to the NAAQS)
PM_{10}	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0798-122
Operating Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	Met One BAM-1020
Analysis Methods	Beta Attenuation
Data Use	SLAMS (Comparison to the NAAQS) Real-Time Data
$PM_{2.5}$	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0308-170
Operating Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration
Sampling Method	Met One BAM-1020
Analysis Methods	Beta Attenuation
Data Use	SLAMS (Comparison to the NAAQS) Real-Time Data

10.7.1 Research Farm Site PM_{10} Data

PM_{10} sampling began at this site in 2015. The annual average for this site ranged from 15 micrograms per cubic meter in 2016 to 22 micrograms per cubic meter in 2020. Testing for this parameter is meeting the goals of high concentration and population. Figure 10-28 contains a graph of the annual averages since the site was setup.

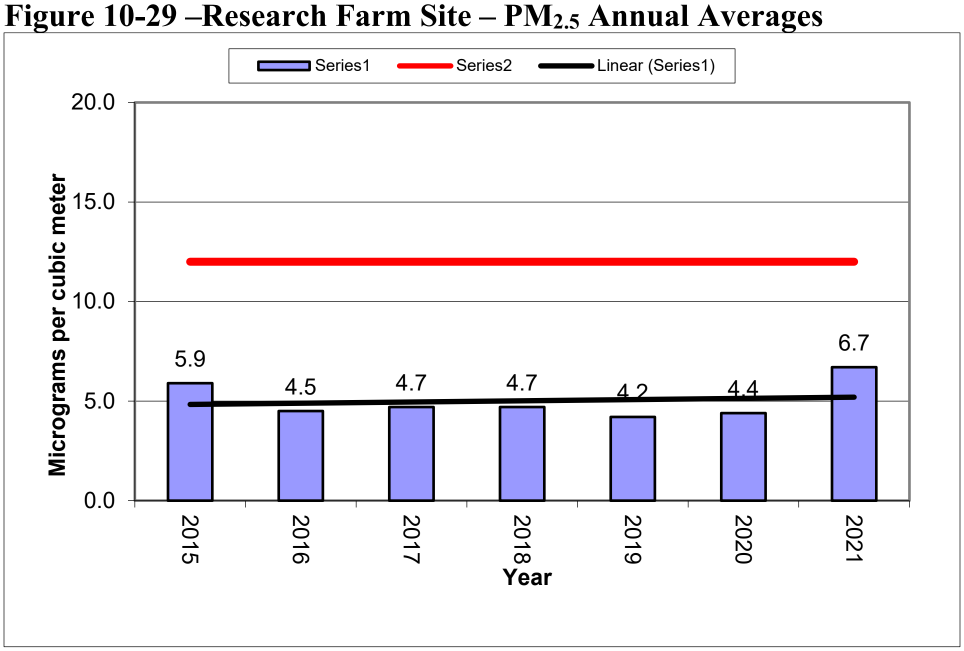
Figure 10-28 –Research Farm Site – PM_{10} Annual Averages



10.7.2 Research Farm Site $PM_{2.5}$ Data

$PM_{2.5}$ sampling began at this site in 2015. The annual average for this site ranged from 6.7 micrograms per cubic meter in 2021 to 4.2 micrograms per cubic meter in 2019. Annual averages are well under the standard. Figure 10-29 contains a graph of the annual averages since the site was setup.

Figure 10-29 –Research Farm Site – $PM_{2.5}$ Annual Averages

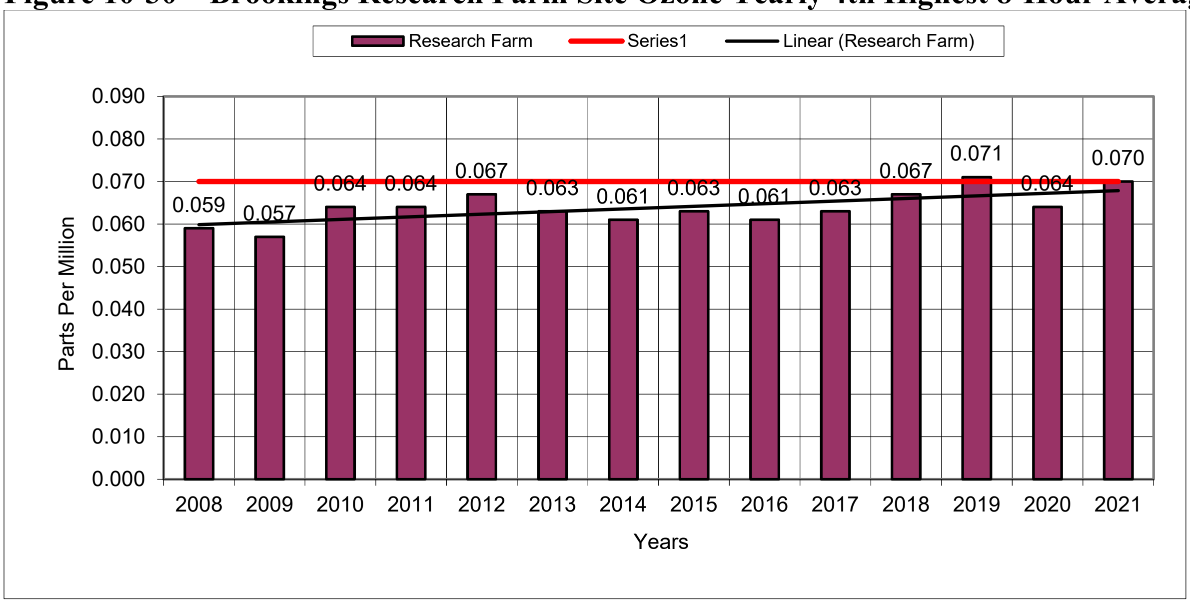


10.7.3 Research Farm Site Ozone Data

The 2021 sampling year is the 14th ozone season of testing. The highest fourth highest 8-hour average for this site was at 0.071 parts per million in 2019. The SD School Site was the highest ozone concentration site in the state since 2010. In 2019, the Brookings Research Farm had the highest readings. There was a noticeable increase in concentration and in the number of high concentrations. EPA concurred these readings were out of the ordinary. The department received a new ozone analyzer and put it at the Brookings site to do a side by side comparison toward the end of October. The two analyzers tracked very well, but the new analyzer read 6-7 ppb lower. On October 30, the new analyzer was put into service and the Brooking's readings are more comparable to the other eastern sites. In 2020, an additional ozone analyzer was added in Watertown. This will expand our network along the entire eastern part of the state giving a better view of regional transport and another site to compare to the Brookings' readings.
The ozone data trend indicates an increasing level.

The testing for this parameter is meeting the goals of high concentration and population and will be continued. The graph in Figure 10-30 shows the yearly 4th highest ozone concentration levels for the last 14 years.

Figure 10-30 – Brookings Research Farm Site Ozone Yearly 4th Highest 8-Hour Averages



10.8 Watertown Site

In 2020, one sampling site was operated in the city of Watertown. Watertown is the fifth largest city in South Dakota. The city has an increasing growth rate and industrial base. The industrial base is a mixture of service-oriented business and light industry. One other air monitoring site was operated in Watertown starting in 1974 and closed 1987. Figure 10-31 shows a picture of the monitoring site.

Figure 10-31 – Watertown Site

The current Watertown Site was established in 2003 as part of the implementation of the $PM_{2.5}$ network. In 2012, the manual $PM_{2.5}$ monitors were replaced with a continuous monitor. Testing at the site includes the parameters of PM_{10} and $PM_{2.5}$ at a sampling frequency of every day. The monitoring site is in the western third of the city just east of an industrial park area. The site is located on City property in a monitoring shelter. The area around the site has service type businesses and light industry to the west and south. Residential areas are located to the north and east of the site. There have been no significant changes noted in buildings or trees around the site during this review. Table 10-8 contains details on the monitoring site specific to the requirements in Title 40 of the Code of Federal Regulations Part 58. An ozone analyzer was added to the site in 2020.

Table 10-8 – Watertown Site Specifics

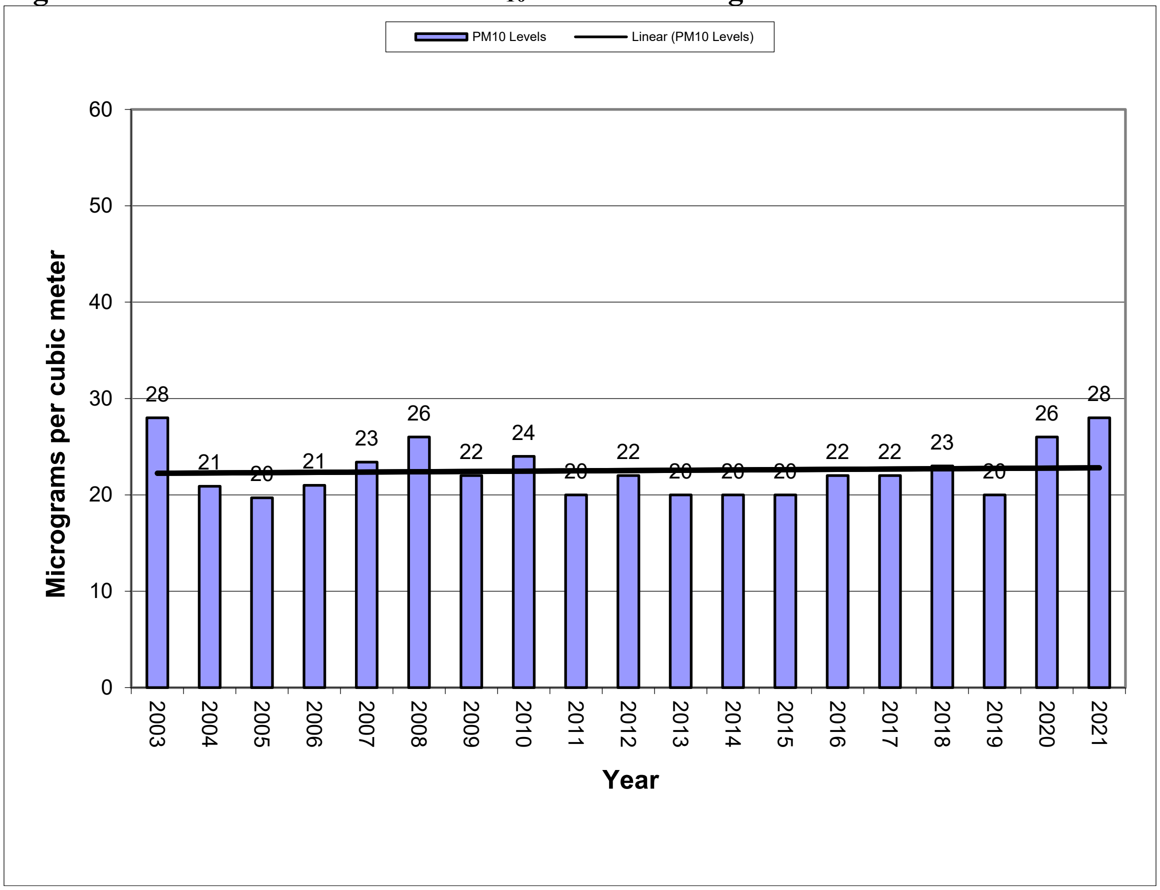
Parameter	Information
Site Name	Watertown
AQS ID Number	46-029-0002
Street Address	801 4th Ave. SW, Watertown, SD
Geographic Coordinates	UTM Zone 14, NAD 83, E 647,740.74 N 4,973,300.25
MSA	None
PM_{10}	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0798-122
Operating Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	Met One BAM-1020 Continuous
Analysis Methods	Beta Attenuation
Data Use	SLAMS (Comparison to the NAAQS) Real-Time Data

Parameter	Information
$PM_{2.5}$	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0308-170
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Met One BAM-1020 w/$PM_{2.5}$ VSCC
Analysis Method	Beta Attenuation
Data Use	SLAMS (Comparison to the NAAQS) Real-time Data
Ozone	**(Continuous)**
Sampler Type	Federal Equivalent Method EQOA-0880-047
Operating Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	High Concentration, Population, and Background
Sampling Method	Thermo 49i
Analysis Methods	Ultraviolet
Data Use	SLAMS (Comparison to the NAAQS)

10.8.1 Watertown Site PM_{10} Data

The PM_{10} monitor operated on an every third day sampling schedule until 2006 when a continuous PM_{10} monitor replaced the manual monitors and an everyday sampling schedule began. The highest recorded annual average for PM_{10} concentrations was 28 micrograms per cubic meter recorded in 2003 and 2021. The lowest annual average concentration of 20 micrograms per cubic meter was recorded in 2005, 2011, 2013, 2014, 2015, and 2019. The annual average indicates concentration levels are steady during the 19 years of testing. The PM_{10} concentration can get close to and has exceeded the 24-hour standard. Testing for this parameter is meeting the goals of high concentration and population and will be continued. Figure 10-32 contains a graph of the annual averages.

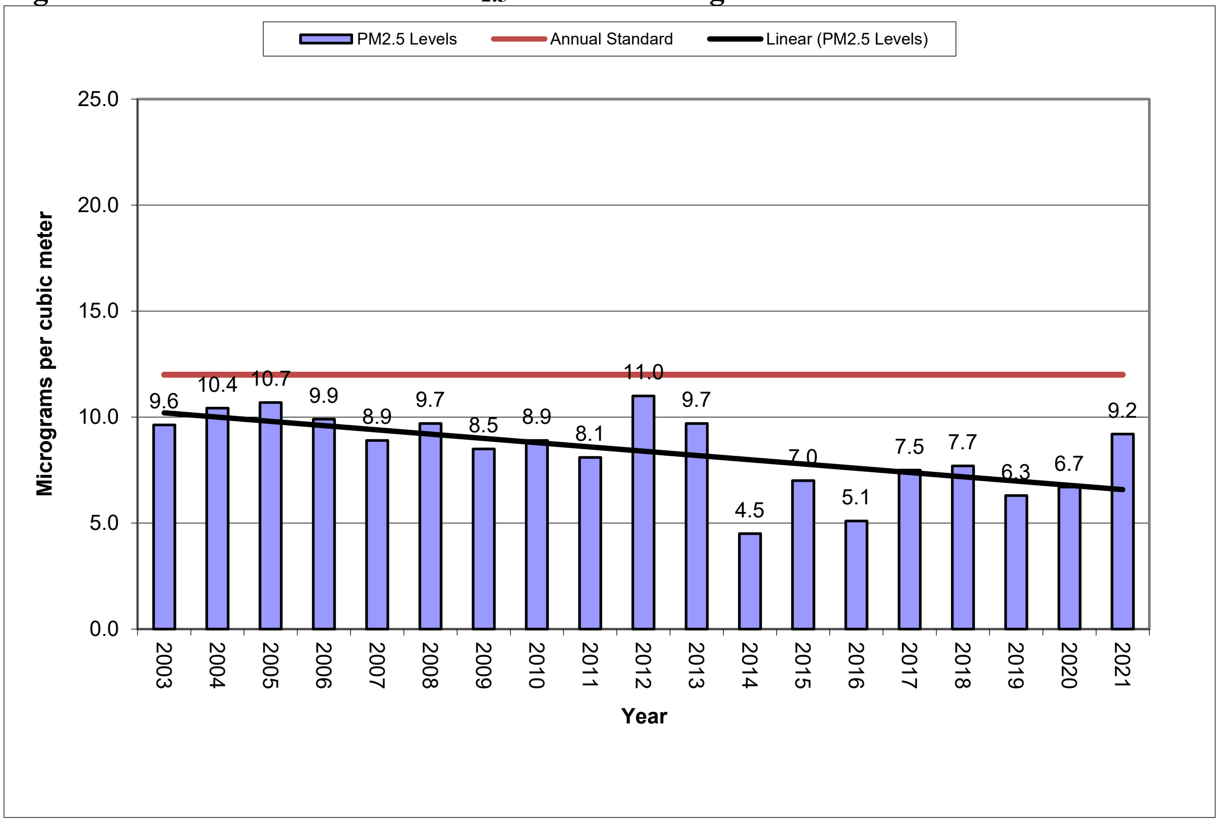
Figure 10-32 – Watertown Site – PM_{10} Annual Averages



10.8.2 Watertown Site $PM_{2.5}$ Data

The $PM_{2.5}$ monitors were run on an every third day schedule since the $PM_{2.5}$ monitors were setup in 2003. Beginning in 2012, a continuous monitor was installed, and the site reported hourly concentrations on an everyday schedule. Annual averages for the Watertown Site range from a high of 11.0 micrograms per cubic meter in 2012 to a low of 4.5 micrograms per cubic meter in 2014. The annual average shows a decrease in $PM_{2.5}$ concentration levels over the 19 years of testing. Testing for this parameter is meeting the goals of high concentration and population and will be continued. Figure 10-33 contains a graph showing the annual average concentration for each year of operation.

Figure 10-33 – Watertown Site $PM_{2.5}$ Annual Averages



10.8.3 <u>Watertown Site Ozone Data</u>

In 2020, an additional ozone analyzer was added in Watertown. This will expand our network along the entire eastern part of the state giving a better view of regional transport and another site to compare to the Brookings' readings. The fourth highest 8-hour average for this site was at 0.057 parts per million in 2020 and 0.066 parts per million in 2021. A graph will be added once three years of data is collected.

10.9 UC #1 Site – Union County

At the beginning of 2009, three new monitoring sites were set up in Union County. No ambient air quality testing had ever been completed in this county. All three sites were located north of Elk Point. The sampling goals for the new sites were to determine air pollution levels near the location of the proposed Hyperion Energy Center prior to construction, during construction, and post construction. The proposed project's Prevention of Significant Deterioration air quality permit has expired, no new application was submitted by the company and purchase easements on the property in Union County have all expired. By the end of 2013, the sites had collected five years of data so there is an adequate amount of data for use to show background levels and the difference in sampling locations for future use.

With no current project pending there was only need for one site to continue to show current levels in rural Union County. In 2012, the UC #3 Site was closed with the ozone parameter moved to the UC #1 Site. At the end of 2013, the UC #2 Site was closed because it was a duplicate site to the UC #1 Site. At the end of 2013, the Carbon Monoxide testing at UC #1 Site was discontinued because recorded concentrations were very low and there was no indication concentrations would ever get close to the standard level.

The UC #1 Site was located about 4 1/2 miles north of Elk Point. Sampling began just before January 1, 2009. The goals for the site were background and for comparison to the National Ambient Air Quality Standards. The landowner did not want to continue the contract at the site and the site was closed after the third quarter of 2021. There currently are discussion with Iowa and Nebraska to see if the monitoring for the Sioux City MSA could be done in one of those states. Figure 10-34 provides a picture of the monitoring site looking to the North. Table 10-10 contains details on the monitoring site specific to the requirements in Title 40 of the Code of Federal Regulations Part 58.

Figure 10-34 – UC #1 Site

Table 10-9 – UC #1 Site Specifics

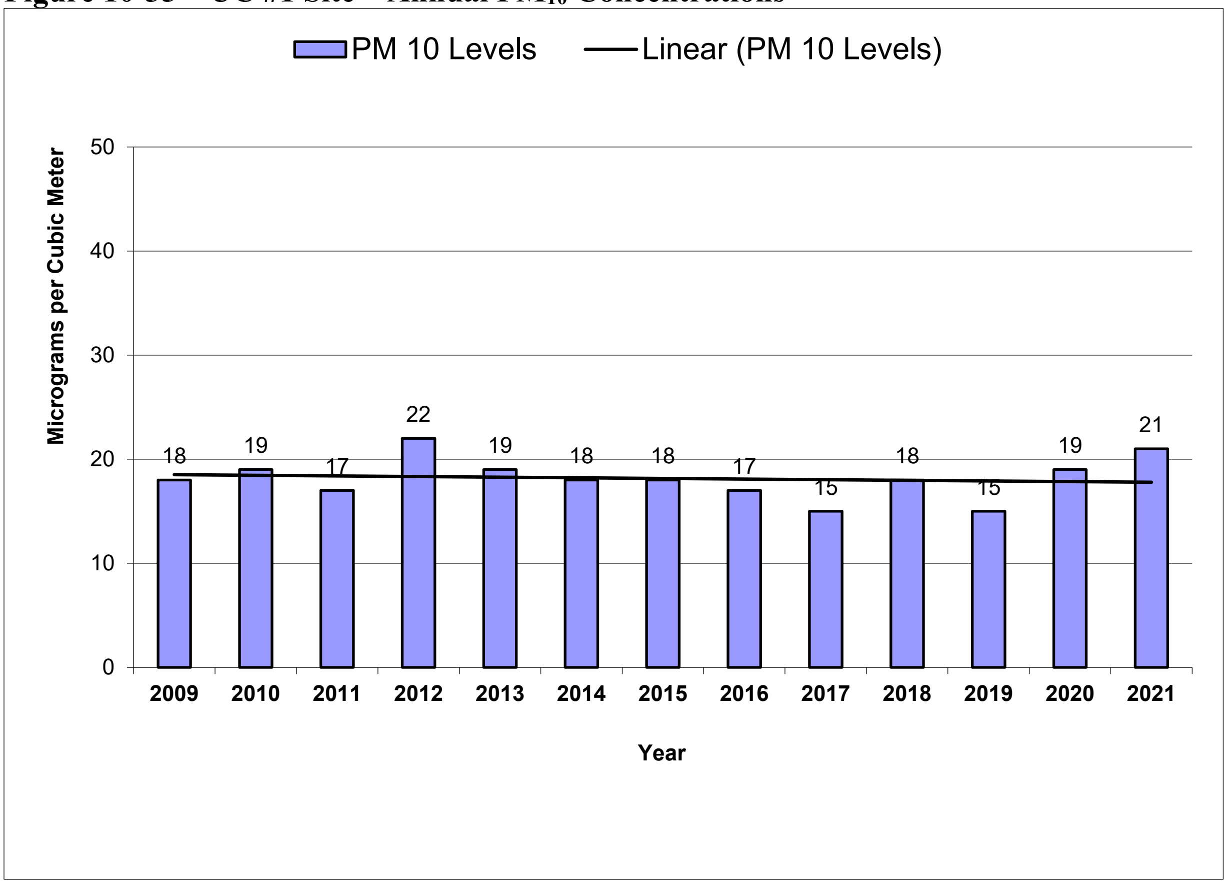
Parameter	Information
Site Name	UC #1
AQS ID Number	46-127-0001
Street Address	31988 457th Ave.
Geographic Coordinates	Lat. + 42.751518 Long. – 96.707208
MSA	Sioux City, IA-NE-SD
PM_{10}	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0798-122
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Met One BAM-1020
Analysis Method	Beta Attenuation
Data Use	Real-time Data and SLAMS (Comparison to the NAAQS)
$PM_{2.5}$	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0308-170
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Met One BAM-1020 w/$PM_{2.5}$ VSCC
Analysis Method	Beta Attenuation
Data Use	Real-time Data and SLAMS (Comparison to the NAAQS)
SO_2	**(Continuous)**
Sampler Type	Federal Equivalent Method EQSA-0486-060
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Instrumental 43i Trace Level Thermo
Analysis Methods	Pulsed Fluorescent
Data Use	Real-time Data and SLAMS (Comparison to the NAAQS)
NO_2	**(Continuous)**
Sampler Type	Federal Reference Method RFNA-1194-099
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Teledyne API T200
Analysis Method	Chemiluminescence
Data Use	Real-time Data and SLAMS (Comparison to the NAAQS)
Ozone	**(Continuous)**
Sampler Type	Federal Equivalent Method EQOA-0880-047
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Thermo 49i

Parameter	Information
Analysis Method	Ultraviolet
Data Use	Real-time Data and SLAMS (Comparison to the NAAQS)

10.9.1 UC #1 Site PM_{10} Data

The annual average PM_{10} concentrations at this site range from 15 micrograms per cubic meter in 2017 and 2019 to 22 micrograms per cubic meter in 2012. Trends indicate concentrations show a slight decrease for UC #1 Site. Testing for this parameter has met the goal and has been discontinued. See the annual averages for the UC #1 Site in Figure 10-35.

Figure 10-35 – UC #1 Site – Annual PM_{10} Concentrations

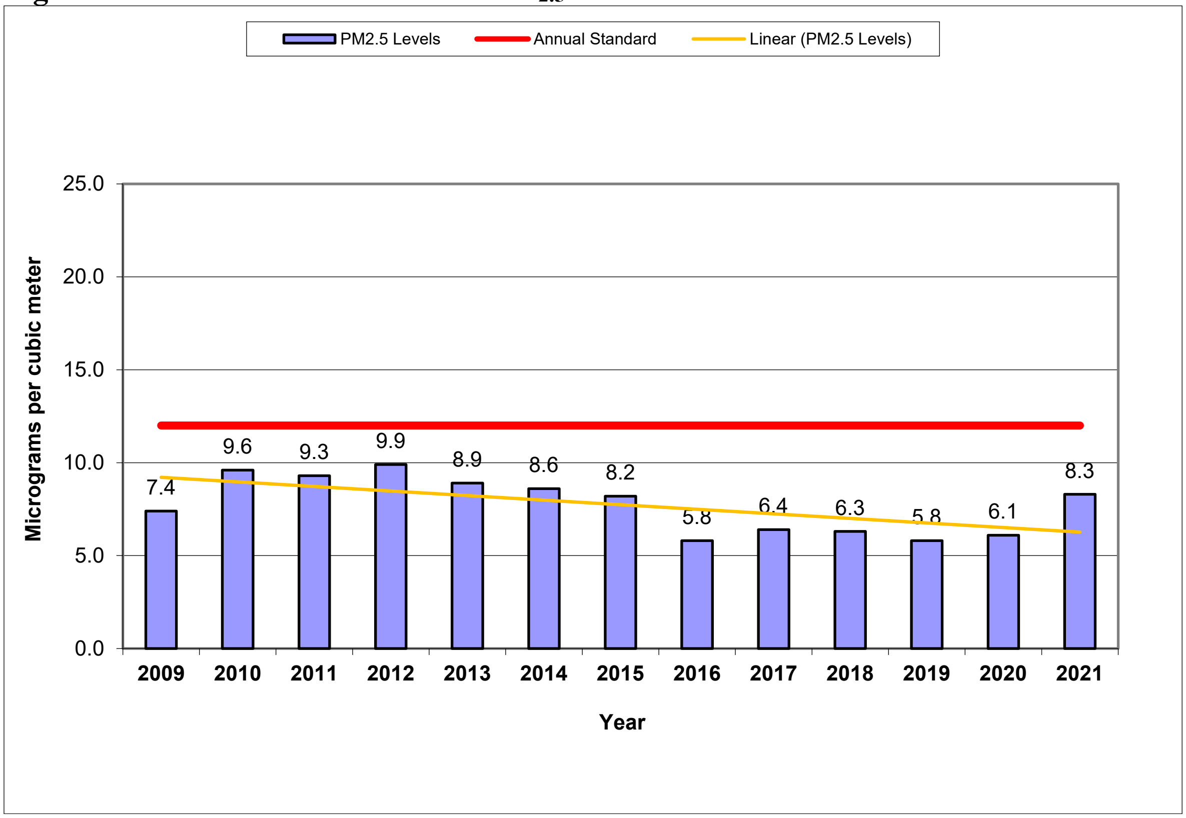


*The site was closed after October of 2021.

10.9.2 UC #1 Site $PM_{2.5}$ Data

The annual average $PM2_{2.5}$ concentrations at this site range from 9.9 micrograms per cubic meter in 2012 to 5.8 micrograms per cubic meter in 2016. Trends indicate concentrations show a decrease for UC #1 Site. Testing for this parameter has met the goal and has been discontinued. See the annual averages for the UC #1 Site in Figure 10-36.

Figure 10-36 –UC #1 Site – Annual $PM_{2.5}$ Concentrations

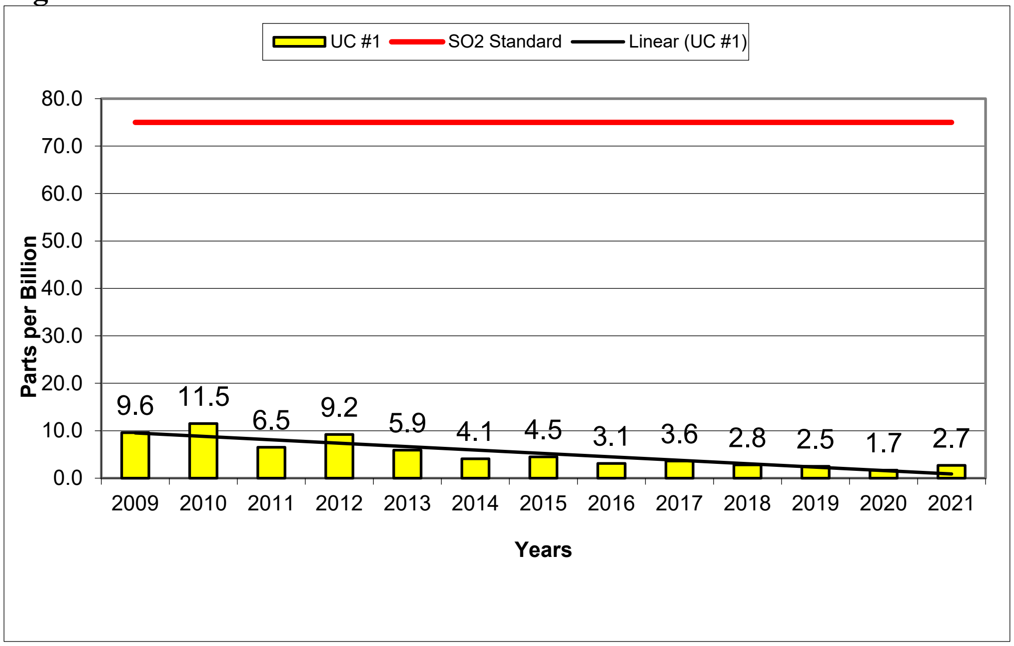


*The site was closed after October of 2021.

10.9.3 UC #1 Site Sulfur Dioxide Data

Concentrations of Sulfur Dioxide follow the same trend as other sites in the state with many hourly average concentrations low near the detection level (0.1 parts per billion) for the analyzer method being used to collect the data. A trace level Sulfur Dioxide analyzer has operated at this site beginning in 2009. Trends indicate Sulfur Dioxide levels are dropping at this site. Testing for this parameter has met the goals and will be discontinued. See Figure 10-37 for a graph showing the 1-hour 99th percentile for this site.

Figure 10-37 –UC #1 Sulfur Dioxide 1-hour Concentrations

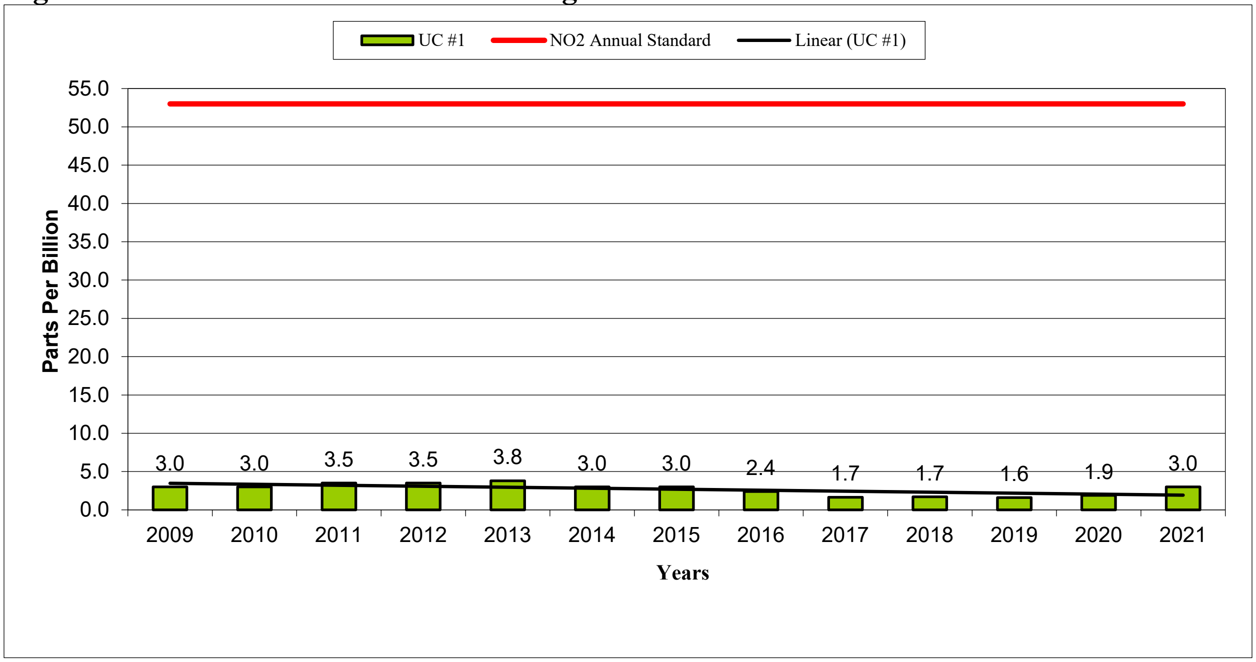


*The site was closed after October of 2021.

10.9.4 UC #1 Site – Nitrogen Dioxide Data

Concentrations of Nitrogen Dioxide follow the same trends as other rural areas in the state like the Badlands and Wind Cave sites. Annual average concentrations are very low near the detection level for the analyzer method being used to collect the data. Just as the Sulfur Dioxide parameter, the Nitrogen Dioxide parameter differences are noted from year to year when comparing a 1-hour average but the annual averages are very close in concentration. Trends indicate a slightly decreasing concentration level for UC #1 over the twelve years of testing. Testing for this parameter is meeting the goals and will be continued. Figure 10-38 shows a graph of the annual average concentrations for this site.

Figure 10-38 –UC #1 Site – Annual Nitrogen Dioxide Concentrations

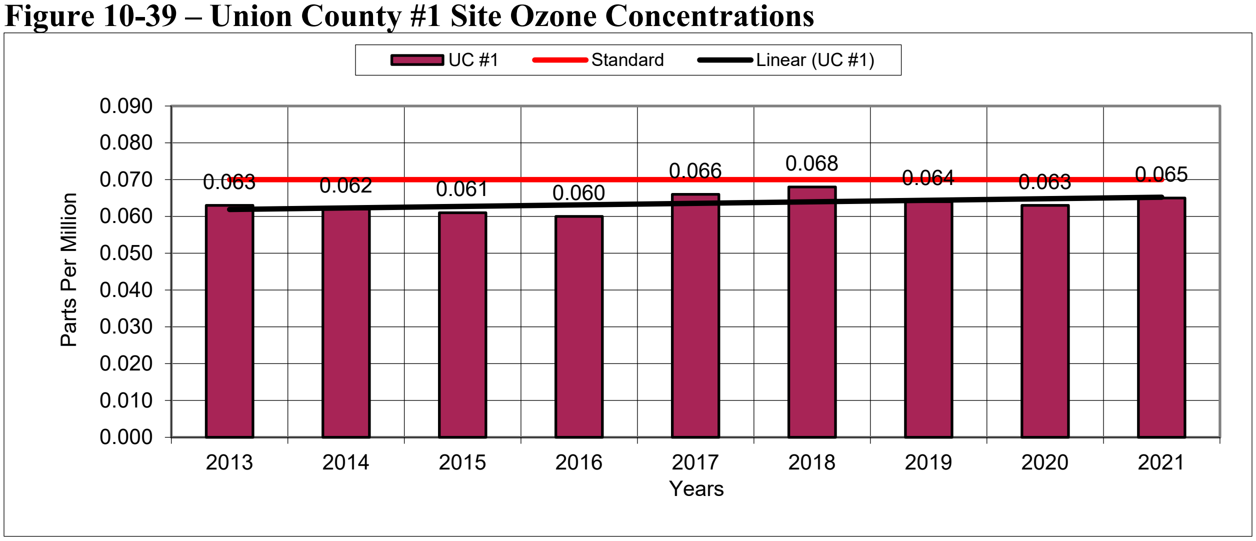


*The site was closed after October of 2021.

10.9.5 UC #1 Site Ozone Data

The ozone 8-hour average for the UC #1 Site recorded a concentration that was the same as that recorded at the Sioux Falls site in 2021. 2021 had an 8-hour average for this site of 0.063 parts per million. See Figure 10-39 for a graph of the ozone concentrations at the UC #1 Site. The trend is slightly increasing in concentration levels. Testing for this parameter has met the goals and will be discontinued.

Figure 10-39 – Union County #1 Site Ozone Concentrations



*The site was closed after October of 2021.

10.10 Pierre Airport Site

Pierre is the capital city of South Dakota. It is in the center of the state along the rough river bluffs overlooking the Missouri River. It is the 8th largest city in the state. Pierre has a relatively dry, four-season climate with long, dry, cold winters, hot summers and brief spring and autumn transitions.

At the beginning of 2015, a new monitoring site was set up in Pierre. The site is located at the Pierre Regional Airport Industrial Park in northeast Pierre. The sampling goal for the new site was to test a new area of the state with no past $PM_{2.5}$ monitoring. Figure 10-40 provides a picture of the monitoring site looking to the North. Table 10-10 contains details on the monitoring site specific to the requirements in Title 40 of the Code of Federal Regulations Part 58.

Figure 10-40 – Pierre Airport Site

Table 10-10 – Pierre Airport Site Specifics

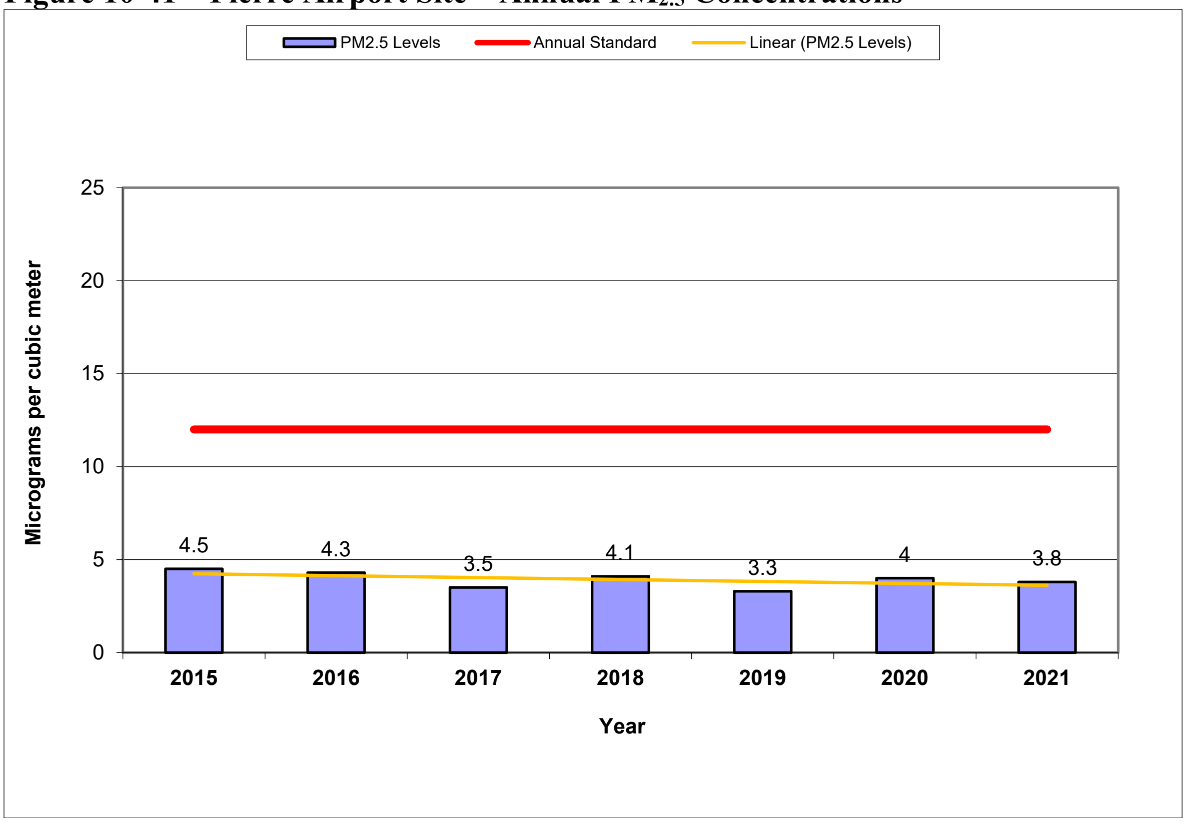
Parameter	Information
Site Name	Pierre Airport
AQS ID Number	46-065-0003
Street Address	4293 Airport Road
Geographic Coordinates	Lat. + 44.373786 Long. – 100.287269
MSA	None

Parameter	Information
$PM_{2.5}$	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0308-170
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Met One BAM-1020 w/$PM_{2.5}$ VSCC
Analysis Method	Beta Attenuation
Data Use	Real-time Data and SLAMS (Comparison to the NAAQS)

10.10.1 Pierre Airport Site – $PM_{2.5}$ Data

2021 was the 7th year of monitoring at the Pierre Airport Site. The annual PM2.5 concentration at the site ranged from 4.5 micrograms per cubic meter in 2015 to 3.3 micrograms per cubic meter in 2019. The Pierre Airport Site shows relatively low concentrations, like those at the two National Parks sites. See Figure 10-41 to view a graph of the annual averages. Testing for this parameter is meeting the goals and will be continued.

Figure 10-41 – Pierre Airport Site – Annual $PM_{2.5}$ Concentrations



11.0 SPECIAL AIR QUALITY MONITORING

11.1 PM2.5 Speciation Network

The $PM_{2.5}$ Speciation Network quantifies mass concentrations and significant $PM_{2.5}$ constituents which include trace elements, sulfate, nitrate, sodium, potassium, ammonium, and carbon. This series of analytes is very similar to those measured within the Interagency Monitoring of Protected Visual Environments program.

Physical and chemical speciation data are anticipated to provide valuable information for:

1. Assessing trends in mass component concentrations and related emissions, including specific source categories;
2. Characterizing annual and seasonal spatial variation of aerosols;
3. Determining the effectiveness of implementation control strategies;
4. Helping to implement the $PM_{2.5}$ standard by using speciated data as input to air quality modeling analyses;
5. Aiding the interpretation of health studies by linking effects to $PM_{2.5}$ constituents; and
6. Understanding the effects of atmospheric constituents on visibility impairment and regional haze.

South Dakota has one site that collects samples as part of the $PM_{2.5}$ Speciation Network. This site is located at the SF USD Site and collects 24-hour air samples on a 3-day schedule. The $PM_{2.5}$ speciation monitor was moved from the KELO site to the SD School Site at the beginning of 2009. It was moved again in early 2021 to the new SD USD site. The SF USD Site is located on the northwest part of the city. The site is just west of I-29. The predominant wind direction is northwest for most of the year with southeast winds during the summer months. Carbon samples were originally taken by the Met One SASS monitor. In September 2009, the Interagency Monitoring of Protected Visual Environments URG 3000N sampler was set up to do the carbon sampling. In November 2016, EPA Region 8 gave the department a Met One Super SASS monitor to replace the existing monitor. The speciation monitoring was moved to the new SF USD site in 2021.

At the beginning of 2016, a new lab was contracted to analyze and enter the data into EPA's Air Quality System. There is a lag in data entry and all the 2021 data has not yet been entered at the time this annual report was written. Graphs will be added back into the report once three complete years of data have been collected.

12.0 CONCLUSIONS

All areas in the state are in attainment of the federal National Ambient Air Quality Standards. All sites meet the requirements of Title 40 of the Code of Federal Regulation, Part 58, Appendix A, C, D, and E.

The ambient air quality monitoring network is continually reviewed to ensure that there is adequate coverage of populated areas in the state as well as rural areas. As the state's population and industry changes, monitoring sites will be added or moved to new locations.

Major modifications to the sampling network include:

1. In 2021, the Sioux Falls SD School site was closed and all monitors were moved to the new SF USD site; and
2. The landowner at the Union County site did not want to continue the contract. The site was closed in October of 2021. Discussions are taking place with Iowa and Nebraska to see if they will conduct the required sampling for the Sioux City MSA.

Equipment Purchase Priorities include the following items:

1. Continue to replace ESC 8816 and 8832 data loggers;
2. Continue to replace equipment as needed to maintain the National Core site; and
3. Purchase new equipment as required to meet EPA requirements.

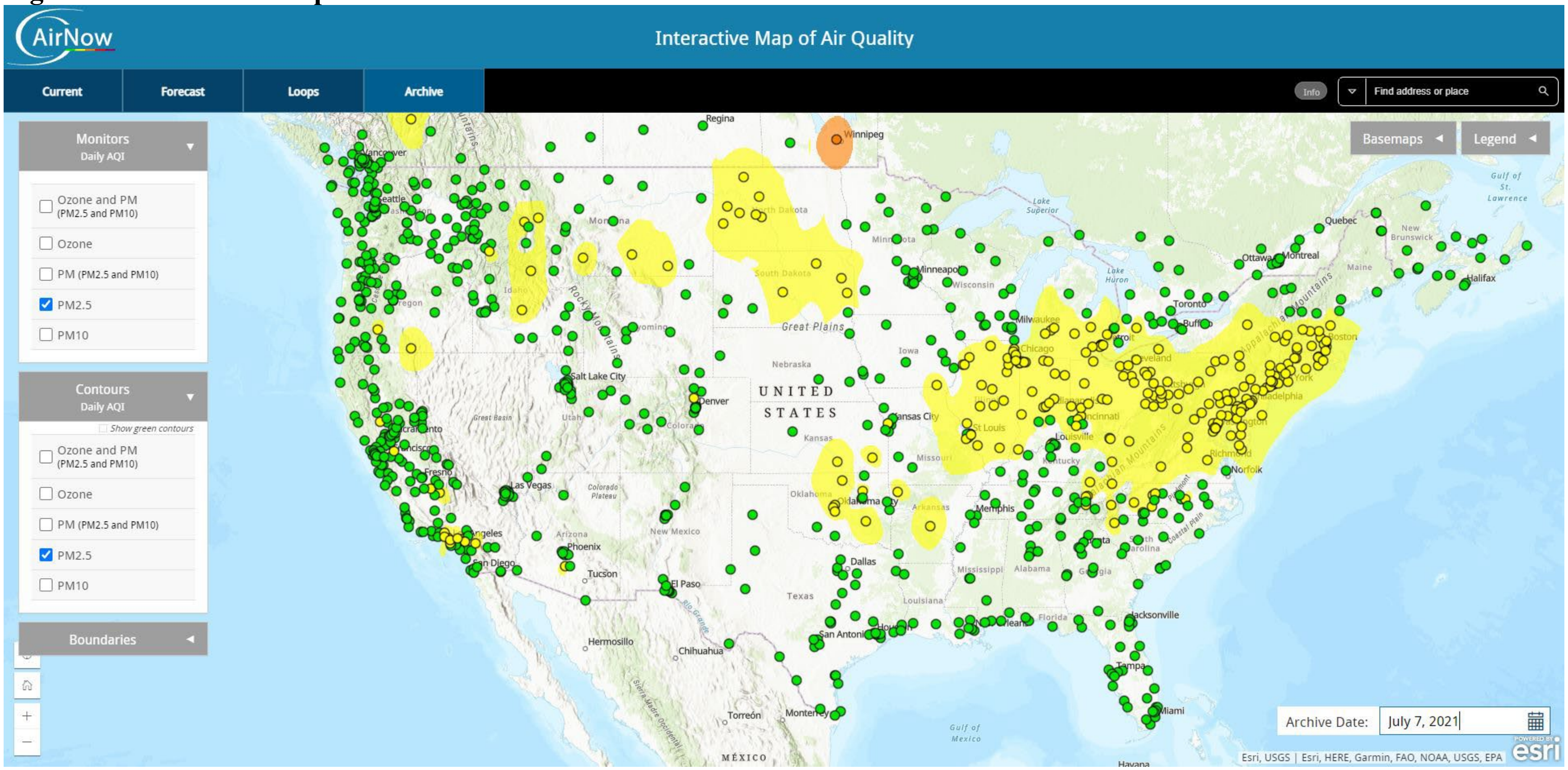
There is an ongoing effort to maintain staff training regarding the latest monitoring techniques and procedures to perform these studies. It is anticipated that the ambient air monitoring network will operate in much the same manner as it has in the past. This will include the identification of pollution problems, measurement and evaluation of the extent of the problem, and determination of action to be taken to protect the environment and the health of the people of South Dakota.

13.0 REFERENCES

1. Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Monitoring Program, EPA-54/B-17-001, January 2017, located at https://www3.epa.gov/ttn/amtic/files/ambient/pm25/qa/Final%20Handbook%20Document%201_17.pdf;
2. Title 40, Code of Federal Regulation, Part 50, located at https://www.ecfr.gov/cgi-bin/text-idx?SID=52f340d421aa94fe820d7ba0d1eb1e28&mc=true&node=pt40.2.50&rgn=div5;
3. Title 40, Code of Federal Regulation, Part 58, located at https://www.ecfr.gov/cgi-bin/text-idx?SID=eb02812221844f2f21472cc2dd32fc0e&mc=true&node=pt40.6.58&rgn=div5; and
4. SLAMS/NAMS/PAMS Network Review Guidance, EPA-454/R-98-003, March 1998, located at https://www3.epa.gov/ttn/amtic/files/ambient/criteria/netrev98.pdf.

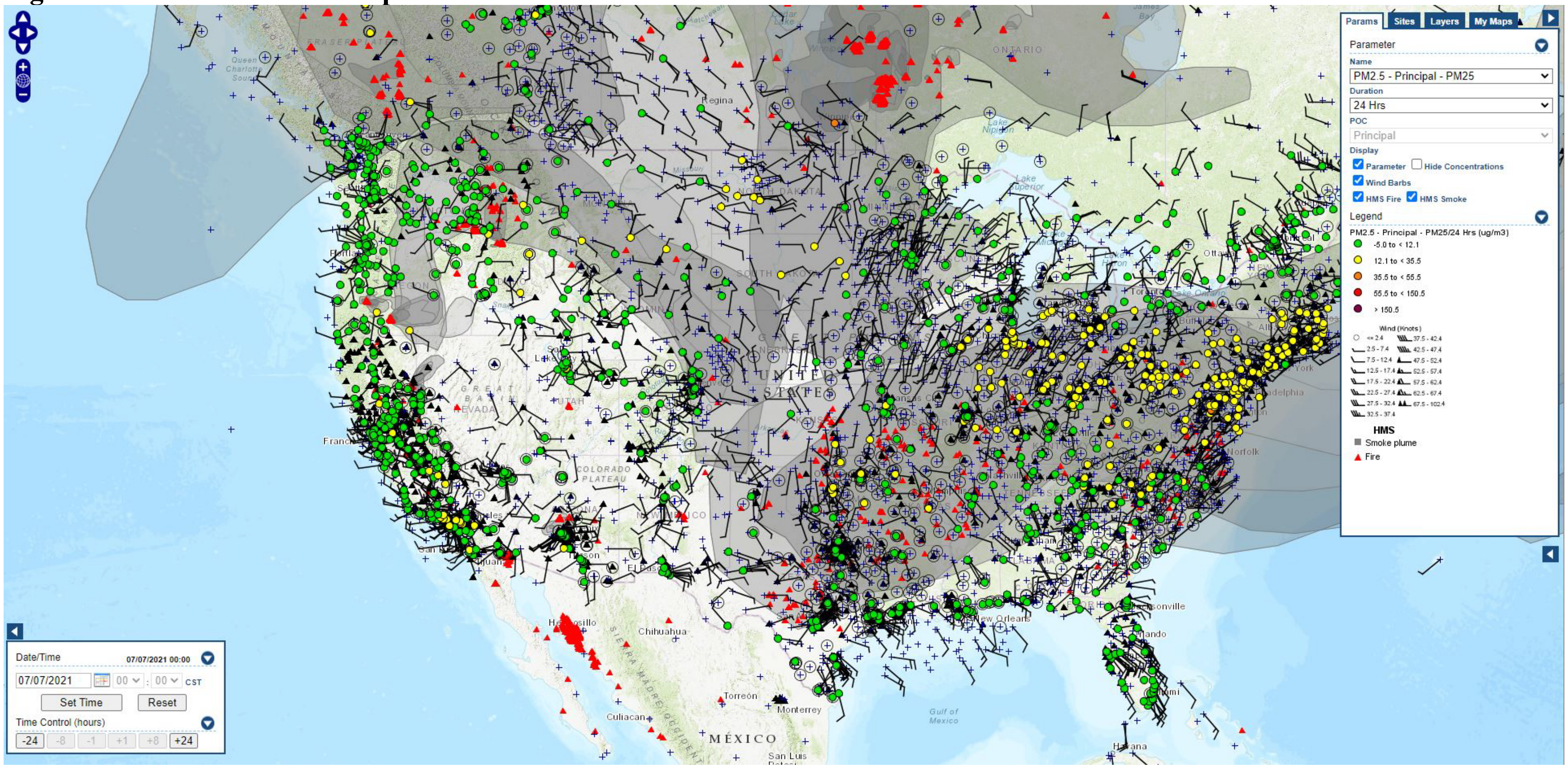
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-1 – AirNow Map for 7/7/21



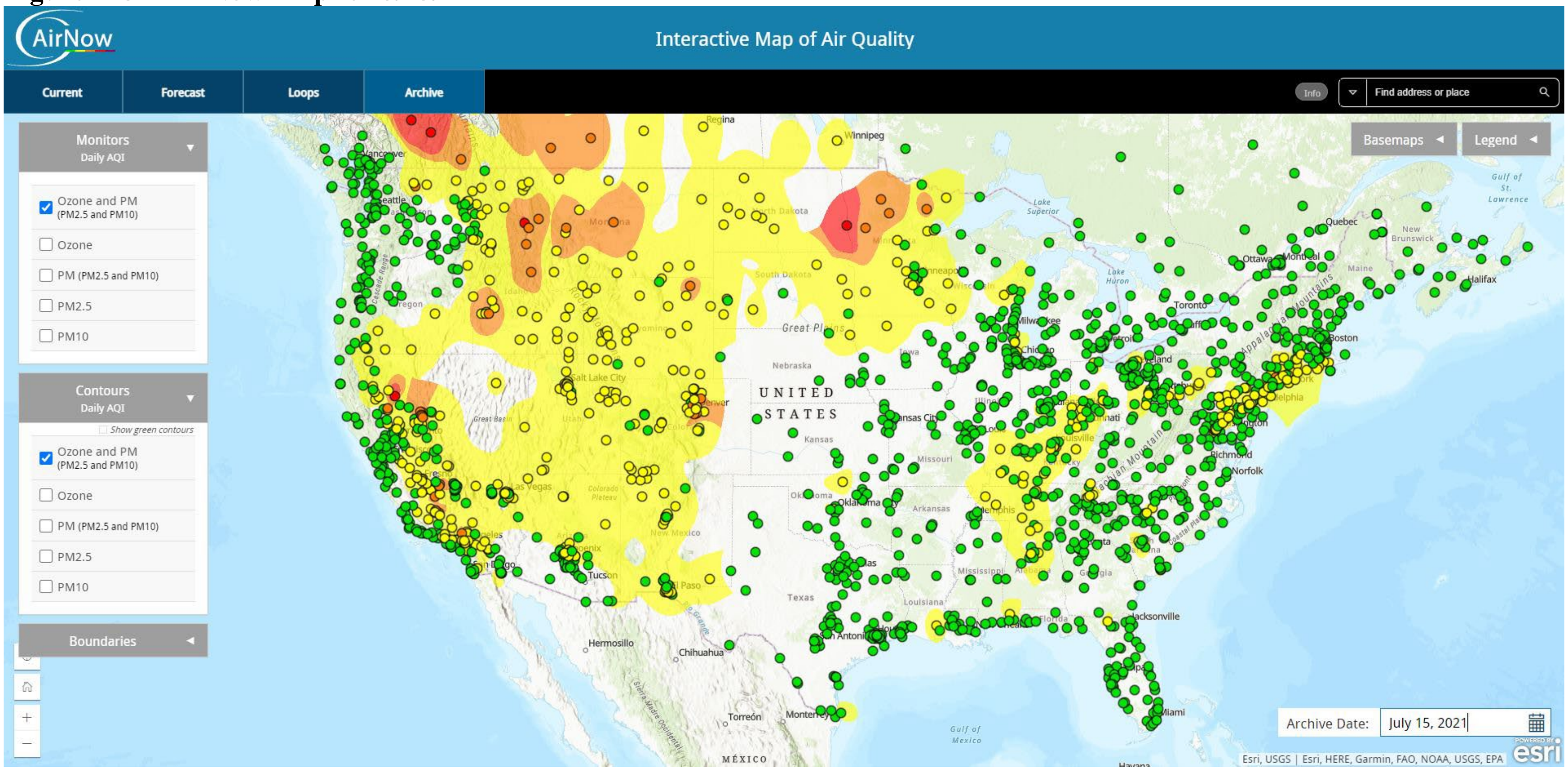
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-2 – AirNow Tech Map for 7/7/21



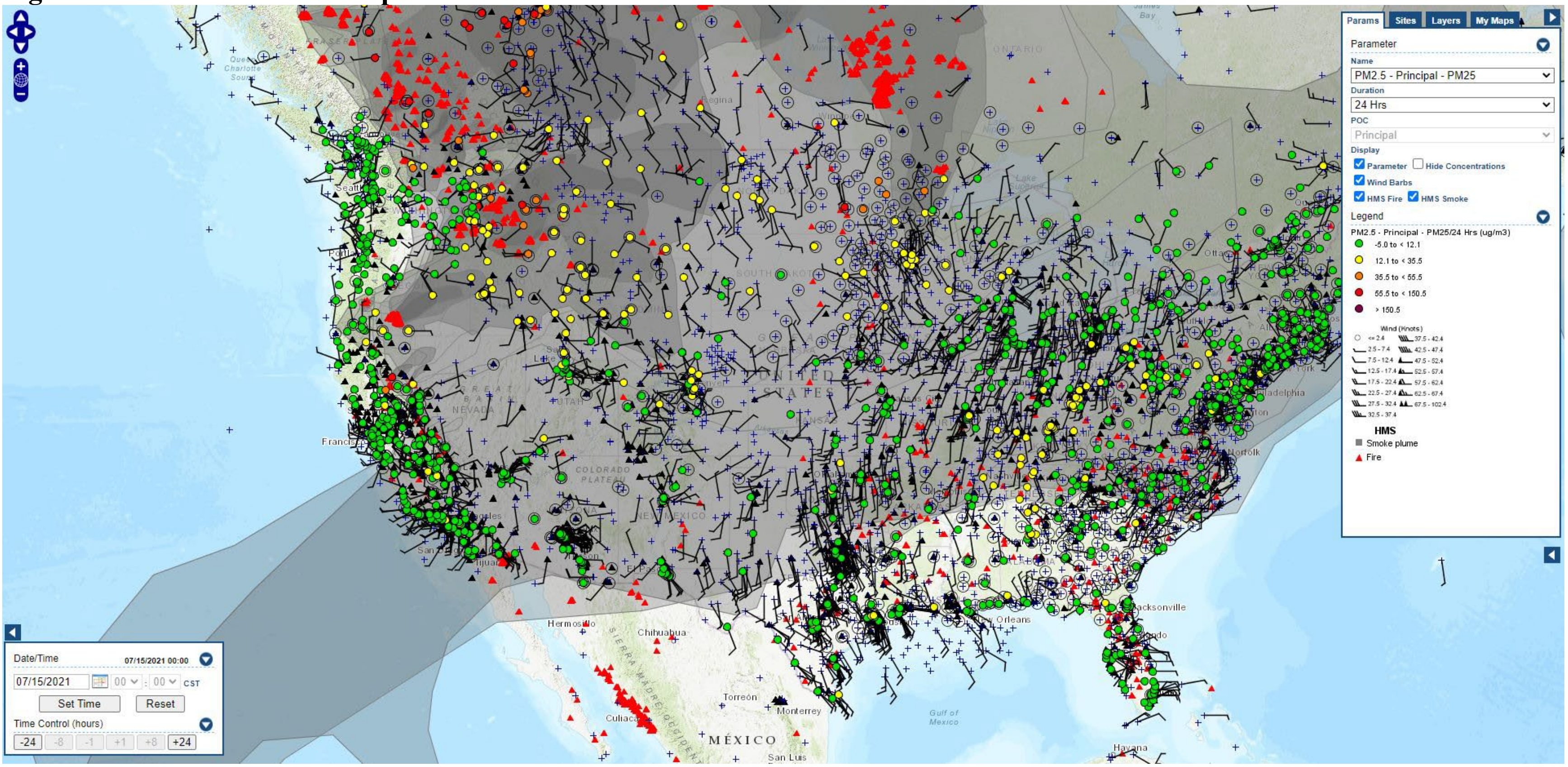
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-3 – AirNow Map for 7/15/21



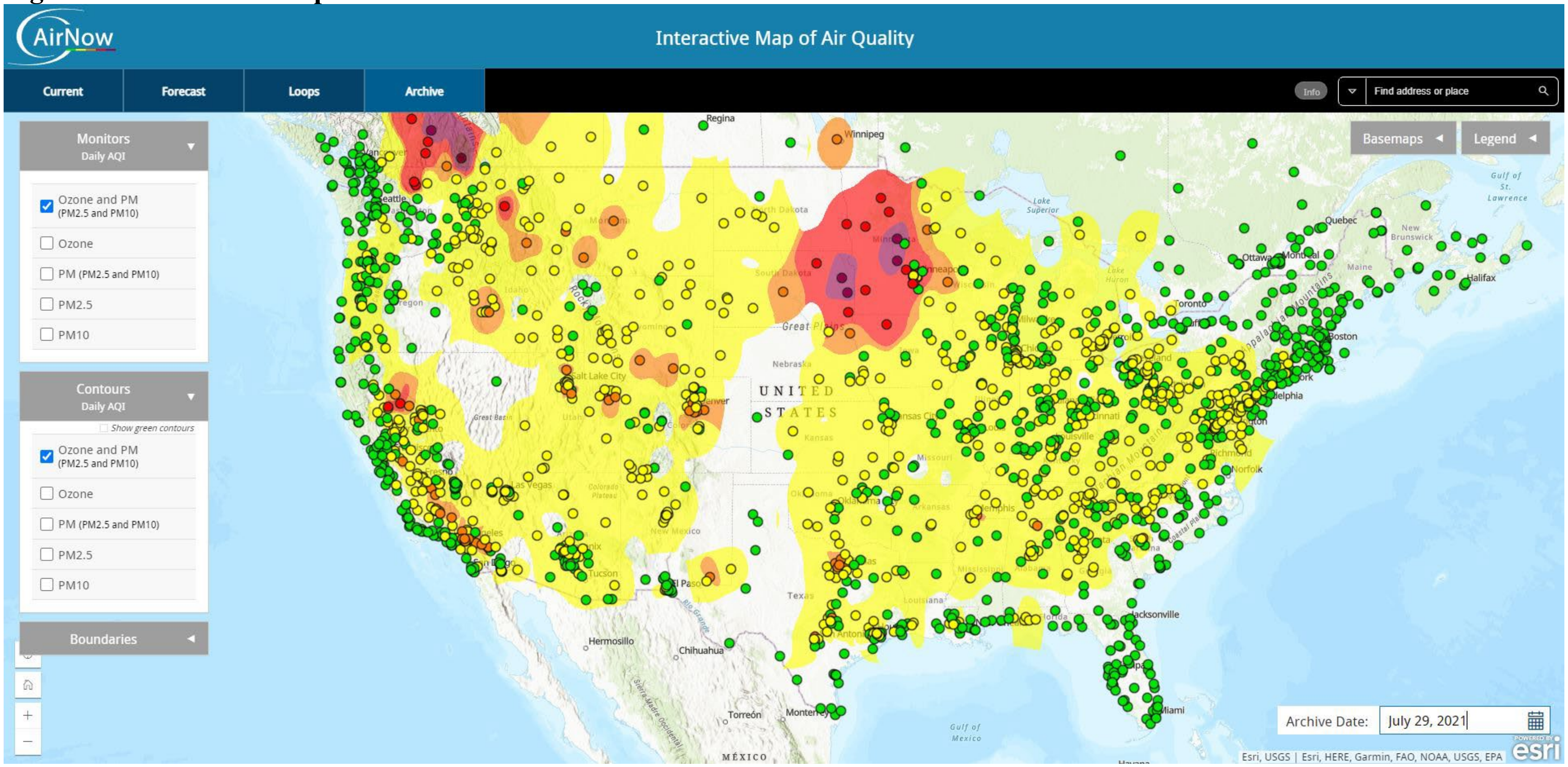
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-4 – AirNow Tech Map for 7/15/21



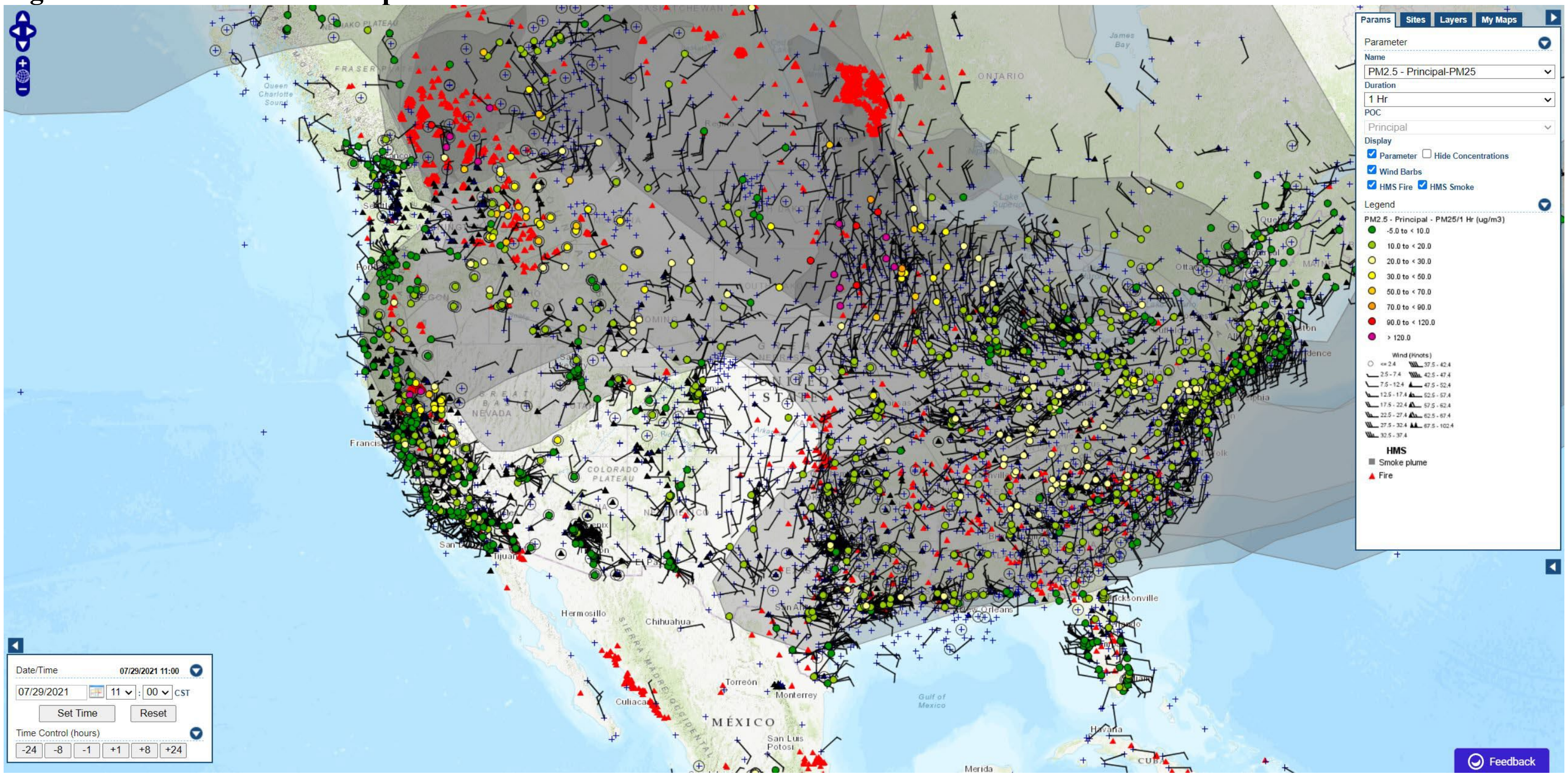
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-5 – AirNow Map for 7/29/21



