Iowa DNR Five-Year Ambient Monitoring Network Assessment

Iowa Department of Natural Resources
Air Quality Bureau
Ambient Air Monitoring Group

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The Five-Year Network Assessment: An Overview

Once every five years, federal rules require that states supplement their annual ambient air monitoring network plan with a five-year network assessment.[1] While the focus of the annual network plan is to demonstrate that a State's monitoring network meets the minimum federal requirements, the five-year assessment is intended to provide a more general explanation of how the State's air monitoring network meets the qualitative monitoring objectives established in federal monitoring rules,[2] for example, how the network protects individuals sensitive to the effects of air pollution. The five-year assessment also provides an opportunity for States to make significant changes to their long-term monitoring efforts (i.e. changes to State and Local Air Monitoring Stations or SLAMS), renew waivers of federal monitoring requirements[3] or to implement new technologies in their air monitoring network.

To the extent that important changes in the National Ambient Air Quality Standards[4] (NAAQS) and federal ambient air monitoring requirements are pending[5,6], and air monitoring resources are likely to be limited[7,8], we think that it is prudent to consider changes to Iowa's long term (SLAMS) monitoring efforts on the implementation schedules prescribed in the final versions of these rules.

In this document, changes as they appeared in Iowa's *2015 Network Plan*[9] have been reiterated. These changes do not include any reductions to Iowa's SLAMs monitors. The DNR has reviewed the tools developed by EPA for the previous five-year network assessment and included results from some of these tools in this document.[10] As we are not proposing any changes to the SLAMs network, we have not have attempted to utilize tools developed to evaluate scenarios for making these changes.

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[1] The federal requirement for the five-year assessment is reproduced in Appendix A.

[2] Objectives for the federal ambient air monitoring program are indicated in Appendix B.

[3] The Department's request for waiver of lead monitoring requirements near certain sources is contained in Appendix C.

[4] The current NAAQS revision schedule is provided in Section 2 of Appendix D. Perhaps the most significant of the pending changes currently under consideration are changes to the ozone NAAQS. If a significantly lower ozone NAAQS is finalized, then additional federal resources are likely to be needed to establish the attainment status of previously unmonitored areas. An analysis of recent ozone levels monitored in Iowa relative to the levels under consideration for the new NAAQS is contained in Section 3 of Appendix D.

[5] A new federal rule that requires additional SO2 monitoring near large SO2 emitters is scheduled to be finalized on 9/2015. See: http://yosemite.epa.gov/opei/rulegate.nsf/byRIN/2060-AR19.

[6] A new federal rule that changes some of the federal quality assurance requirements for ambient monitoring is scheduled to be finalized during the summer of 2015. See: http://www.epa.gov/ttn/amtic/files/monregs/20140813fr.pdf.

[7] For a discussion of federal funding see: http://www2.epa.gov/sites/production/files/2015-04/documents/final_fy_2016-2017_oar_npm_guidance.pdf.

[8] For a discussion of stakeholder recommendations for funding ambient air monitoring with permit fees, see: http://www.iowadnr.gov/Portals/idnr/uploads/air/insidednr/stakeholder/stakeholder/finalreport_stakeholder1214.pdf.

[9] The changes in the Iowa Ambient Air Monitoring Network identified in Iowa's 2015 Network Plan are indicated in Appendix E.

[10] The results from the network assessment tools utilized are reproduced in Appendix F.

Background: Local and Regional Pollutants

EPA has established NAAQS[11] for seven common ("criteria") pollutants: lead, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), ozone (O_3), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and particulate matter less than 10 microns in diameter (PM_{10}).[12]

Lead, PM_{10}, CO, NO_2, and SO_2 are considered local pollutants. These pollutants are emitted directly from air pollution sources, and ambient levels are typically highest in "hotspots" in the neighborhoods near the emissions sources. (Power plant stacks are the exception to this general rule, as stacks approaching 200 feet in height are common, and the hotspots associated with the stack emissions may be miles from the location of the stack.) For a local air pollutant, concentrations approach background levels in areas distant from the emissions sources, and these background levels are usually small compared to the level of the NAAQS.[13]

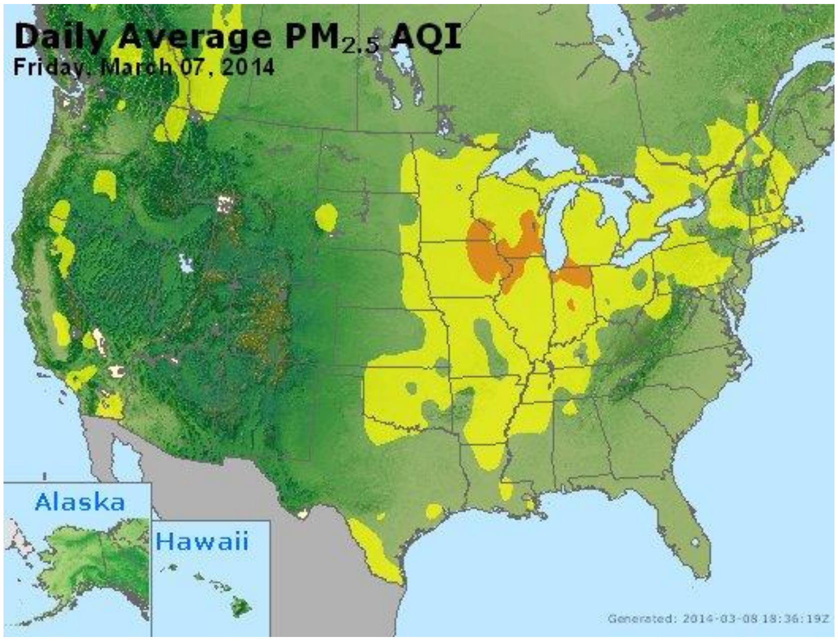
Local Air Pollutant Example. Industrial lead emissions (left) and modeled hotspot (right). The area inside the orange contour is predicted to violate the NAAQS.

$PM_{2.5}$ concentrations approaching NAAQS levels may occur during regional episodes and encompass large, multi-state areas. Such episodes are possible because under certain meteorological conditions $PM_{2.5}$ and ozone are formed in the atmosphere from chemical reactions between precursor compounds. For this reason, ozone and $PM_{2.5}$ are often referred to as regional pollutants because of the potential for background levels comparable to the NAAQS that are generated by secondary formation. $PM_{2.5}$ is also a local pollutant, as directly emitted smoke from combustion processes may also give rise to hot spots in the neighborhood of the emissions source even in the absence of an elevated background due to a regional episode.

[11] A collection of resources concerning the NAAQS maybe be found at: http://www.epa.gov/ttn/naaqs/.

[12] A description of the Iowa criteria pollutant monitoring network is contained in Appendix G.

[13] PM_{10} background levels in Iowa have occasionally generated NAAQS exceedances during dust storms driven by extremely high winds.



Regional Air Pollutant Example. $PM_{2.5}$ Episode Involving Iowa Monitors.
Orange area exceeds the NAAQS. Graphic Courtesy of EPA's AirNow Program.

Objectives of an Ambient Air Monitoring Network

- **The monitoring network is designed to alert the public to air pollution levels that may threaten their health.** Associated with each of EPA's NAAQS is a level that represents the threshold for adverse health effects for sensitive groups (e.g. asthmatics, children, and the elderly). When an ambient air monitor records levels that exceed this threshold, it is said to have recorded a "NAAQS exceedance". An important objective of an ambient air monitoring network is to alert individuals to air pollution levels that exceed the level of the NAAQS.[14]

- **The monitoring network is designed to identify areas where the air quality does not meet health standards, and regulatory intervention is required.** A single monitored exceedance of the NAAQS is usually not sufficient to establish that the NAAQS is violated at a monitoring site. Violation of the NAAQS typically requires multiple exceedances at a monitoring site over several years.[15] For ozone, $PM_{2.5}$ and other criteria pollutants, federal regulations specify that a statistic called the "design value" is calculated from three years of monitoring data from a monitoring site. The design value is compared to the level of the NAAQS to establish whether the monitoring data violates the NAAQS. If the air quality at a monitoring location is poor enough to violate the NAAQS, then after giving the State a year or so to try to work out the problem through its normal permitting process, EPA will formally declare the area around the monitor to be in non-attainment, and special and more stringent federal permitting rules apply within the area. The size of the non-attainment area is determined by dialog between EPA and the State; but any area that causes or contributes to the non-attainment problem at the monitor must be included in the non-attainment area. Additional monitors are often installed to articulate the

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[14] NAAQS exceedances recorded in Iowa over the past 5 years are described in Appendix H.

[15] NAAQS violations (and design values) in Iowa over the past 5 years are discussed in Appendix I.

non-attainment area and establish the effectiveness of control strategies after a monitor in an area records non-attainment.

- **The monitoring network is designed to characterize pollutant levels in heavily populated areas.** One of main objectives of air monitoring is to protect human health. In large cities, there are many people affected by the air quality, and larger numbers of individuals (such as people with heart or lung ailments, children and the elderly) that are sensitive to the effects of air pollution. Certain types of air pollutant emissions, such as motor vehicle emissions, are also likely to be larger in urban areas than in outlying areas. EPA has established minimum requirements that apply to urban areas; or more precisely, areas established as metropolitan statistical areas (MSA's) by the U.S. Census Bureau.[16,17,18]

- **The monitoring network is designed to support permitting activities.** The DNR frequently conducts ambient air impact analyses as part of the permitting process.[19] Dispersion modeling is used to estimate the air pollutant levels generated from a new source. Some existing sources in the vicinity of the new source are usually included in the dispersion modeling analysis, but more distant sources are assumed to be part of the "background". Good estimates of background levels are an important part of the ambient impact analysis[20], especially in cases where background levels are significant compared to the NAAQS. Federal permitting requirements for large air pollution sources require industries to collect monitoring data if the State's air monitoring data is not adequate to characterize background levels. Currently, the State's ambient monitoring data and regional modeling is used to develop background levels for most permitting projects.

Public Availability of Iowa's Air Monitoring Data

In Iowa, the Iowa Department of Natural Resources (DNR) contracts with Local Air Pollution Control Programs in Polk and Linn Counties as well as the State Hygienic Laboratory (SHL) to gather air monitoring data. Data from each of these organizations is made available to the public in two formats: real-time data, to alert the public to air quality problems as they arise, and quality-assured data suitable for environmental decision making. The DNR also places reports that describe the State's air monitoring network and summarize the State's air monitoring data on its website.

- **Real-time Data.** On the local level, the SHL[21], and the Local Programs in Polk[22] and Linn[23] counties post real-time data from continuous monitors on their websites. On the national level, real-time data from all of the continuous monitors in Iowa is aggregated and disseminated by

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[16] A description of Iowa's MSA's and monitors located in these MSA's is contained in Appendix J.

[17] A description of the locations where some of the Iowans that are sensitive to the effects of air pollution reside is contained in Appendix K.

[18] A discussion of population changes in Iowa is contained in Appendix L.

[19] The department's dispersion modeling procedures are available at: http://www.iowadnr.gov/InsideDNR/RegulatoryAir/Modeling/DispersionModeling.aspx.

[20] http://www.iowadnr.gov/InsideDNR/RegulatoryAir/Modeling/DispersionModeling/BackgroundData.aspx.

[21] Available at: http://www.shl.uiowa.edu/env/ambient/realtime.xml.

[22] Available at: http://www.polkcountyiowa.gov/airquality/air-quality-monitoring/current-aqi-real-time-data/.

[23] Available at: http://www.linncleanair.org/ under Current Air Quality tab.

EPA's **AirNow**[24] program. EPA also provides access to real-time data to researchers via the ***AirNow API***[25]***.***

- **Finalized Monitoring Data.** Quality-assured data from continuous and non-continuous (e.g. filter samplers) monitors is loaded to EPA's Air Quality System (AQS) database by SHL and the Local Programs in a form that is suitable for environmental decision-making. In AQS, data from Iowa's air monitoring network along with the data from other States is aggregated and made available to EPA as well as the regulated and general public. This data is used for public health and air quality research,[26] to establish compliance with ambient air quality standards, and emissions reduction strategy development. AQS data is available online at EPA's ***AirData*** website[27] and through the ***AQS Data Mart***[28]***.*** Quality assured air monitoring data is also available upon request from the DNR and the Local Programs.

[24] Available at: http://www.airnow.gov/.
[25] Available at: http://airnowapi.org/.
[26] See for example: C. Stanier, et. al, ***Understanding Episodes of High Airborne Particulate Matter in Iowa,*** 2/29/09***,*** available online at: http://www.engineering.uiowa.edu/~cs_proj/iowa_pm_project/iowa_pm.htm.
[27] Available at: http://www.epa.gov/airdata/.
[28] Available at: http://www.epa.gov/ttn/airs/aqsdatamart.

Appendix A: 40 CFR Part 58[29] Requiring 5-Year Network Assessments

§ 58.10 Annual monitoring network plan and periodic network assessment.

(a)(1) Beginning July 1, 2007, the State, or where applicable local, agency shall adopt and submit to the Regional Administrator an annual monitoring network plan which shall provide for the establishment and maintenance of an air quality surveillance system that consists of a network of SLAMS monitoring stations including FRM, FEM, and ARM monitors that are part of SLAMS, NCore stations, STN stations, State speciation stations, SPM stations, and/or, in serious, severe and extreme ozone nonattainment areas, PAMS stations, and SPM monitoring stations. The plan shall include a statement of purposes for each monitor and evidence that siting and operation of each monitor meets the requirements of appendices A, C, D, and E of this part, where applicable. The annual monitoring network plan must be made available for public inspection for at least 30 days prior to submission to EPA.

(2) Any annual monitoring network plan that proposes SLAMS network modifications (including new monitoring sites, new determinations that data are not of sufficient quality to be compared to the NAAQS, and changes in identification of monitors as suitable or not suitable for comparison against the annual $PM_{2.5}$ NAAQS) is subject to the approval of the EPA Regional Administrator, who shall provide opportunity for public comment and shall approve or disapprove the plan and schedule within 120 days. If the State or local agency has already provided a public comment opportunity on its plan and has made no changes subsequent to that comment opportunity, and has submitted the received comments together with the plan, the Regional Administrator is not required to provide a separate opportunity for comment.

(3) The plan for establishing required NCore multipollutant stations shall be submitted to the Administrator not later than July 1, 2009. The plan shall provide for all required stations to be operational by January 1, 2011.

(4) A plan for establishing source-oriented Pb monitoring sites in accordance with the requirements of appendix D to this part for Pb sources emitting 1.0 tpy or greater shall be submitted to the EPA Regional Administrator no later than July 1, 2009, as part of the annual network plan required in paragraph (a)(1) of this section. The plan shall provide for the required source-oriented Pb monitoring sites for Pb sources emitting 1.0 tpy or greater to be operational by January 1, 2010. A plan for establishing source-oriented Pb monitoring sites in accordance with the requirements of appendix D to this part for Pb sources emitting equal to or greater than 0.50 tpy but less than 1.0 tpy shall be submitted to the EPA Regional Administrator no later than July 1, 2011. The plan shall provide for the required source-oriented Pb monitoring sites for Pb sources emitting equal to or greater than 0.50 tpy but less than 1.0 tpy to be operational by December 27, 2011.

(5)(i) A plan for establishing or identifying an area-wide NO_2 monitor, in accordance with the requirements of Appendix D, section 4.3.3 to this part, shall be submitted as part of the Annual Monitoring Network Plan to the EPA Regional Administrator by July 1, 2012. The plan shall provide for these required monitors to be operational by January 1, 2013.

(ii) A plan for establishing or identifying any NO_2 monitor intended to characterize vulnerable and susceptible populations, as required in Appendix D, section 4.3.4 to this part, shall be submitted as part of the Annual Monitoring Network Plan to the EPA Regional Administrator by July 1, 2012. The plan shall provide for these required monitors to be operational by January 1, 2013.

(iii) A plan for establishing a single near-road NO_2 monitor in CBSAs having 1,000,000 or more persons, in accordance with the requirements of Appendix D, section 4.3.2 to this part, shall be submitted as part of the Annual Monitoring Network Plan to the EPA Regional Administrator by July 1, 2013. The plan shall provide for these required monitors to be operational by January 1, 2014.

(iv) A plan for establishing a second near-road NO_2 monitor in any CBSA with a population of 2,500,000 or more persons, or a second monitor in any CBSA with a population of 500,000 or more persons that has one or more roadway segments with 250,000 or greater AADT counts, in accordance with the requirements of Appendix D, section 4.3.2 to this part, shall be submitted as part of the Annual Monitoring Network Plan to the EPA Regional Administrator by July 1, 2014. The plan shall provide for these required monitors to be operational by January 1, 2015.

(v) A plan for establishing a single near-road NO_2 monitor in all CBSAs having 500,000 or more persons, but less than 1,000,000, not already required by paragraph (a)(5)(iv) of this section, in accordance with the requirements of Appendix D, section 4.3.2 to this part, shall be submitted as part of the Annual Monitoring Network Plan to the EPA Regional Administrator by July 1, 2016. The plan shall provide for these monitors to be operational by January 1, 2017.

(6) A plan for establishing SO_2 monitoring sites in accordance with the requirements of appendix D to this part shall be submitted to the EPA Regional Administrator by July 1, 2011 as part of the annual network plan required in paragraph (a) (1). The plan shall provide for all required SO_2 monitoring sites to be operational by January 1, 2013.

(7) A plan for establishing CO monitoring sites in accordance with the requirements of appendix D to this part shall be submitted to the EPA Regional Administrator. Plans for required CO monitors shall be submitted at least six months prior to the date such monitors must be established as required by section 58.13.

(8)(i) A plan for establishing near-road $PM_{2.5}$ monitoring sites in CBSAs having 2.5 million or more persons, in accordance with the requirements of appendix D to this part, shall be submitted as part of the annual monitoring network plan to the EPA Regional Administrator by July 1, 2014. The plan shall provide for these required monitoring stations to be operational by January 1, 2015.

[29] Available online at: http://www.ecfr.gov/cgi-bin/text-idx?SID=49668ba9ef8ccf774b83029e68ae1f1f&node=se40.6.58_110&rgn=div8.

(ii) A plan for establishing near-road $PM_{2.5}$ monitoring sites in CBSAs having 1 million or more persons, but less than 2.5 million persons, in accordance with the requirements of appendix D to this part, shall be submitted as part of the annual monitoring network plan to the EPA Regional Administrator by July 1, 2016. The plan shall provide for these required monitoring stations to be operational by January 1, 2017.

(b) The annual monitoring network plan must contain the following information for each existing and proposed site:

(1) The AQS site identification number.
(2) The location, including street address and geographical coordinates.
(3) The sampling and analysis method(s) for each measured parameter.
(4) The operating schedules for each monitor.
(5) Any proposals to remove or move a monitoring station within a period of 18 months following plan submittal.
(6) The monitoring objective and spatial scale of representativeness for each monitor as defined in appendix D to this part.
(7) The identification of any sites that are suitable and sites that are not suitable for comparison against the annual $PM_{2.5}$ NAAQS as described in §58.30.
(8) The MSA, CBSA, CSA or other area represented by the monitor.
(9) The designation of any Pb monitors as either source-oriented or non-source-oriented according to Appendix D to 40 CFR part 58.
(10) Any source-oriented monitors for which a waiver has been requested or granted by the EPA Regional Administrator as allowed for under paragraph 4.5(a)(ii) of Appendix D to 40 CFR part 58.
(11) Any source-oriented or non-source-oriented site for which a waiver has been requested or granted by the EPA Regional Administrator for the use of Pb-PM_{10} monitoring in lieu of Pb-TSP monitoring as allowed for under paragraph 2.10 of Appendix C to 40 CFR part 58.
(12) The identification of required NO_2 monitors as near-road, area-wide, or vulnerable and susceptible population monitors in accordance with Appendix D, section 4.3 of this part.
(13) The identification of any $PM_{2.5}$ FEMs and/or ARMs used in the monitoring agency's network where the data are not of sufficient quality such that data are not to be compared to the NAAQS. For required SLAMS where the agency identifies that the $PM_{2.5}$ Class III FEM or ARM does not produce data of sufficient quality for comparison to the NAAQS, the monitoring agency must ensure that an operating FRM or filter-based FEM meeting the sample frequency requirements described in §58.12 or other Class III $PM_{2.5}$ FEM or ARM with data of sufficient quality is operating and reporting data to meet the network design criteria described in appendix D to this part.

(c) The annual monitoring network plan must document how state and local agencies provide for the review of changes to a $PM_{2.5}$ monitoring network that impact the location of a violating $PM_{2.5}$ monitor. The affected state or local agency must document the process for obtaining public comment and include any comments received through the public notification process within their submitted plan.

(d) The state, or where applicable local, agency shall perform and submit to the EPA Regional Administrator an assessment of the air quality surveillance system every 5 years to determine, at a minimum, if the network meets the monitoring objectives defined in appendix D to this part, whether new sites are needed, whether existing sites are no longer needed and can be terminated, and whether new technologies are appropriate for incorporation into the ambient air monitoring network. The network assessment must consider the ability of existing and proposed sites to support air quality characterization for areas with relatively high populations of susceptible individuals (e.g., children with asthma), and, for any sites that are being proposed for discontinuance, the effect on data users other than the agency itself, such as nearby states and tribes or health effects studies. The state, or where applicable local, agency must submit a copy of this 5-year assessment, along with a revised annual network plan, to the Regional Administrator. The assessments are due every five years beginning July 1, 2010.

(e) All proposed additions and discontinuations of SLAMS monitors in annual monitoring network plans and periodic network assessments are subject to approval according to §58.14.

[71 FR 61298, Oct. 17, 2006, as amended at 72 FR 32210, June 12, 2007; 73 FR 67059, Nov. 12, 2008; 73 FR 77517, Dec. 19, 2008; 75 FR 6534, Feb. 9, 2010; 75 FR 35601, June 22, 2010; 75 FR 81137, Dec. 27, 2010; 76 FR 54341, Aug. 31, 2011; 78 FR 16188, Mar. 14, 2013; 78 FR 3282, Jan. 15, 2013]

Appendix B: 40 CFR Part 58 Appendix D[30] – Monitoring Objectives

Appendix D to Part 58—Network Design Criteria for Ambient Air Quality Monitoring
1. Monitoring Objectives and Spatial Scales

The purpose of this appendix is to describe monitoring objectives and general criteria to be applied in establishing the required SLAMS ambient air quality monitoring stations and for choosing general locations for additional monitoring sites. This appendix also describes specific requirements for the number and location of FRM, FEM, and ARM sites for specific pollutants, NCore multipollutant sites, PM_{10} mass sites, $PM_{2.5}$ mass sites, chemically-speciated $PM_{2.5}$ sites, and O_3 precursor measurements sites (PAMS). These criteria will be used by EPA in evaluating the adequacy of the air pollutant monitoring networks.

1.1 Monitoring Objectives. The ambient air monitoring networks must be designed to meet three basic monitoring objectives. These basic objectives are listed below. The appearance of any one objective in the order of this list is not based upon a prioritized scheme. Each objective is important and must be considered individually.

(a) Provide air pollution data to the general public in a timely manner. Data can be presented to the public in a number of attractive ways including through air quality maps, newspapers, Internet sites, and as part of weather forecasts and public advisories.

(b) Support compliance with ambient air quality standards and emissions strategy development. Data from FRM, FEM, and ARM monitors for NAAQS pollutants will be used for comparing an area's air pollution levels against the NAAQS. Data from monitors of various types can be used in the development of attainment and maintenance plans. SLAMS, and especially NCore station data, will be used to evaluate the regional air quality models used in developing emission strategies, and to track trends in air pollution abatement control measures' impact on improving air quality. In monitoring locations near major air pollution sources, source-oriented monitoring data can provide insight into how well industrial sources are controlling their pollutant emissions.

(c) Support for air pollution research studies. Air pollution data from the NCore network can be used to supplement data collected by researchers working on health effects assessments and atmospheric processes, or for monitoring methods development work.

1.1.1 In order to support the air quality management work indicated in the three basic air monitoring objectives, a network must be designed with a variety of types of monitoring sites. Monitoring sites must be capable of informing managers about many things including the peak air pollution levels, typical levels in populated areas, air pollution transported into and outside of a city or region, and air pollution levels near specific sources. To summarize some of these sites, here is a listing of six general site types:

(a) Sites located to determine the highest concentrations expected to occur in the area covered by the network.
(b) Sites located to measure typical concentrations in areas of high population density.
(c) Sites located to determine the impact of significant sources or source categories on air quality.
(d) Sites located to determine general background concentration levels.
(e) Sites located to determine the extent of regional pollutant transport among populated areas; and in support of secondary standards.
(f) Sites located to measure air pollution impacts on visibility, vegetation damage, or other welfare-based impacts.

1.1.2 This appendix contains criteria for the basic air monitoring requirements. The total number of monitoring sites that will serve the variety of data needs will be substantially higher than these minimum requirements provide. The optimum size of a particular network involves trade-offs among data needs and available resources. This regulation intends to provide for national air monitoring needs, and to lend support for the flexibility necessary to meet data collection needs of area air quality managers. The EPA, State, and local agencies will periodically collaborate on network design issues through the network assessment process outlined in §58.10.

1.1.3 This appendix focuses on the relationship between monitoring objectives, site types, and the geographic location of monitoring sites. Included are a rationale and set of general criteria for identifying candidate site locations in terms of physical characteristics which most closely match a specific monitoring objective. The criteria for more specifically locating the monitoring site, including spacing from roadways and vertical and horizontal probe and path placement, are described in appendix E to this part.

1.2 Spatial Scales. (a) To clarify the nature of the link between general monitoring objectives, site types, and the physical location of a particular monitor, the concept of spatial scale of representativeness is defined. The goal in locating monitors is to correctly match the spatial scale represented by the sample of monitored air with the spatial scale most appropriate for the monitoring site type, air pollutant to be measured, and the monitoring objective.

(b) Thus, spatial scale of representativeness is described in terms of the physical dimensions of the air parcel nearest to a monitoring site throughout which actual pollutant concentrations are reasonably similar. The scales of representativeness of most interest for the monitoring site types described above are as follows:
(1) *Microscale*—Defines the concentrations in air volumes associated with area dimensions ranging from several meters up to about 100 meters.

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[30] Available online at:
http://www.ecfr.gov/cgi-bin/retrieveECFR?gp=&SID=da38e6b9e47cb1162b5843000573c1c8&mc=true&n=pt40.6.58&r=PART&ty=HTML.

(2) *Middle scale*—Defines the concentration typical of areas up to several city blocks in size with dimensions ranging from about 100 meters to 0.5 kilometer.
(3) *Neighborhood scale*—Defines concentrations within some extended area of the city that has relatively uniform land use with dimensions in the 0.5 to 4.0 kilometers range. The neighborhood and urban scales listed below have the potential to overlap in applications that concern secondarily formed or homogeneously distributed air pollutants.
(4) *Urban scale*—Defines concentrations within an area of city-like dimensions, on the order of 4 to 50 kilometers. Within a city, the geographic placement of sources may result in there being no single site that can be said to represent air quality on an urban scale.
(5) *Regional scale*—Defines usually a rural area of reasonably homogeneous geography without large sources, and extends from tens to hundreds of kilometers.
(6) *National and global scales*—These measurement scales represent concentrations characterizing the nation and the globe as a whole.

(c) Proper siting of a monitor requires specification of the monitoring objective, the types of sites necessary to meet the objective, and then the desired spatial scale of representativeness. For example, consider the case where the objective is to determine NAAQS compliance by understanding the maximum ozone concentrations for an area. Such areas would most likely be located downwind of a metropolitan area, quite likely in a suburban residential area where children and other susceptible individuals are likely to be outdoors. Sites located in these areas are most likely to represent an urban scale of measurement. In this example, physical location was determined by considering ozone precursor emission patterns, public activity, and meteorological characteristics affecting ozone formation and dispersion. Thus, spatial scale of representativeness was not used in the selection process but was a result of site location.

(d) In some cases, the physical location of a site is determined from joint consideration of both the basic monitoring objective and the type of monitoring site desired, or required by this appendix. For example, to determine $PM_{2.5}$ concentrations which are typical over a geographic area having relatively high $PM_{2.5}$ concentrations, a neighborhood scale site is more appropriate. Such a site would likely be located in a residential or commercial area having a high overall $PM_{2.5}$ emission density but not in the immediate vicinity of any single dominant source. Note that in this example, the desired scale of representativeness was an important factor in determining the physical location of the monitoring site.

(e) In either case, classification of the monitor by its type and spatial scale of representativeness is necessary and will aid in interpretation of the monitoring data for a particular monitoring objective (e.g., public reporting, NAAQS compliance, or research support).

(f) Table D-1 of this appendix illustrates the relationship between the various site types that can be used to support the three basic monitoring objectives, and the scales of representativeness that are generally most appropriate for that type of site.

TABLE D-1 OF APPENDIX D TO PART 58—RELATIONSHIP BETWEEN SITE TYPES AND SCALES OF REPRESENTATIVENESS

Site type	Appropriate siting scales
1. Highest concentration	Micro, middle, neighborhood (*sometimes* urban or regional for secondarily formed pollutants).
2. Population oriented	Neighborhood, urban.
3. Source impact	Micro, middle, neighborhood.
4. General/background & regional transport	Urban, regional.
5. Welfare-related impacts	Urban, regional.

Appendix C: Request of Lead Monitoring Waiver

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Section 1: Summary

EPA requires source-oriented SLAMS lead monitoring near industries that emit over 0.5 tons per year (tpy) of lead. The rule allows for a waiver of monitoring requirements if air dispersion modeling predicts ambient air concentrations less than half the NAAQS. These waivers must be renewed as an element of each State's five year network assessment. [31]

Facilities with 2013 NEI lead emissions that round to or exceed 0.25 tons per year (tpy) are indicated below:

Facility Name	Lead Emissions (tpy)
Grain Processing Corporation – Muscatine	2.732
MidAmerican Energy (Walter Scott Jr. Energy Center) – Council Bluffs	0.448
MidAmerican Energy (Louisa Station) – Muscatine	0.263
Amsted Rail Company, Inc. – Keokuk	0.246

Ambient impacts of the emissions from GPC and Walter Scott Jr. Energy Center were modeled by the DNR. The ambient impacts from both facilities were well below half of the lead NAAQS, and the DNR requests a waiver of the lead monitoring requirements for these two facilities.

[31] Federal lead monitoring requirements are found in 40 CFR Part 58 Appendix D Section 4.5.

Section 2: Lead Modeling for Facilities in Iowa with Lead Emissions Over 0.5 Tons

IOWA DEPARTMENT OF NATURAL RESOURCES

Environmental Services Division
Air Quality Bureau
Modeling Group

M E M O R A N D U M

DATE: 1/23/15

TO: SEAN FITZSIMMONS

FROM: ALYSSA FIZEL, PETER ZAYUDIS

RE: LEAD MODELING FOR 2013 EMISSIONS

CC: BRIAN HUTCHINS, JIM MCGRAW, JASON MARCEL, BRAD ASHTON, NICK PAGE, DON PETERSON

INTRODUCTION

On January 12, 2009, the EPA's new and more stringent NAAQS standard for airborne lead (Pb) became effective. The primary standard for lead is 0.15 µg/m^3 based on the maximum (not to be exceeded) 3-month rolling average. On December 23, 2009 EPA proposed to decrease the emissions threshold for ambient monitoring to 0.5 tons/yr. Each year the Department will evaluate sources of lead emissions in the state to determine if any facilities meet or exceed this value.

In 2013, two facilities actual lead emissions were greater than the site specific monitoring threshold of 0.5 tons for lead. The two facilities are Grain Processing Corporation at approximately 2.7 tons and MidAmerican Walter Scott Jr Energy Center at approximately 0.45 tons.

Grain Processing Corporation (Plant No. 70-01-004)

In 2013, the lead emissions from Grain Processing Corporation (GPC) increased from 2.2 tons in 2012 to 2.7 tons due to an increase in the amount of coal combusted. However, past ambient air analysis conducted in January of 2014 was based on emission rate of 0.97 lb/hr (4.24 tons). For emissions year 2013 no other changes have occurred that would affect lead emissions or dispersion characteristics at GPC.

Note: On July 15, 2015, GPC is required to combust only natural gas in Boilers 1, 2, 3, 4, 6 and 7 and coal combustion will be discontinued within these boilers. Potential lead emissions from these boilers will be reduced to approximately 0.002 tons per year based on natural gas combustion. After 2015, the estimated actual lead emissions from GPC will fall below the site specific monitoring threshold of 0.5tons.

MidAmerican Energy Company - Walter Scott Jr Energy Center (Plant No. 78-01-026)

In 2013, the lead emissions MidAmerican Energy Company - Walter Scott Jr Energy Center decreased from 0.451 tons in 2012 to 0.448 tons due a slight decrease in the amount of coal combusted. For emissions year 2013 no other changes at MidAmerican Energy Company - Walter Scott Jr Energy Center have occurred that would affect lead emissions or dispersion characteristics.

Therefore the Department has decided to model the impacts from lead emissions from these facilities. Monitoring may, at the EPA Regional Administrator's discretion, be waived if modeled concentrations do not exceed 50% of the standard. The purposes of the current modeling are to evaluate ambient concentrations around these facilities for aid in determining if a monitoring waiver can be issued and, if necessary, where to site monitors.

ANALYSIS SUMMARY

Previous lead modeling for each facility was used as a base on which to build the current analysis. The analysis was evaluated using the newest version of AERMOD (version 14134). The sources at each facility were modeled using the stack parameters and emission rates listed in Table 1. Sources were modeled using the most recent actual emission rates approved by the construction permit engineering staff. No stack parameters or emission rates were changed from the previously modeled values.

Table 1: Modeled Emission Rates and Stack Parameters

Emission Point	Pb (lb/hr)	Stack Height (ft)	Stack Gas Exit Temperature (°F)	Stack Tip Diameter (in)	Stack Gas Flow Rate (acfm)
MidAmerican Energy – Walter Scott Energy Center					
1 (Boiler 1)	1.17	250	287	144	220,270
2 (Boiler 2)	1.65	250	316	144	446,200
3 (Boiler 3)	0.14	550	180	300	2,619,890
4 (Boiler 4)	0.025	551	207	296	2,447,050
Grain Processing Corporation					
EP001 (GEP Boilers)	0.97	219	379	180	402,340

MODEL RESULTS

Since the dispersion model AERMOD does not provide the ability to directly compute the 3-month rolling averages, results must go through a post-processing procedure. EPA's "leadpost" tool was used to determine the highest 3-month rolling average lead concentration, the receptor location, and the period of time.

According to the results from the AMS/EPA Regulatory Model (AERMOD, dated 14134), as post-processed by leadpost (dated 13262), the Pb emissions from these facilities will cause predicted concentrations that are less than 50% of the Pb NAAQS. All sources were assumed to operate 24 hours/day, 8760 hours/year.

The Pb modeling result for the worst case calendar quarter and year is listed in Tables 2 and 3. Visual displays of isopleths are provided in Figures 1 and 2. The isopleths are based on the highest 3-month rolling average concentrations at each receptor. The coordinates for both facilities are based on UTM zone 15, NAD27. The location of the maximum concentration is marked with either a red dot or red contour line. This will facilitate a determination of where the highest predicted impacts are and where monitors may best be located, if monitoring will be required.

Table 2: Worst Case Modeling Results for Pb – MidAmerican – WSEC

Averaging Period	Year in which event occurred	Predicted Concentration* ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
Rolling 3-month	2009 (May – July)	0.0285	0	0.0285	0.15

* The rolling 3-month concentration is the highest predicted value.

Figure 1: Concentration Profile – MidAmerican – WSEC

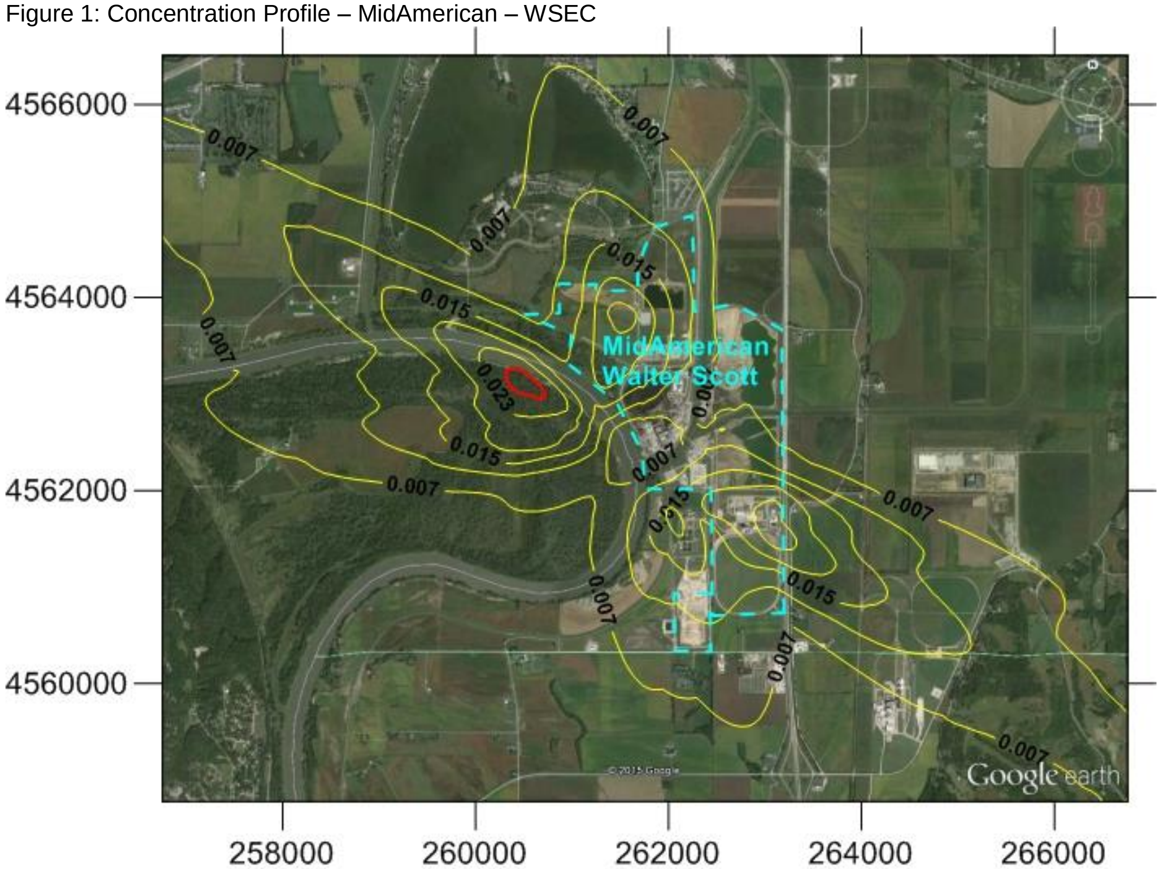
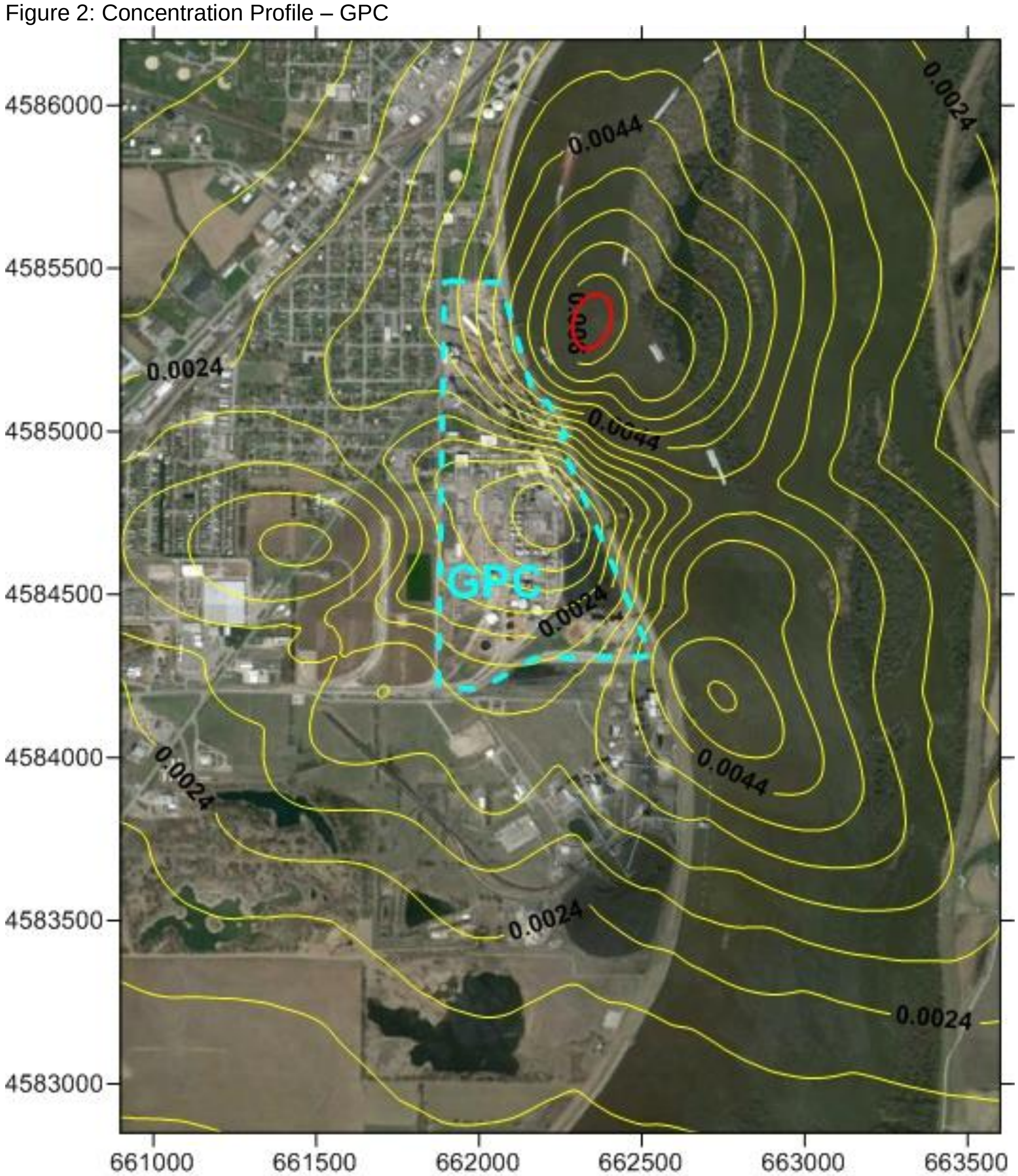


Table 3: Worst Case Modeling Results for Pb – GPC

Averaging Period	Year in which event occurred	Predicted Concentration* ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
Rolling 3-month	2005 (August – October)	0.00632	0	0.00632	0.15

* The rolling 3-month concentration is the highest predicted value.

Figure 2: Concentration Profile – GPC



Appendix D: New and Proposed NAAQS

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Section 1: Summary

Changes to federal rules may affect the Iowa air monitoring network in several important ways. They may change the threshold for adverse health effects (NAAQS exceedance levels) used for real-time reporting or the regulatory intervention levels (NAAQS violation levels). They may also affect the minimum number of monitors required in state networks and the location of these monitors. Changes to the ambient air monitoring network should reflect anticipation of these regulatory changes.

Section 2 contains EPA's schedule for reviewing the NAAQS. Sections 3 examines the effects of proposed changes in the ozone NAAQS.

Section 2: EPA's NAAQS Review Schedule

The Clean Air Act requires EPA to set National Ambient Air Quality Standards to protect the public against levels of exposure to air contaminants that are considered harmful to human health or welfare. Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against visibility impairment, damage to animals, crops, vegetation, and buildings.

EPA's current NAAQS review schedule is indicated below[32].

MILESTONE	POLLUTANT						
	Lead	NO_2 Primary	SO_2 Primary	Ozone Reconsideration	CO	PM	NO_2/SO_2 Secondary
Proposed	Dec 19, 2014	Nov 2016	May 2017	11/26/2014	TBD	TBD	May 2017
Final	2015	Aug 2017	Feb 2018	<u>10/1/2015</u>	TBD	TBD	Feb 2018

NOTE: <u>Underlined</u> dates indicate court-ordered or settlement agreement deadlines.

[32] The schedule above is based on departmental participation on a national workgroup. A recent published version of the schedule is available on page 3 of: http://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download/?cid=nrcseprd343045&ext=pdf.

Section 3: Proposed Ozone NAAQS and Ozone Monitoring Regulations

NAAQS Violations under the Proposed Range for the Ozone NAAQS: An Analysis of Historical Data

A NAAQS violation occurs when the design value is greater than the level of the standard. The form of the design value described in the proposed rule[33] is the same definition as that in current usage: the three-year average of the annual 4th highest daily maximum 8-hour ozone values. EPA has proposed a range for the level of the ozone NAAQS between 65 and 70 ppb, and has requested comment on a range between 60 and 75 ppb. The most recent five years of ozone design values are shown below. For example, based on the most recent set of 2012-2014 design values if the NAAQS is set at 70 ppb, no sites would violate the NAAQS, but at 65 ppb NAAQS, four sites would violate the NAAQS.

AQS ID	Site	Three-Year Period				
		2008-2010	2009-2011	2010-2012	2011-2013	2012-2014
190170011	Waverly Airport	62	63	65	64	63
190450021	Clinton, Rainbow Park	63	64	68	68	67
190850007	Pisgah, Forestry Office		64	68	68	67
190851101	Pisgah, Highway Shed	63	65	69	69	67
191130028	Cedar Rapids, Kirkwood College	62	62	66	65	63
191130033	Coggon, Coggon Elementary	62	63	65	64	63
191130040	Cedar Rapids, Public Health		61	64	63	62
191370002	Viking Lake State Park	62	64	67	65	63
191471002	Emmetsburg, Iowa Lakes College	60	65	68	67	65
191530030	Des Moines, Health Dept.	56	57	61	61	62
191630014	Scott County Park	63	63			
191630015	Davenport, Jefferson School	64	65	67	66	63
191690011	Slater, City Hall	58	60	62	62	62
191770006	Lake Sugema	62	63	68	66	66
191810022	Lake Ahquabi	61	62	65	64	63

Legend	
Color	Design Value (DV) Range
Red	75 < DV
Orange	70 < DV ≤ 75
Yellow	68 < DV ≤ 70
Green	65 < DV ≤ 68
Blue	60 < DV ≤ 65
White	DV ≤ 60

Ozone Design Values (ppb) at Iowa Sites; Gray cells indicate monitor not operational or missing data.

[33] Available online at: http://epa.gov/glo/pdfs/20141125proposal.pdf.

Ozone Exceedances Relative to the Possible Range for the NAAQS: An Analysis of Historical Data

An ozone exceedance day occurs when the highest eight-hour average in the day exceeds the level of the standard. The table below shows the number of exceedance days that would have occurred over the past 5 years, given that the level of the standard was in the 60-75 ppb range of the NAAQS in the proposed rule. For example, if the level of the NAAQS drops from 75 ppb to 70 ppb, the number of exceedance days in the Iowa network over the past five years would increase from 20 to 91.

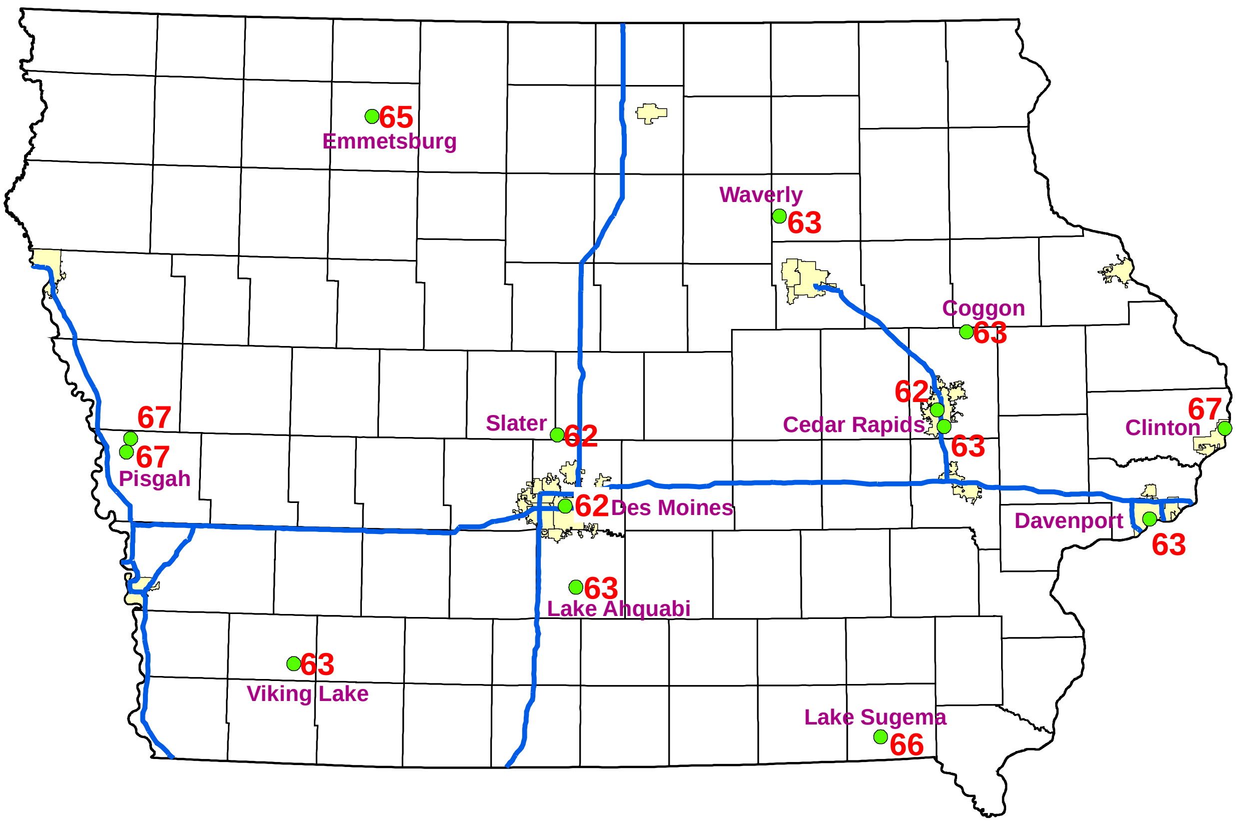
AQS ID - POC	Possible NAAQS Level	60 ppb					65 ppb					70 ppb					75 ppb				
	Site Name	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
190170011-1	Waverly Airport	8	8	27	2	4	3	4	7	0	1	1	0	2	0	0	0	0	0	0	0
190450021-1	Clinton, Rainbow Park	10	14	33	9	11	3	5	24	1	2	0	0	11	0	1	0	0	4	0	0
190850007-1	Pisgah, Forestry Office	13	14	42	9	6	8	2	27	2	1	2	1	10	0	0	1	0	3	0	0
190851101-1	Pisgah, Highway Maintenance Shed	11	17	45	7	7	5	6	27	3	0	2	1	13	0	0	1	0	4	0	0
191130028-1	Cedar Rapids, Kirkwood College	9	8	34	2	3	2	3	13	0	1	1	0	4	0	0	0	0	1	0	0
191130033-1	Coggon, Coggon Elementary	9	8	25	0	5	2	1	9	0	0	1	0	2	0	0	0	0	1	0	0
191130040-1	Cedar Rapids, Public Health	5	6	30	2	2	1	1	10	0	0	1	0	2	0	0	0	0	1	0	0
191370002-1	Viking Lake State Park	12	5	27	3	1	6	3	12	1	0	2	0	5	1	0	0	0	0	0	0
191471002-1	Emmetsburg, Iowa Lakes College	9	8	16	10	6	4	4	7	2	0	2	0	2	0	0	0	0	1	0	0
191530030-1	Des Moines, Health Dept.	2	3	20	2	4	0	2	9	0	1	0	0	0	0	0	0	0	0	0	0
191630014-1	Scott County Park[34]	10	10	23	2	12	3	1	7	0	1	1	0	4	0	0	0	0	0	0	0
191630015-1	Davenport, Jefferson School	12	11	28	3	1	3	4	11	0	0	0	1	5	0	0	0	0	1	0	0
191690011-1	Slater, City Hall	4	5	19	4	5	2	2	1	0	1	0	0	0	0	0	0	0	0	0	0
191770006-1	Lake Sugema	12	6	34	7	7	6	0	17	1	1	1	0	10	0	0	0	0	2	0	0
191810022-1	Lake Ahquabi	8	7	27	3	3	2	1	15	0	1	0	0	2	0	0	0	0	0	0	0
Total		**134**	**130**	**430**	**65**	**77**	**50**	**39**	**196**	**10**	**10**	**14**	**3**	**72**	**1**	**1**	**2**	**0**	**18**	**0**	**0**

Ozone Exceedance Days Calculated According to the Proposed NAAQS

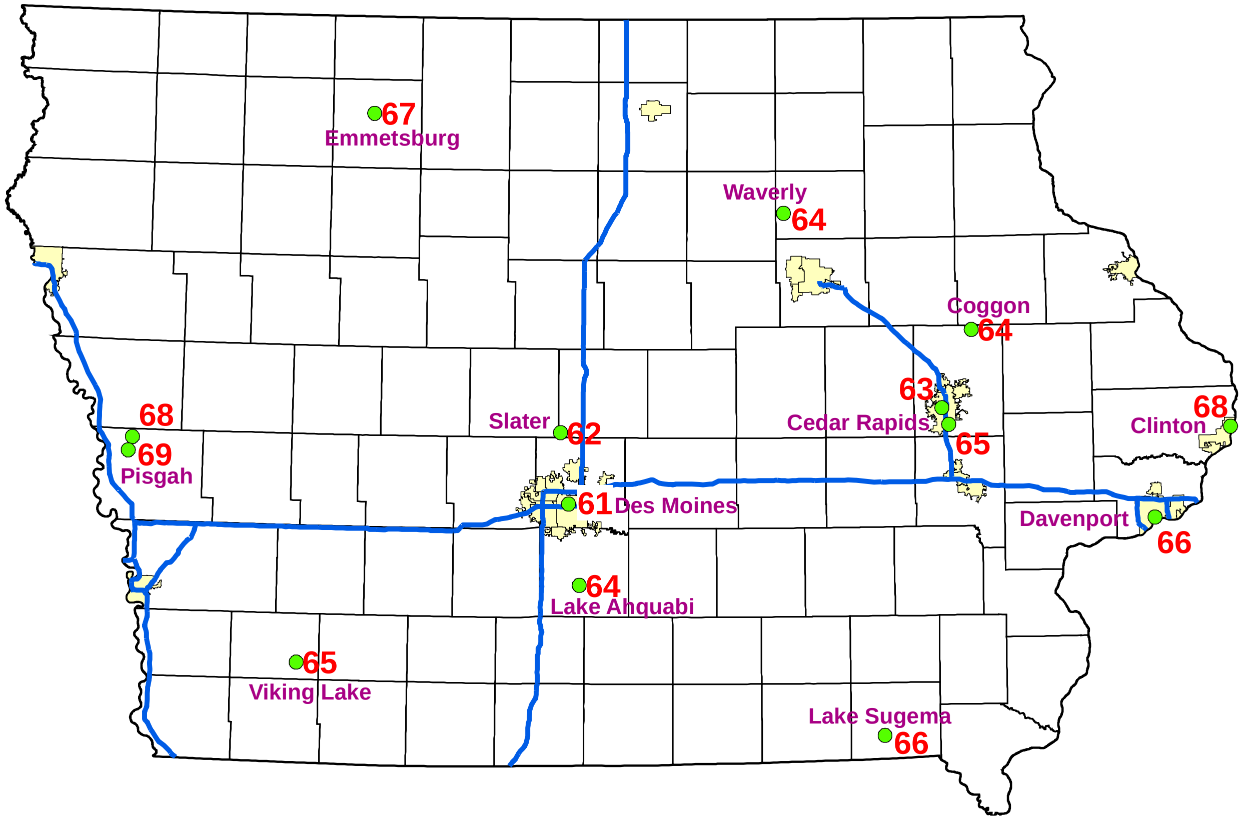
[34] Data for Scott County Park was invalidated from 1300 LST on September 6, 2012 through 1300 LST on August 30, 2013. Exceedance counts may be low during this period.

Maps of Ozone Design Values

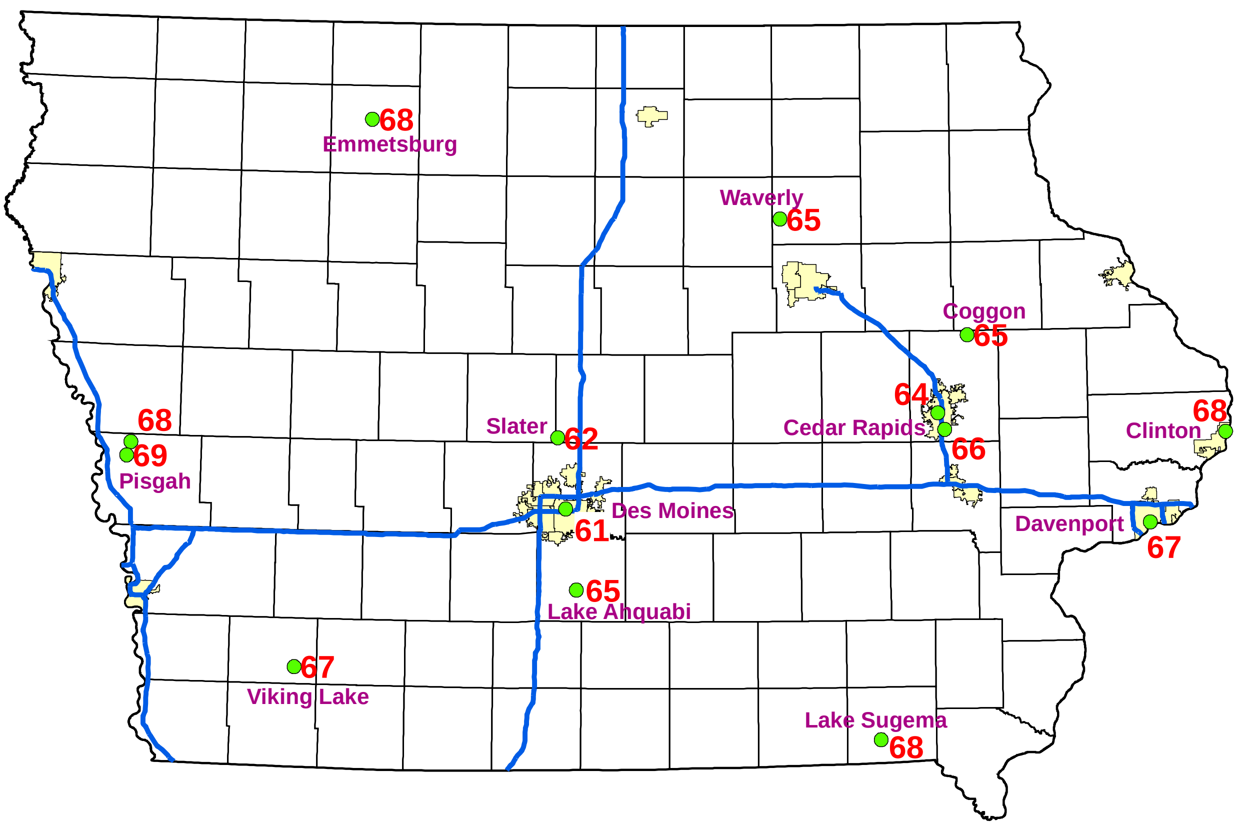
Maps of ozone design values calculated according to the proposed ozone rule are indicated below. Three years of complete data are required to compute a design value; only sites with complete data are indicated. Monitors downwind of eastern Iowa cities and downwind of the Omaha-Council Bluffs area usually record the highest design values.



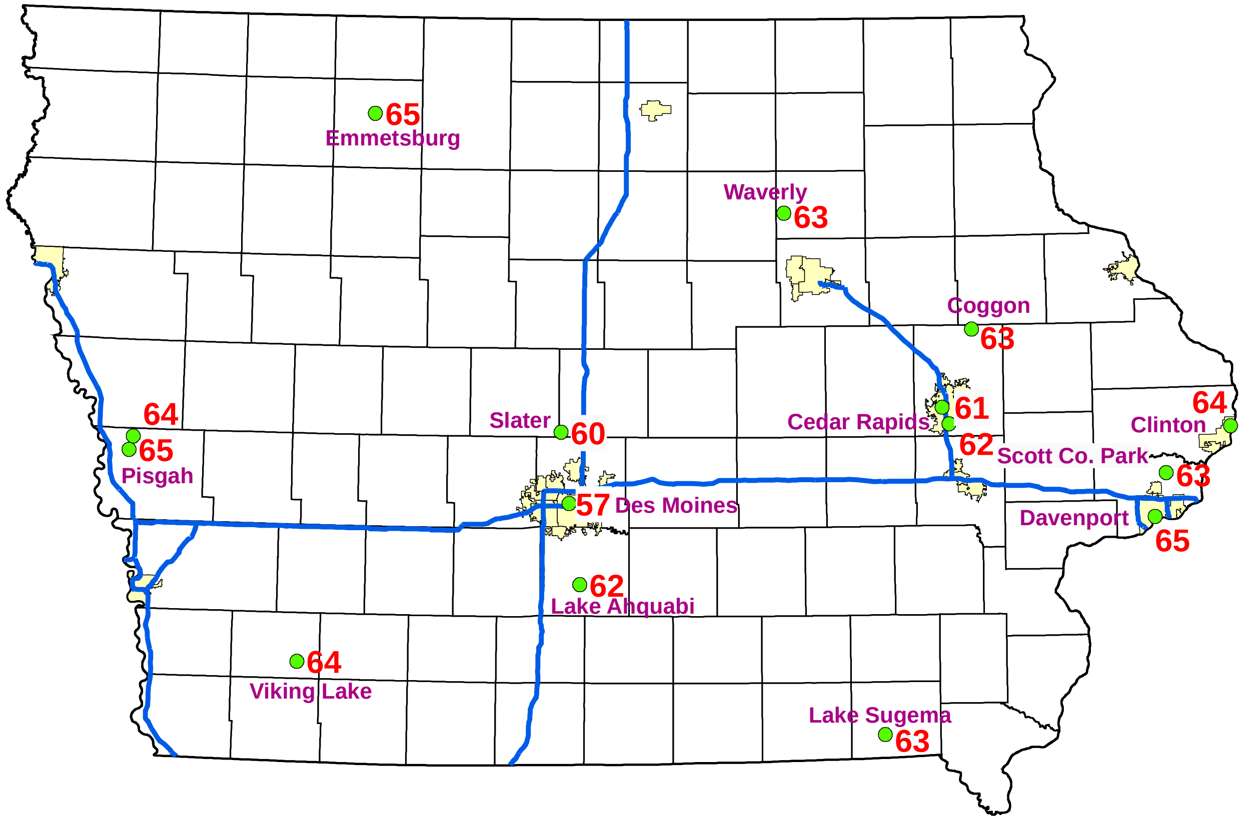
2012-2014 Ozone Design Values (ppb)



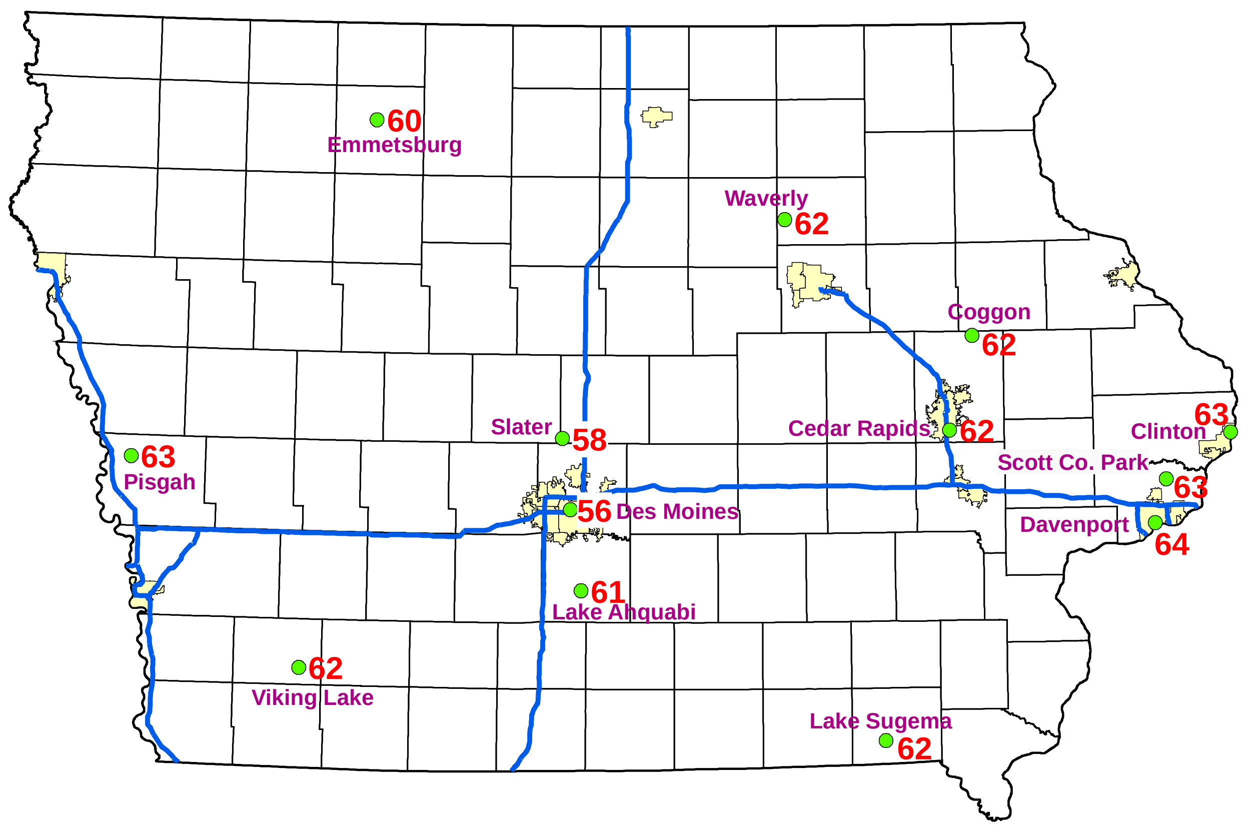
2011-2013 Ozone Design Values (ppb)



2010-2012 Ozone Design Values (ppb)



2009-2011 Ozone Design Values (ppb)



2008-2010 Ozone Design Values (ppb)

Appendix E: Changes to the Iowa Monitoring Network

Iowa's *2015 Ambient Air Monitoring Network Plan*[35] describes the following changes to the Iowa monitoring network that are scheduled to occur before the submission of the next (2016) Network Plan:

Discontinuation of Manganese analysis in Council Bluffs.

In 2011, DNR added manganese analysis at its lead monitoring site[36] near Griffin Pipe in Council Bluffs. Average levels at the site in 2011, 2012, and 2013 were (104 ±53) ng/m^3, (95 ±16) ng/m^3 and (79 ±14) ng/m^3, respectively.[37, 38, 39] Griffin Pipe suspended production indefinitely in May of 2014[40], and the average manganese concentration in 2014 dropped to (44 ± 6) ng/m^3.[41] Recently, EPA relaxed its manganese health effects benchmark for manganese from 50 ng/m^3 to 300 ng/m^3.[42, 43, 44]

Manganese levels at the site have never approached the new EPA benchmark. DNR proposes to discontinue its supplemental manganese analysis at the site on January 1, 2016.

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[35] Iowa's *2015 Ambient Air Monitoring Network Plan* is available online at: http://www.iowadnr.gov/Portals/idnr/uploads/air/insidednr/monitoring/network_plan_2015.pdf.

[36] State Implementation Plan Lead Non-Attainment Council Bluffs, Iowa.

[37] Iowa DNR 2011 Manganese Report.

[38] Iowa DNR 2012 Manganese Report.

[39] Iowa DNR 2013 Manganese Report.

[40] KETV: Griffin Pipe goes to skeleton crew.

[41] Iowa DNR 2014 Manganese Report.

[42] Quality Assurance Project Plan For the EPA School Air Toxics Monitoring Program.

[43] Experiences with Next Generation Technologies, Motria Caudill, PhD --EPA Region 5.

[44] ATSDR MRL list.

Appendix F: Results from Network Assessment Tools

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Section 1: Summary

The Data Analysis and Assessment group at EPA's Office of Air Quality Planning and Standards (OAQPS) developed a new set of analytical tools to assist states in performing their 2010 5-year network assessments.[45] These tools utilized the open source statistical analysis package R.[46]

Those tools were not updated for the 5-year network assessments due in 2015. The following sections contain results obtained utilizing monitoring data in Excel to generate levels of correlation within the ambient monitoring network. QGIS[47] was used to generate Voronoi diagrams to convey spatial coverage of monitors in the network.

The following matrices provide a graphical representation of the correlation coefficient, average root mean square (RMS) relative difference and counts of the pairs. This analysis of the Iowa data showed that as the distance between monitor pairs increased, R^2 values tend to decrease and the RMS relative difference between the monitor pairs tended to increase. Monitors located near emissions sources tended to exhibit lower R^2 values and higher average relative percent differences than monitors that were not located near emissions sources.

Dendrogram analysis via R was also conducted. The dendrograms pair monitors together based on how well-correlated they are and the value of the RMS relative difference between pairs and groups of monitors. Pairs are made of individual monitors and groups until the whole monitoring network is covered.

Voronoi polygons utilize a mathematical technique to divide the area to be monitored into a number of polygons (one monitor is associated with each of the polygons) and counts the number of people living in these polygons. We apply this technique to the Iowa Network as it appeared in 2014 when the analysis was performed. It is clear from this analysis that, all other things being equal, monitors in a less dense network tend to serve more area and more people than monitors in a denser network.

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[45] Available online at: http://www.epa.gov/ttn/amtic/network-assessment.html.
[46] Available online at: http://www.r-project.org/.
[47] Available online at: http://qgis.org/en/site/.

Section 2: Correlation Matrix and Monitor Grouping

A correlation matrix provides a graphical representation of how closely concentrations of pollutants are correlated to other monitors. Correlation values are displayed as R^2 values. A R^2 value close to one (1.0) conveys that there is high correlation between the two monitors. As the R^2 value drops and gets closer to zero (0), the correlation decreases.

A similar concept is displayed via RMS Deviation Matrices. The numbers shown convey a typical expected difference between two monitoring sites. As the RMS deviation increases, so does the magnitude of discrepancy between two monitoring sites.

Site-pairing also conveys how closely sites are related to each other. Via a clustering algorithm, site and group pairs are created based on R^2 values until the whole network is included in one large group. The process of pairing is demonstrated by a dendrogram. The earliest pairs created on the bottom of the graph show monitoring sites that tend to be very closely correlated.

The analysis utilizes data gathered from monitoring sites with complete data records from 2010-2013. Daily maximum 8-hour average-ozone data from April through October was selected for the ozone analysis. In cases where States have indicated that the quality of their $PM_{2.5}$ continuous data is acceptable for establishing NAAQS compliance, it has been included in the analyses along with the filter (FRM) data by computation of 24-hour averages. Iowa has not yet determined that the quality of its continuous $PM_{2.5}$ data is adequate for regulatory decision making, and data from $PM_{2.5}$ continuous monitors in the Iowa network were not included in this analysis. Sites that did not meet 75% completeness for the available comparable samples are highlighted in red. Rock Island $PM_{2.5}$ FRM failed to meet completeness criteria and was thus removed from the $PM_{2.5}$ dendrogram.

The ozone correlation dendrogram groups monitors into four distinct regions. There is a northwestern grouping of the monitors in South Dakota and the monitor at Emmetsburg, Iowa. The next cluster includes monitors in the Omaha MSA, western (Viking Lake) and central Iowa (Lake Ahquabi, Des Moines and Slater). The northeastern Iowa (Waverly and monitors in Linn County) group includes monitors from southeastern Minnesota and southwest Wisconsin. The final grouping consists of east-central and southeastern Iowa (Clinton, Davenport, Scott County Park and Lake Sugema) along with monitors in western Illinois.

The ozone RMS deviation dendrogram has three distinct sections that consist of a western, central and eastern group. This grouping has similarities to the correlation dendrogram and suggests that there are three or four regional ozone basins in and around Iowa.

The $PM_{2.5}$ correlation matrix dendrogram outlines five distinct areas: the northwestern section of Iowa and southeastern South Dakota, the Omaha MSA, south-central and southeastern Iowa, east-central Iowa, and southeastern Minnesota and southwestern Wisconsin. The $PM_{2.5}$ RMS deviation map outlines three areas that differ from each other. The three sections can be categorized as: southeastern South Dakota, eastern Nebraska and western Iowa; central and northeastern Iowa along with southeastern Minnesota and southwestern Wisconsin; and the last cluster comprises east-central and far southeastern Iowa. This grouping suggests that there are at least three regional $PM_{2.5}$ air basins that vary to an extent based on the amount of industry and proximity to the Great Lakes Region.

The PM_{10} dendrogram creates five correlation clusters: northwest Iowa and southeastern South Dakota, the Omaha MSA, southern Iowa, northern Iowa, and eastern Iowa into southwestern Wisconsin. The RMS deviation dendrogram sets up groupings in southeastern South Dakota, the northwestern two-thirds of Iowa and southeastern Iowa into southwestern Wisconsin. This suggests that there are three to five potential regional PM_{10} basins if major sources such as rock quarries are not factored into the analysis.

The Iowa sites included in the analysis for ozone, $PM_{2.5}$ and PM_{10} data in 2013 contain most sites in the current (January 2015) network. Primary $PM_{2.5}$ FRM samplers in Iowa operate at a frequency of at least 1 sample every three days. Site locations are displayed on the accompanying maps following each analysis.

Graphical output of the Correlation and RMS Deviation Matrices for ozone, $PM_{2.5}$ and PM_{10} data is indicated below, along with a map and tables describing the monitoring sites that were included in the data set. The data in all three tables suggests that as the distance between monitor pairs increases, R^2 values typically decrease and the average difference between monitor pairs typically increases.

The ozone monitoring site at the South Dakota School for the Deaf in Sioux Falls, South Dakota exhibits the most differences with the largest number of sites as demonstrated by a high RMS deviation in the ozone RMS deviation matrix. The rooftop monitor at Golden Hills Elementary in Bellevue, Nebraska has the highest number of sites with an RMS deviation greater than the median. The monitor at Musser Park in Muscatine exhibits the highest RMS deviation relative to other monitors in the $PM_{2.5}$ correlation matrix. Source-oriented PM_{10} monitors at Buffalo, Iowa (Linwood Mining); and Omaha, Nebraska exhibit the highest RMS deviation relative to other monitors in the PM_{10} correlation matrix.