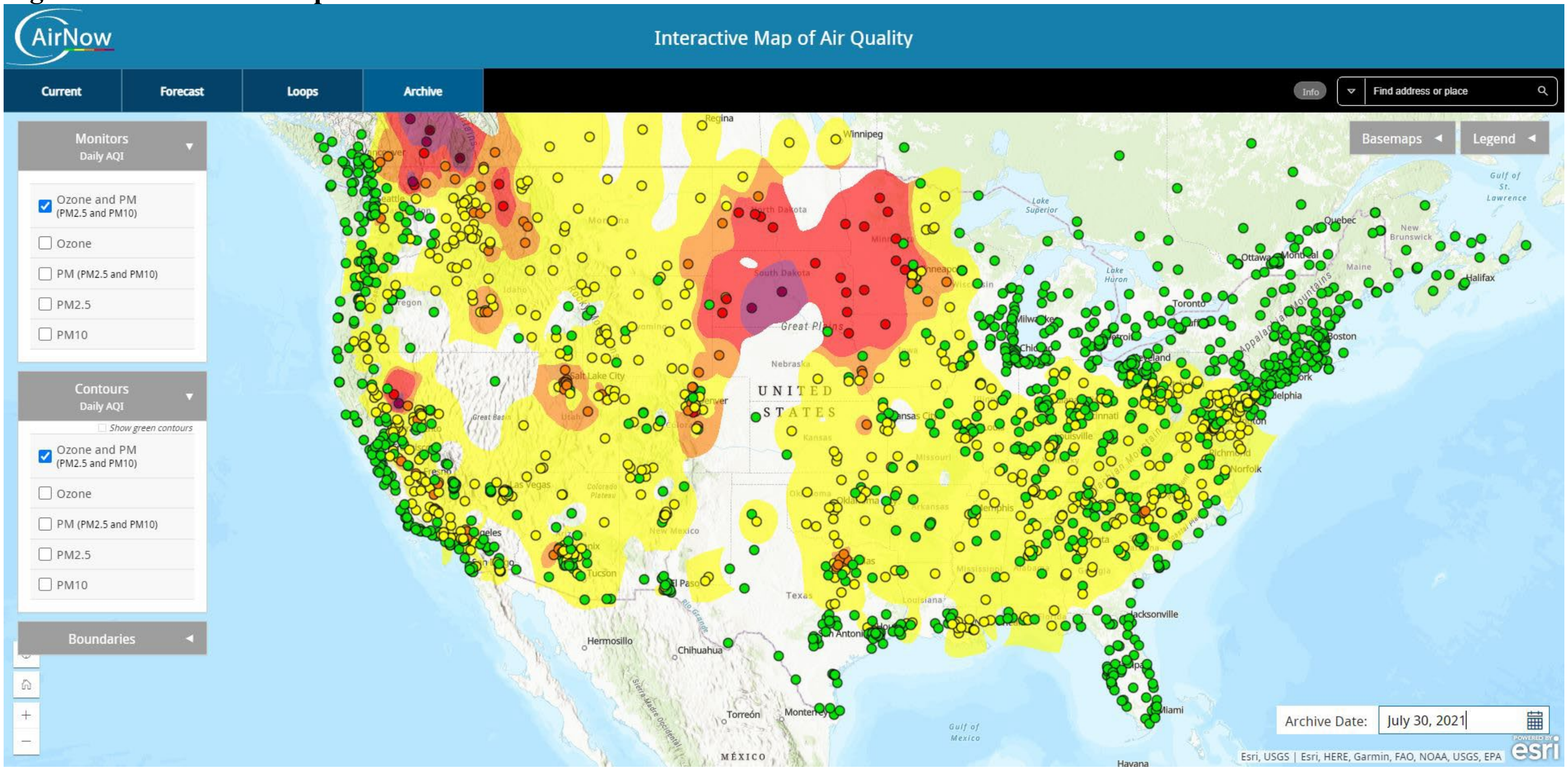
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-6 – AirNow Tech Map for 7/29/21



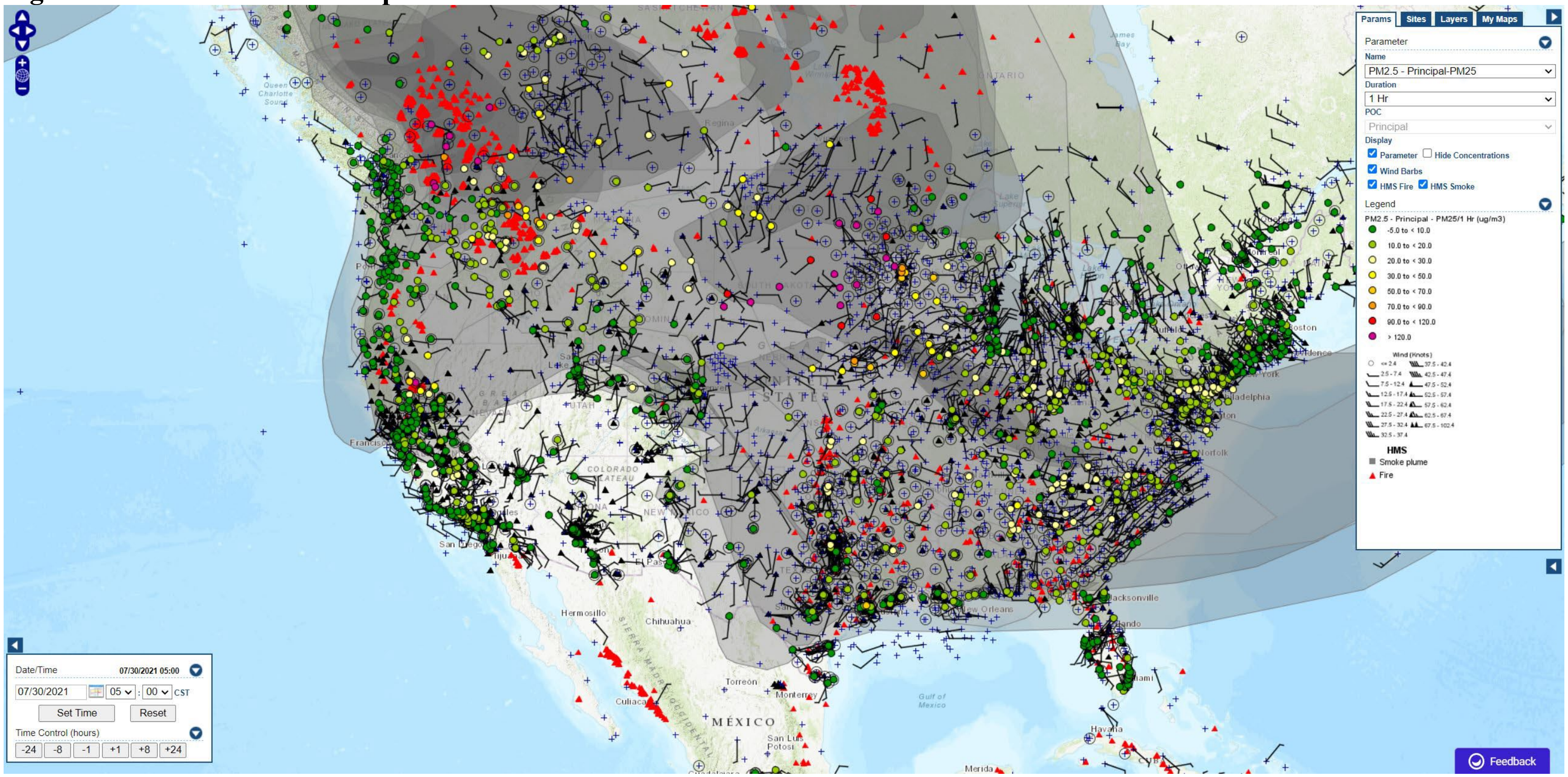
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-7 – AirNow Map for 7/30/21



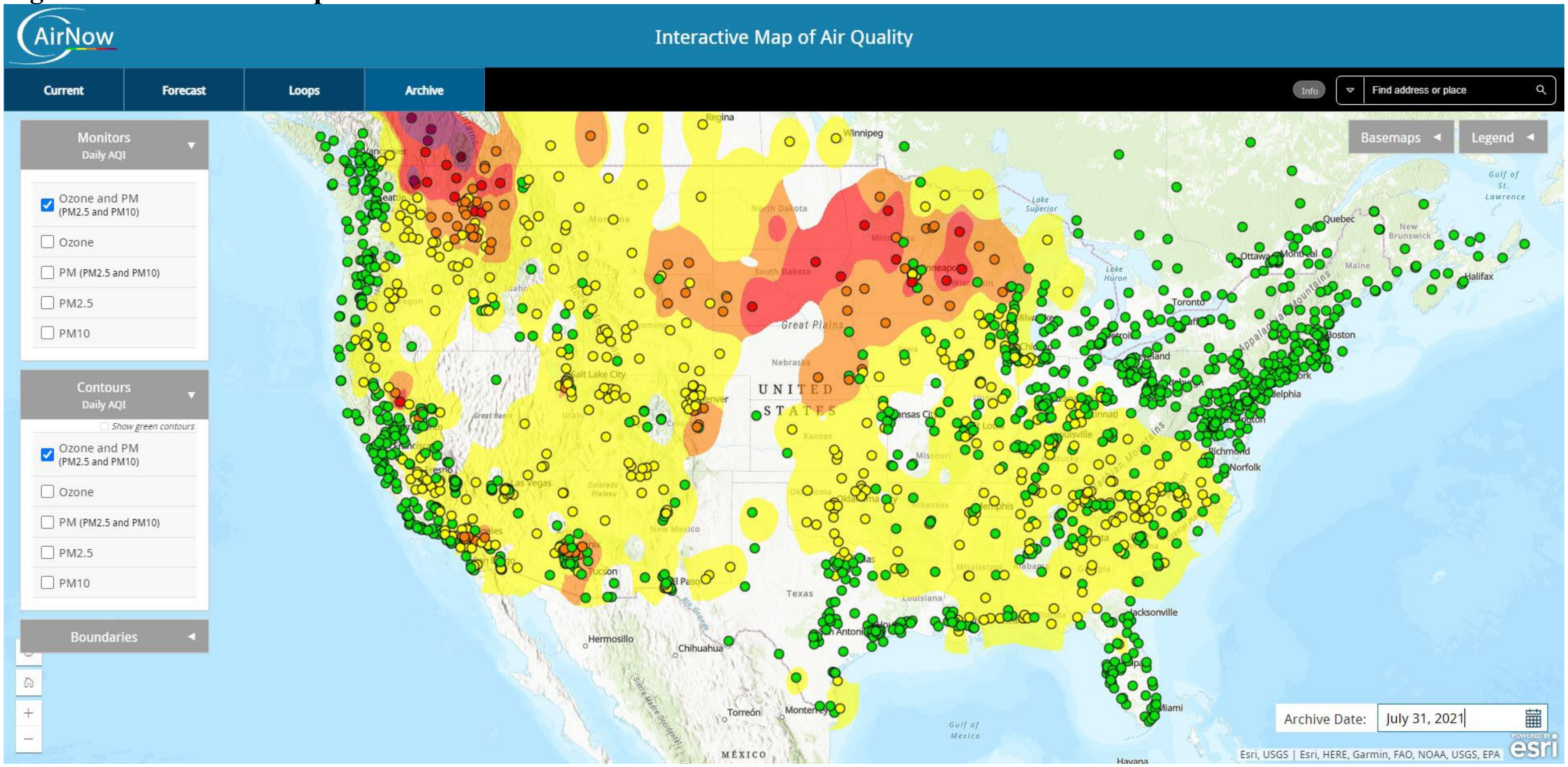
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-8 – AirNow Tech Map for 7/30/21



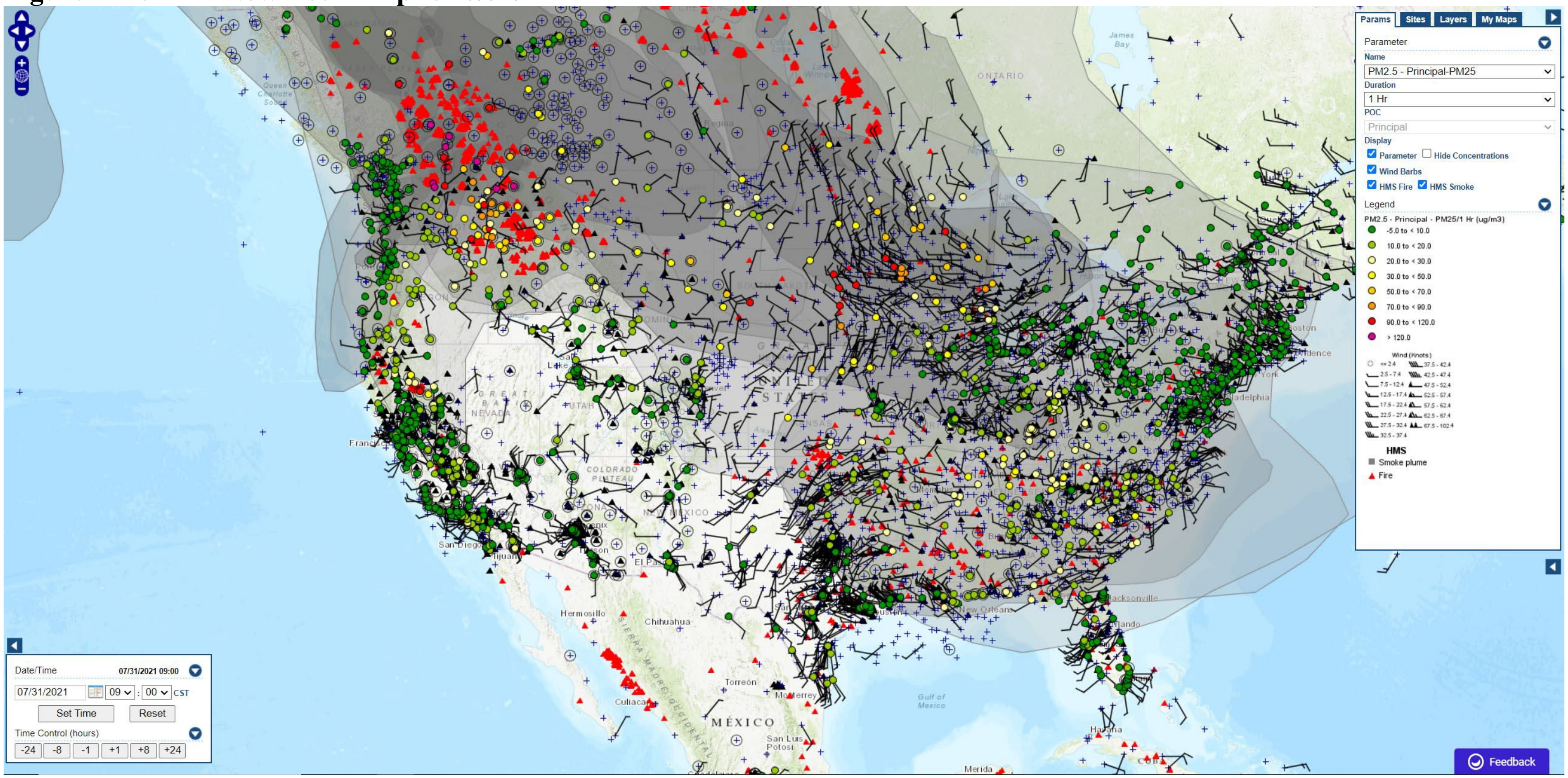
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-9 – AirNow Map for 7/31/21



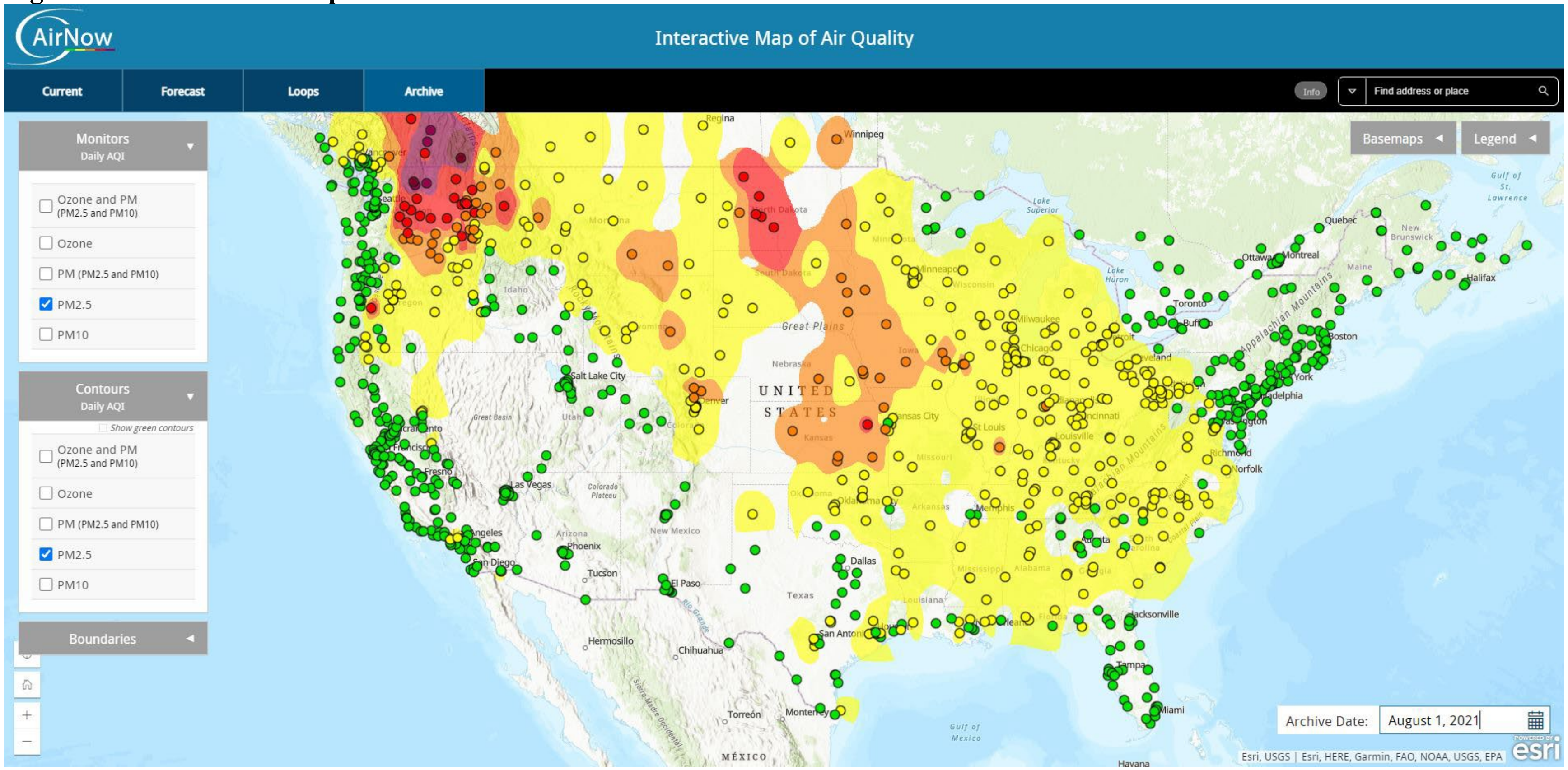
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-10 – AirNow Tech Map for 7/31/21



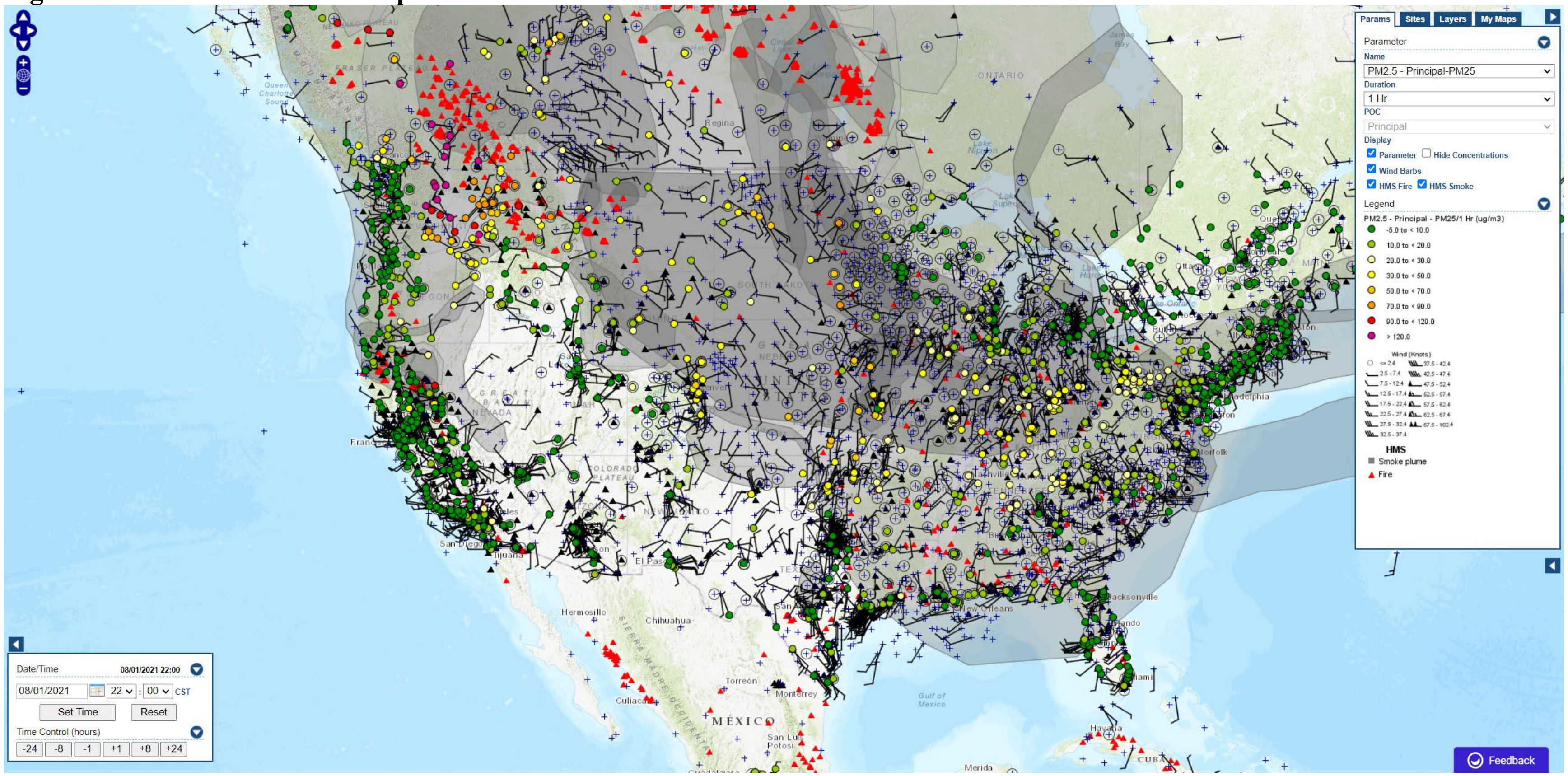
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-11 – AirNow Map for 8/1/21



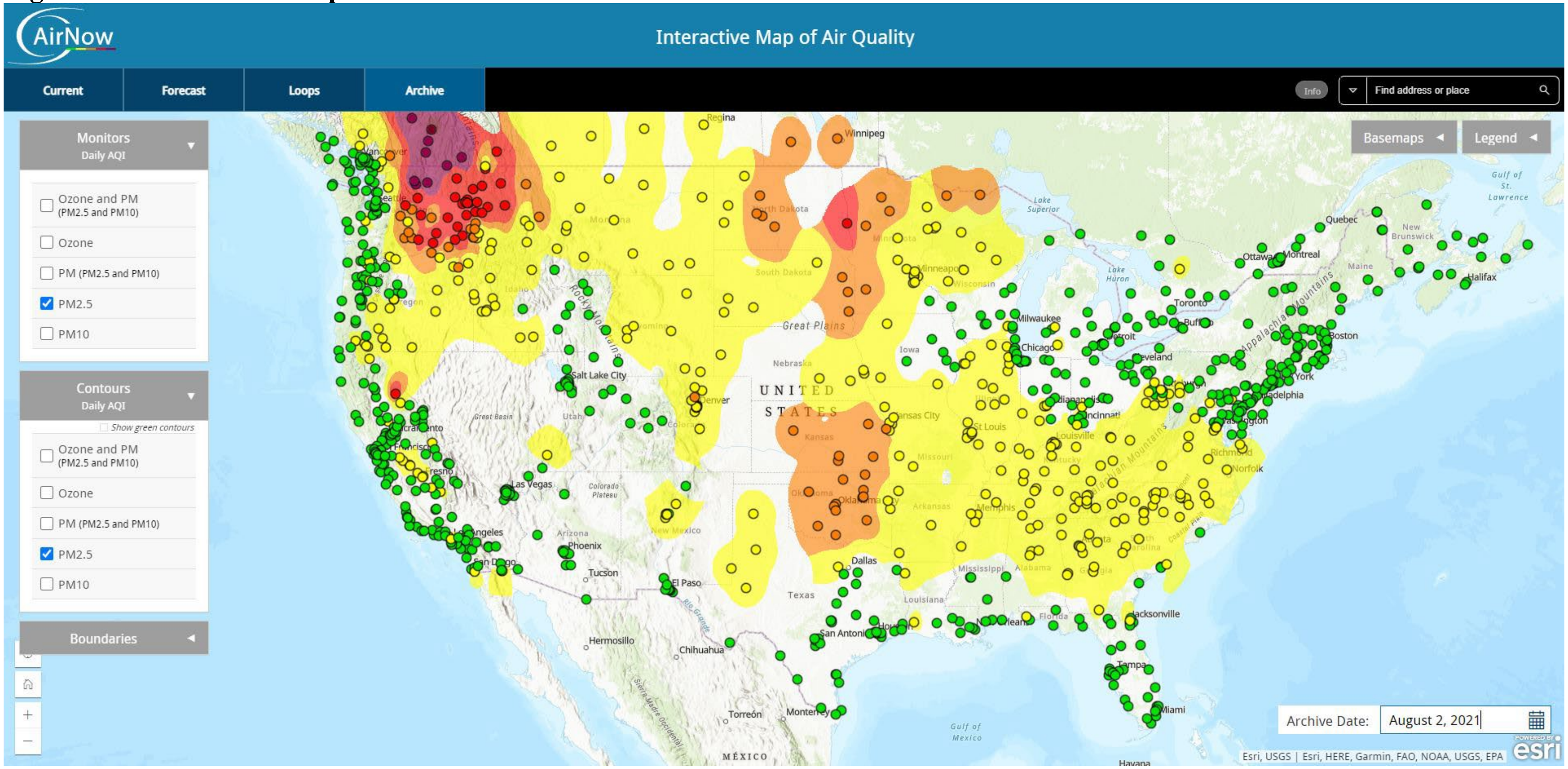
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-12 – AirNow Tech Map for 8/1/21



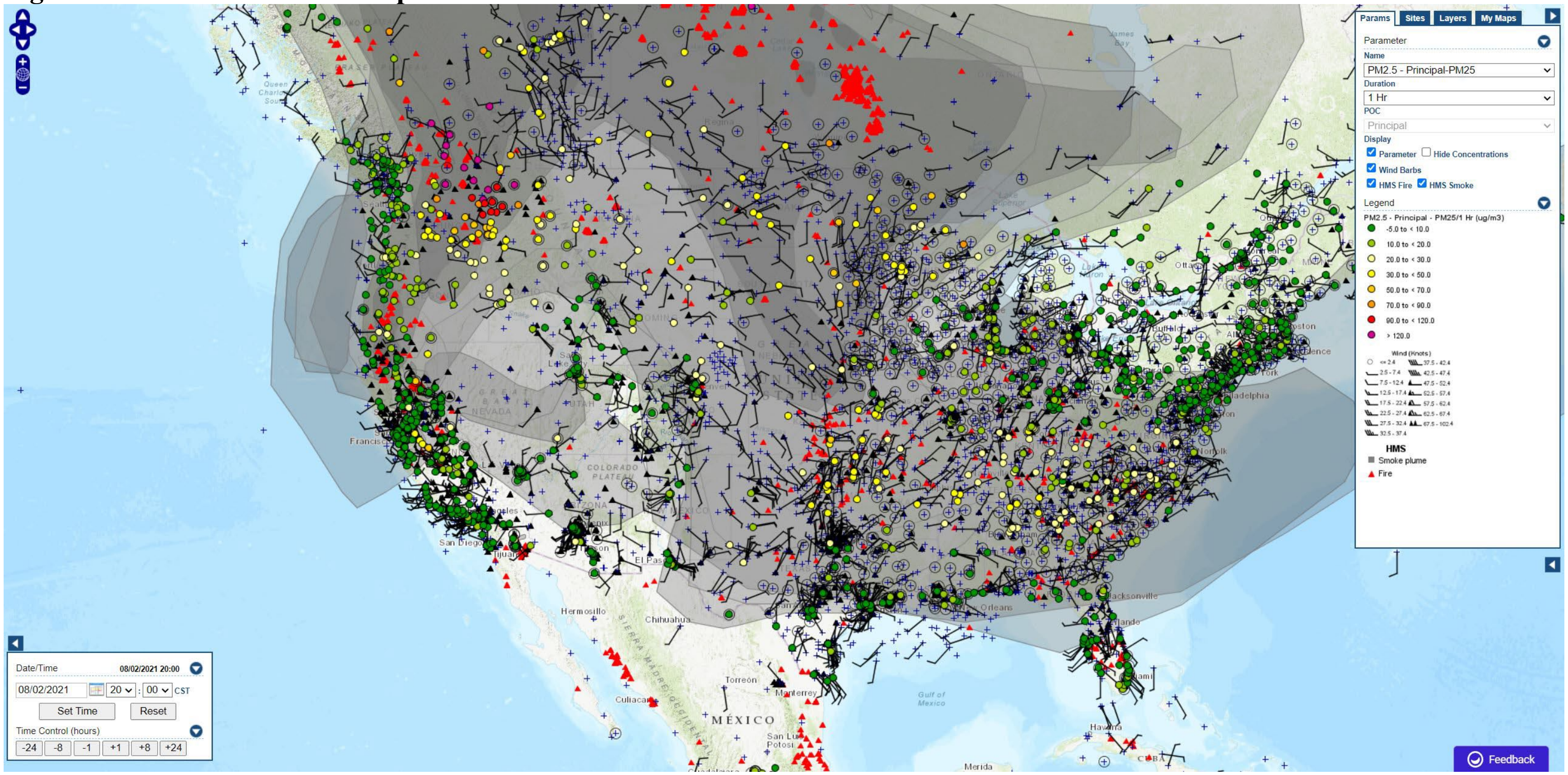
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-13 – AirNow Map for 8/2/21



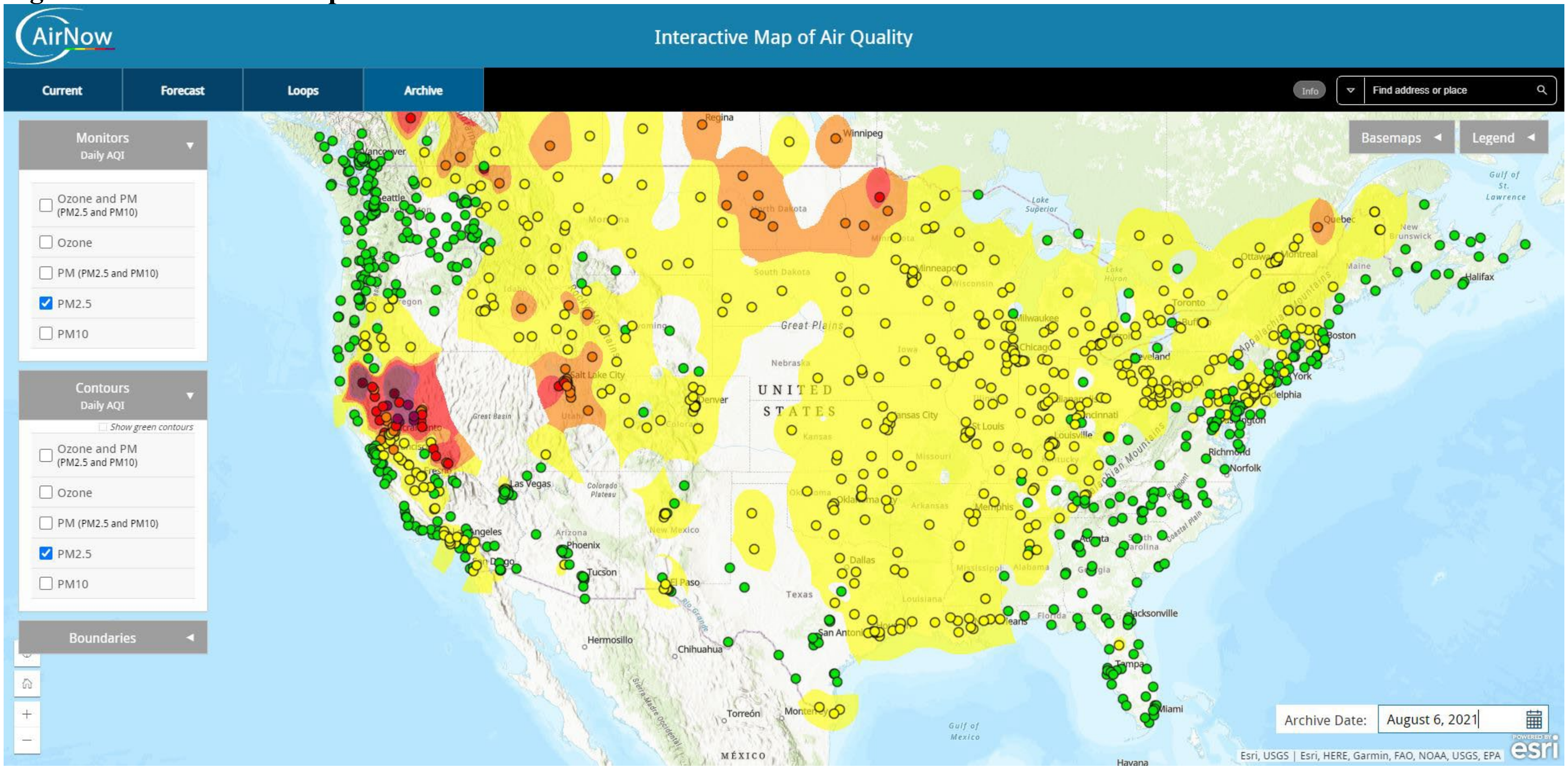
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-14 – AirNow Tech Map for 8/2/21



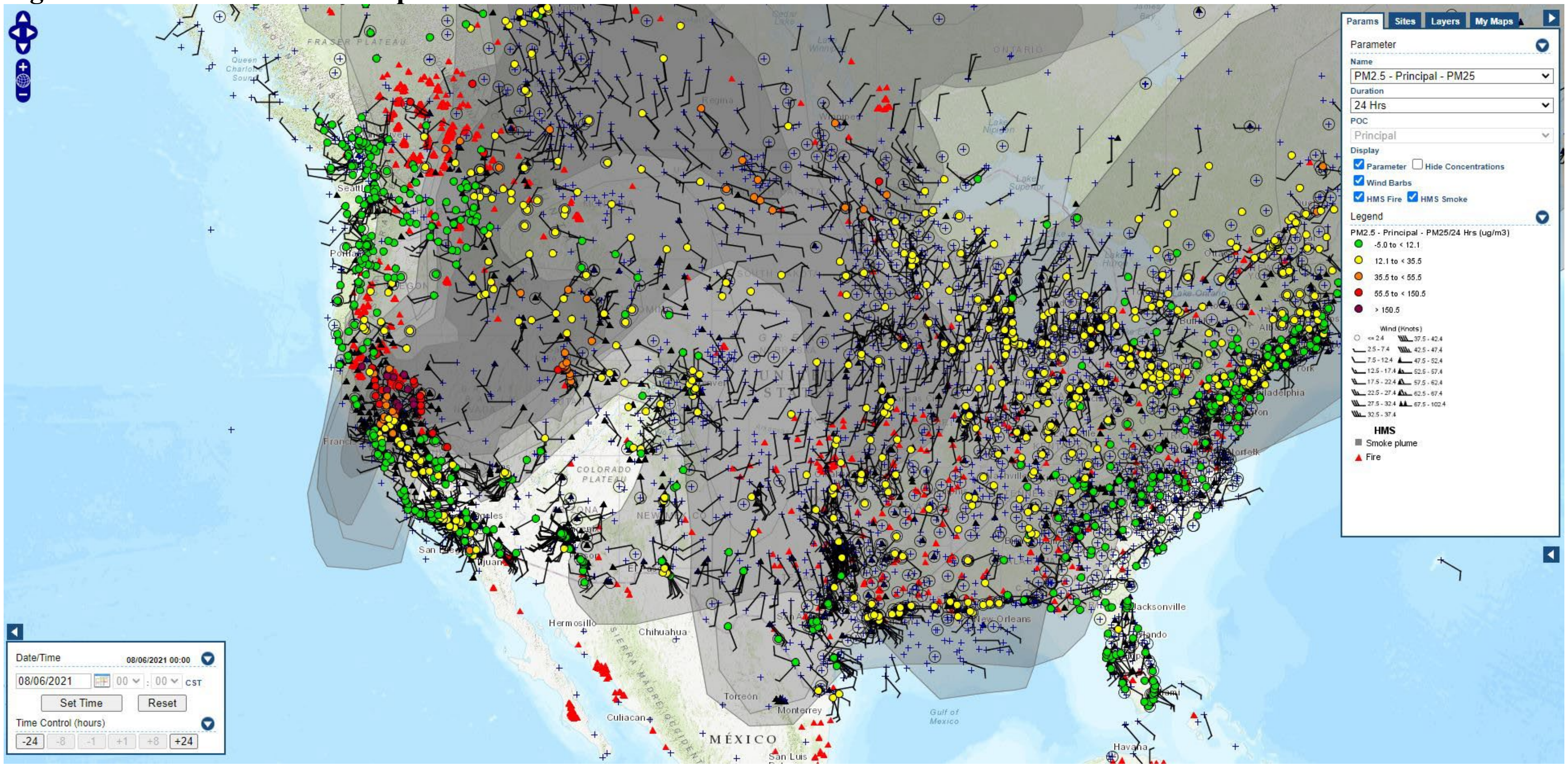
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-15 – AirNow Map for 8/6/21



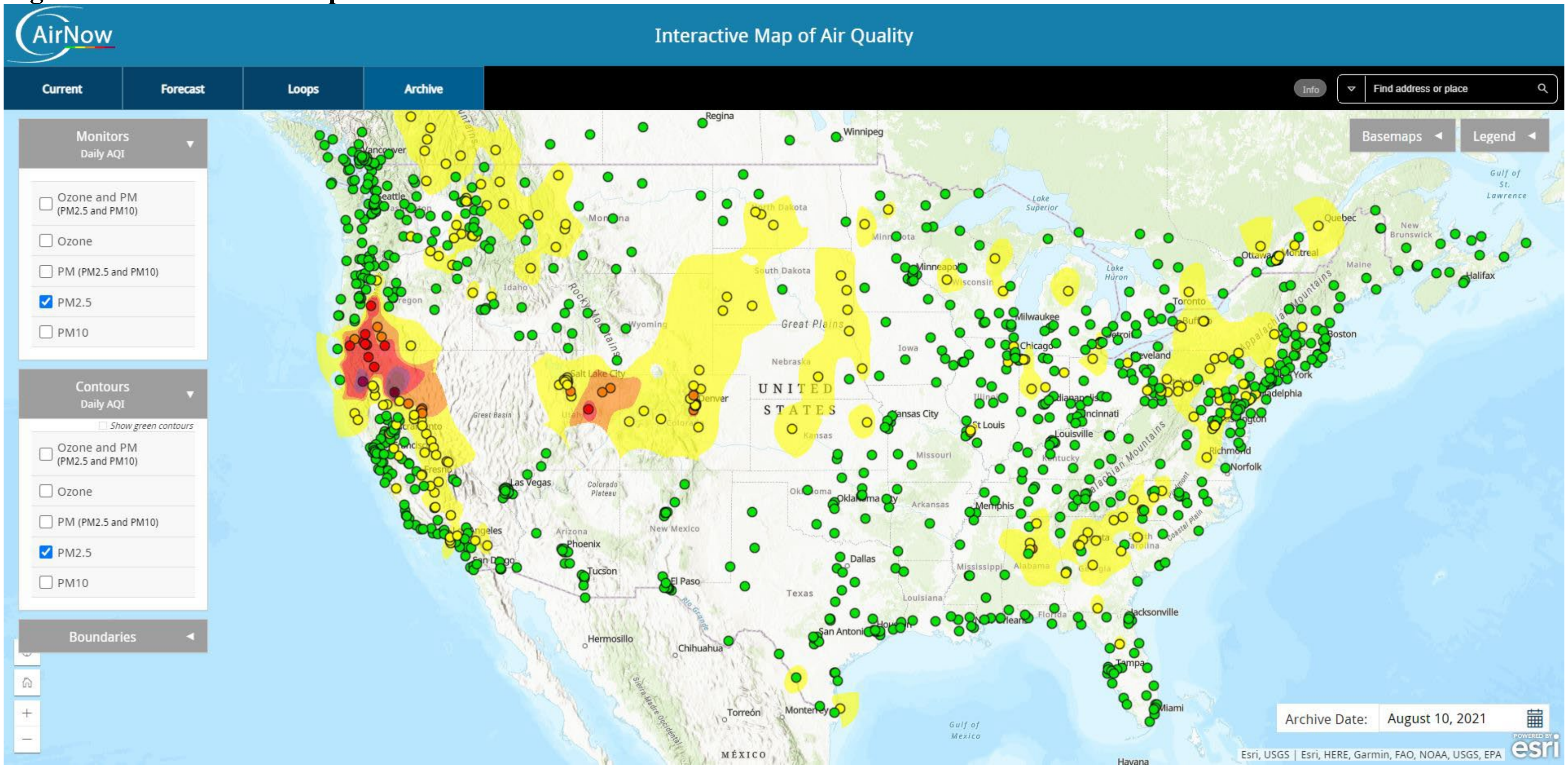
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-16 – AirNow Tech Map for 8/6/21



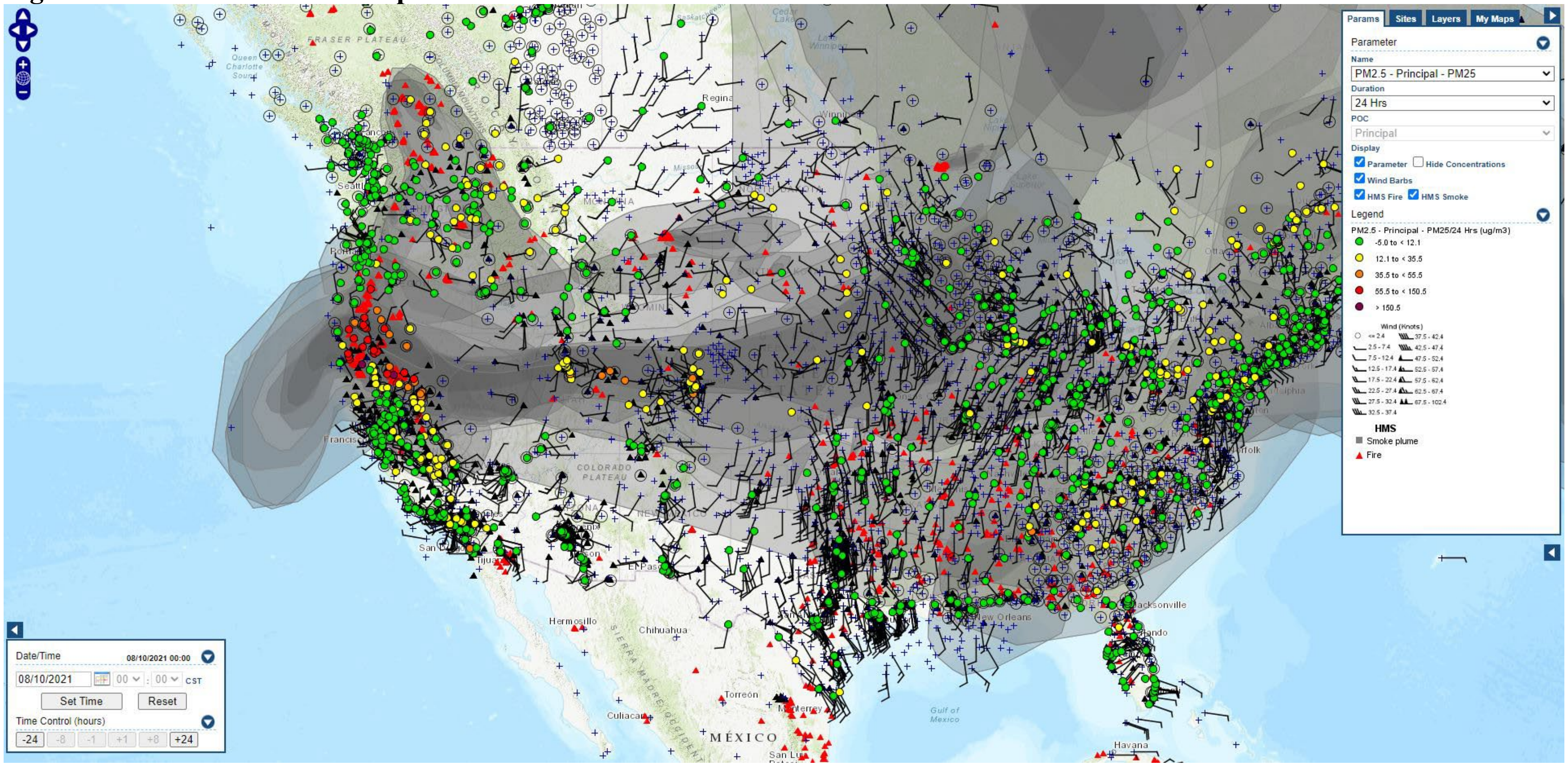
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-17 – AirNow Map for 8/10/21



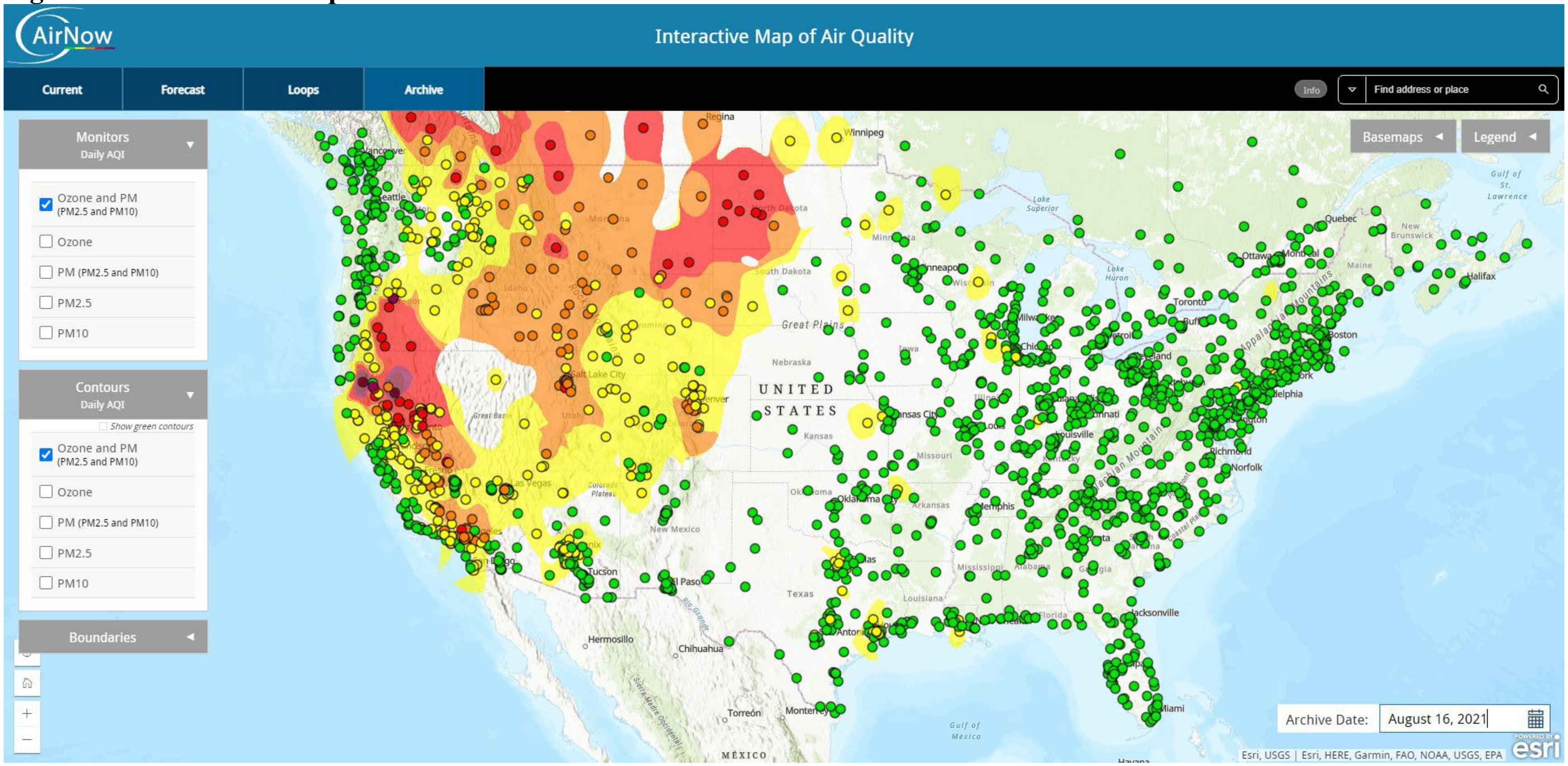
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-18 – AirNow Tech Map for 8/10/21



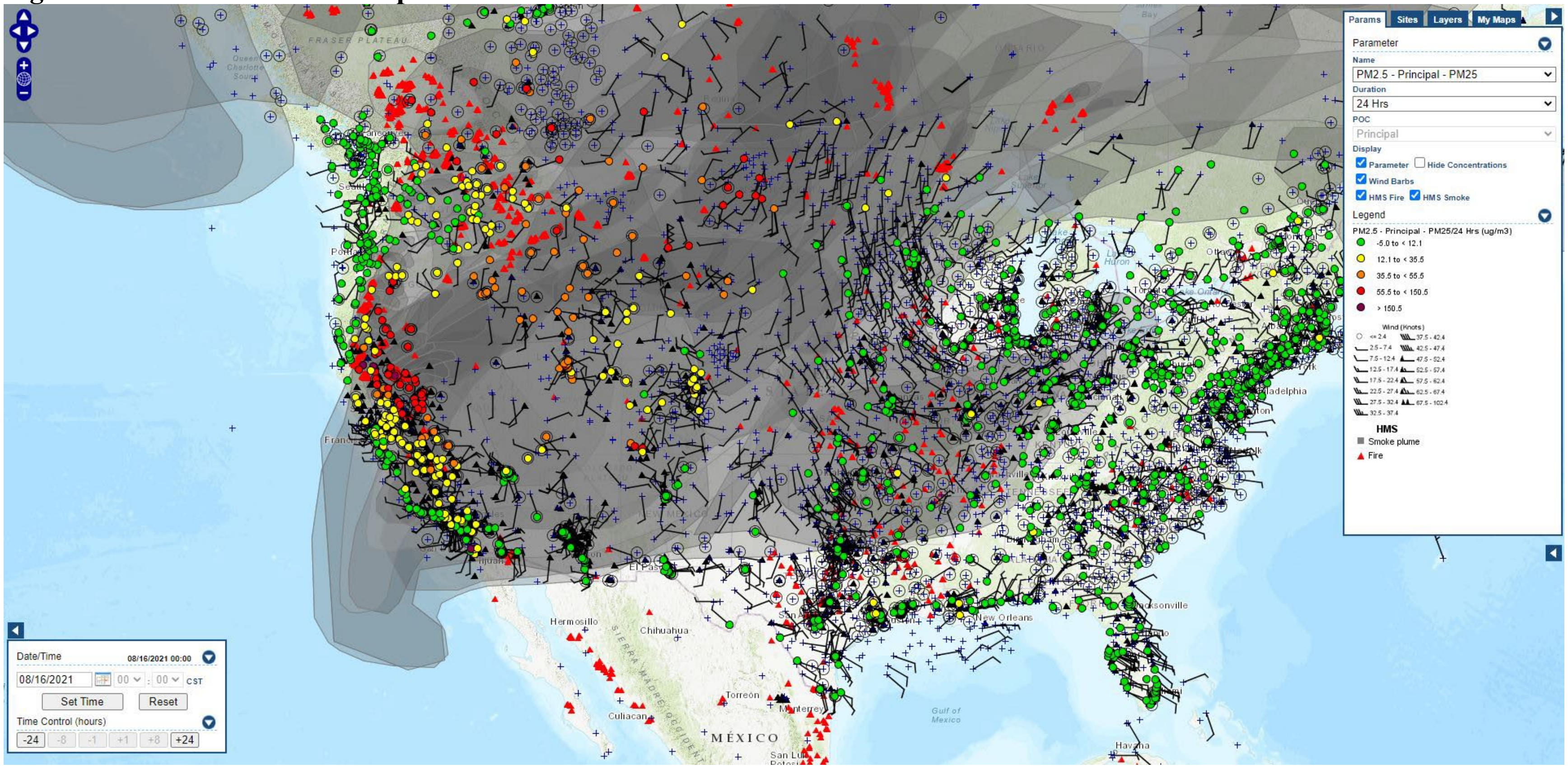
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-19 – AirNow Map for 8/16/21



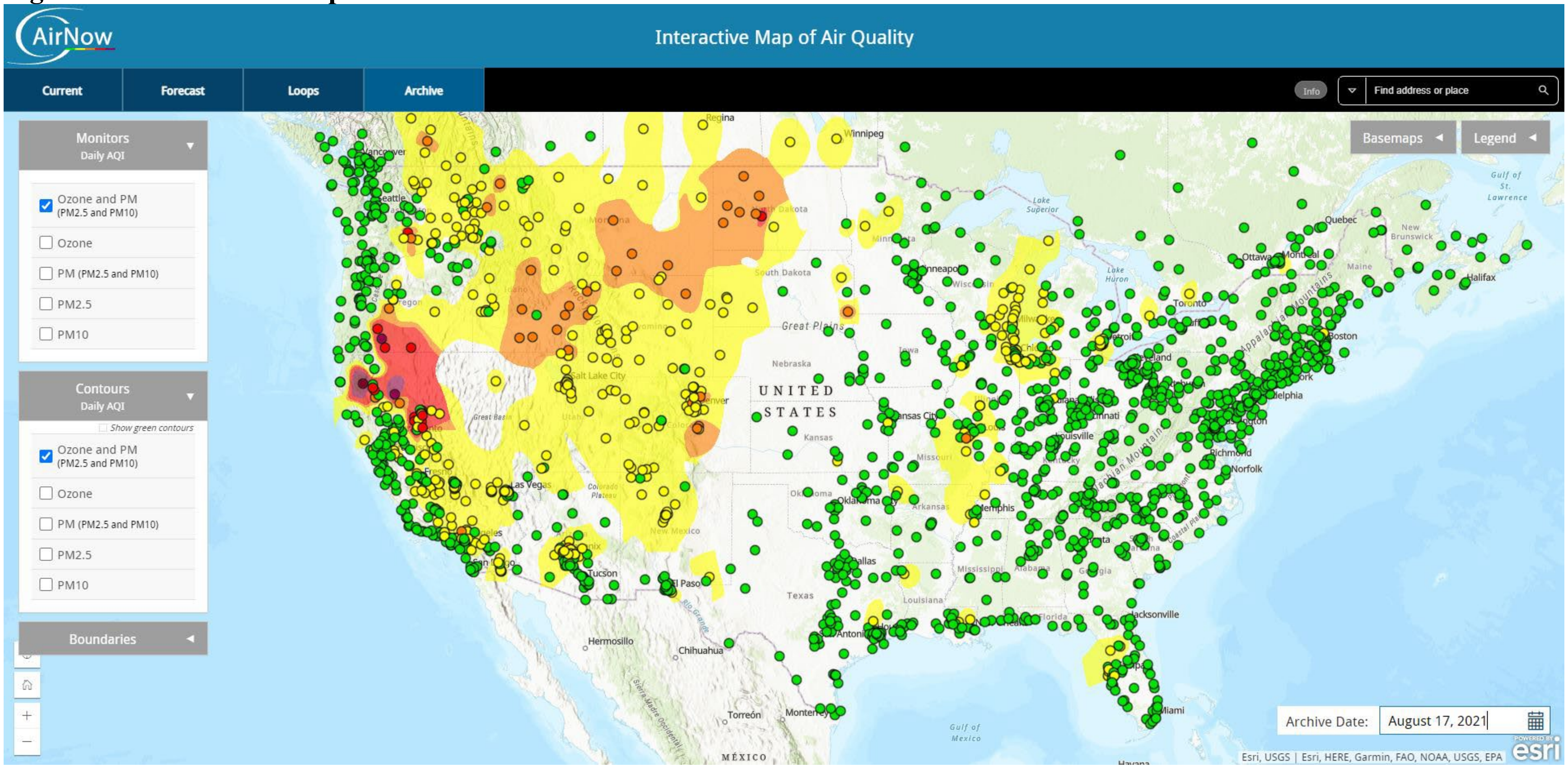
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-20 – AirNow Tech Map for 8/16/21



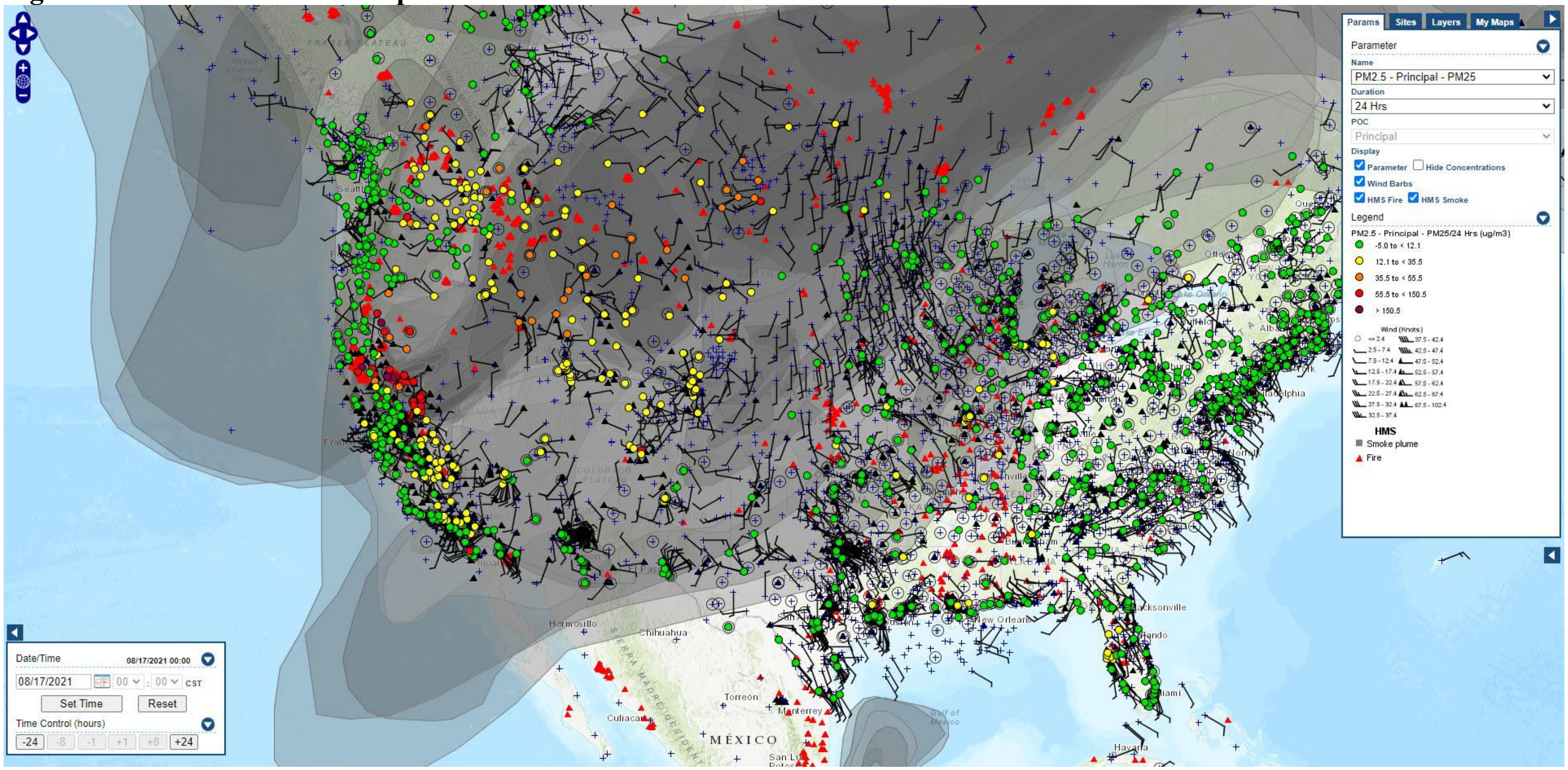
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-21 – AirNow Map for 8/17/21



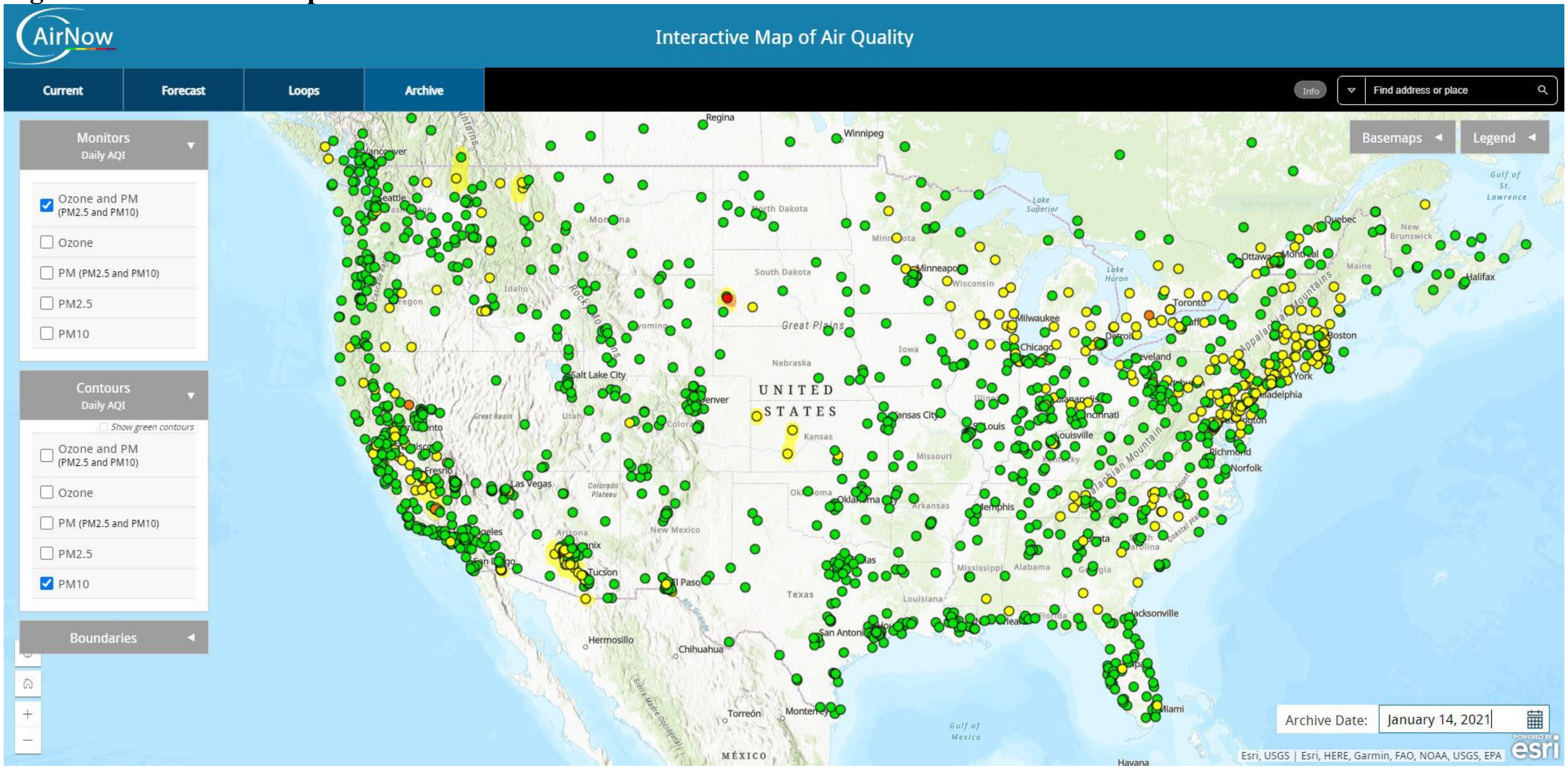
Appendix A
AirNow Maps for 24-hour $PM_{2.5}$ High Concentration Days