R^2	170010007	170859991	171613002	190170011	190450021	190850007	190851101	191130028	191130033	191130040	191370002	191471002	191530030	191630014	191630015	191690011	191770006	191810022	271095008	310550019	310550028	310550035	460990008	461270001	550630012
170010007	1.00																								
170859991	0.53	1.00																							
171613002	0.59	0.75	1.00																						
190170011	0.46	0.73	0.57	1.00																					
190450021	0.57	0.90	0.78	0.70	1.00																				
190850007	0.40	0.49	0.45	0.64	0.50	1.00																			
190851101	0.39	0.46	0.43	0.62	0.47	0.98	1.00																		
191130028	0.60	0.80	0.75	0.80	0.81	0.58	0.56	1.00																	
191130033	0.53	0.85	0.69	0.86	0.83	0.58	0.55	0.91	1.00																
191130040	0.58	0.79	0.75	0.80	0.81	0.58	0.56	0.96	0.92	1.00															
191370002	0.48	0.47	0.44	0.59	0.47	0.71	0.71	0.56	0.54	0.57	1.00														
191471002	0.35	0.48	0.40	0.71	0.47	0.74	0.72	0.54	0.58	0.55	0.60	1.00													
191530030	0.50	0.57	0.59	0.69	0.59	0.69	0.67	0.73	0.68	0.75	0.68	0.64	1.00												
191630014	0.60	0.87	0.82	0.70	0.92	0.50	0.47	0.84	0.84	0.85	0.52	0.49	0.63	1.00											
191630015	0.63	0.78	0.85	0.63	0.86	0.49	0.46	0.81	0.78	0.81	0.46	0.43	0.61	0.88	1.00										
191690011	0.48	0.58	0.56	0.77	0.58	0.73	0.71	0.74	0.71	0.74	0.70	0.73	0.90	0.64	0.58	1.00									
191770006	0.76	0.63	0.66	0.59	0.64	0.50	0.48	0.74	0.67	0.73	0.62	0.44	0.68	0.71	0.70	0.64	1.00								
191810022	0.55	0.57	0.58	0.66	0.57	0.66	0.65	0.71	0.66	0.72	0.75	0.60	0.90	0.63	0.60	0.85	0.74	1.00							
271095008	0.36	0.63	0.47	0.72	0.54	0.53	0.51	0.60	0.64	0.61	0.46	0.67	0.56	0.54	0.47	0.61	0.45	0.53	1.00						
310550019	0.38	0.41	0.48	0.55	0.47	0.82	0.80	0.56	0.52	0.56	0.67	0.60	0.68	0.52	0.49	0.67	0.47	0.63	0.45	1.00					
310550028	0.38	0.42	0.46	0.51	0.44	0.79	0.77	0.54	0.48	0.54	0.67	0.56	0.67	0.48	0.47	0.65	0.49	0.63	0.46	0.90	1.00				
310550035	0.39	0.43	0.44	0.49	0.44	0.79	0.77	0.52	0.48	0.52	0.63	0.54	0.57	0.47	0.47	0.56	0.48	0.56	0.45	0.78	0.81	1.00			
460990008	0.23	0.35	0.32	0.49	0.33	0.64	0.64	0.42	0.41	0.42	0.43	0.69	0.53	0.35	0.31	0.56	0.33	0.48	0.51	0.56	0.51	0.47	1.00		
461270001	0.22	0.34	0.30	0.57	0.37	0.75	0.72	0.40	0.44	0.39	0.55	0.74	0.53	0.53	0.34	0.62	0.32	0.45	0.54	0.67	0.54	0.51	0.80	1.00	
550630012	0.38	0.68	0.48	0.69	0.61	0.43	0.41	0.62	0.69	0.63	0.40	0.53	0.49	0.59	0.52	0.52	0.46	0.45	0.79	0.35	0.36	0.35	0.34	0.39	1.00

Ozone Correlation Matrix (2010-2013)

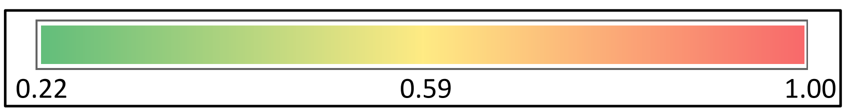


Table of Contents

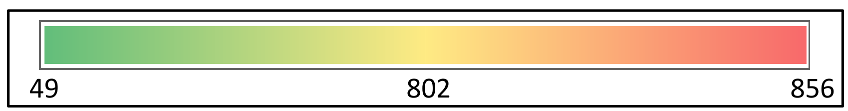
RMS Deviation	170010007	170859991	171613002	190170011	190450021	190850007	190851101	191130028	191130033	191130040	191370002	191471002	191530030	191630014	191630015	191690011	191770006	191810022	271095008	310550019	310550028	310550035	460990008	461270001	550630012
170010007	0.0																								
170859991	8.4	0.0																							
171613002	8.2	7.2	0.0																						
190170011	8.6	6.5	7.9	0.0																					
190450021	7.9	4.0	6.9	6.6	0.0																				
190850007	9.7	9.4	10.2	7.5	9.1	0.0																			
190851101	9.9	9.8	10.5	7.8	9.4	1.8	0.0																		
191130028	7.4	5.5	7.0	5.2	5.1	8.1	8.4	0.0																	
191130033	7.9	4.8	7.3	4.2	5.0	8.1	8.4	3.4	0.0																
191130040	7.7	5.7	6.5	5.1	5.3	8.2	8.5	2.4	3.2	0.0															
191370002	8.3	9.5	9.1	7.3	9.1	6.6	6.7	8.0	8.0	7.8	0.0														
191471002	9.6	9.3	9.6	6.0	9.0	6.2	6.5	8.1	7.6	8.0	7.2	0.0													
191530030	8.8	8.8	7.2	6.7	8.5	7.9	8.1	7.0	7.3	6.3	6.8	7.3	0.0												
191630014	7.3	4.9	6.2	6.3	3.5	9.1	9.4	4.6	4.5	4.6	8.2	8.4	8.0	0.0											
191630015	7.1	5.9	5.8	7.2	4.5	9.2	9.5	5.1	5.5	5.1	8.9	9.3	8.1	4.1	0.0										
191690011	8.5	8.5	7.5	5.5	8.2	6.9	7.2	6.3	6.5	6.1	6.2	5.9	3.6	7.3	7.9	0.0									
191770006	5.3	7.4	8.0	7.5	7.2	8.7	9.0	5.9	6.6	6.2	7.3	9.0	7.6	6.3	6.4	7.4	0.0								
191810022	7.7	8.3	7.8	6.6	8.0	7.3	7.3	6.3	6.7	6.2	5.6	7.3	4.3	7.1	7.5	4.5	5.9	0.0							
271095008	10.0	8.1	8.6	6.3	8.8	9.1	9.4	8.0	7.4	7.7	8.9	6.9	7.9	8.5	9.3	7.2	9.5	8.2	0.0						
310550019	10.2	10.2	10.1	8.7	9.9	5.4	5.8	8.6	9.0	8.7	7.4	8.1	7.8	9.1	9.5	7.6	9.3	7.7	10.2	0.0					
310550028	10.7	11.4	8.5	9.3	10.7	7.9	8.2	9.7	9.9	9.2	7.7	8.9	6.9	10.0	10.2	7.3	10.3	8.1	9.2	7.0	0.0				
310550035	10.7	11.5	9.4	9.4	10.5	6.9	7.1	9.6	9.8	9.4	7.9	8.9	8.2	9.7	10.0	8.3	10.2	8.7	9.7	7.6	5.7	0.0			
460990008	11.1	10.6	11.4	8.9	10.7	7.4	7.4	9.6	9.5	9.8	9.3	6.7	9.4	10.1	10.7	8.5	10.2	8.9	9.4	8.7	10.7	10.5	0.0		
461270001	10.6	10.1	9.9	7.3	9.9	5.9	6.1	9.4	8.8	9.5	7.7	5.8	7.9	8.9	10.0	6.8	9.9	8.5	8.0	7.5	8.2	9.2	7.1	0.0	
550630012	9.4	7.2	8.2	6.2	7.8	9.7	9.9	7.5	6.5	7.1	9.1	7.9	8.3	7.7	8.4	7.7	9.0	8.7	5.0	10.7	9.9	10.4	10.5	8.9	0.0

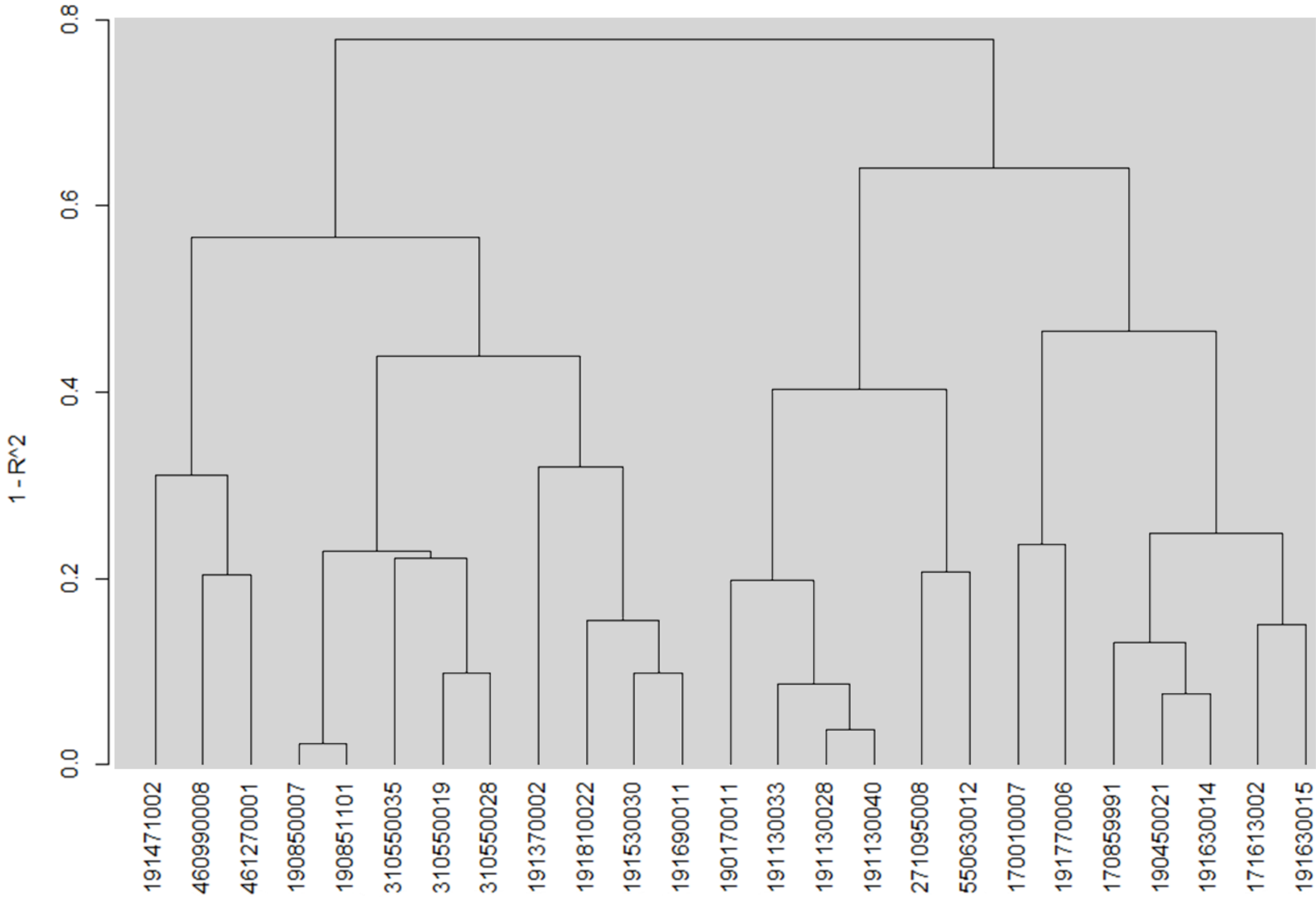
Ozone RMS Deviation Matrix (2010-2013)

0.0 7.9 11.5

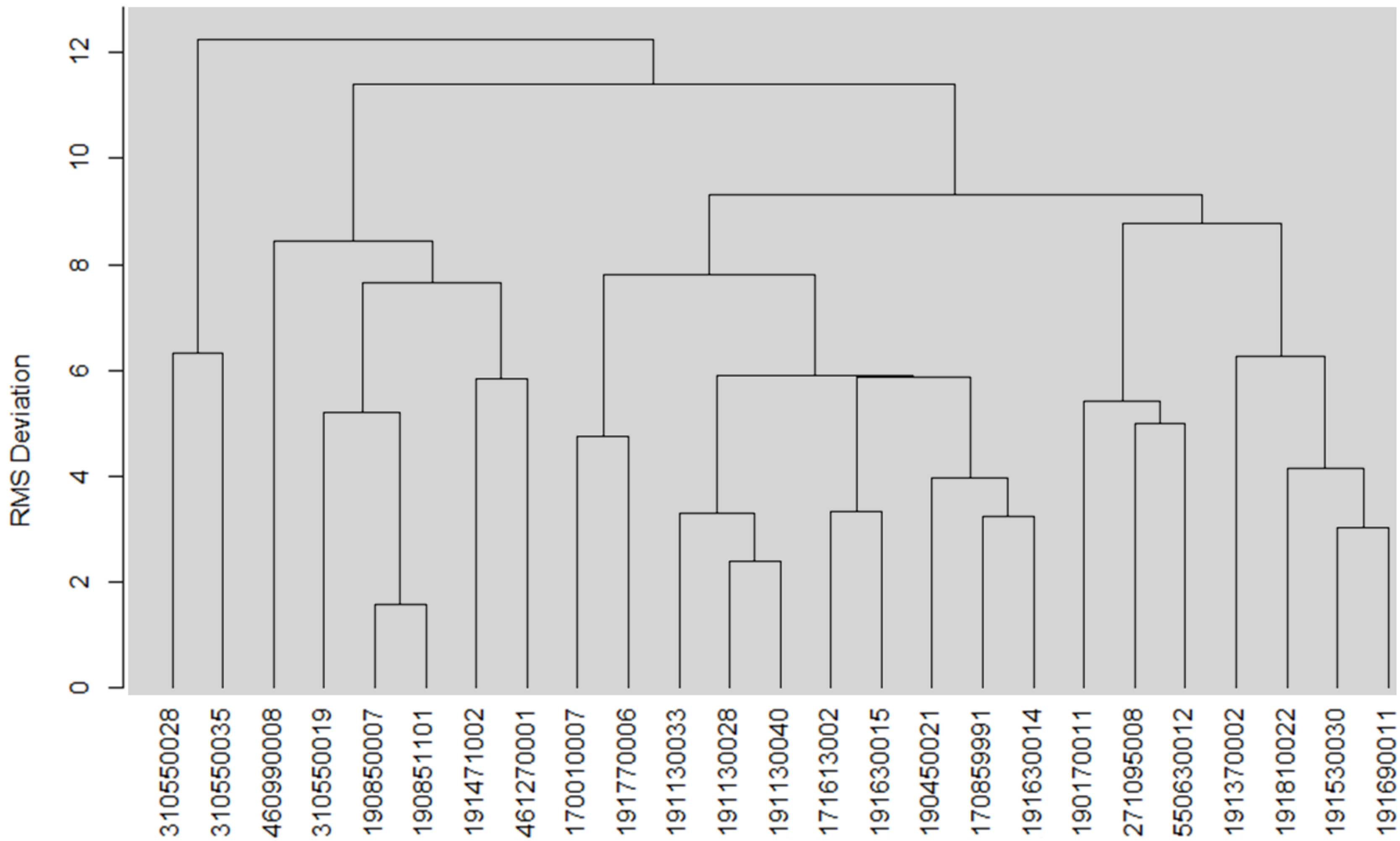
Count	170010007	170859991	171613002	190170011	190450021	190850007	190851101	191130028	191130033	191130040	191370002	191471002	191530030	191630014	191630015	191690011	191770006	191810022	271095008	310550019	310550028	310550035	460990008	461270001	550630012
170010007	840																								
170859991	577	578																							
171613002	814	559	830																						
190170011	830	570	821	846																					
190450021	830	576	820	836	846																				
190850007	819	569	812	827	826	835																			
190851101	822	562	813	828	828	823	838																		
191130028	797	555	790	804	803	796	797	813																	
191130033	792	543	782	798	797	789	790	767	807																
191130040	803	557	793	810	809	801	802	776	772	819															
191370002	824	564	815	830	830	819	823	800	791	803	840														
191471002	820	563	814	827	826	816	818	795	788	799	825	836													
191530030	835	576	823	839	839	828	831	806	801	813	833	829	849												
191630014	621	372	624	632	628	621	625	599	601	606	623	620	631	637											
191630015	826	564	816	833	832	821	824	800	796	805	826	822	836	628	842										
191690011	839	577	829	845	845	834	837	812	806	819	839	835	848	636	841	855									
191770006	823	564	813	831	829	818	821	797	792	804	823	819	832	627	826	839	839								
191810022	834	572	824	840	840	829	832	807	801	813	834	830	843	635	837	849	833	850							
271095008	801	573	791	807	807	796	799	776	769	782	801	797	810	600	803	816	801	811	817						
310550019	625	563	605	617	624	615	609	595	588	606	611	609	624	412	613	626	611	621	602	626					
310550028	833	572	823	839	839	828	831	806	800	812	833	829	842	631	835	848	833	844	811	620	849				
310550035	802	546	792	809	808	798	802	777	772	781	803	798	811	602	804	817	804	812	782	593	815	818			
460990008	821	561	813	828	827	816	821	794	789	801	821	818	830	634	824	836	821	831	798	608	830	800	837		
461270001	203	201	191	199	202	201	195	201	193	200	202	201	203	49	198	204	200	198	202	201	201	201	188	204	
550630012	790	548	780	796	796	786	789	764	759	769	790	786	799	604	792	805	789	801	786	589	802	769	787	192	806

Ozone Pair Counts (2010-2013); red text indicates incomplete data.

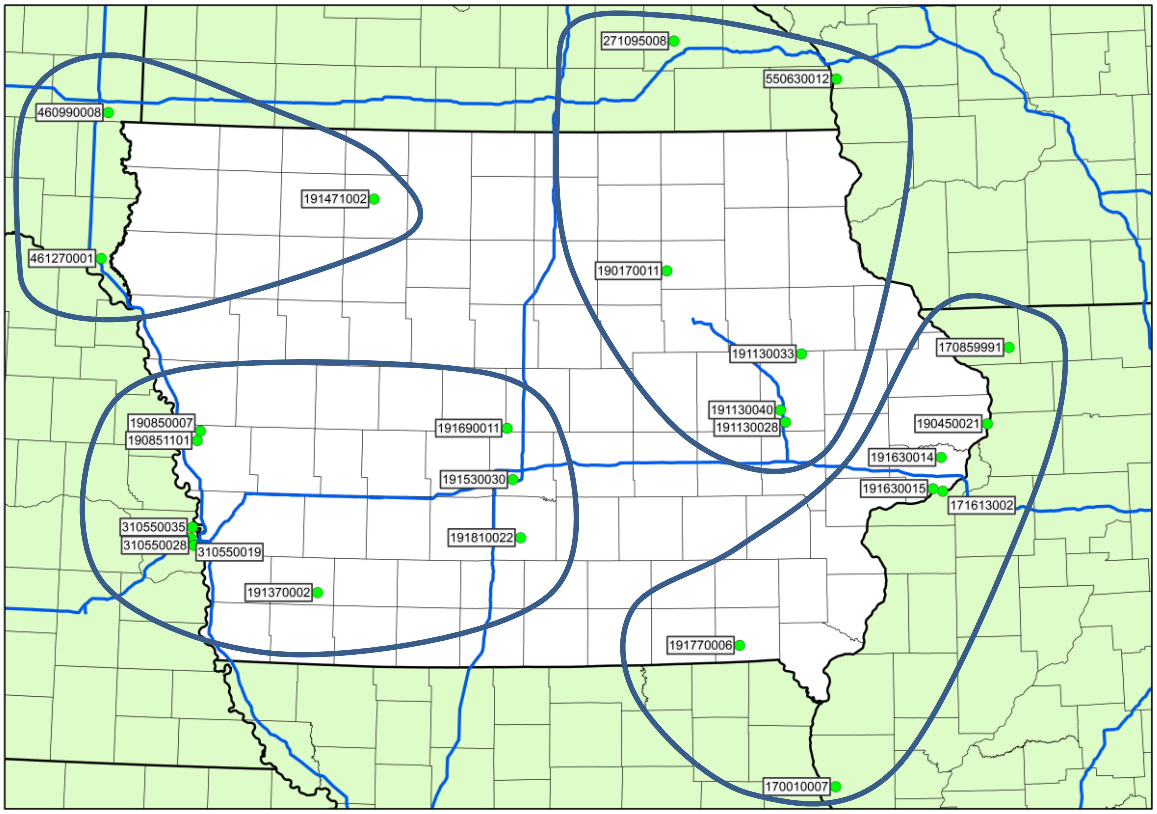




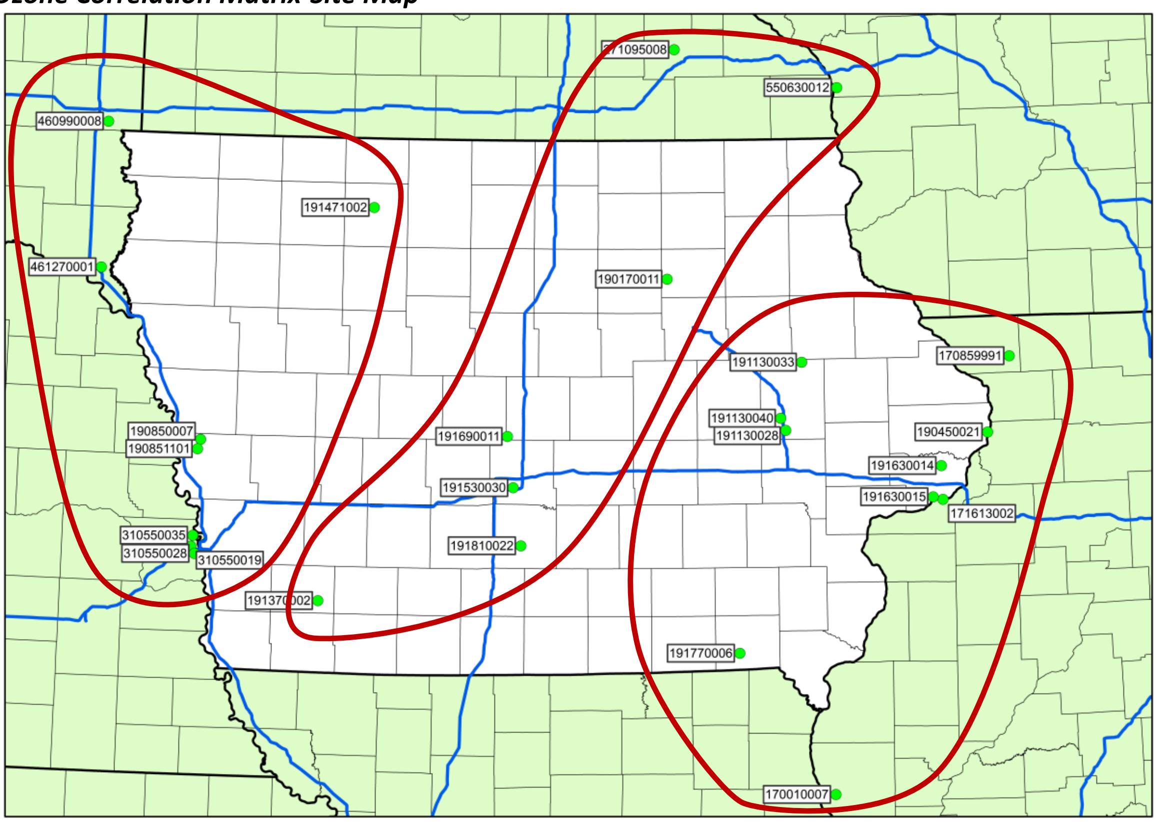
Ozone Correlation Dendrogram (2010-2013)



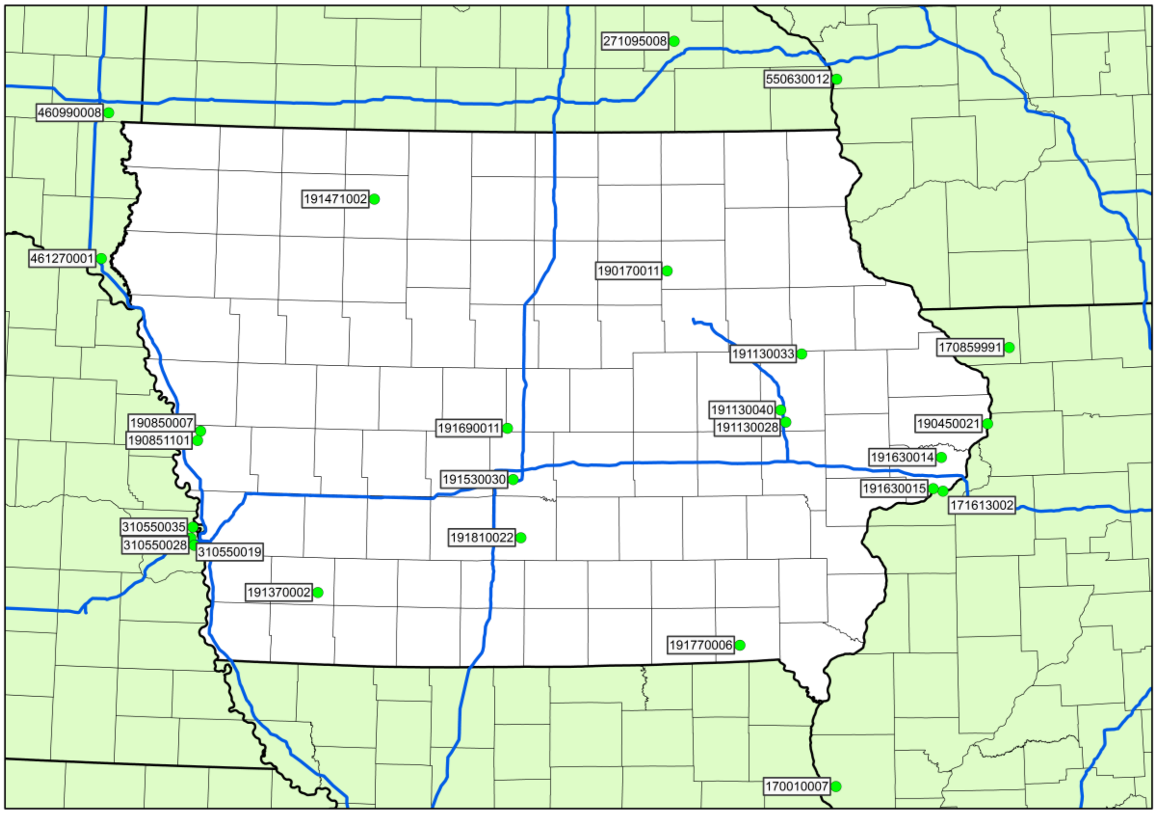
Ozone RMS Deviation Dendrogram (2010-2013)



Ozone Correlation Matrix-Site Map



Ozone RMS Deviations-Site Map



Ozone – Site Map

AQS Site ID	Local Site Name	State	City	Address
170010007	John Wood Community College	Illinois	Quincy	1301 S. 48th St.
170859991	Stockton	Illinois	N/A	10952 E. Parker Rd.
171613002	Rock Island Arsenal	Illinois	Rock Island	32 Rodman Ave.
190170011	Waverly Airport	Iowa	Waverly	Waverly Airport
190450021	Rainbow Park	Iowa	Clinton	Roosevelt St.
190850007	Pisgah, Forestry Office	Iowa	N/A	206 Polk St
190851101	Highway Maintenance Shed	Iowa	N/A	1575 Hwy 183
191130028	Kirkwood	Iowa	Cedar Rapids	6301 Kirkwood Blvd. SW
191130033	Coggon Elementary School	Iowa	Coggon	408 E. Linn St.
191130040	Public Health	Iowa	Cedar Rapids	500 11th St. NW
191370002	Viking Lake State Park	Iowa	N/A	2780 Viking Lake Rd.
191471002	Iowa Lakes Community College	Iowa	Emmetsburg	Iowa Lakes Community College
191530030	Carpenter	Iowa	Des Moines	1907 Carpenter
191630014	Scott County Park	Iowa	Davenport	Scott County park
191630015	Jefferson School	Iowa	Davenport	10th St. & Vine St.
191690011	City Hall	Iowa	Slater	105 Greene St.
191770006	Lake Sugema	Iowa	N/A	24430 Lacey Trail
191810022	Lake Ahquabi	Iowa	N/A	1650 118Th Ave.
271095008	Ben Franklin School	Minnesota	Rochester	1801 9th Ave. SE
310550019	Healthcenter Warehouse	Nebraska	Omaha	42nd & Woolworth
310550028	South Omaha	Nebraska	Omaha	2411 O St.
310550035	Metro-Tech Campus	Nebraska	Omaha	30th & Fort St.
460990008	SD School for the Deaf	South Dakota	Sioux Falls	2001 E 8th St.
461270001	Union County #1 Jensen	South Dakota	N/A	31986 475th Ave.
550630012	DOT Building	Wisconsin	La Crosse	3550 Mormon Coulee Rd.

Ozone Correlation Matrix-Site Information

R^2	171613002	190130009	190450019	190450021	190550001	191032001	191110008	191130040	191370002	191390015	191390016	191390018	191390020	191471002	191530030	191532510	191550009	191630015	191630018	191630020	191770006	191930019	271095008	310550019	311530007	311770002	460990008	461270001	550430009	550630012
171613002	1.00																													
190130009	0.54	1.00																												
190450019	0.63	0.68	1.00																											
190450021	0.65	0.70	0.92	1.00																										
190550001		0.78	0.72	0.73	1.00																									
191032001	0.65	0.83	0.77	0.80	0.78	1.00																								
191110008	0.70	0.67	0.64	0.63	0.58	0.73	1.00																							
191130040	0.55	0.89	0.77	0.78	0.79	0.91	0.70	1.00																						
191370002	0.57	0.59	0.49	0.52	0.54	0.57	0.62	0.58	1.00																					
191390015	0.38	0.49	0.49	0.54	0.55	0.63	0.46	0.60	0.35	1.00																				
191390016	0.72	0.75	0.79	0.76	0.73	0.87	0.72	0.83	0.55	0.58	1.00																			
191390018	0.63	0.72	0.79	0.75	0.69	0.83	0.75	0.79	0.52	0.54	0.89	1.00																		
191390020		0.49	0.67	0.65	0.52	0.61	0.56	0.60	0.38	0.44	0.70	0.81	1.00																	
191471002	0.29	0.64	0.37	0.37	0.54	0.49	0.40	0.54	0.55	0.30	0.45	0.38	0.26	1.00																
191530030	0.49	0.77	0.54	0.55	0.61	0.72	0.69	0.75	0.78	0.49	0.67	0.63	0.41	0.64	1.00															
191532510	0.50	0.77	0.55	0.55	0.62	0.68	0.67	0.71	0.78	0.47	0.65	0.61	0.38	0.65	0.96	1.00														
191550009	0.48	0.53	0.37	0.36	0.41	0.48	0.49	0.47	0.68	0.26	0.44	0.38	0.19	0.49	0.65	0.65	1.00													
191630015	0.72	0.75	0.85	0.87	0.74	0.86	0.72	0.82	0.54	0.64	0.86	0.85	0.65	0.39	0.62	0.62	0.41	1.00												
191630018	0.71	0.76	0.86	0.87	0.75	0.87	0.73	0.86	0.54	0.60	0.86	0.85	0.63	0.41	0.65	0.63	0.43	0.96	1.00											
191630020	0.75	0.75	0.84	0.84	0.70	0.82	0.70	0.81	0.50	0.60	0.84	0.83	0.61	0.43	0.61	0.61	0.42	0.94	0.92	1.00										
191770006	0.61	0.68	0.59	0.60	0.57	0.77	0.77	0.69	0.62	0.51	0.73	0.72	0.52	0.40	0.70	0.67	0.45	0.71	0.71	0.67	1.00									
191930019	0.35	0.57	0.35	0.34	0.42	0.47	0.45	0.50	0.63	0.27	0.45	0.37	0.23	0.62	0.67	0.67	0.73	0.40	0.43	0.41	0.39	1.00								
271095008	0.50	0.71	0.52	0.57	0.69	0.60	0.45	0.64	0.48	0.31	0.55	0.51	0.35	0.57	0.55	0.56	0.39	0.53	0.56	0.55	0.48	0.43	1.00							
310550019	0.54	0.48	0.34	0.35	0.40	0.47	0.50	0.49	0.69	0.32	0.47	0.38	0.23	0.46	0.65	0.66	0.82	0.39	0.43	0.42	0.46	0.73	0.39	1.00						
311530007	0.52	0.44	0.28	0.31	0.40	0.41	0.42	0.41	0.61	0.27	0.41	0.34	0.21	0.44	0.58	0.56	0.73	0.36	0.38	0.39	0.42	0.57	0.36	0.84	1.00					
311770002	0.40	0.53	0.35	0.32	0.40	0.47	0.47	0.48	0.72	0.26	0.43	0.38	0.19	0.54	0.68	0.67	0.79	0.39	0.42	0.41	0.44	0.80	0.38	0.84	0.69	1.00				
460990008	0.31	0.39	0.26	0.27	0.31	0.36	0.30	0.39	0.45	0.29	0.33	0.27	0.16	0.52	0.48	0.48	0.50	0.30	0.30	0.31	0.31	0.68	0.37	0.58	0.43	0.60	1.00			
461270001	0.26	0.46	0.26	0.26	0.31	0.36	0.35	0.40	0.52	0.25	0.35	0.29	0.16	0.59	0.53	0.56	0.56	0.29	0.32	0.31	0.34	0.81	0.36	0.64	0.48	0.70	0.64	1.00		
550430009	0.53	0.72	0.74	0.79	0.81	0.73	0.55	0.68	0.47	0.41	0.69	0.67	0.51	0.44	0.52	0.53	0.33	0.73	0.73	0.70	0.55	0.36	0.67	0.31	0.32	0.32	0.24	0.26	1.00	
550630012	0.60	0.69	0.67	0.69	0.71	0.61	0.50	0.63	0.43	0.35	0.61	0.58	0.42	0.45	0.50	0.52	0.34	0.61	0.62	0.60	0.49	0.37	0.76	0.35	0.30	0.33	0.27	0.27	0.83	1.00

$PM_{2.5}$ Correlation Matrix (2010-2013)

0.16 0.56 1.00

RMS Deviation	171613002*	190130009	190450019	190450021	190550001	191032001	191110008	191130040	191370002	191390015	191390016	191390018	191390020	191471002	191530030	191532510	191550009	191630015	191630018	191630020	191770006	191930019	271095008	310550019	311530007	311770002	460990008	461270001	550430009	550630012
171613002*	0.0																													
190130009	4.6	0.0																												
190450019	5.0	3.7	0.0																											
190450021	4.4	3.2	2.0	0.0																										
190550001		2.5	3.4	2.9	0.0																									
191032001	4.3	2.4	3.2	2.7	2.5	0.0																								
191110008	5.0	3.6	3.8	3.9	4.0	3.2	0.0																							
191130040	4.8	1.9	3.3	2.9	2.5	1.8	3.5	0.0																						
191370002	3.8	3.8	5.1	4.4	3.7	4.0	4.2	4.1	0.0																					
191390015	10.2	5.8	5.6	5.4	4.5	4.9	6.1	5.2	6.9	0.0																				
191390016	4.2	3.0	3.0	3.1	3.0	2.3	3.4	2.7	4.4	5.3	0.0																			
191390018	5.2	3.4	2.9	3.3	3.4	2.7	3.2	3.1	4.9	5.4	2.1	0.0																		
191390020		4.7	3.7	4.0	4.9	4.1	4.3	4.3	5.8	5.3	3.6	2.8	0.0																	
191471002	4.9	3.6	5.5	5.0	3.7	4.4	5.1	4.1	3.5	7.2	4.7	5.4	6.3	0.0																
191530030	5.6	2.8	4.7	4.3	3.3	3.2	3.7	3.0	2.6	6.0	3.8	4.2	5.4	3.2	0.0															
191532510	5.5	2.8	4.6	4.2	3.3	3.4	3.9	3.3	2.6	6.3	3.9	4.4	5.6	3.1	1.1	0.0														
191550009	5.1	4.4	5.4	5.3	4.5	4.6	4.7	4.8	3.7	7.2	4.8	5.4	6.4	4.7	3.7	3.7	0.0													
191630015	4.1	3.0	2.5	2.2	2.9	2.3	3.3	2.6	4.4	4.7	2.3	2.5	3.9	5.0	3.9	3.9	5.0	0.0												
191630018	4.1	3.0	2.4	2.3	2.9	2.2	3.3	2.4	4.4	5.3	2.3	2.5	4.1	4.9	3.8	4.0	5.0	1.2	0.0											
191630020	4.3	3.2	2.5	2.6	3.3	2.6	3.4	2.8	4.7	4.8	2.5	2.5	4.0	4.8	4.1	4.2	5.0	1.6	1.7	0.0										
191770006	4.0	3.4	4.5	4.0	3.6	3.0	3.4	3.5	3.3	6.2	3.5	3.9	5.1	4.3	3.1	3.4	5.0	3.5	3.6	4.0	0.0									
191930019	6.0	4.1	5.6	5.3	4.5	4.6	5.0	4.6	3.7	7.3	4.8	5.6	6.4	3.7	3.4	3.4	3.3	5.1	5.1	5.2	5.0	0.0								
271095008	4.1	3.5	4.9	4.2	3.2	3.9	5.3	3.7	4.1	6.9	4.7	5.2	6.2	3.5	3.9	4.0	5.4	4.5	4.7	4.8	4.4	4.9	0.0							
310550019	4.6	4.5	5.9	5.4	4.4	4.6	4.8	4.6	3.1	6.9	4.9	5.6	6.3	4.2	3.5	3.4	2.9	5.2	5.1	5.2	4.5	3.3	4.7	0.0						
311530007	5.0	4.9	5.6	5.4	5.0	4.9	5.0	4.9	4.4	6.6	5.2	5.5	6.2	5.2	4.3	4.6	3.3	5.1	5.3	5.1	5.4	4.5	5.6	3.3	0.0					
311770002	5.0	4.3	5.8	5.5	4.5	4.6	5.0	4.7	2.8	7.6	5.1	5.7	6.8	3.7	3.2	3.3	3.2	5.2	5.2	5.3	4.6	2.8	4.9	2.4	4.2	0.0				
460990008	6.0	5.0	6.6	6.1	5.0	5.3	6.1	5.2	4.2	7.5	5.8	6.5	7.3	3.7	4.5	4.4	5.0	5.9	5.9	6.0	5.2	3.7	4.7	4.0	5.6	3.7	0.0			
461270001	6.2	4.5	6.2	5.7	4.8	5.0	5.4	4.9	3.9	7.3	5.4	6.0	6.6	3.6	4.0	3.9	4.3	5.6	5.5	5.6	5.0	2.6	4.7	3.5	4.7	3.1	3.6	0.0		
550430009	4.3	3.2	3.5	2.8	2.3	3.2	4.4	3.5	4.3	6.5	3.6	3.9	5.0	4.4	4.2	4.2	5.5	3.2	3.4	3.6	4.0	5.3	3.5	5.4	5.7	5.3	5.7	5.5	0.0	
550630012	3.8	3.5	4.5	3.8	2.9	4.1	4.8	3.9	4.3	7.3	4.3	4.7	5.7	4.1	4.2	4.0	5.5	4.4	4.2	4.4	4.2	5.1	2.9	4.9	6.3	5.0	5.1	5.2	2.4	0.0

$PM_{2.5}$ RMS Deviation Matrix (2010-2013)

0.0 4.3 10.2

Count	171613002	190130009	190450019	190450021	190550001	191032001	191110008	191130040	191370002	191390015	191390016	191390018	191390020	191471002	191530030	191532510	191550009	191630015	191630018	191630020	191770006	191930019	271095008	310550019	311530007	311770002	460990008	461270001	550430009	550630012
171613002	50																													
190130009	45	480																												
190450019	50	466	1421																											
190450021	48	451	1348	1382																										
190550001		328	351	335	358																									
191032001	48	438	1287	1261	319	1326																								
191110008	41	390	440	428	306	409	453																							
191130040	50	471	1384	1345	347	1292	443	1424																						
191370002	44	418	452	437	326	422	386	454	465																					
191390015	50	455	1347	1307	337	1257	428	1349	441	1384																				
191390016	48	428	470	458	334	439	394	471	421	459	482																			
191390018	46	424	466	450	330	436	394	467	421	456	434	478																		
191390020		329	351	337	344	320	309	349	329	338	337	336	359																	
191471002	46	424	457	442	333	423	392	460	425	446	430	425	338	469																
191530030	50	464	1381	1341	345	1292	439	1384	449	1345	466	462	346	454	1420															
191532510	47	427	446	434	333	417	398	449	424	438	438	428	334	428	446	460														
191550009	49	447	469	455	349	439	415	472	443	459	454	450	350	449	468	455	483													
191630015	49	457	1344	1309	341	1251	437	1348	441	1312	462	456	342	447	1342	439	461	1381												
191630018	45	430	458	445	331	430	398	462	423	450	433	425	333	428	455	432	451	446	471											
191630020	48	438	464	450	342	435	404	469	434	454	445	439	345	436	463	443	464	457	443	478										
191770006	43	424	454	441	335	424	385	457	417	443	427	422	336	421	451	428	446	445	427	438	467									
191930019	50	441	467	453	344	437	408	470	435	457	448	442	345	441	465	447	470	458	444	457	440	481								
271095008	47	215	219	216	104	215	188	223	210	213	214	214	107	210	221	219	226	213	210	217	209	221	230							
310550019	43	405	1101	1070	354	1017	382	1101	394	1068	409	405	354	403	1104	393	411	1068	400	406	397	411	165	1133						
311530007	21	43	45	42		44	44	46	42	45	44	45		41	44	46	45	44	43	44	43	45	43	25	46					
311770002	48	429	450	436	332	420	397	452	425	439	439	432	333	432	447	437	456	441	434	446	428	451	220	392	45	462				
460990008	49	434	456	442	336	428	405	461	429	447	438	433	337	435	454	438	459	448	435	448	431	452	220	400	46	441	470			
461270001	48	472	1395	1357	353	1303	442	1397	456	1361	473	471	354	460	1393	451	474	1356	462	468	458	473	225	1115	44	453	461	1434		
550430009	47	416	452	437	319	420	387	453	411	440	426	420	321	415	450	425	443	444	418	432	414	437	210	391	45	425	428	455	463	
550630012	48	373	384	378	270	365	340	386	367	375	373	374	271	372	384	378	392	376	374	384	368	384	220	327	44	378	375	389	365	397

Sampling Frequency	
(green)	1 in 6
(cyan)	1 in 3
(pink)	Daily

21 4.3 1434

PM2.5 Pair Count Matrix (2010-2013); red text indicates incomplete data.