Figure A-22 – AirNow Tech Map for 8/17/21



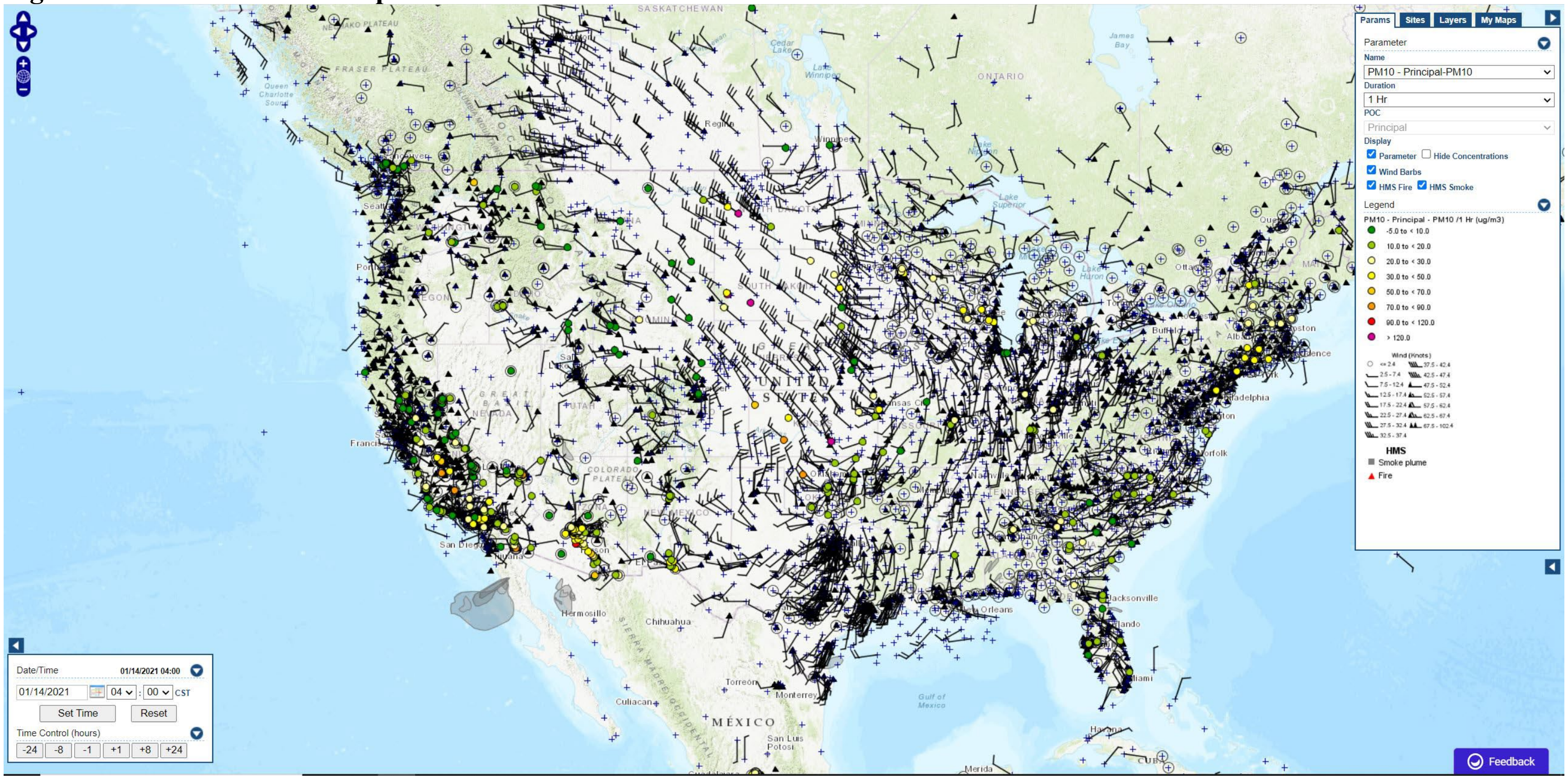
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-1 - AirNow Map for 1/14/21



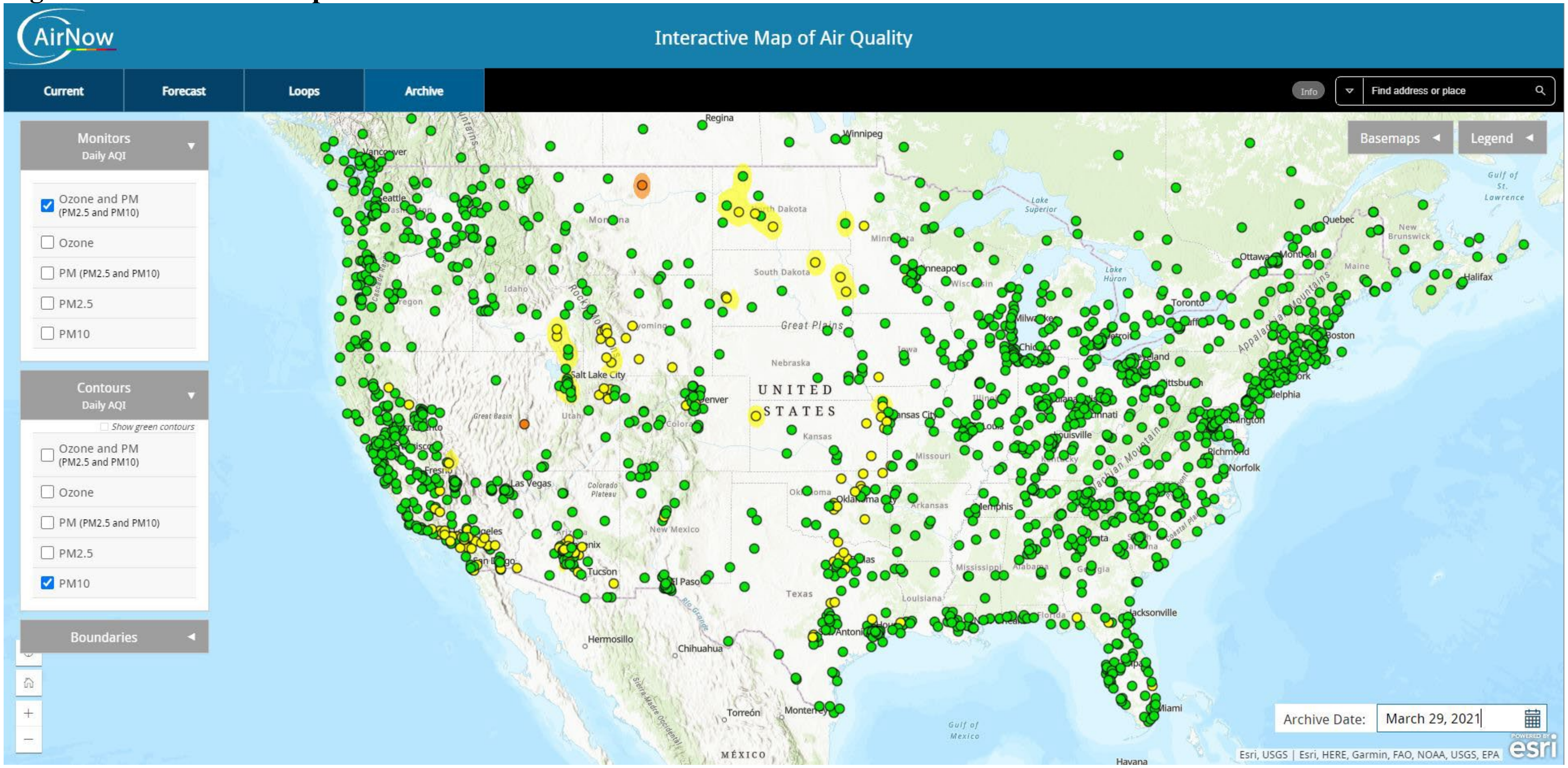
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-2 - AirNow Tech Map for 1/14/21



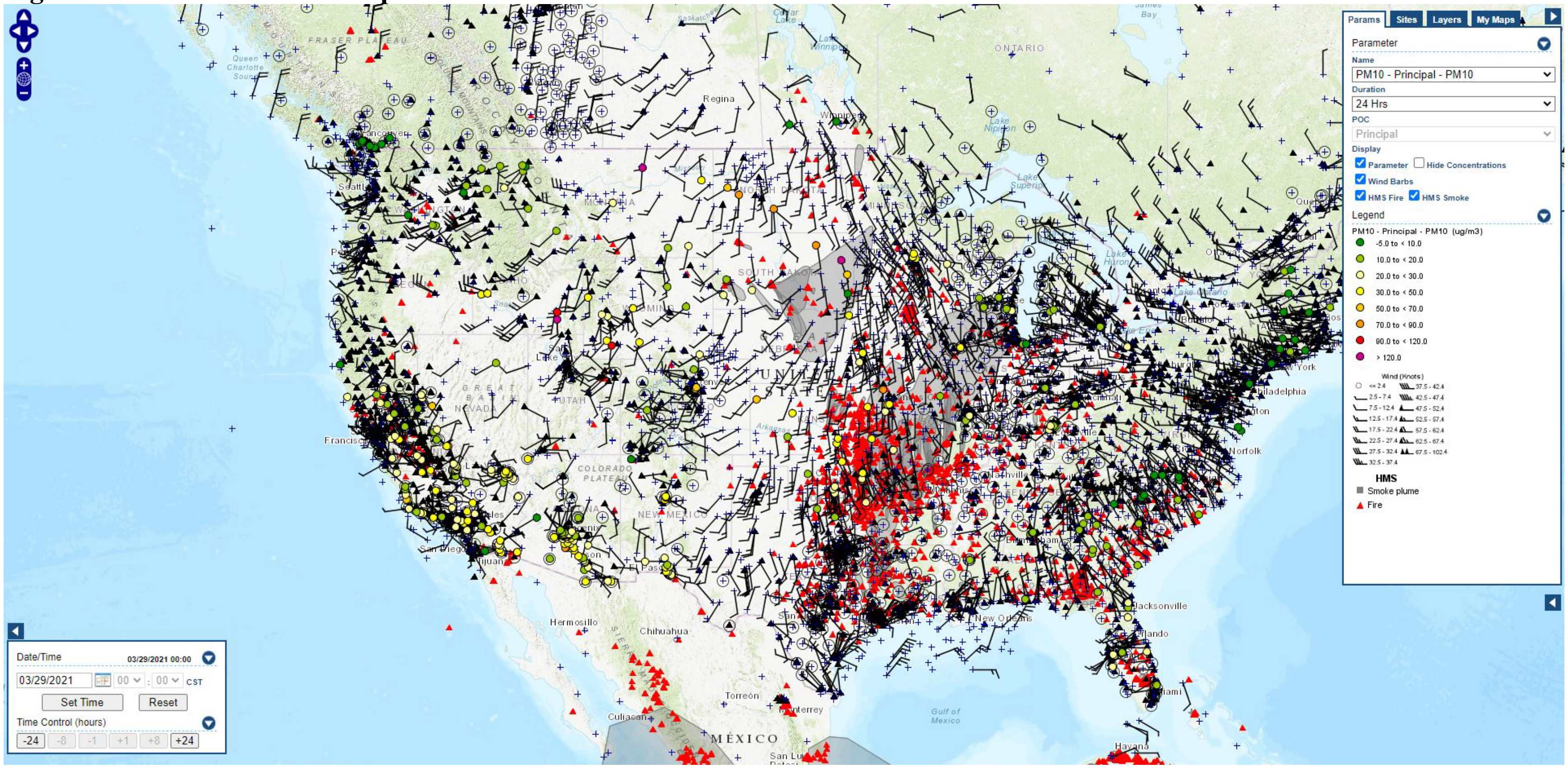
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-3 – AirNow Map for 3/29/21



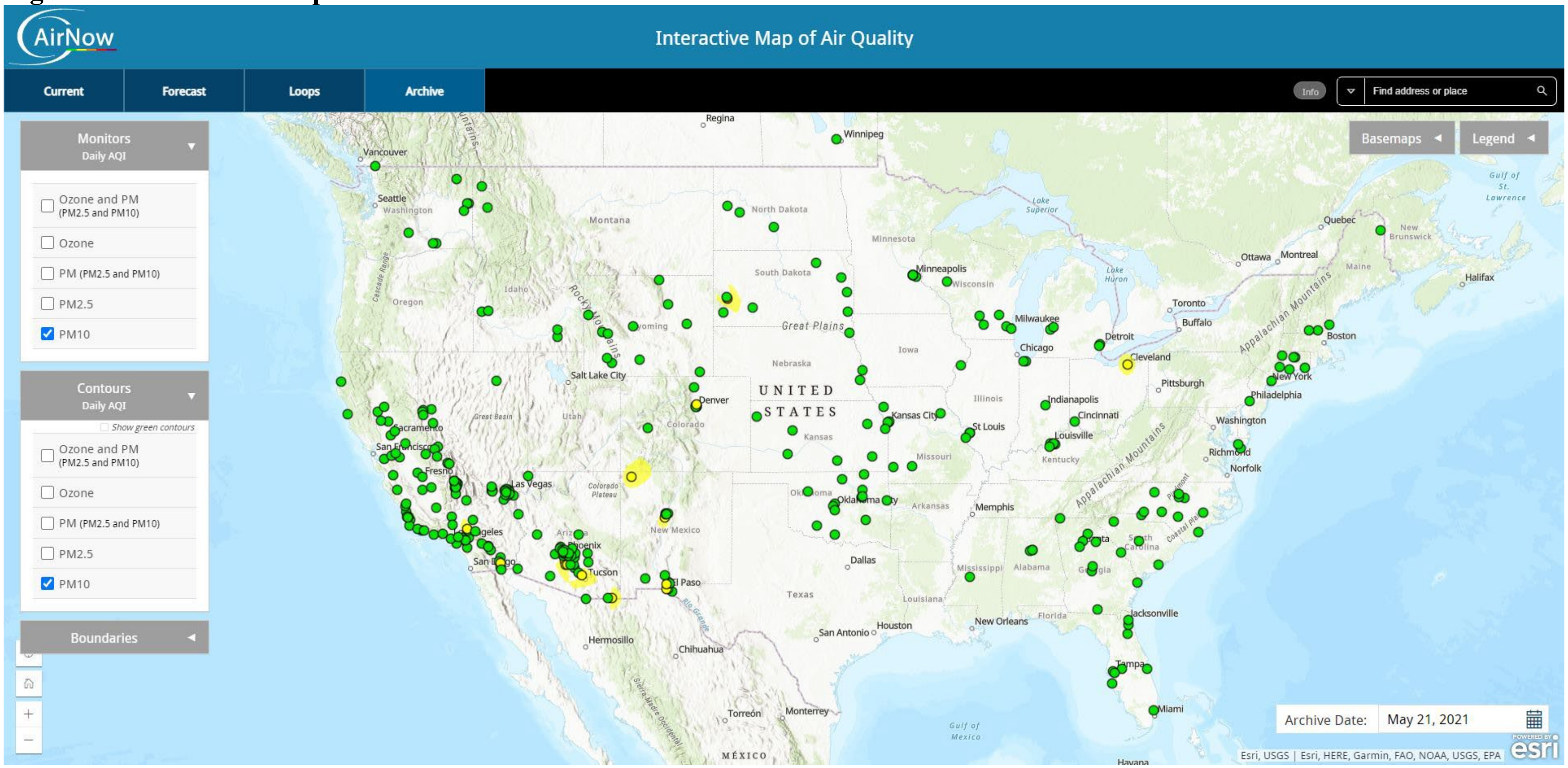
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-4 – AirNow Tech Map for 3/29/21



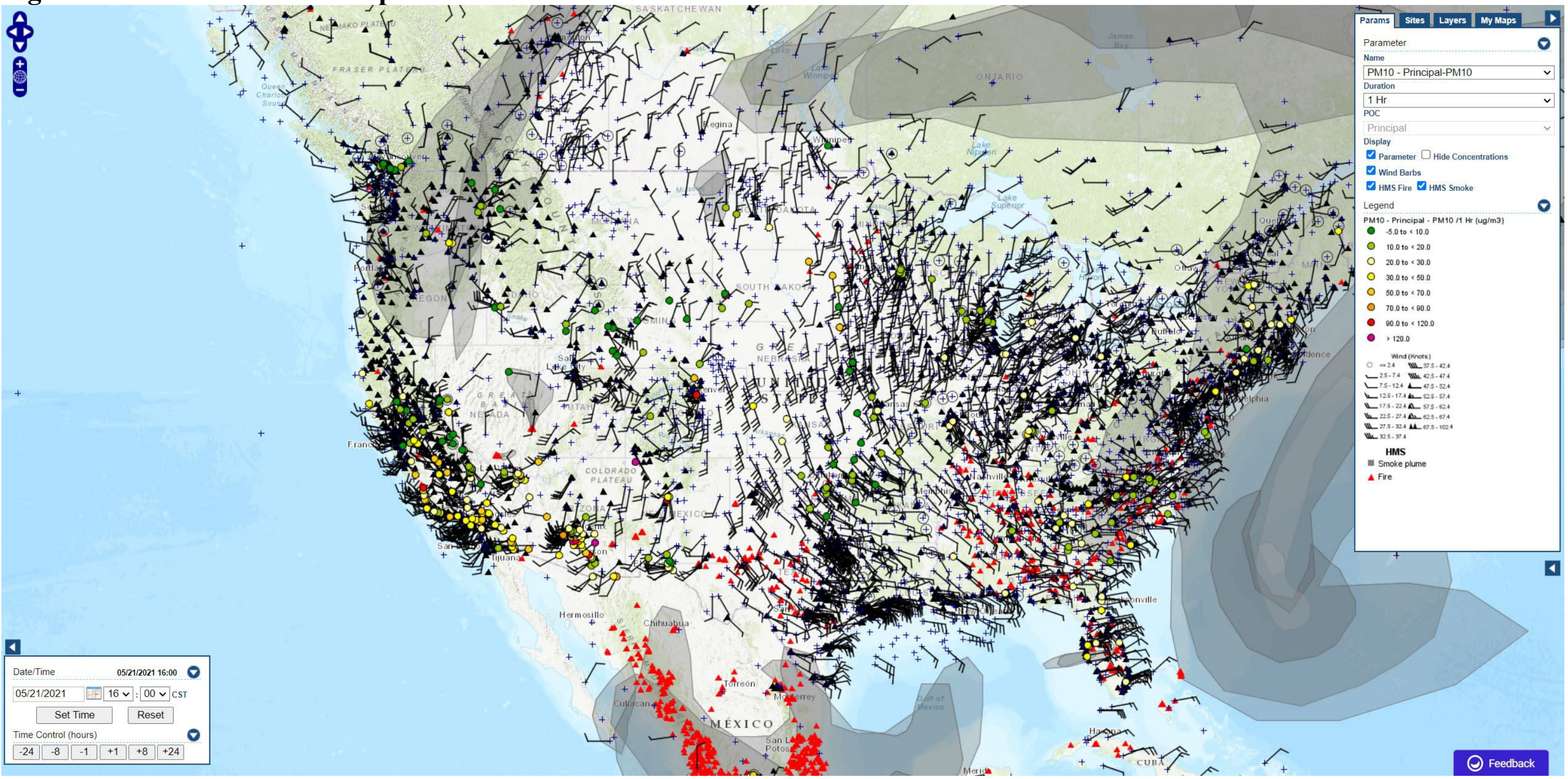
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-5 – AirNow Map for 5/21/21



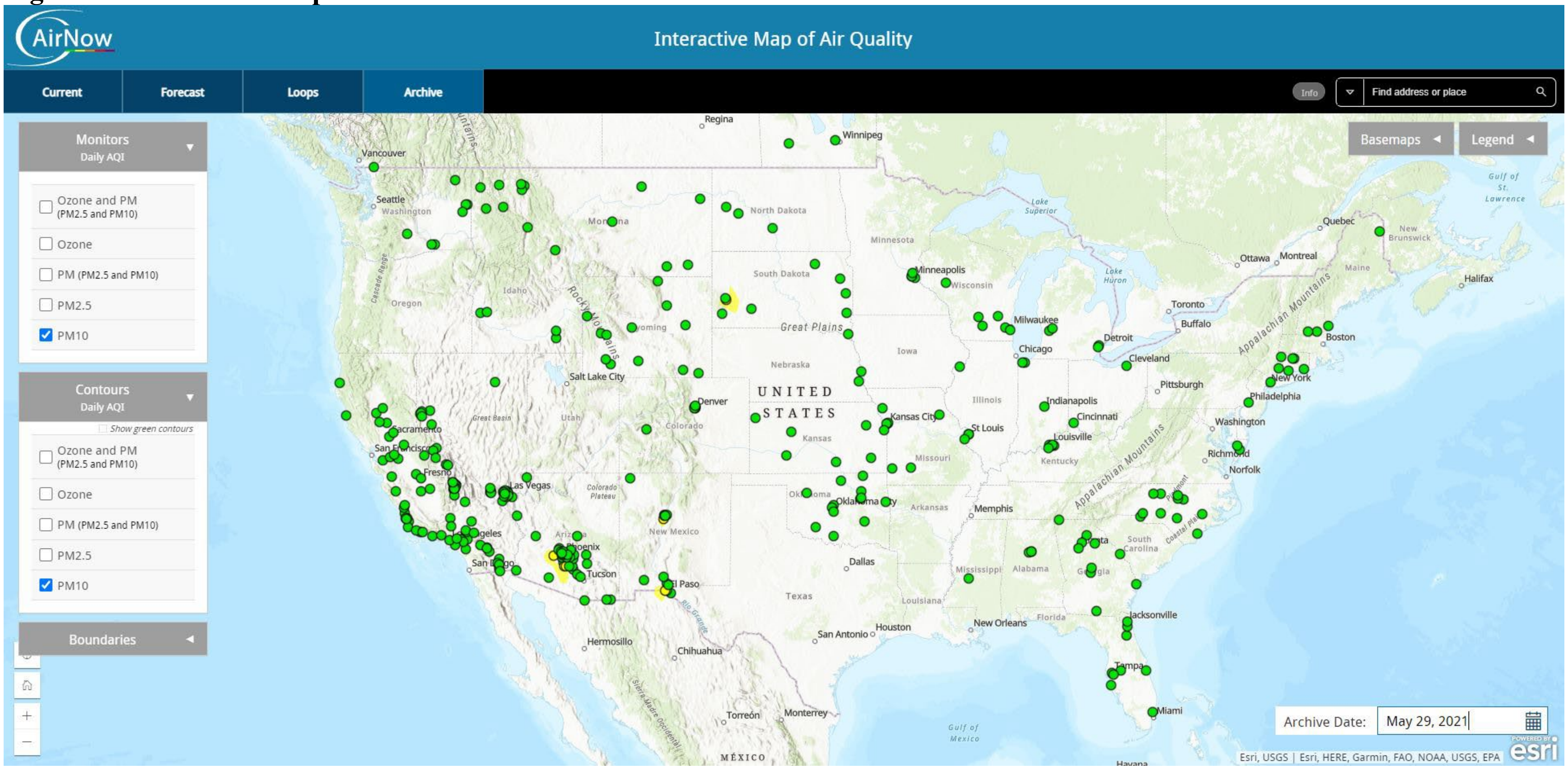
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-6 – AirNow Tech Map for 5/21/21



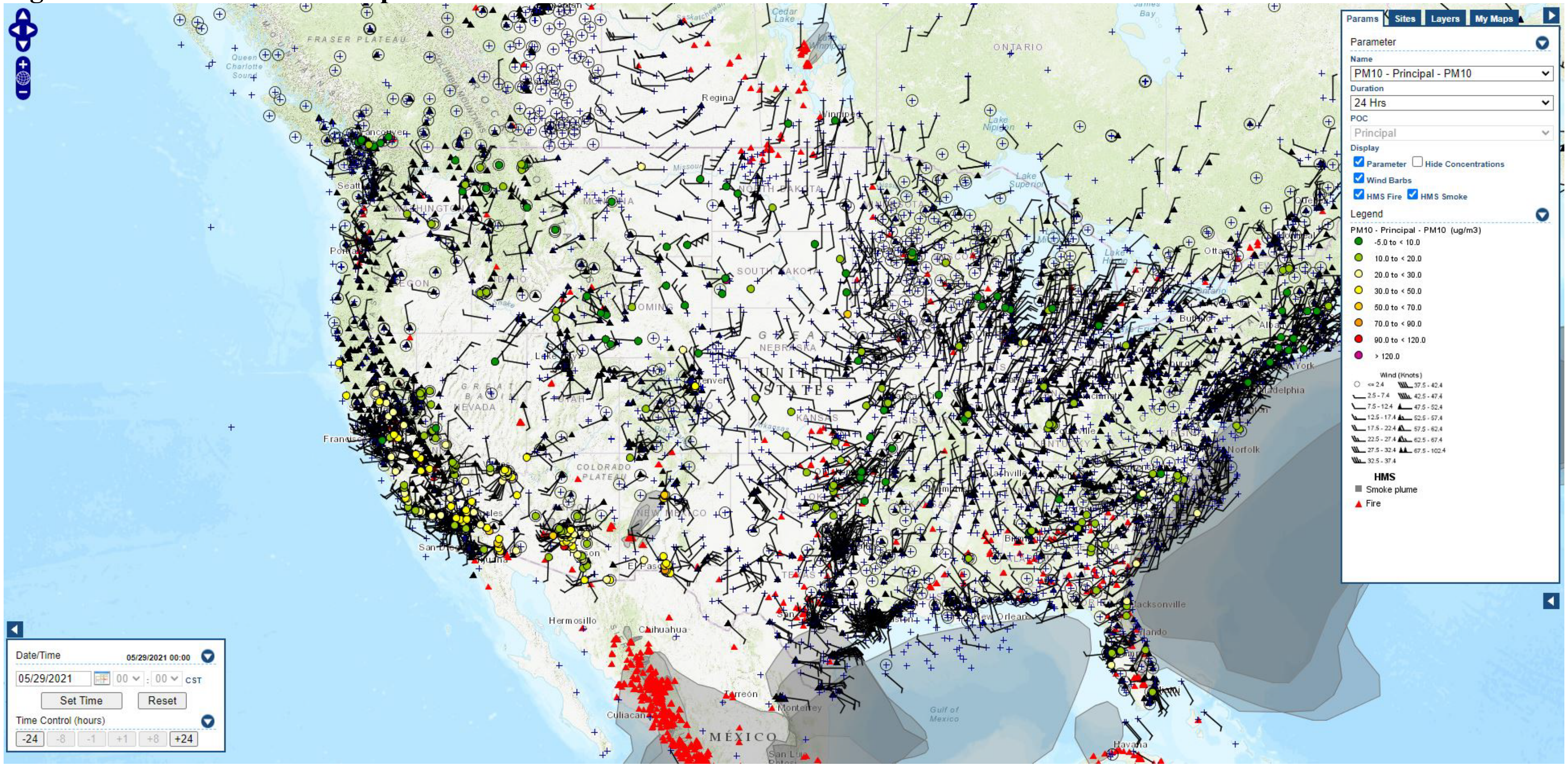
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-7 – AirNow Map for 5/29/21



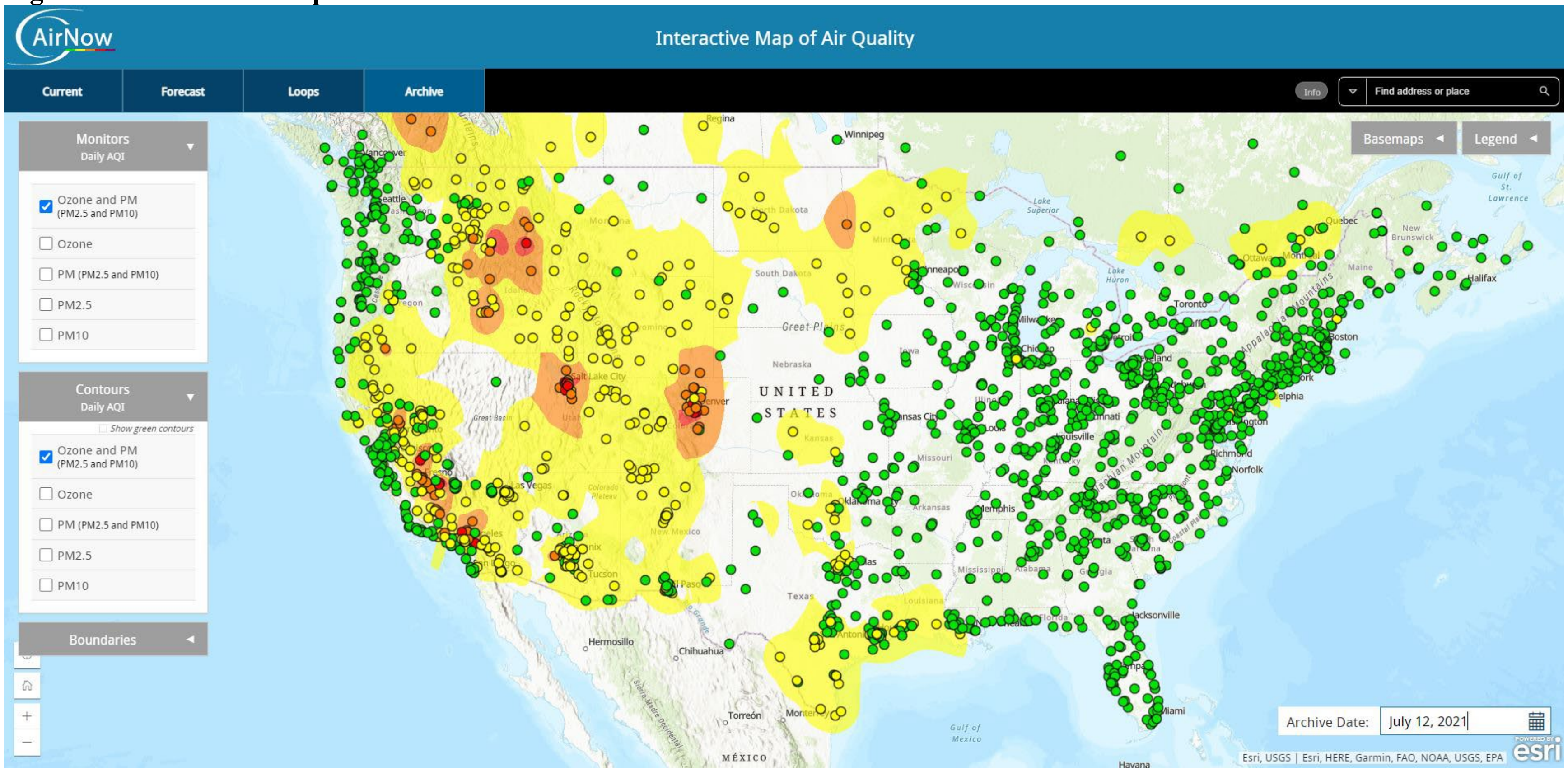
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-8 – AirNow Tech Map for 5/29/21



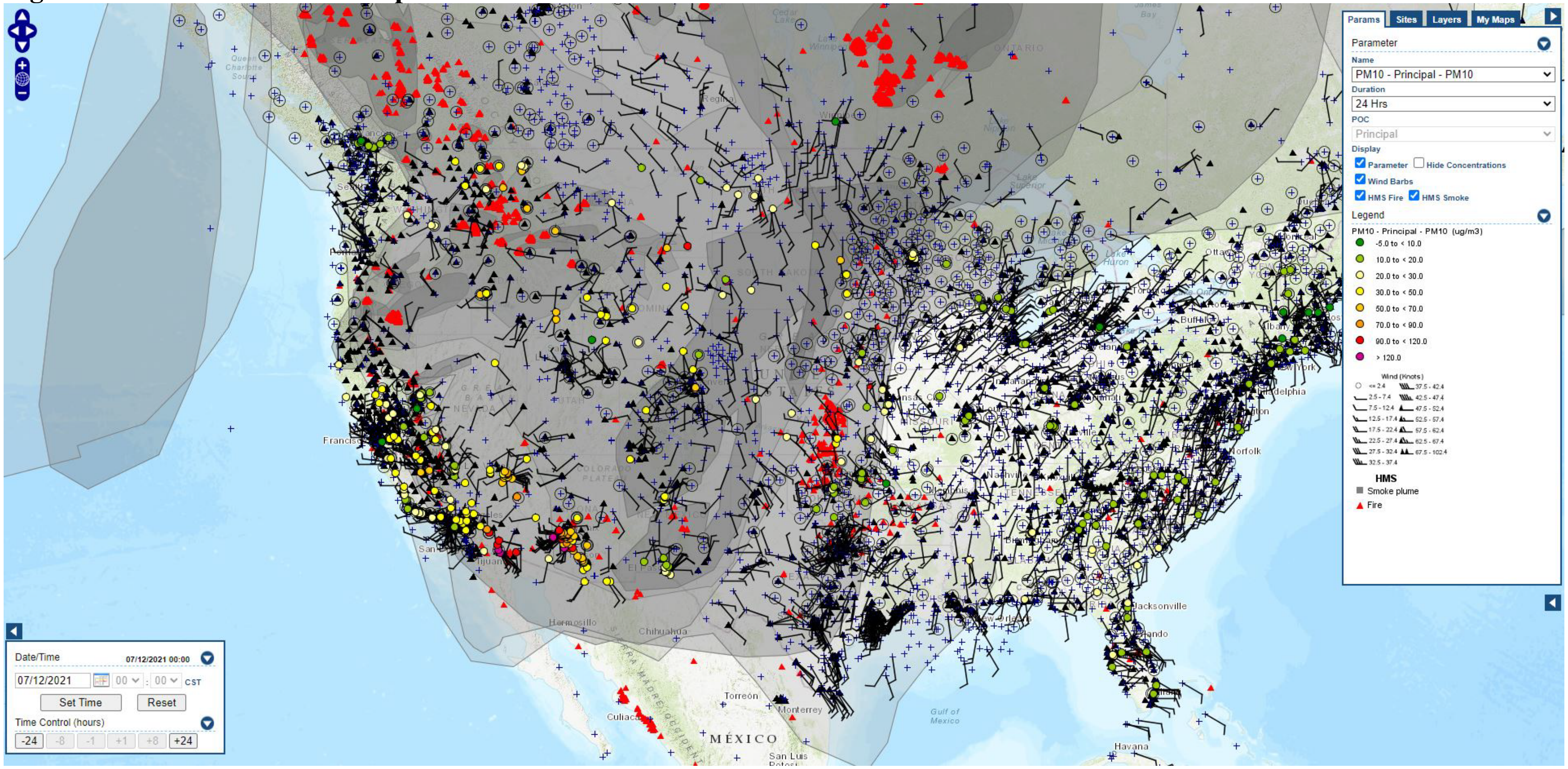
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-9 – AirNow Map for 7/12/21



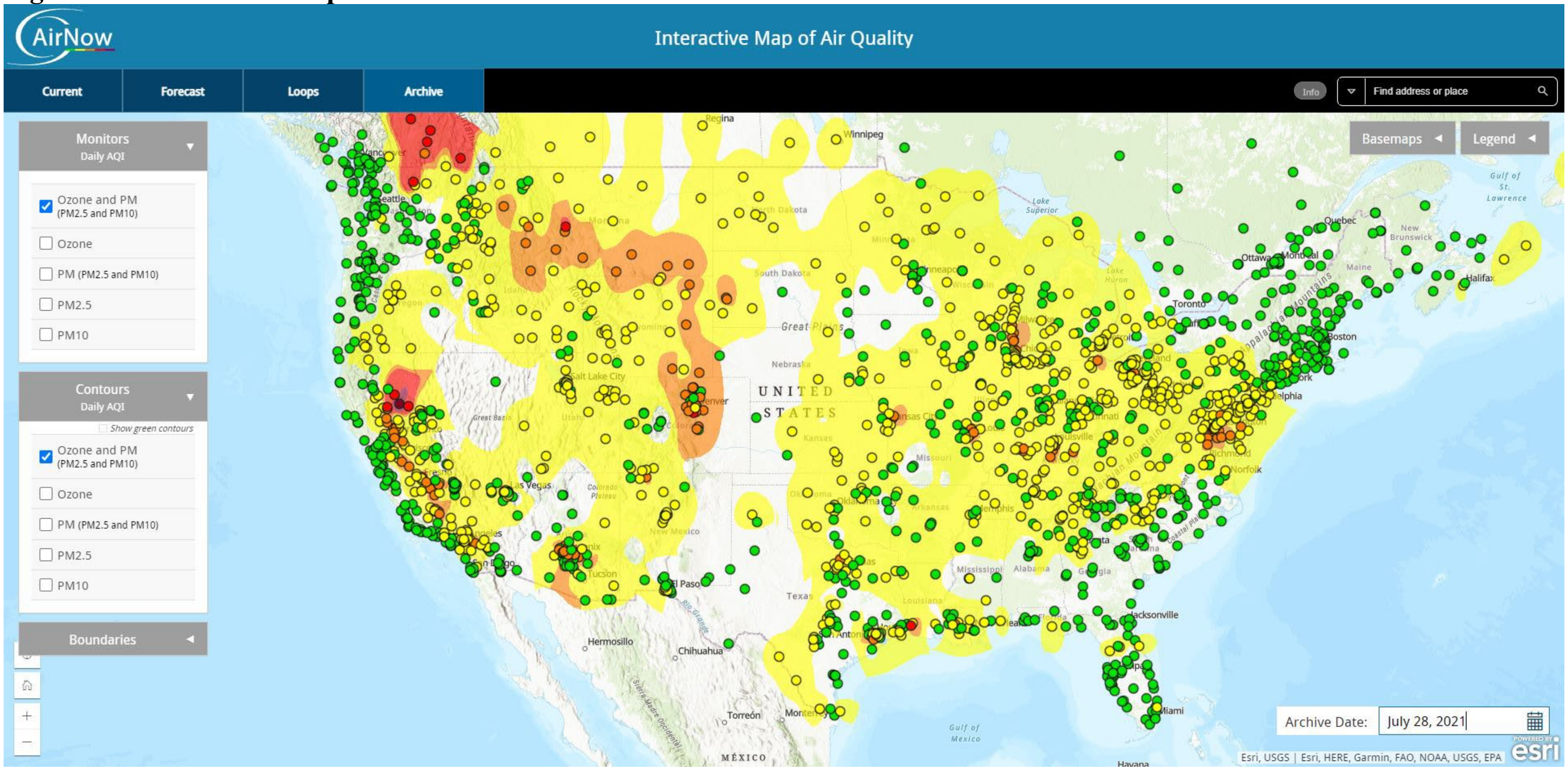
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-10 – AirNow Tech Map for 7/12/21



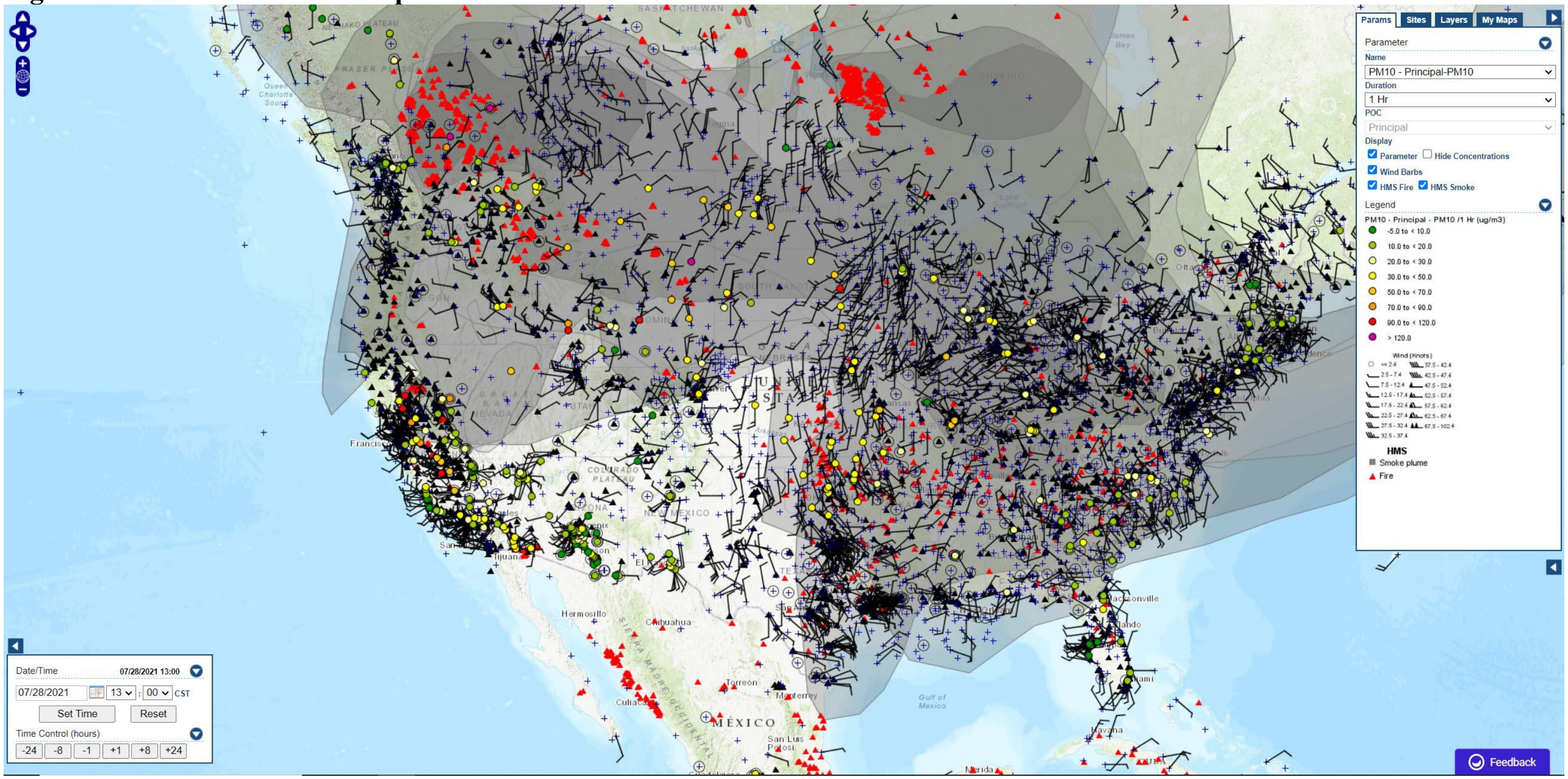
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-11 – AirNow Map for 7/28/21



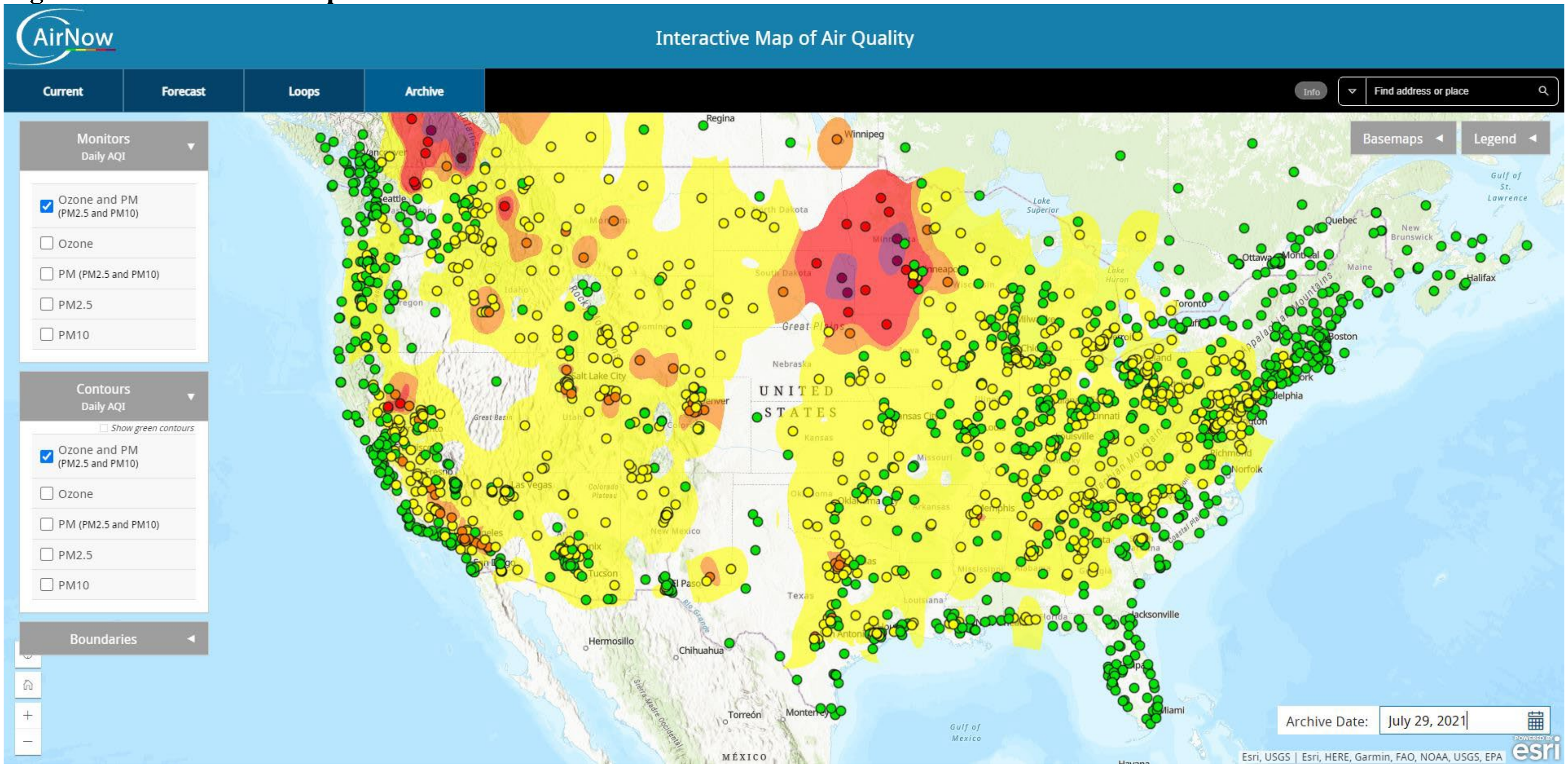
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-12 – AirNow Tech Map for 7/28/21



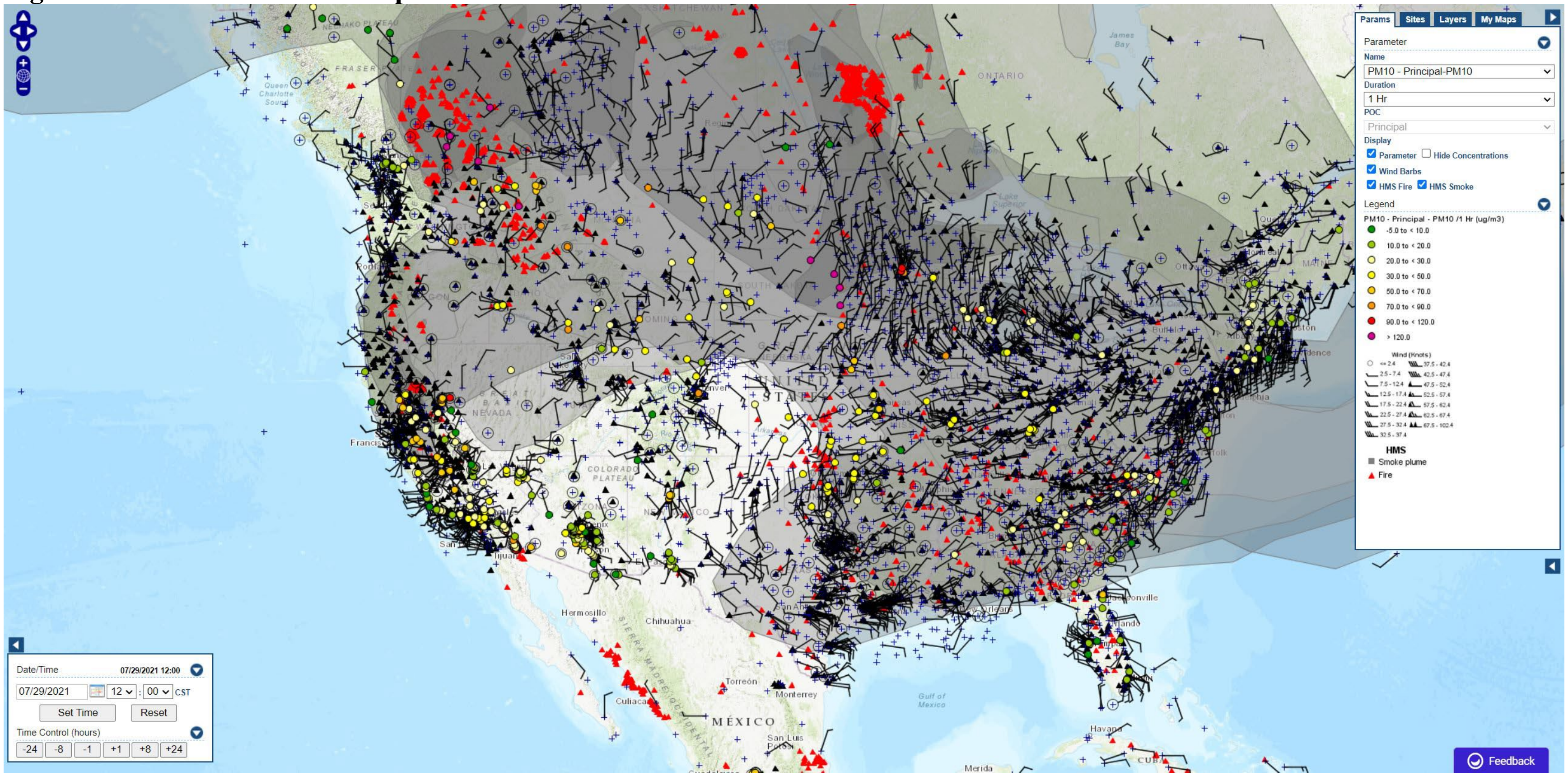
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-13 – AirNow Map for 7/29/21



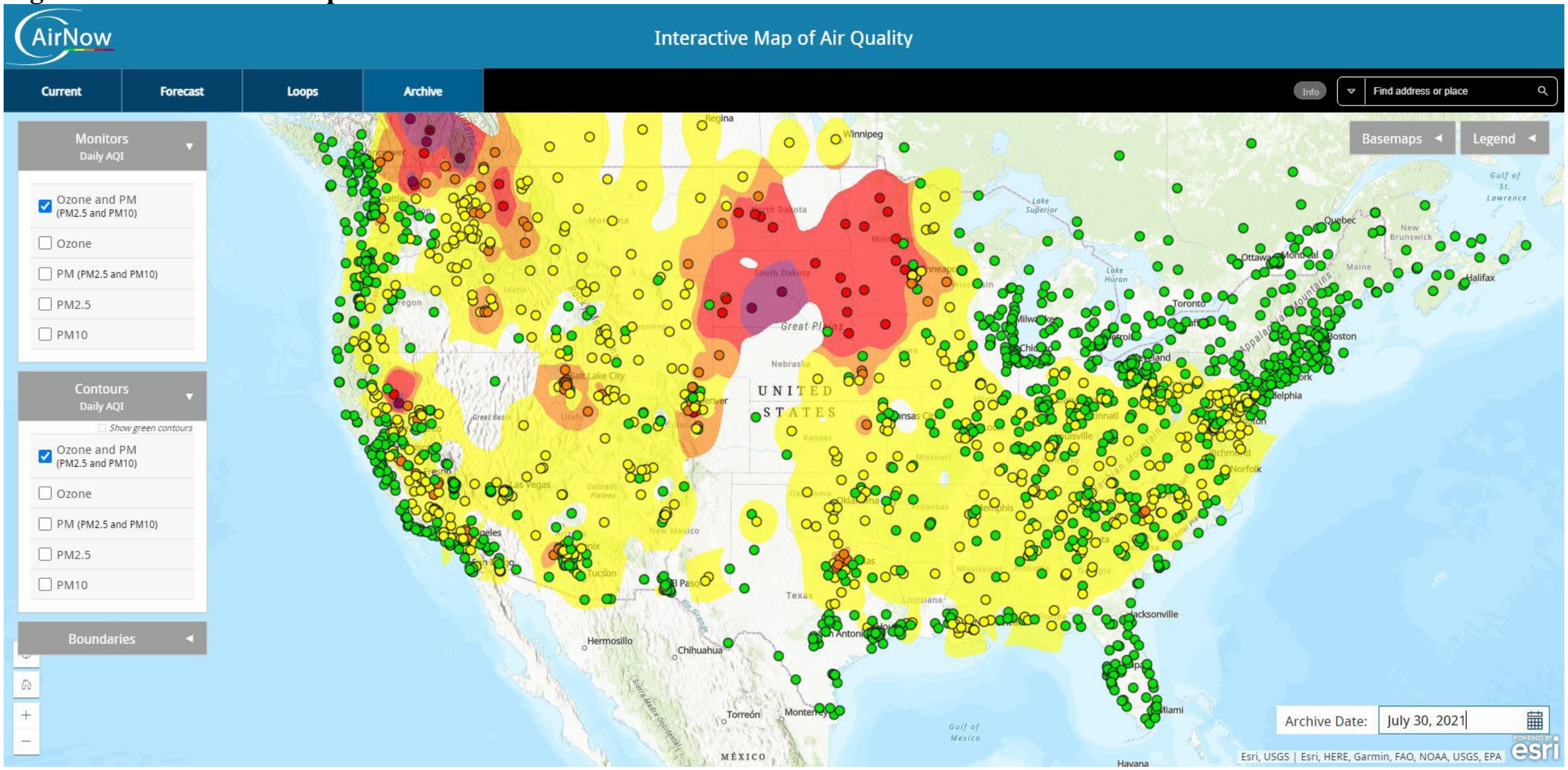
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-14 – AirNow Tech Map for 7/29/21



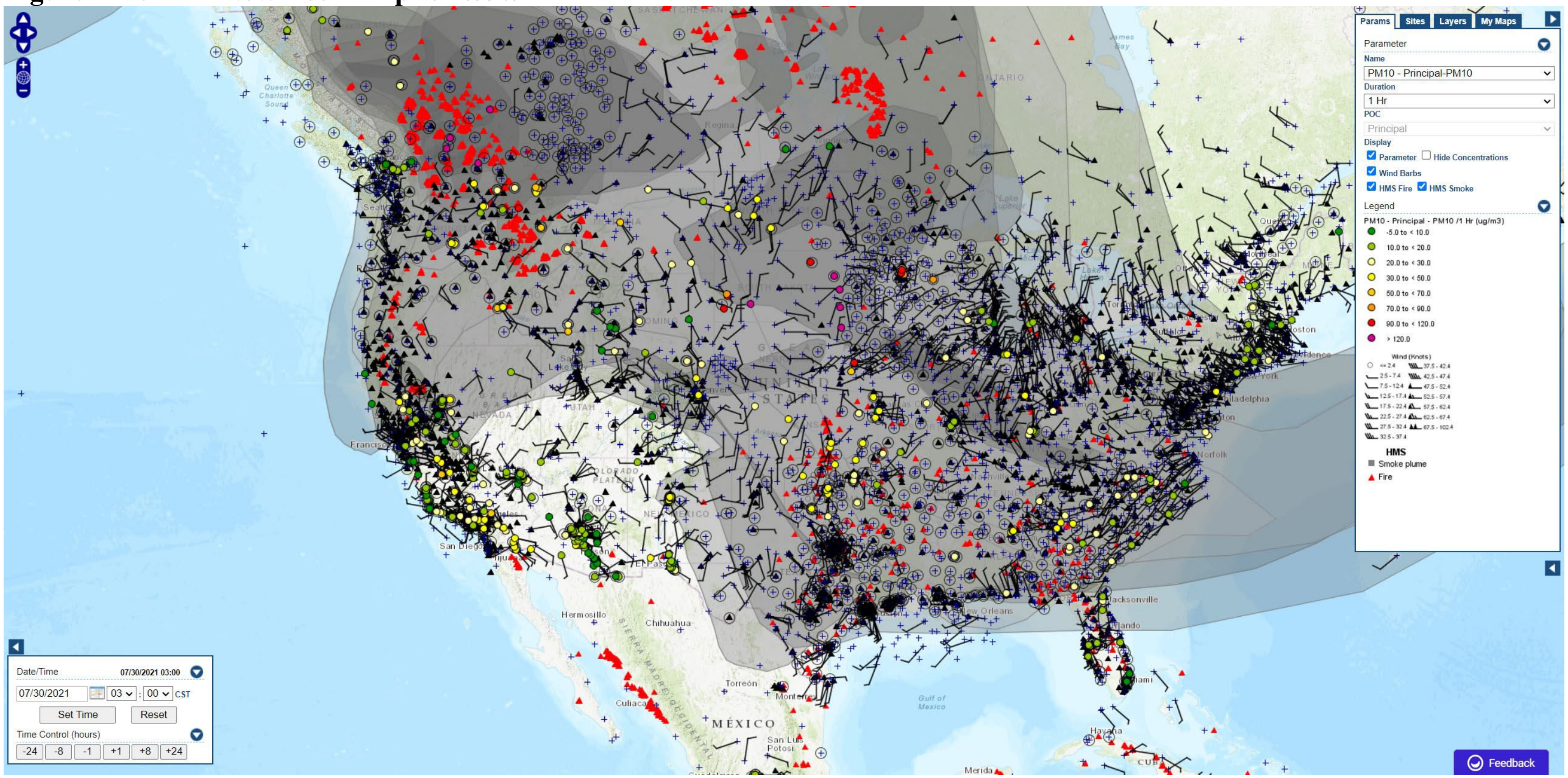
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-15 – AirNow Map for 7/30/21



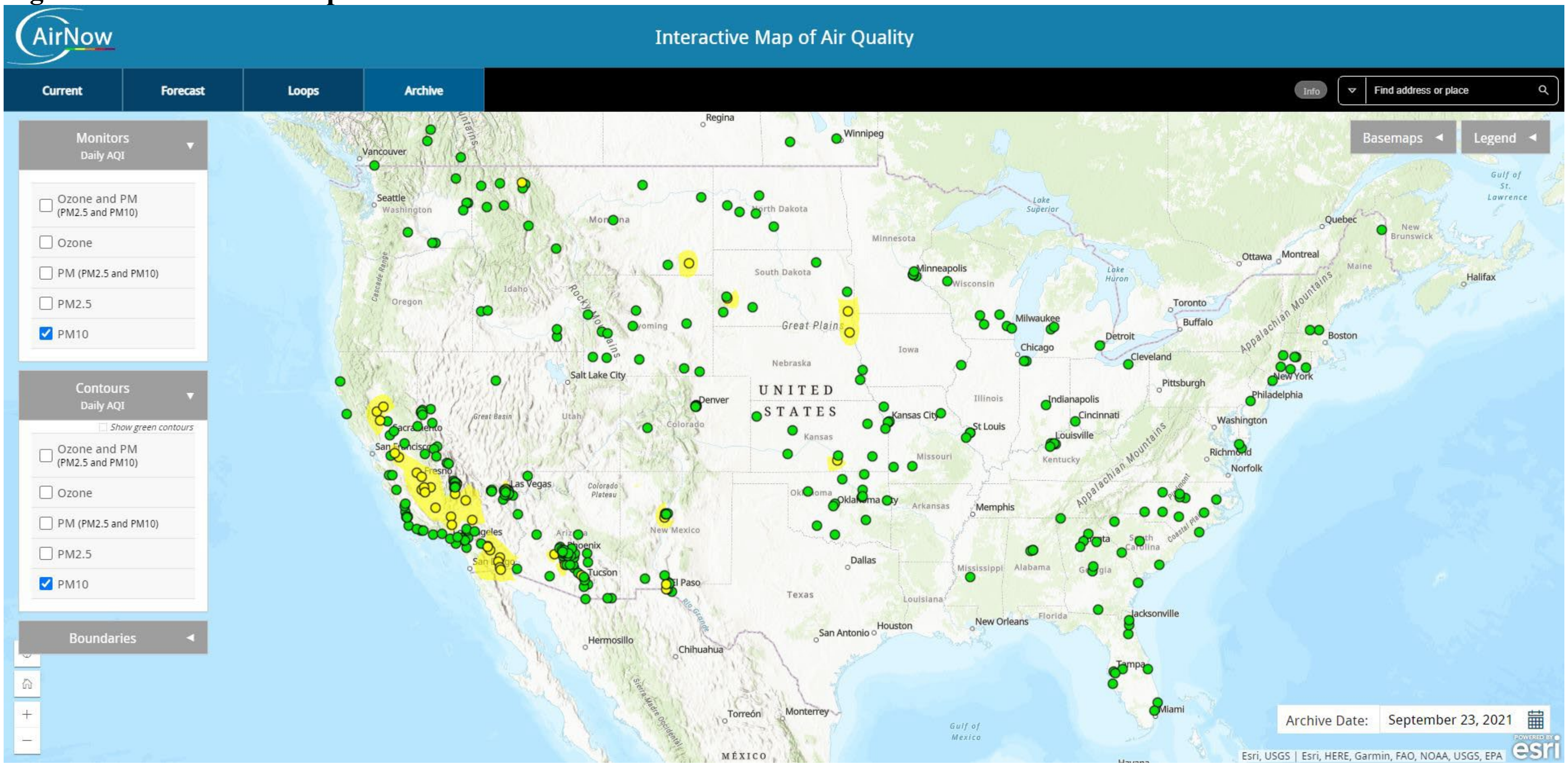
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-16 – AirNow Tech Map for 7/30/21



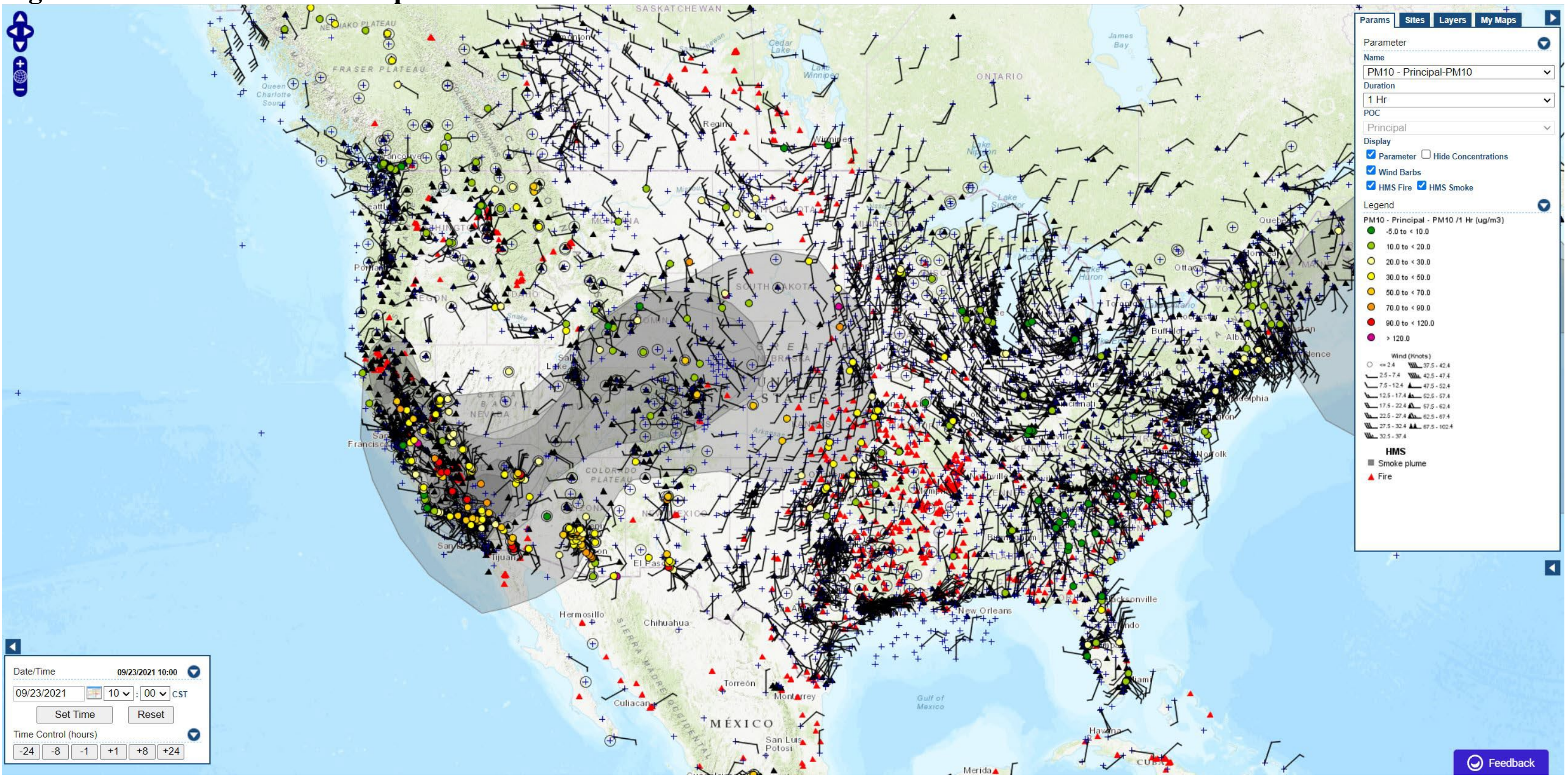
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-17 – AirNow Map for 9/23/21



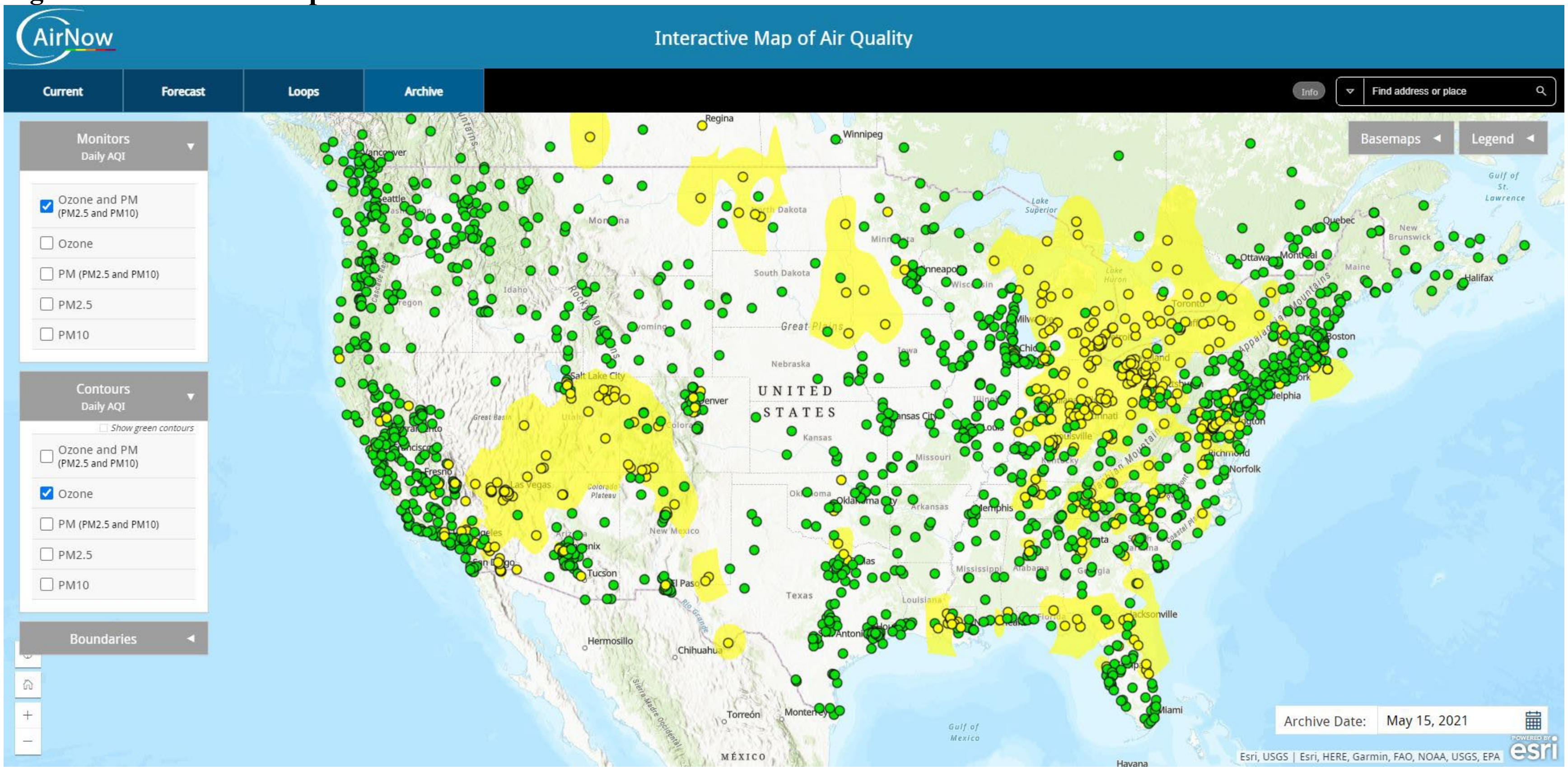
Appendix B
AirNow Maps for 24-hour PM_{10} High Concentration Day

Figure B-18 – AirNow Tech Map for 9/23/21



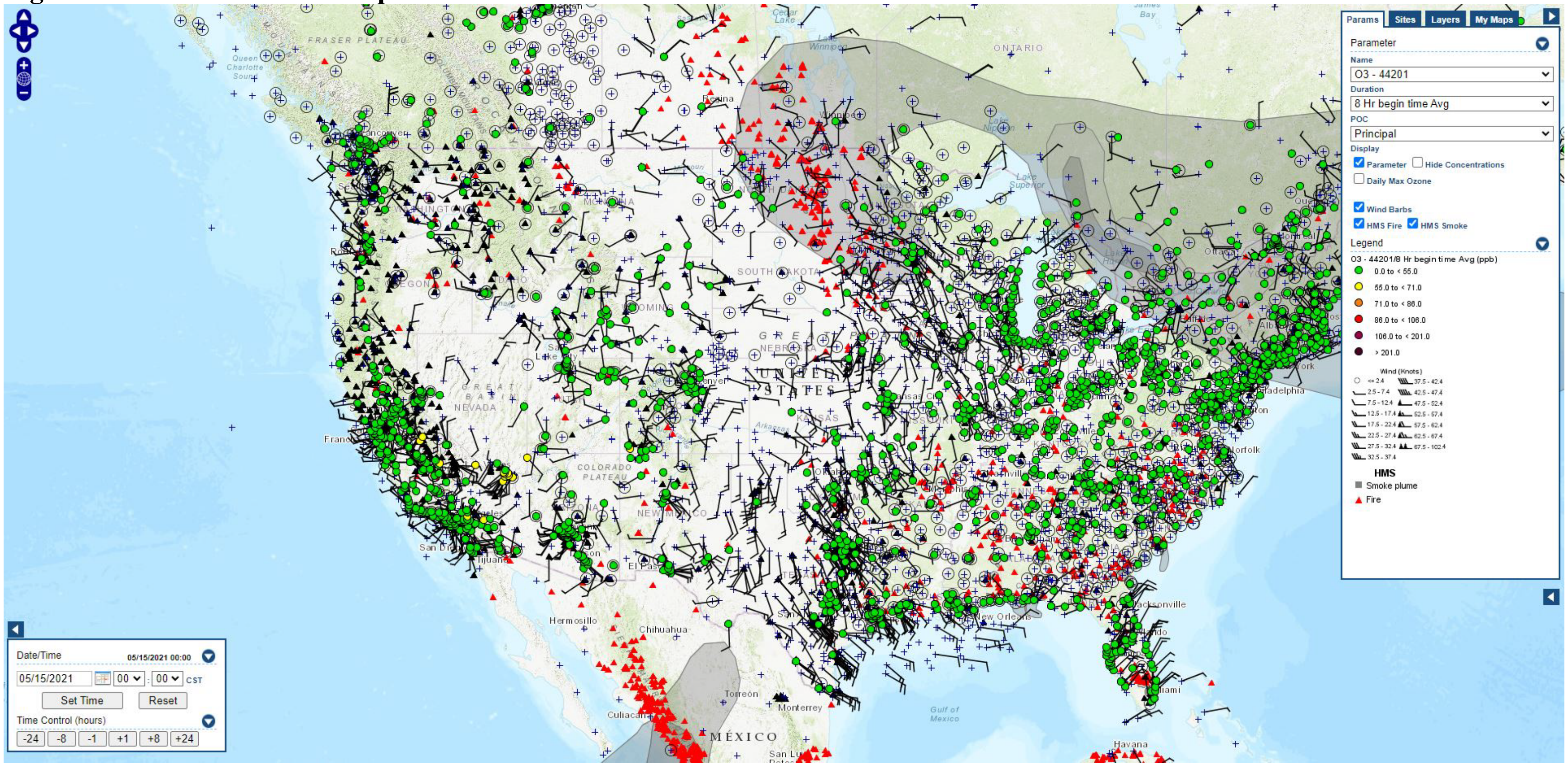
Appendix C
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-1 - AirNow Map for 5/15/21



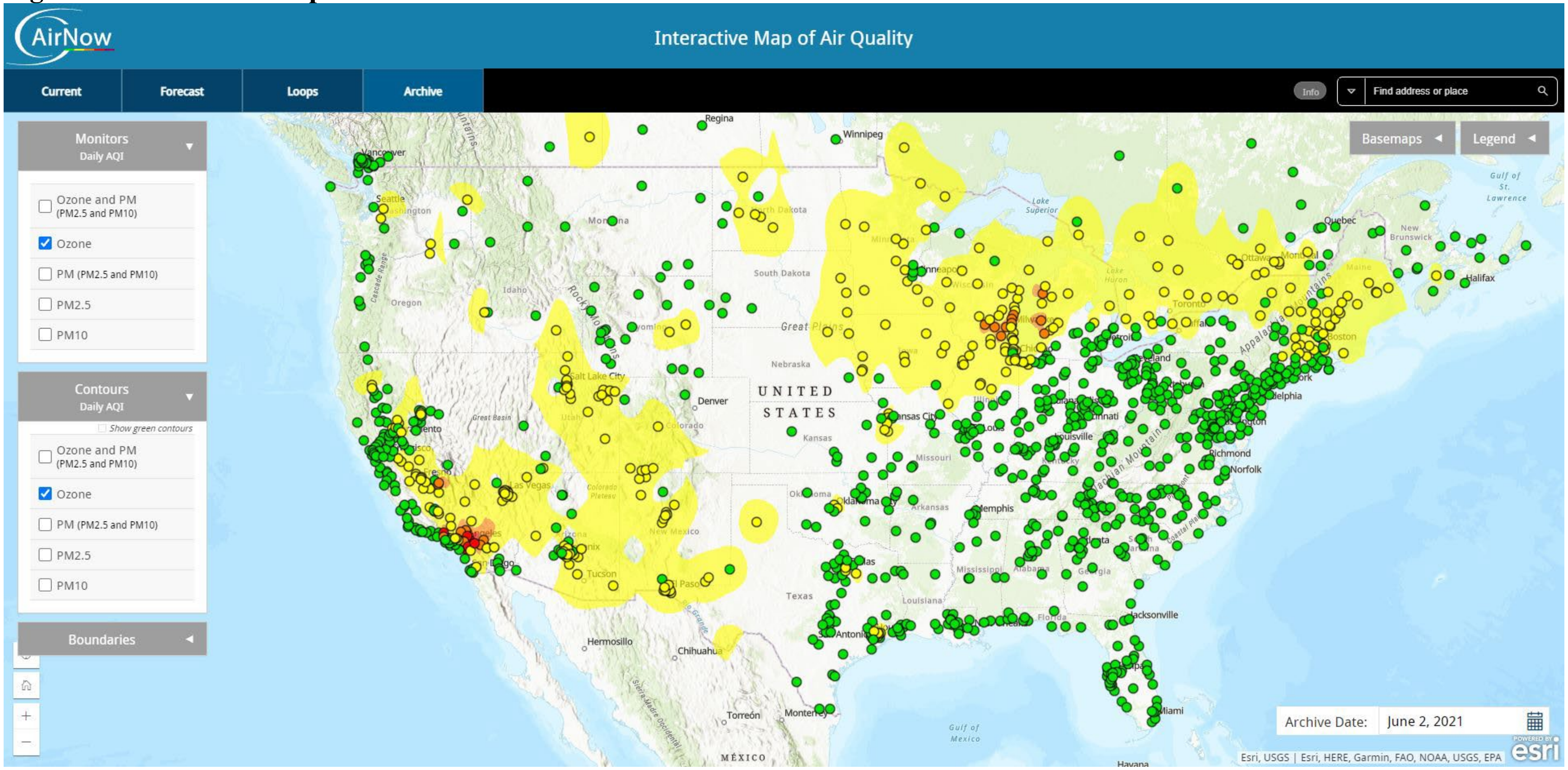
Appendix C
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-2 - AirNow Tech Map for 5/15//21



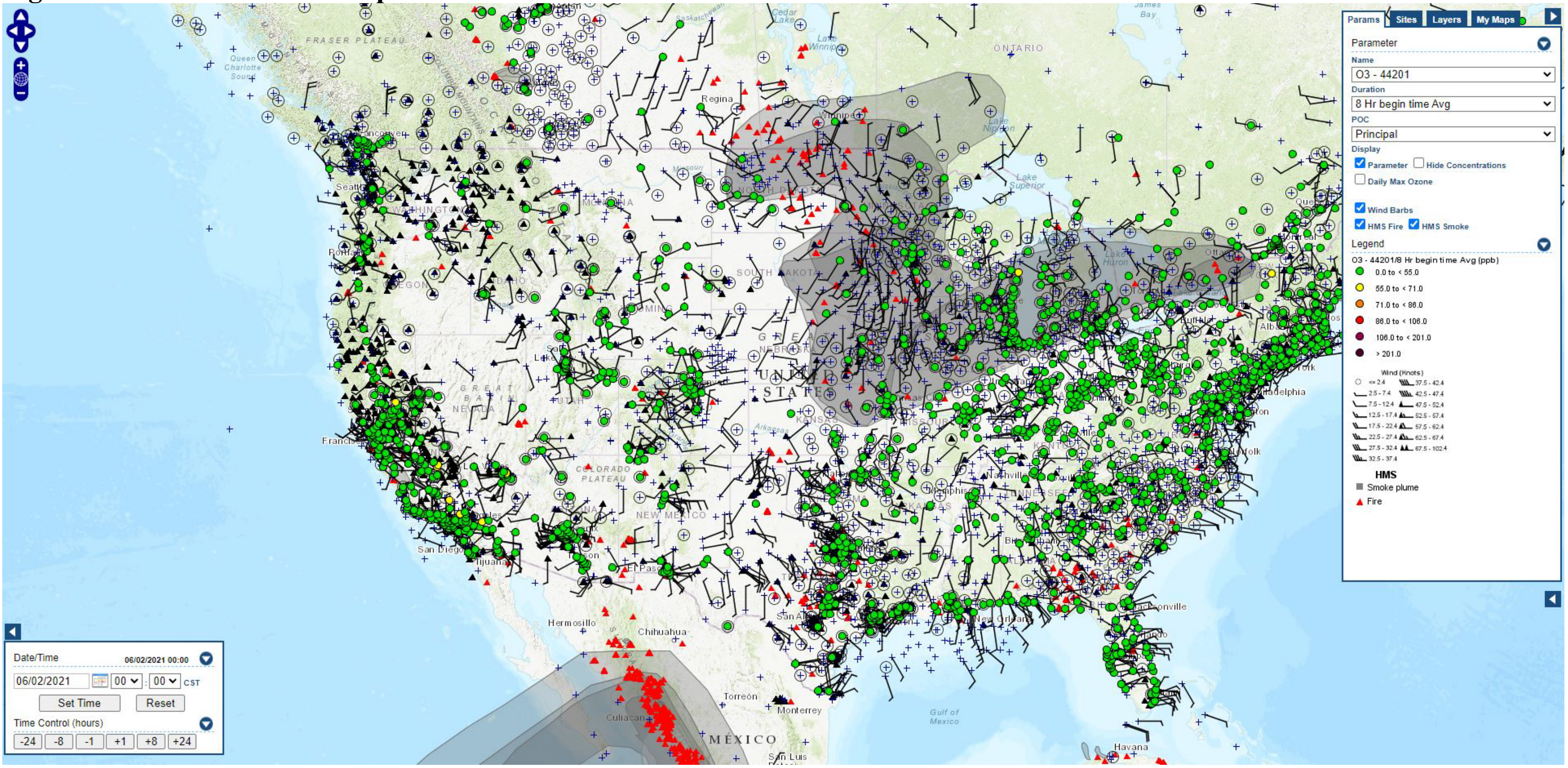
Appendix C
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-3 - AirNow Map for 6/2/21



Appendix C
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-4 - AirNow Tech Map for 6/2/21



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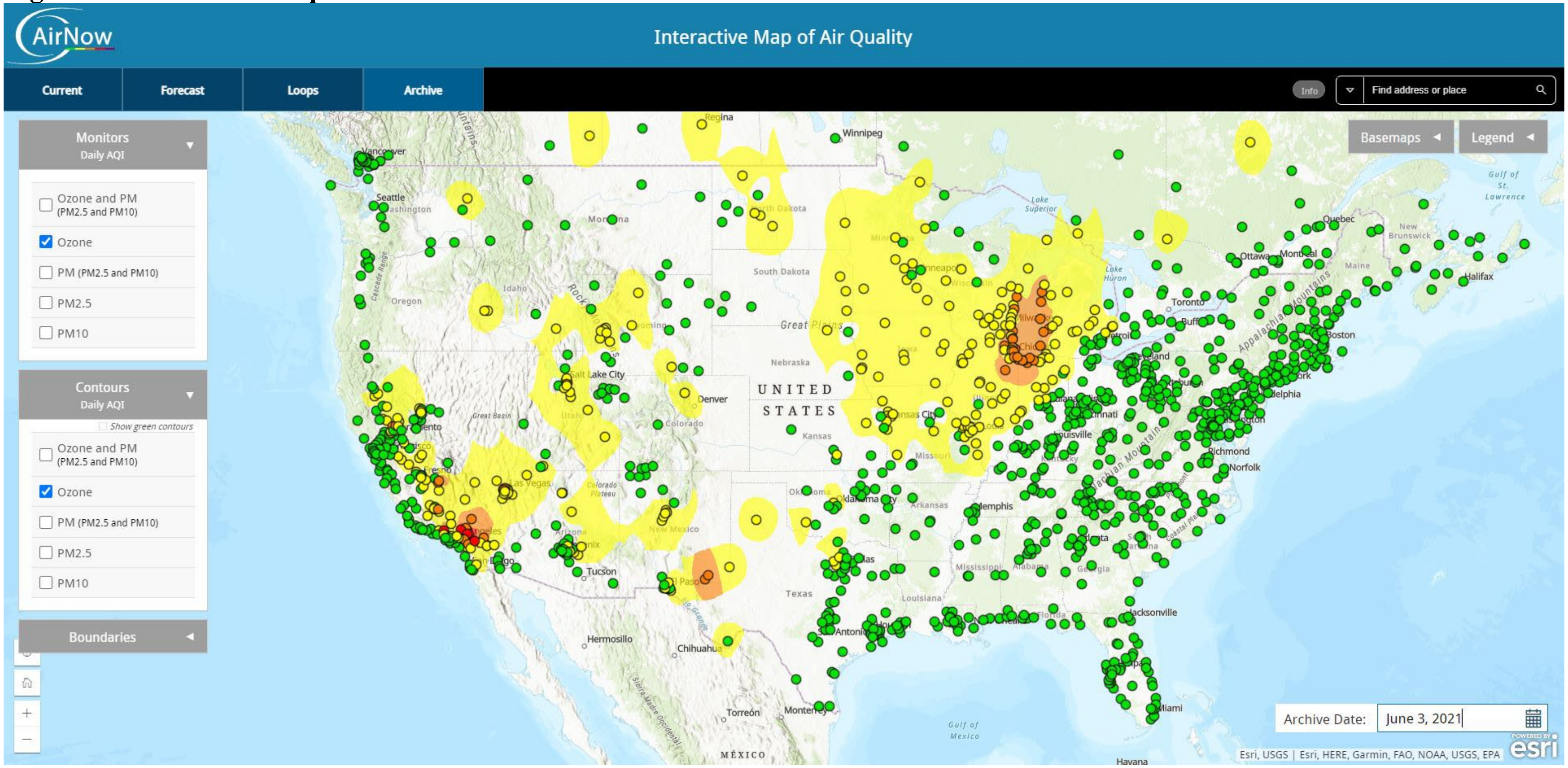
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-5 - AirNow Map for 6/3/21



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AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-6 - AirNow Tech Map for 6/3/21

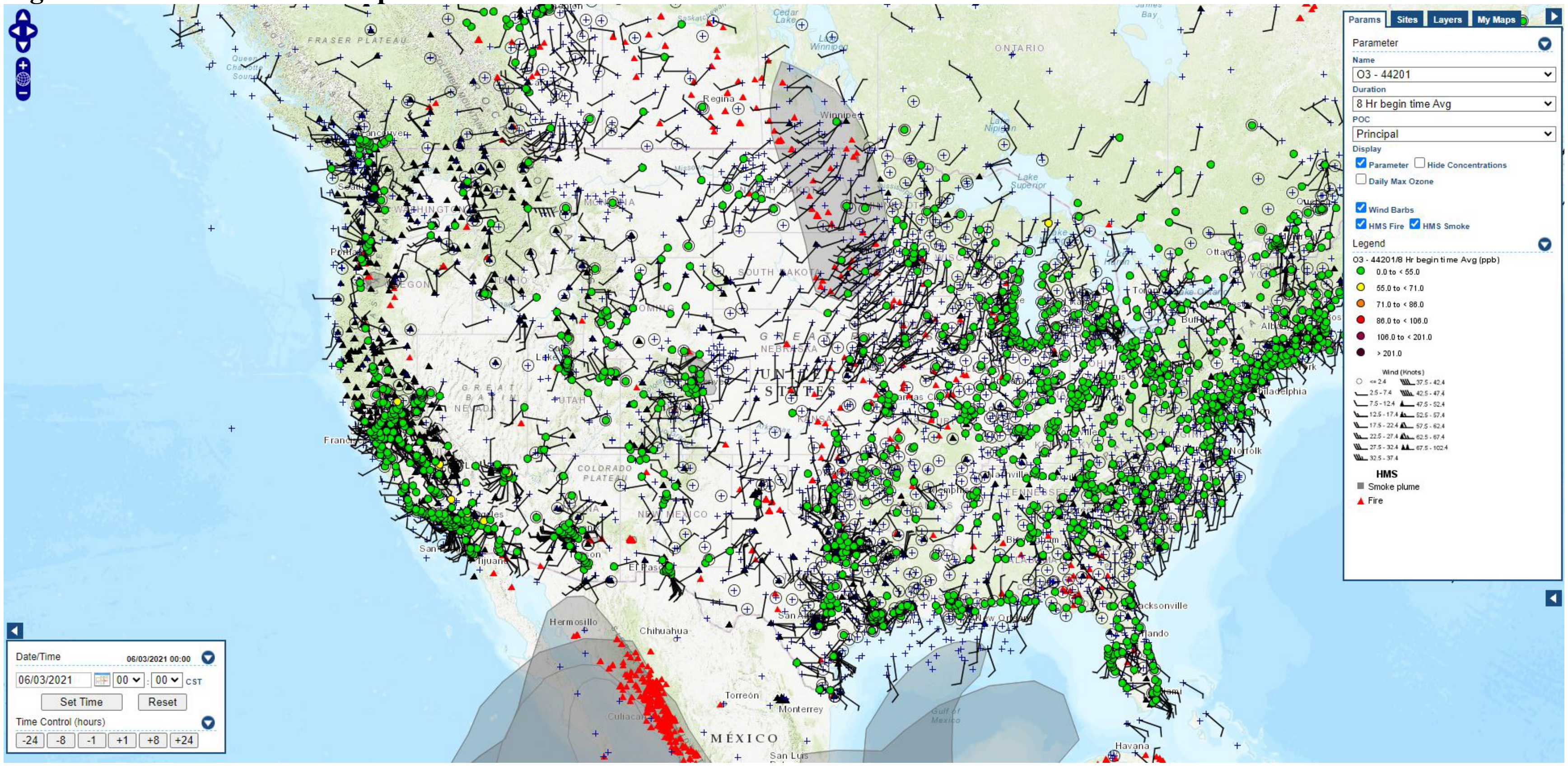

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Figure C-7 - AirNow Map for 6/4/21

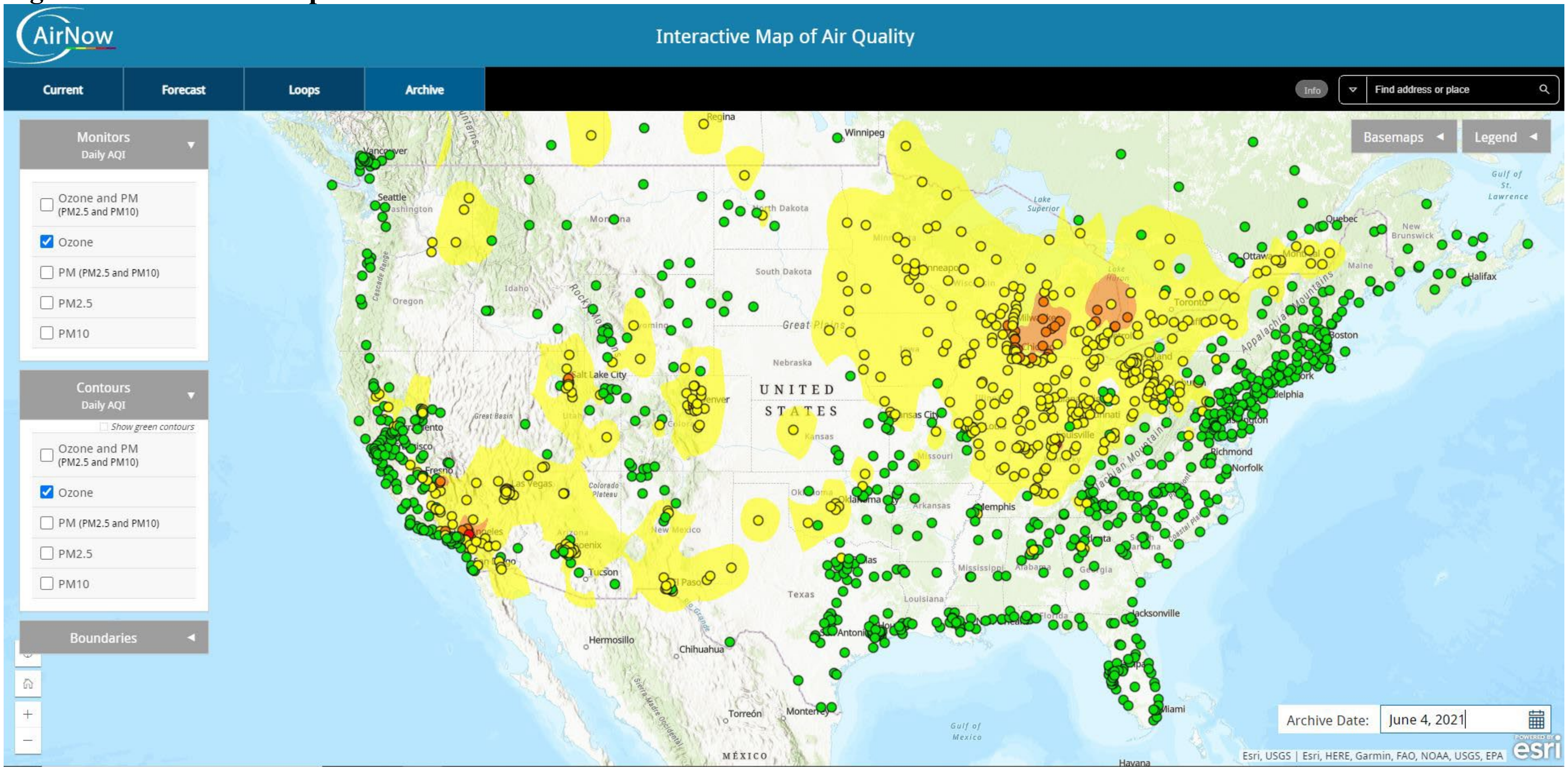

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Figure C-8 - AirNow Tech Map for 6/4/21

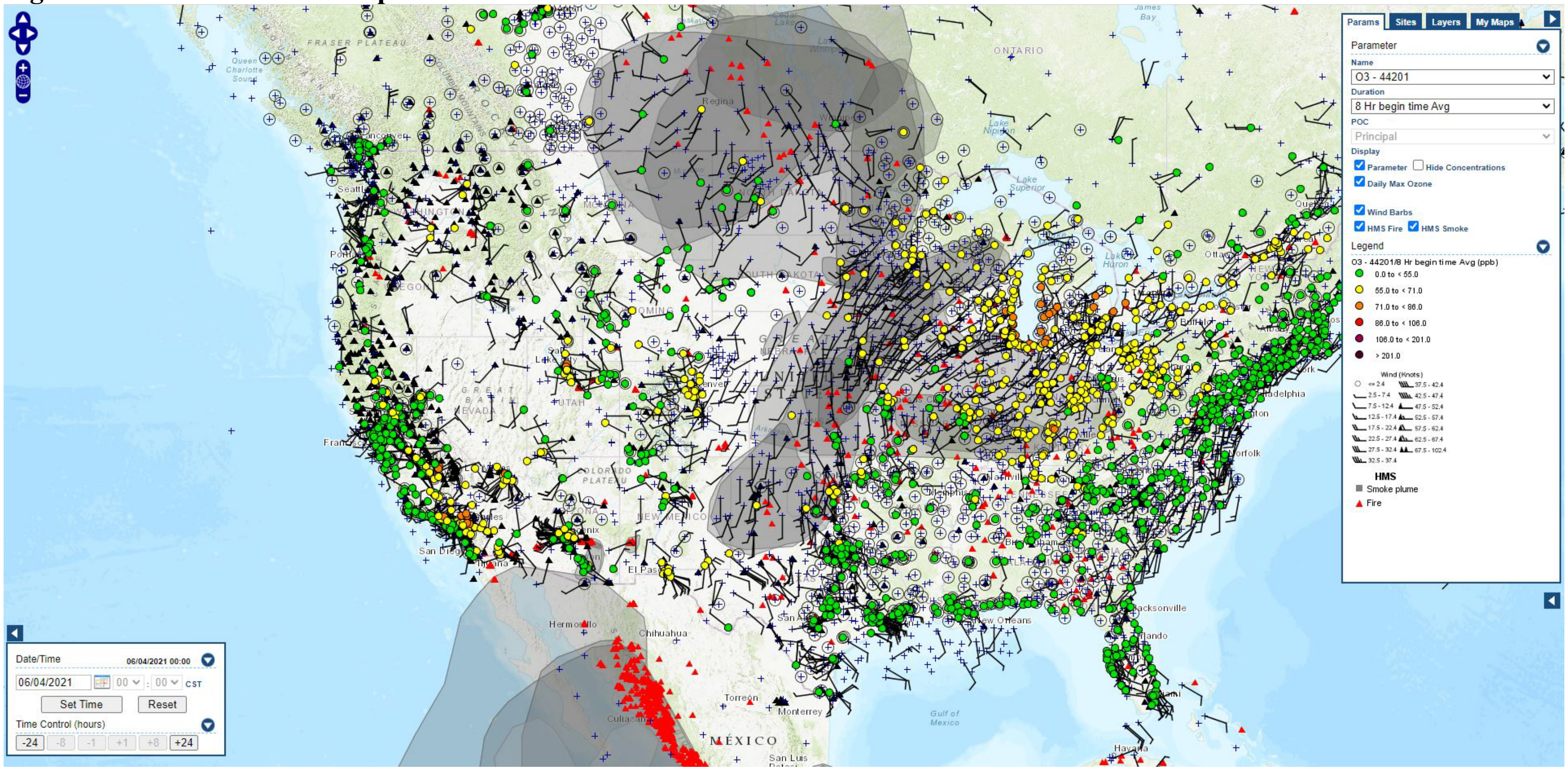

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Figure C-9 - AirNow Map for 6/5/21

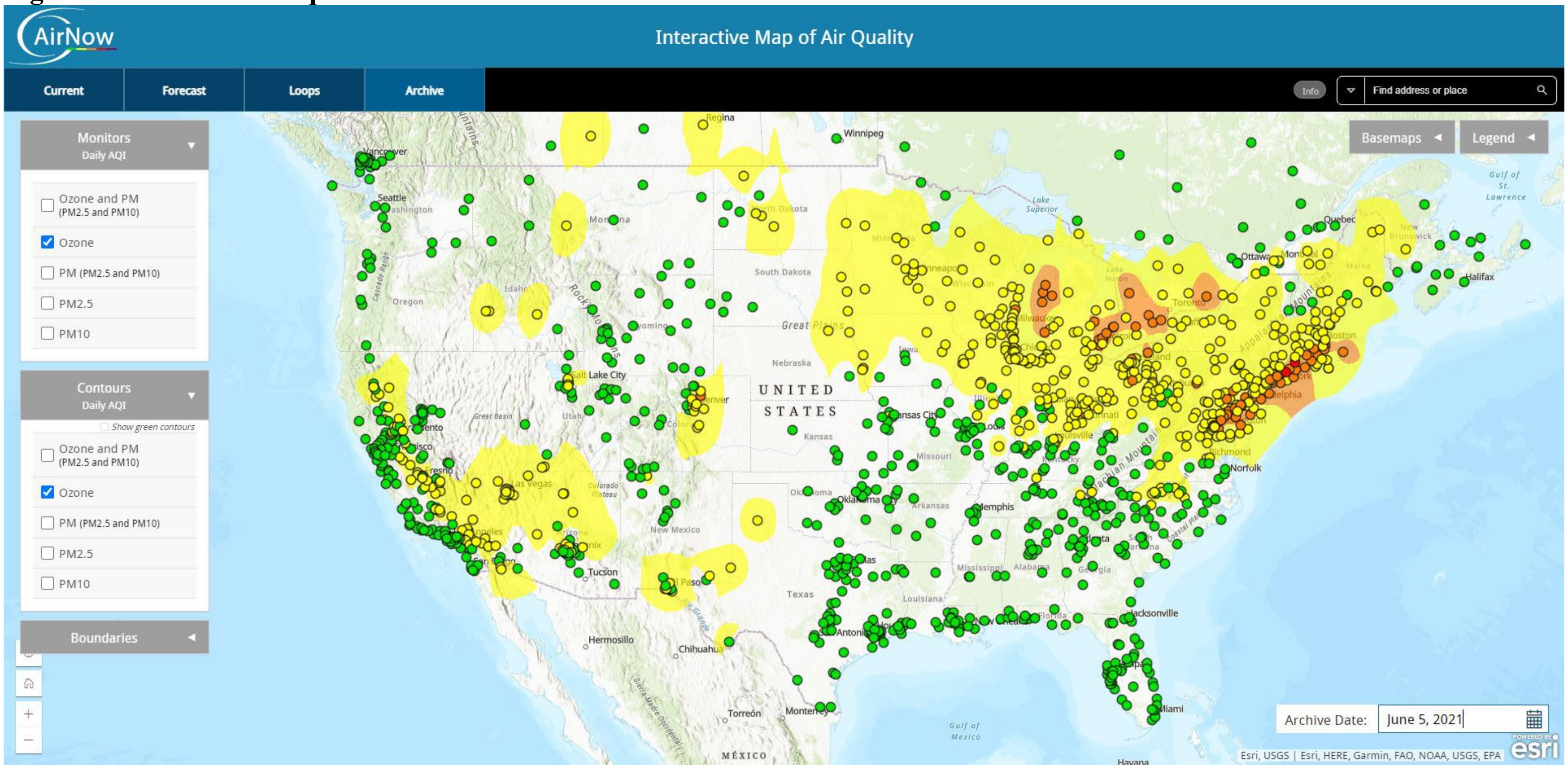

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Figure C-10 - AirNow Tech Map for 6/5/21

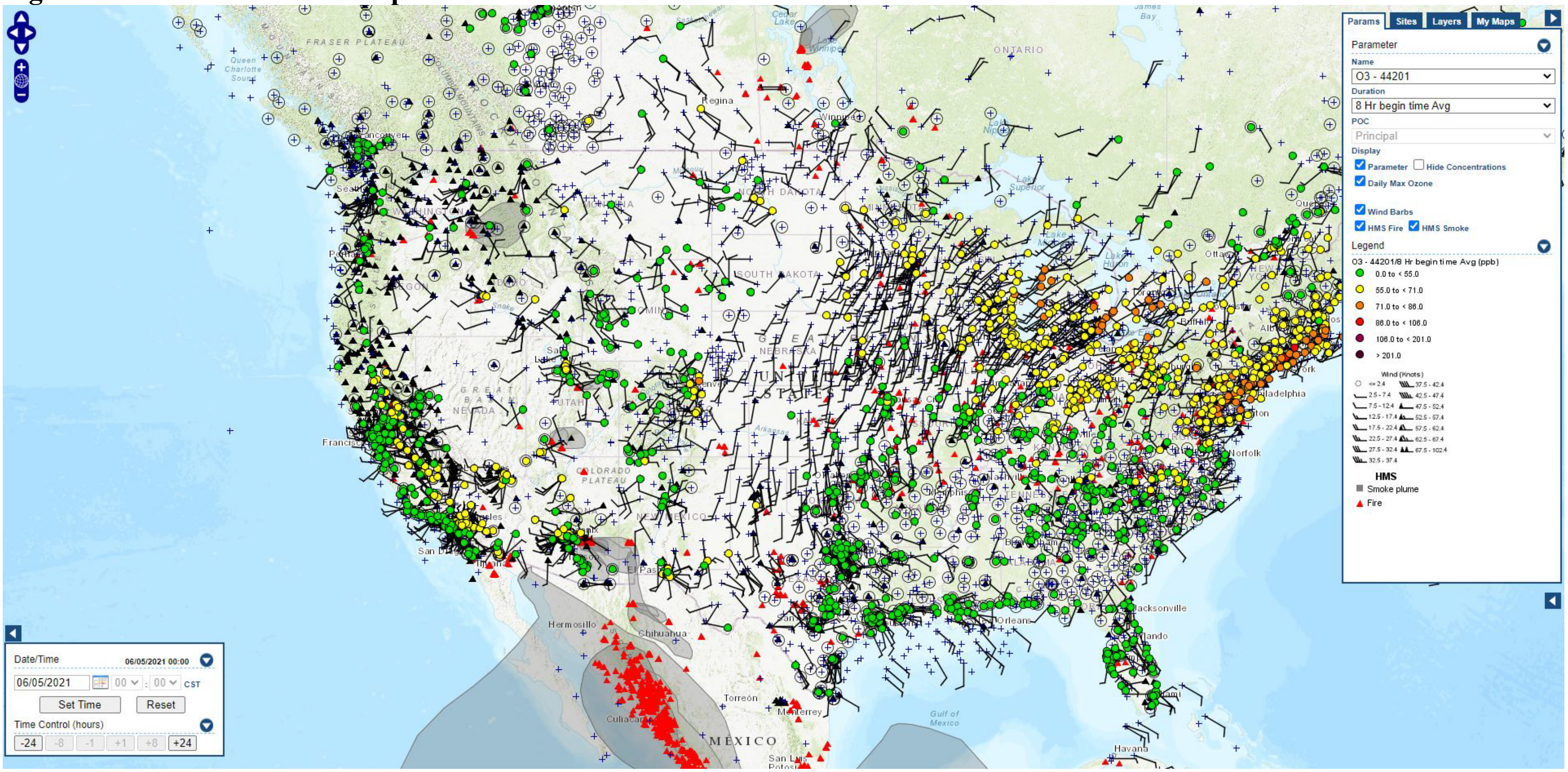

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Figure C-11 - AirNow Map for 6/7/21

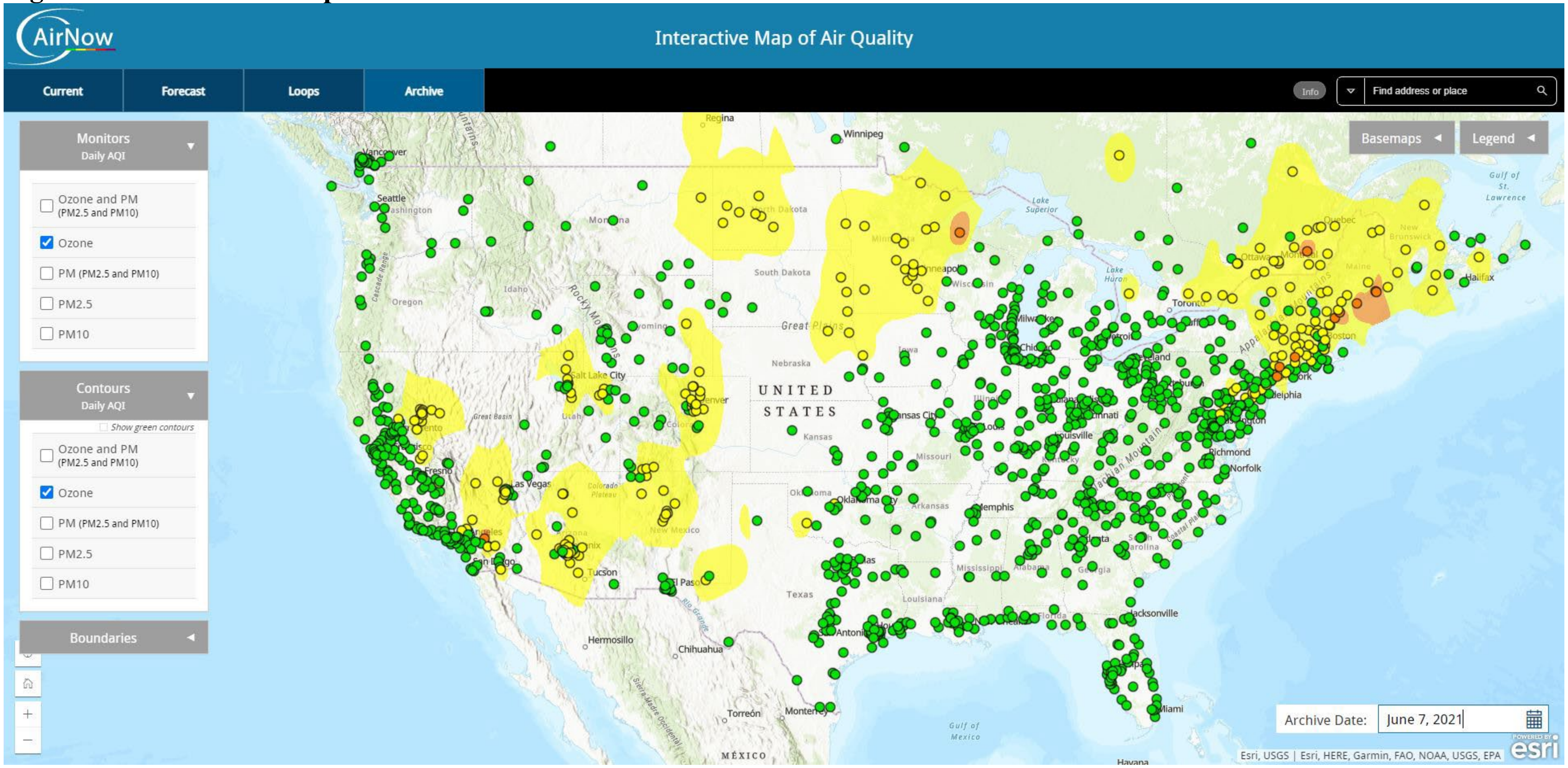

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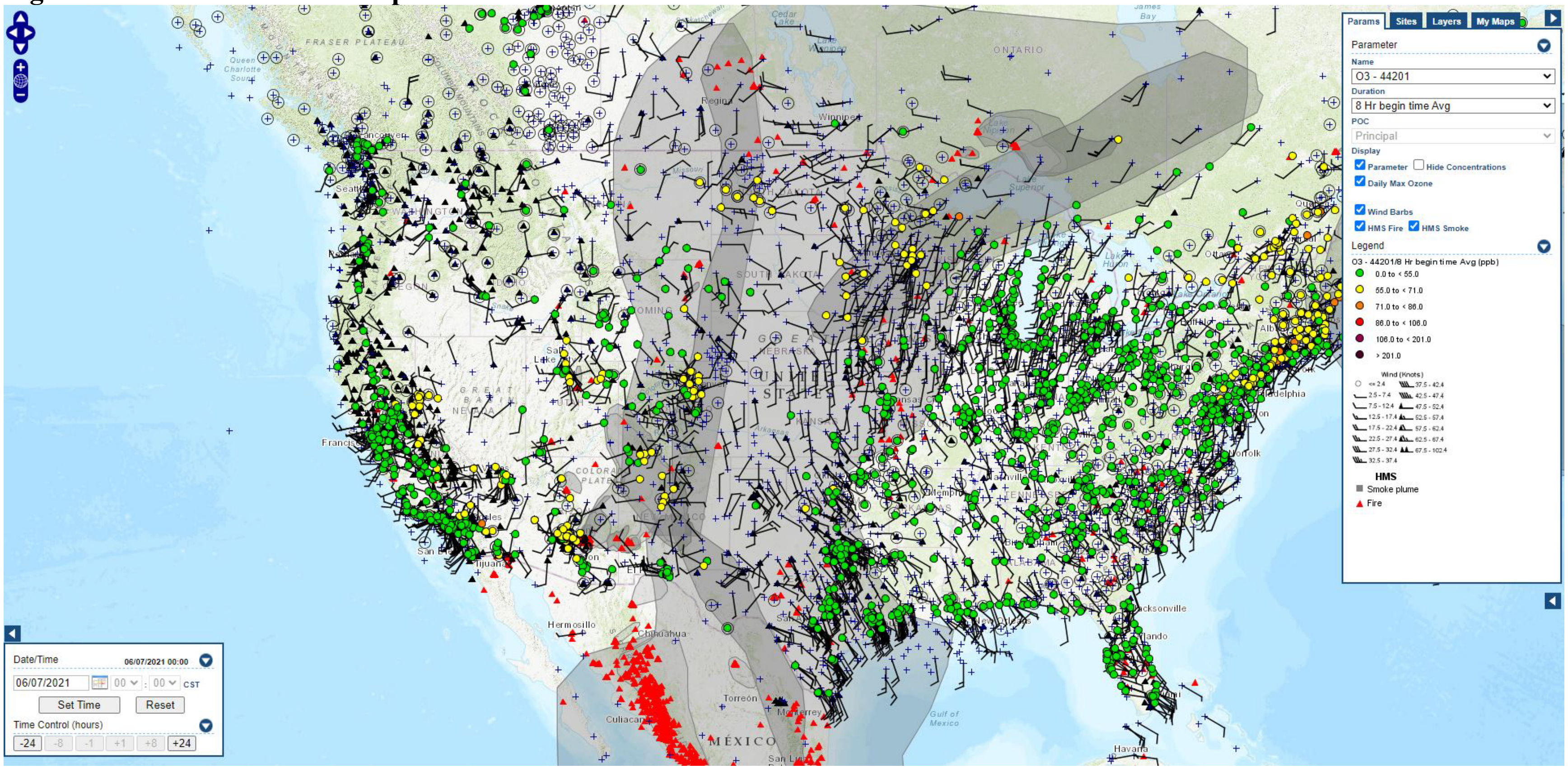
Figure C-12 - AirNow Tech Map for 6/7/21



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AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-13 - AirNow Map for 6/10/21

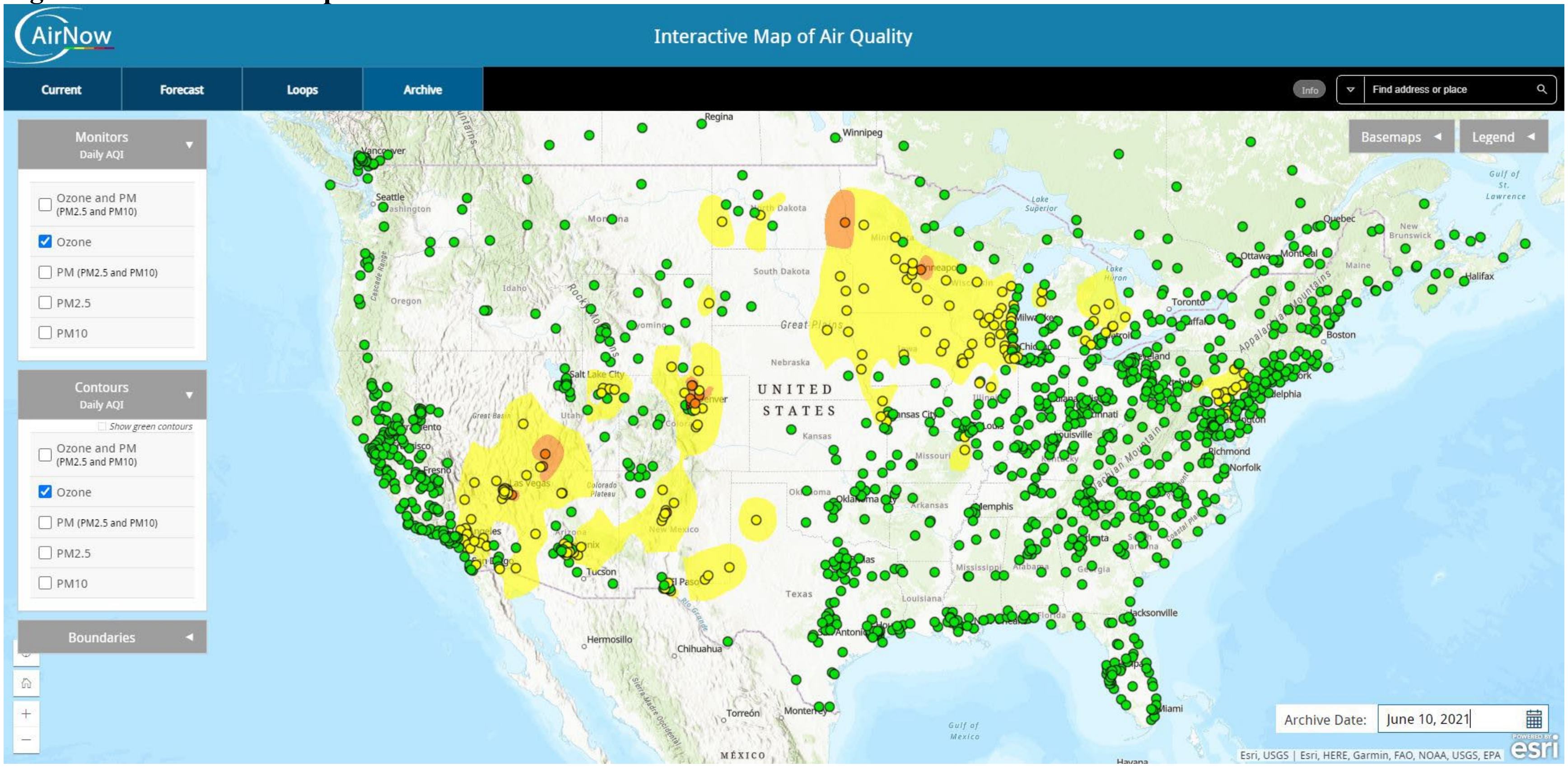

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Figure C-14 - AirNow Tech Map for 6/10/21

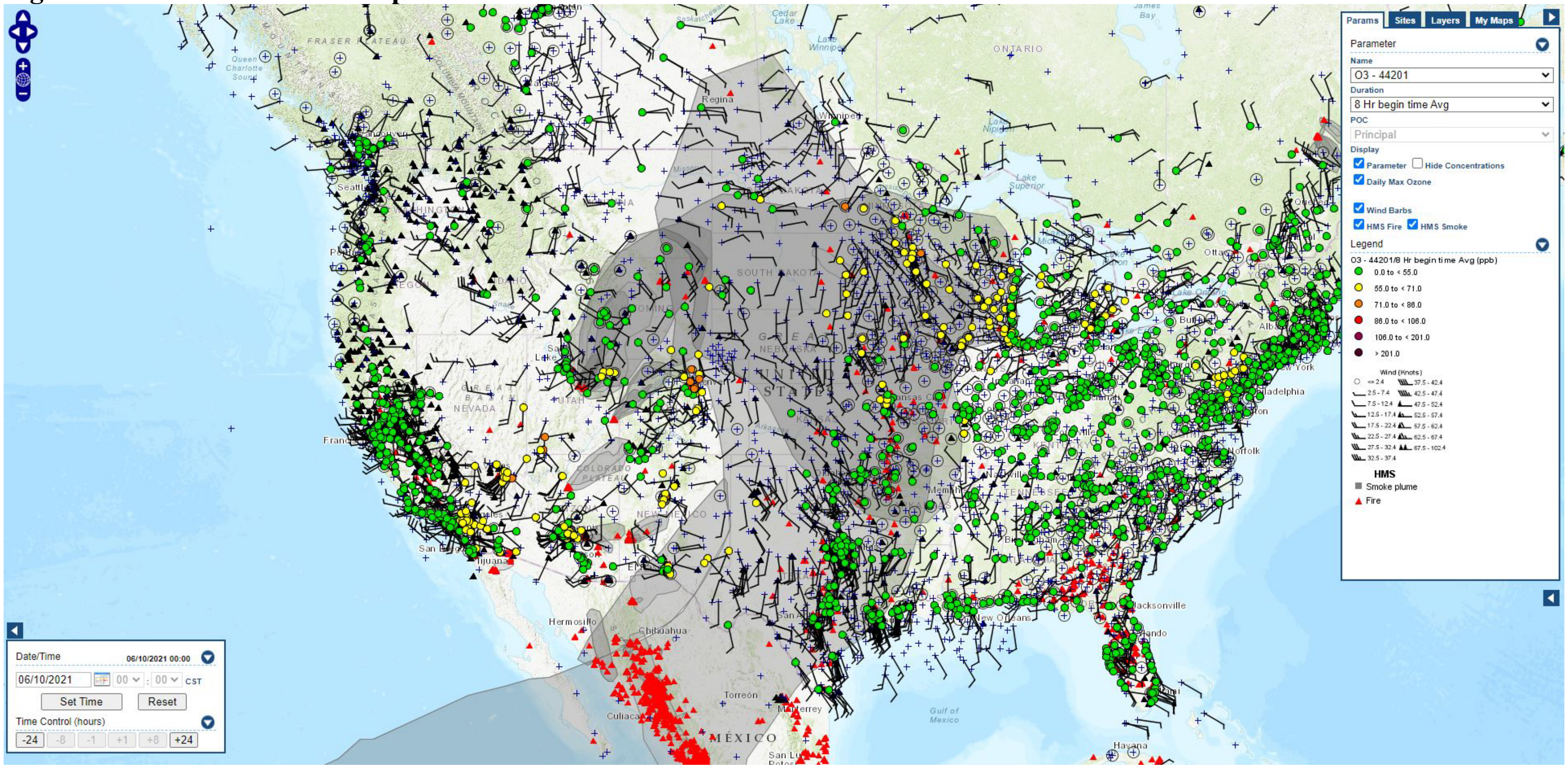

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Figure C-15 - AirNow Map for 6/13/21

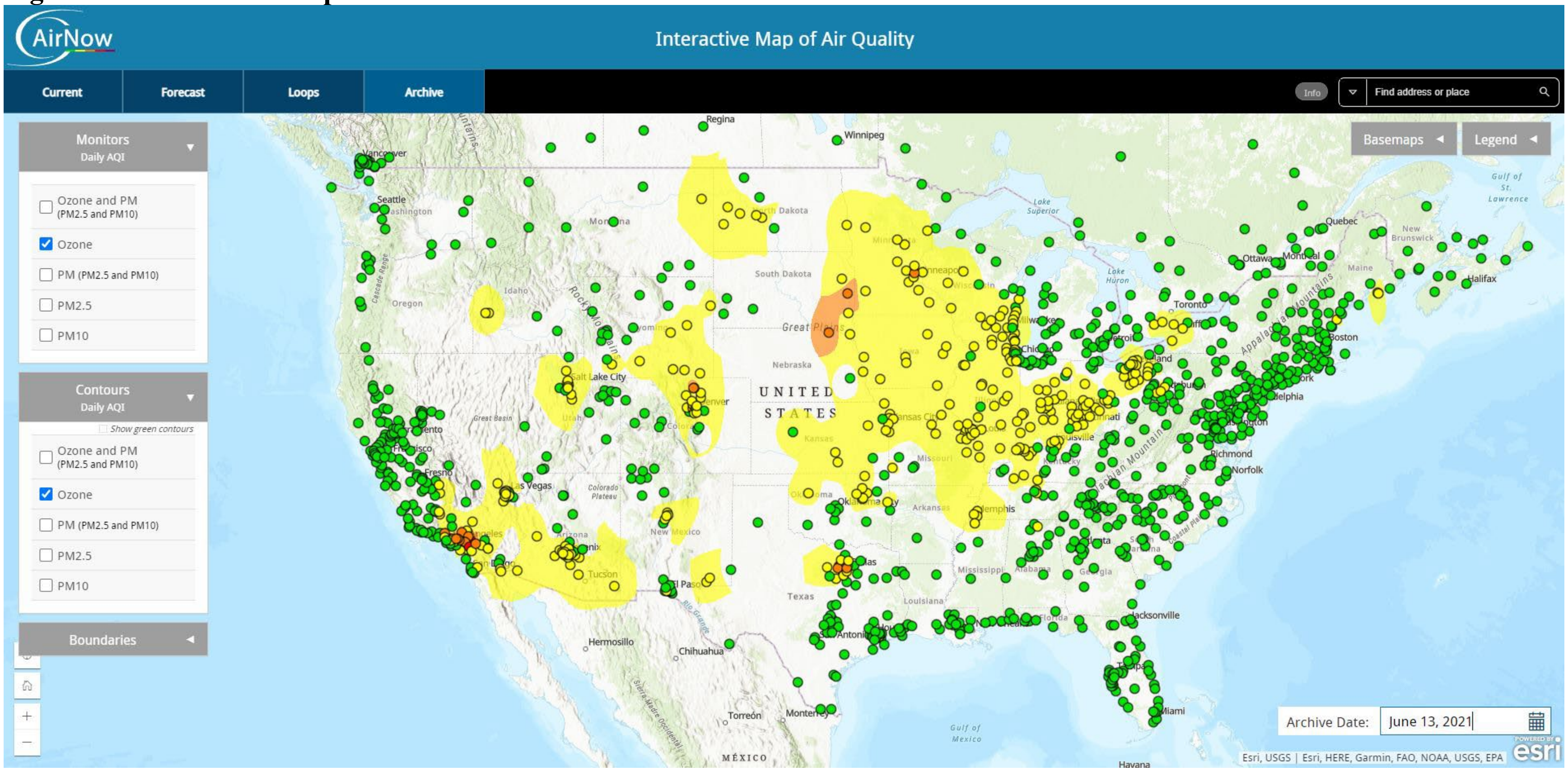

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Figure C-16 - AirNow Tech Map for 6/13/21

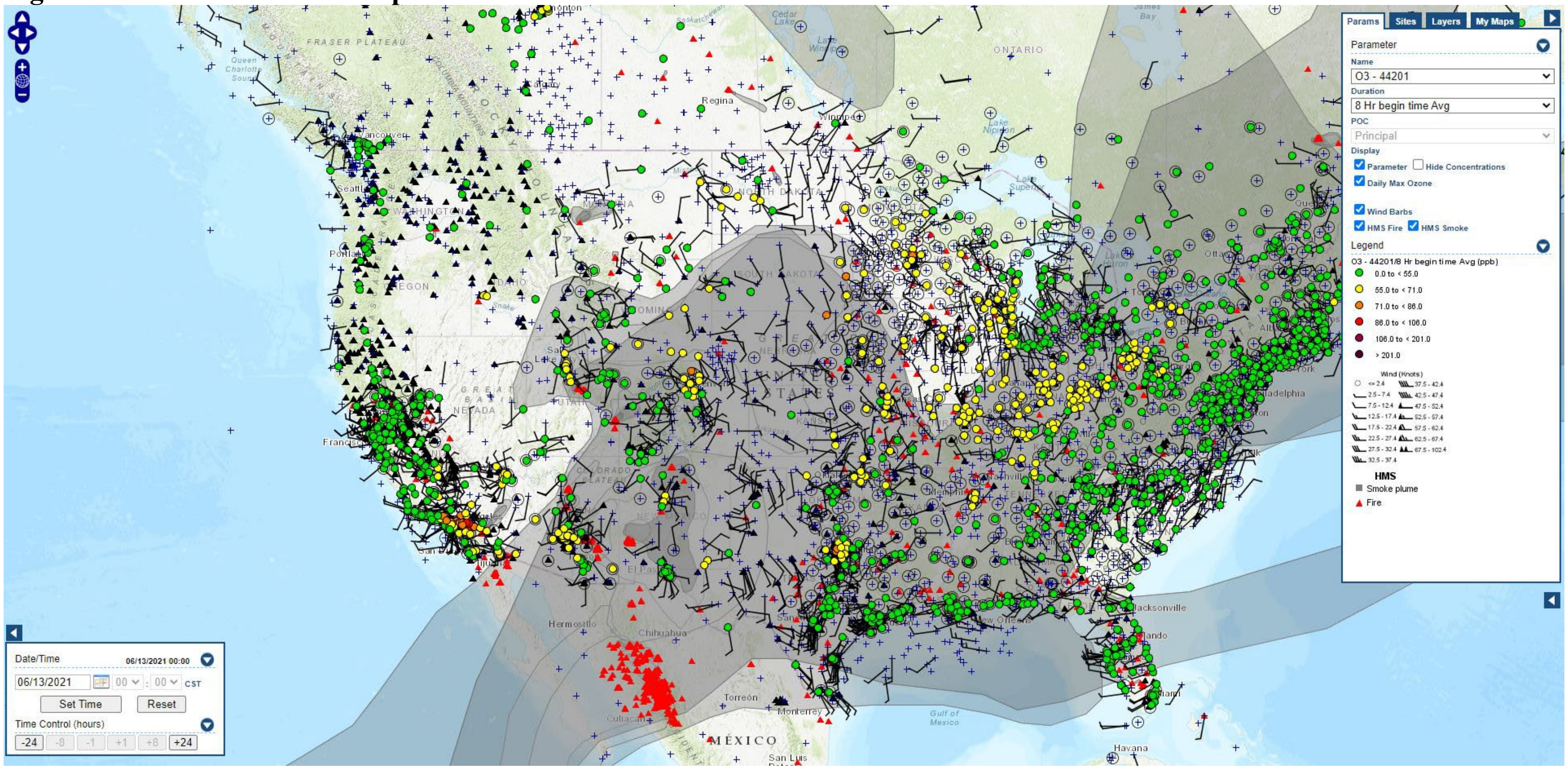

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Figure C-17 - AirNow Map for 6/14/21

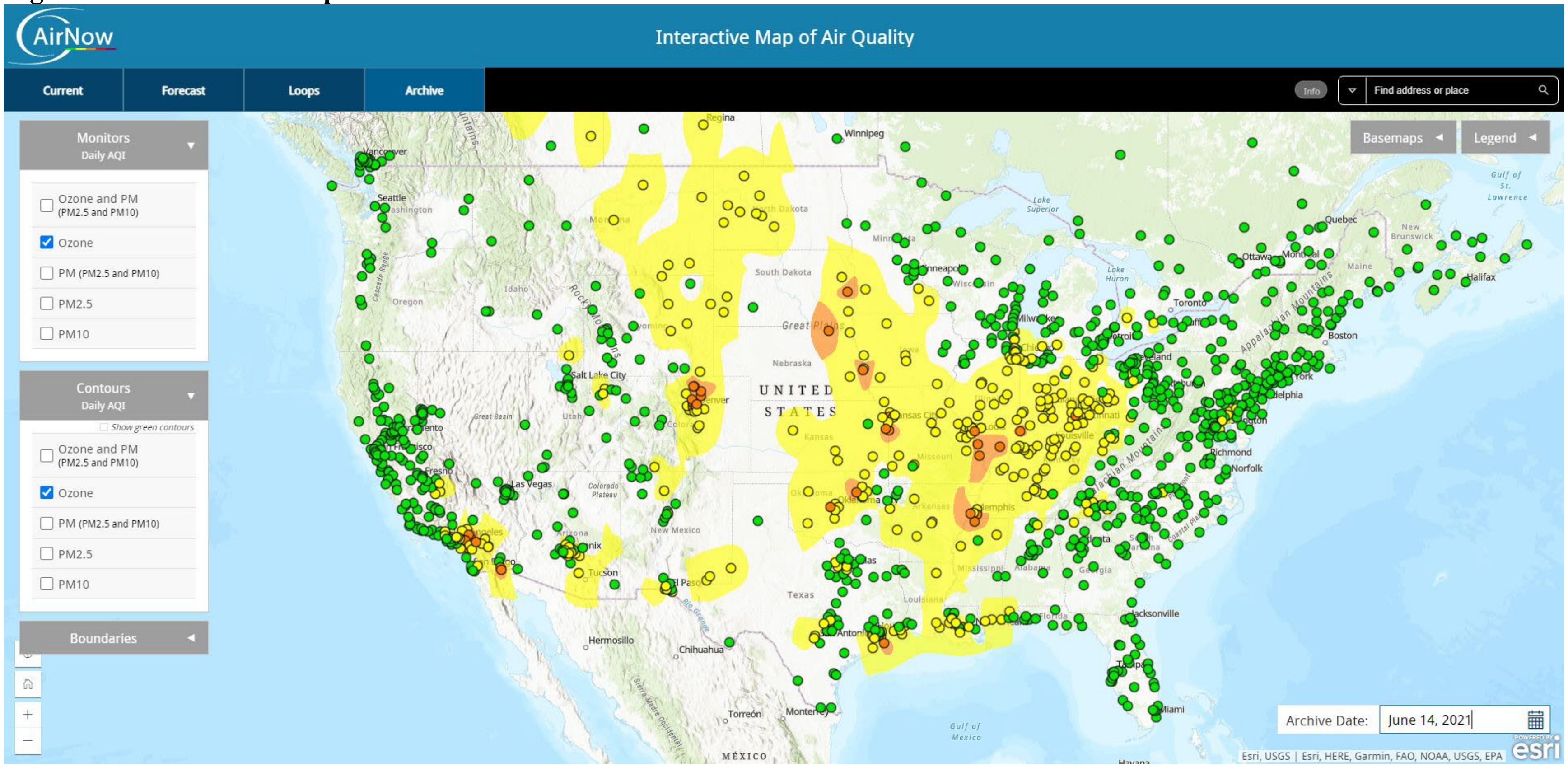

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Figure C-18 - AirNow Tech Map for 6/14/21

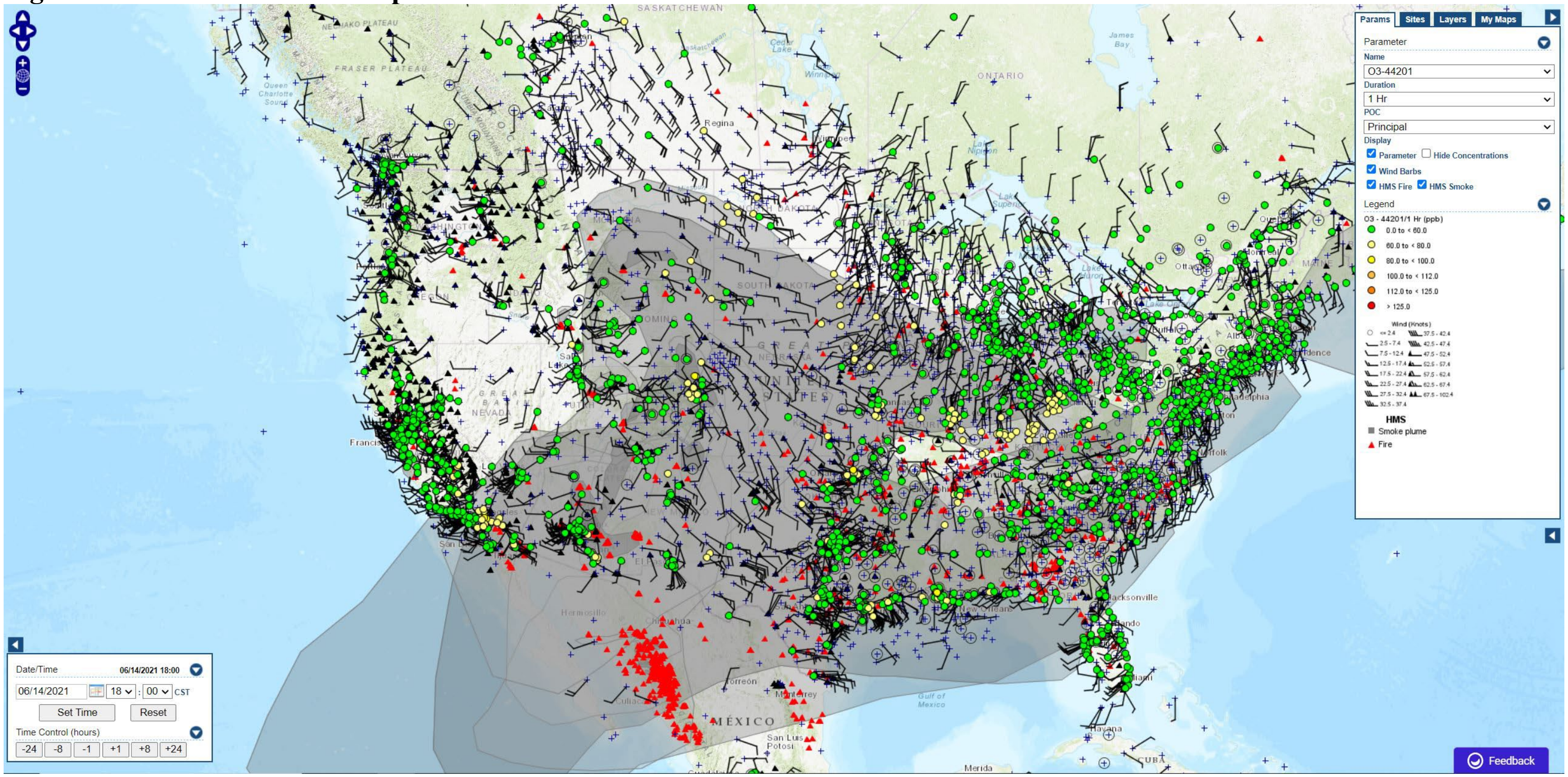

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Figure C-19 - AirNow Map for 6/15/21