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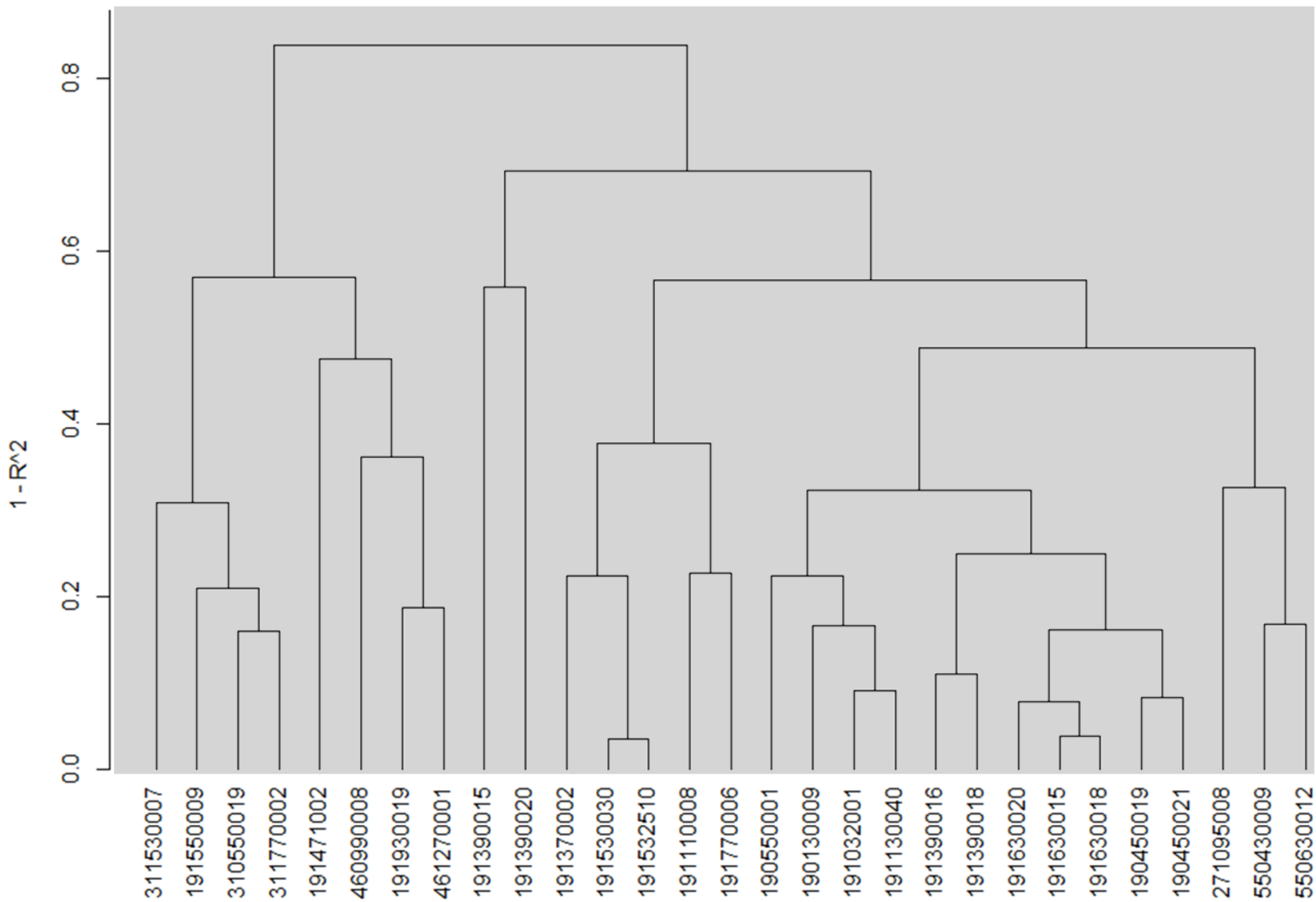
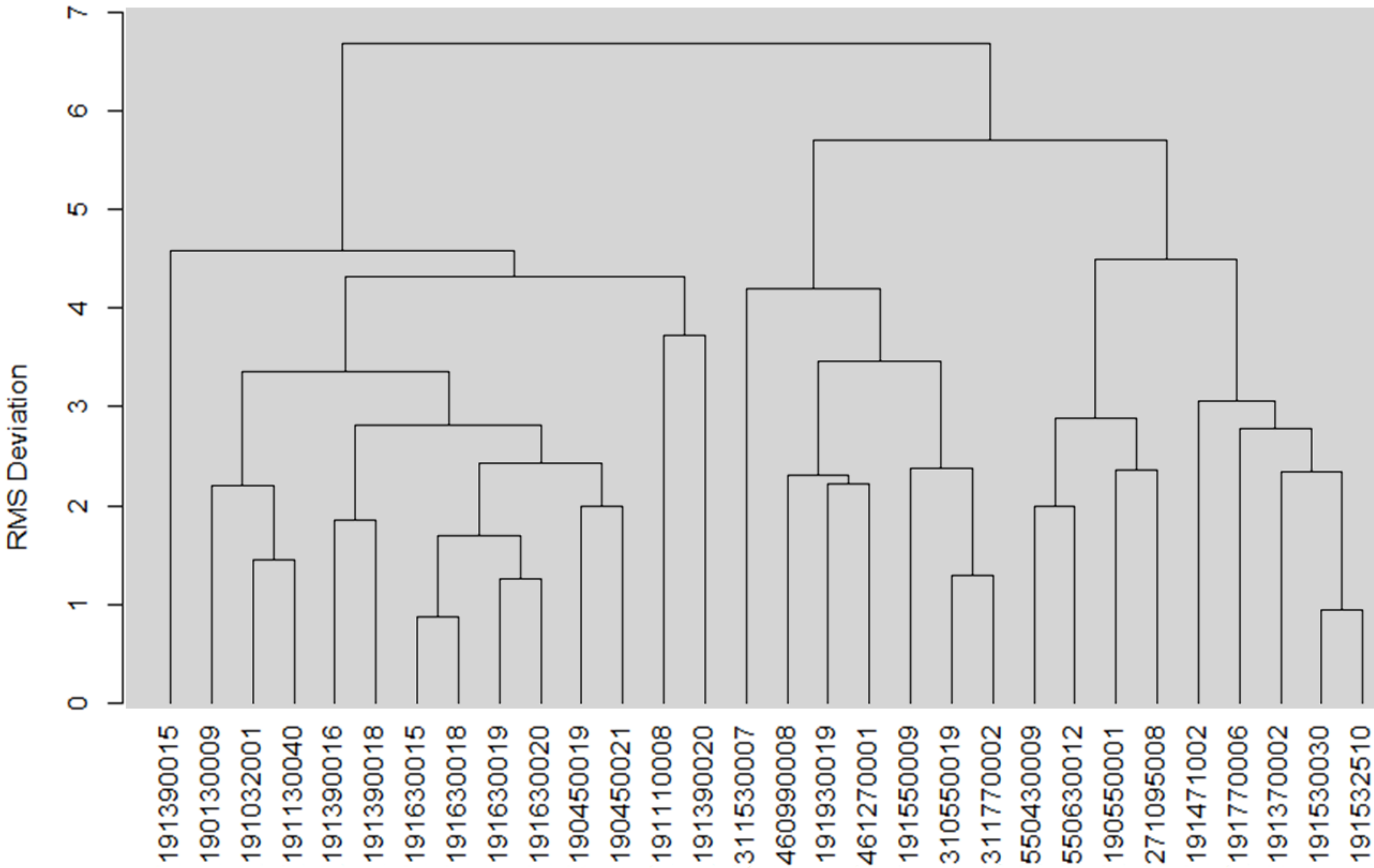
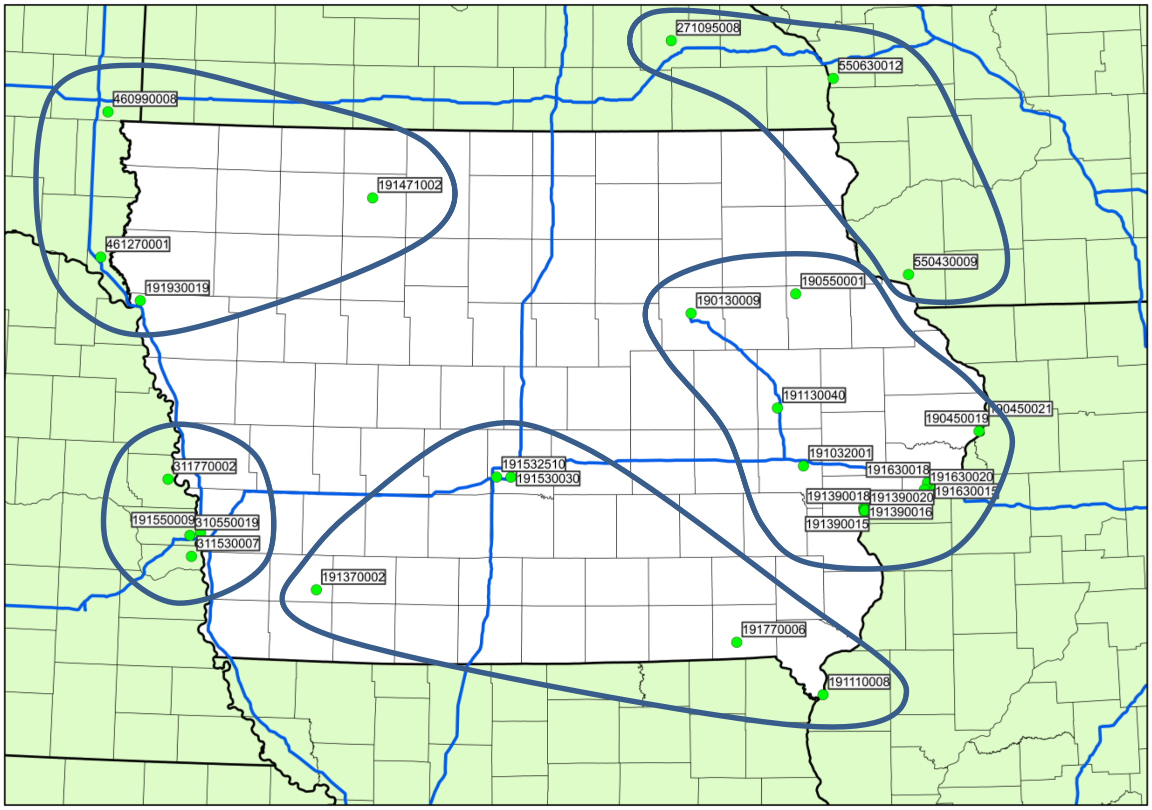


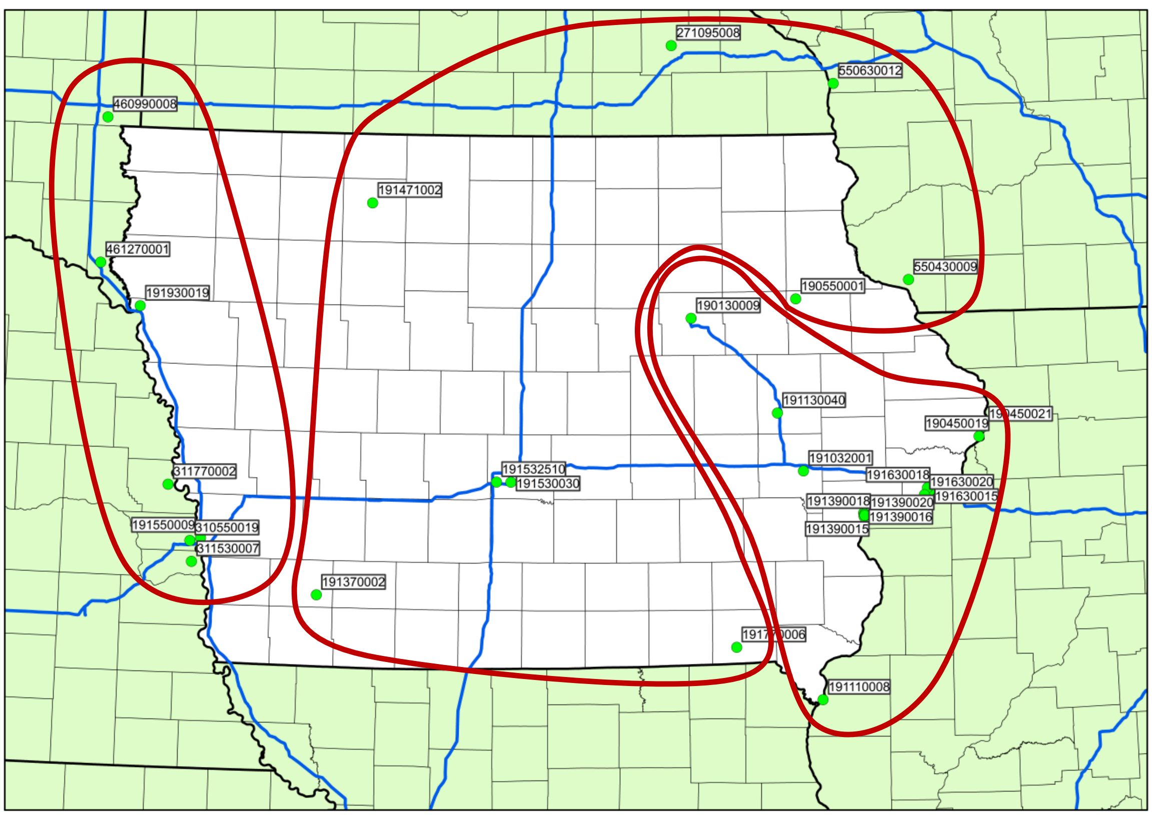
$PM_{2.5}$ Correlation Dendrogram (2010-2013)



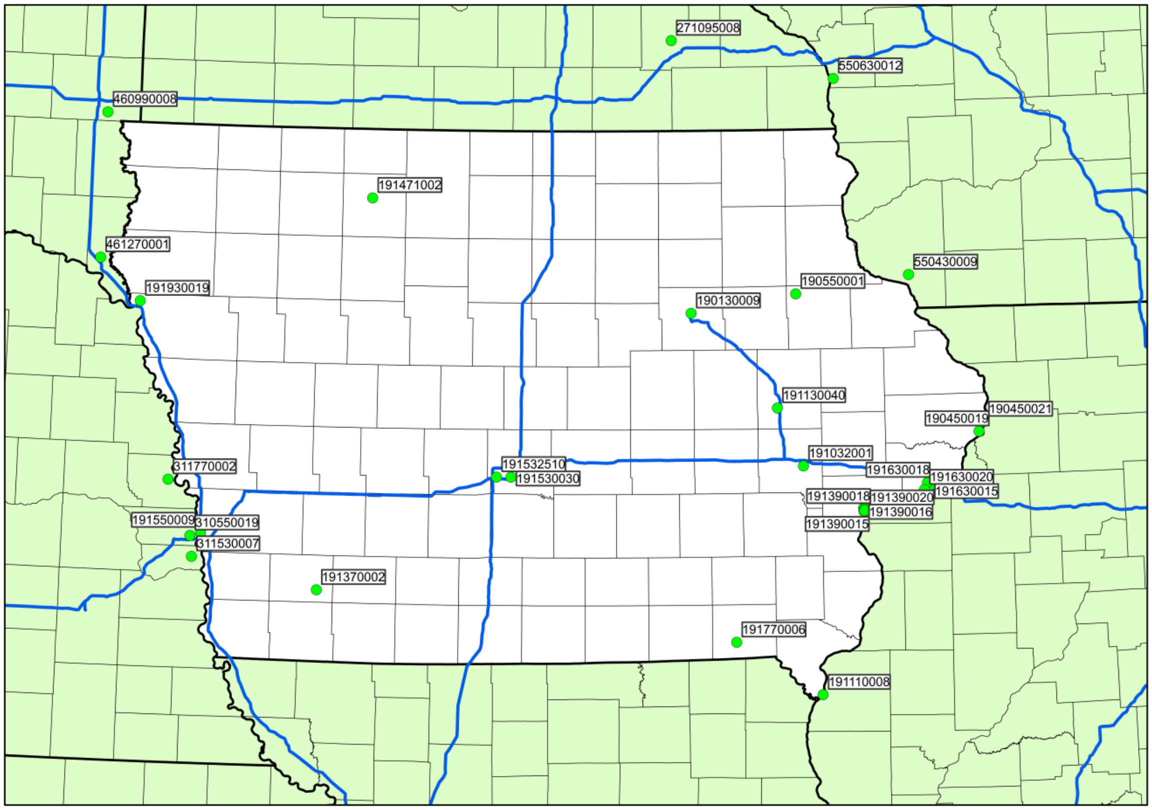
$PM_{2.5}$ RMS Deviation Dendrogram (2010-2013)



PM$_{2.5}$ Correlation Matrix - Site Map



PM$_{2.5}$ RMS Deviation - Site Map



PM2.5 – Site Map

AQS Site ID	Local Site Name	State	City	Address
171613002	Rock Island Arsenal	Illinois	Rock Island	32 Rodman Ave.
190130009	Water Tower	Iowa	Waterloo	Vine St. & Steely
190450019	Chancy Park	Iowa	Clinton	23rd & Camanche
190450021	Rainbow Park	Iowa	Clinton	Roosevelt St.
190550001	Backbone State Park	Iowa	N/A	Backbone State Park
191032001	Hoover School	Iowa	Iowa City	2200 E. Court
191110008	Fire Station	Iowa	Keokuk	111 S. 13th St.
191130040	Public Health	Iowa	Cedar Rapids	500 11th St. NW
191370002	Viking Lake State park	Iowa	N/A	2780 Viking Lake Road
191390015	Muscatine HS - East Campus Roof	Iowa	Muscatine	1409 Wisconsin
191390016	Greenwood Cemetery	Iowa	Muscatine	Fletcher St. & Kimble St.
191390018	Franklin School	Iowa	Muscatine	210 Taylor St.
191390020	Musser Park	Iowa	Muscatine	Oregon St. & Earl Ave.
191471002	Iowa Lakes Community College	Iowa	Emmetsburg	Iowa Lakes Community College
191530030	Carpenter	Iowa	Des Moines	1907 Carpenter
191532510	Indian Hills Jr. High	Iowa	Clive	9401 Indian Hills Dr.
191550009	Franklin School	Iowa	Council Bluffs	3130 C Ave.
191630015	Jefferson School	Iowa	Davenport	10th St. & Vine St.
191630018	Adams School	Iowa	Davenport	3029 N Division St.
191630020	Hayes School	Iowa	Davenport	622 S. Concord St.
191770006	Lake Sugema	Iowa	N/A	24430 Lacey Trail
191930019	Bryant Elementary	Iowa	Sioux City	821 30th St.
271095008	Ben Franklin School	Minnesota	Rochester	1801 9th Ave. SE
310550019	Healthcenter Warehouse	Nebraska	Omaha	42nd & Woolworth
311530007	Golden Hills Elementary	Nebraska	Bellevue	2912 Coffey Ave.
311770002	Good Shepard Lutheran Home	Nebraska	Blair	2242 Wright St.
460990008	SD School for the Deaf	South Dakota	Sioux Falls	2001 E. 8th St.
461270001	Union County #1	South Dakota	N/A	31986 475th Ave.
550430009	Potosi	Wisconsin	Potosi	128 Hwy 61 N
550630012	DOT Building	Wisconsin	La Crosse	3550 Mormon Coulee Rd.

$PM_{2.5}$ Correlation Matrix-Site Information

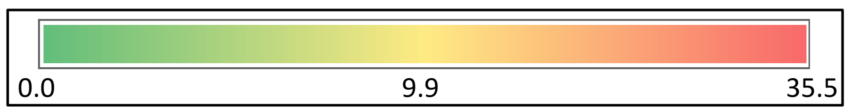
R^2	190130009	190330018	190330020	190550001	191032001	191130040	191370002	191390015	191471002	191530030	191532510	191550009	191630015	191630017	191630018	191770006	191930019	310250002	310550028	310550054	460990008	461270001	550811002
190130009	1.00																						
190330018	0.78	1.00																					
190330020	0.80	0.89	1.00																				
190550001	0.65	0.56	0.54	1.00																			
191032001	0.63	0.46	0.50	0.56	1.00																		
191130040	0.77	0.58	0.73	0.66	0.73	1.00																	
191370002	0.63	0.48	0.46	0.38	0.41	0.52	1.00																
191390015	0.50	0.31	0.27	0.47	0.46	0.61	0.27	1.00															
191471002	0.64	0.69	0.60	0.40	0.33	0.53	0.44	0.25	1.00														
191530030	0.69	0.61	0.60	0.45	0.52	0.63	0.73	0.40	0.51	1.00													
191532510	0.70	0.61	0.59	0.48	0.55	0.66	0.72	0.38	0.53	0.88	1.00												
191550009	0.54	0.46	0.47	0.32	0.41	0.48	0.69	0.20	0.49	0.64	0.66	1.00											
191630015	0.49	0.37	0.40	0.65	0.60	0.65	0.31	0.54	0.25	0.45	0.47	0.24	1.00										
191630017	0.20	0.18	0.20	0.18	0.18	0.25	0.11	0.16	0.16	0.16	0.15	0.14	0.19	1.00									
191630018	0.49	0.37	0.43	0.66	0.61	0.68	0.33	0.52	0.24	0.46	0.48	0.25	0.91	0.21	1.00								
191770006	0.44	0.34	0.33	0.40	0.49	0.44	0.55	0.42	0.30	0.56	0.55	0.36	0.41	0.10	0.44	1.00							
191930019	0.56	0.59	0.58	0.36	0.34	0.48	0.62	0.21	0.60	0.61	0.62	0.74	0.23	0.13	0.23	0.35	1.00						
310250002	0.43	0.37	0.37	0.26	0.25	0.35	0.72	0.16	0.42	0.55	0.54	0.71	0.20	0.10	0.21	0.33	0.55	1.00					
310550028	0.51	0.38	0.39	0.21	0.25	0.44	0.70	0.20	0.37	0.58	0.55	0.66	0.21	0.19	0.22	0.39	0.60	0.75	1.00				
310550054	0.52	0.40	0.44	0.23	0.30	0.49	0.66	0.20	0.34	0.64	0.60	0.78	0.23	0.14	0.26	0.45	0.63	0.75	0.72	1.00			
460990008	0.39	0.53	0.52	0.28	0.22	0.31	0.40	0.20	0.55	0.42	0.41	0.46	0.16	0.10	0.15	0.24	0.68	0.35	0.45	0.41	1.00		
461270001	0.37	0.48	0.43	0.24	0.22	0.30	0.43	0.15	0.51	0.40	0.45	0.48	0.17	0.11	0.17	0.24	0.63	0.41	0.52	0.49	0.63	1.00	
550811002	0.60	0.52	0.56	0.72	0.64	0.64	0.40	0.28	0.48	0.41	0.45	0.29	0.54	0.26	0.58	0.33	0.37	0.27	0.25	0.28	0.37	0.21	1.00

PM_{10} Correlation Matrix (2010-2013)

0.1 0.45 1.0

RMS Deviation	190130009	190330018	190330020	190550001	191032001	191130040	191370002	191390015	191471002	191530030	191532510	191550009	191630015	191630017	191630018	191770006	191930019	310250002	310550028	310550054	460990008	461270001	550811002
190130009	0.0																						
190330018	6.1	0.0																					
190330020	5.8	4.5	0.0																				
190550001	9.7	10.3	8.4	0.0																			
191032001	7.9	9.8	8.6	9.2	0.0																		
191130040	5.9	8.5	6.4	9.3	6.3	0.0																	
191370002	7.9	9.6	8.9	9.1	9.3	8.8	0.0																
191390015	8.8	11.8	12.4	11.0	9.7	7.3	11.7	0.0															
191471002	8.7	8.6	10.3	12.7	12.6	9.8	11.5	14.0	0.0														
191530030	6.9	8.0	7.4	9.1	8.1	7.2	5.5	9.8	10.6	0.0													
191532510	7.3	8.5	7.6	8.1	8.1	7.4	5.4	10.6	10.5	3.8	0.0												
191550009	10.3	10.7	10.6	14.7	11.2	10.6	9.3	13.3	12.2	8.9	9.5	0.0											
191630015	9.4	10.6	9.3	7.0	7.4	7.6	9.3	8.9	13.2	8.2	8.0	12.9	0.0										
191630017	32.2	31.1	31.1	35.5	31.9	31.4	34.2	30.8	33.1	32.5	33.8	29.7	32.7	0.0									
191630018	9.5	10.8	8.8	6.2	7.4	7.6	8.8	9.3	13.4	7.9	7.6	12.8	3.0	32.9	0.0								
191770006	10.5	11.2	10.2	7.9	9.1	10.4	6.8	11.0	12.9	7.5	7.0	12.9	8.3	35.5	7.6	0.0							
191930019	8.9	8.6	8.0	10.5	10.6	9.6	7.2	12.7	9.4	7.4	7.3	8.2	11.1	33.1	11.0	9.9	0.0						
310250002	10.1	10.7	9.7	12.1	11.4	10.5	6.6	12.9	11.0	7.7	8.2	7.4	11.3	32.2	11.1	10.3	8.3	0.0					
310550028	10.6	11.6	12.1	15.3	13.6	10.9	10.3	13.6	14.6	9.9	11.1	7.8	13.4	25.2	13.4	13.7	10.5	8.0	0.0				
310550054	9.2	10.3	10.0	13.3	11.9	9.0	7.9	13.0	13.7	7.4	8.4	6.4	11.7	28.1	11.3	10.6	8.2	5.8	7.6	0.0			
460990008	10.8	9.1	8.7	11.6	12.3	11.4	9.7	13.2	10.4	9.4	9.6	11.4	12.4	33.1	12.2	11.1	7.0	10.9	11.6	10.6	0.0		
461270001	12.2	10.5	10.5	13.6	12.9	13.0	10.4	14.5	10.9	10.5	10.2	11.5	13.1	33.0	12.8	12.7	8.2	10.9	11.6	9.9	8.5	0.0	
550811002	10.8	11.4	9.0	4.1	7.5	10.4	9.9	10.6	10.3	10.4	9.3	16.4	7.1	30.8	6.7	8.3	11.0	12.0	15.9	14.0	11.3	14.2	0.0

PM_{10} RMS Deviation Matrix (2010-2013)



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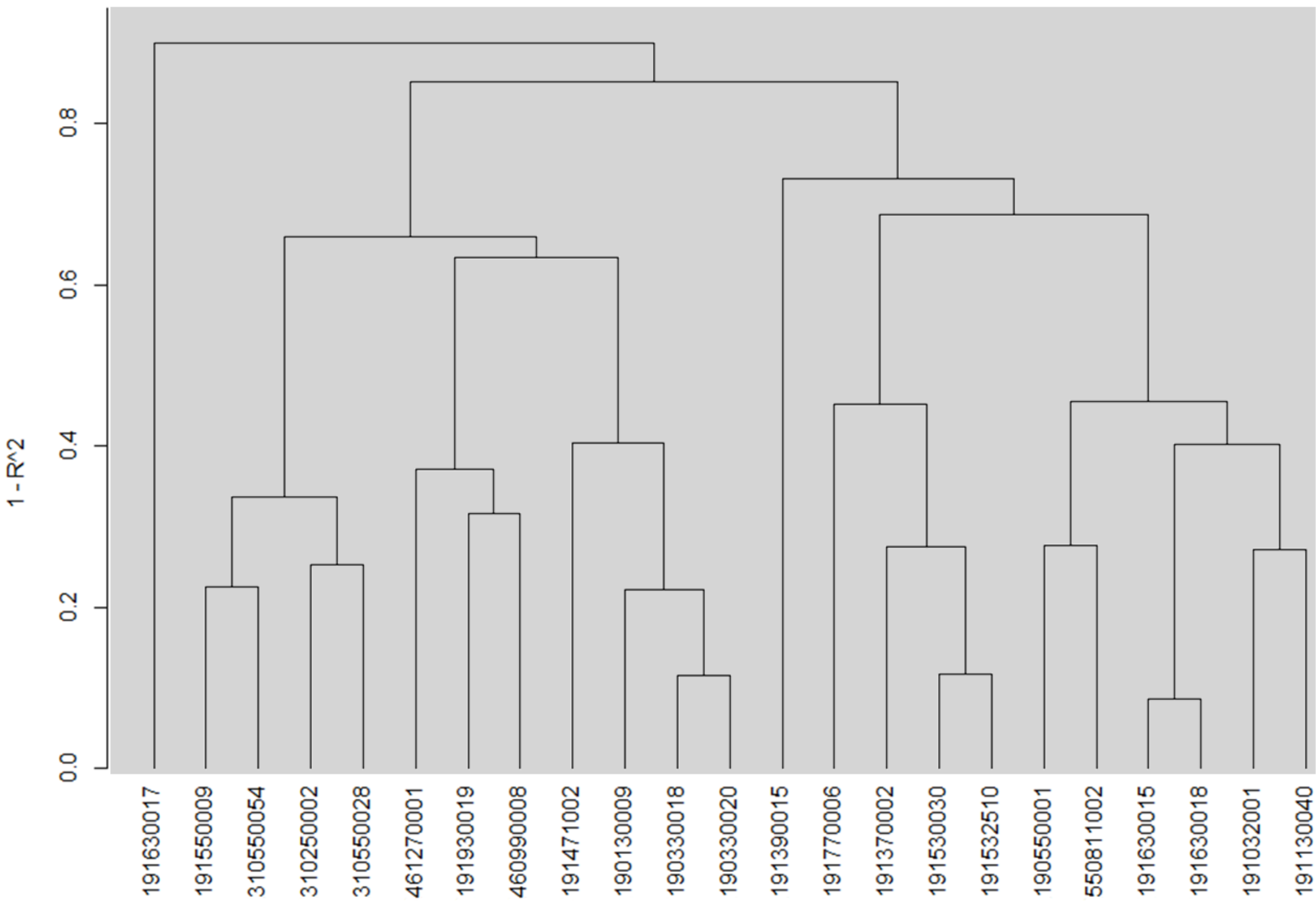
190130009	241																						
190330018	219	1371																					
190330020	116	650	689																				
190550001	208	312	161	335																			
191032001	212	446	231	305	473																		
191130040	229	219	116	217	220	242																	
191370002	205	434	224	293	411	216	463																
191390015	224	454	222	317	442	234	420	481															
191471002	215	441	229	307	424	225	413	435	467														
191530030	229	454	232	325	452	240	433	463	449	482													
191532510	222	449	226	314	442	231	423	454	439	468	472												
191550009	215	438	216	299	421	225	404	432	421	446	438	461											
191630015	226	457	235	321	450	237	432	460	446	474	464	442	484										
191630017	235	1357	683	331	467	236	457	475	462	476	466	456	478	1447									
191630018	224	451	228	312	436	235	421	448	434	461	454	434	460	473	479								
191770006	213	442	222	302	423	222	404	435	421	447	443	418	444	459	433	465							
191930019	227	453	233	322	449	238	430	461	446	474	464	442	471	475	458	445	481						
310250002	202	414	210	289	409	212	399	421	409	434	426	413	434	437	421	405	432	439					
310550028	112	221	220	159	226	117	211	226	224	237	231	218	237	235	227	221	237	215	238				
310550054	113	218	217	159	221	118	208	225	220	233	227	215	233	231	222	216	233	213	228	234			
460990008	236	993	503	327	346	237	341	353	343	356	345	335	356	1056	352	341	353	314	175	173	1070		
461270001	234	1337	672	327	461	235	452	470	457	471	462	450	473	1411	468	455	470	430	232	228	1047	1425	
550811002	76	69	73	75	74	80	73	77	75	80	74	71	79	78	76	75	79	66	75	79	79	78	81

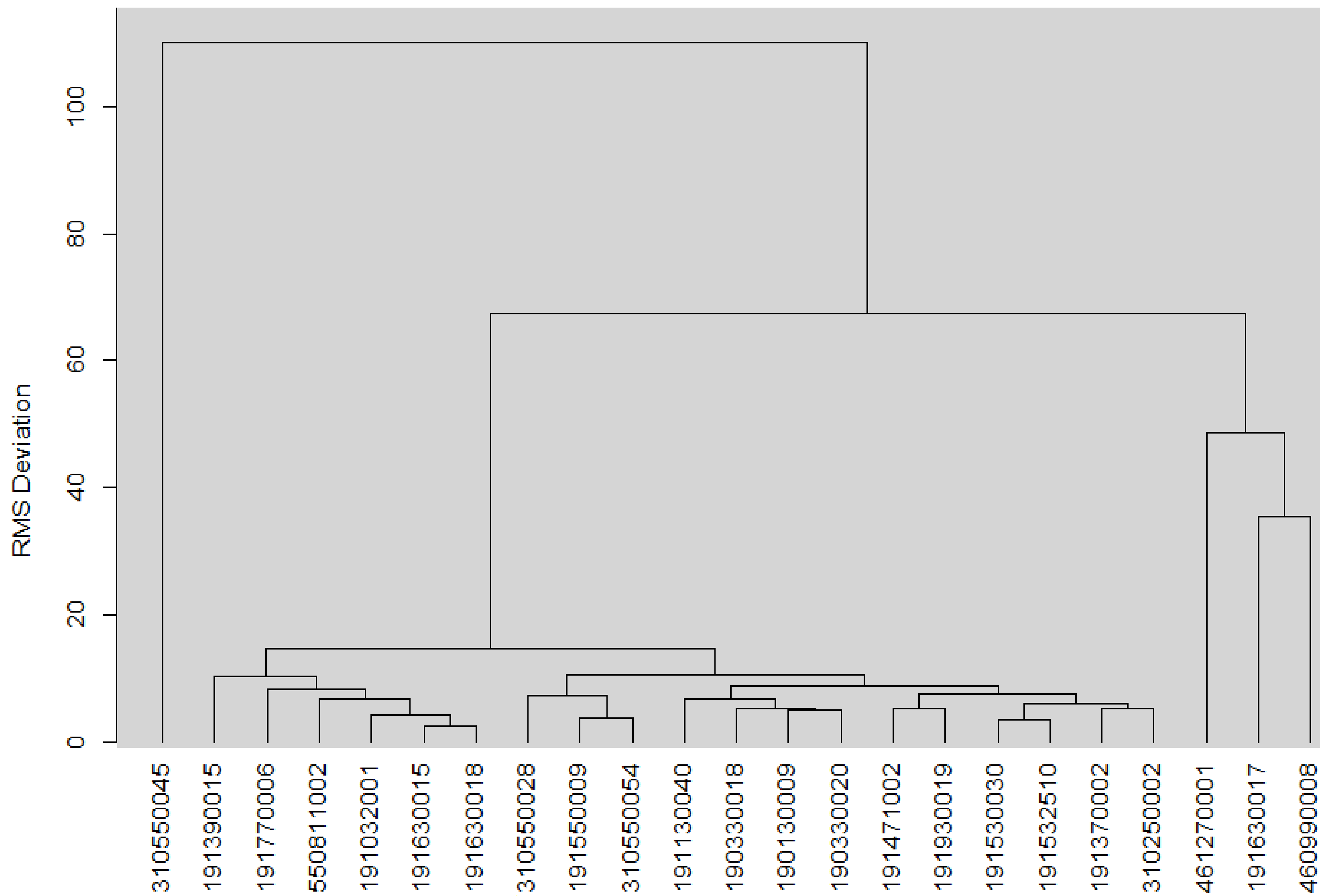
Sampling Schedule
Daily
1 in 2
1 in 3
1 in 6

PM$_{10}$ Pair Count Matrix (2010-2013); red text indicates incomplete data.