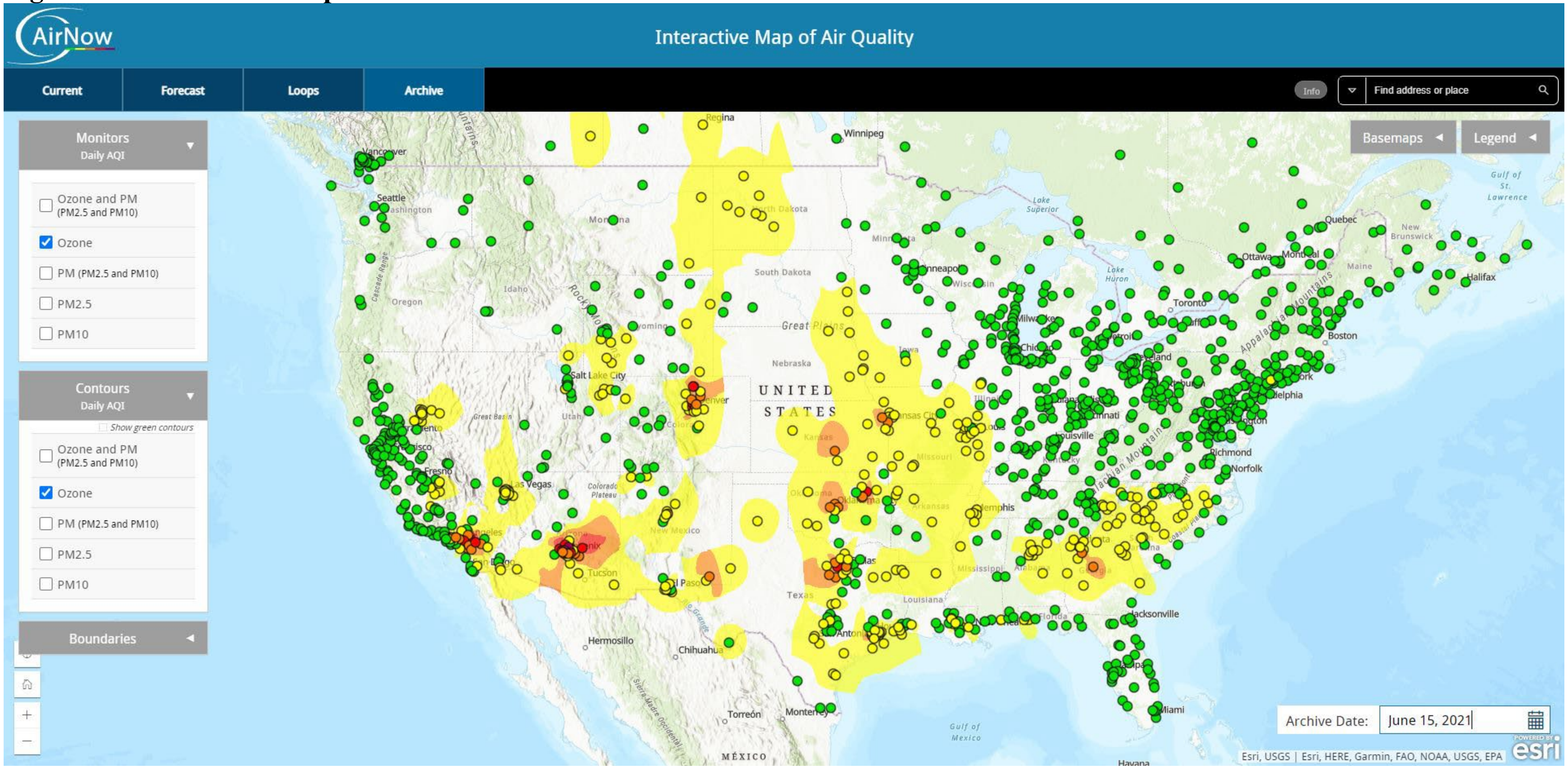

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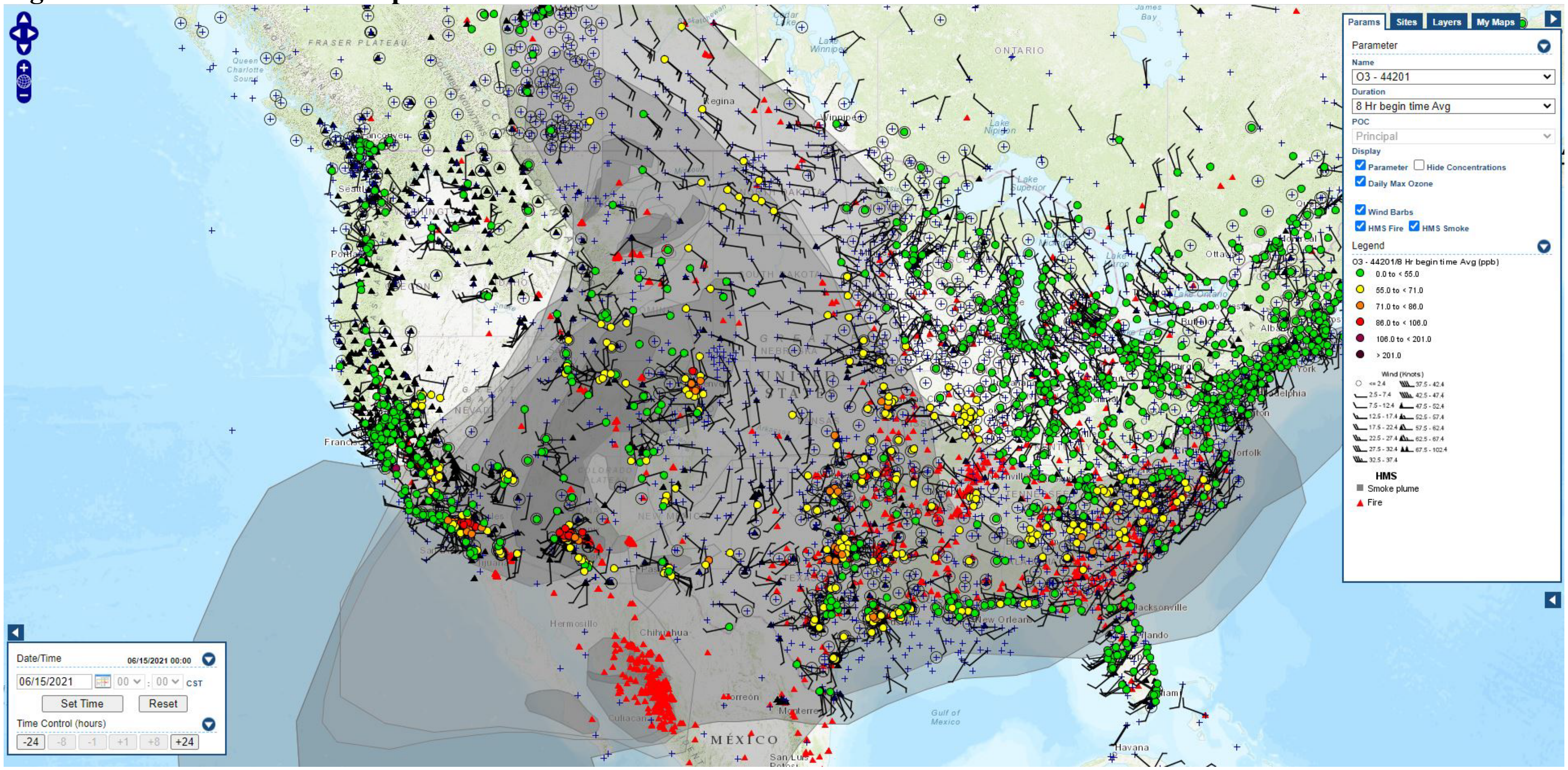
Figure C-20 - AirNow Tech Map for 6/15/21



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AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-21 - AirNow Map for 6/16/21

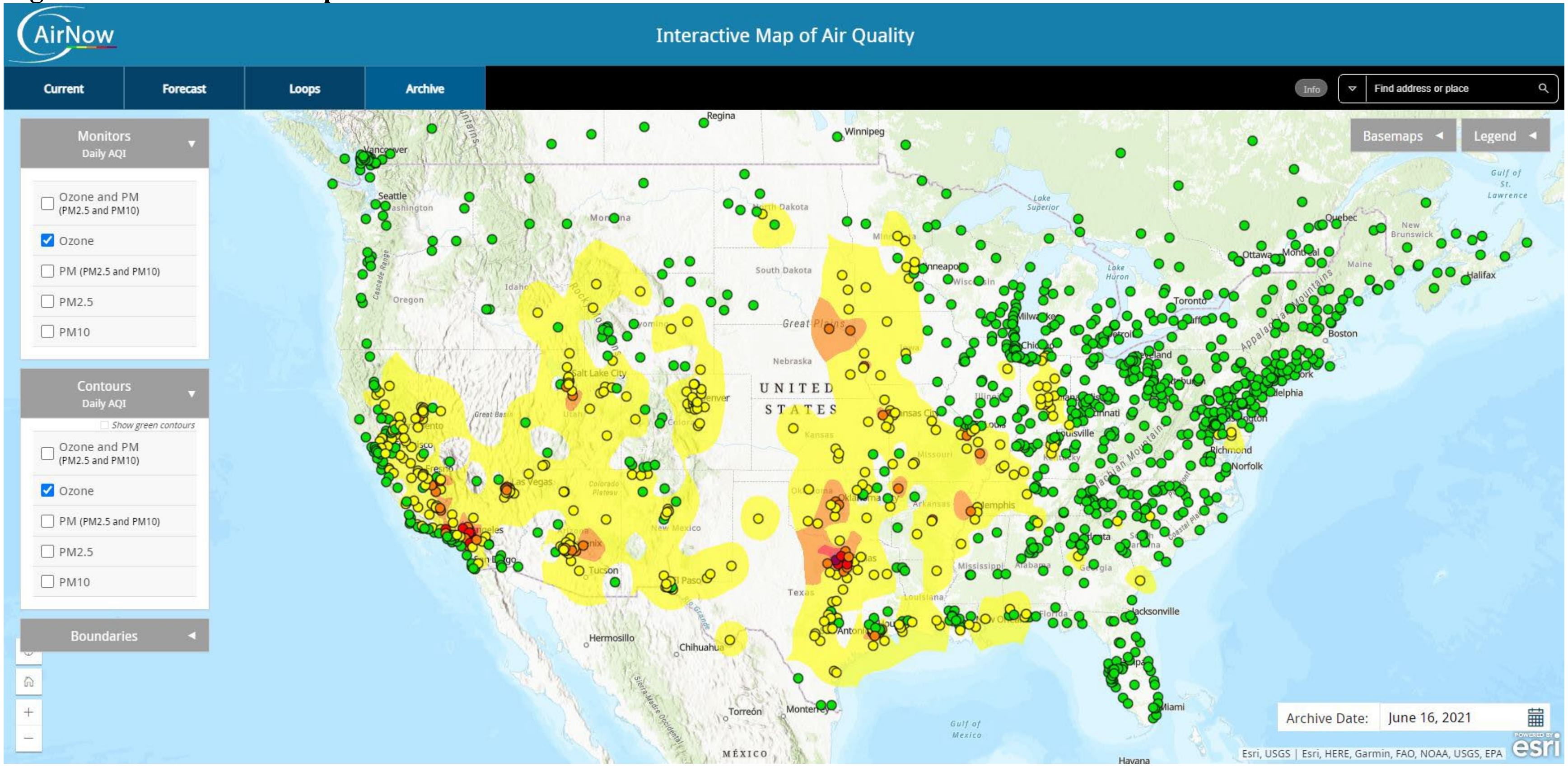

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Figure C-22 - AirNow Tech Map for 6/16/21

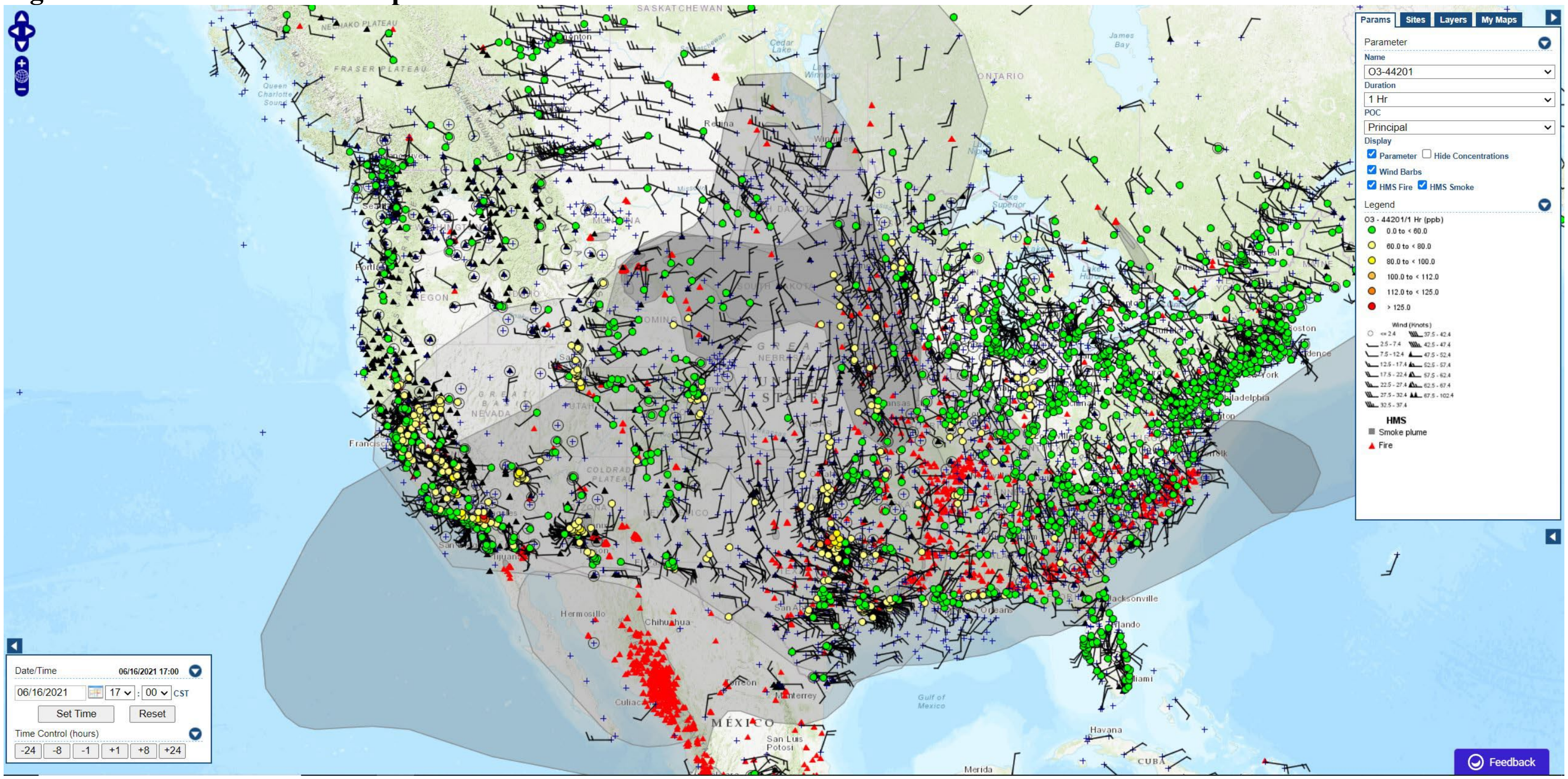

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Figure C-23 - AirNow Map for 6/17/21

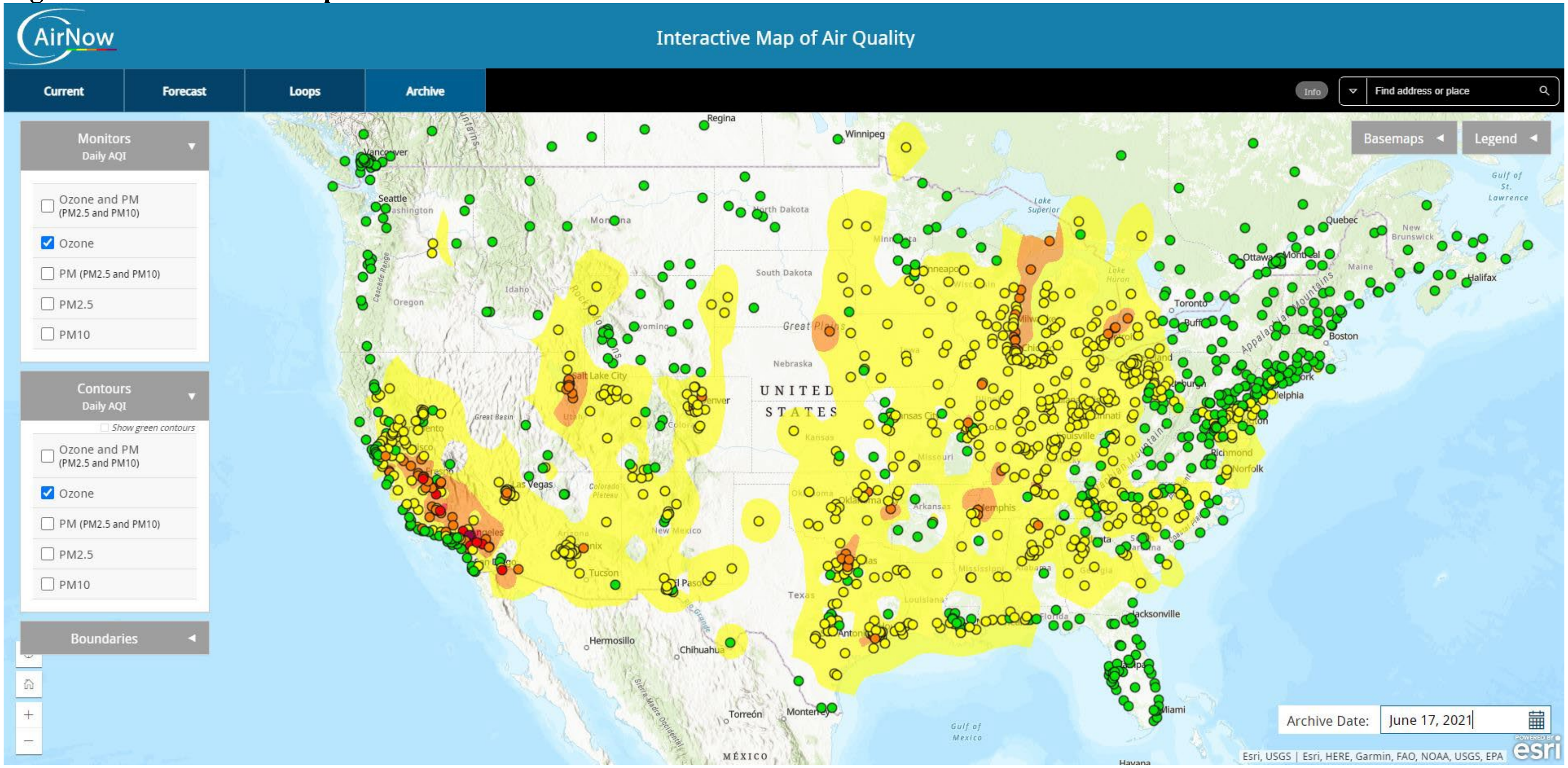

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Figure C-24 - AirNow Tech Map for 6/17/21

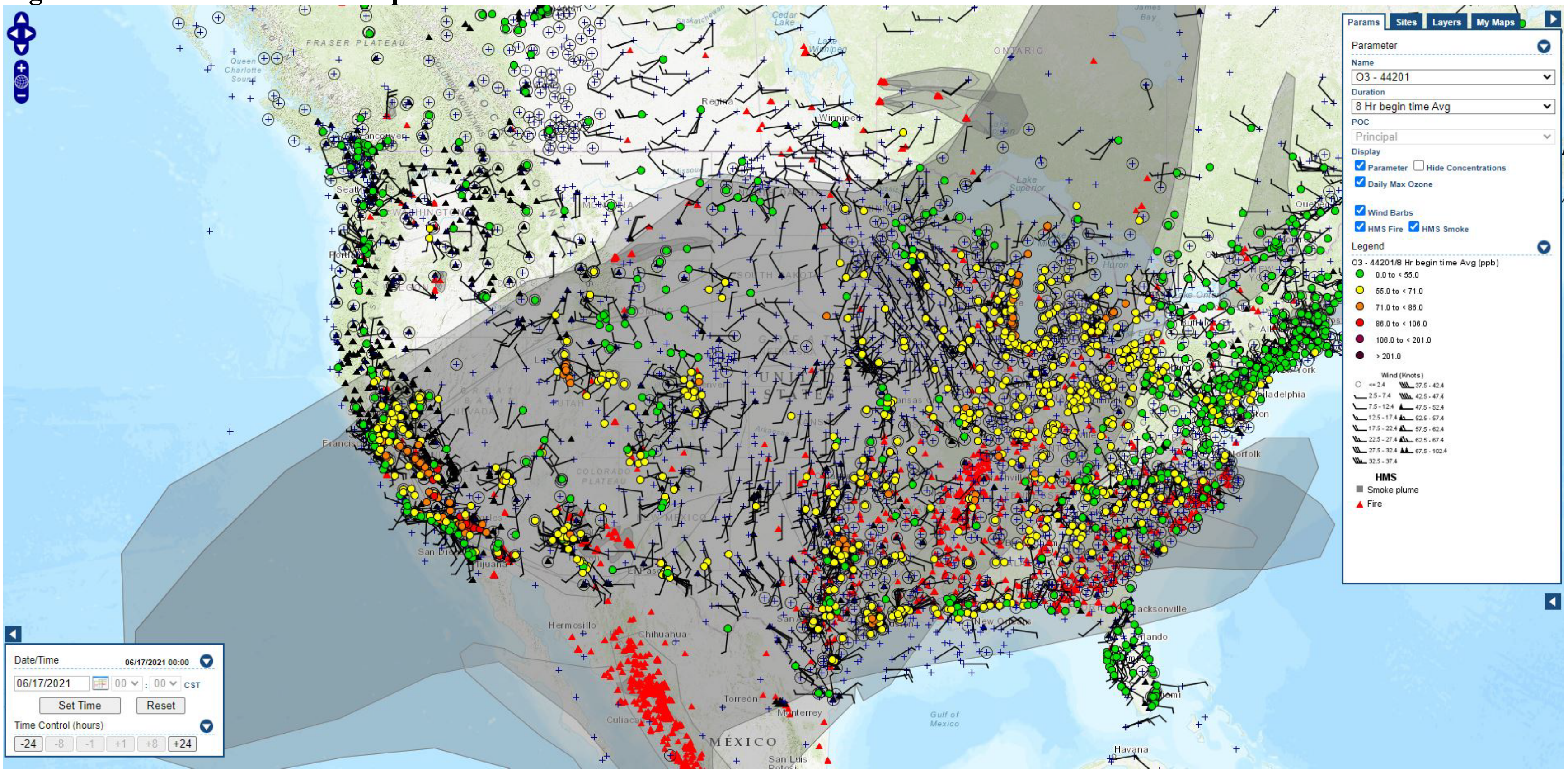

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Figure C-25 - AirNow Map for 6/18/21

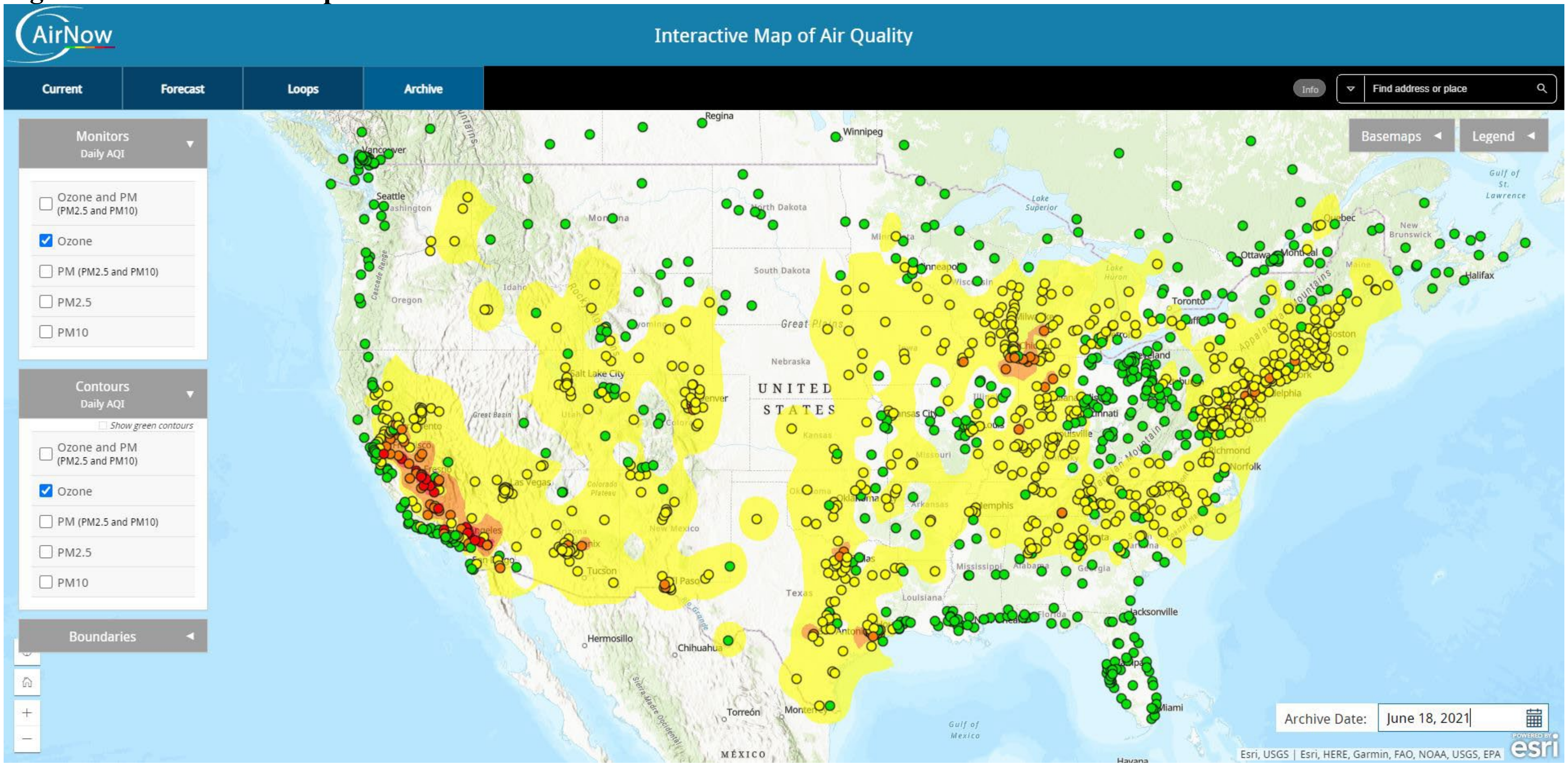

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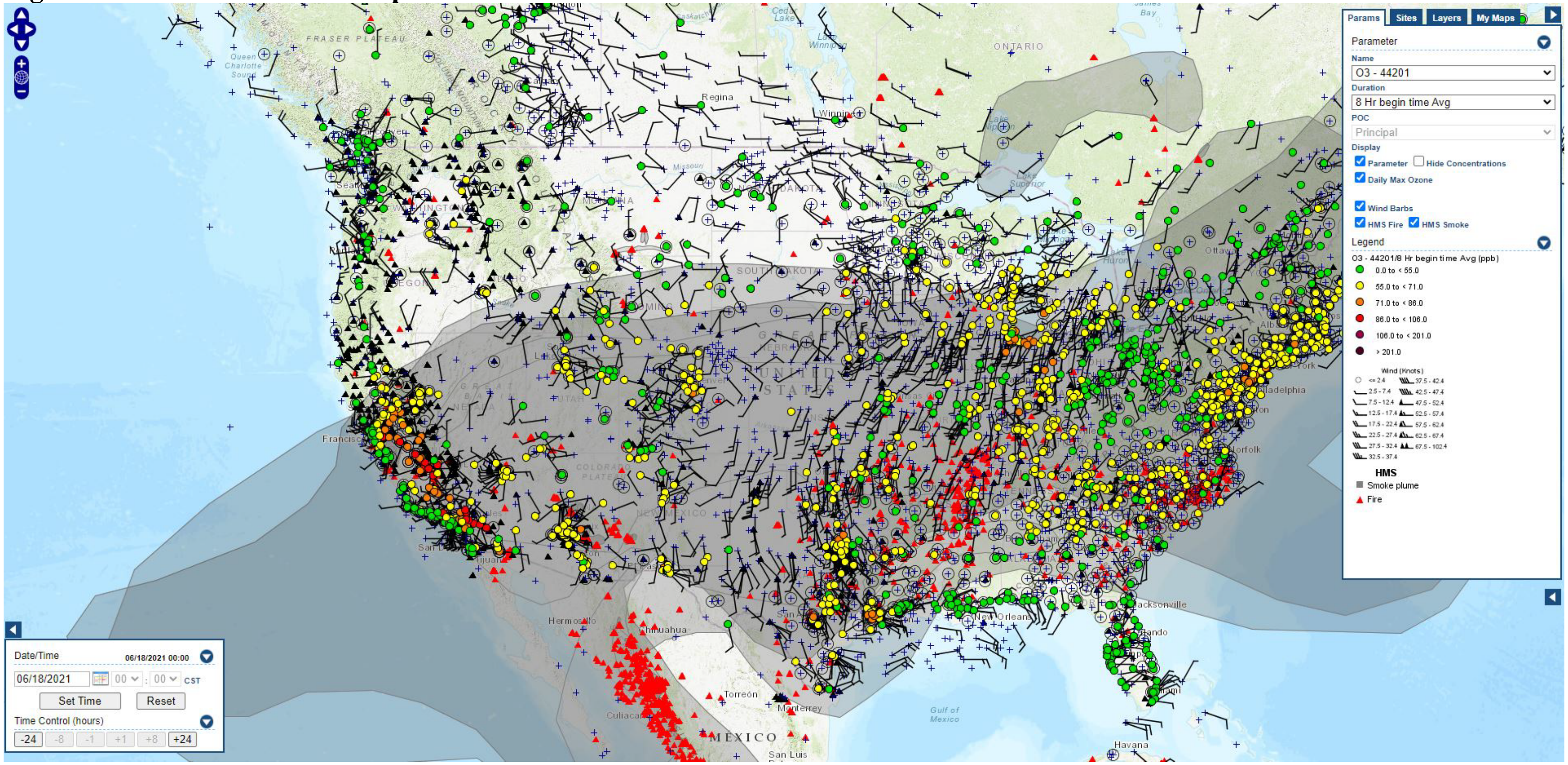
Figure C-26 - AirNow Tech Map for 6/18/21



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AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-27 - AirNow Map for 6/23/21

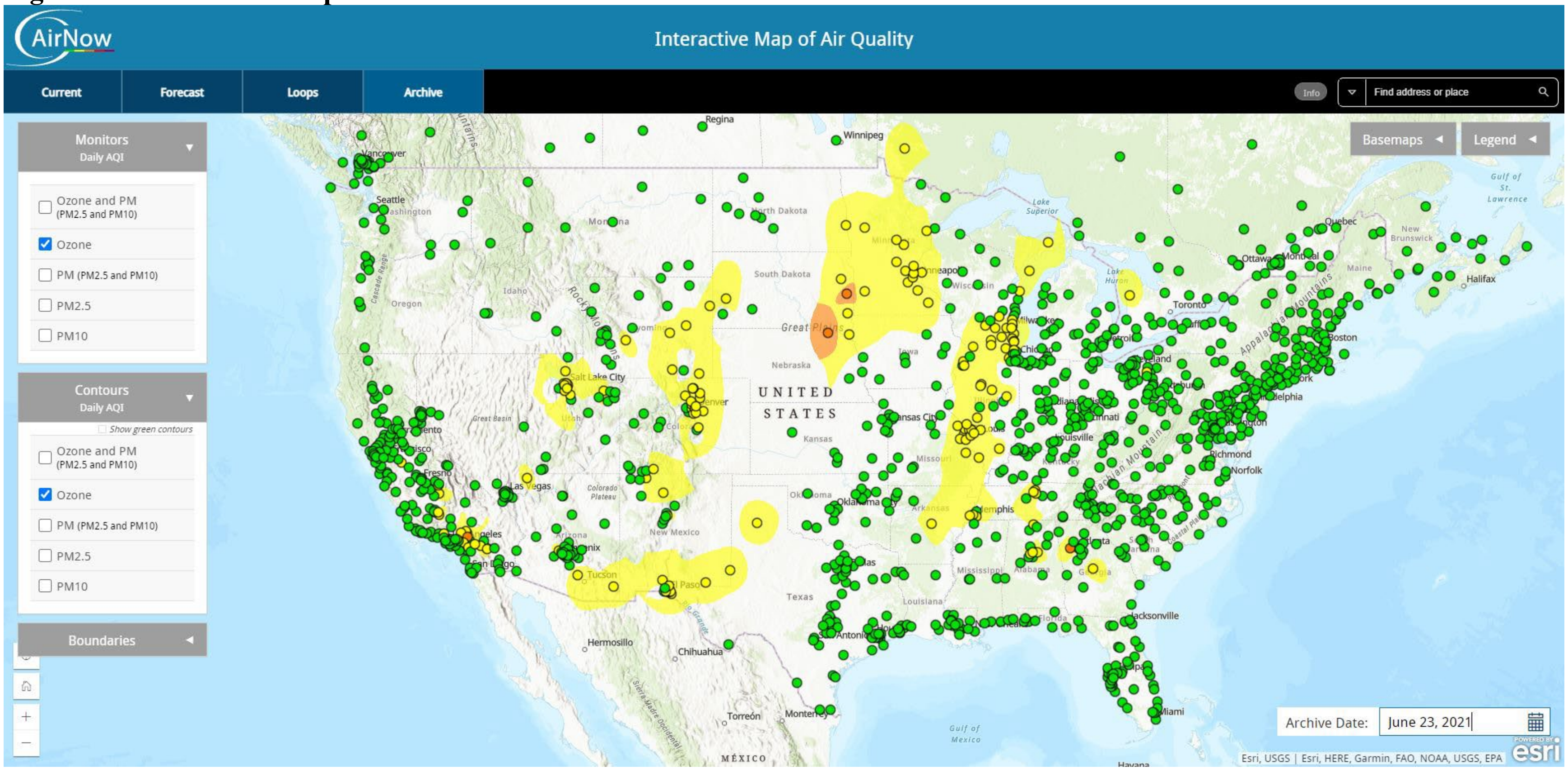

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Figure C-28 - AirNow Tech Map for 6/23/21

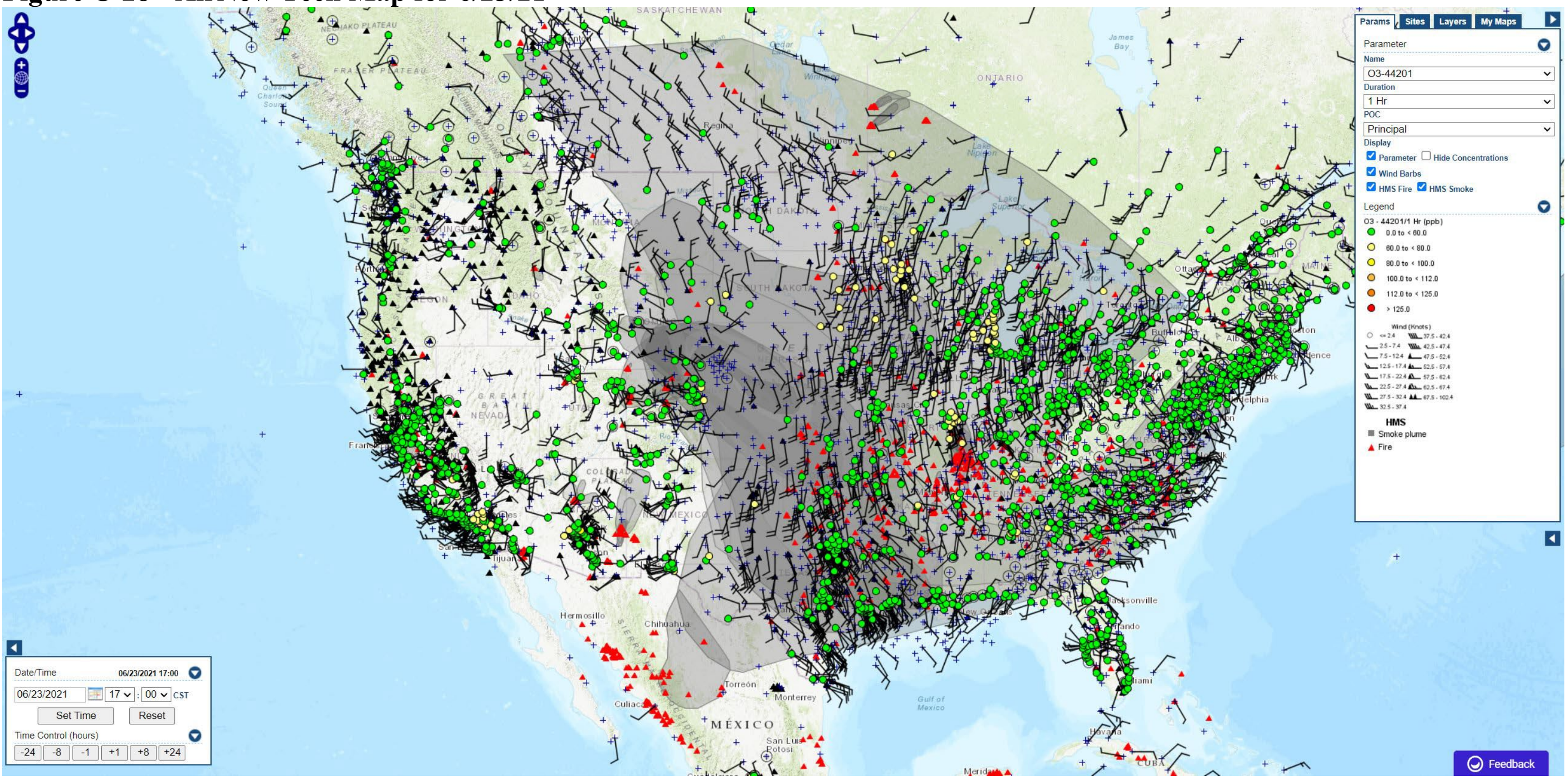

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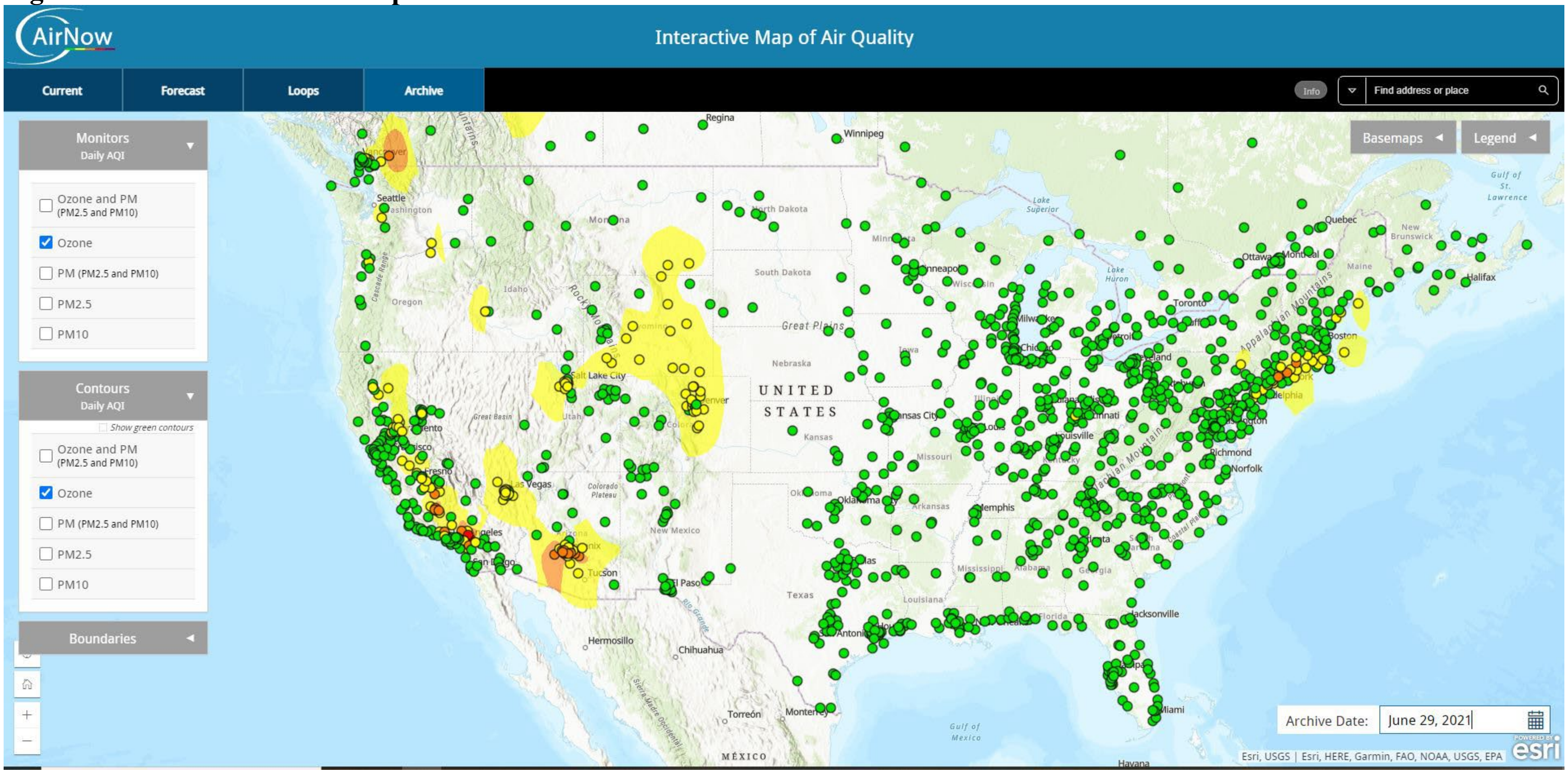
Figure C-29 - AirNow Tech Map for 6/29/21



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AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-30 - AirNow Tech Map for 6/29/21

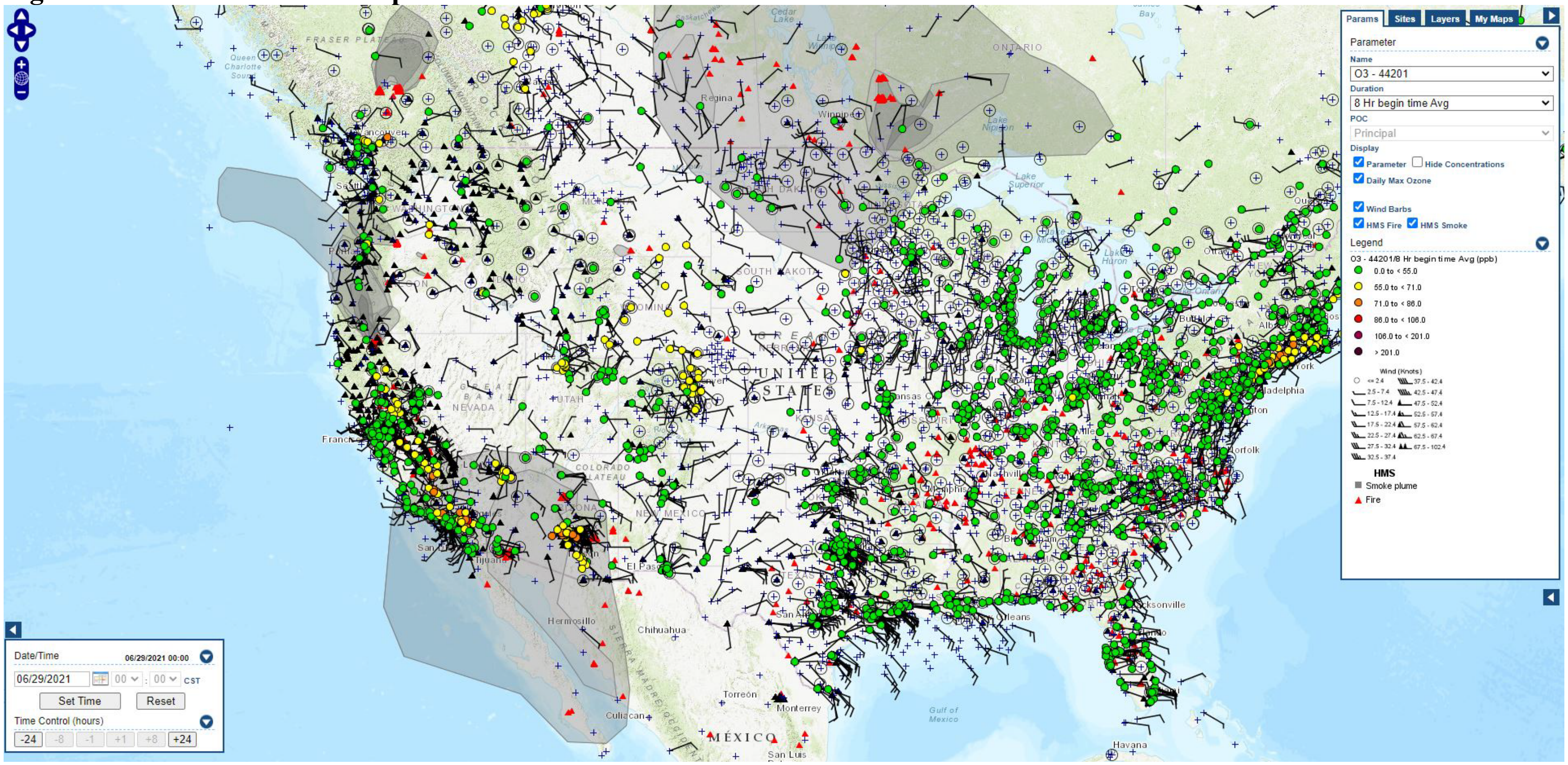

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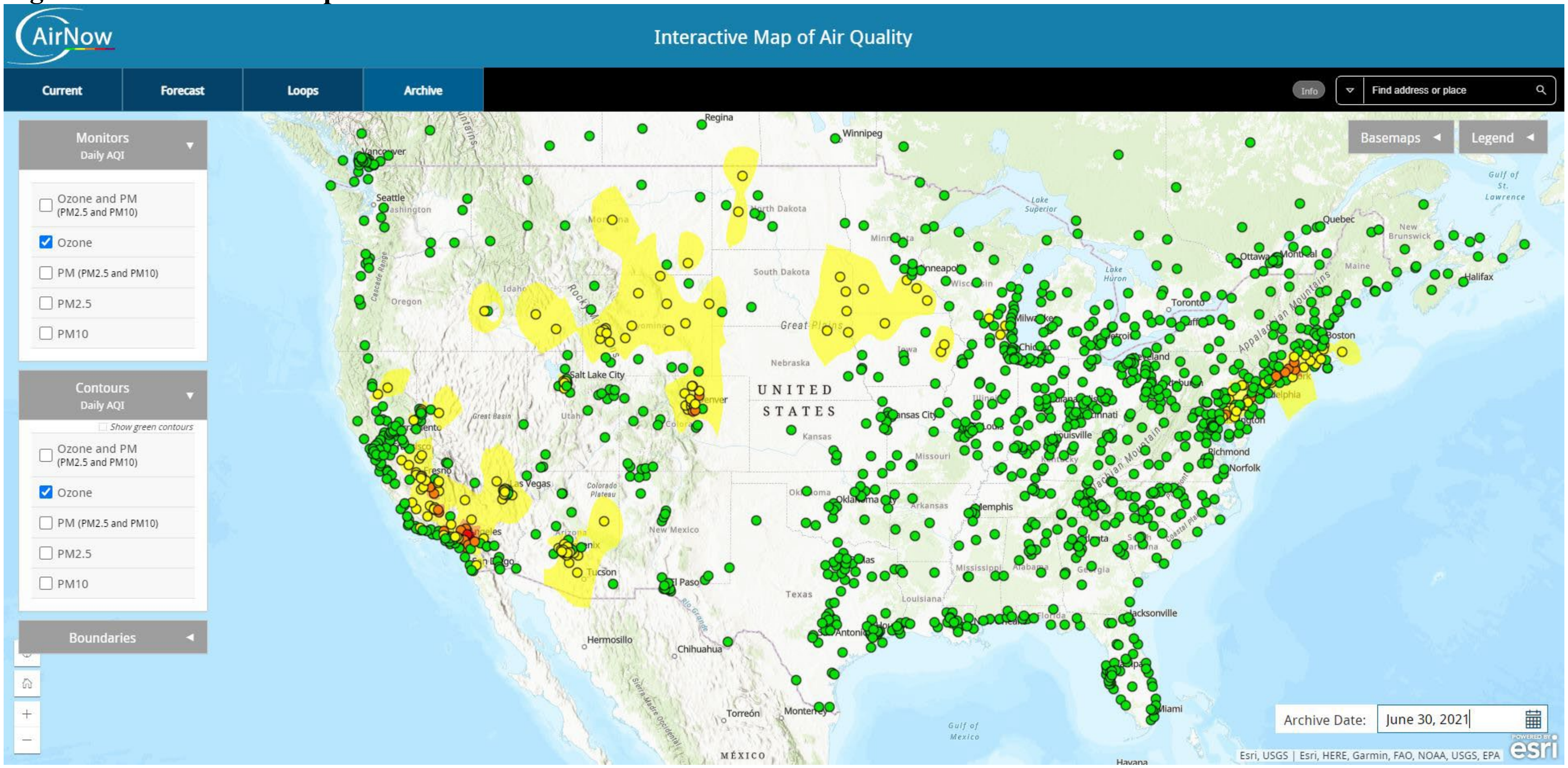
Figure C-31 - AirNow Map for 6/30/21



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AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-32 - AirNow Tech Map for 6/30/21

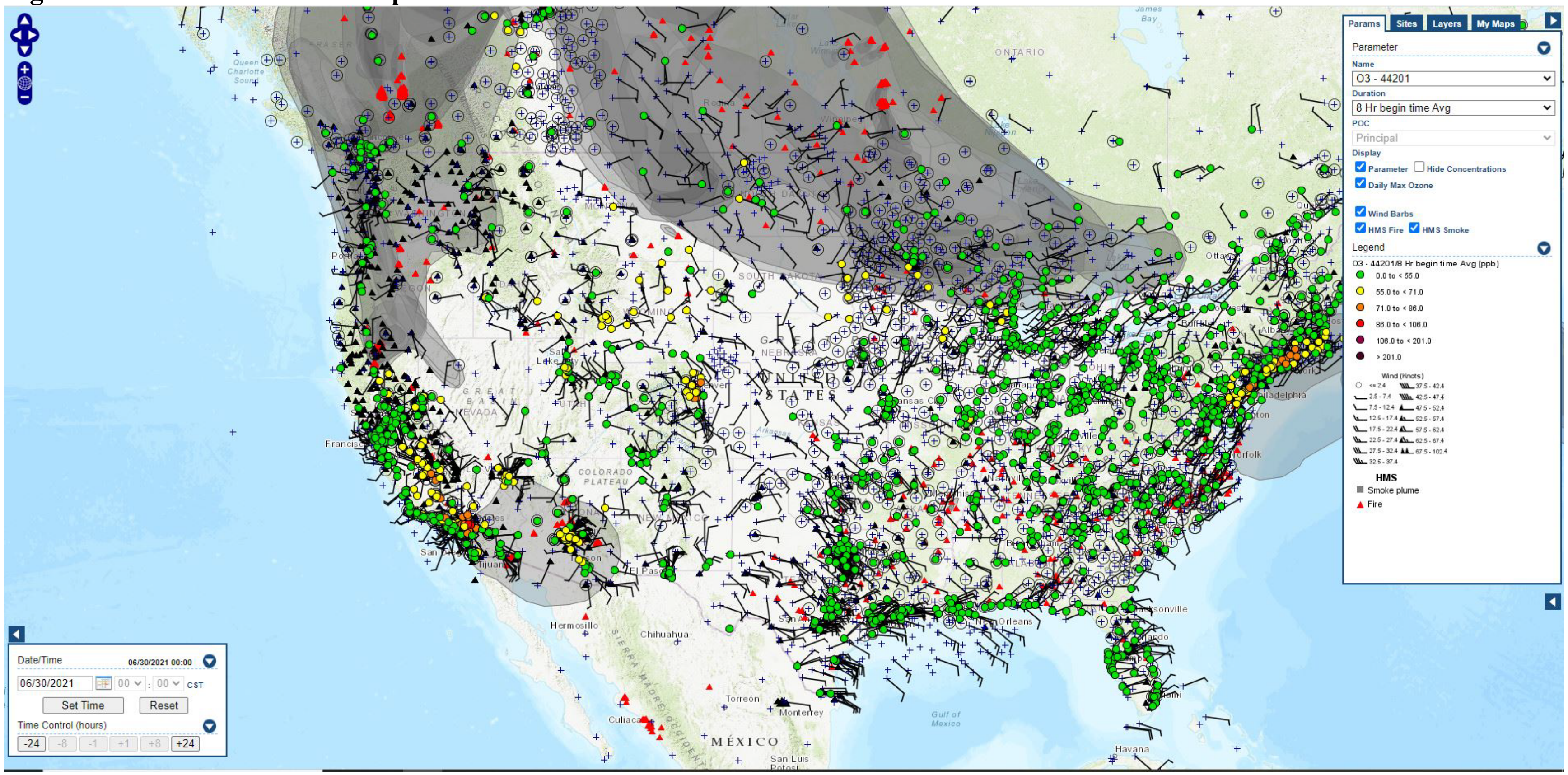

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Figure C-33 - AirNow Map for 7/2/21

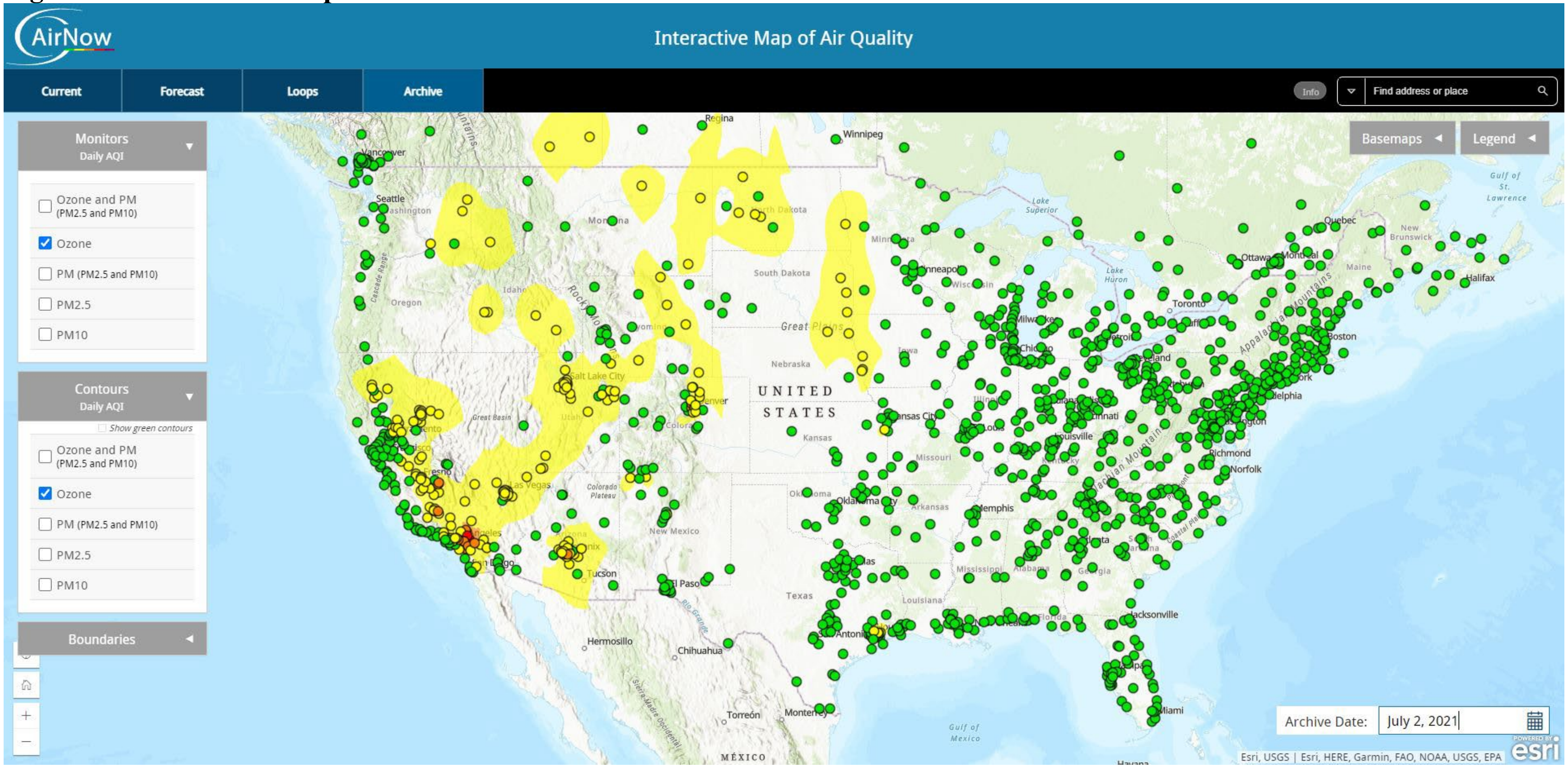

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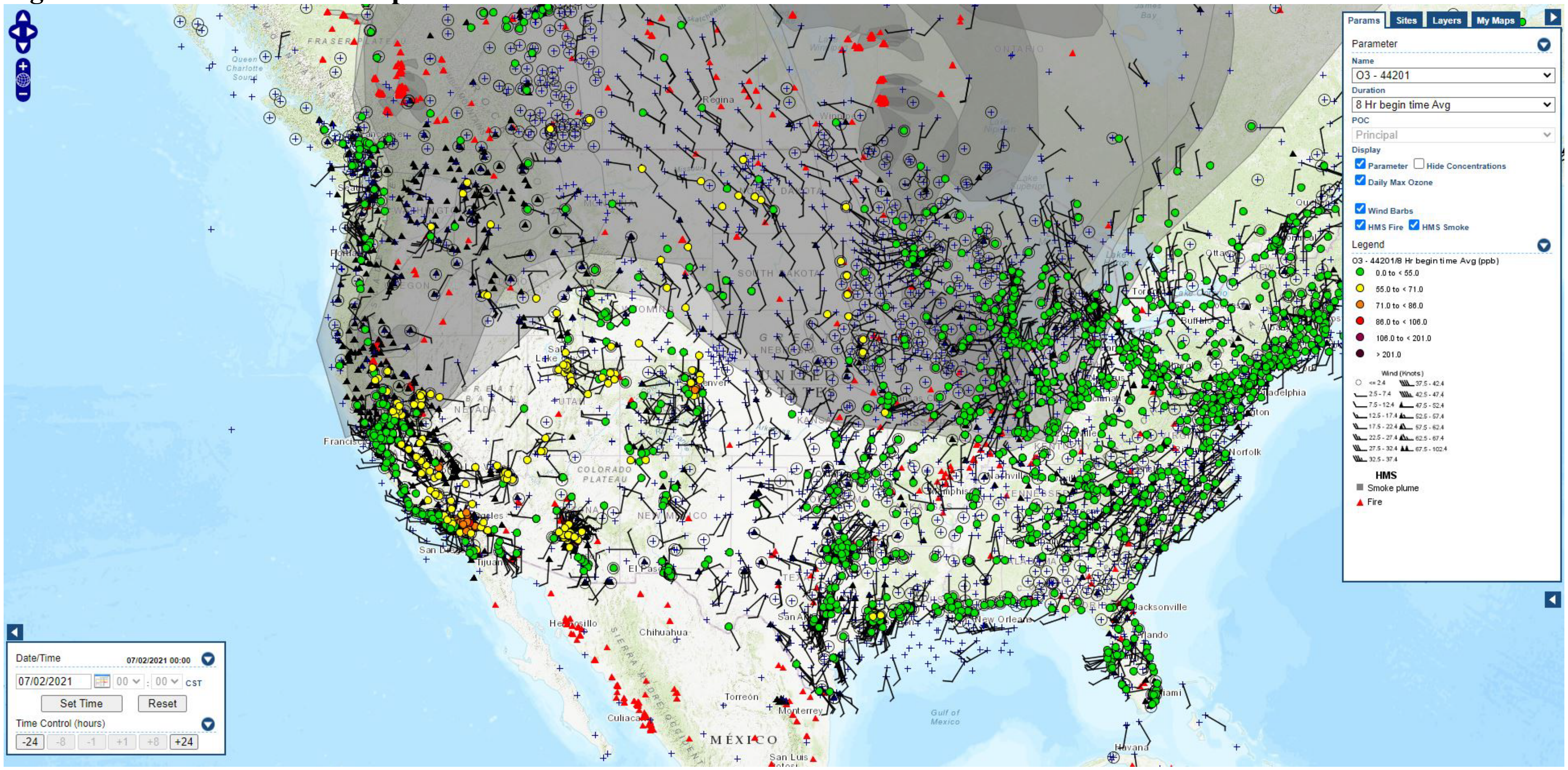
Figure C-34 - AirNow Tech Map for 7/2/21



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AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-35 - AirNow Map for 7/4/21

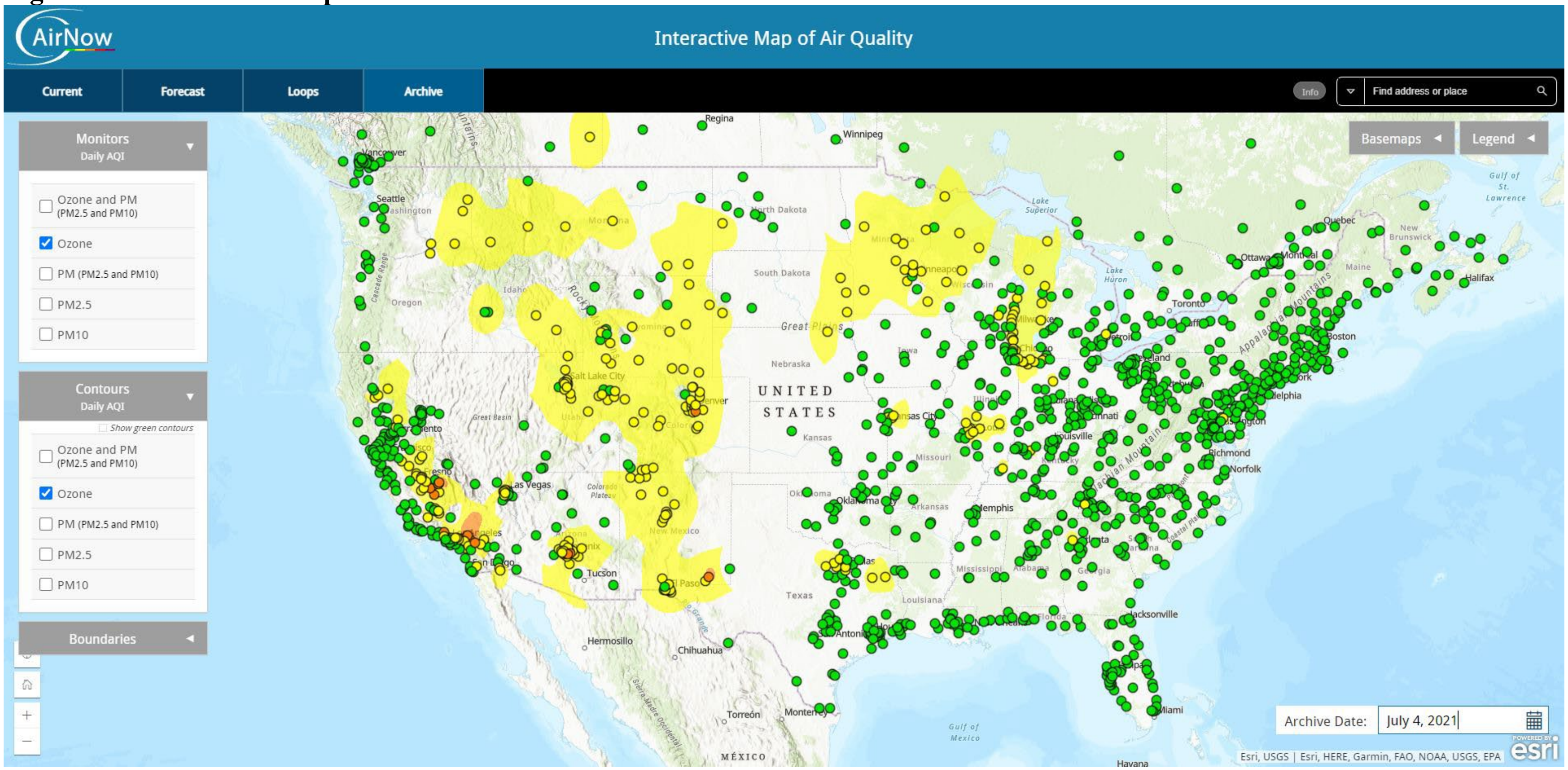

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Figure C-36 - AirNow Tech Map for 7/4/21

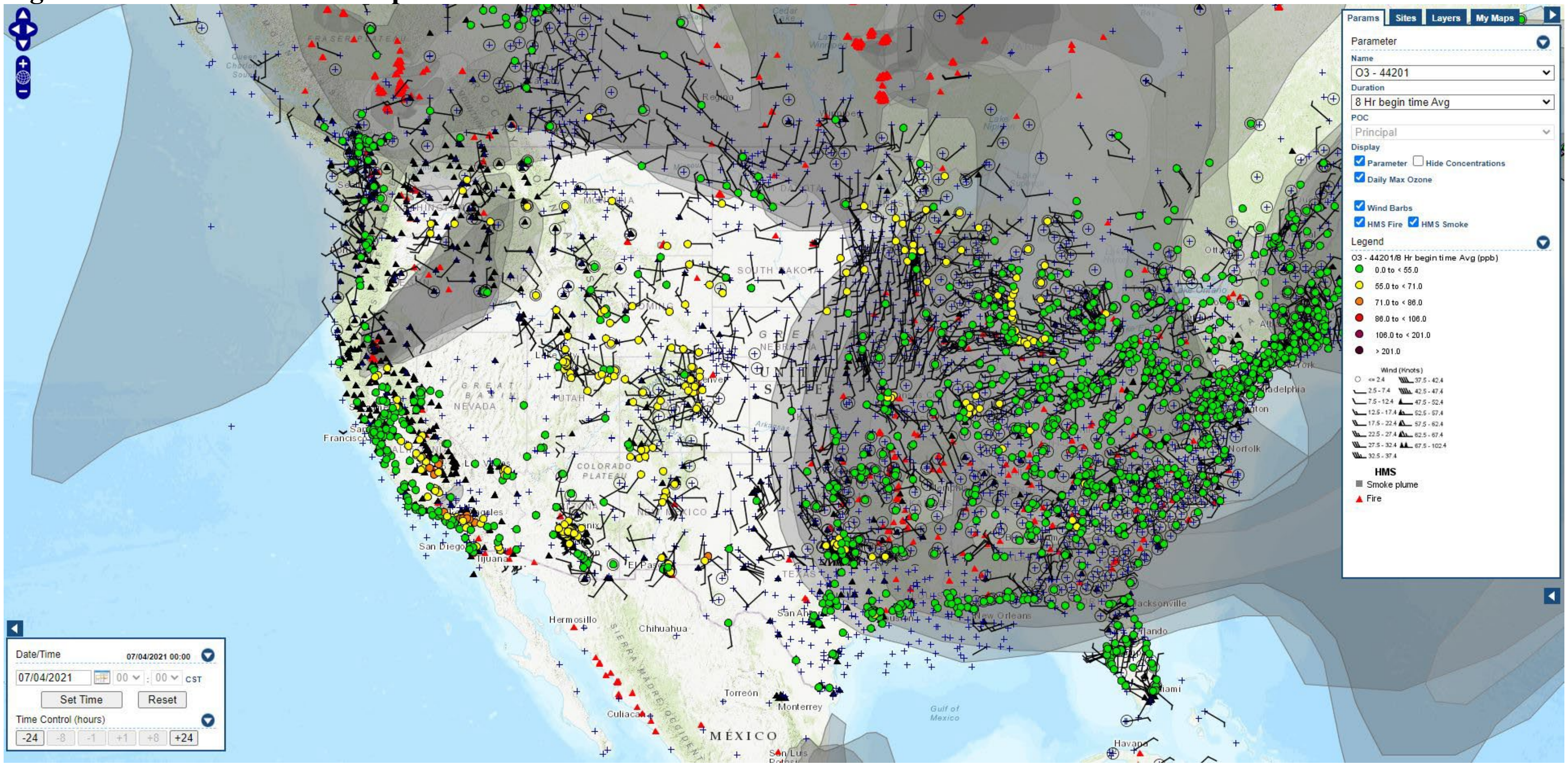

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Figure C-37 - AirNow Map for 7/8/21

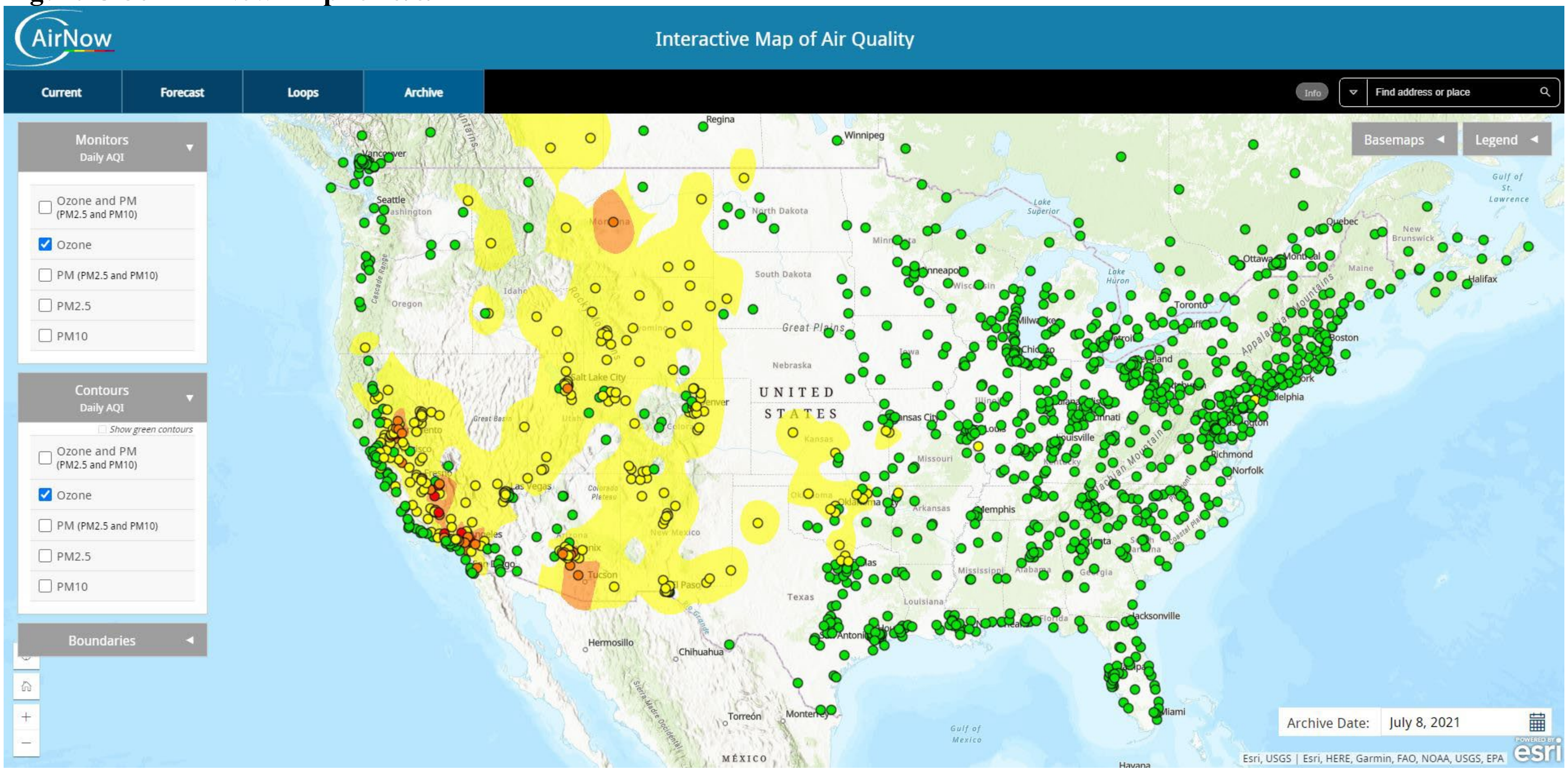

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Figure C-38 - AirNow Tech Map for 7/8/21

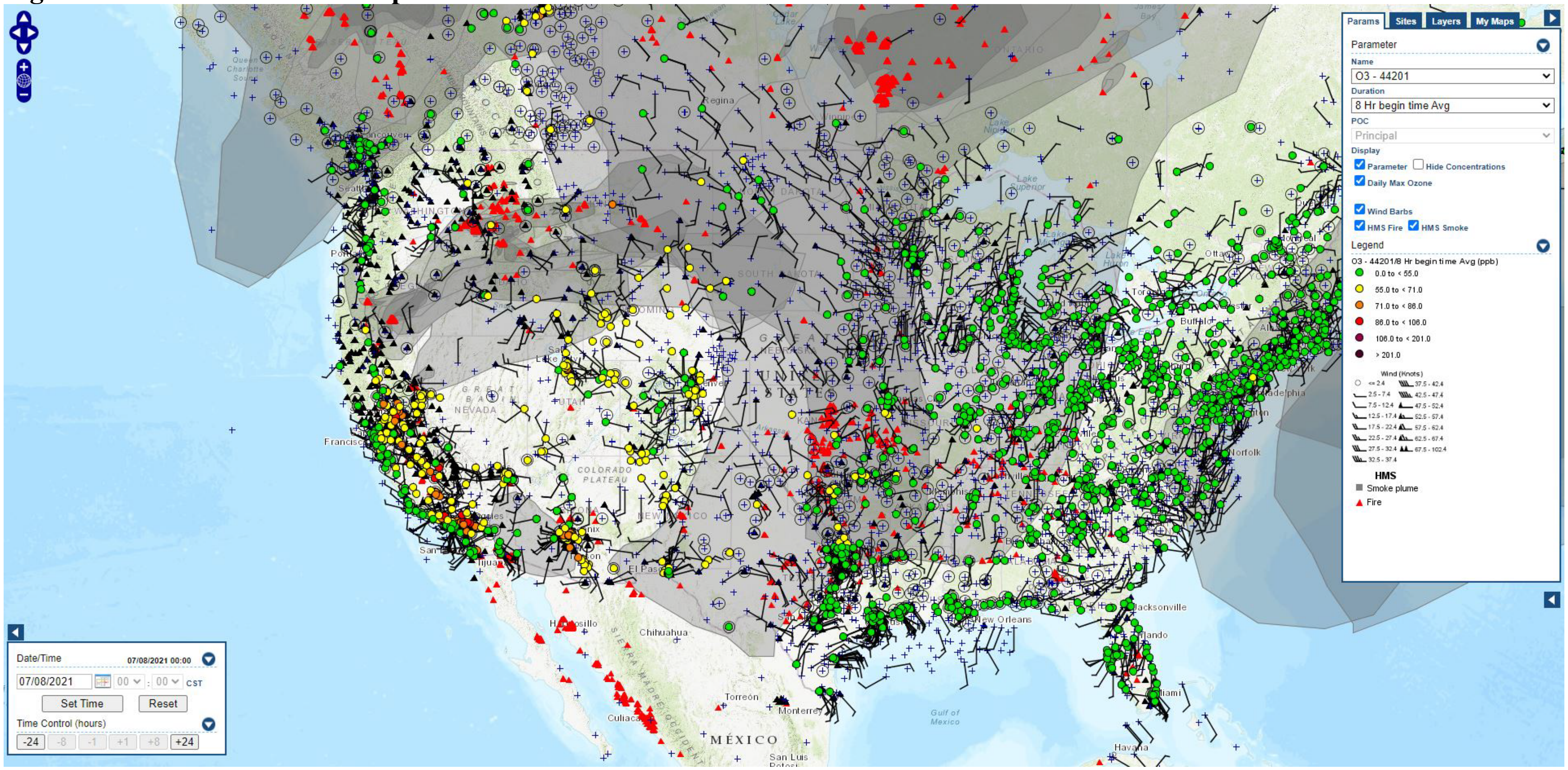

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Figure C-39 - AirNow Tech Map for 7/9/21

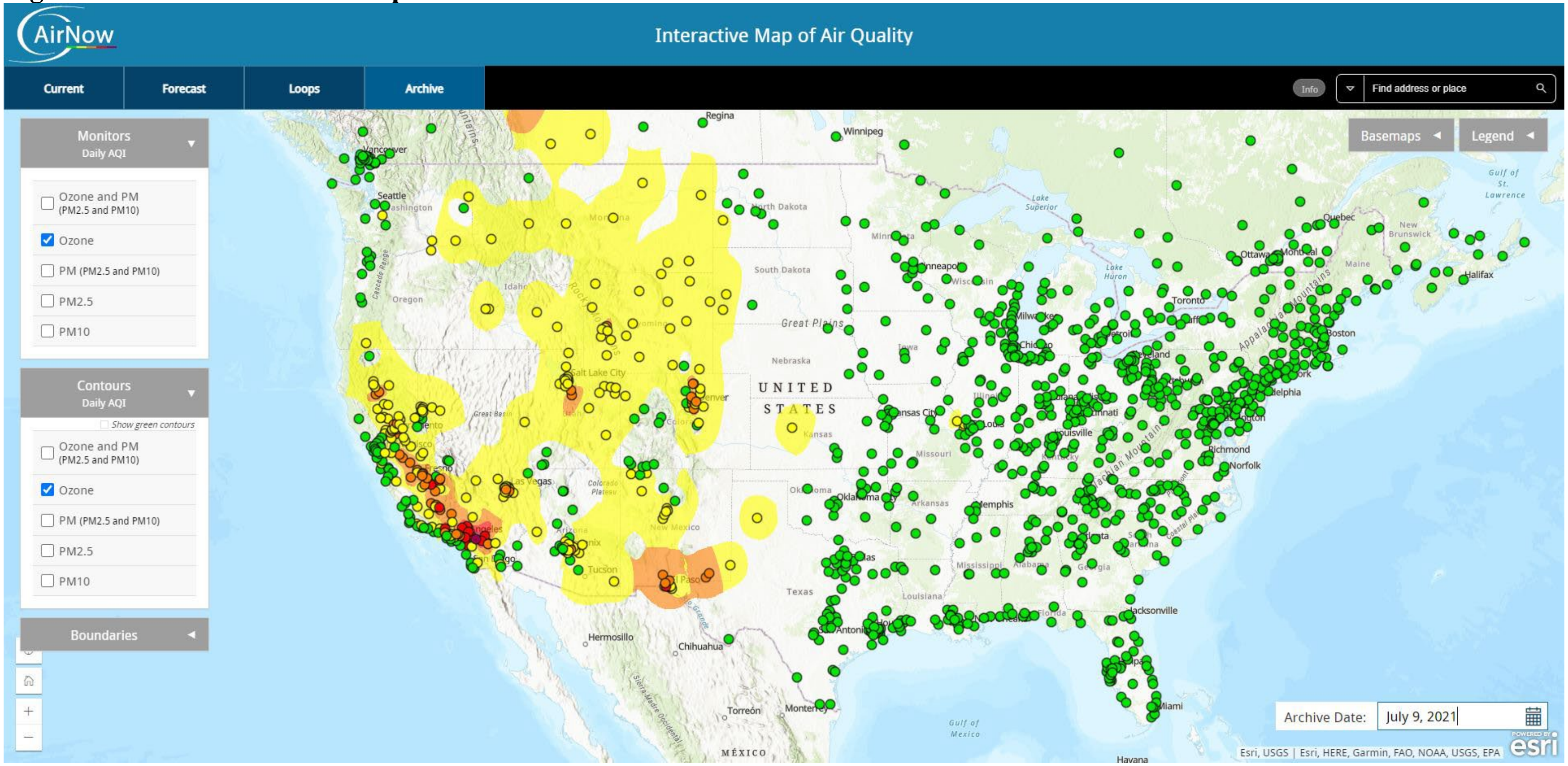

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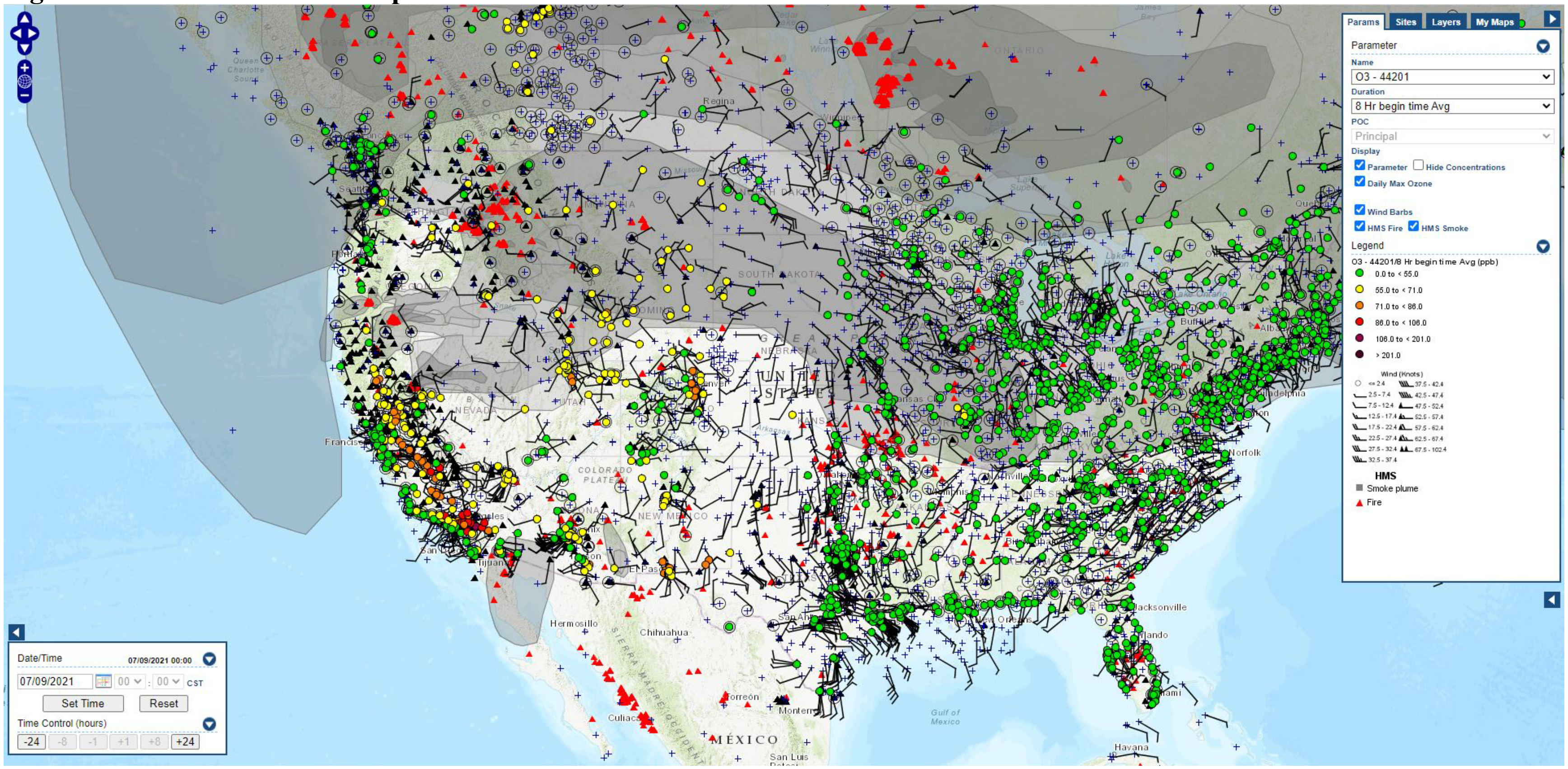
Figure C-40 - AirNow Tech Map for 7/9/21



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AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-41 - AirNow Map for 7/10/21

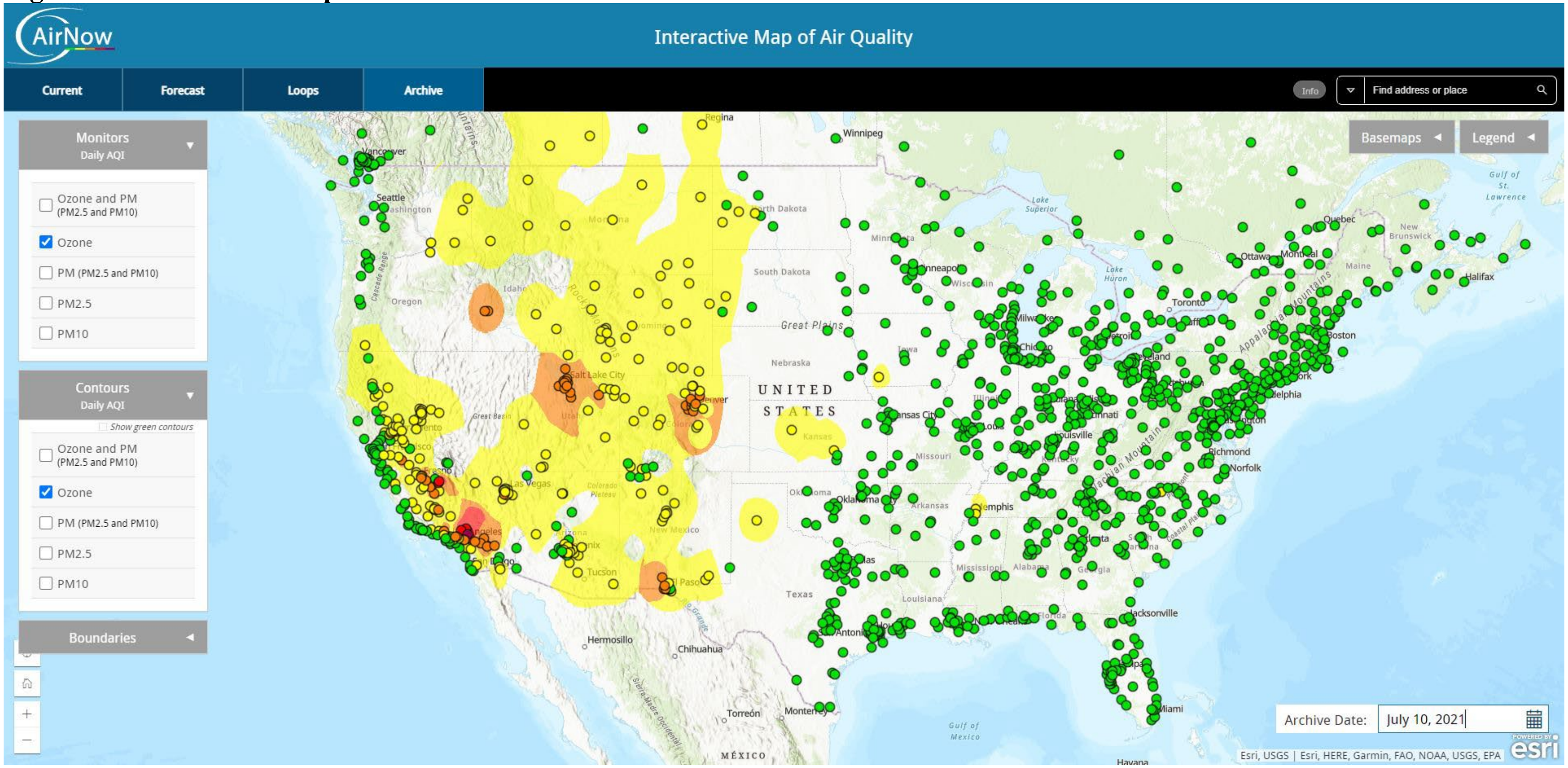

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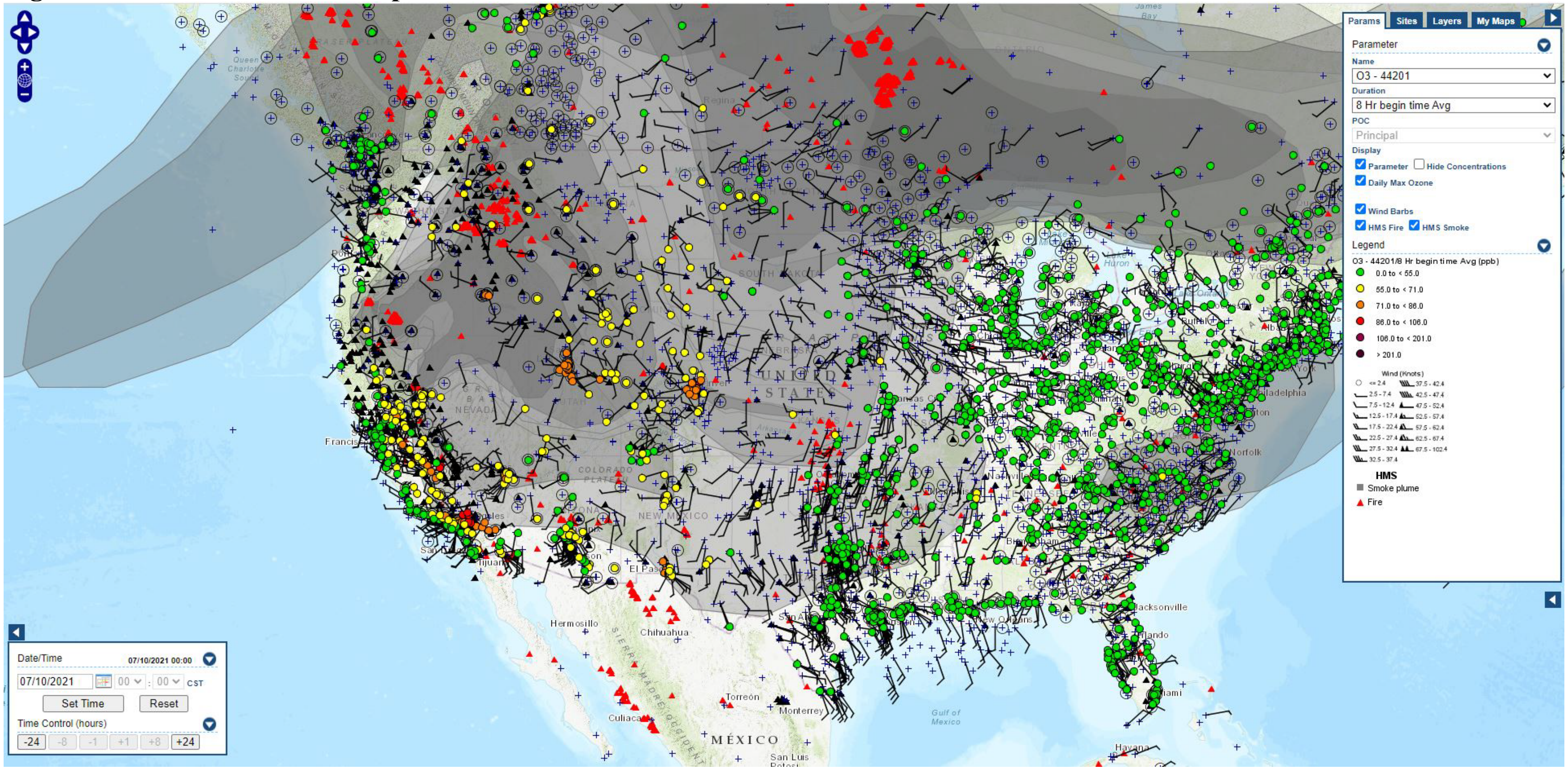
Figure C-42 - AirNow Tech Map for 7/10/21



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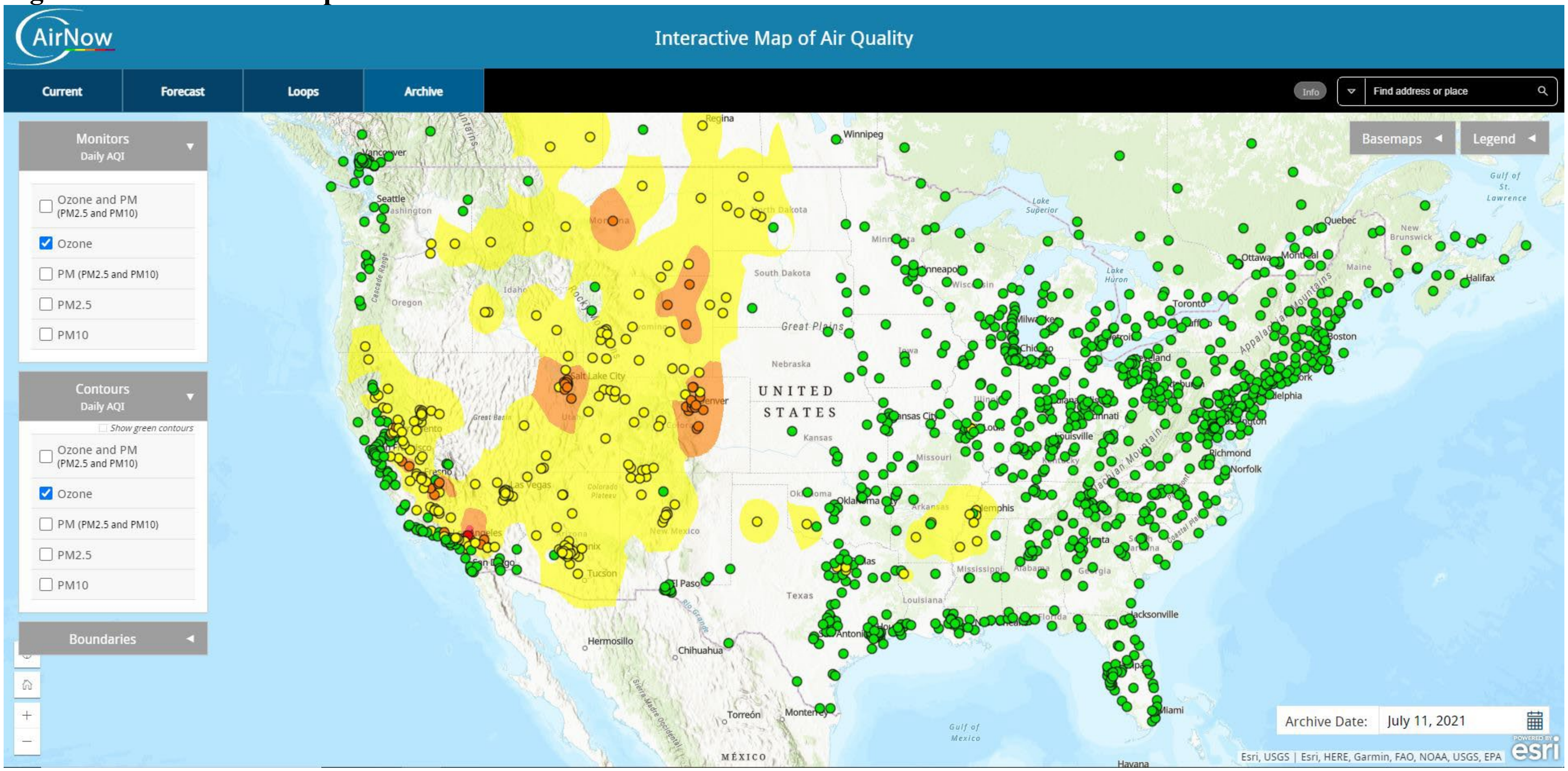
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-43 - AirNow Map for 7/11/21



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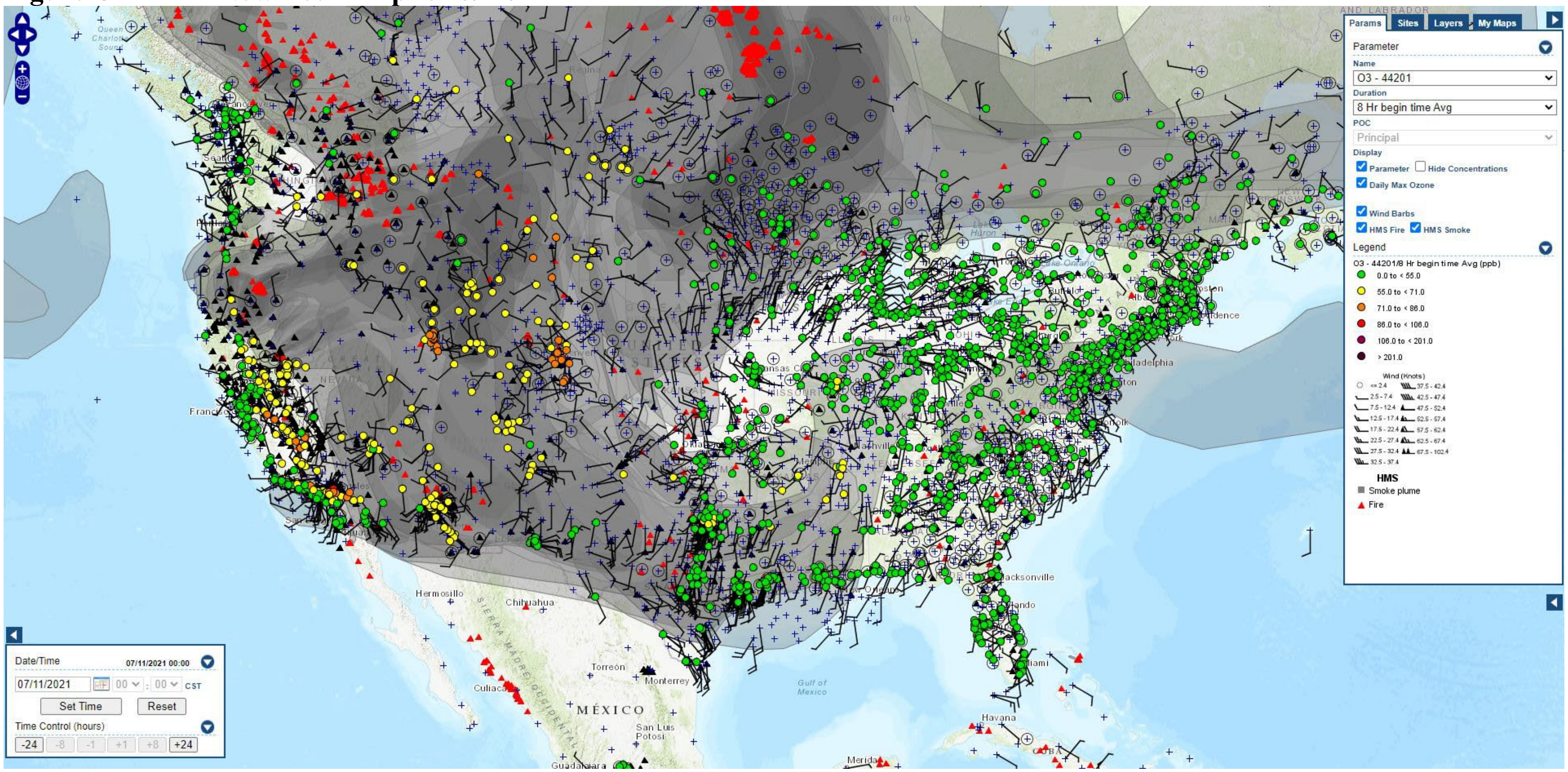
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-44 - AirNow Tech Map for 7/11/21



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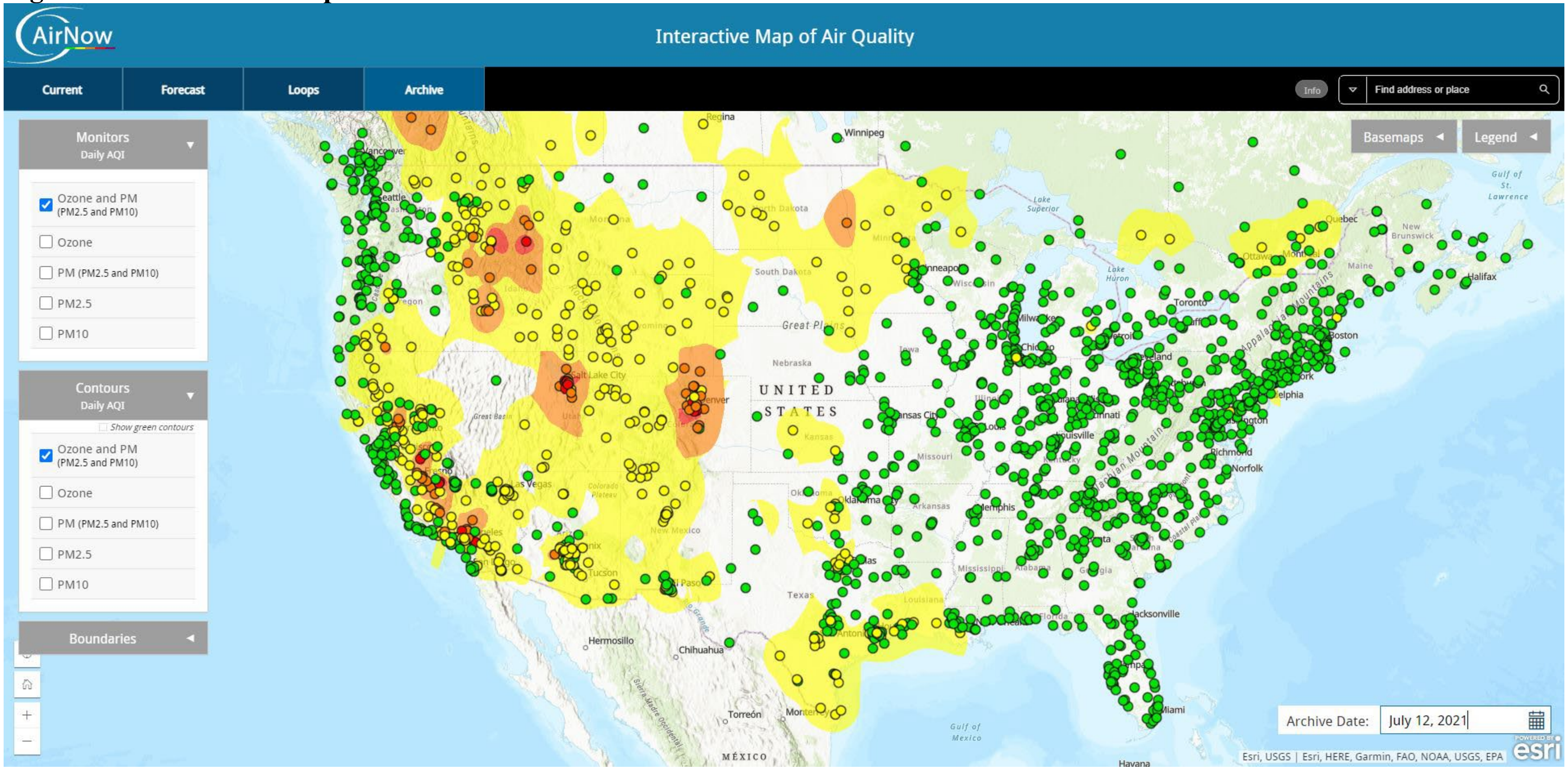
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-45 - AirNow Map for 7/12/21



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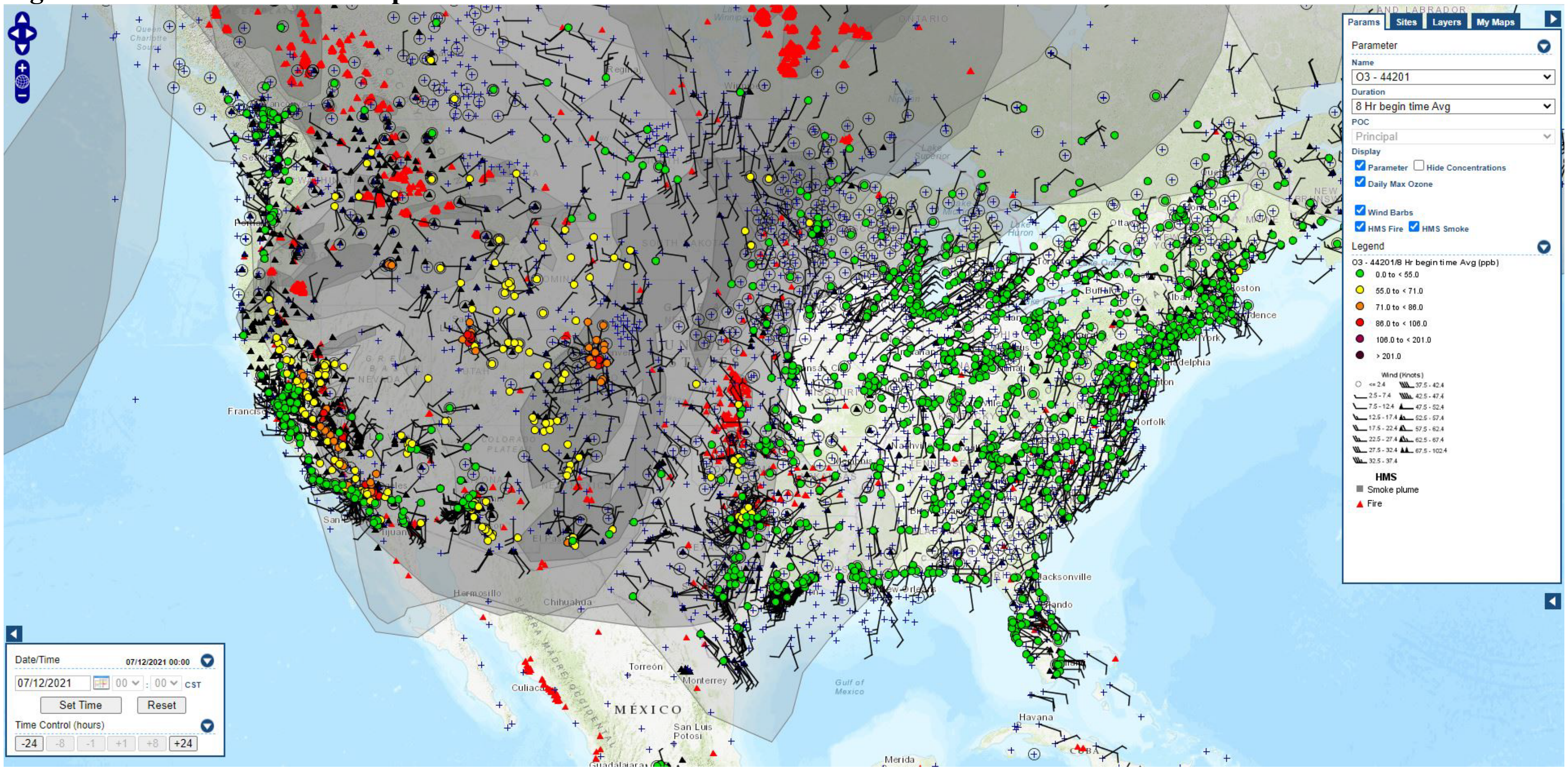
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-46 - AirNow Tech Map for 7/12/21



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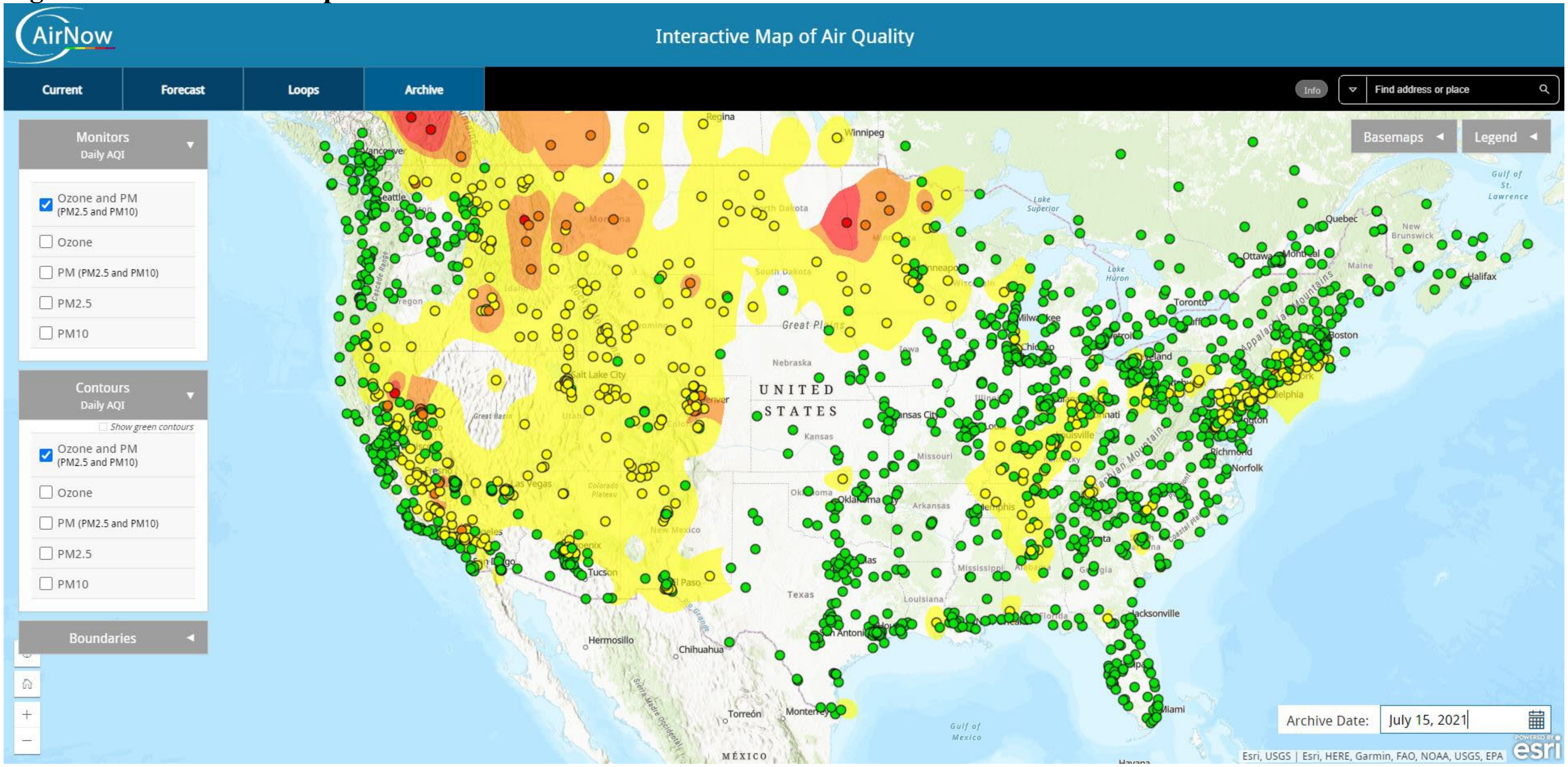
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-47 - AirNow Map for 7/15/21



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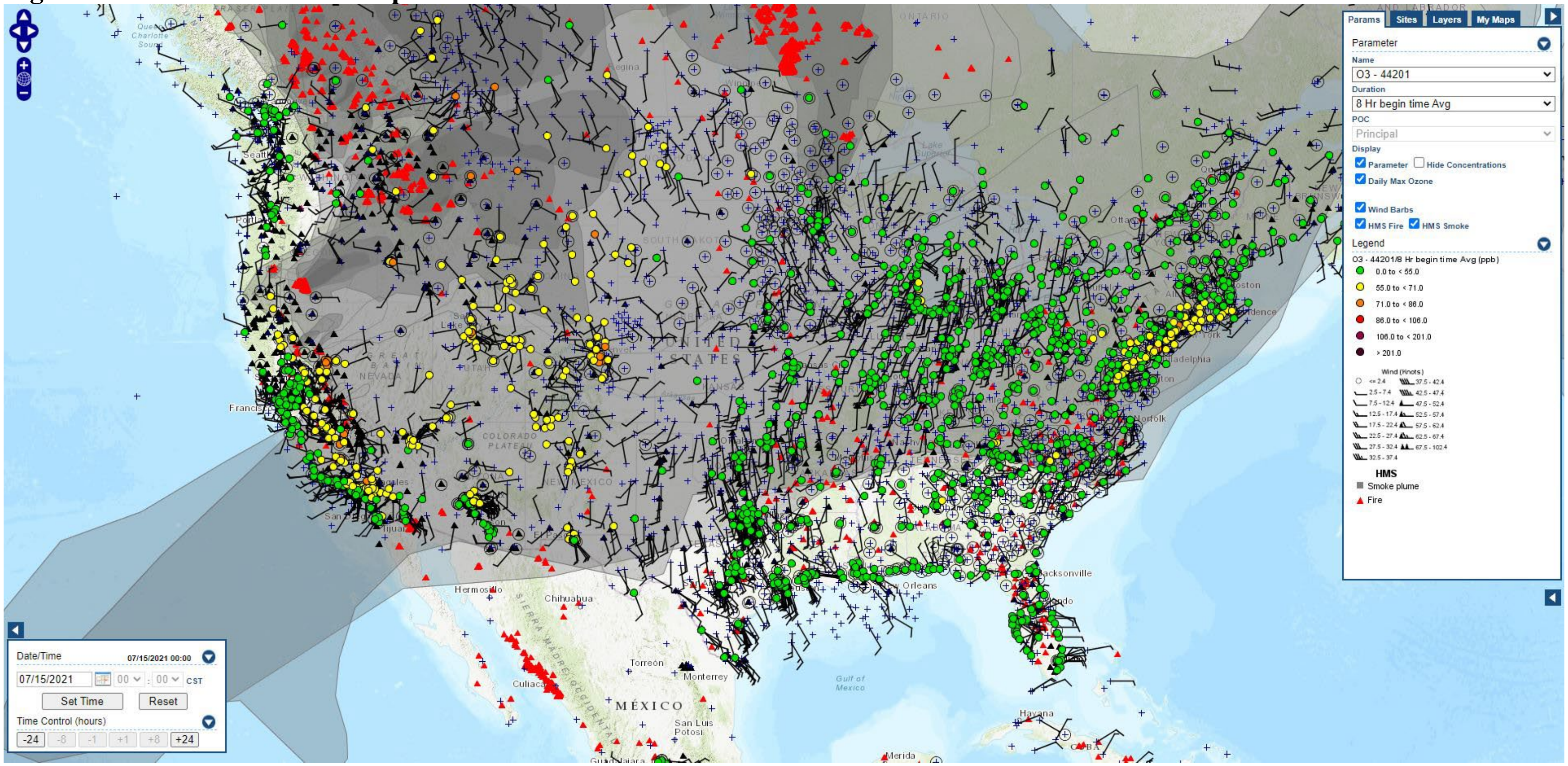
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-48 - AirNow Tech Map for 7/15/21



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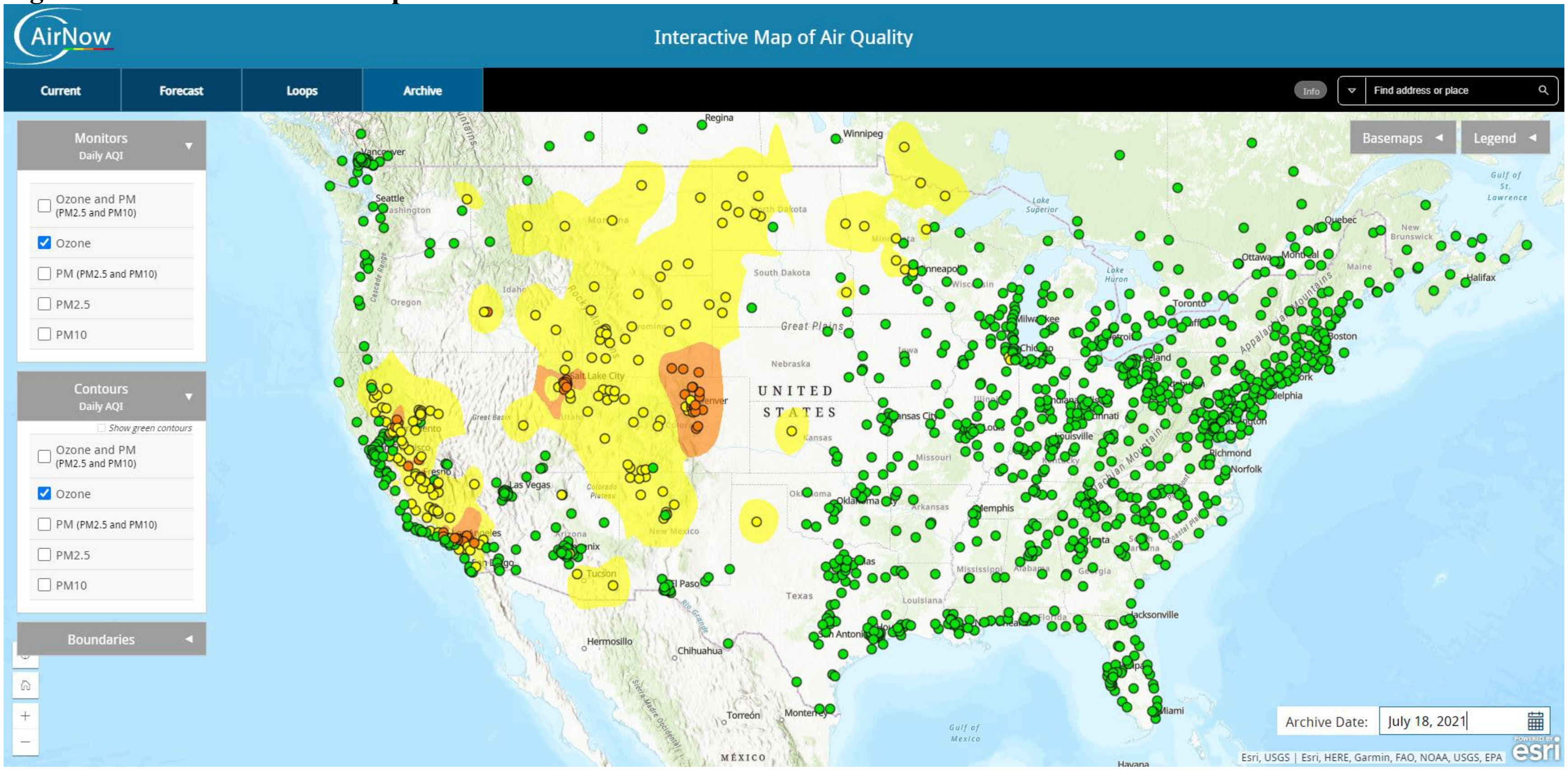
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-49 - AirNow Tech Map for 7/18/21



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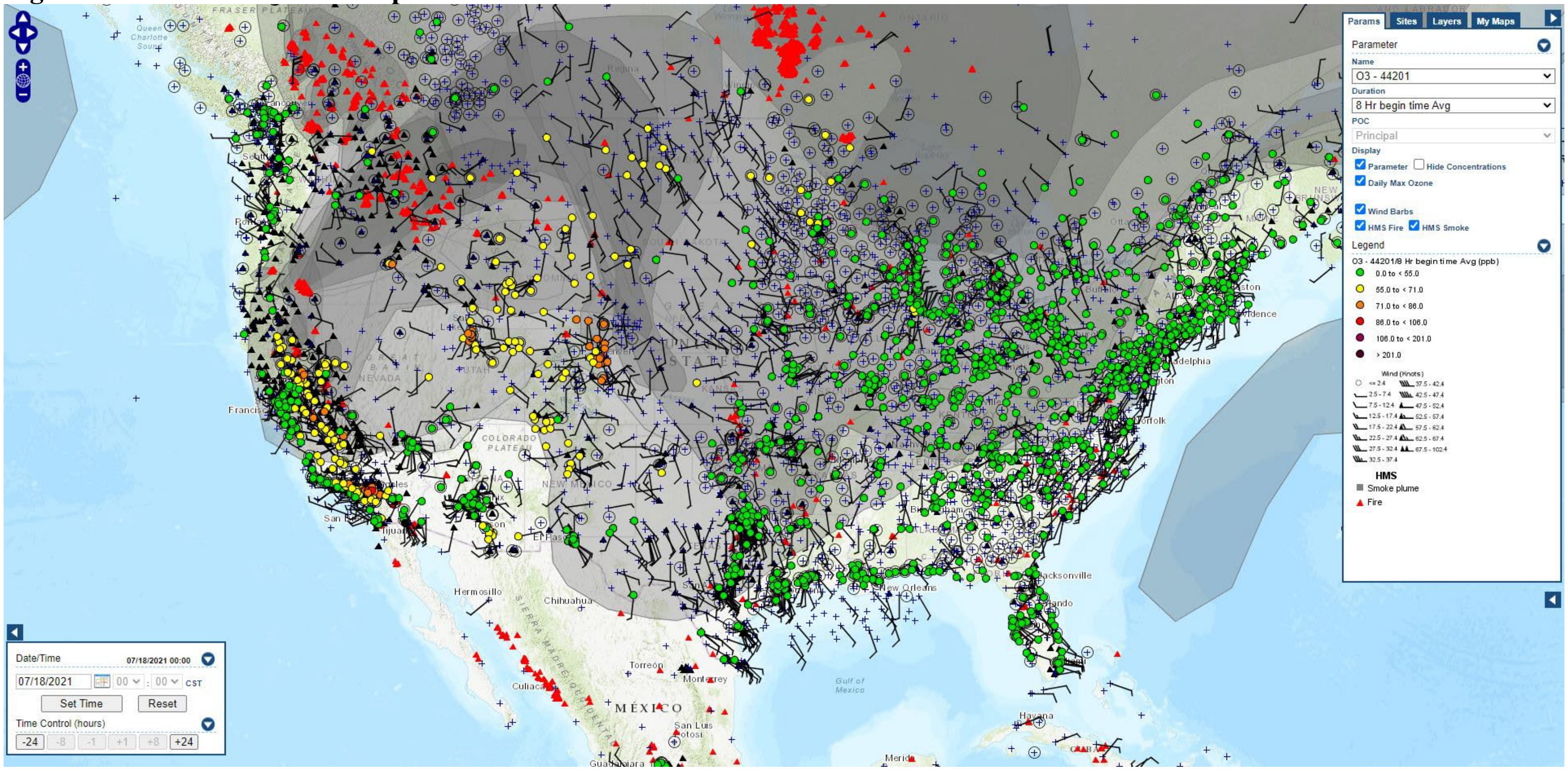
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-50 - AirNow Tech Map for 7/18/21



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AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-51 - AirNow Map for 7/19/21

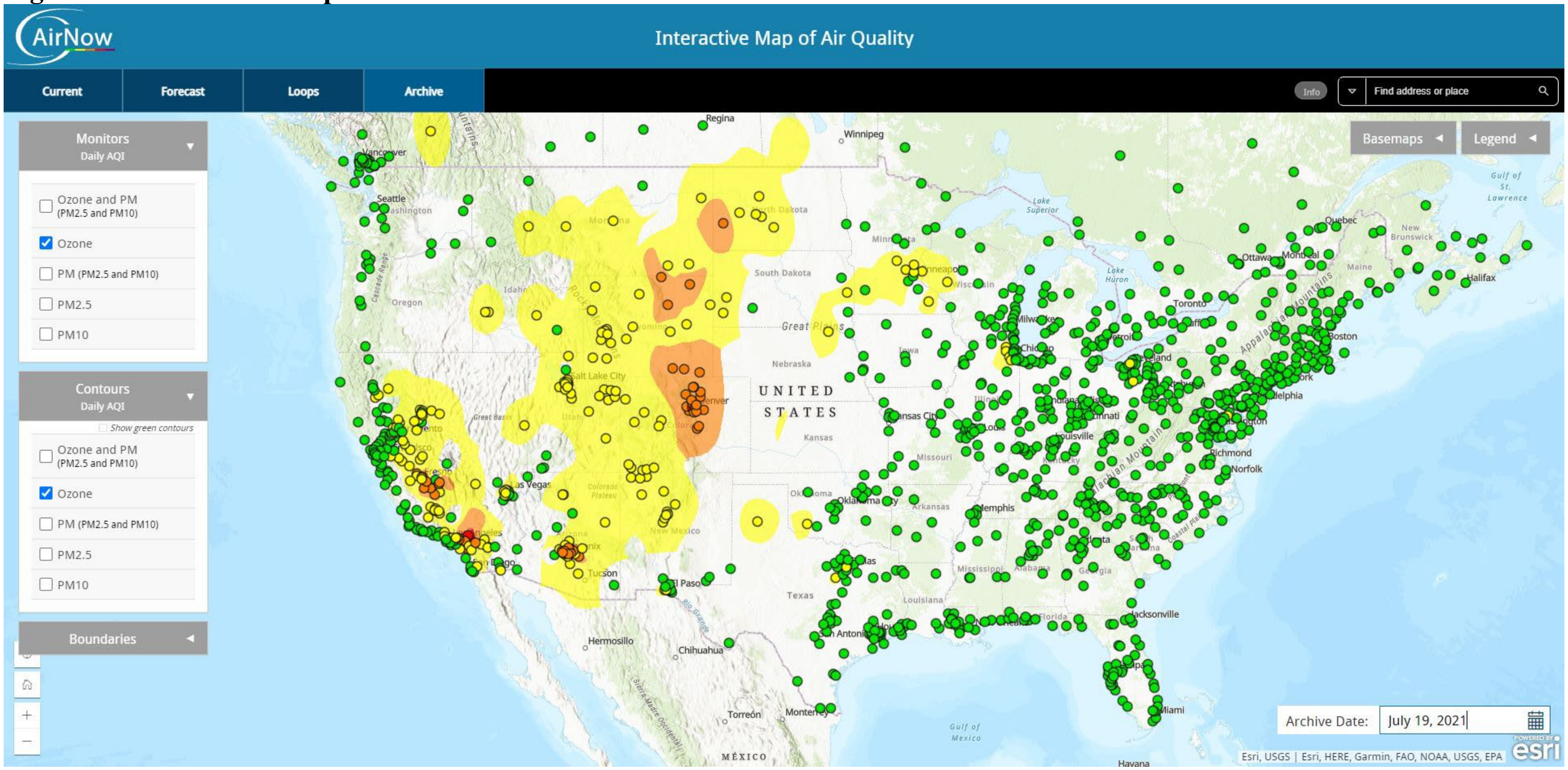

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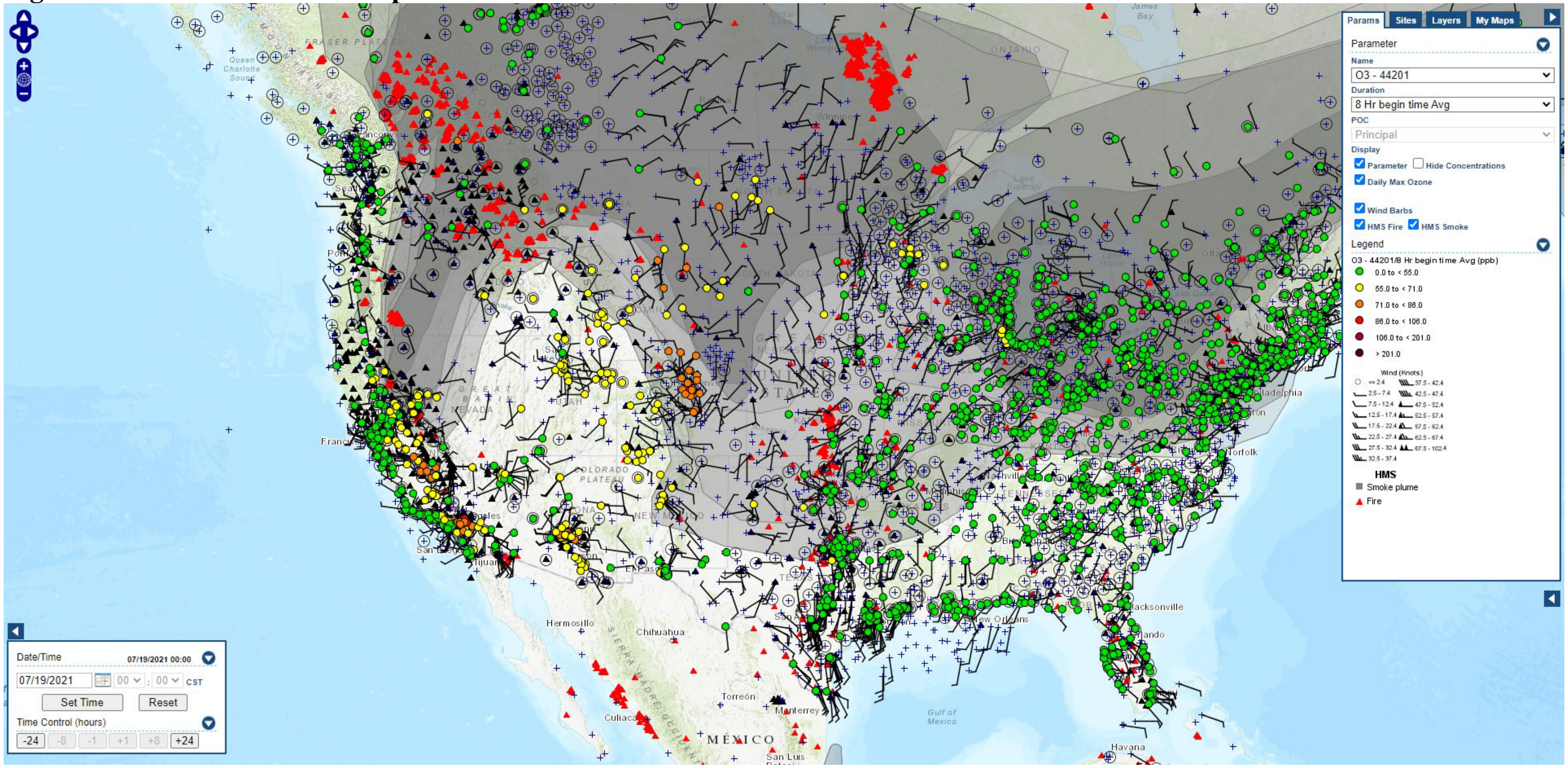
Figure C-52 - AirNow Tech Map for 7/19/21



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AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-53 - AirNow Map for 7/20/21