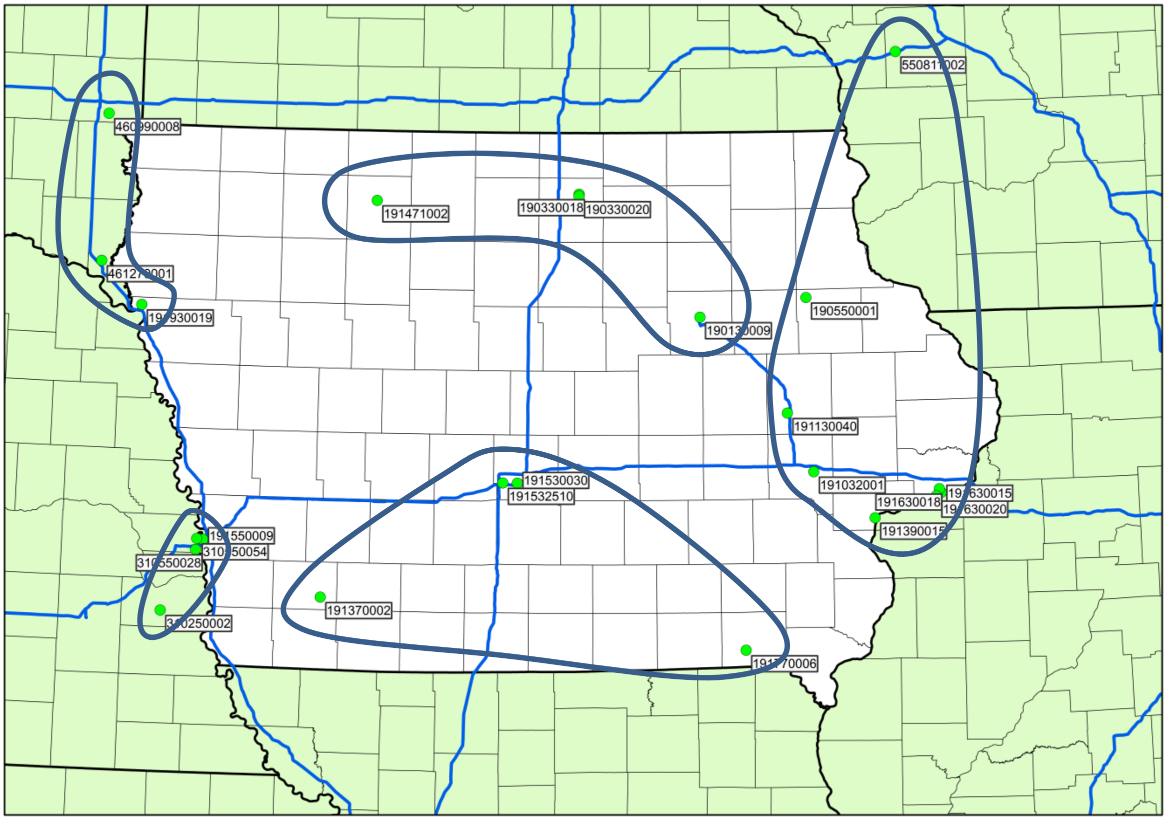
66 331 1447



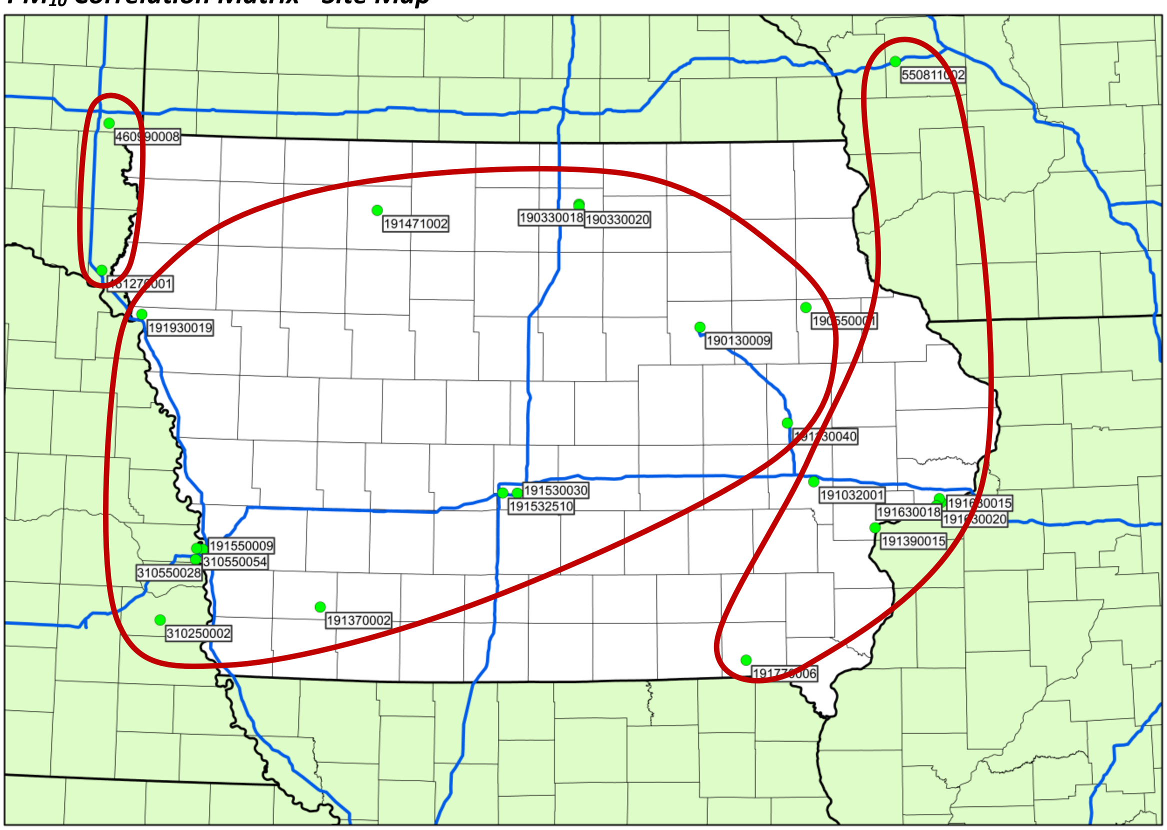
PM$_{10}$ Correlation Dendrogram (2010-2013)



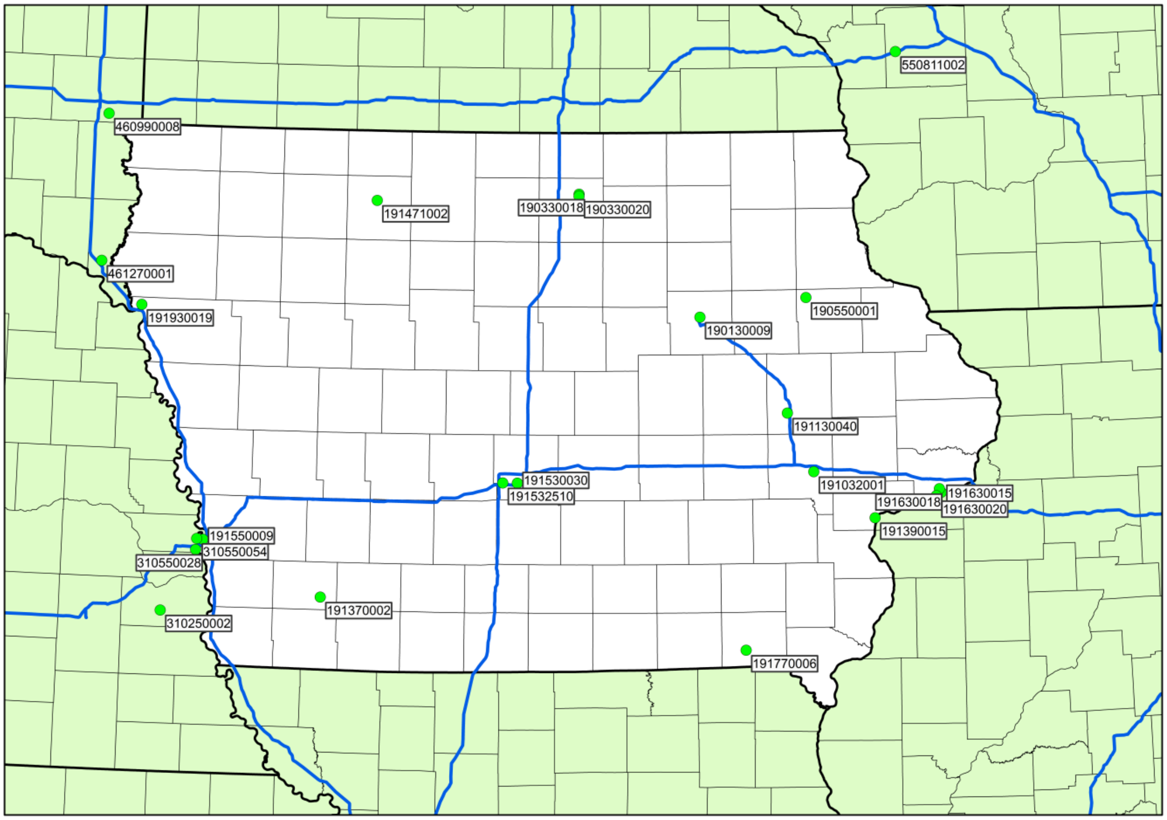
PM_{10} RMS Deviation Dendrogram (2010-2013)



PM₁₀ Correlation Matrix - Site Map



PM₁₀ RMS Deviation - Site Map



PM$_{10}$ – Site Map

AQS Site ID	Name	State	City	Address
190130009	Water Tower	Iowa	Waterloo	Vine St. & Steely
190330018	Holcim Cement	Iowa	Mason City	17th St. & Washington St
190330020	Washington School	Iowa	Mason City	700 N. Washington
190550001	Backbone State Park	Iowa	N/A	Backbone State Park
191032001	Hoover School	Iowa	Iowa City	2200 E. Court
191130040	Public Health	Iowa	Cedar Rapids	500 11th St. NW
191370002	Viking Lake State Park	Iowa	N/A	2780 Viking Lake Rd.
191390015	Muscatine HS - East Campus Roof	Iowa	Muscatine	1409 Wisconsin
191471002	Iowa Lakes Community College	Iowa	Emmetsburg	Iowa Lakes Community College
191530030	Carpenter	Iowa	Des Moines	1907 Carpenter
191532510	Indian Hills Jr. High School	Iowa	Clive	9401 Indian Hills Dr.
191550009	Franklin School	Iowa	Council Bluffs	3130 C Ave.
191630015	Jefferson School	Iowa	Davenport	10th St. & Vine St.
191630017	Buffalo Mining	Iowa	Buffalo	11100 110th Ave.
191630018	Adams School	Iowa	Davenport	3029 N Division St.
191630020*	Hayes School*	Iowa	Davenport	622 S Concord St.
191770006	Lake Sugema	Iowa	N/A	24430 Lacey Trail
191930019	Bryant Elementary	Iowa	Sioux City	821 30th St.
310250002	N/A	Nebraska	Weeping Water	City Sanitation Building
310550028	N/A	Nebraska	Omaha	2411 O St.
310550054	19th & Burt	Nebraska	Omaha	19th & Burt
460990008	SD School for the Deaf	South Dakota	Sioux Falls	2001 E 8th St.
461270001	Union County #1 Jensen	South Dakota	N/A	31986 475th Ave.
550811002	N/A	Wisconsin	N/A	2500 Iband Ave.

PM$_{10}$ Correlation Matrix Tool-Site Information

****Site did not produce PM$_{10}$ data until 1-1-2014.***

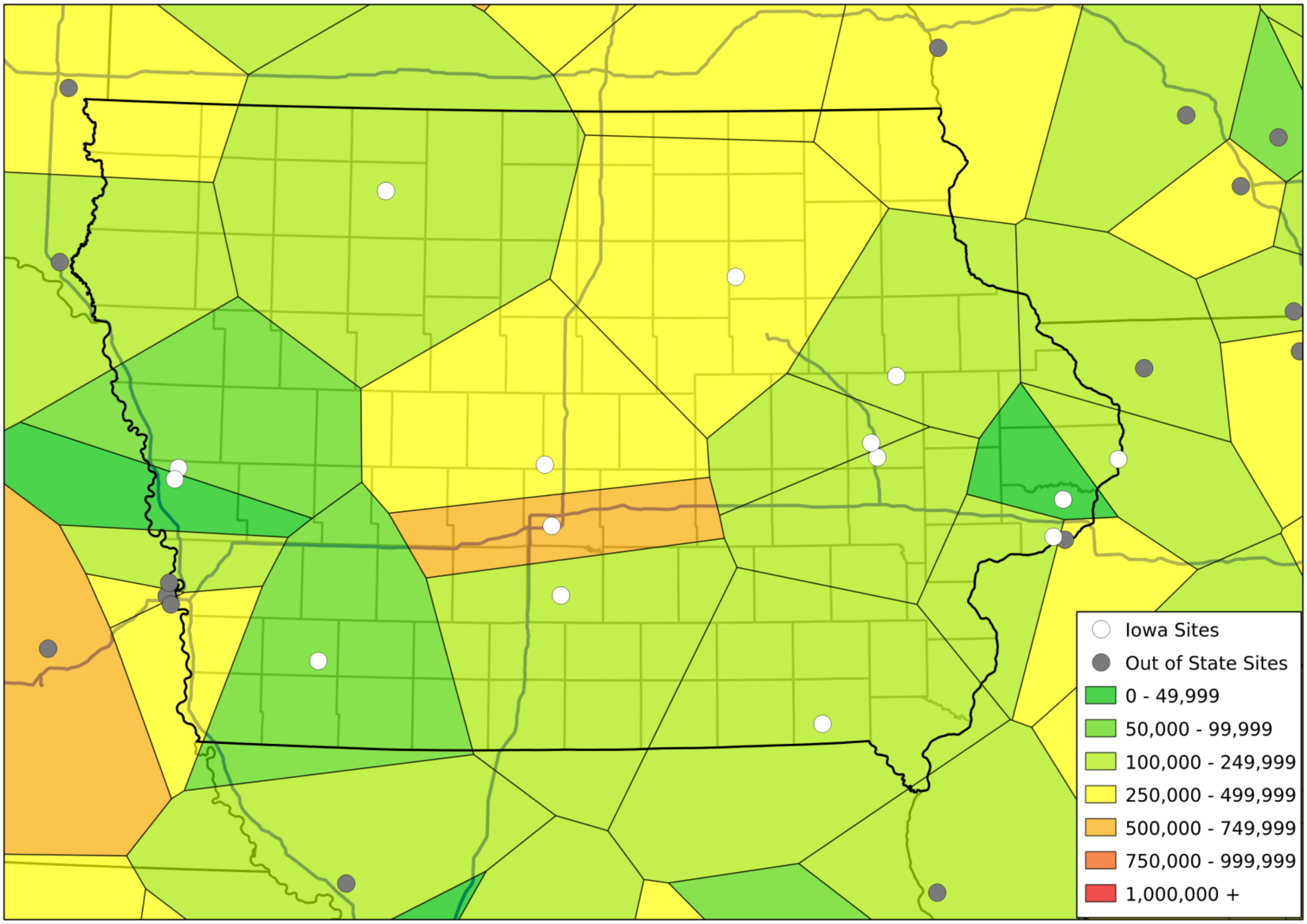
Section 3: Area Served Tool

Given a group of points on a plane contained inside a boundary, one can construct the perpendicular bisector between pairs of points, and extend each bisector until it meets another bisector or meets the boundary. Proceeding in this manner, the area of the plane inside the boundary is divided into polygons. The interior of each polygon contains only one point, and any location in the interior of the polygon is closer to this point than any other. These polygons are called Voronoi polygons.[48]

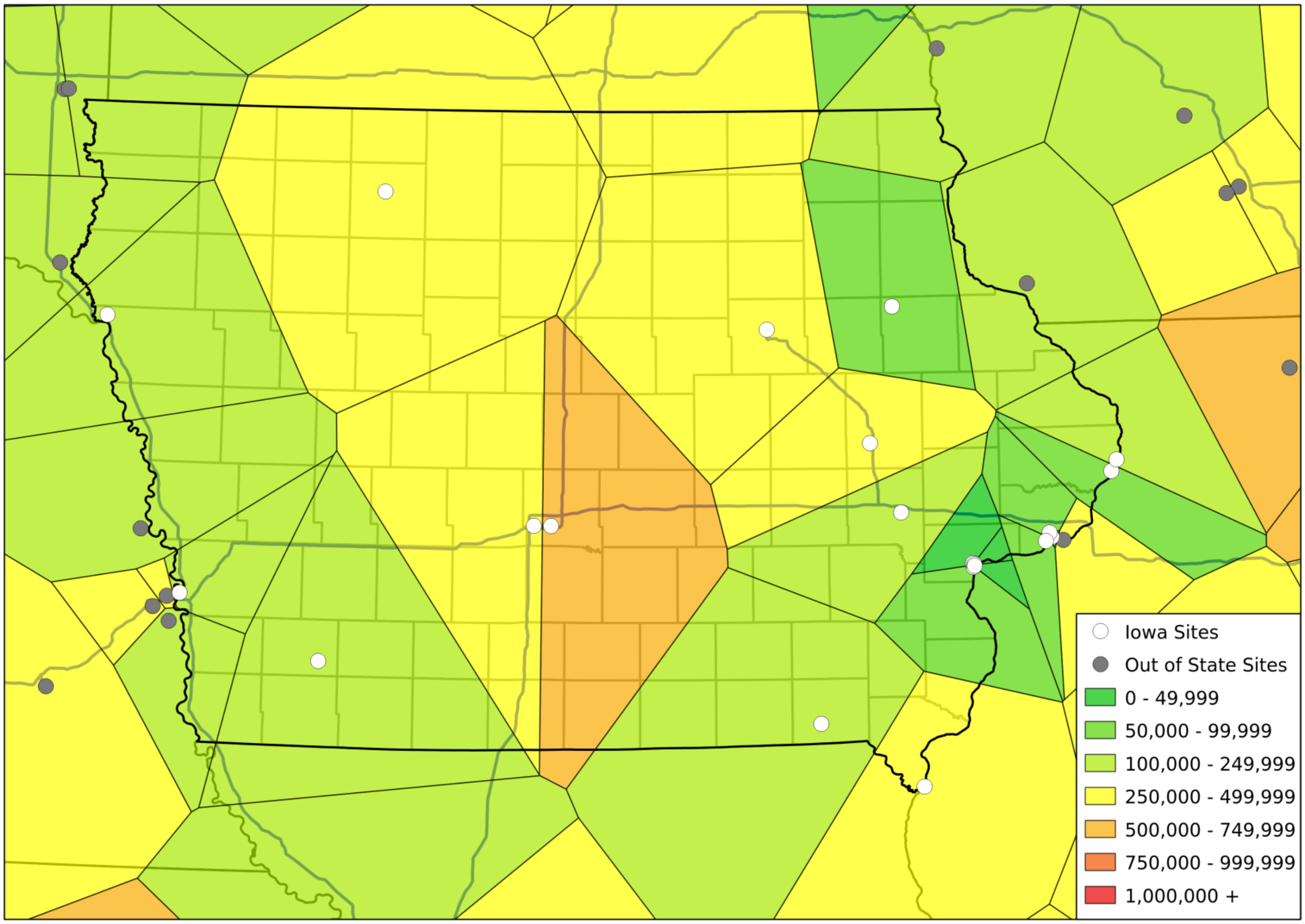
Voronoi polygons are associated with the locations of a group of air monitoring sites specified by the user. The area of the Voronoi Polygon is defined as the "area served" by the monitor. The population residing inside each Voronoi polygon is computed by the tool from census tract data compiled from the 2010 US Census.

Voronoi polygons and their associated populations are indicated below for each NAAQS pollutant in Iowa's ambient air monitoring network as of December 2014 and the last known configuration of surrounding states. Voronoi polygons that contain counties in Metropolitan Statistical Areas tend to have the highest populations. Pollutant networks with a larger number of monitors have a greater number of Voronoi polygons and smaller average populations in each Voronoi polygon. It should be noted that a Voronoi polygon is a purely mathematical construct, and the scale of an air pollution monitor (i.e. the area over which the monitor readings are representative) is not related to the area of the Voronoi polygon associated with the monitor.

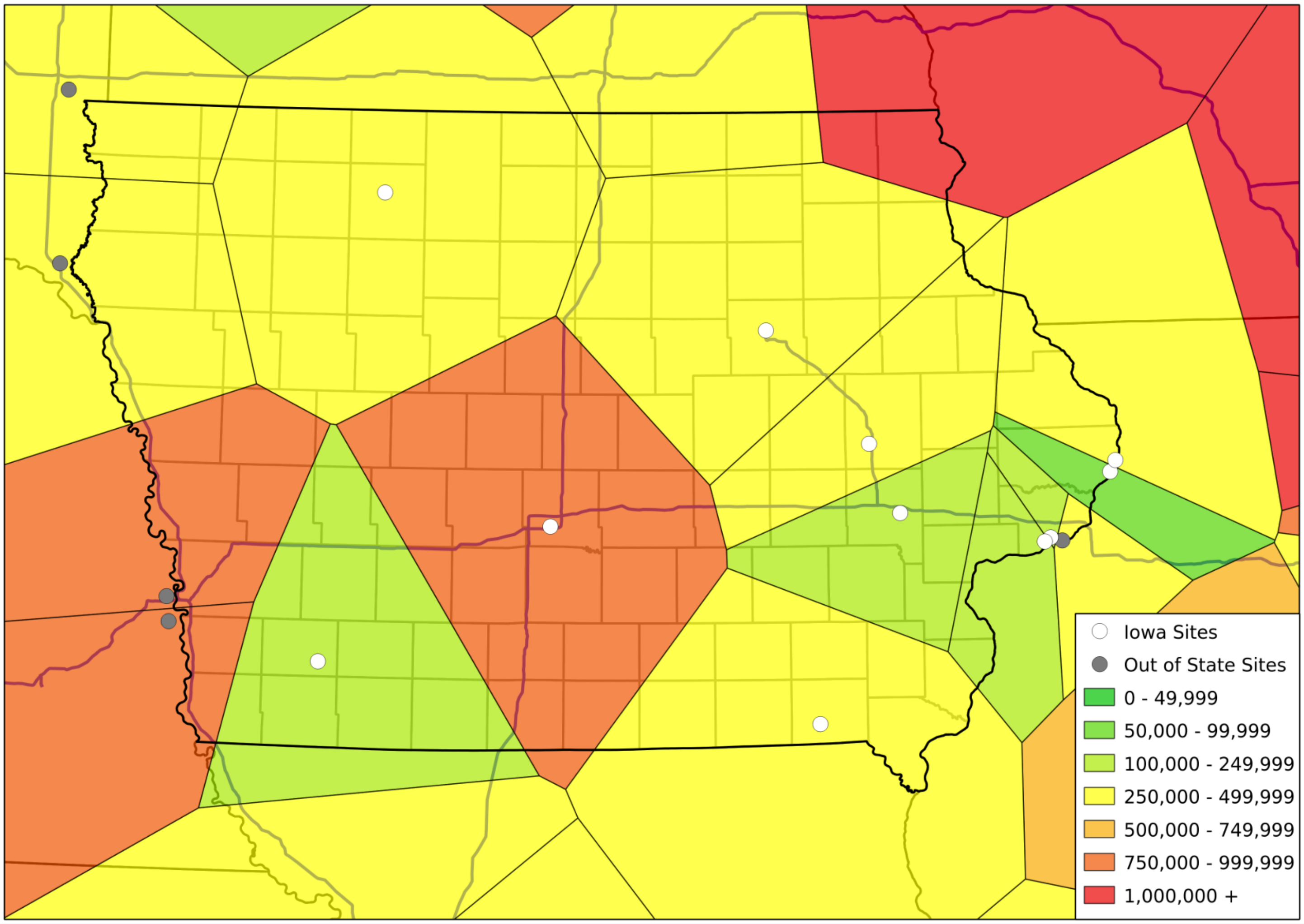
[48] A explanation of Voronoi Polygons is available online at: http://mathworld.wolfram.com/VoronoiDiagram.html.



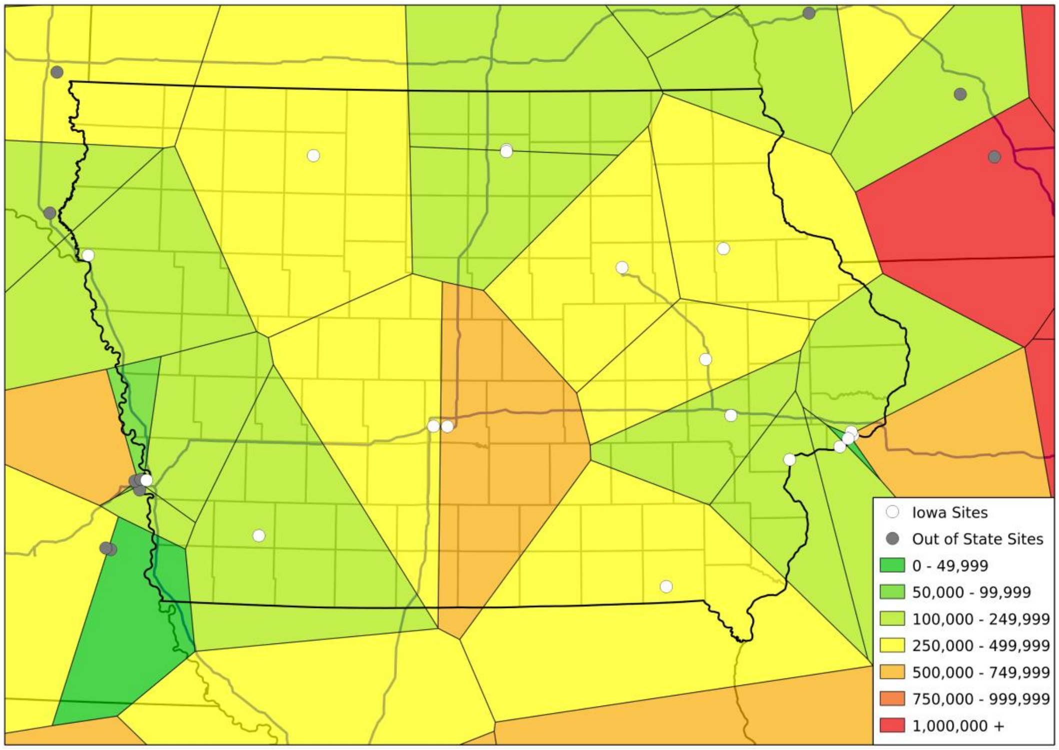
Ozone Voronoi Polygons and Associated Populations



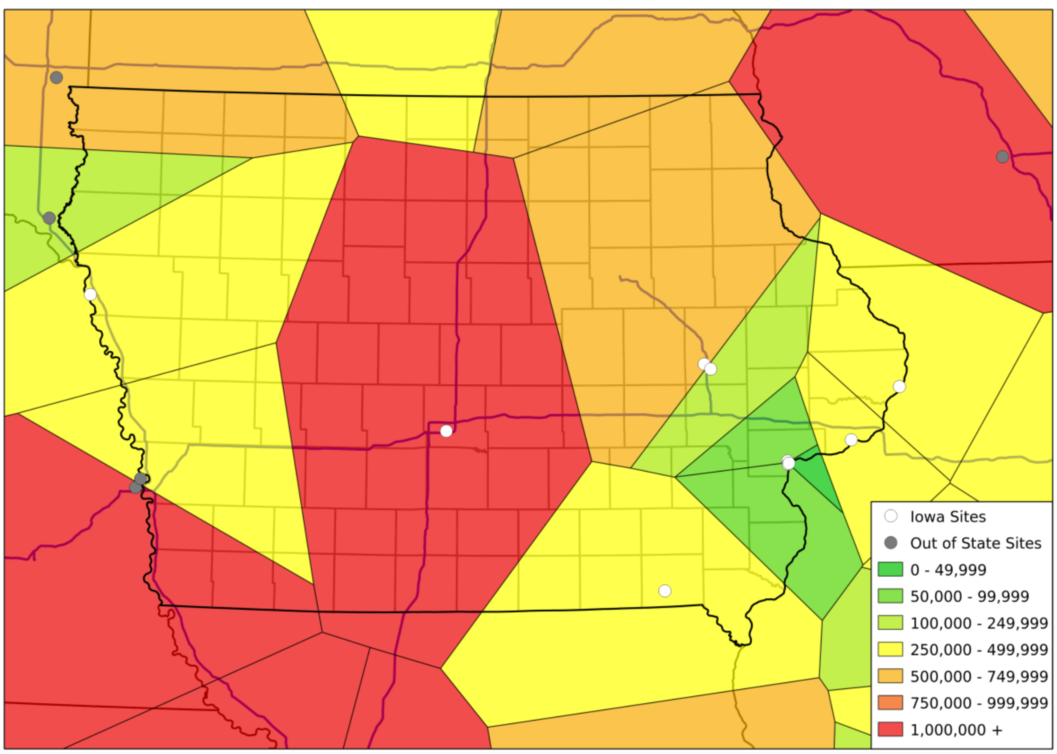
$PM_{2.5}$ FRM Voronoi Polygons and Associated Populations



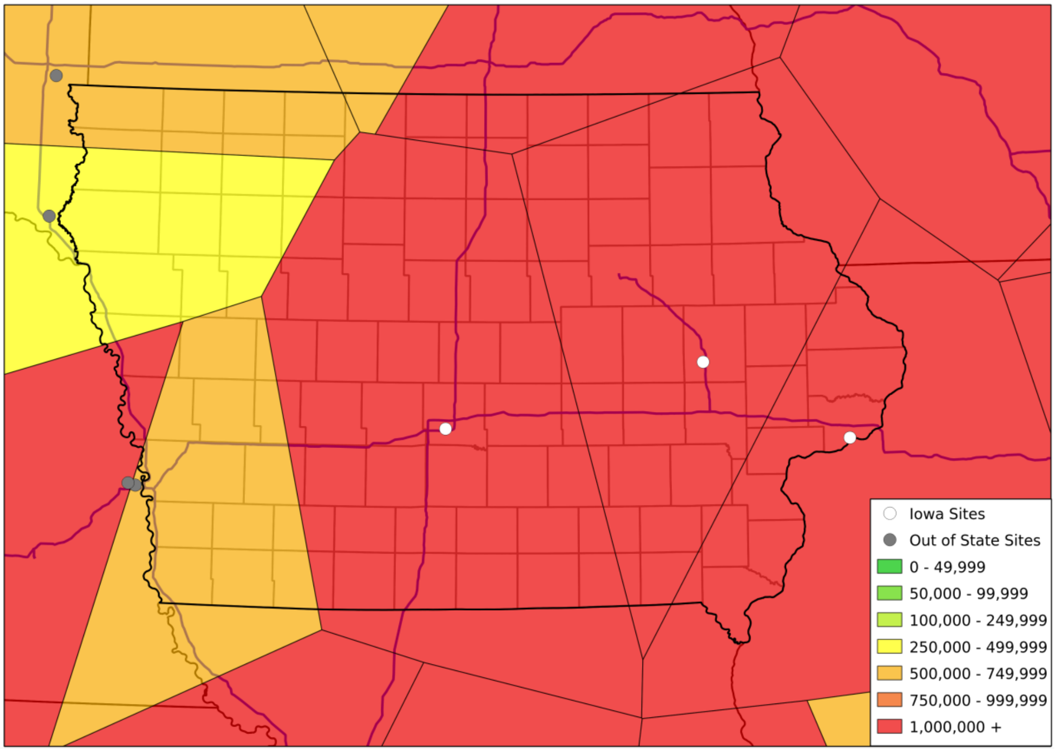
$PM_{2.5}$ Continuous Voronoi Polygons and Associated Populations



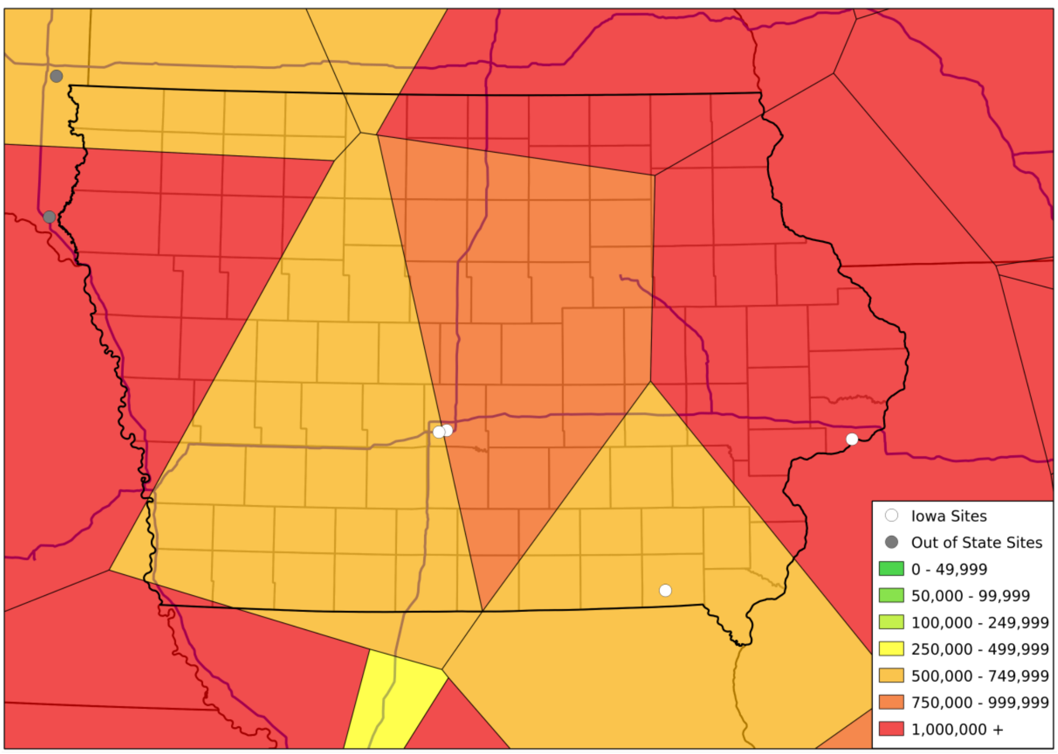
PM_{10} Voronoi Polygons and Associated Populations



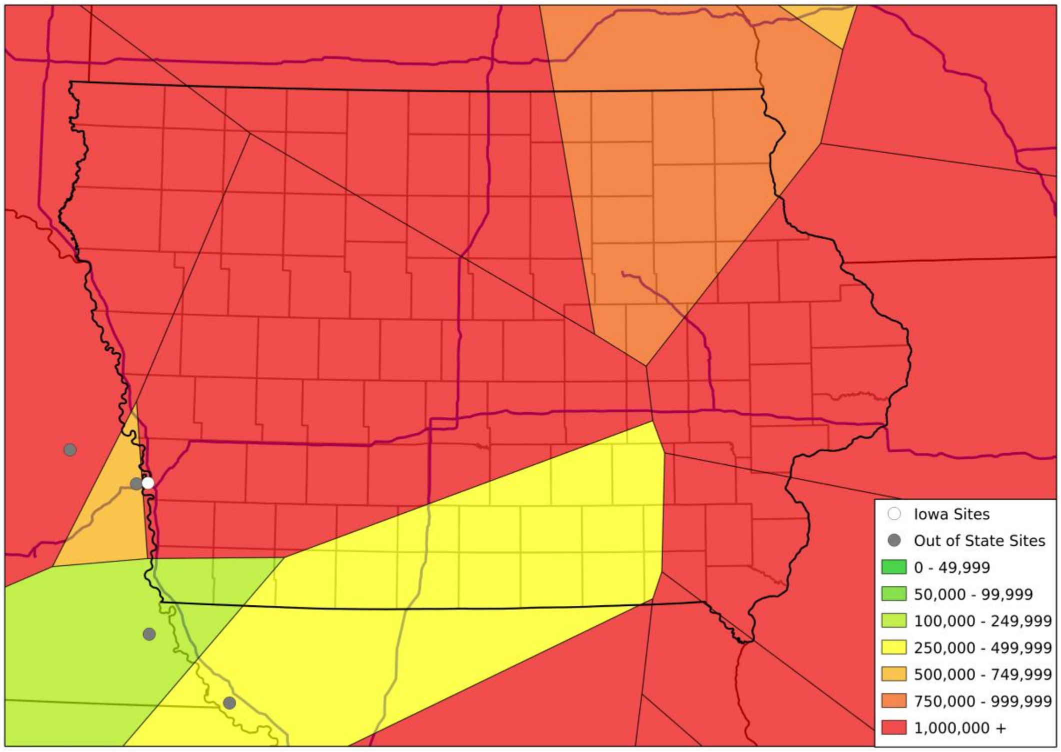
SO_2 Voronoi Polygons and Associated Populations



CO Voronoi Polygons and Associated Populations



NO_2 Voronoi Polygons and Associated Populations



Lead Voronoi Polygons and Associated Populations

Appendix G: Current Ambient Air Monitoring Network

Table of Contents

Section 1: Summary

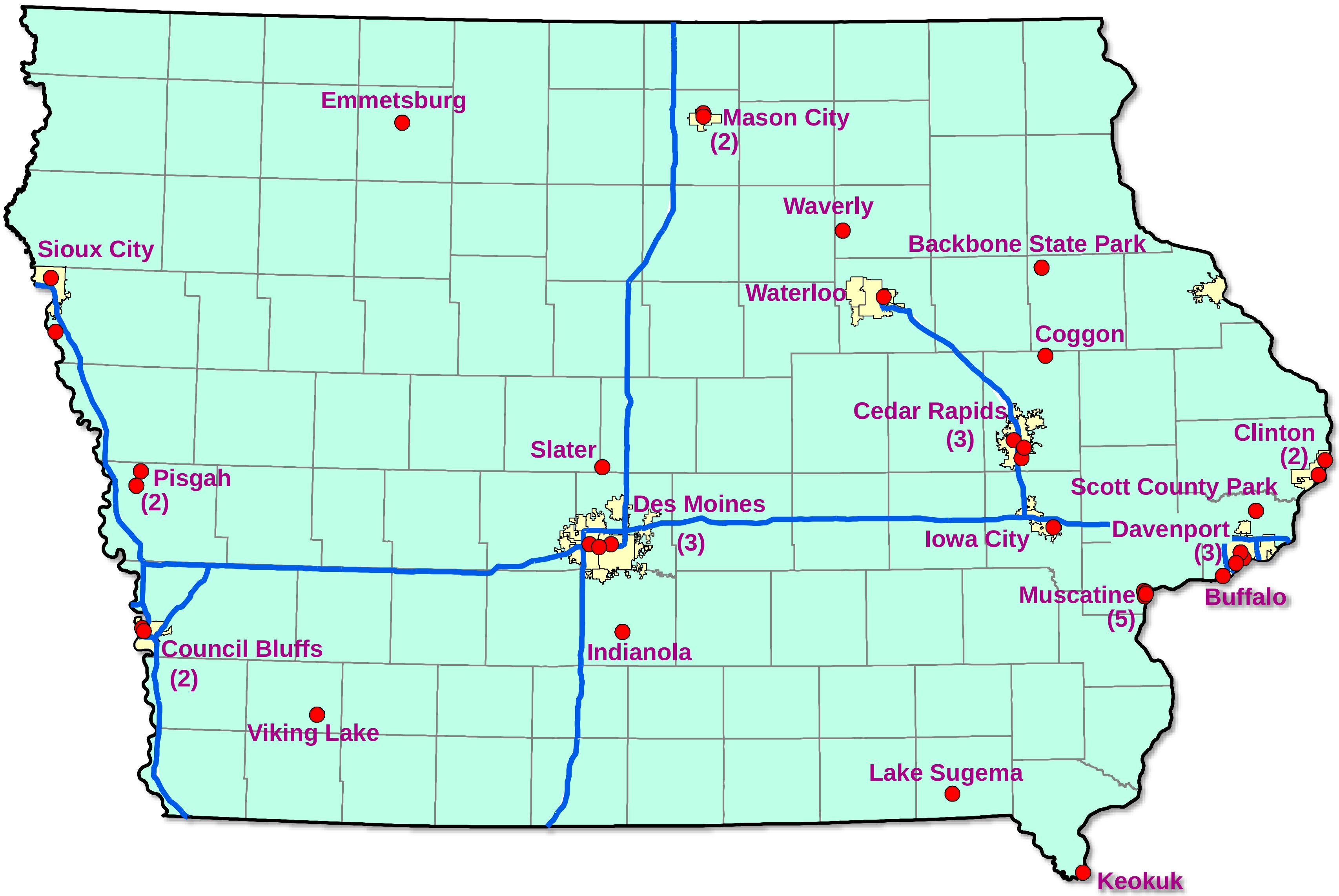
This appendix contains a description of the current (January 2015) Iowa ambient air monitoring network. A table of monitoring sites is contained in Section 2, and a count of monitors in the network is contained in Section 3. Section 4 compares the number of monitors for different pollutants; $PM_{2.5}$ filter samplers are the most numerous discrete samplers in the network, ozone monitors are the most numerous continuous samplers. Section 5 contains maps of monitor locations for the various pollutants. Additional information concerning Iowa's current ambient air monitoring network is contained in Iowa's *2015 Ambient Air Monitoring Network Plan*.[49]

[49] Available online at:
http://www.iowadnr.gov/Portals/idnr/uploads/air/insidednr/monitoring/network_plan_2015.pdf.