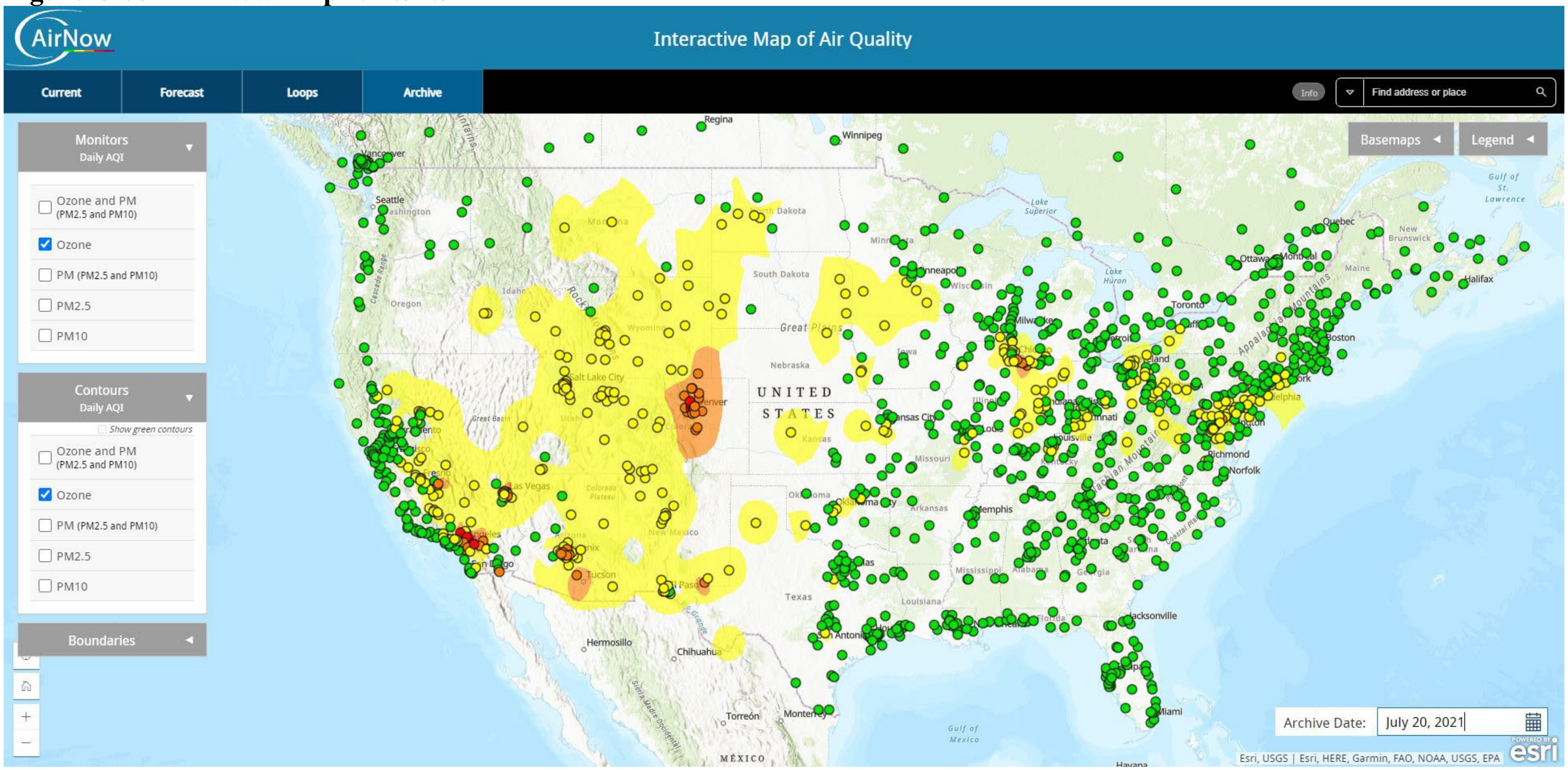

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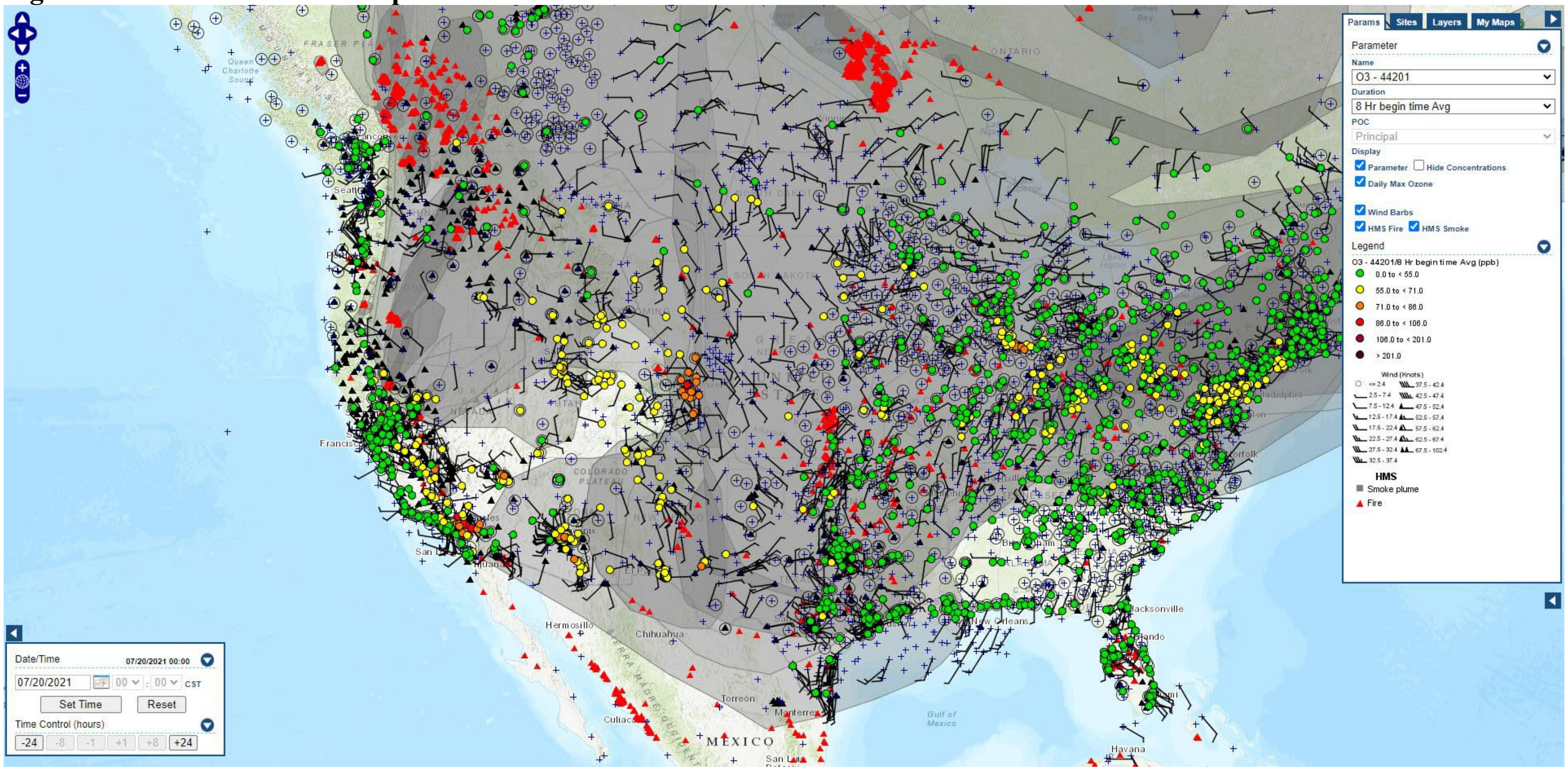
Figure C-54 - AirNow Tech Map for 7/20/21



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AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-55 - AirNow Map for 7/22/21

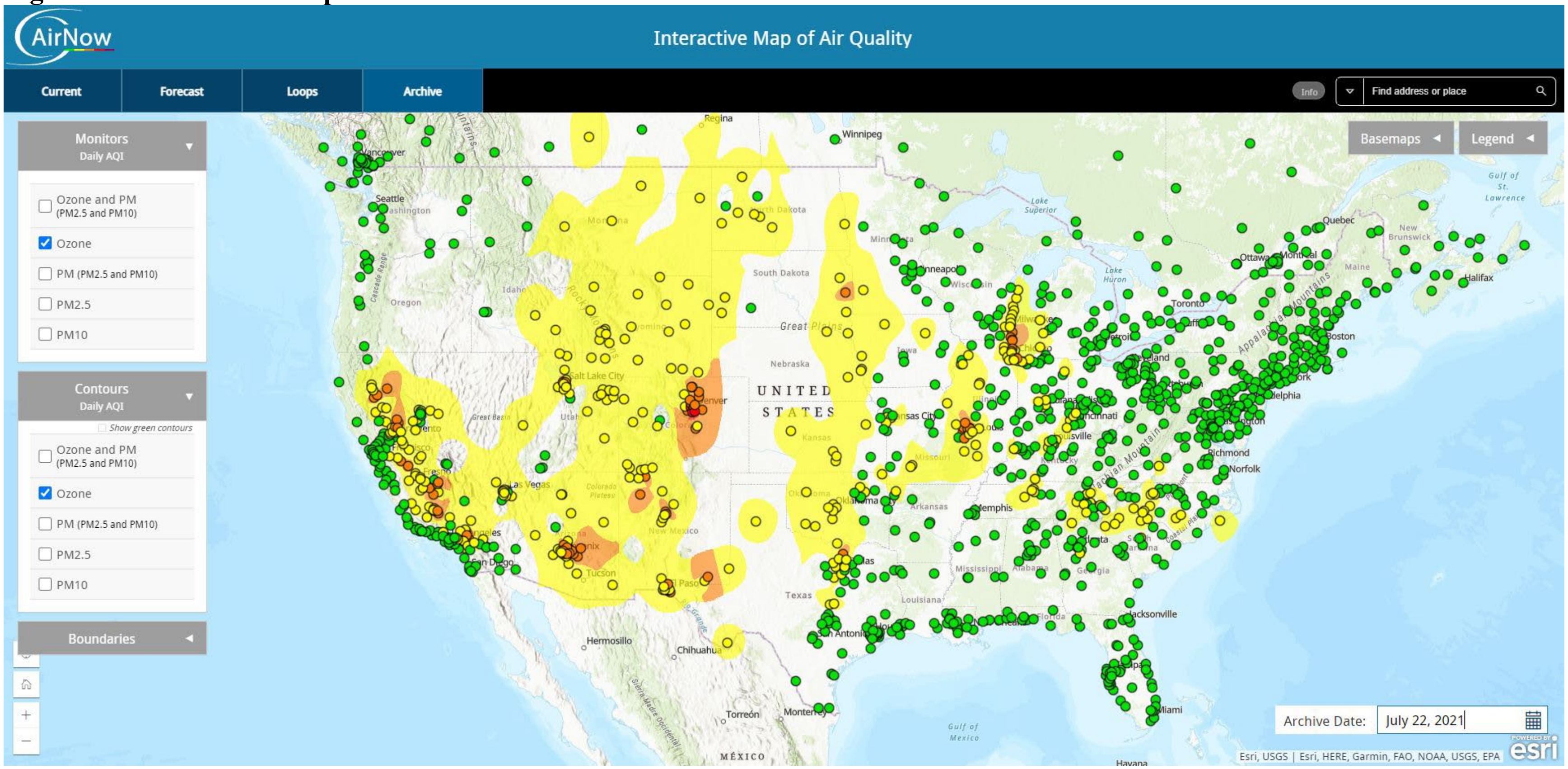

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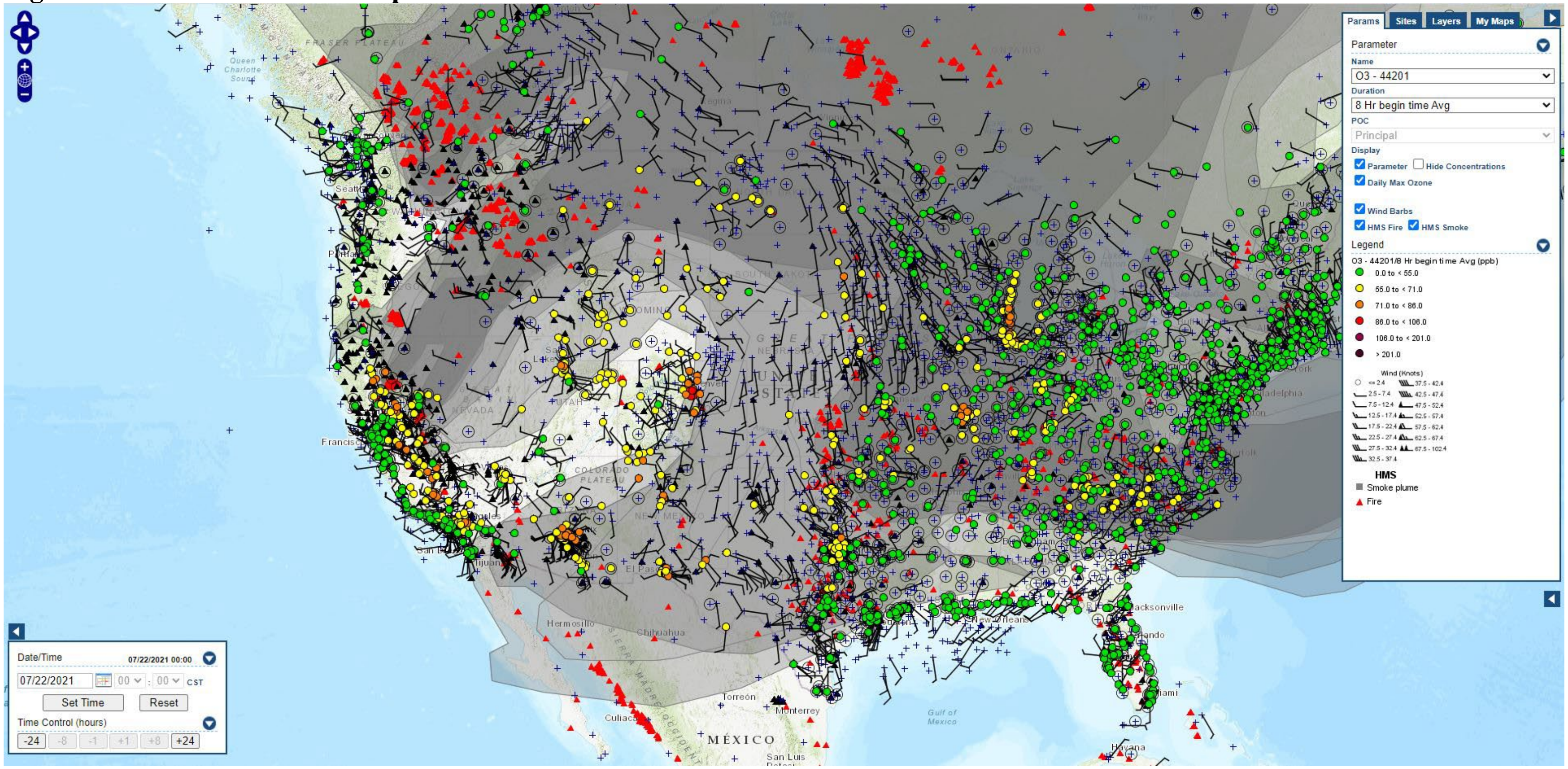
Figure C-56 - AirNow Tech Map for 7/22/21



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AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-57 - AirNow Map for 7/24/21

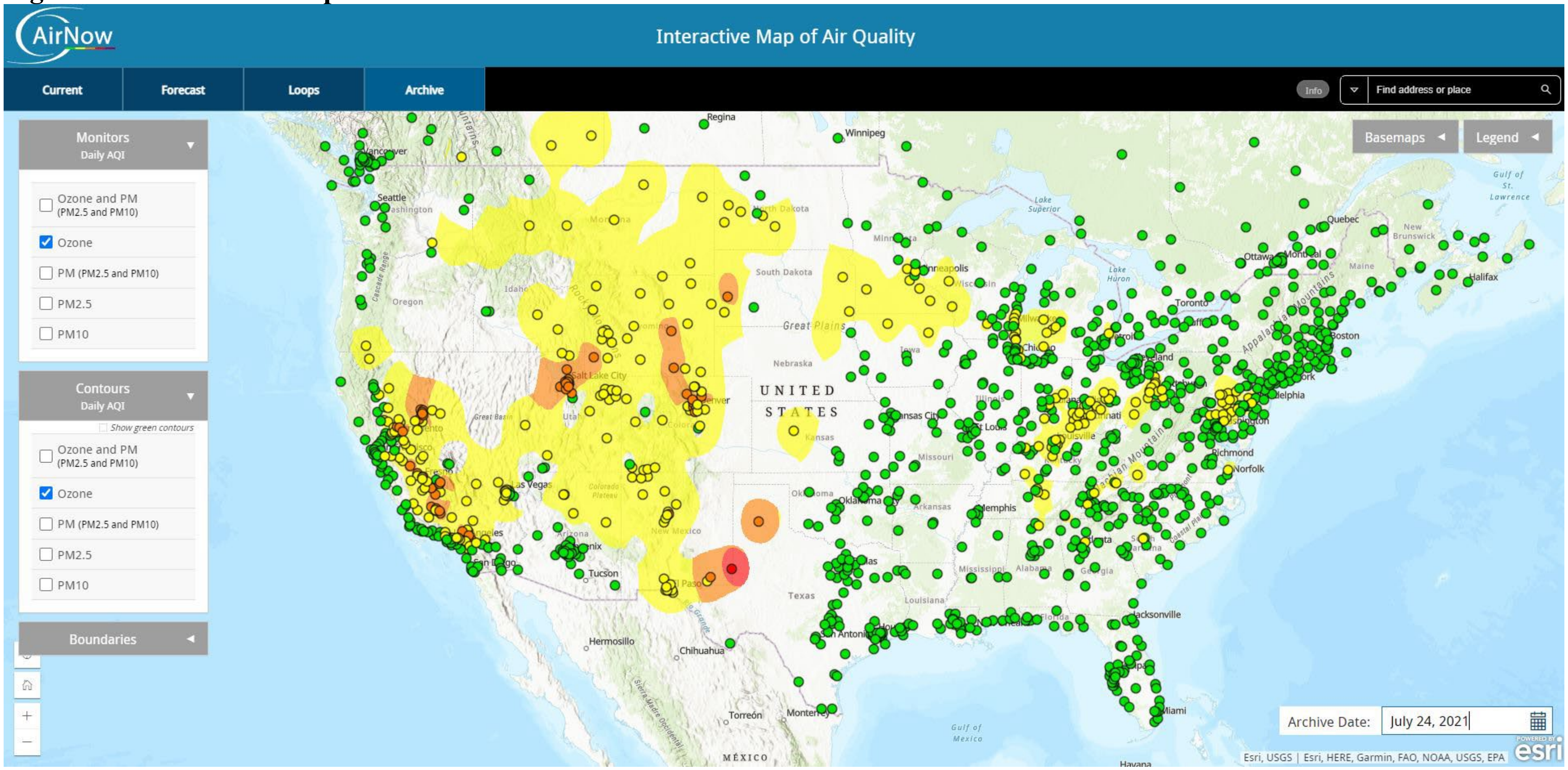

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Figure C-58 - AirNow Tech Map for 7/24/21

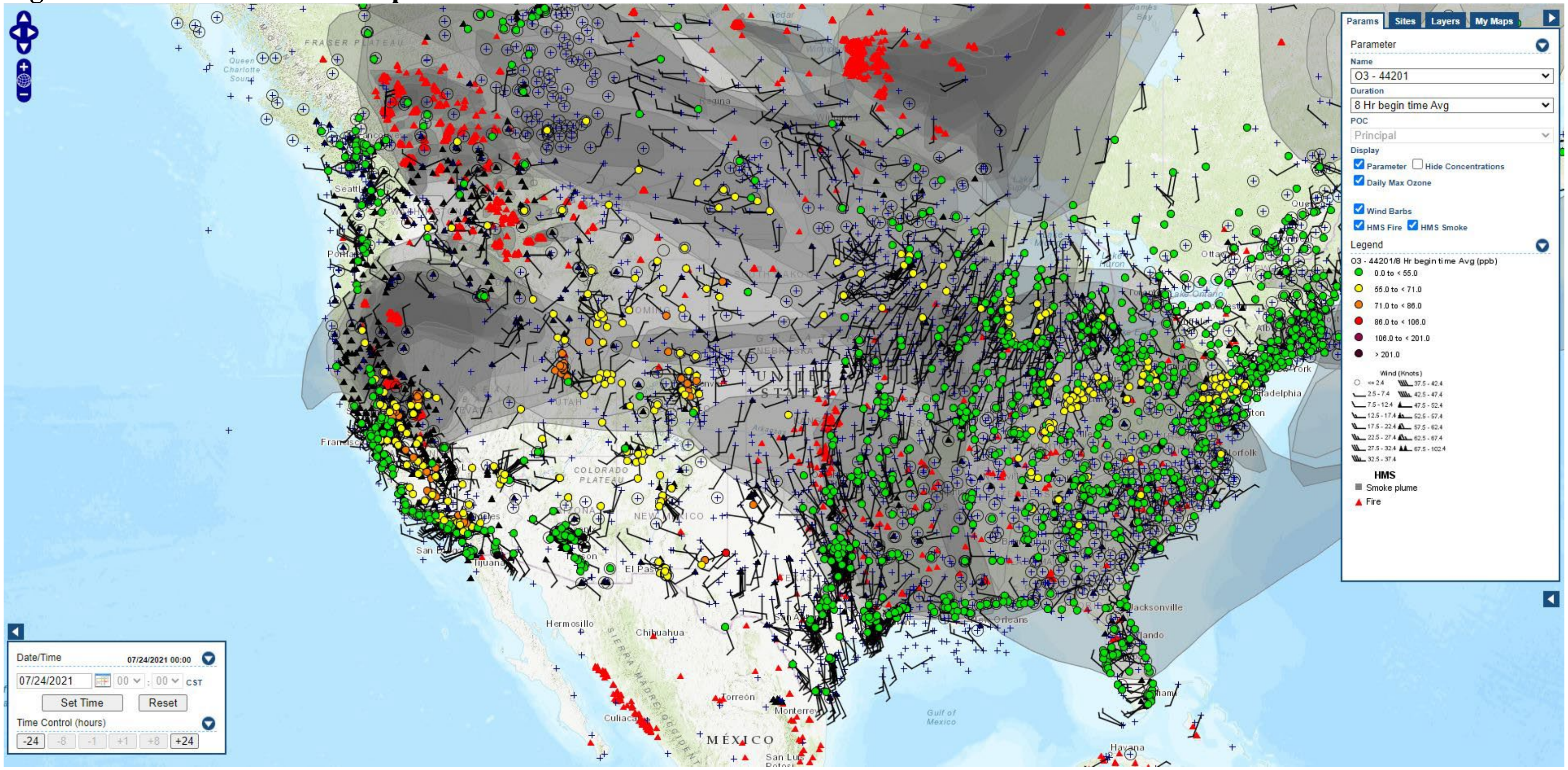

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Figure C-59 - AirNow Tech Map for 7/25/21

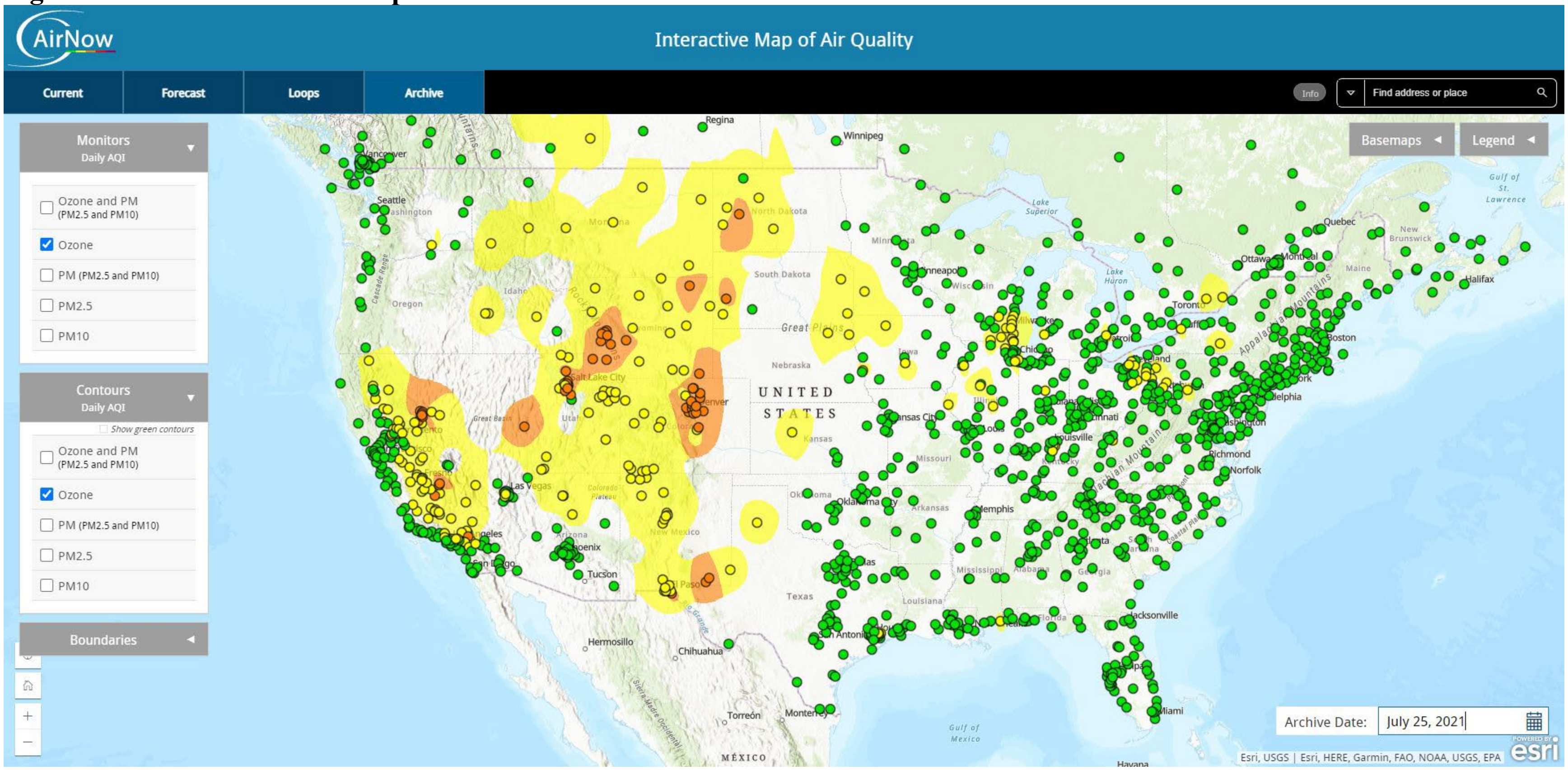

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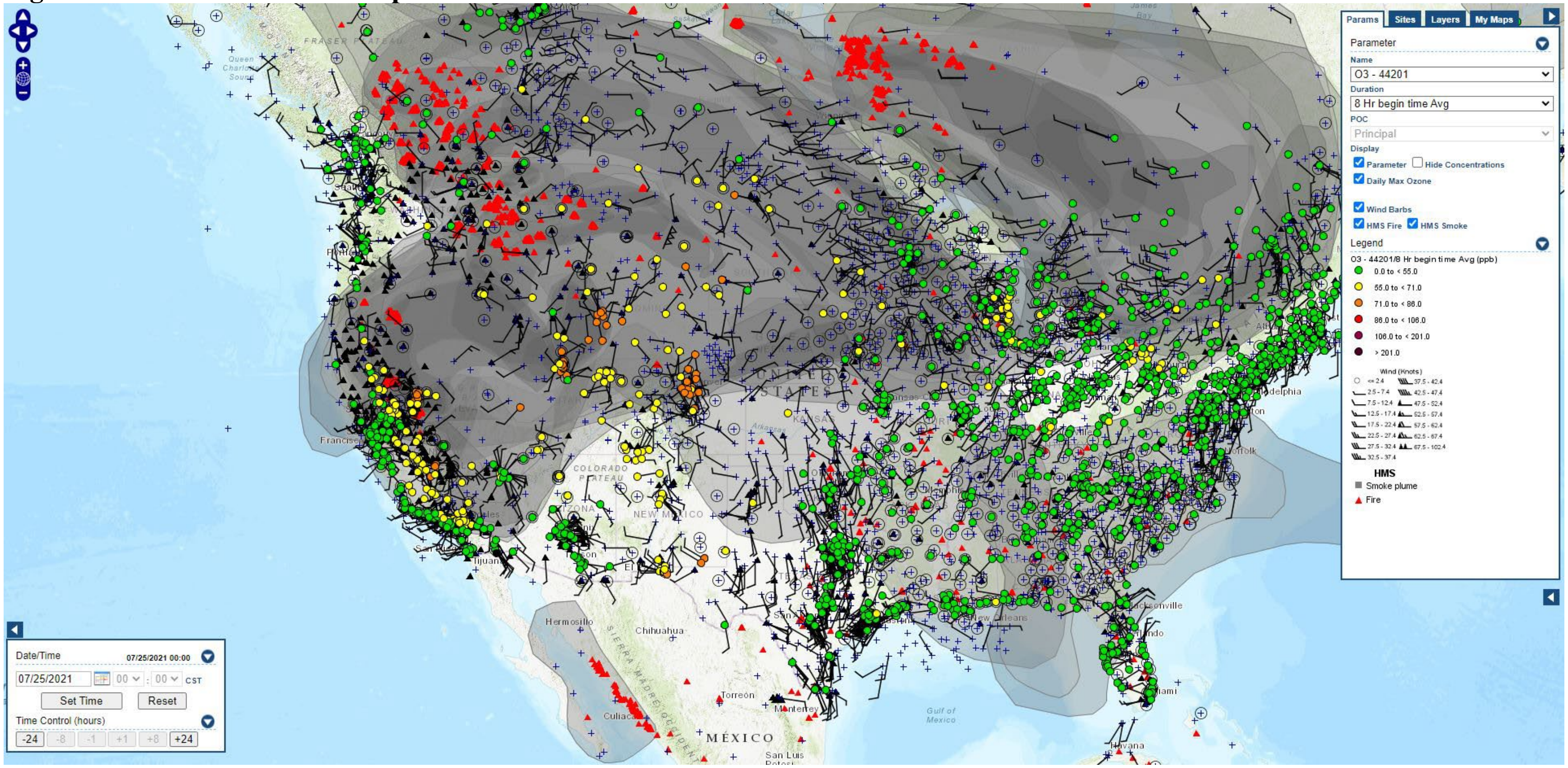
Figure C-60 - AirNow Tech Map for 7/25/21



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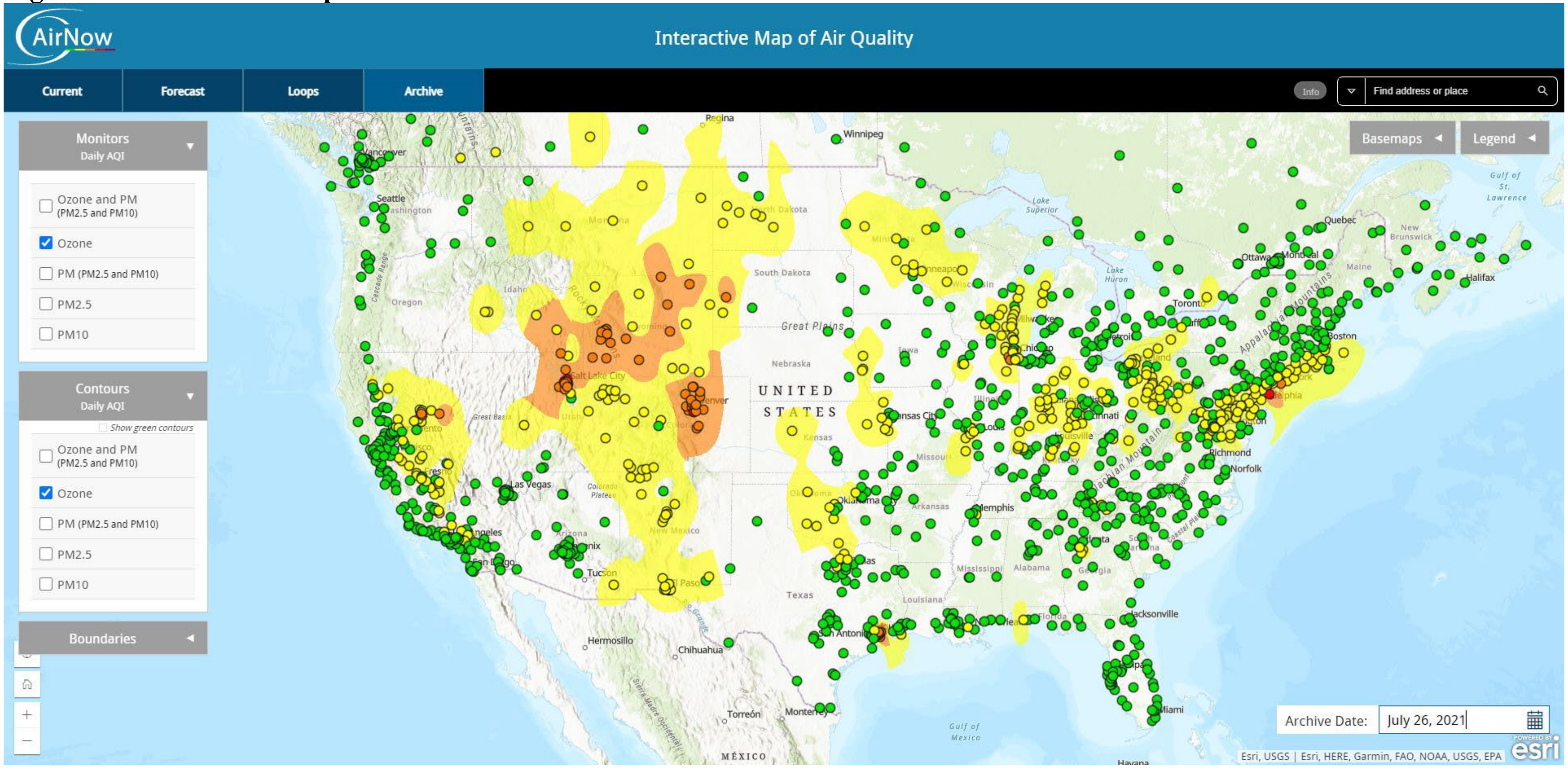
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-61 - AirNow Map for 7/26/21



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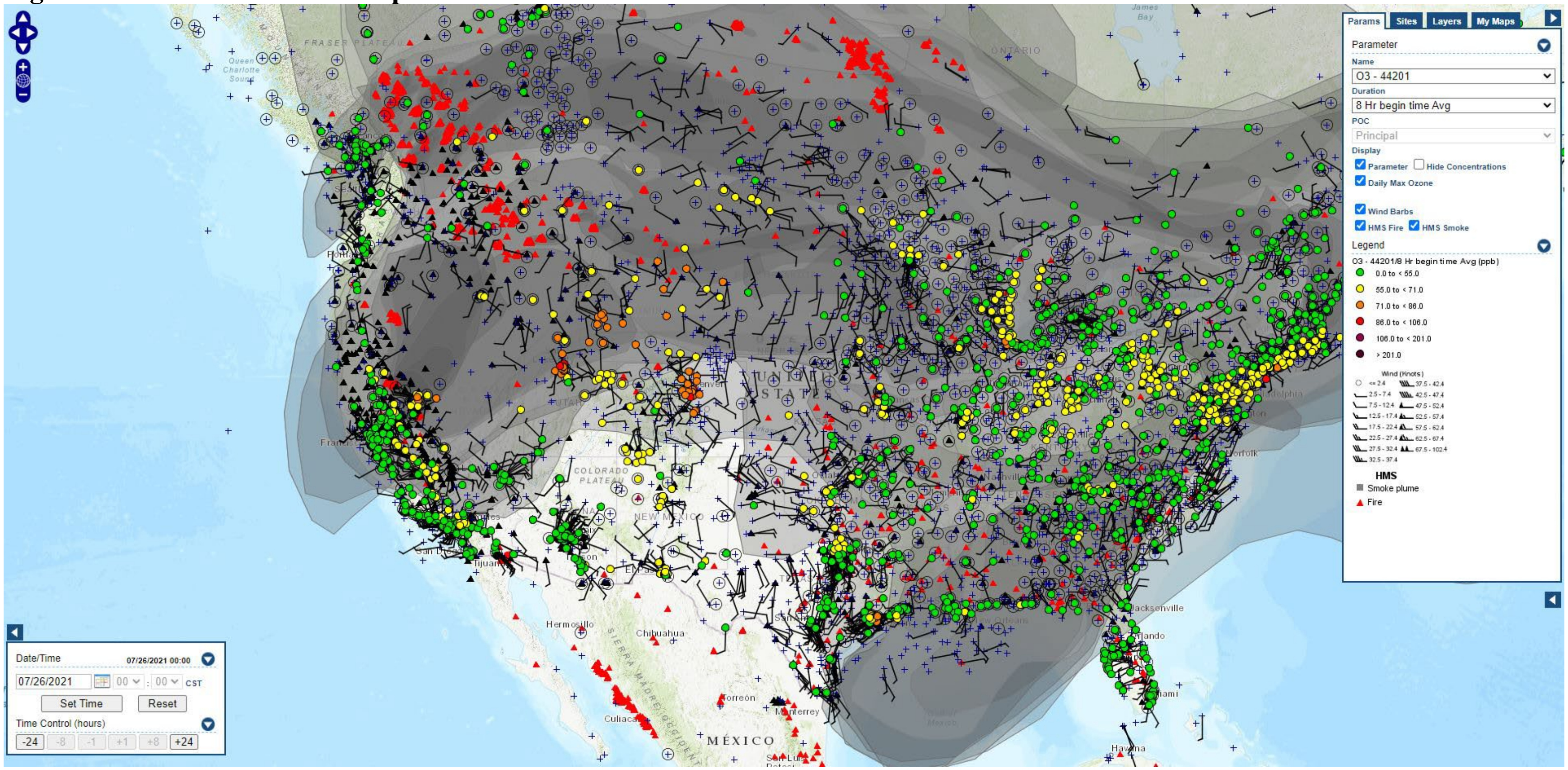
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-62 - AirNow Tech Map for 7/26/21



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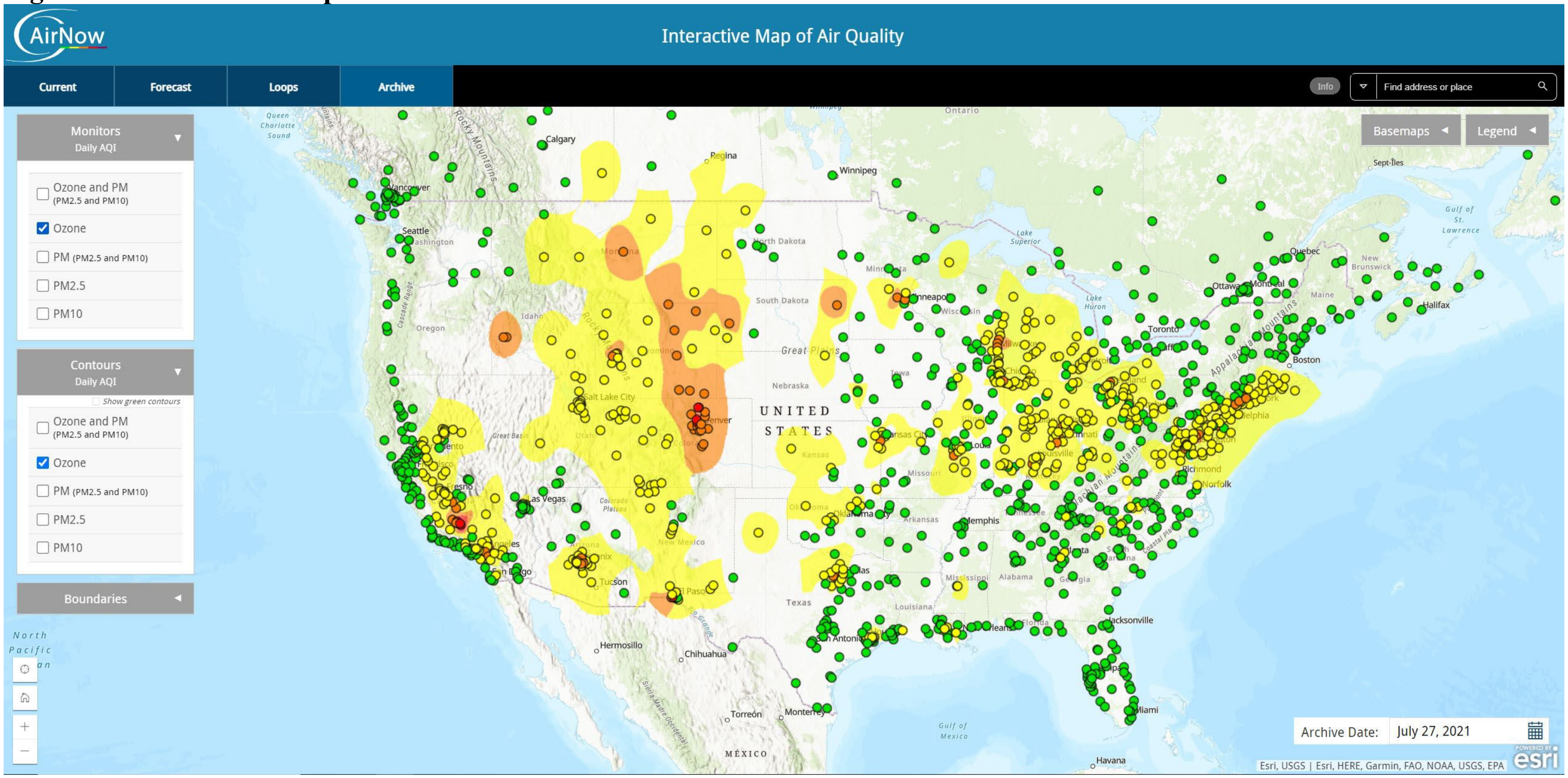
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-63 - AirNow Map for 7/27/21



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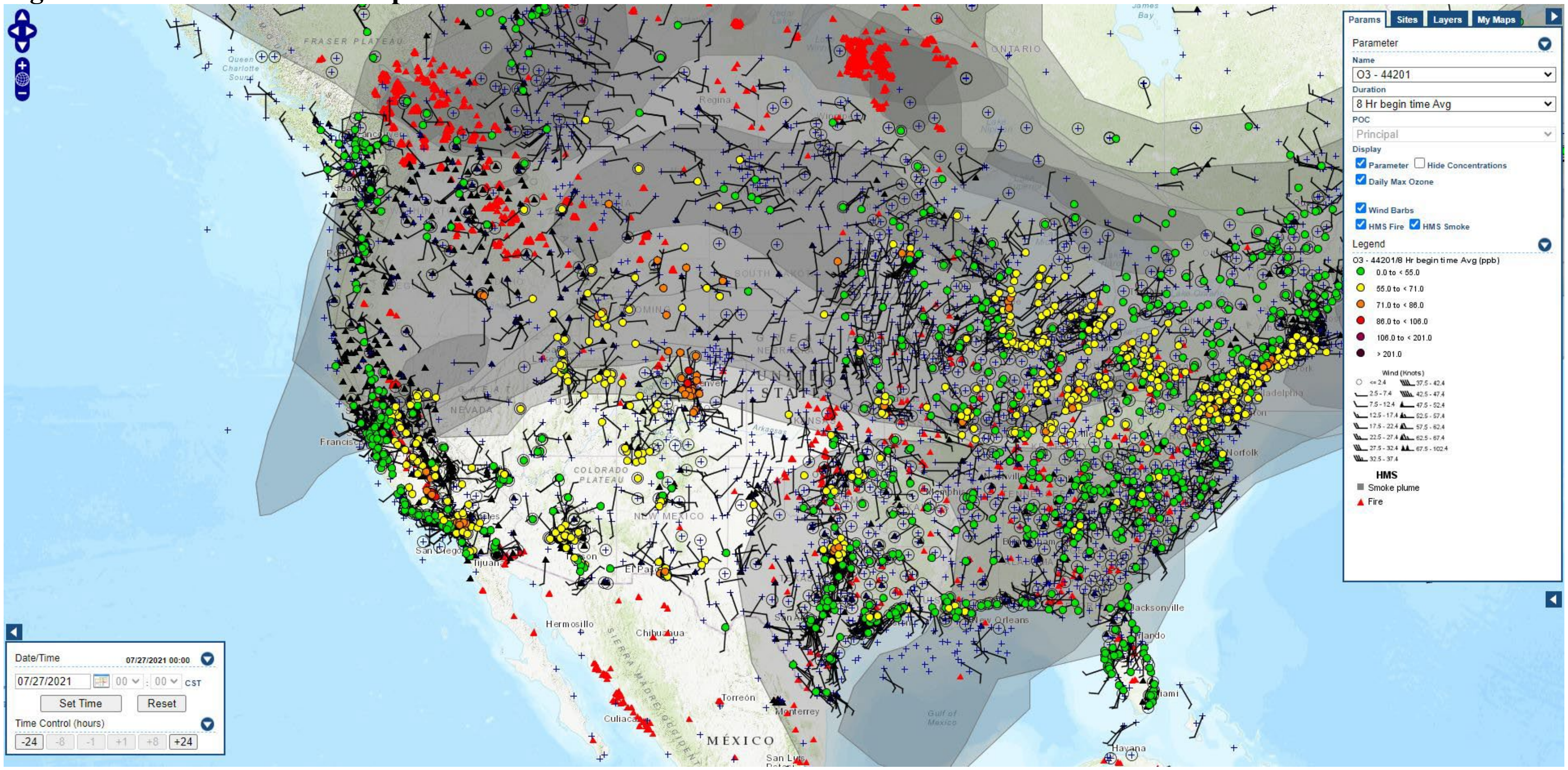
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-64 - AirNow Tech Map for 7/27/21



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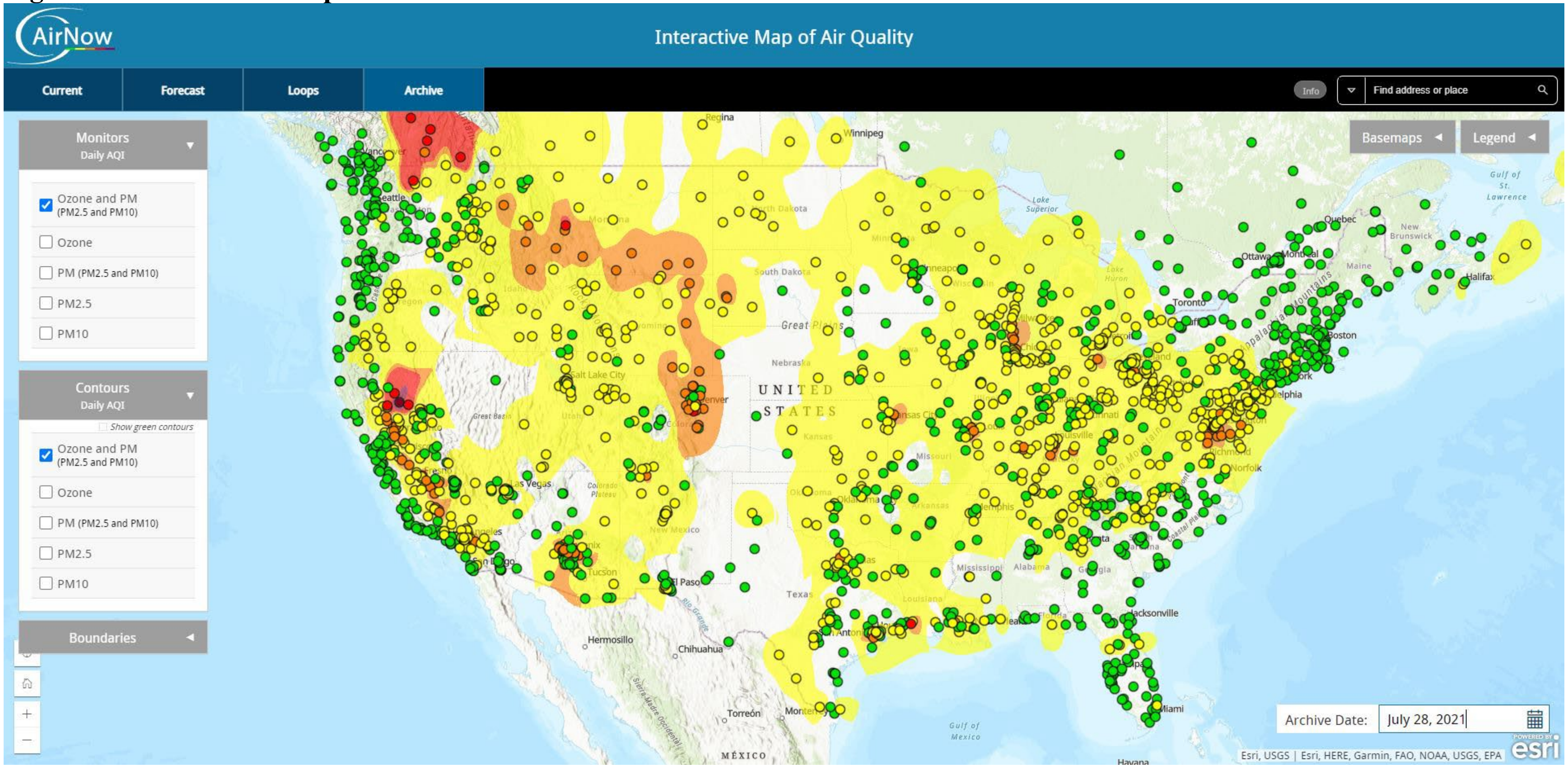
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-65 - AirNow Map for 7/28/21



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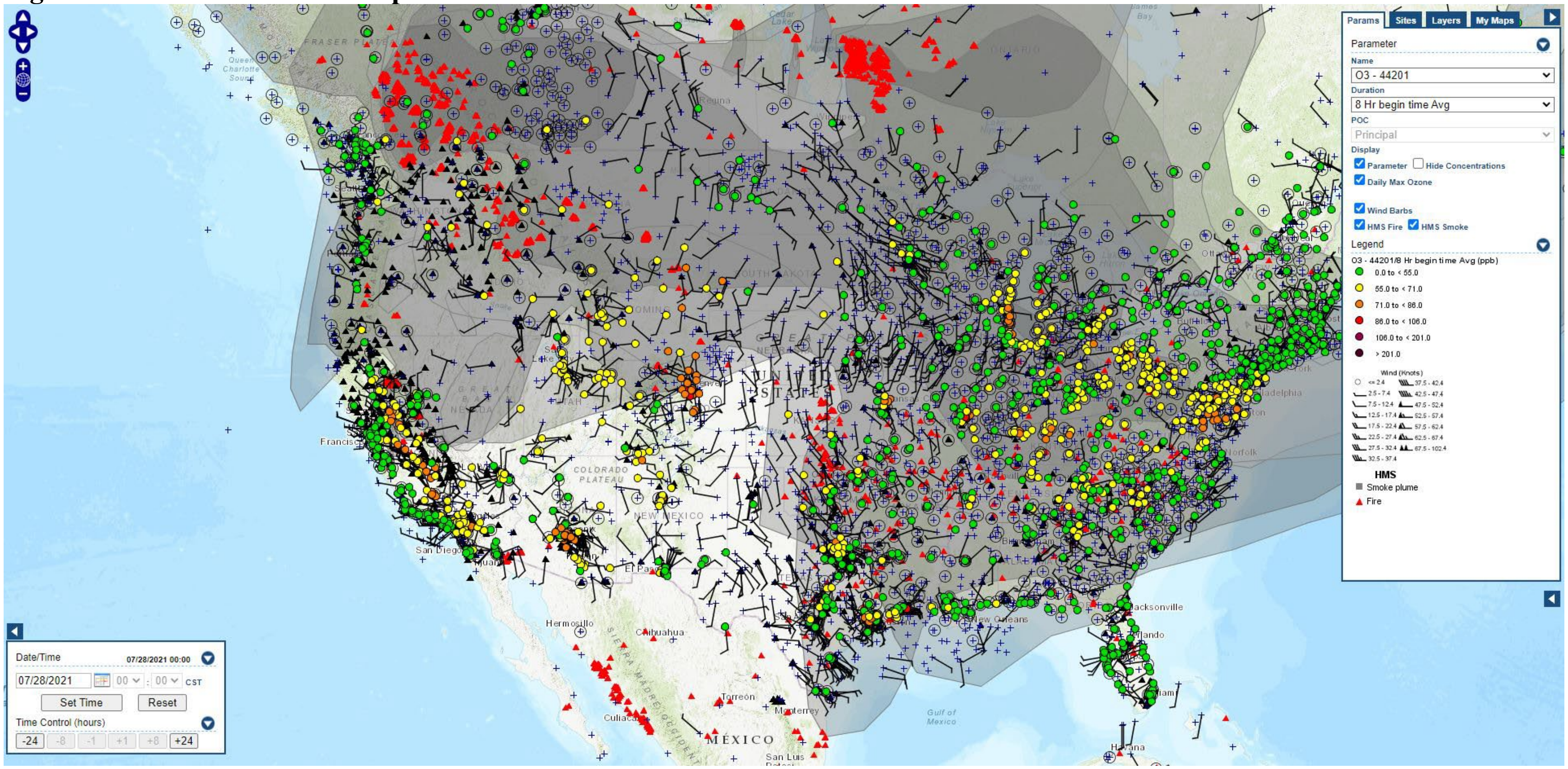
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-66 - AirNow Tech Map for 7/28/21



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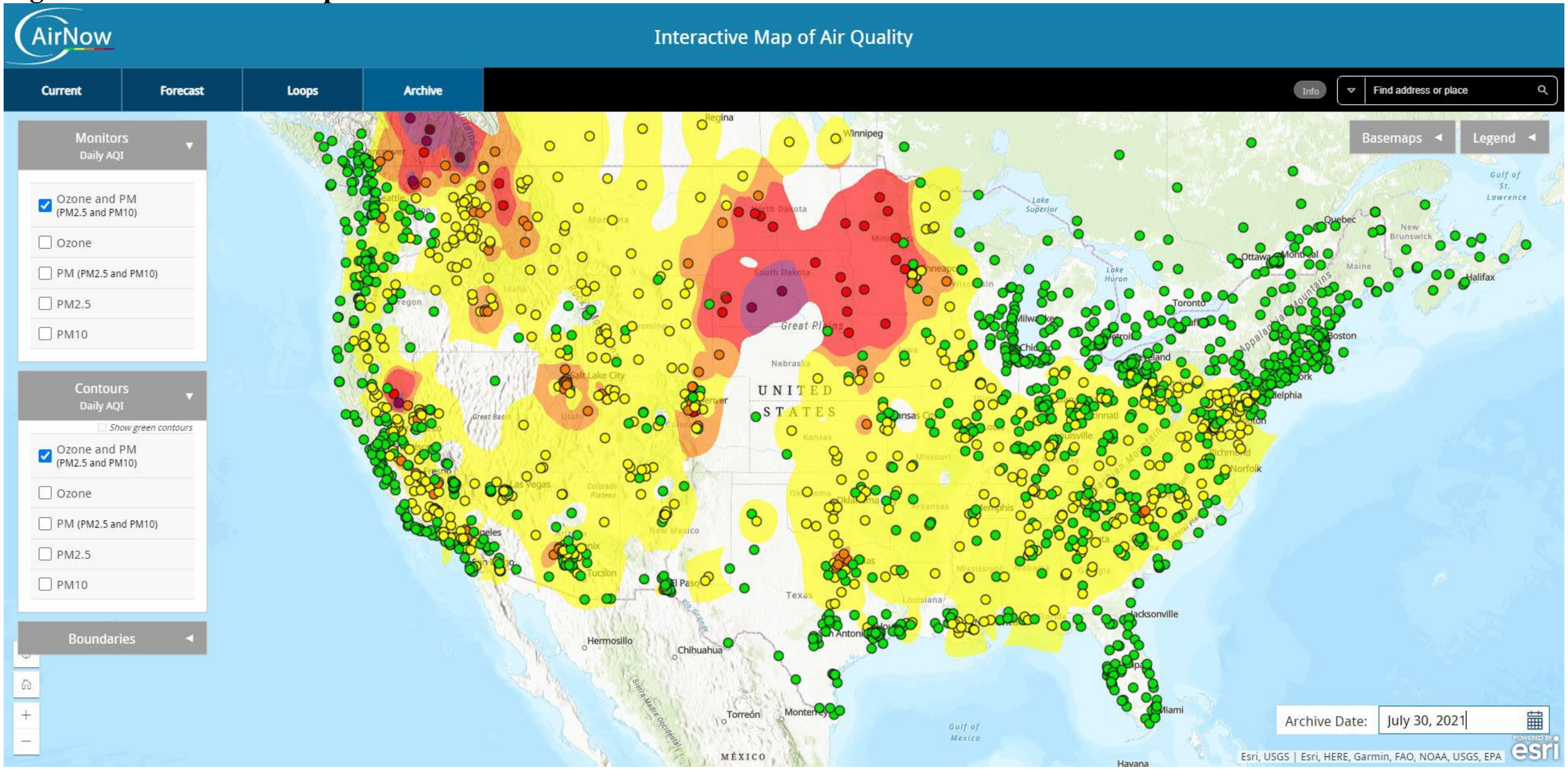
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-67 - AirNow Map for 7/30/21



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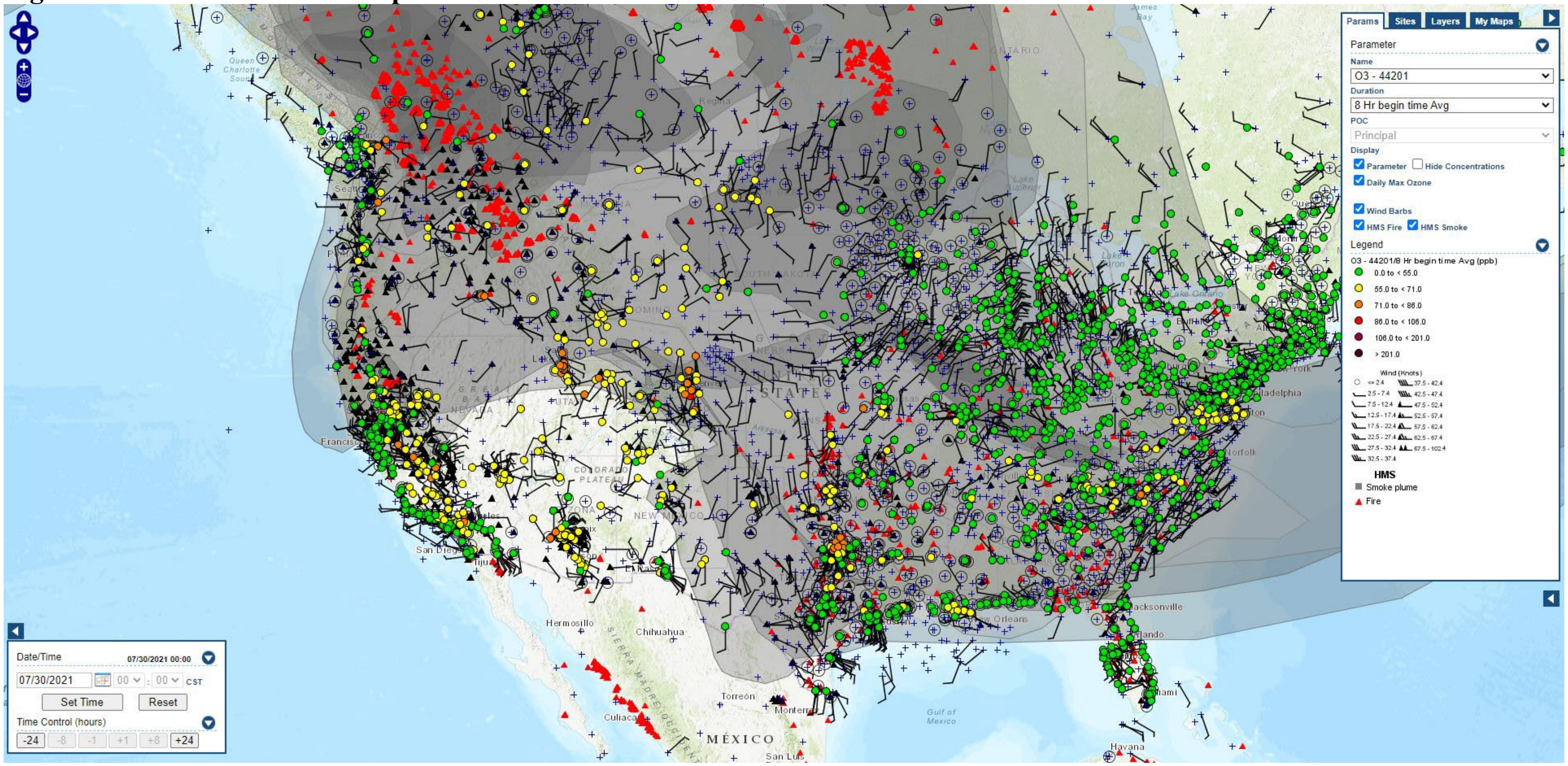
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-68 - AirNow Tech Map for 7/30/21



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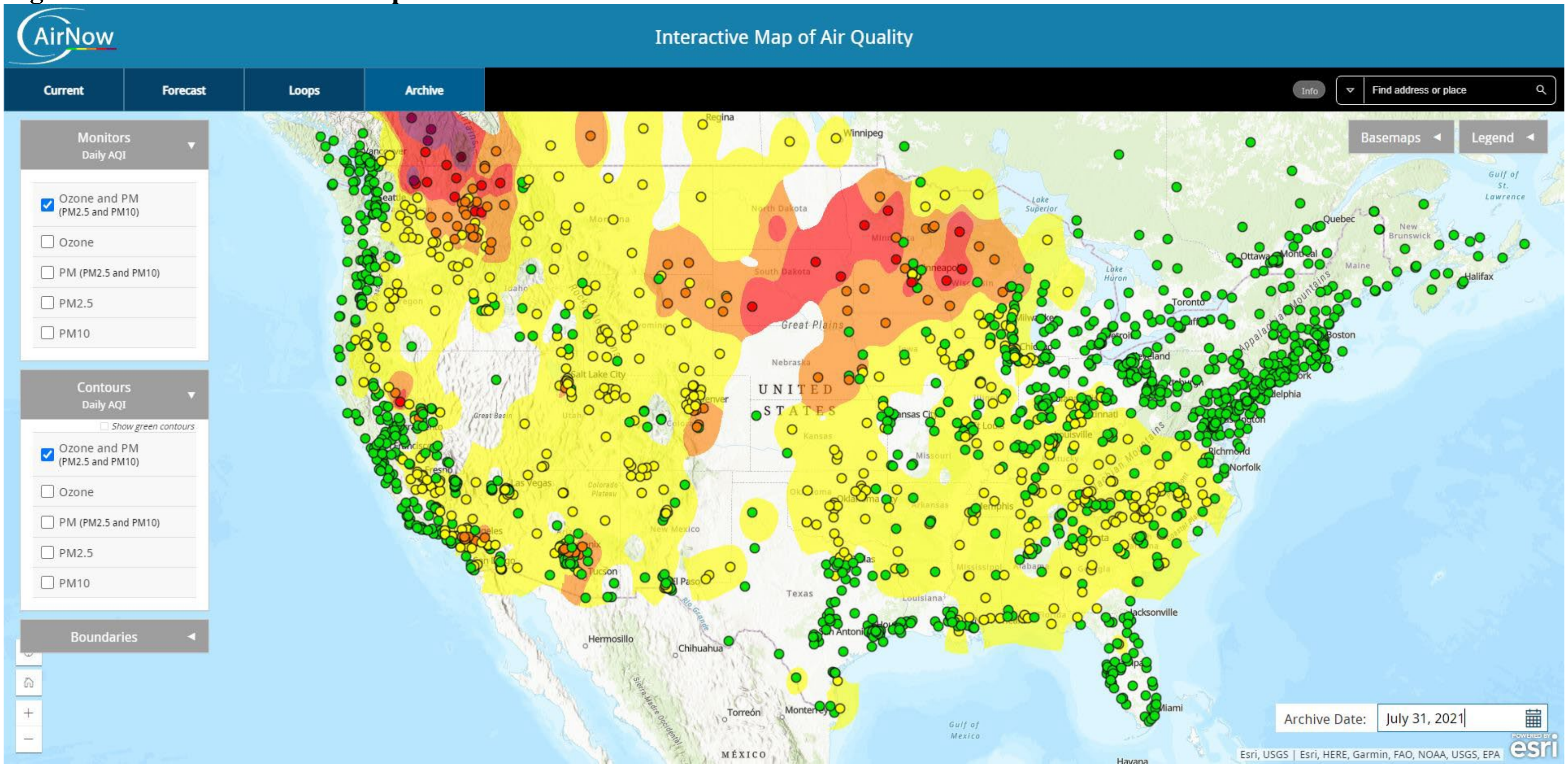
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-69 - AirNow Tech Map for 7/31/21



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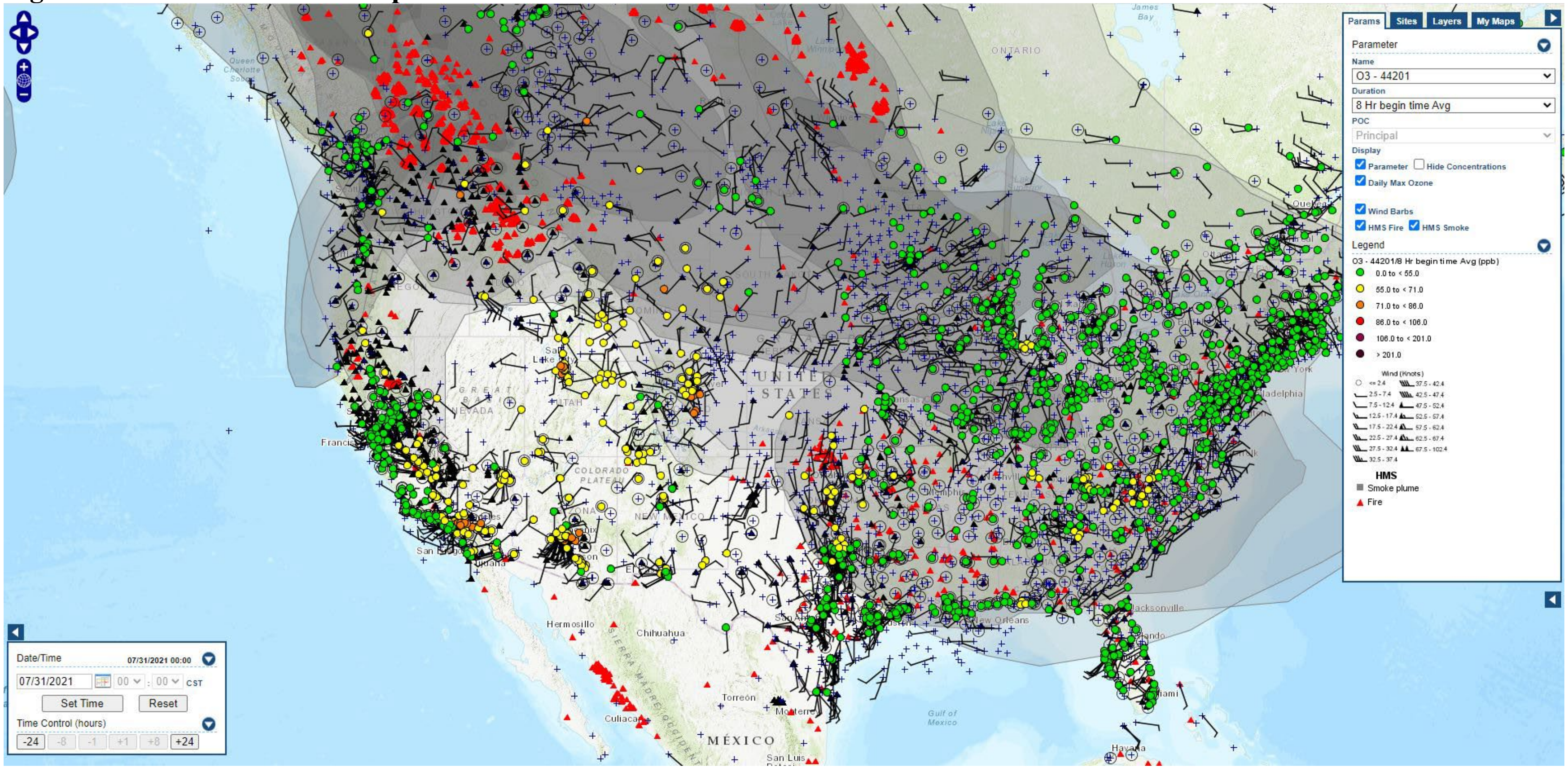
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-70 - AirNow Tech Map for 7/31/21