Section 2: Current Iowa Air Monitoring Sites (January 2015)

City	Site	Address	County	MSA	Latitude	Longitude	AQS Site ID	Responsible Agency
Buffalo	Linwood Mining	11100 110th Ave.	Scott	DMR	41.46724	-90.68845	191630017	DNR
Cedar Rapids	Kirkwood College	6301 Kirkwood Blvd SW	Linn	CDR	41.91056	-91.65194	191130028	Linn Local Prog.
	Public Health	500 11th St. NW	Linn	CDR	41.97677	-91.68766	191130040	Linn Local Prog.
	Tait Cummins Park (Prairie Creek)	3000 C St SW	Linn	CDR	41.94871	-91.63954	191130041	Linn Local Prog.
Clinton	Chancy Park	23rd & Camanche	Clinton	-	41.82328	-90.21198	190450019	DNR
	Rainbow Park	Roosevelt St.	Clinton	-	41.87500	-90.17757	190450021	DNR
Clive	Indian Hills Jr. High School	9401 Indian Hills	Polk	DSM	41.60352	-93.74790	191532510	Polk Local Prog.
Coggon	Coggon Elementary School	408 E Linn St.	Linn	CDR	42.28056	-91.52694	191130033	Linn Local Prog.
Council Bluffs	Franklin School	3130 C Ave.	Pottawattamie	OMC	41.26417	-95.89612	191550009	DNR
	Griffin Pipe	8th Avenue and 27th St	Pottawattamie	OMC	41.25425	-95.88725	191550011	DNR
Davenport	Jefferson School	10th St. & Vine St.	Scott	DMR	41.53001	-90.58761	191630015	DNR
	Adams School	3029 N Division St.	Scott	DMR	41.55001	-90.60012	191630018	DNR
	Hayes School	622 South Concord St	Scott	DMR	41.51208	-90.62404	191630020	DNR
Des Moines	Health Dept.	1907 Carpenter	Polk	DSM	41.60318	-93.64330	191530030	Polk Local Prog.
	Near Road NO2	6011 Rollins Avenue	Polk	DSM	41.59257	-93.70014	191536011	Polk Local Prog.
Emmetsburg	Iowa Lakes College	3200 College Dr	Palo Alto	-	43.12370	-94.69352	191471002	DNR
Indianola	Lake Ahquabi State Park	1650 118th Ave.	Warren	DSM	41.28553	-93.58398	191810022	DNR
Iowa City	Hoover School	2200 East Court	Johnson	IAC	41.65723	-91.50348	191032001	DNR
Keokuk	Fire Station	111S. 13th St.	Lee	-	40.40096	-91.39101	191110008	DNR
Mason City	Holcim Cement	17th St. & Washington St.	Cerro Gordo	-	43.16944	-93.20243	190330018	DNR
	Washington School	700 N. Washington Avenue	Cerro Gordo	-	43.15856	-93.20301	190330020	DNR
Muscatine	Muscatine HS, East Campus Roof	1409 Wisconsin	Muscatine	-	41.40095	-91.06781	191390015	DNR
	Greenwood Cemetery	Fletcher St. & Kimble St.	Muscatine	-	41.41943	-91.07098	191390016	DNR
	Franklin School	210 Taylor St.	Muscatine	-	41.41439	-91.06261	191390018	DNR
	Muscatine HS, East Campus Trailer	1409 Wisconsin	Muscatine		41.40145	-91.06845	191390019	DNR
	Musser Park	Oregon St. & Earl Ave.	Muscatine	-	41.40690	-91.06160	191390020	DNR
Pisgah	Forestry Office	206 Polk St.	Harrison	OMC	41.83226	-95.92819	190850007	DNR
	Highway Maintenance Shed	1575 Hwy 183	Harrison	OMC	41.78026	-95.94844	190851101	DNR
Sergeant Bluff	George Neal North	2761 Port Neal Circle	Woodbury	SXC	42.32767	-96.36807	191930020	DNR
Sioux City	Bryant School	821 30th St.	Woodbury	SXC	42.52236	-96.40021	191930019	DNR
Slater	City Hall	105 Greene	Story	DSM	41.88287	-93.68780	191690011	Polk Local Prog.
Waterloo	Water Tower	Vine St. & Steely	Black Hawk	WTL	42.50154	-92.31602	190130009	DNR
Waverly	Waverly Airport	Waverly Airport	Bremer	WTL	42.74306	-92.51306	190170011	DNR
-	Backbone State Park	Backbone State Park	Delaware	-	42.60083	-91.53833	190550001	DNR
-	Lake Sugema	24430 Lacey Trl, Keosauqua	Van Buren	-	40.69508	-92.00632	191770006	DNR
-	Scott County Park	Scott County Park	Scott	DMR	41.69917	-90.52194	191630014	DNR
-	Viking Lake State Park	2780 Viking Lake Road	Montgomery	-	40.96911	-95.04495	191370002	DNR

MSA abbreviations are as follows: DMR = Davenport, Moline, Rock Island; CDR = Cedar Rapids; DSM = Des Moines; OMC = Omaha-Council Bluffs; IAC = Iowa City; SXC = Sioux City; AMW = Ames; WTL = Waterloo. More information on MSA's is available in Appendix J.



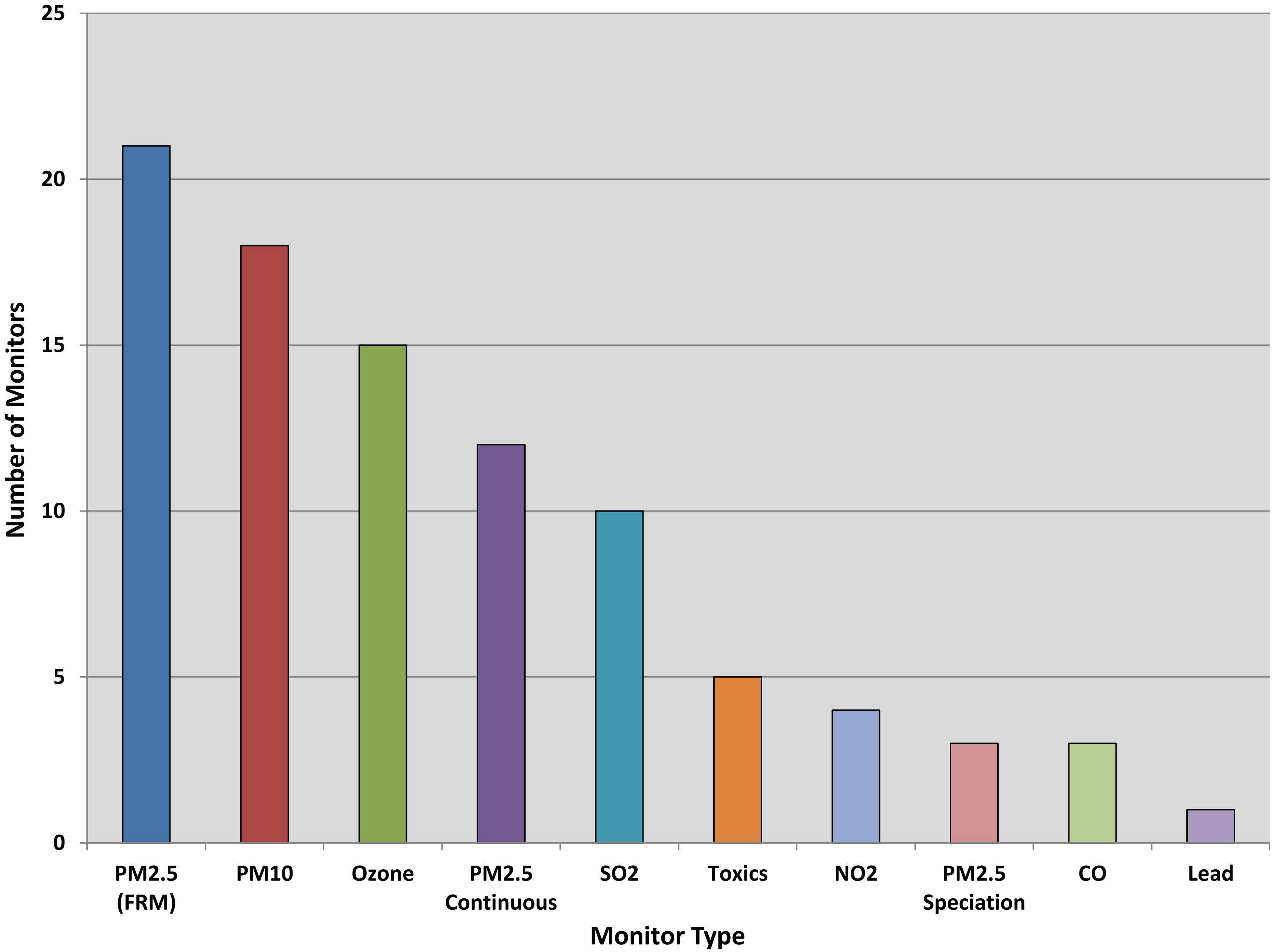
2015 Iowa Ambient Air Monitoring Network (37 sites)

Section 3: Criteria[50] Pollutant Monitors at Each Site in the Network as of January 1, 2015.

City	Site Name	$PM_{2.5}$ (FRM)	PM_{10} (FRM/FEM)	Ozone	$PM_{2.5}$ Continuous	SO_2	$PM_{2.5}$ Speciation	CO	Toxics	NO_2	Lead
Buffalo	Linwood Mining		1								
Cedar Rapids	Kirkwood College			1							
	Public Health	1	1	1	1	1		1	1		
	Tait Cummins Park					1					
Clinton	Chancy Park	1			1	1			1		
	Rainbow Park	1		1	1						
Clive	Indian Hills Jr. High School	1	1								
Coggon	Coggon Elementary School			1					1		
Council Bluffs	Franklin School	1	1								
	Griffin Pipe										1
Davenport	Jefferson School	1	1	1	1	1	1	1	1	1	
	Adams School	1	1								
	Hayes School	1	1		1						
Des Moines	Health Dept.	1	1	1	1	1		1	1	1	
	Near-Road NO2									1	
Emmetsburg	Iowa Lakes College	1	1	1	1						
Indianola	Lake Ahquabi State Park			1							
Iowa City	Hoover School	1	1		1						
Keokuk	Fire Station	1									
Mason City	Holcim Cement		1								
	Washington School		1								
Muscatine	Muscatine HS, East Campus Roof	1	1								
	Greenwood Cemetery	1				1					
	Franklin School	1									
	Muscatine HS, East Campus Roof				1	1					
	Musser Park	1				1			1		
Pisgah	Forestry Office			1							
	Highway Maintenance Shed			1							
Sergeant Bluff	George Neal North					1					
Sioux City	Bryant School	1	1								
Slater	City Hall			1							
Waterloo	Water Tower	1	1		1						
Waverly	Waverly Airport			1							
-	Backbone State Park	1	1								
-	Lake Sugema	1	1	1	1	1	1			1	
-	Scott County Park			1							
-	Viking Lake State Park	1	1	1	1		1				
	Totals	**21**	**18**	**15**	**12**	**10**	**3**	**3**	**6**	**4**	**1**

[50] $PM_{2.5}$ Speciation and Toxics monitors do not monitor criteria pollutants, but are an important component of the network and are included for completeness.

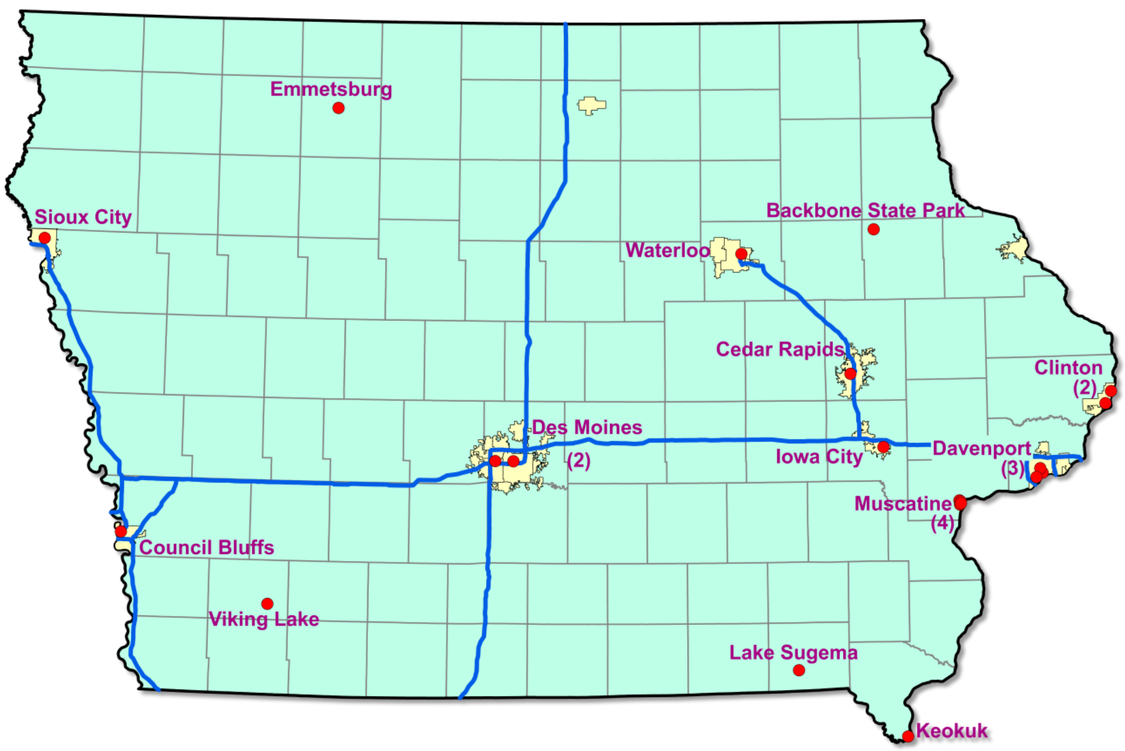
Section 4: Criteria[51] Pollutant Monitors Operated in the Current Network



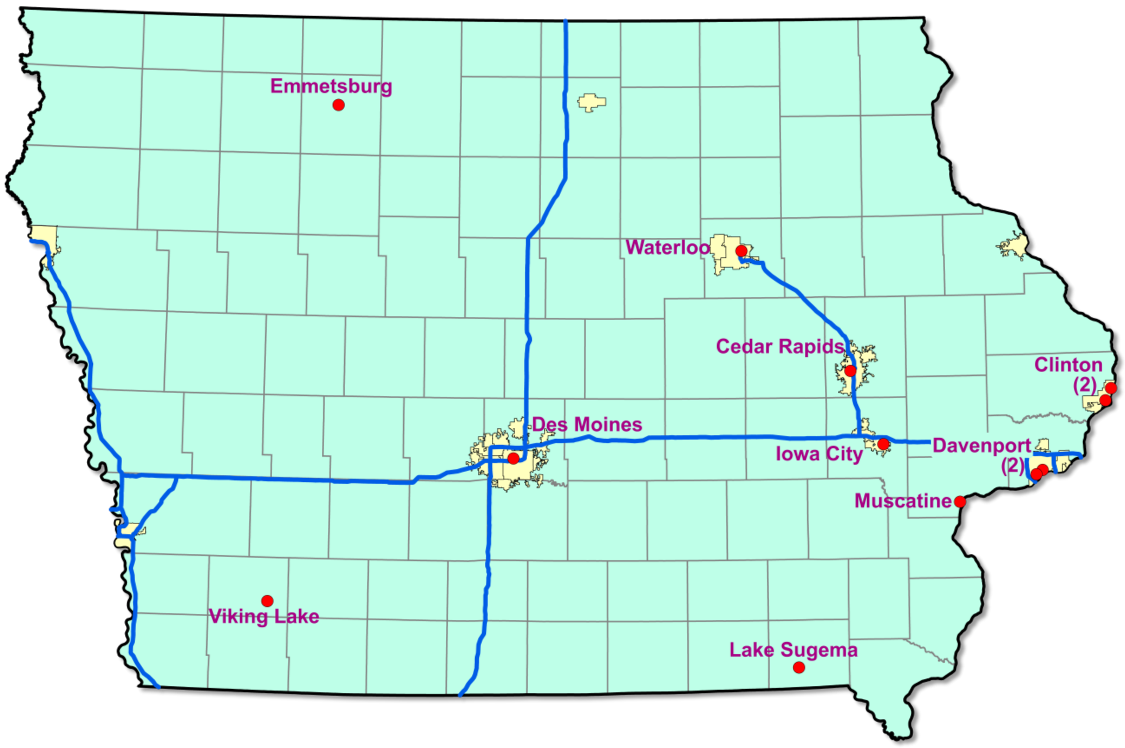
[51] $PM_{2.5}$ Speciation and Toxics monitors do not monitor criteria pollutants, but are an important component of the network and are included for completeness.

Section 5: Monitoring Network Maps

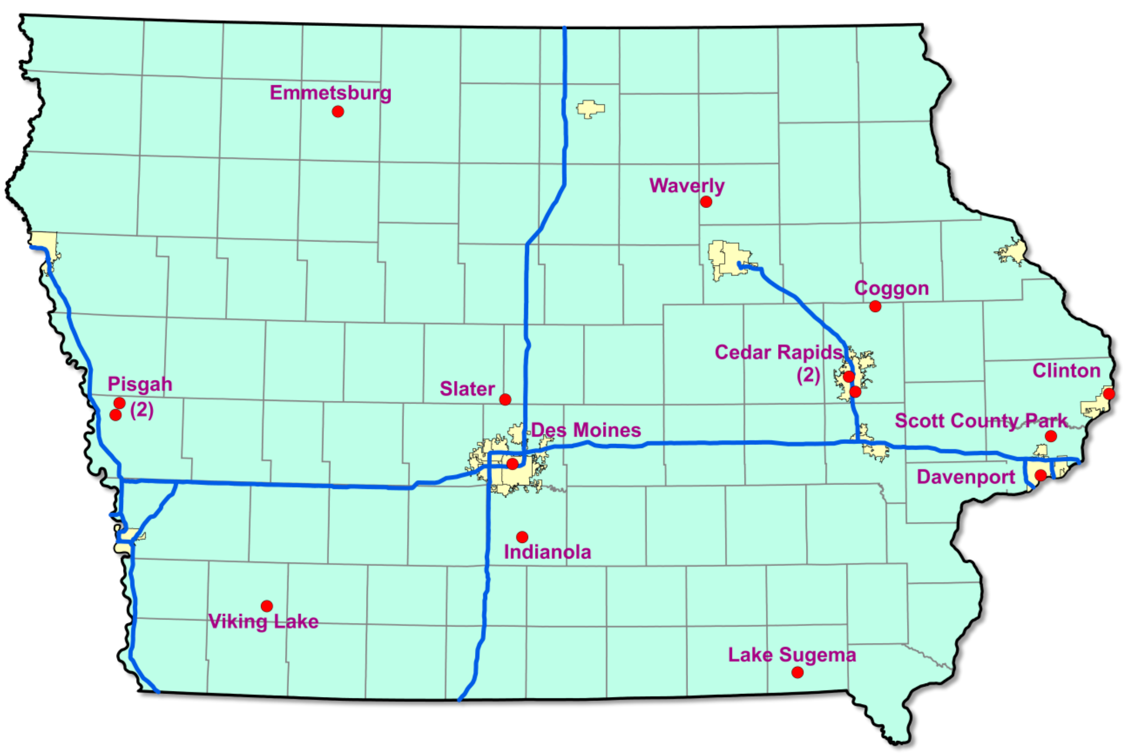
The following maps show the locations for the criteria pollutant monitors in the state of Iowa which are current as of January 1, 2015. A map of the continuous $PM_{2.5}$ monitoring network is also included. This data is only used for real time reporting of fine particulate levels and is not used to establish NAAQS attainment. Non-criteria pollutant maps are also included for the toxics and speciation monitoring networks.



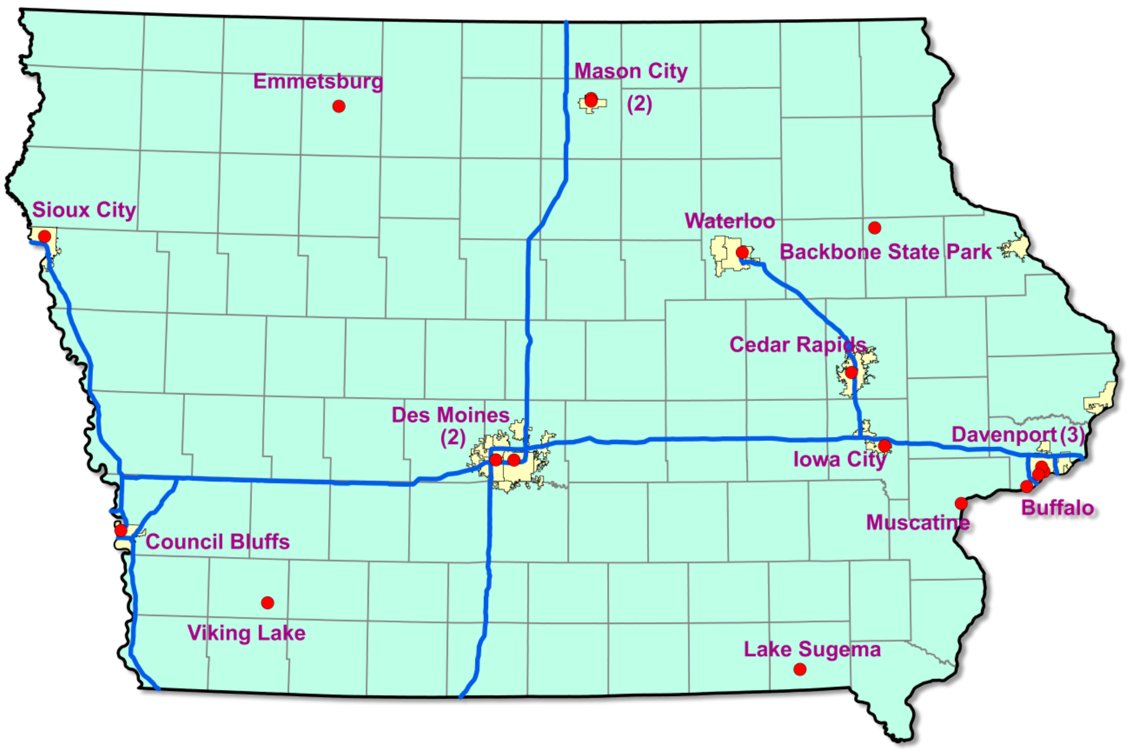
Manual $PM_{2.5}$ (FRM) Monitoring Sites



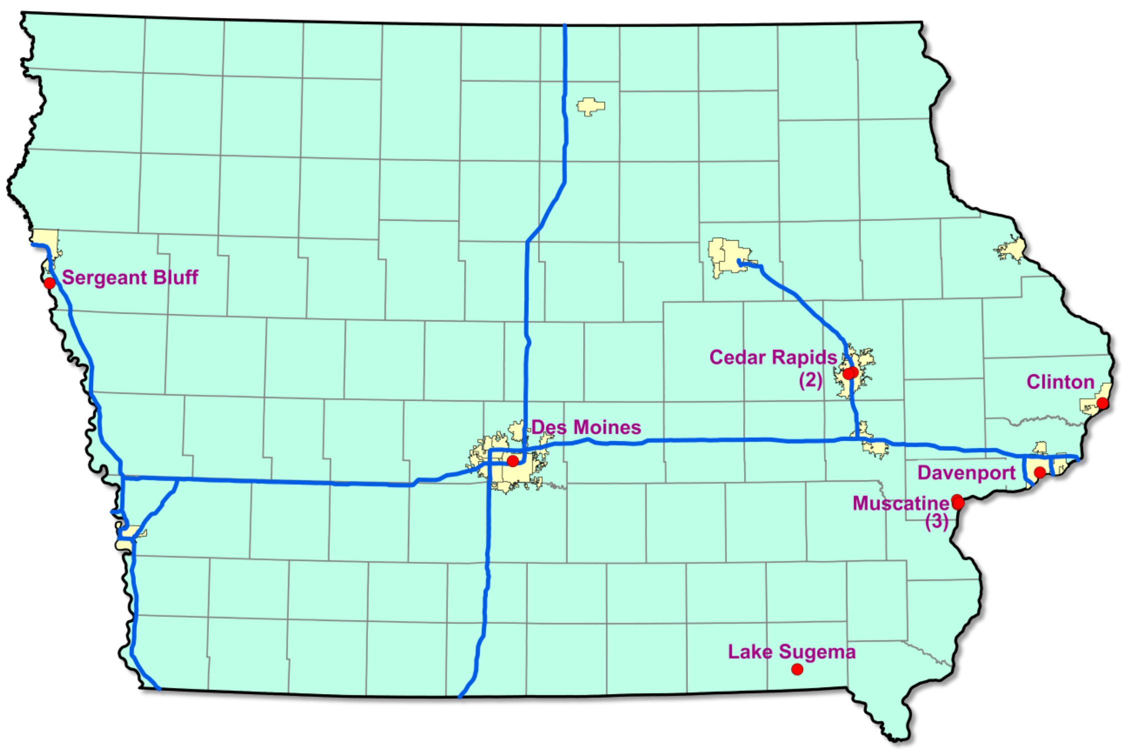
Continuous $PM_{2.5}$ (non-FRM) Monitoring Sites



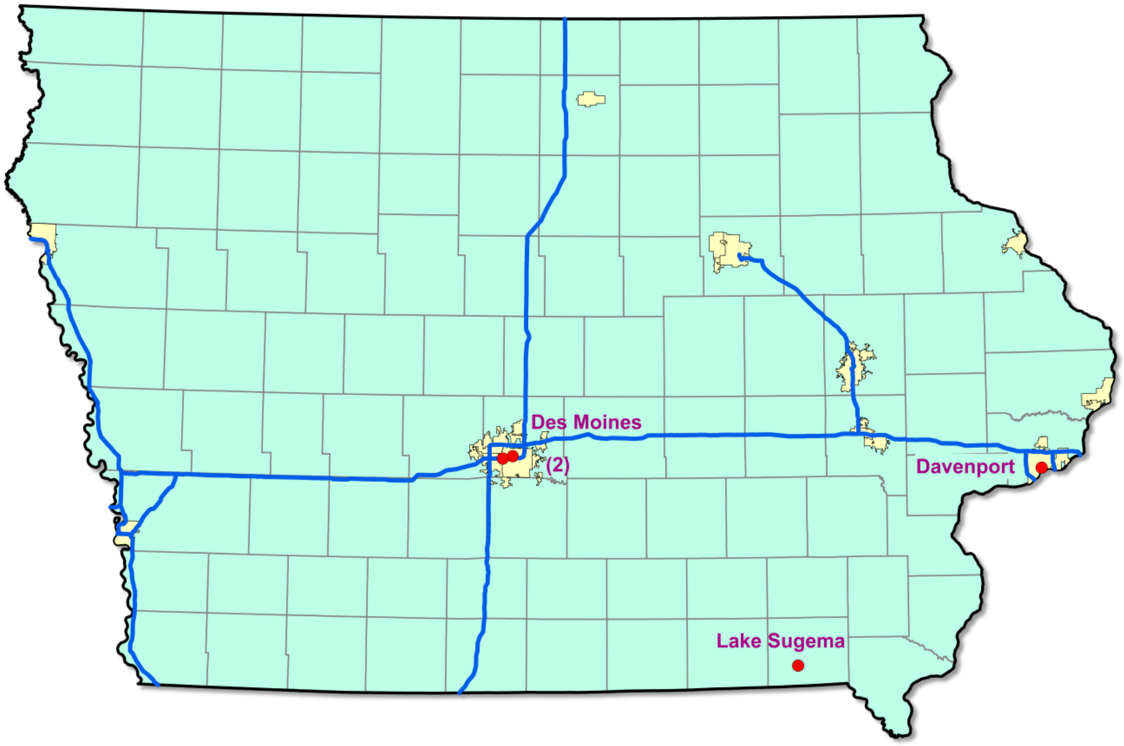
Ozone Monitoring Sites



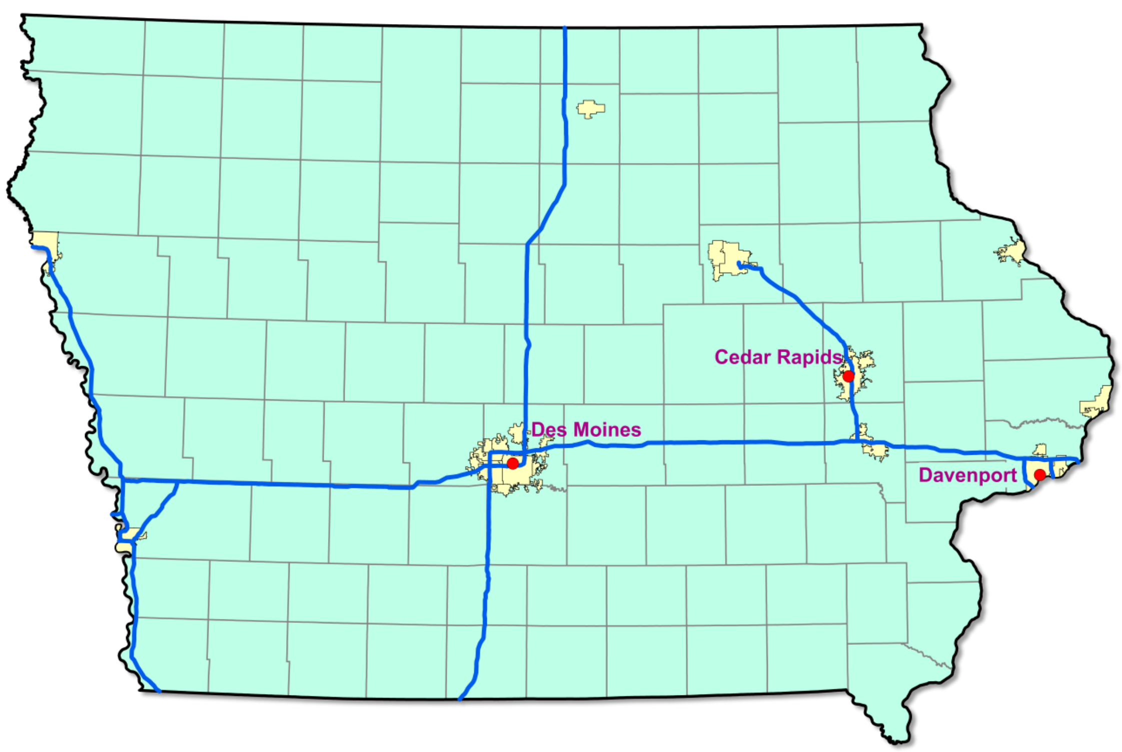
PM_{10} Monitoring Sites



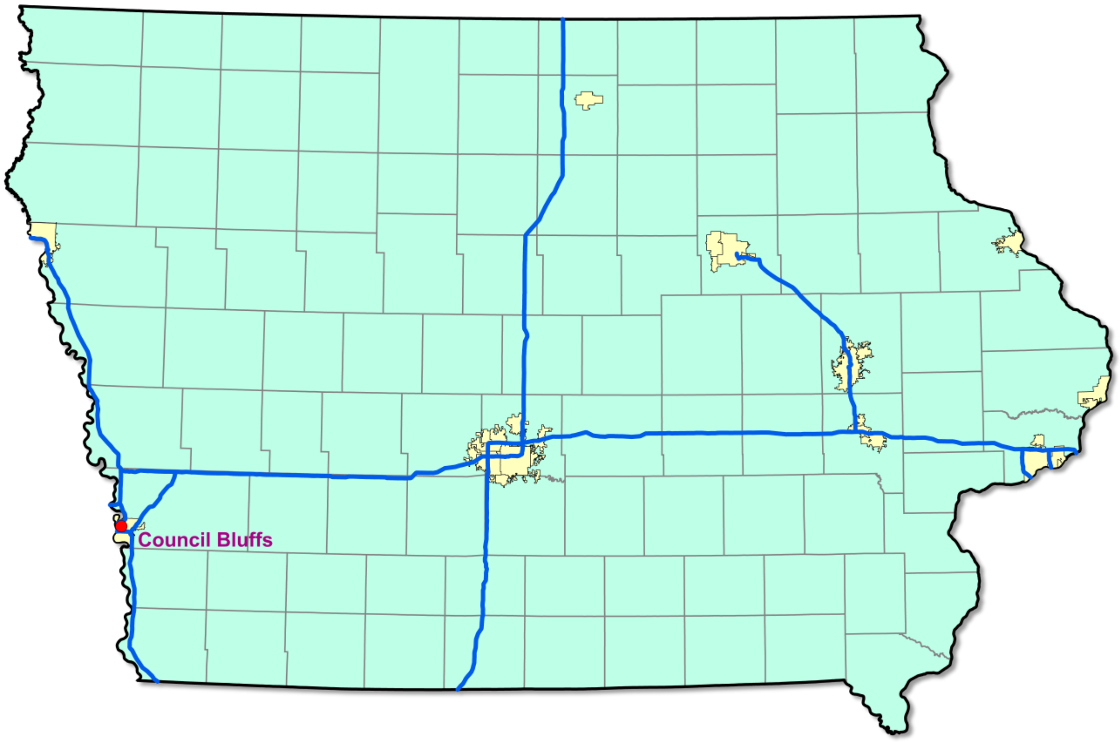
SO_2 Monitoring Sites



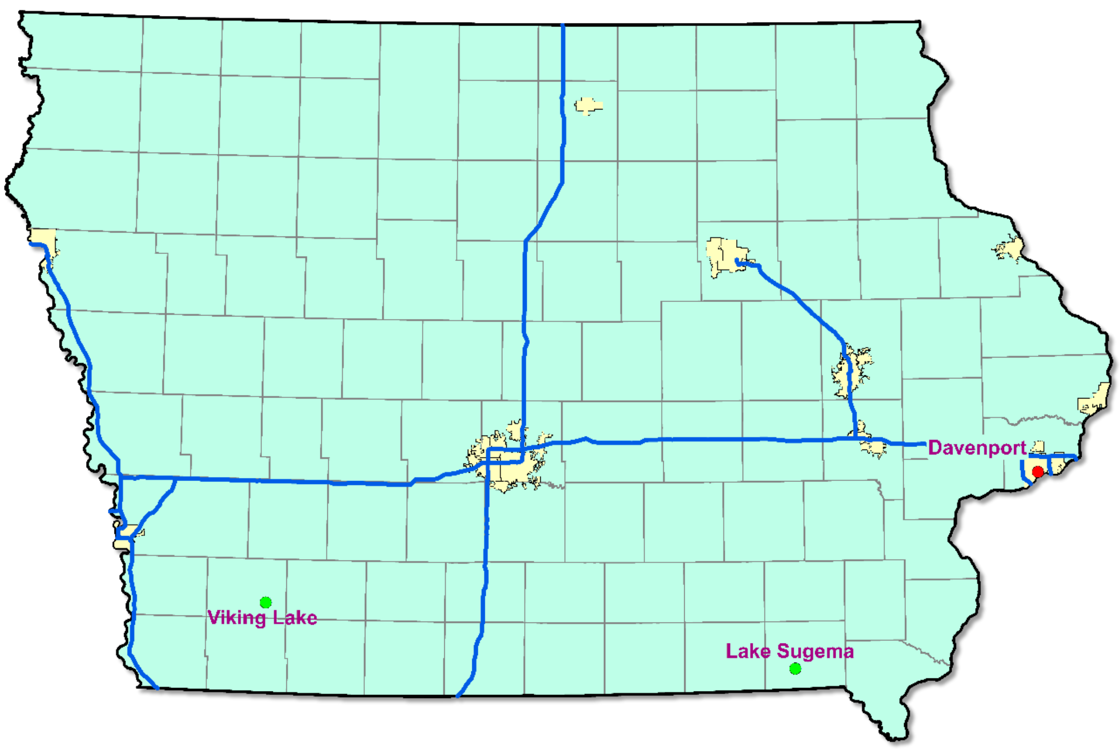
NO_2 Monitoring Sites



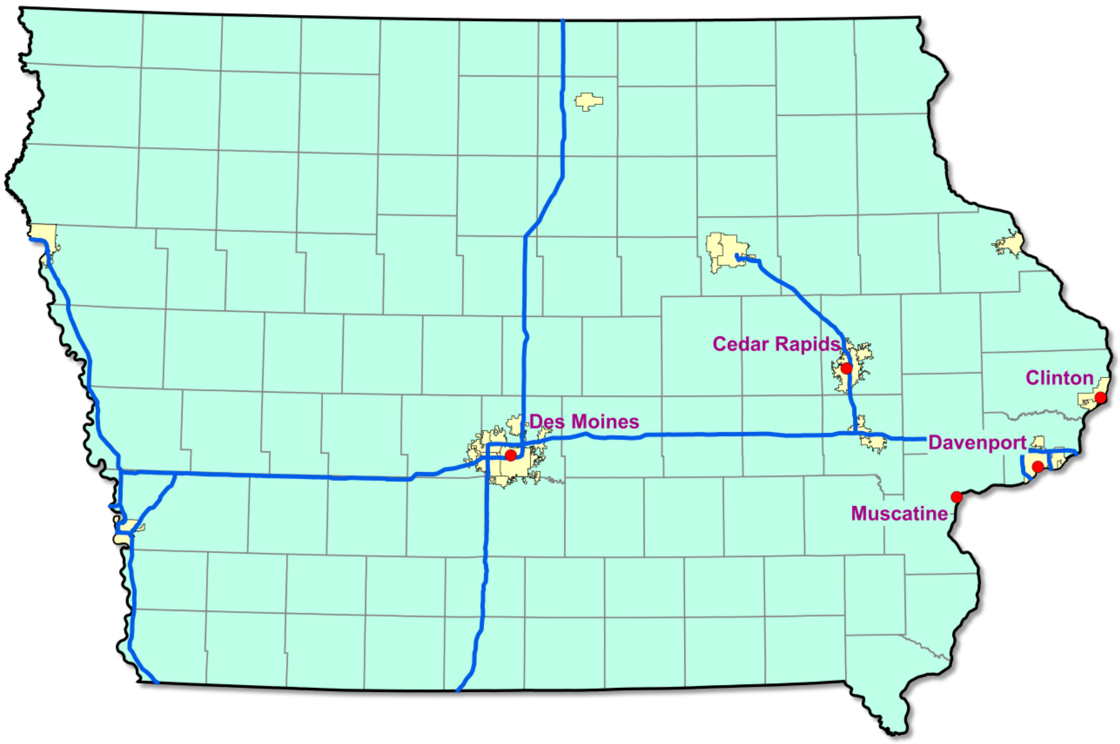
CO Monitoring Sites



Lead (Pb) Monitoring Sites



Speciation Monitors; CSN Speciation samplers are located at the red dots, IMPROVE Speciation samplers are located at the green dots.



Toxics Monitoring Sites

Appendix H: NAAQS Exceedances

Table of Contents

Section 1: Summary

A NAAQS exceedance for a given pollutant occurs when an air monitor records a concentration that exceeds the level of the short-term, primary NAAQS.[52] When an air pollutant concentration reaches this level, sensitive groups such as children, the elderly, and those with respiratory illness may experience adverse health effects.

From 2010 to 2014, $PM_{2.5}$, ozone, SO_2 and lead exceedances were recorded in the Iowa network.[53] Sections 2, 3, 4 and 5 contain tables detailing the sites and dates of these exceedances. Section 6 contains an exceedance chart and map.

Most of the exceedances that occurred over this period were caused by sulfur dioxide (SO_2). The data in Section 2 suggests that there are two types of $PM_{2.5}$ exceedances routinely recorded in the Iowa network: local exceedances and regional exceedances.[54] Local exceedances occur when a single monitor records an exceedance on a given day, usually because the wind is blowing from the direction of a nearby primary $PM_{2.5}$ emitter. Regional exceedances occur when multiple monitors over a wide (multi-county or multi-state) area record exceedances on a given day. Regional exceedances are common in Iowa during wintertime periods when a temperature inversion and stagnant air persists over much of the state, causing pollutant concentrations build up, and secondary fine particles to form.

In this report, data from PM_{10} and $PM_{2.5}$ filter samplers are used for computing exceedance counts and design values. In principle, filter samplers should produce the most accurate data, as they are specified in EPA's reference methods defining these pollutants. However, filter samplers are unsuitable for real-time reporting of PM data, because the filters must be retrieved from the field and weighed in an analytical lab to determine the particulate concentration, a process that typically takes about a month. For this reason, Iowa also operates continuous PM samplers in its network, in order to provide real-time data to the public. Data from continuous samplers is not currently used for regulatory decision making in Iowa, as the department has not yet been able to consistently demonstrate adequate comparability with filter-based methods. Because some States do use continuous data for regulatory purposes, EPA has requested that each State specify the intended use of their continuous PM data in their annual network plan, so that its use of continuous PM data can reviewed and approved by EPA.[55,56]

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[52] When there is more than one short-term primary NAAQS for a given pollutant, the averaging period used to define the Air Quality Index is selected to define a NAAQS exceedance. For the period from 2010-2014, 24-hour average PM_{10} and $PM_{2.5}$, one-hour SO_2 values, one-hour NO_2 values and 8-hour average O_3 and CO values were compared to the level of the corresponding NAAQS to determine exceedance counts. Information concerning the Air Quality Index is available in 40 CFR Part 58, Appendix G available online at: http://www.ecfr.gov/cgi-bin/text-idx?SID=c62e265a5857751dedc3fbf4b267315e&node=ap40.6.58_161.g&rgn=div9 Additional guidance is available online at: http://www.epa.gov/airnow/aqi-technical-assistance-document-dec2013.pdf.

[53] NAAQS exceedance counts for the Iowa monitoring network are available online at: http://www.iowadnr.gov/InsideDNR/RegulatoryAir/MonitoringAmbientAir.aspx.

[54] A discussion of the causes of fine particulate episodes in Iowa is available at: http://www.engineering.uiowa.edu/~cs_proj/iowa_pm_project/understanding_episodes_feb19version_all_sections.pdf.

[55] For EPA guidance on integration of continuous monitoring data into PM monitoring networks see: Implementing Continuous $PM_{2.5}$ Federal Equivalent Methods (FEMs) and Approved Regional Methods (ARMs) in State or Local Air Monitoring Station (SLAMS) Networks and Instructions and Template for Requesting that data from $PM_{2.5}$ Continuous FEMs are not compared to the NAAQS.

[56] See for example, Appendix D and K of Iowa's 2015 Annual Network Plan: http://www.iowadnr.gov/Portals/idnr/uploads/air/insidednr/monitoring/network_plan_2015.pdf.

Section 2: 2010-2014 $PM_{2.5}$ NAAQS Exceedance Sites and Dates

The table below provides the monitoring sites and dates of $PM_{2.5}$ exceedances measured in Iowa from 2010 through 2014. Values used to compare to the short-term primary NAAQS were 24-hour average concentrations throughout this period. Concentrations greater than or equal to 35.5 $\mu g/m^3$ were considered to be exceeding the NAAQS. $PM_{2.5}$ monitors in Iowa sample on a 1 in 3 day or daily schedule, with daily sampling frequencies reserved for highly populated areas or areas that have a history of elevated $PM_{2.5}$ levels.

The table below gives the locations and dates of $PM_{2.5}$ exceedances measured in Iowa from 2010-2014. Monitors in Muscatine (Garfield School) and Clinton (Chancy Park) are located near industries that emit $PM_{2.5}$. Davenport (Blackhawk Foundry) monitoring was discontinued at the conclusion of 2013 due to Blackhawk Foundry shutting down operations, selling their land and the new owner requesting that the monitor be removed from the property effective January 1, 2014.

Monitoring Sites	Sioux City, Bryant School 191930019	Council Bluffs, Franklin School 191550009	Viking Lake State Park 191370002	Emmetsburg, Iowa Lakes College 191471002	Clive, Indian Hills Jr. High School 191532510	Des Moines, Health Dept. 191530030	Waterloo, Grout Museum 190130008	Waterloo, Water Tower 190130009	Keosauqua, Lake Sugema 191770006	Cedar Rapids, Public Health 191130040	Cedar Rapids, Army Reserve 191130037	Iowa City, Hoover School 191032001	Keokuk, Fire Station 191110008	Muscatine, Greenwood Cemetery 191390016	Muscatine, Muscatine HS, East Campus Roof 191390015	Muscatine, Franklin School 191390018	Muscatine, Musser Park 191390020	Davenport, Hayes School 191630020	Davenport, Blackhawk Foundry 191630019	Davenport, Adams School 191630018	Davenport, Jefferson School 191630015	Clinton, Chancy Park 190450019	Clinton, Rainbow Park 190450021	
Date	Concentration (micrograms per cubic meter)																							Count
1/5/2010	46.2	48.8																						2
1/13/2010																			40					1
1/20/2010															62.9									1
1/22/2010															37.5									1
1/31/2010										36.3														1
2/1/2010										36.7	35.8				36.3							35.5		4
2/2/2010																					35.5	38.7	36.6	3
2/3/2010															36				36.5		37	38	36.7	5
2/4/2010							38.8	37.5	38.3	40.2	36.5	39.4	41.2	37.2	41.3	38.3		40.7	41.9	40.5	40.5	42.8	42.2	16
2/5/2010						41.5																		1
2/12/2010						36.3																37		2
2/13/2010					40.3	41.6							40.7											3
2/19/2010							36.7	35.8						36	37.9	36.3				35.9				6
3/3/2010							37.7	37.8		39.2	36.2	38.6			35.9	35.6								7
3/4/2010										38.8		35.9			49.7									3
3/5/2010															36.7									1
3/8/2010															35.7							37.8		2
3/9/2010															52.3							37.1		2
4/23/2010															63.4									1
5/20/2010															53.7									1
12/15/2010															40.7									1
12/20/2010															56.1									1
2010 Total	1	1	0	0	1	3	3	3	1	5	3	3	2	2	15	3	0	1	3	2	3	7	3	65
1/10/2011															45									1
3/22/2011															52.3									1
2011 Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
2/15/2012				35.5																				1
3/26/2012															39.7									1
4/2/2012															60.2									1
4/28/2012															36.1									1
4/29/2012															47.3									1
2012 Total	0	0	0	1	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	5
2/24/2013	43.5																							1
3/4/2013															47.3									1
3/17/2013															40.1									1
5/26/2013															39									1
12/2/2013															39.8				40.3		38.5			3
12/3/2013										43.2				35.6	38	36.5		38.6	39.6	35.7		37.4		8
2013 Total	1	0	0	0	0	0	0	0	0	1	0	0	0	1	5	1	0	1	2	1	1	1	0	15
3/6/2014	38.2	39.5	36.1																					3
3/7/2014										40.0		38.3			36.4			37.7			36.9	38.7	38.2	7
3/27/2014																	40.2							1
3/30/2014	35.8																							1
4/3/2014															41.2									1
4/27/2014															44.2									1
12/5/2014															37.7									1
2014 Total	2	1	1	0	0	0	0	0	0	1	0	1	0	0	4	0	1	1	0	0	1	1	1	15
Five Year Totals	4	2	1	1	1	3	3	3	1	7	3	4	2	3	30	4	1	3	5	3	5	9	4	102

Monitor not operational or missing data.

2010-2014 $PM_{2.5}$ NAAQS Exceedances

Section 3: 2010-2014 Ozone NAAQS Exceedance Sites and Dates

The table below provides the monitoring sites and dates of ozone exceedances measured in Iowa from 2010-2014. The primary NAAQS utilized 8-hour average ozone values throughout this period. States are required to measure ozone levels during ozone season; in Iowa ozone season runs from April through October. In the table below, 76 ppb has been used as the exceedance level. Exceedances were recorded in Pisgah (downwind of Omaha-Council Bluffs), Emmetsburg, Lake Sugema, Cedar Rapids, Coggon (downwind of Cedar Rapids), Davenport and Clinton.

Monitoring Sites	Pisgah, Highway Maintenance Shed 190851101	Pisgah, Forestry Office 190850007	Emmetsburg, Iowa Lakes College 191471002	Keosauqua, Lake Sugema 191770006	Cedar Rapids, Public Health 191130040	Cedar Rapids, Kirkwood College 191130028	Coggon, Coggon Elementary School 191130033	Davenport, Jefferson School 191630015	Clinton, Rainbow Park 190450021	
Exceedance Date	Concentration (parts per billion)									Count
5/29/2010	77	76								2
2010 Totals	1	1	0	0	0	0	0	0	0	2
2011 Totals	0	0	0	0	0	0	0	0	0	0
5/18/2012									76	1
6/9/2012	76	76								2
6/14/2012				79						1
6/15/2012									77	1
6/27/2012				76						1
7/12/2012	79	80								2
7/17/2012	76									1
7/30/2012								76	76	2
8/1/2012									78	1
8/3/2012					76	76	77			3
8/30/2012	78	77	76							3
2012 Totals	4	3	1	2	1	1	1	1	4	18
2013 Totals	0	0	0	0	0	0	0	0	0	0
2014 Totals	0	0	0	0	0	0	0	0	0	0
Five Year Totals	5	4	1	2	1	1	1	1	4	20

2010-2014 Ozone NAAQS Exceedances

Section 4: 2010-2014 SO_2 NAAQS Exceedance Sites and Dates

The table below provides the monitoring sites and dates of SO_2 exceedances measured in Iowa from 2010 through 2014. Values used to compare to the short-term primary NAAQS were hourly concentrations throughout this period. Concentrations greater than or equal to 75.5 ppb were considered to be exceeding the NAAQS. SO_2 monitors in Iowa sample continuously.

The table below gives the locations and dates of SO_2 exceedances measured in Iowa from 2010-2014. Monitors in Muscatine, Cedar Rapids and Clinton are located near industries that emit SO_2.

Monitoring Site	Clinton, Chancy Park 190450019	Cedar Rapids, Tait Cummins Park 191130041	Muscatine, Greenwood Cemetery 191390016	Muscatine HS, East Campus Trailer 191390019	Muscatine, Musser Park 191390020	
Date	Concentration (ppb)					Count
8/27/2010					96	1
8/28/2010					76	1
8/29/2010					130	1
8/31/2010					123	1
9/5/2010					128	1
9/6/2010					135	1
9/20/2010					121	1
9/23/2010					103	1
10/23/2010					91	1
10/26/2010					134	1
11/21/2010					134	1
12/27/2010					76	1
12/30/2010					168	1
12/31/2010					109	1
1/17/2011					176	1
2/17/2011					195	1
3/16/2011					147	1
3/17/2011					193	1
3/20/2011					96	1
4/3/2011					323	1
4/9/2011					144	1
4/10/2011					77	1
4/30/2011					224	1
5/5/2011					163	1
5/10/2011					112	1
5/21/2011					118	1
5/22/2011					209	1
5/30/2011					290	1
5/31/2011					231	1
6/3/2011					109	1
6/21/2011					96	1
7/9/2011					120	1
8/16/2011					130	1
8/23/2011					171	1

Monitoring Site	Clinton, Chancy Park 190450019	Cedar Rapids, Tait Cummins Park 191130041	Muscatine, Greenwood Cemetery 191390016	Muscatine HS, East Campus Trailer 191390019	Muscatine, Musser Park 191390020	
Date	Concentration (ppb)					Count
9/1/2011					100	1
9/20/2011					131	1
10/6/2011					92	1
10/7/2011					141	1
10/8/2011					103	1
10/25/2011					178	1
11/1/2011					200	1
11/2/2011					199	1
11/5/2011					115	1
11/6/2011					248	1
11/11/2011					110	1
11/12/2011					155	1
11/13/2011					210	1
11/18/2011					130	1
11/19/2011					309	1
11/24/2011					100	1
12/3/2011					234	1
1/3/2012					81	1
1/15/2012					143	1
1/16/2012					156	1
1/18/2012					128	1
2/26/2012			139		250	2
3/6/2012			95		197	2
3/7/2012					213	1
3/12/2012					128	1
3/16/2012			167		139	2
3/17/2012					104	1
3/18/2012					86	1
3/19/2012			104		102	2
3/20/2012			171		108	2
3/22/2012			76			1
3/27/2012					147	1
5/11/2012					77	1
5/18/2012					85	1

Monitoring Site	Clinton, Chancy Park 190450019	Cedar Rapids, Tait Cummins Park 191130041	Muscatine, Greenwood Cemetery 191390016	Muscatine HS, East Campus Trailer 191390019	Muscatine, Musser Park 191390020	
Date	Concentration (ppb)					Count
5/22/2012	76					1
9/11/2012					108	1
10/12/2012				171		1
10/24/2012					131	1
10/25/2012					178	1
11/10/2012					309	1
11/11/2012			79		230	2
11/16/2012				79		1
11/22/2012					121	1
12/3/2012					224	1
12/5/2012				152		1
12/9/2012				126		1
12/12/2012					119	1
12/15/2012					96	1
1/8/2013					101	1
1/10/2013				92		1
1/11/2013					146	1
2/10/2013					119	1
3/3/2013				139		1
3/4/2013				158		1
3/7/2013				157		1
3/8/2013				110		1
3/17/2013				113		1
3/22/2013				136		1
4/5/2013				147		1
4/6/2013					91	1
4/7/2013				223		1
4/14/2013			94	110	179	3
4/20/2013				95		1
4/22/2013					144	1
4/26/2013					76	1
4/29/2013			107		132	2
4/30/2013					89	1
5/13/2013					97	1
5/14/2013					102	1
5/17/2013				91	87	2
5/19/2013					79	1
5/27/2013				76		1
5/29/2013					189	1
5/30/2013			105		237	2
5/31/2013					133	1
6/4/2013				199		1
6/5/2013				110		1
6/9/2013					96	1
6/14/2013				87		1
6/20/2013			84			1
6/21/2013				122	95	2
6/22/2013					159	1
7/13/2013				92		1
7/29/2013				96		1
8/17/2013				165		1
8/20/2013					103	1
8/25/2013					151	1
9/3/2013				161	77	2
9/6/2013				96	103	2
9/8/2013				147		1
9/17/2013				109		1
9/23/2013				110		1
9/24/2013				89		1
9/27/2013					95	1
9/28/2013					150	1
9/30/2013					77	1
10/3/2013					100	1
10/4/2013					81	1
10/11/2013			82		129	2
10/12/2013					90	1
10/14/2013				138		1
11/4/2013					156	1

Monitoring Site	Clinton, Chancy Park 190450019	Cedar Rapids, Tait Cummins Park 191130041	Muscatine, Greenwood Cemetery 191390016	Muscatine HS, East Campus Trailer 191390019	Muscatine, Musser Park 191390020	
Date	Concentration (ppb)					Count
11/5/2013					111	1
11/8/2013					131	1
11/16/2013					184	1
12/2/2013				125		1
1/3/2014		87			92	2
1/12/2014					146	1
1/29/2014		122				1
3/26/2014		95	121		76	3
3/27/2014					193	1
3/30/2014			82		170	2
3/31/2014		113			204	2
4/12/2014					88	1
4/17/2014					93	1
4/18/2014				111		1
4/19/2014				140		1
4/23/2014				148		1
4/24/2014				236	94	2
4/27/2014				200		1
5/6/2014				202		1
5/7/2014					108	1
5/19/2014			98		159	2
6/1/2014					77	1
6/6/2014			88			1
6/14/2014			116		77	2
6/15/2014			169		119	2
6/16/2014			107		131	2
6/17/2014					76	1
6/27/2014			83		113	2
6/28/2014					95	1
6/30/2014					104	1
7/20/2014			94		81	2
7/21/2014			117			1
7/22/2014		78			82	2
7/25/2014		79			84	2
8/7/2014				118		1
8/18/2014					87	1
8/28/2014				113		1
8/29/2014					81	1
8/31/2014		93	125			2
9/3/2014		166	112		180	3
9/4/2014		183			231	2
9/8/2014					105	1
9/9/2014					92	1
9/19/2014		99			101	2
9/22/2014				109		1
10/1/2014				117		1
10/12/2014				112		1
10/23/2014			88			1
10/27/2014			110		79	2
11/2/2014			109		167	2
11/3/2014					159	1
11/7/2014					125	1
11/9/2014					93	1
11/10/2014					124	1
11/18/2014					78	1
11/22/2014					99	1
11/23/2014					76	1
12/25/2014			100			1
12/26/2014					104	1

Monitor not operational or missing data.

Monitoring Site	Cedar Rapids, Tait Cummins Park 191130041	Muscatine, Greenwood Cemetery 191390016[57]	Muscatine, Muscatine HS, East Campus Trailer 191390019[58]	Muscatine, Musser Park 191390020[59]	Clinton, Chancy Park 190450019	Group Yearly Total
2010 Totals[60]				14	0	**14**
2011 Totals				37	0	**37**
2012 Totals		7	4	25	1	**37**
2013 Totals		5	28	34	0	**67**
2014 Totals	10	16	11	39	0	**76**
Five Year Total	**10**	**28**	**43**	**149**	**1**	**231**

Monitor not operational or missing data.

Total SO_2 Exceedances for 2010-2014

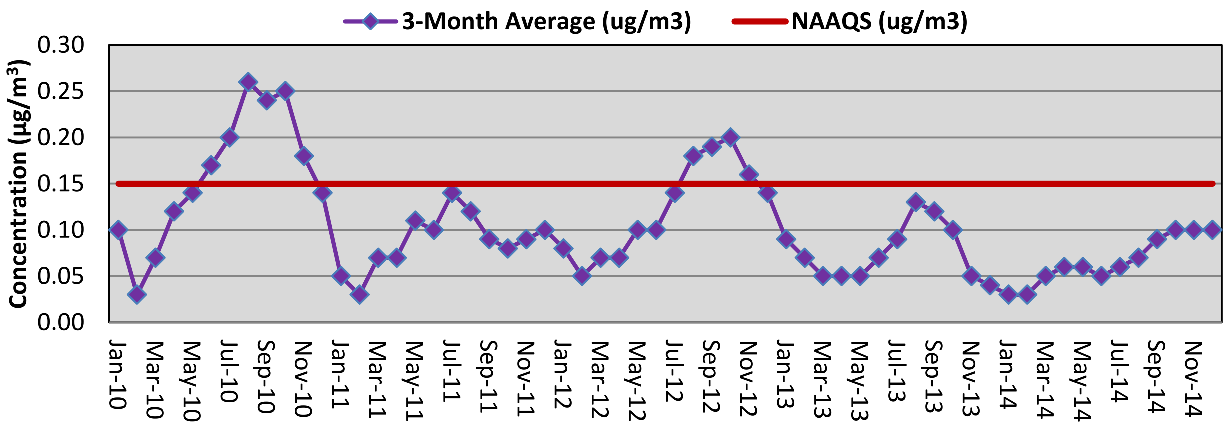
[57] Began operating on 1/1/2012.
[58] Began operating on 8/1/2012.
[59] Data was invalided from 9/30/2008 through 8/20/2010 due to a failed EPA audit. Details are on page 27 in the 2010 criteria pollutant report: http://www.iowadnr.gov/Portals/idnr/uploads/air/insidednr/monitoring/10ambient.pdf.
[60] The DNR began counting exceedances when the one-hour SO_2 standard went into effect in August 2010.

Section 5: 2010-2014 Lead NAAQS Exceedance Sites and Dates

The table below provides the monitoring sites and dates of lead exceedances measured in Iowa from 2010 through 2014. Throughout this period, the lead NAAQS did not change. A rolling three-month average of 0.155 µg/m^3 or greater was counted as an exceedance. Lead monitors sample on a 1 in 3 day schedule. The only lead monitoring site in Iowa as of January 2015 is located in Council Bluffs near Griffin Pipe Products and Alter Metal Recycling.

Lead differs from other criteria pollutants in that a single exceedance equates to a NAAQS violation. Six lead exceedances were recorded in 2010. Concentrations went down in 2011, but again exceeded the NAAQS four times in 2012.

Council Bluffs, Griffin Pipe[61] Rolling Three Month Average Concentrations



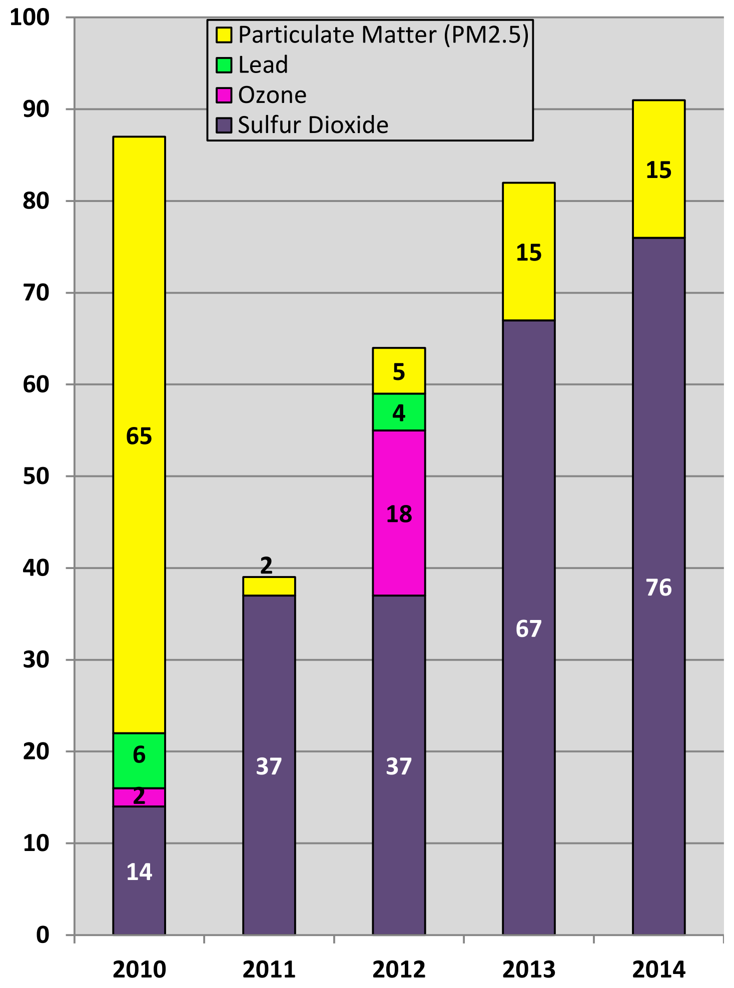
Monitoring Site	Council Bluffs, Griffin Pipe 191550011	
Exceedance Date	Concentration (micrograms per cubic meter)	Count
April-June	0.17	1
May-July	0.2	1
June-August	0.26	1
July-September	0.24	1
August-October	0.25	1
September-November	0.18	1
2010 Total	6	6
2011 Total	0	0
June-August	0.18	1
July-September	0.19	1
August-October	0.2	1
September-November	0.16	1
2012 Total	4	4
2013 Total	0	0
2014 Total	0	0
Five Year Total	10	10

2010-2014 Lead NAAQS Exceedances

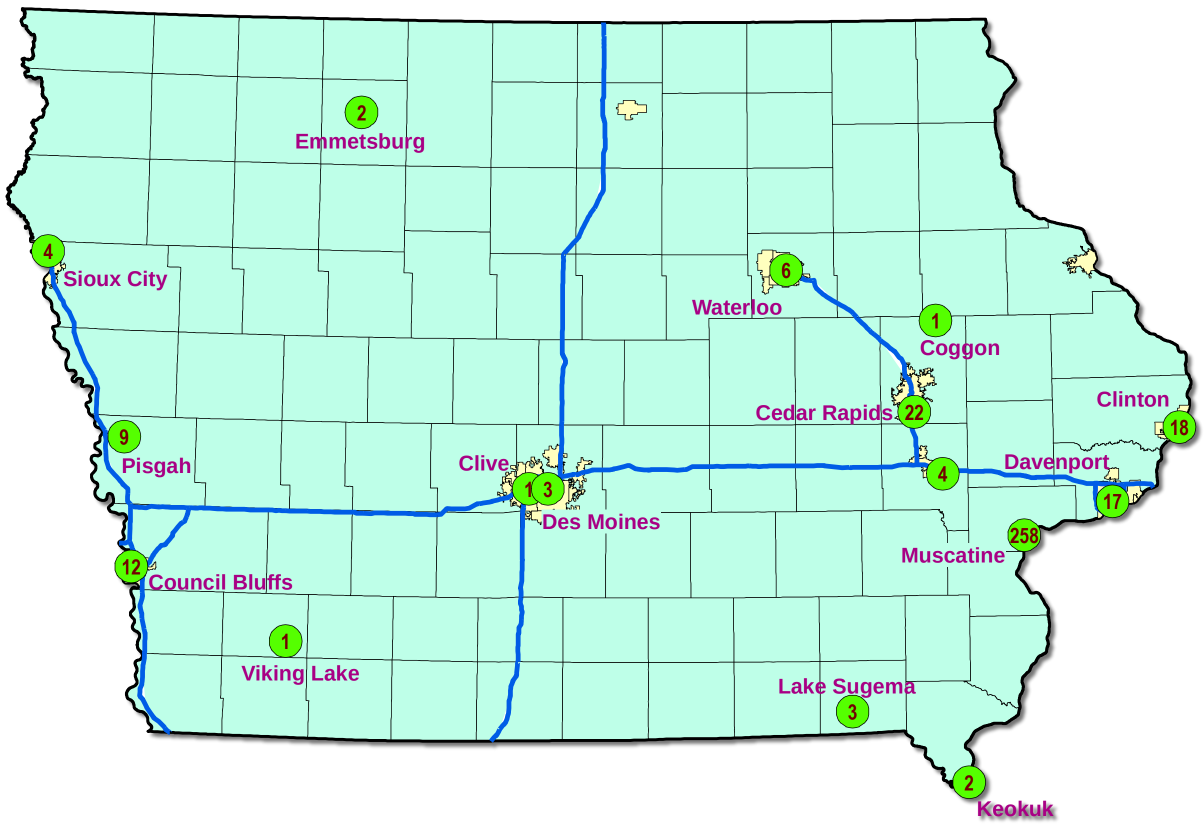
[61] The Council Bluffs lead monitoring site began operations in November 2009, so that a complete three month rolling average could be established for January 2010 and thereafter.

Section 6: Number and Location of NAAQS Exceedances from 2010 to 2014

The number of NAAQS exceedances in Iowa from 2010 to 2014 for the different NAAQS pollutants are shown in the chart below (left). The map (right) indicates the location where the exceedances were measured. SO_2 exceedances comprise the majority of the exceedance count, and most of these were recorded in Muscatine, Iowa. Note that the number of exceedances recorded for a city will depend on the number of monitors in the city and the frequency at which particulate samplers in the city are operated.



Number of NAAQS Exceedances by Pollutant Type: 2010-2014



Location of NAAQS Exceedances: 2010-2014

Appendix I: NAAQS Violations and Design Values

Table of Contents

Section 1: Summary

In recent years, ambient air monitoring data gathered in Iowa has shown concentrations that are considerably less than the NAAQS for criteria pollutants over most of the state with the exception of lead, PM_{10}, $PM_{2.5}$, ozone and SO_2 near some industrial sources.[62] Appendix H provides information concerning NAAQS exceedances in Iowa for the past five years of certified monitoring data. A NAAQS exceedance is not the same as a NAAQS violation. Multiple exceedances of the NAAQS may occur at a monitoring site without violating the NAAQS. (A more precise description of the process used to establish NAAQS violations for PM_{10}, $PM_{2.5}$ and ozone monitoring data is indicated below.) When a NAAQS exceedance occurs at a monitoring site, air pollutant levels have exceeded the threshold for adverse health effects. When a NAAQS violation is recorded at a monitoring site, the State acquires additional authority under the provision of the Clean Air Act[63] to address the air quality problem around the monitor. These measures may include modifications to the State's permitting program that apply to industries with emissions that contribute to the monitored violation.[64]

The 24-hour PM_{10} NAAQS is violated at a monitoring site if the three year average of the annual number of expected exceedances is greater than one (1.05 or greater).[65] A PM_{10} NAAQS exceedance occurs when a 24-hour PM_{10} concentration is 155 $\mu g/m^3$ or greater. The annual number of expected exceedances for a given year is obtained by adding the quarterly expected exceedances for the four quarters of that year. The quarterly expected exceedances are obtained by dividing the number of exceedances in a particular quarter by the data capture rate for that quarter. Agencies typically adopt a daily sampling schedule at a PM_{10} monitoring location where an exceedance is measured and additional exceedances are likely. Owing to the form of the NAAQS, any monitoring site that records four exceedances in three years will violate the standard. A monitoring site that records three exceedances in three years is also quite likely to violate the standard, as data capture rates exceeding 95% are difficult to achieve with a filter sampler. In Iowa, over the past five years, no PM_{10} monitoring sites have recorded violations of the PM_{10} NAAQS.

For $PM_{2.5}$, ozone and other criteria pollutants, a number called the design value is computed from three years of monitoring data to compare the air quality at a monitoring site to the NAAQS.[66,67] The 8-hour design value for ozone is the annual fourth-highest daily maximum 8-hour ozone concentration

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[62] Appendix H of this document contains a discussion of the NAAQS exceedances that have occurred in Iowa over the past five years. The department publishes an annual report which catalogs the maximum values recorded at every monitoring site in the Iowa network. The report also indicates all NAAQS exceedances and the monitoring locations where they were measured. These reports are available under the heading: Ambient Air Monitoring Data Reviews at: http://www.iowadnr.gov/InsideDNR/RegulatoryAir/MonitoringAmbientAir.aspx.

[63] See the Clean Air Act requirements for non-attainment areas in U.S. Code Title 42, Chapter 85, Subchapter I, Part D, available online at: http://www.law.cornell.edu/uscode/html/uscode42/usc_sup_01_42_10_85_20_I_30_D.html.

[64] See the description of permitting requirements in non-attainment areas in 40 CFR 51.165, available on line at: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=5f2b25d1de7e11a0da1dbe1ebd0ce9a1&rgn=div8&view=text&node=40:2.0.1.1.2.6.8.6&idno=40.

[65] Procedures for calculating PM_{10} attainment status from three years of monitoring data are contained in 40 CFR Part 50, Appendix K, available online at: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=6b34e2fa35ba704797138c975ffdd4b5&tpl=/ecfrbrowse/Title40/40cfr50_main_02.tpl.
Note that the procedure described in the text for establishing violations of the PM_{10} NAAQS is somewhat descriptive and does not apply in certain special cases.

[66] Procedures for calculating design values for $PM_{2.5}$ and Ozone are contained in 40 CFR Part 50, Appendices N and P available online at: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=6b34e2fa35ba704797138c975ffdd4b5&tpl=/ecfrbrowse/Title40/40cfr50_main_02.tpl.

[67] Design values for this report have been calculated by the department. When data capture at a monitoring site is poor, EPA has discretion in application of some of the data handling rules in the computation of design values. Official design values are calculated by the EPA and are available online at: http://epa.gov/airtrends/values.html.

averaged over three years. The $PM_{2.5}$ 24-hour design value is the annual 98^{th} percentile 24-hour value averaged over three years. The $PM_{2.5}$ annual design value is the annual mean 24-hour value averaged over three years.

Based on the most recent three year period (2012-2014) median design values for ozone in the Iowa network are 84% of the ozone NAAQS, median $PM_{2.5}$ 24-hour design values are 65% of the $PM_{2.5}$ 24-hour NAAQS, and median $PM_{2.5}$ annual design values are 79% of the $PM_{2.5}$ annual NAAQS.

For the most recent three-year period (2012-2014), NAAQS violations have been recorded at SO_2 monitors in Muscatine (Musser Park and Greenwood Cemetery sites) and at a lead monitor in Council Bluffs (Griffin Pipe).

Sections 2 - 4 examine the ozone and $PM_{2.5}$ design values over the five year period from 2010 to 2014.

Sections 5 - 6 examine the (new) one-hour SO_2 and NO_2 design values for the period 2010 to 2014.

Section 7 examines the lead design values over the period from 2010 to 2014.

Section 2: Ozone Design Values

Trends in ozone design values for the period 2010-2014 are indicated below. Based on the available data the median ozone design value in the Iowa ozone network rose by 1 ppb (1.6%) over the past five years. The largest increase (6 ppb) was recorded by a monitor in Des Moines at the Health Department on Carpenter. Eighteen (18) NAAQS violations were recorded in 2012.

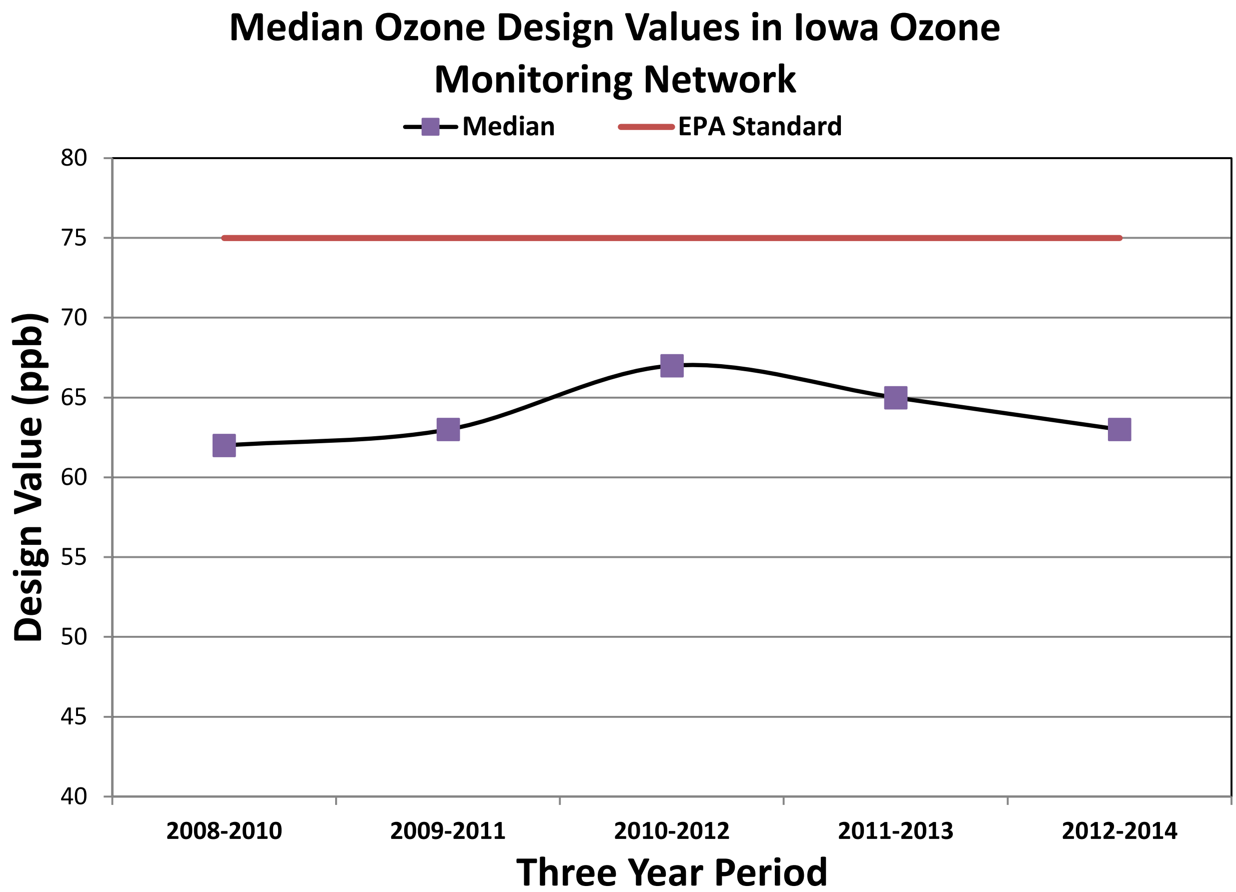
The most recent (2012-2014) monitoring data shows design values across the State ranged from 62 to 67 ppb, with a median value of 63 ppb.