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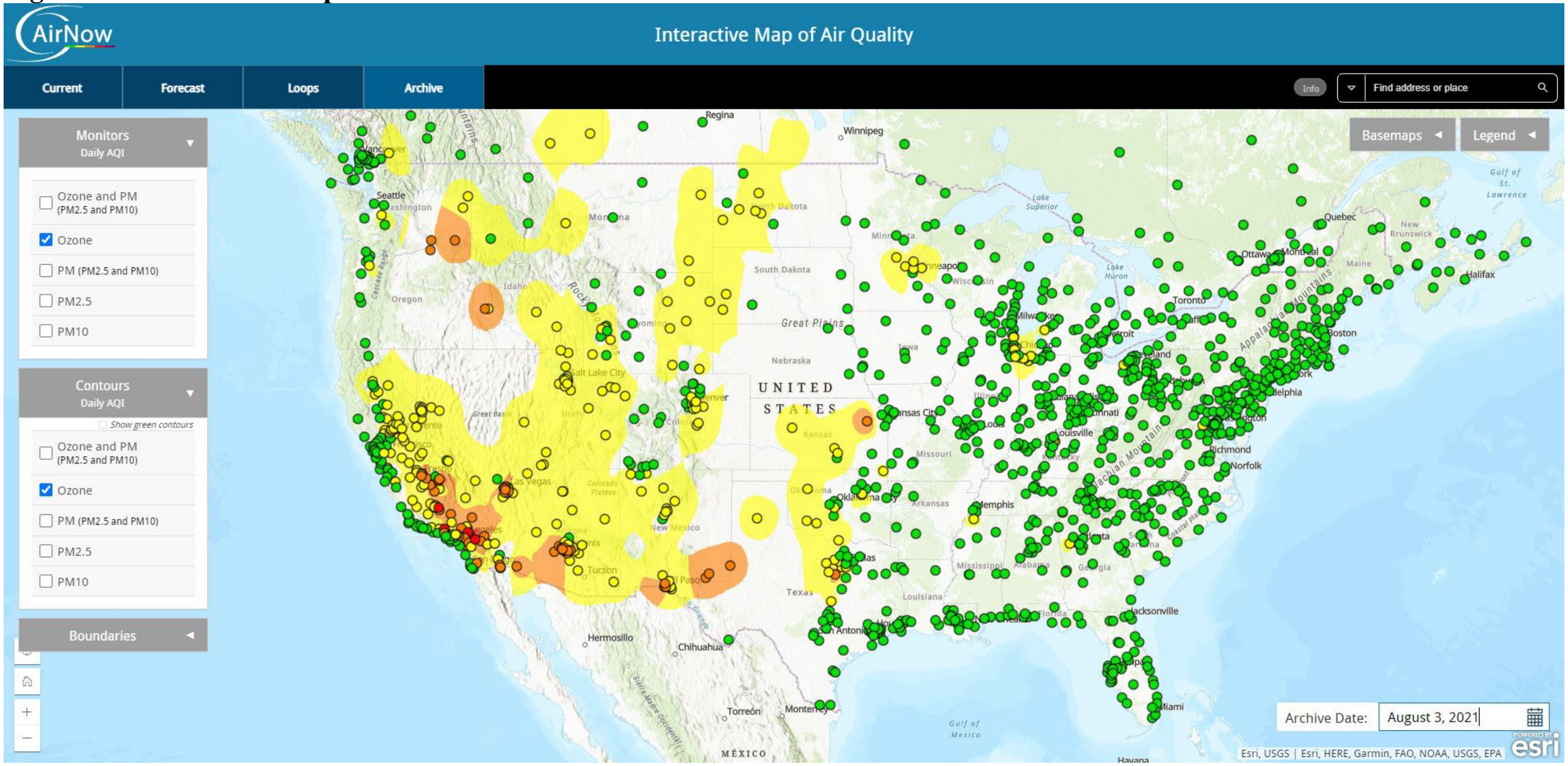
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-71 - AirNow Map for 8/3/21



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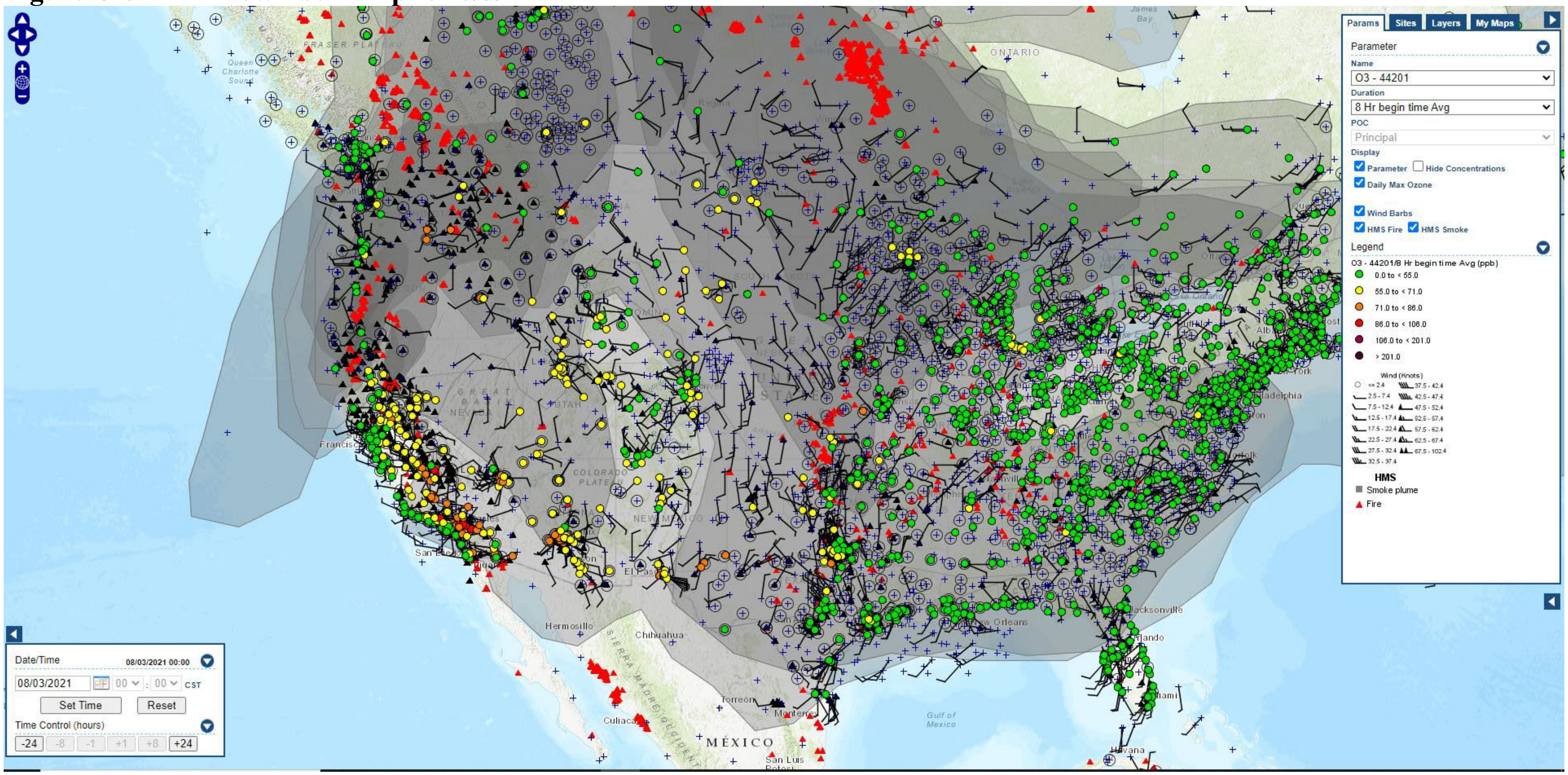
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-72 - AirNow Tech Map for 8/3/21



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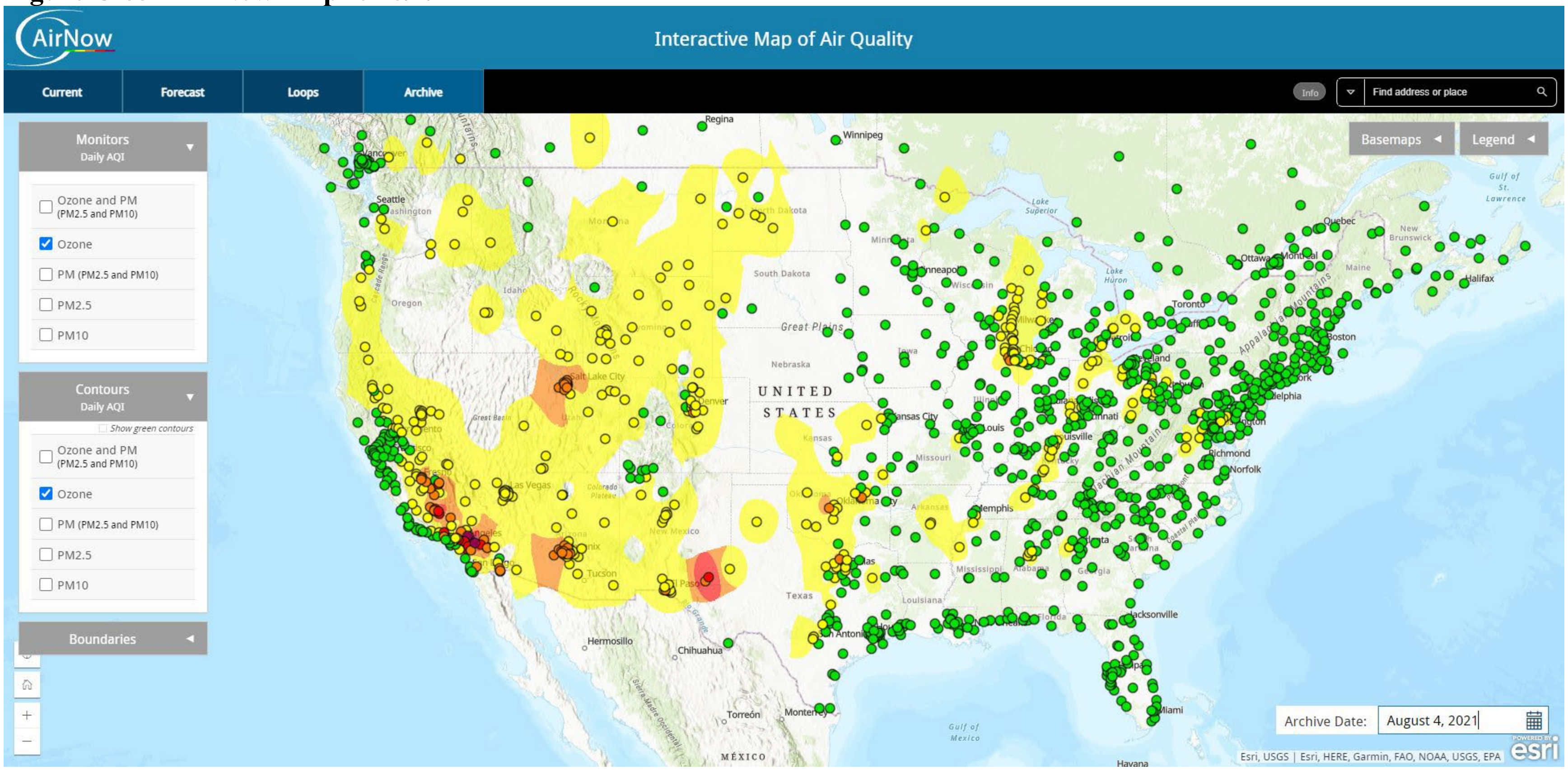
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-73 - AirNow Map for 8/4/21



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AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-74 - AirNow Tech Map for 8/4/21

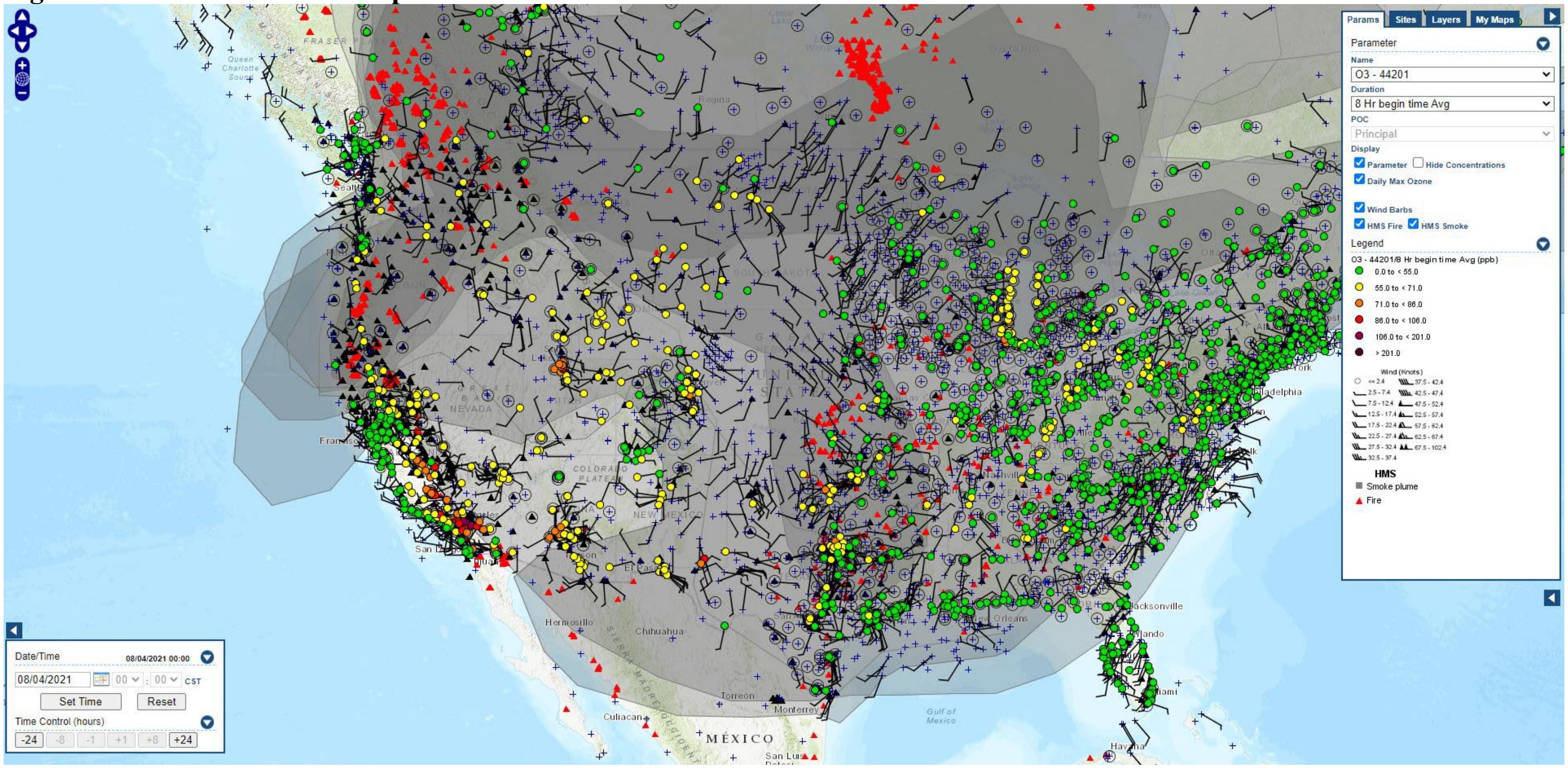

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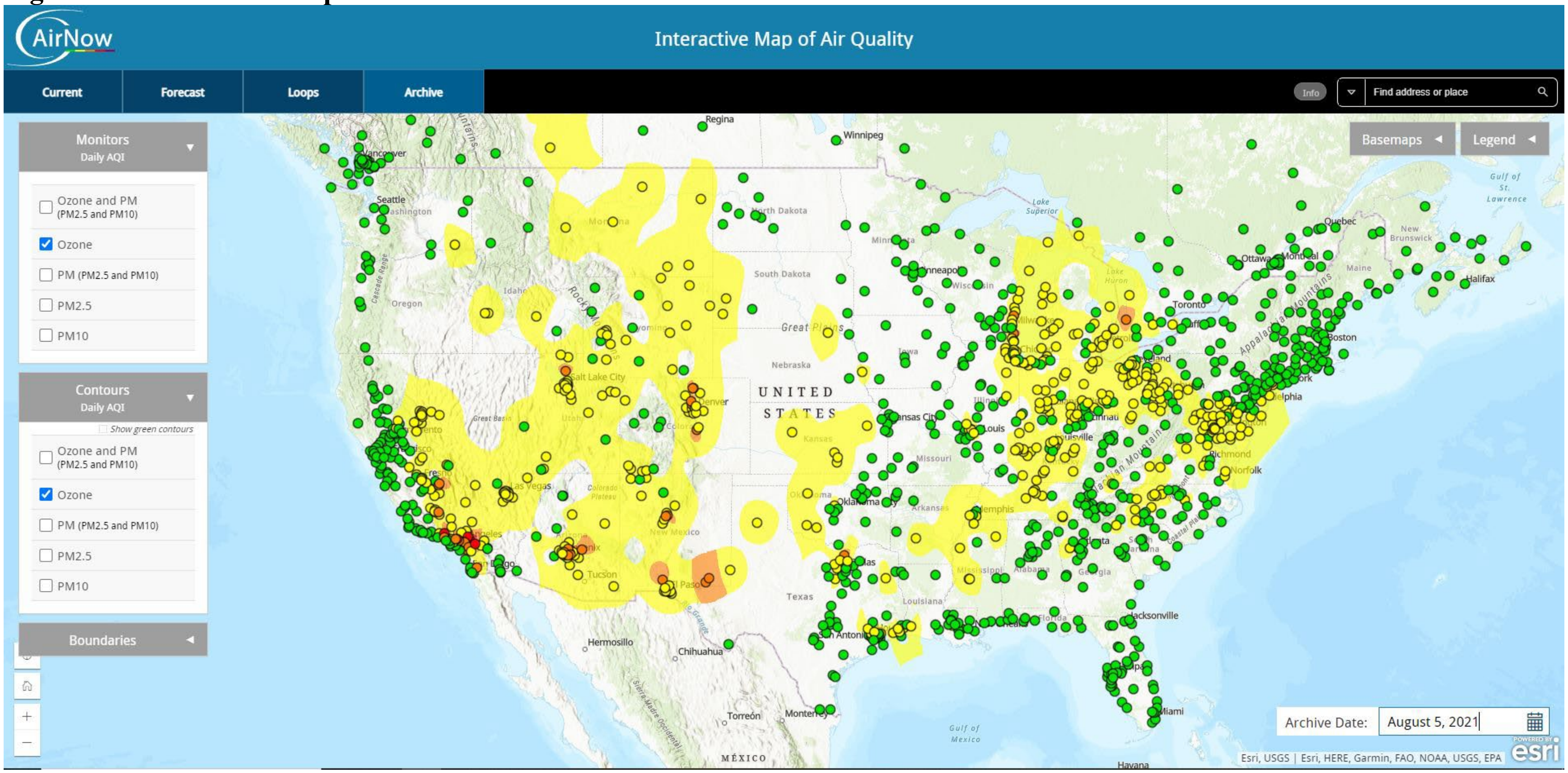
Figure C-75 - AirNow Map for 8/5/21



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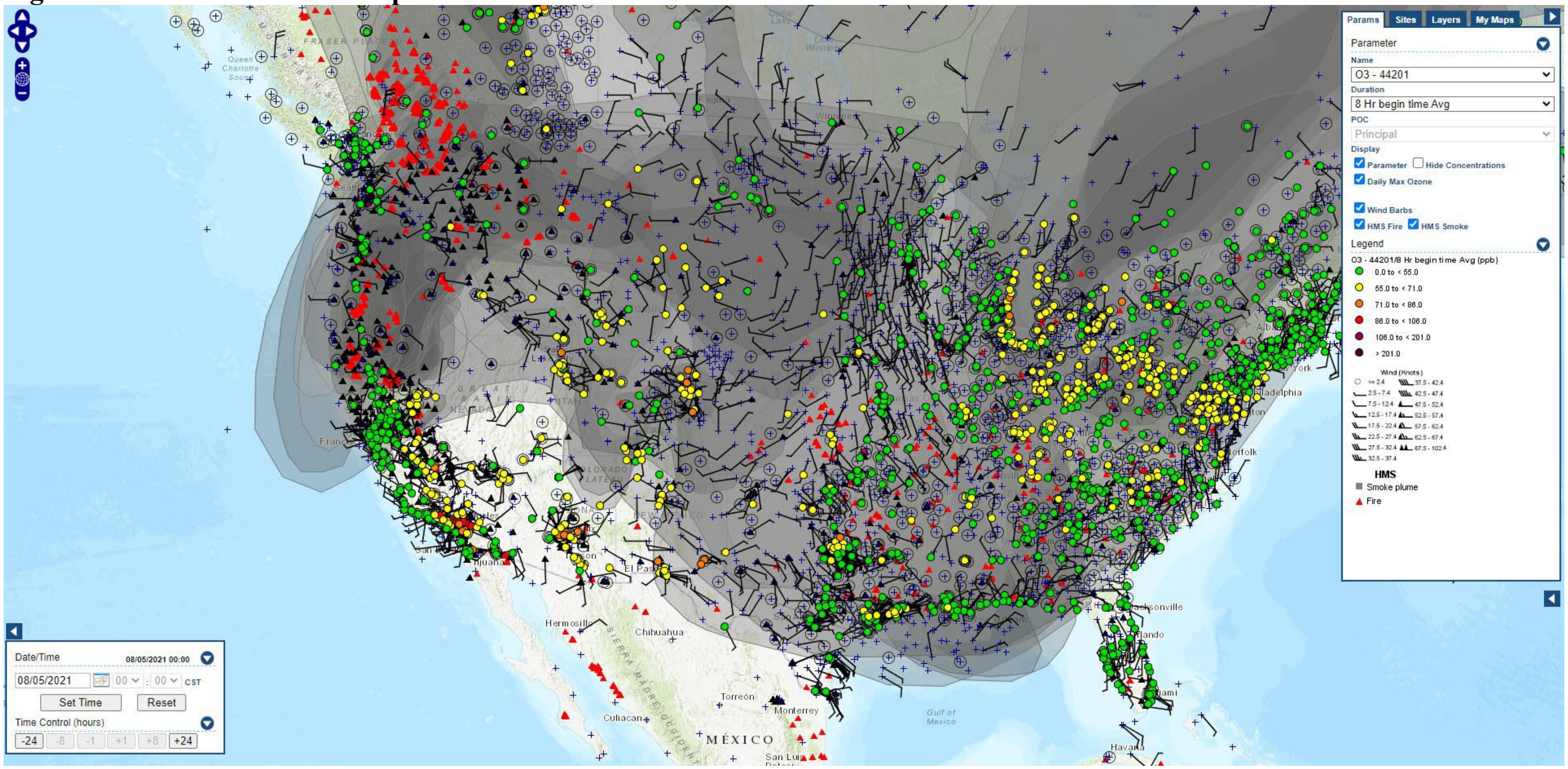
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-76 - AirNow Tech Map for 8/5/21



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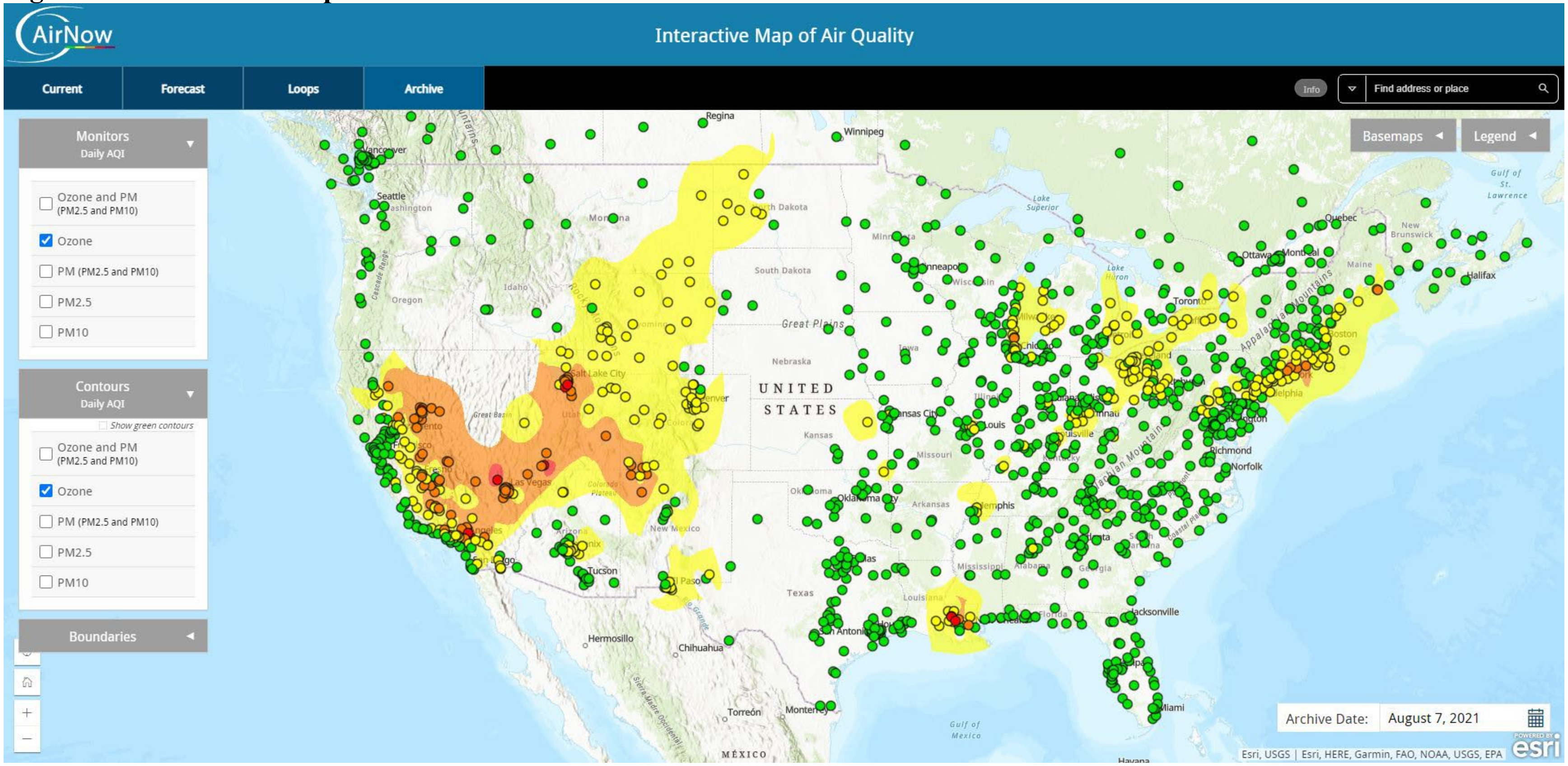
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-77 - AirNow Map for 8/7/21



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AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-78 - AirNow Tech Map for 8/7/21

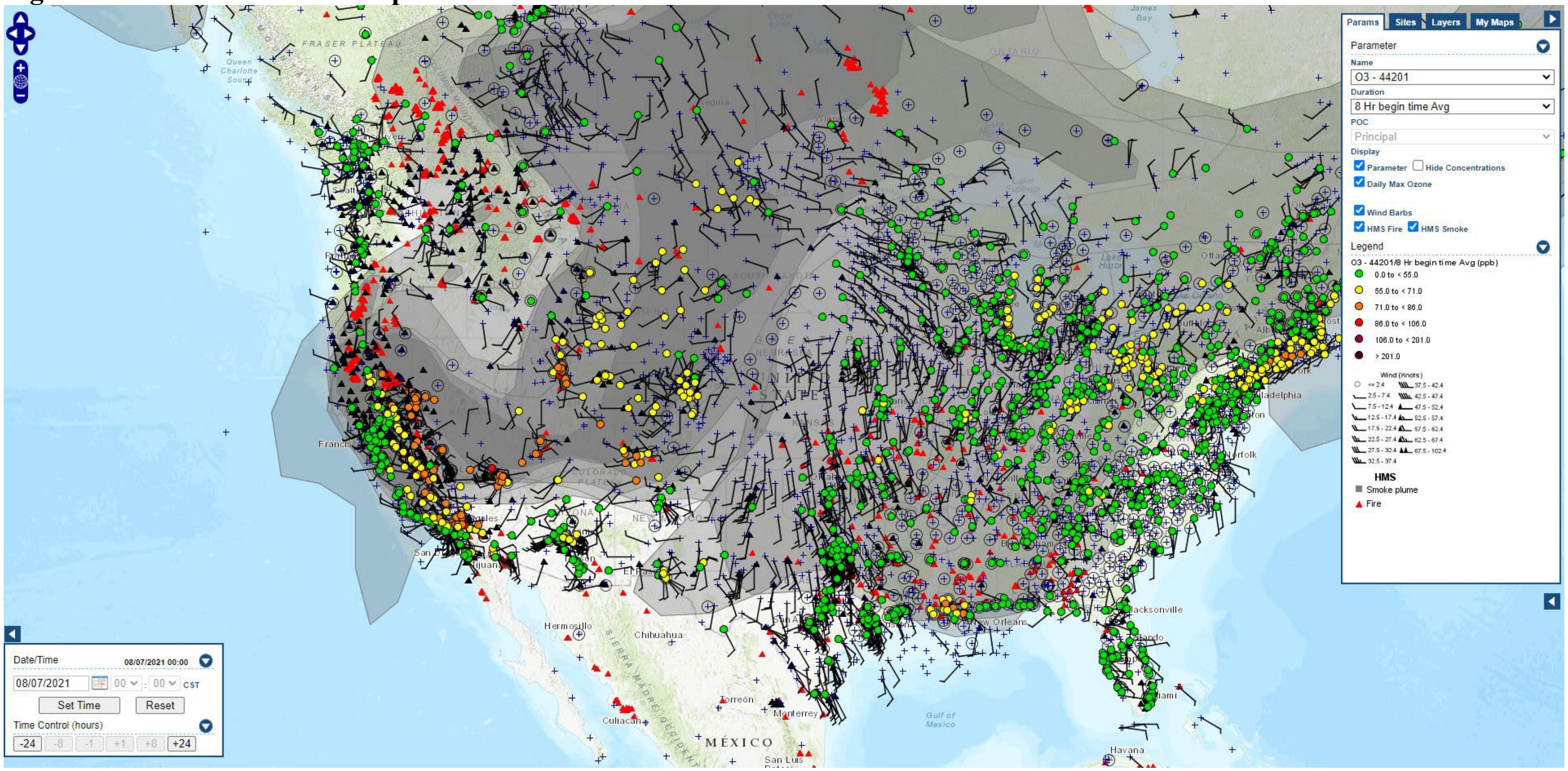

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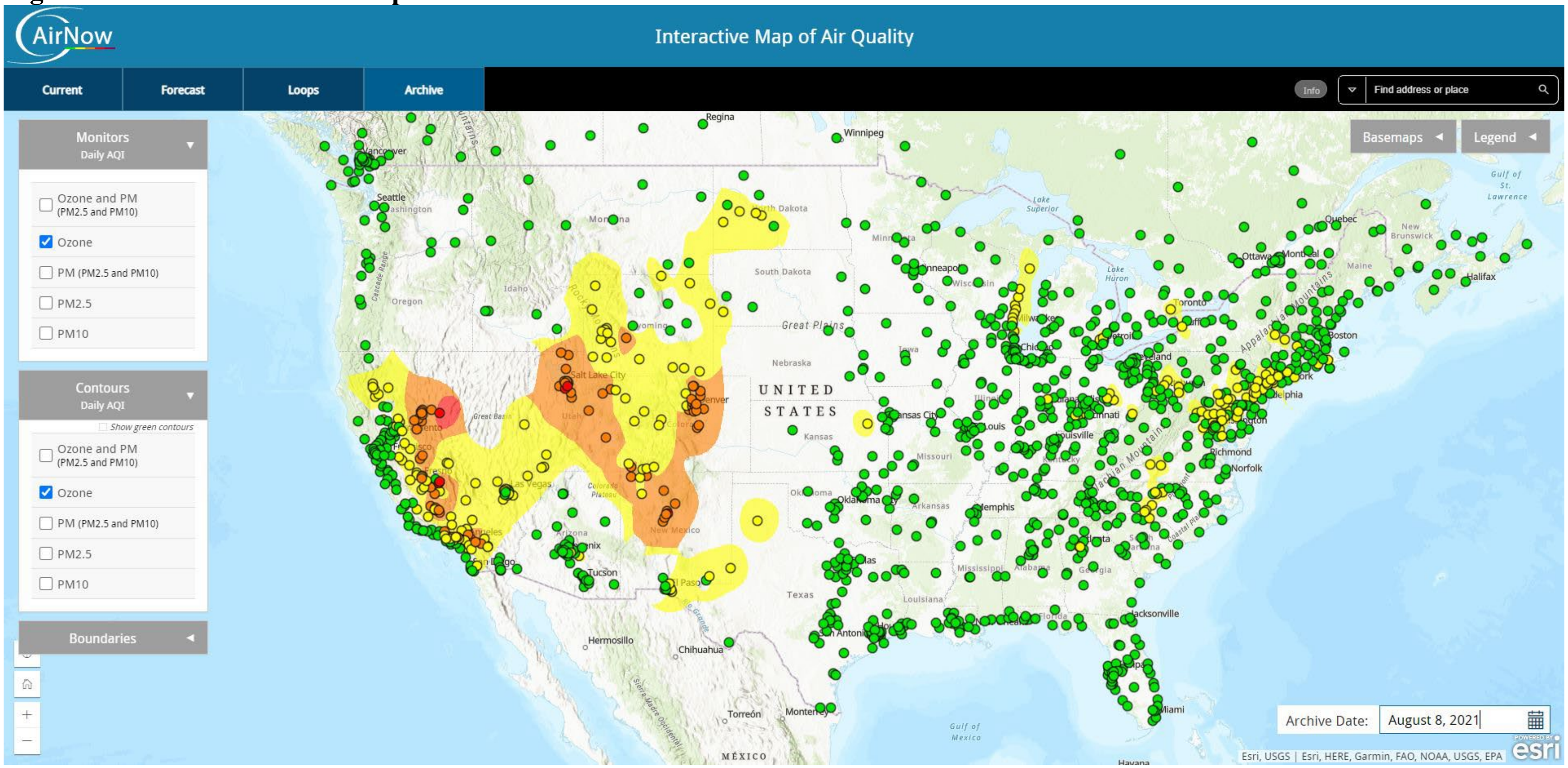
Figure C-79 - AirNow Tech Map for 8/8/21



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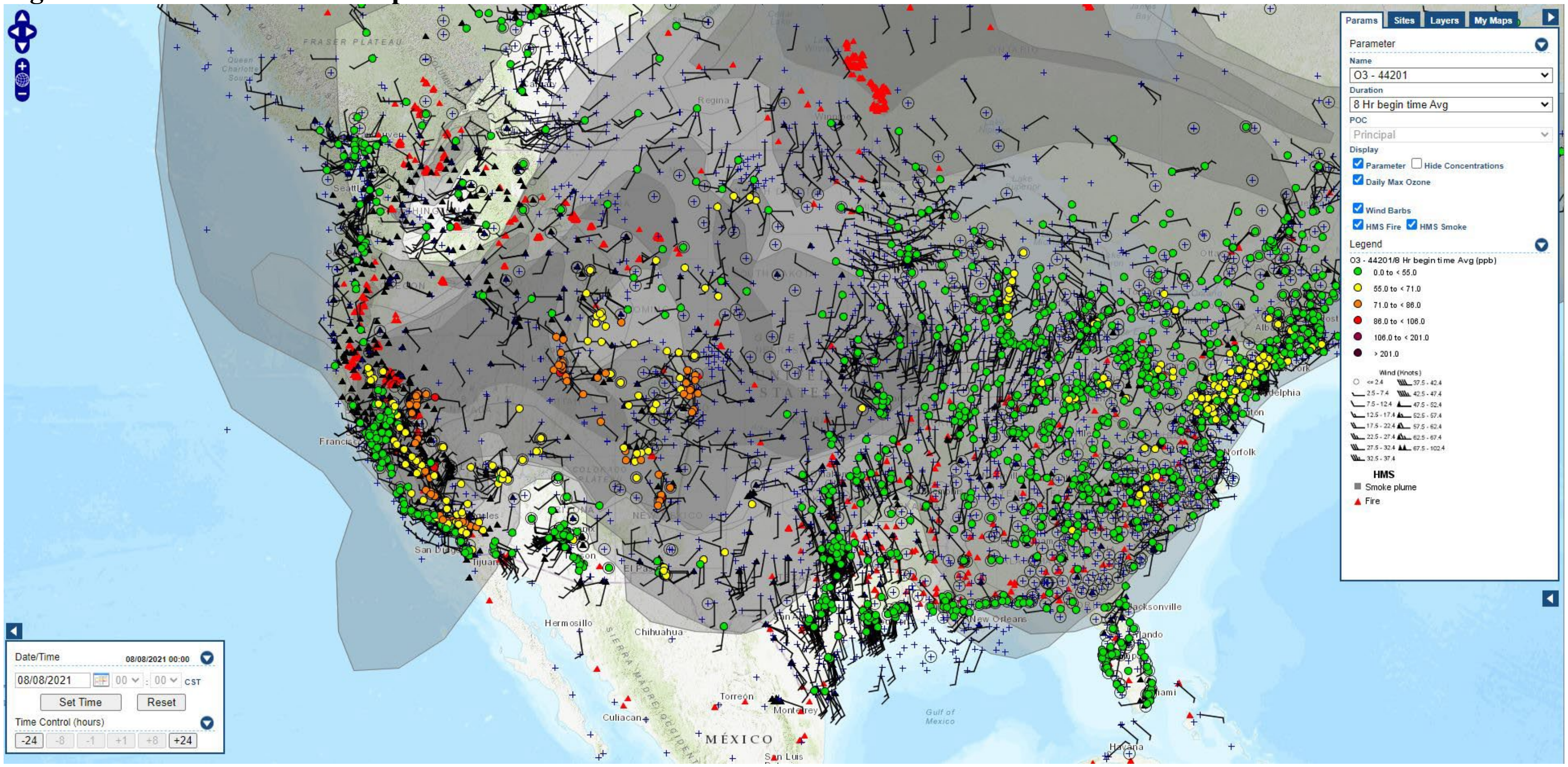
AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-80 - AirNow Tech Map for 8/8/21



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AirNow Maps for 8-hour Average Ozone High Concentration Days

Figure C-81 - AirNow Map for 8/16/21

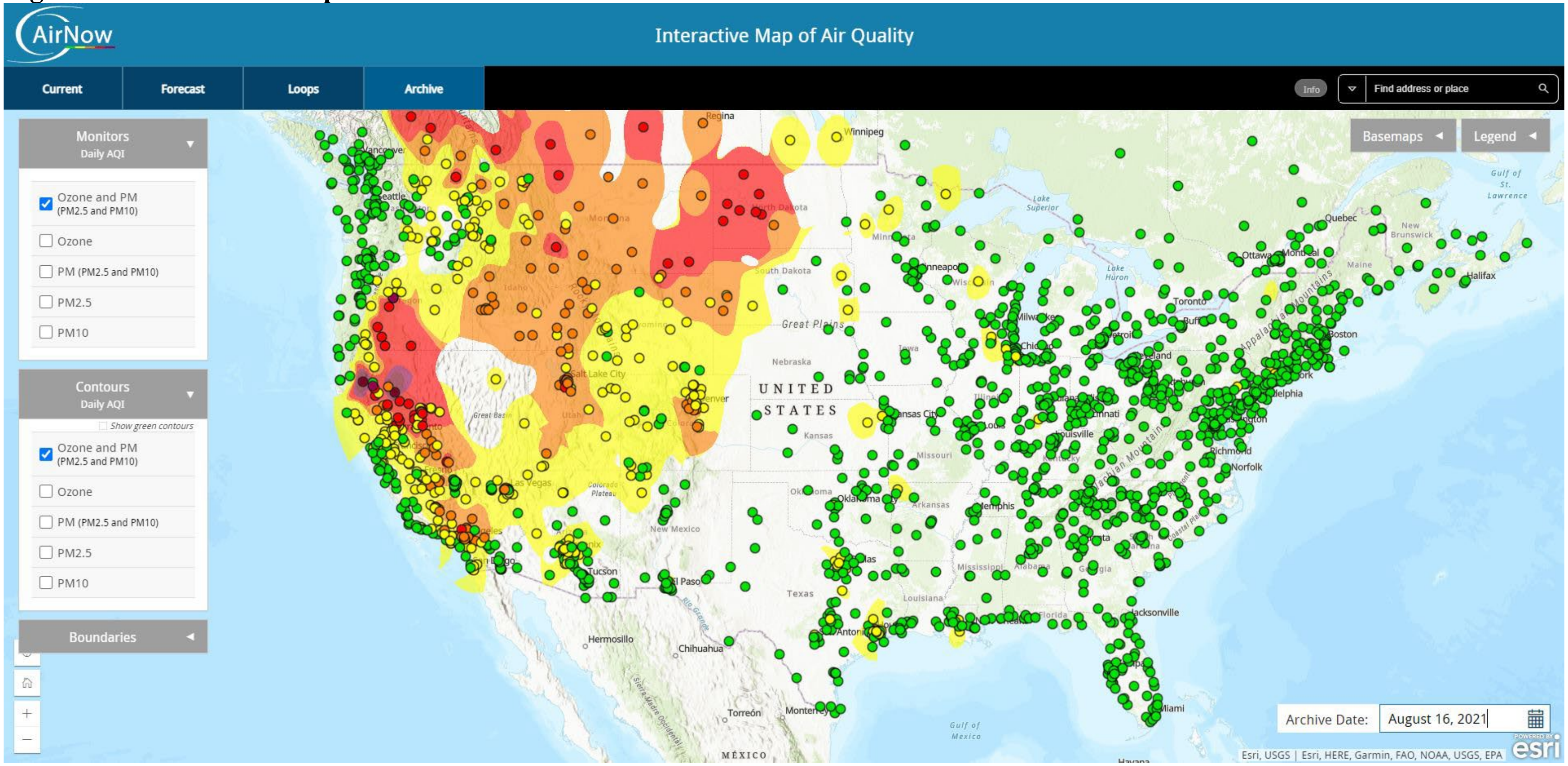

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Figure C-82 - AirNow Tech Map for 8/16/21

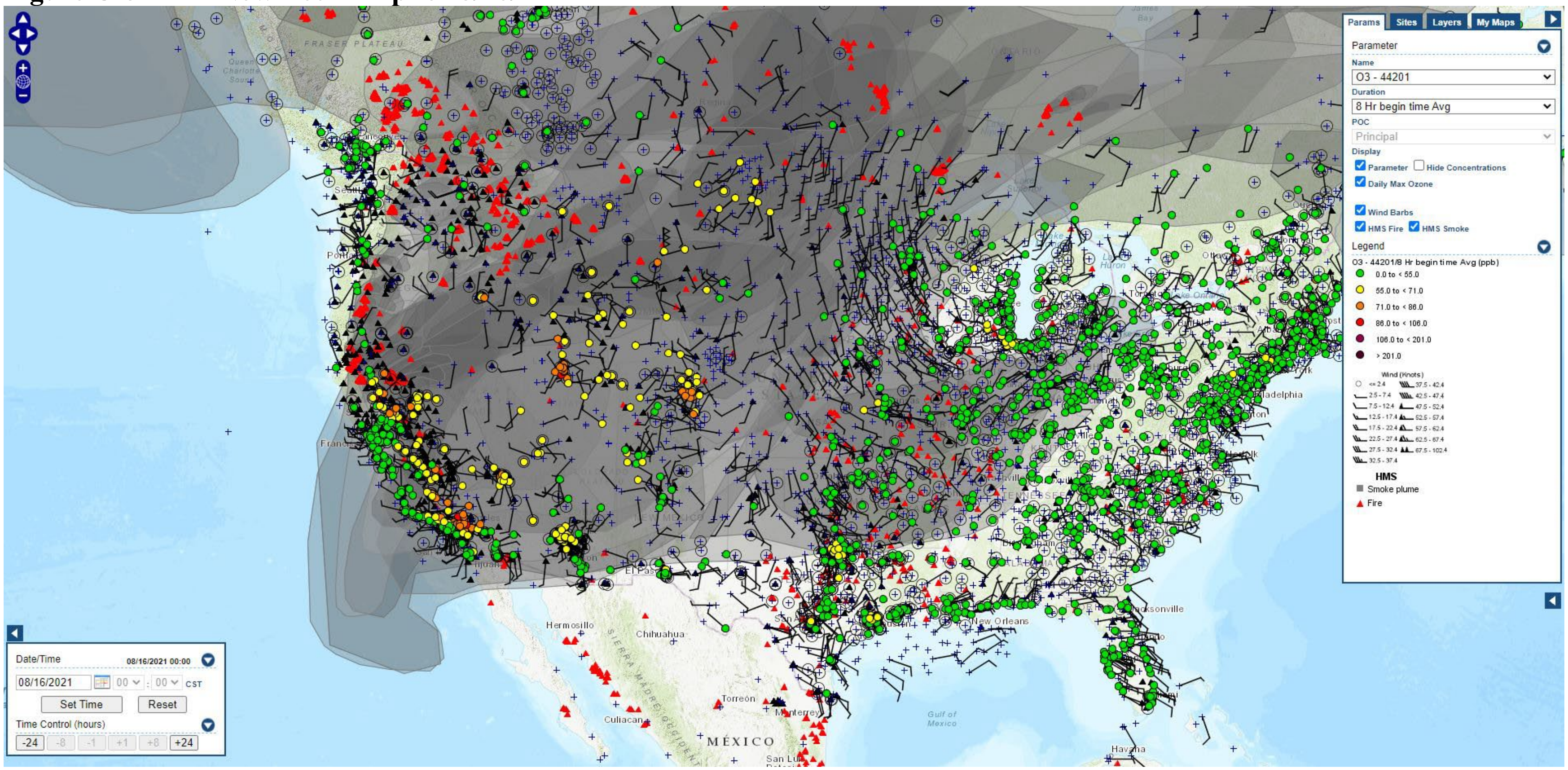

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Figure C-83 - AirNow Map for 8/17/21

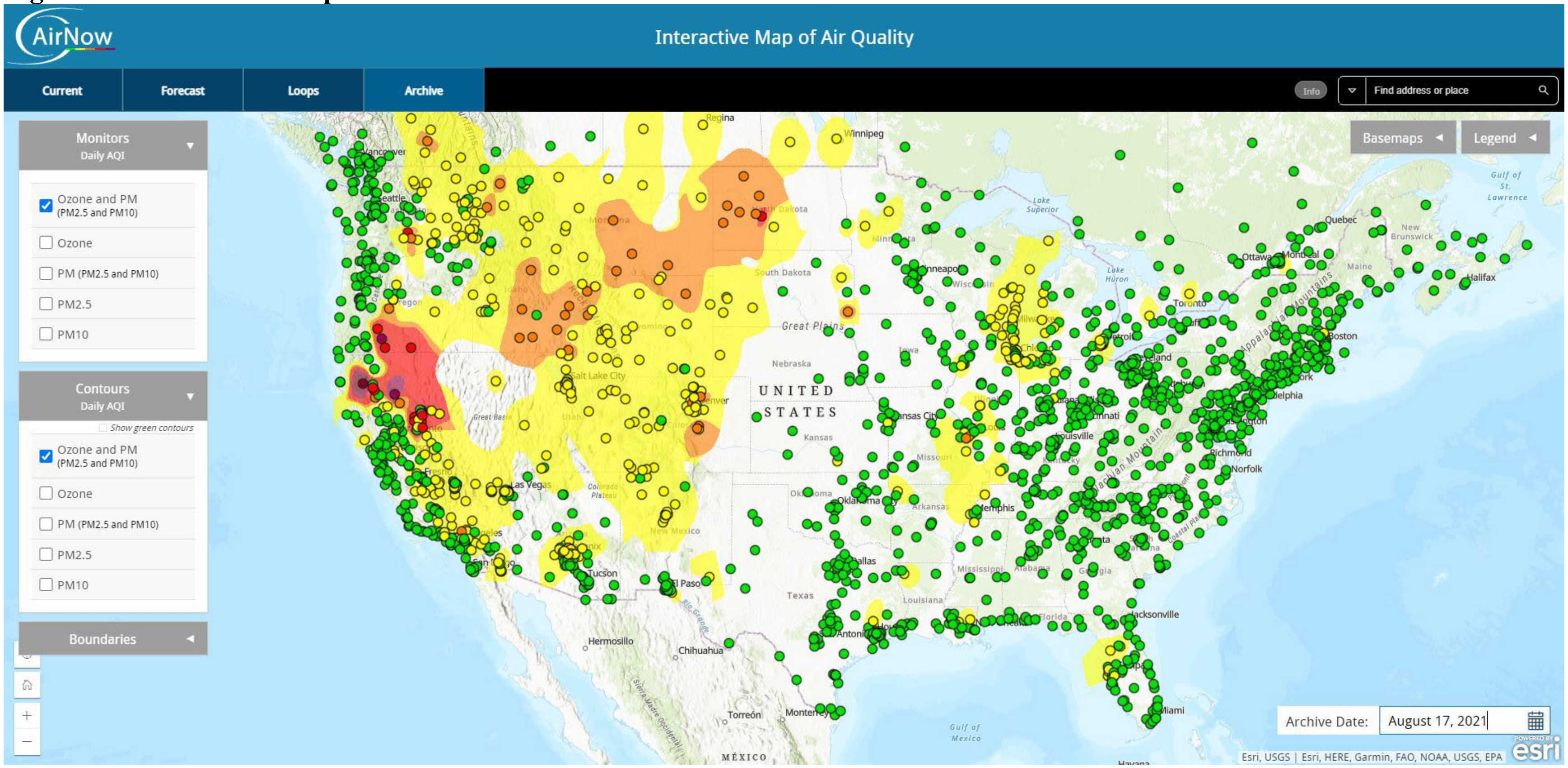

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Figure C-84 - AirNow Tech Map for 8/17/21

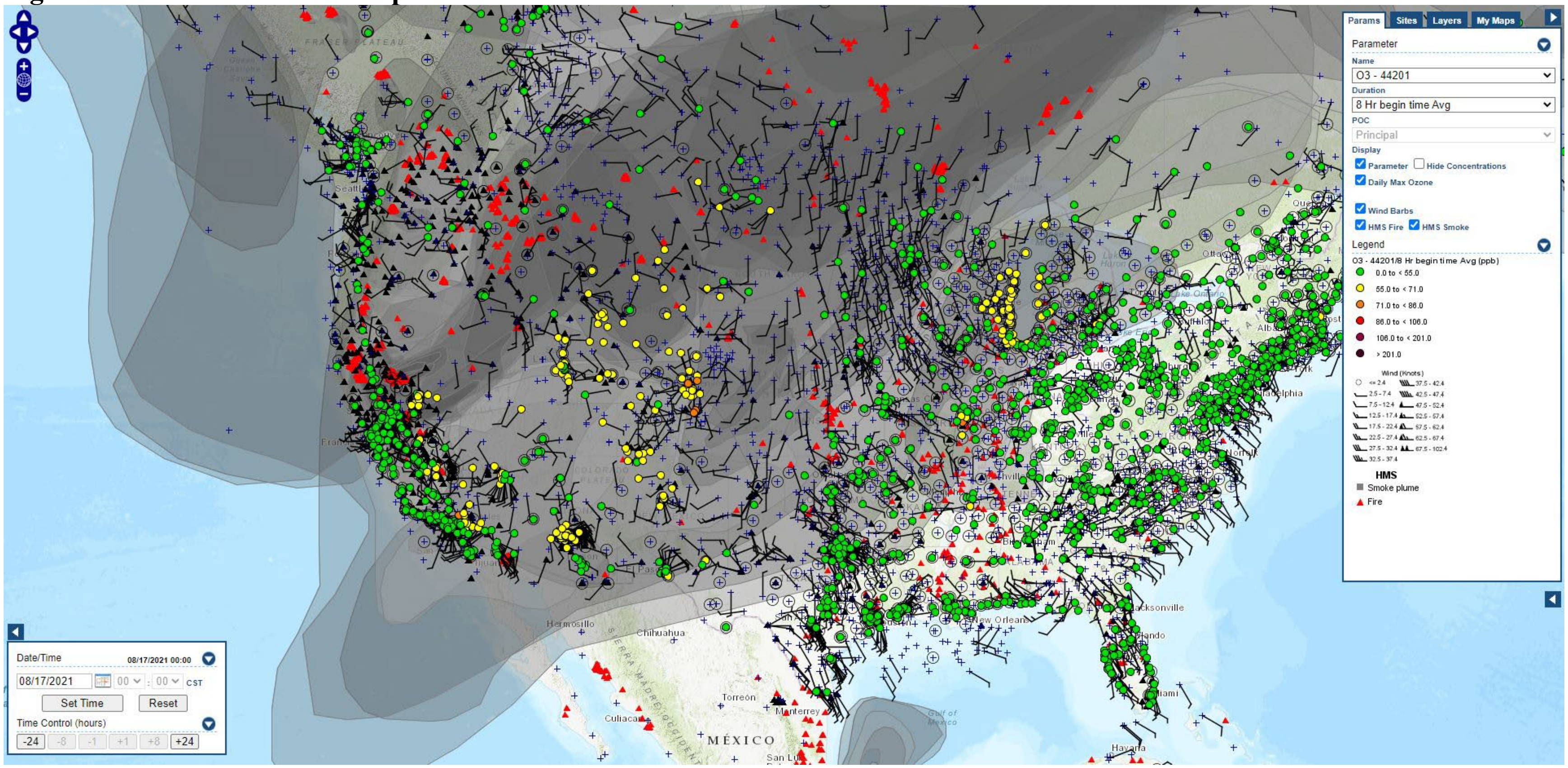

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Figure C-85 - AirNow Map for 8/22/21

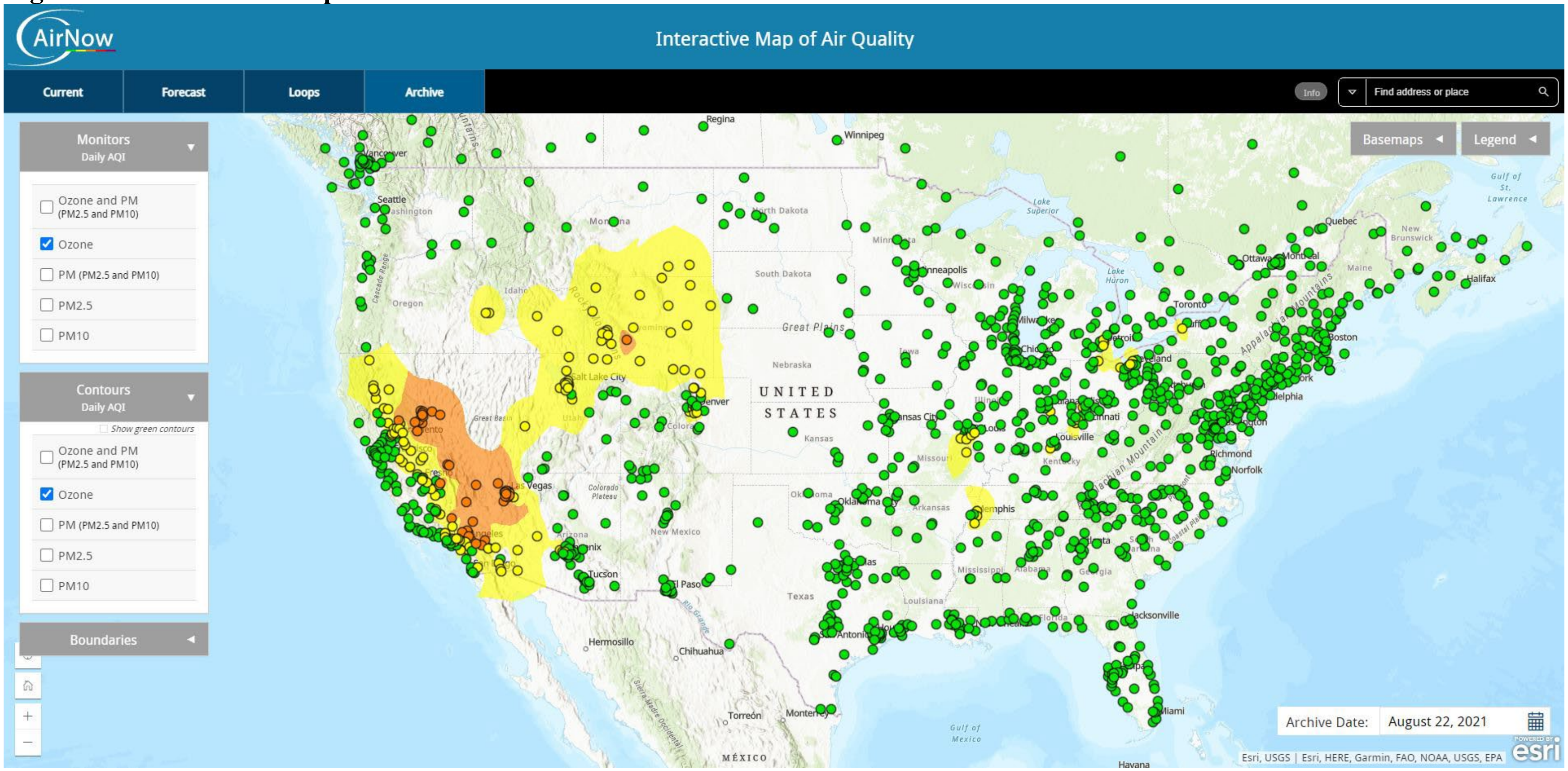

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Figure C-86 - AirNow Tech Map for 8/22/21

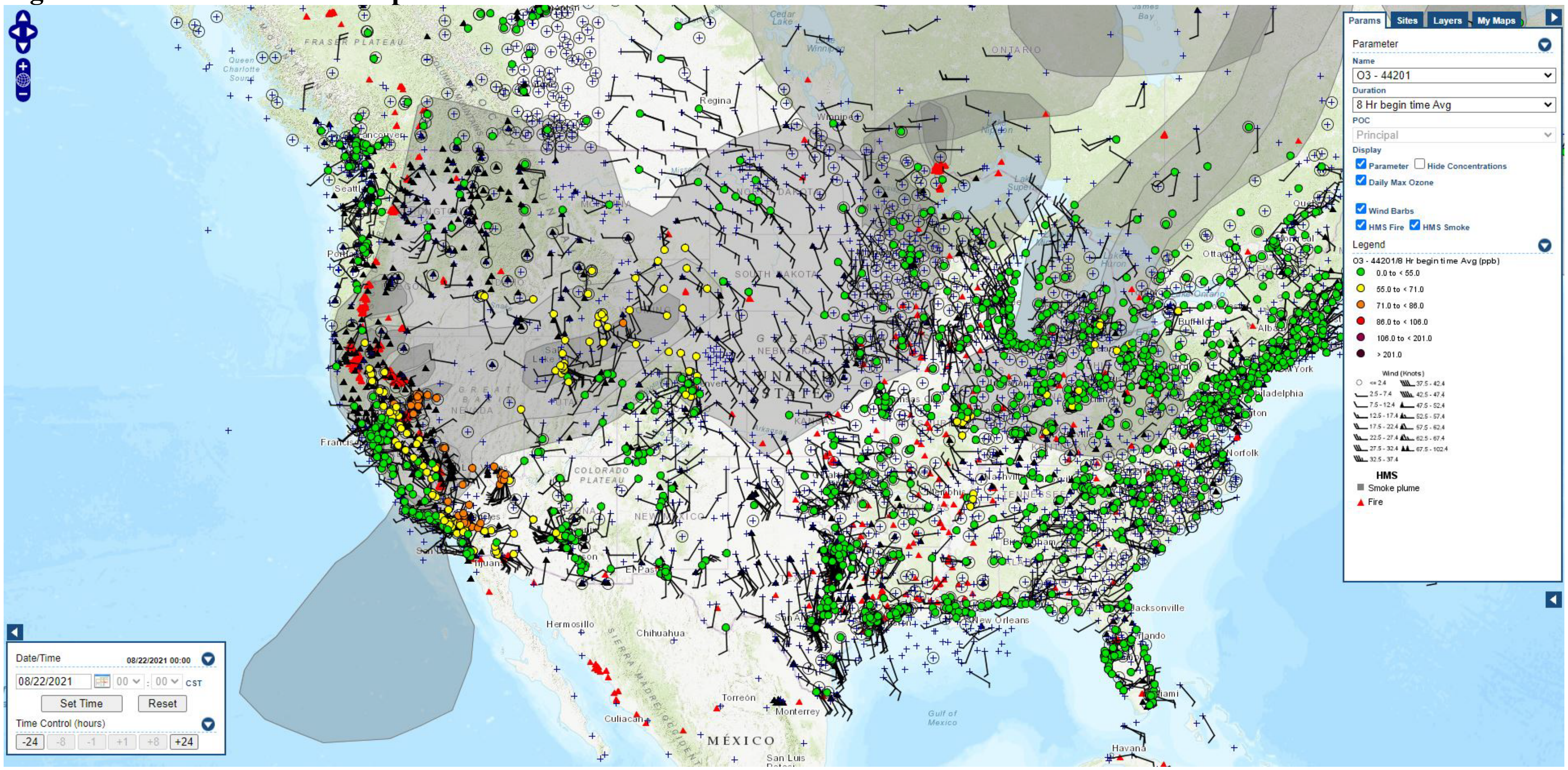

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Figure C-87 - AirNow Map for 8/23/21

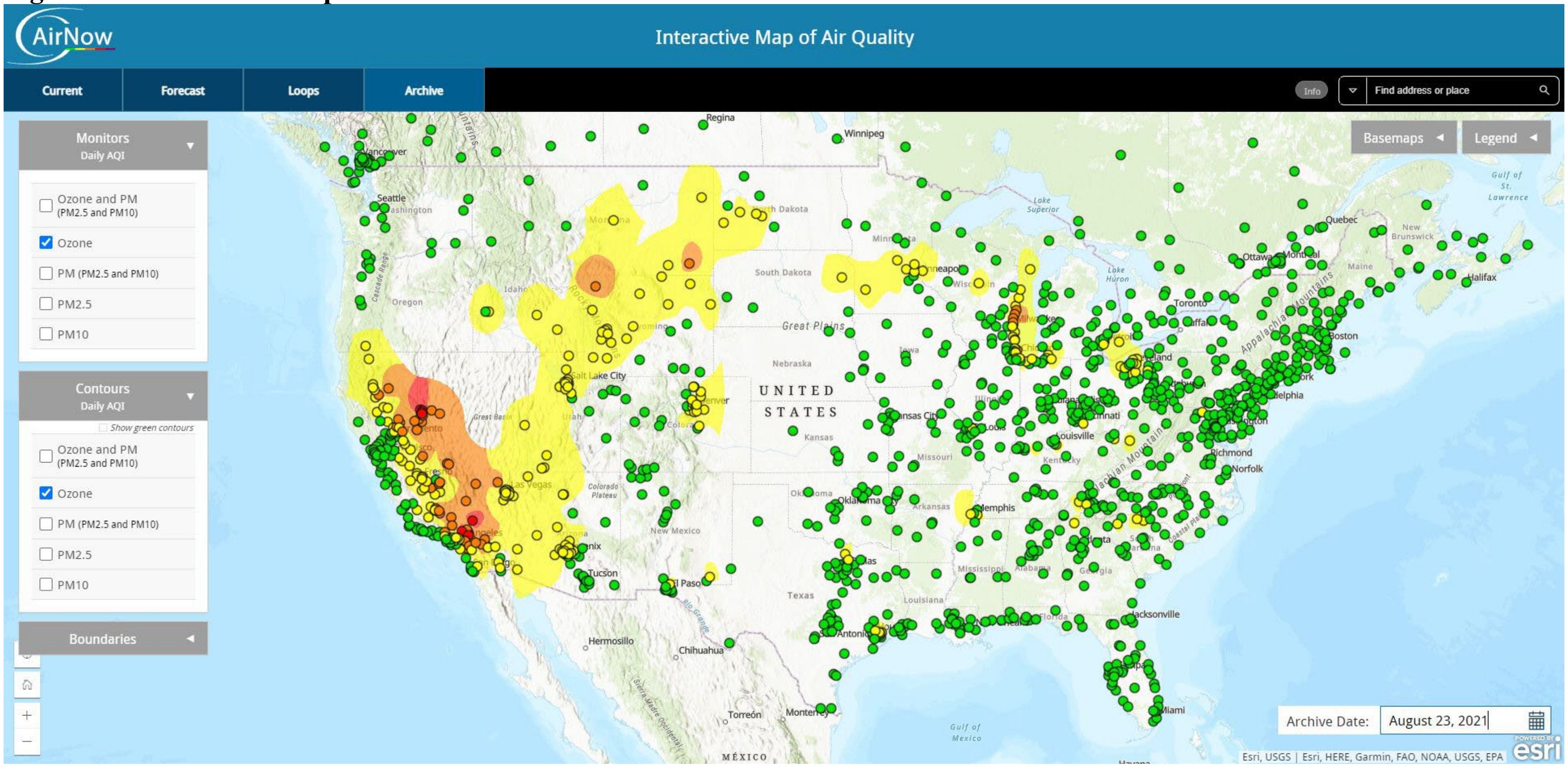

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Figure C-88 - AirNow Tech Map for 8/23/21