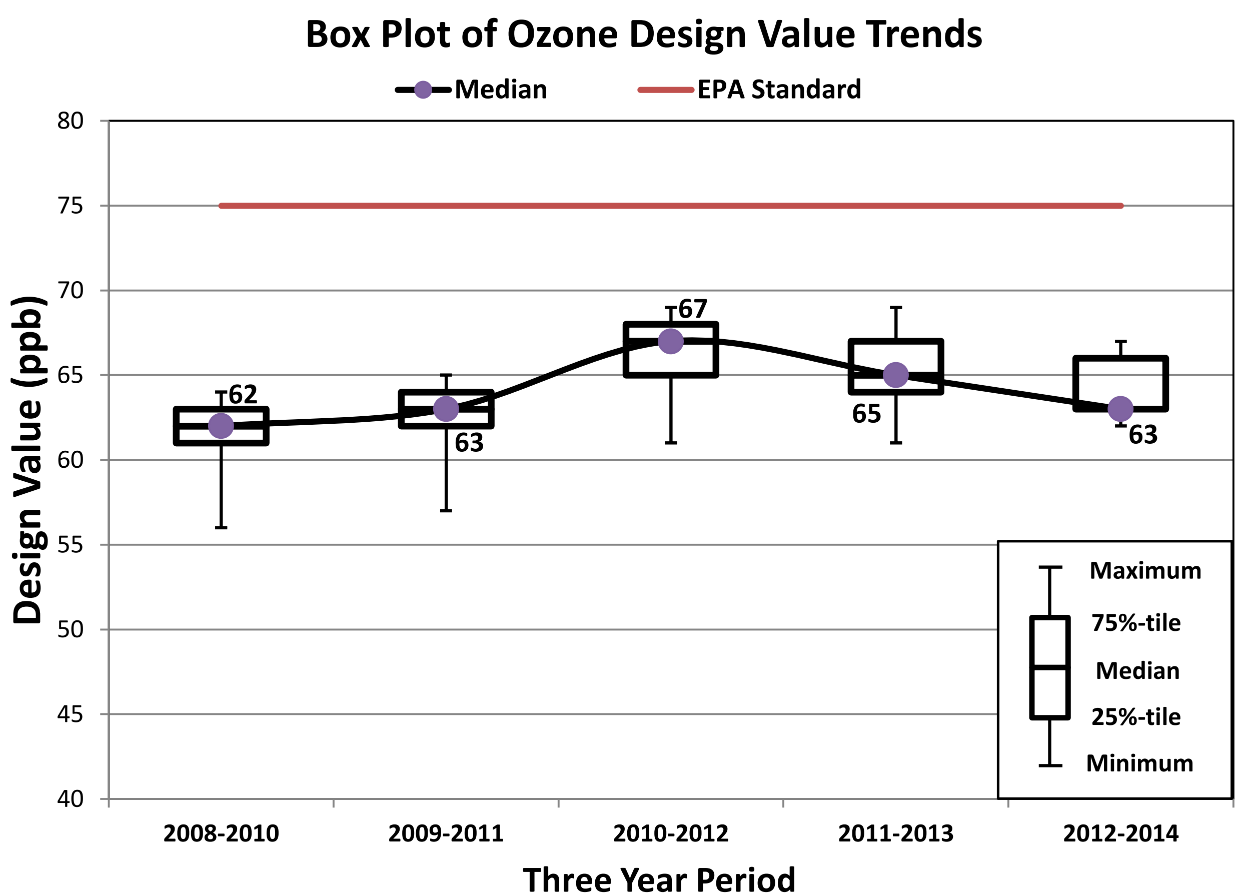
2010 – 2014 Ozone Design Values (ppb)

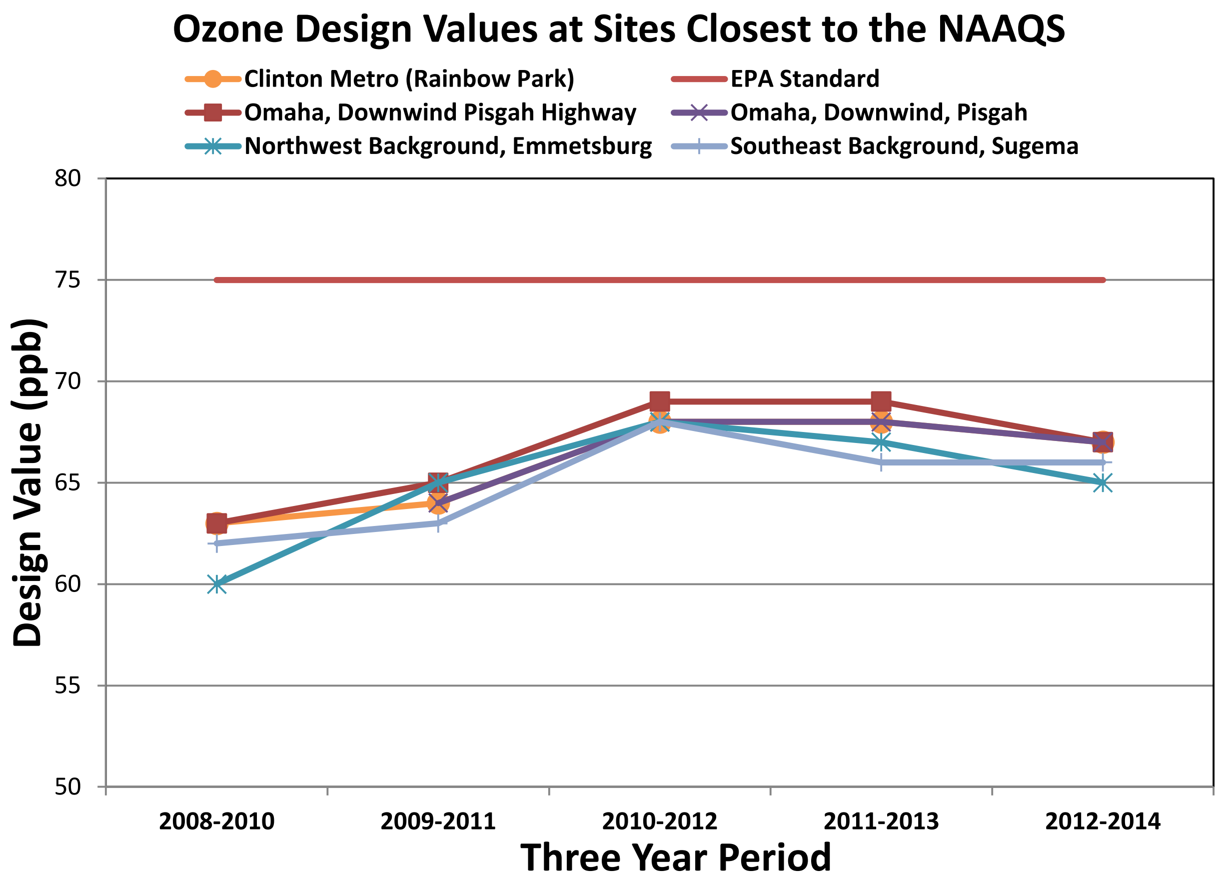
Three Year Period	Omaha-Council Bluffs Downwind Pisgah, Forestry Office	Omaha-Council Bluffs Downwind (Pisgah, Highway Maintenance Shed)	Southwest Background (Viking Lake State Park)	Northwest Background (Emmetsburg, Iowa Lakes Community College)	Des Moines Upwind (Indianola, Lake Ahquabi State Park)	Des Moines Metro (Des Moines, Health Department)	Des Moines Downwind (Slater, Elementary/City Hall)	Cedar Rapids Upwind (Cedar Rapids, Kirkwood College)	Cedar Rapids Metro (Cedar Rapids, Public Health)	Cedar Rapids Downwind (Coggon Elementary School)	Waterloo Downwind (Waverly, Airport)	Southeast Background (Lake Sugema)	Davenport Metro (Davenport, Jefferson School)	Davenport Downwind (Scott County Park)	Clinton Metro (Clinton, Rainbow Park)
2008-2010		63	62	60	61	56	58	62		62	62	62	64	63	63
2009-2011	64	65	64	65	62	57	60	62	61	63	63	63	65	63	64
2010-2012	68	69	67	68	65	61	62	66	64	65	65	68	67		68
2011-2013	68	69	65	67	64	61	62	65	63	64	64	66	66		68
2012-2014	67	67	63	65	63	62	62	63	62	63	63	66	63		67

Invalid Design Value (Site was not operational or data did not meet completeness requirements.)

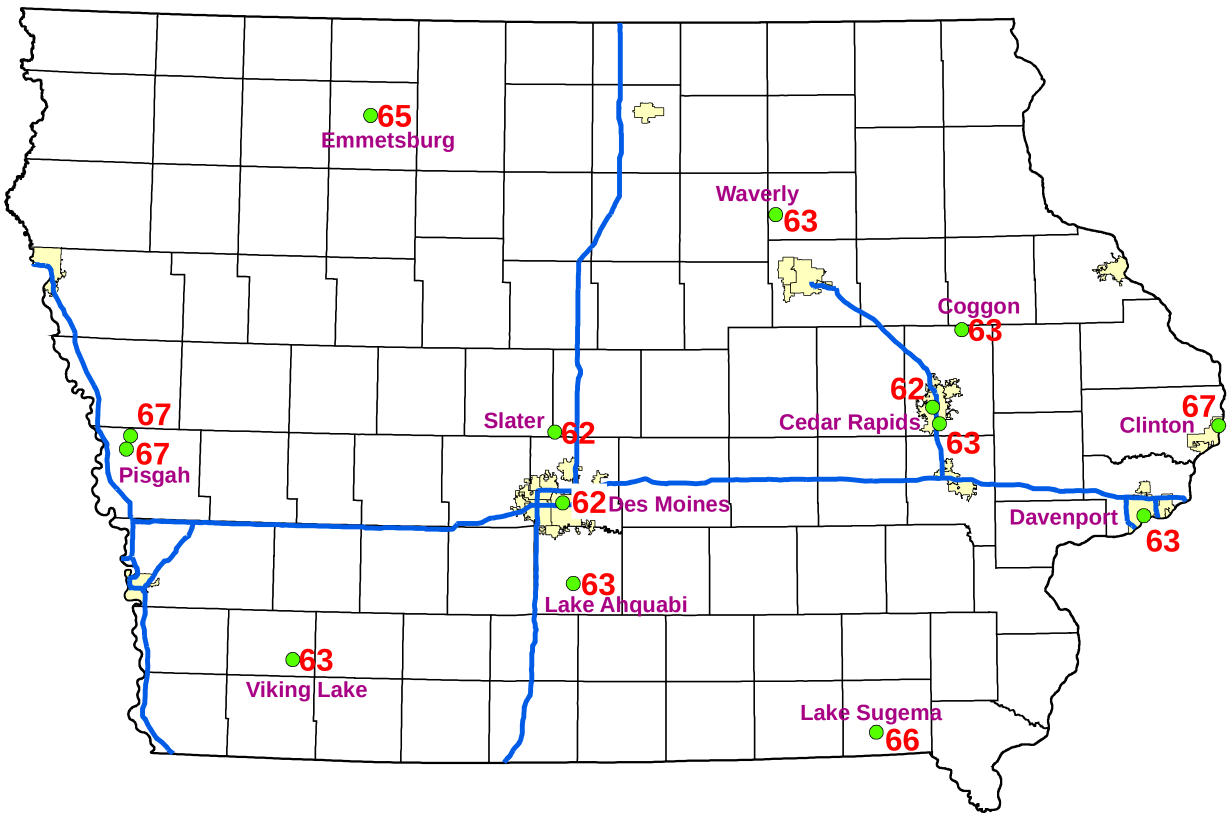
Current NAAQS is 75 ppb.


Median Ozone Design Values in Iowa Ozone Monitoring Network
Median
EPA Standard
80
75
70
65
60
55
50
45
40
Design Value (ppb)
2008-2010
2009-2011
2010-2012
2011-2013
2012-2014
Three Year Period

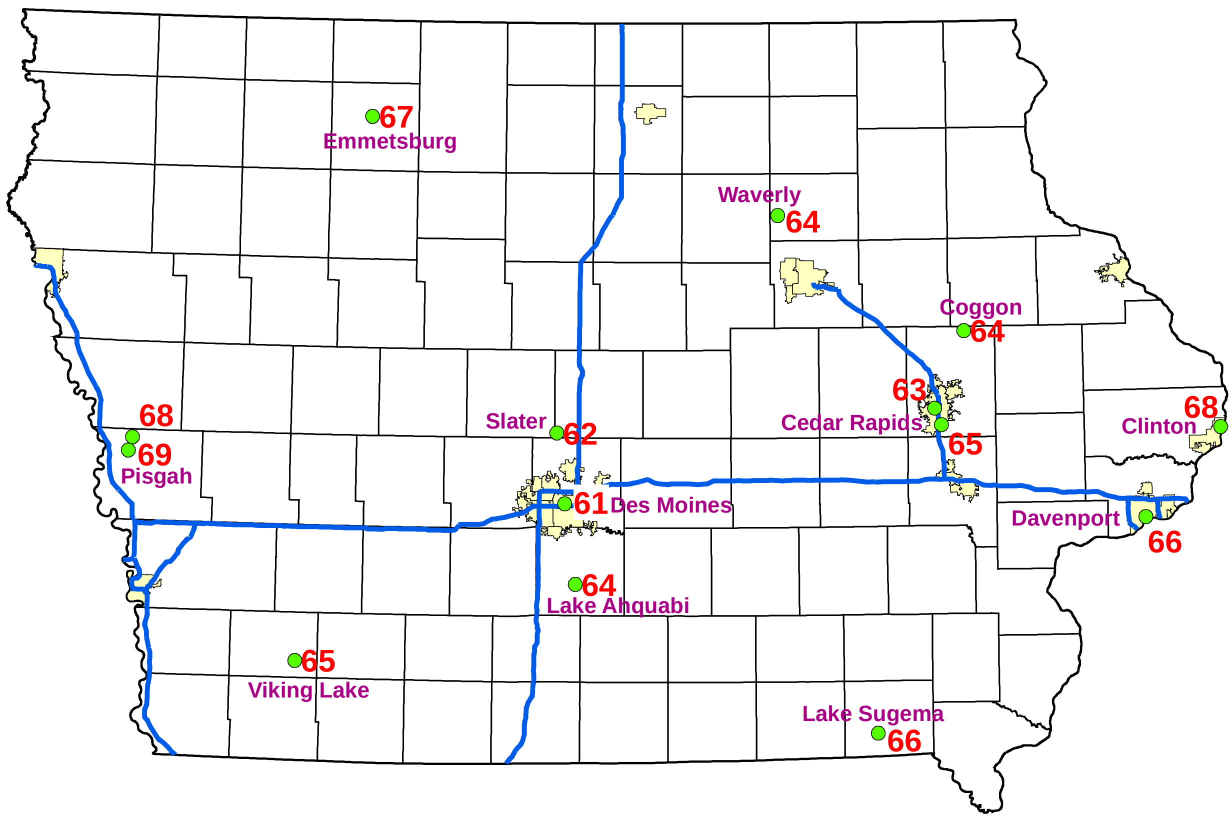

Box Plot of Ozone Design Value Trends
Median
EPA Standard
80
75
70
65
60
55
50
45
40
Design Value (ppb)
62
63
67
65
63
Maximum
75%-tile
Median
25%-tile
Minimum
2008-2010
2009-2011
2010-2012
2011-2013
2012-2014
Three Year Period


Ozone Design Values at Sites Closest to the NAAQS
Clinton Metro (Rainbow Park)
EPA Standard
Omaha, Downwind Pisgah Highway
Omaha, Downwind, Pisgah
Northwest Background, Emmetsburg
Southeast Background, Sugema
Design Value (ppb)
80
75
70
65
60
55
50
2008-2010
2009-2011
2010-2012
2011-2013
2012-2014
Three Year Period

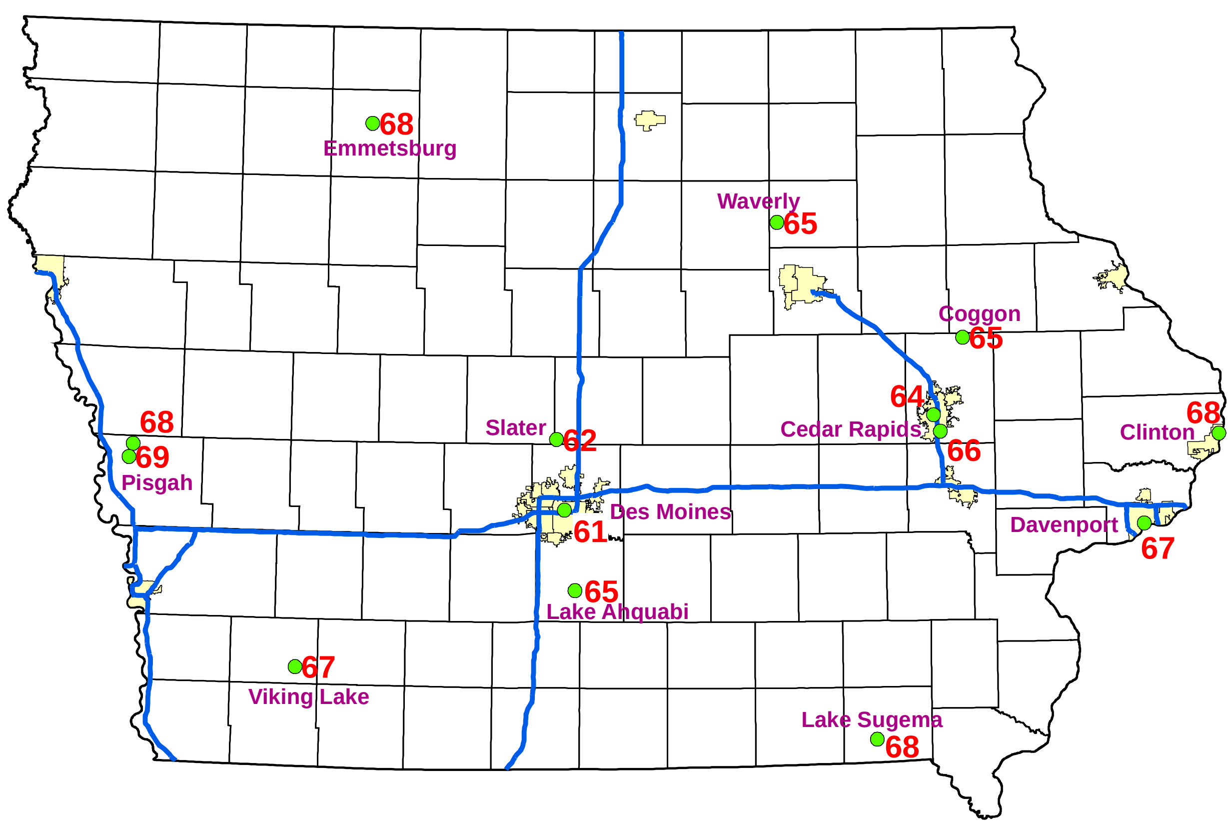
Ozone design value maps for the past five years are shown below. Three years of complete data are required to compute a design value, and only sites with complete data are indicated. Ozone levels near Des Moines, Iowa tend to be the lowest in the network. The most recent (2012-2014) data shows ozone levels at monitoring sites in Palo Alto County, Harrison County and Clinton County to be the highest in the network.



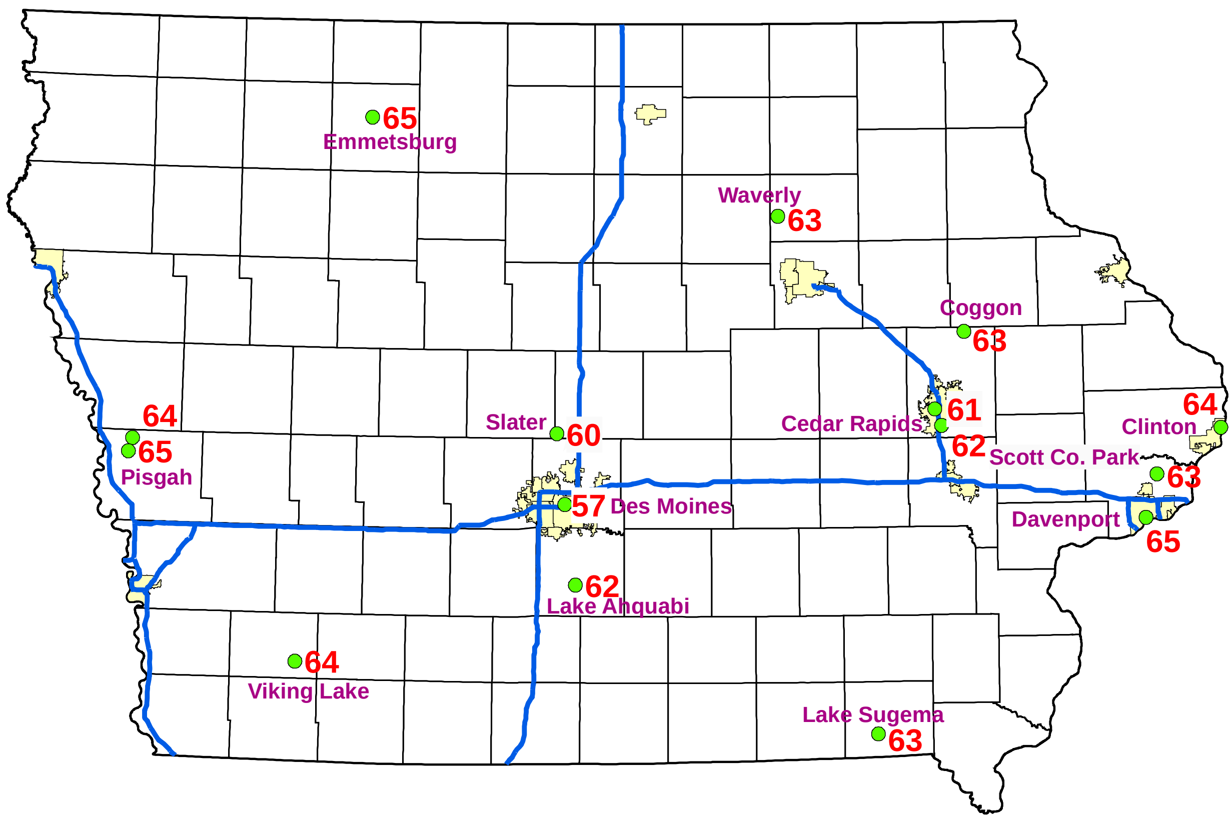
2012-2014 Ozone Design Values (ppb)



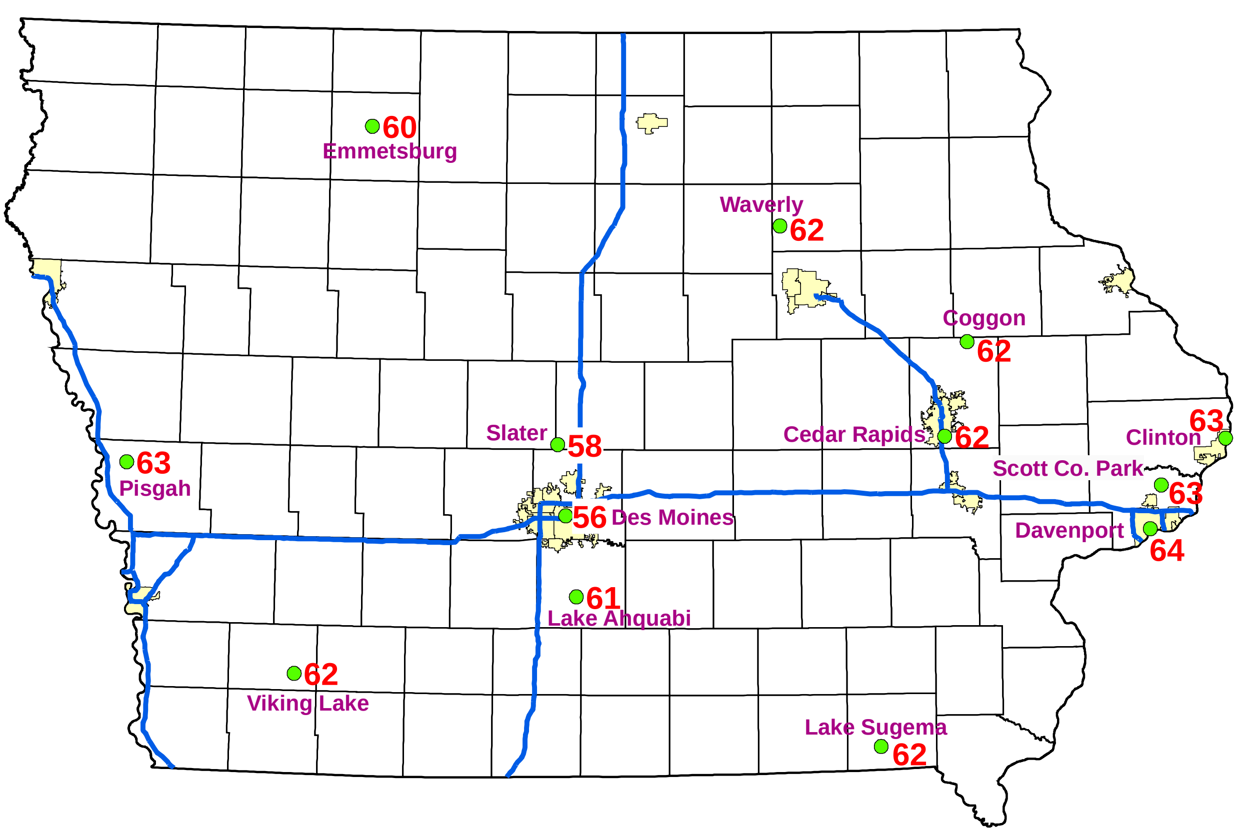
2011-2013 Ozone Design Values (ppb)



2010-2012 Ozone Design Values (ppb)



2009-2011 Ozone Design Values (ppb)



2008-2010 Ozone Design Values (ppb)

Section 3: $PM_{2.5}$ 24-Hour Design Values

Trends and maps of $PM_{2.5}$ 24-hour design values for the period 2010-2014 are provided below. Charts of these trends for cities with monitoring sites that are closest to the standard are also provided. The median $PM_{2.5}$ 24-hour design value in the Iowa $PM_{2.5}$ network has fallen by 6 µg/m³ or about 21% over the past five years. During the five year period, one violation of the NAAQS was recorded at Muscatine, High School East Campus (191390015) for the period 2008-2010.

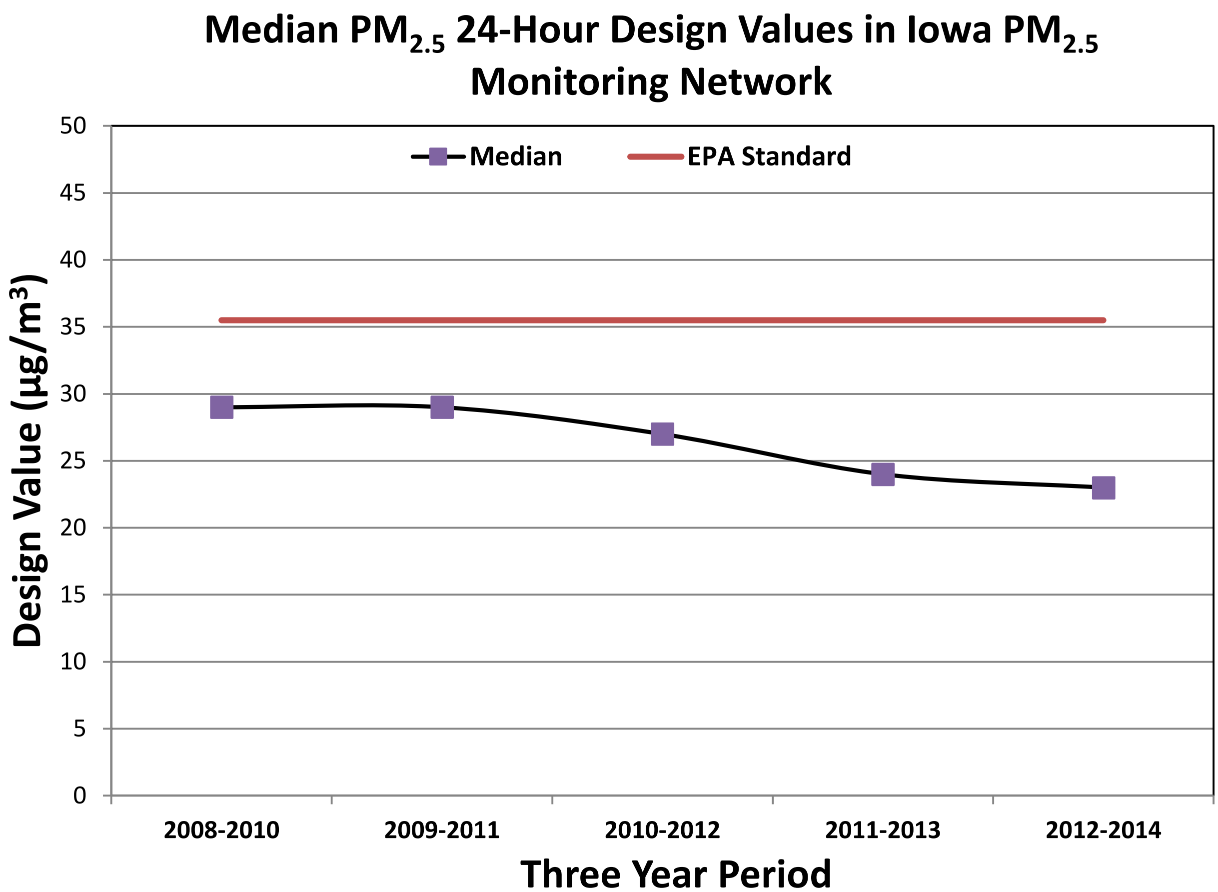
The most recent (2010-2014) monitoring data shows design values ranging from 20 to 29 µg/m³, with a median value of 23 µg/m³. There are three monitoring sites located in Eastern Iowa cities that are influenced by industrial $PM_{2.5}$ emitters. A monitor at Chancy Park (next to the Archer Daniels Midland Plant) in Clinton recorded levels that were 27% less than violation levels. Monitors at Muscatine High School East Campus and Musser Park (both about a quarter mile from Grain Processing Corporation) in Muscatine recorded levels about 18% and 24% under the violation level respectively.

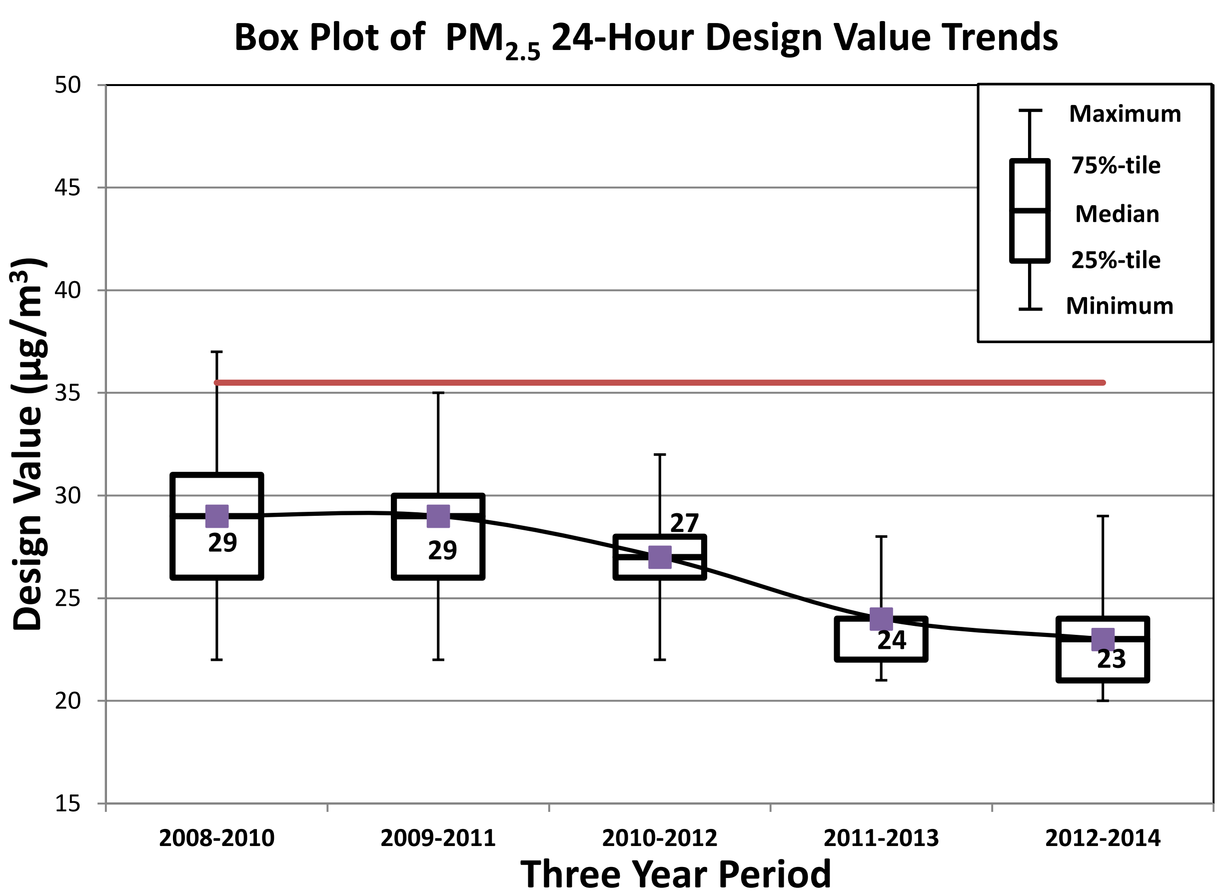
$PM_{2.5}$ 24-Hour Design Values 2010-2014 (µg/m³)

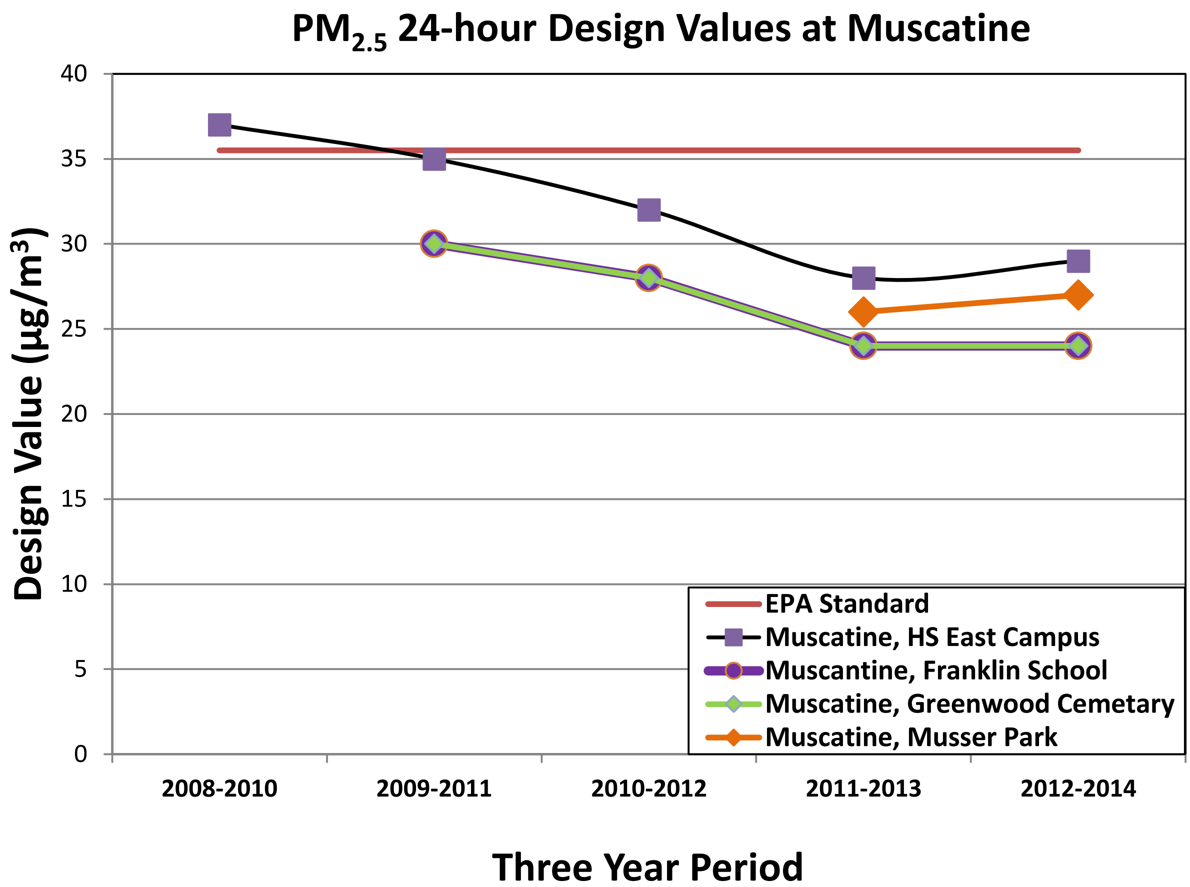
Three Year Period	Sioux City, Bryant School 191930019	Council Bluffs, Franklin School 191550009	Viking Lake State Park 191370002	Emmetsburg, Iowa Lakes Community College 191471002	Clive, Indian Hills School 191532510	Des Moines, Health Building 191530030	Waterloo, Grout Museum 190130008	Waterloo, Water Tower 190130009	Lake Sugema 191770006	Cedar Rapids, Linn County Public Health 191130040	Cedar Rapids, Army Reserve 191130037	Backbone State Park 190550001	Iowa City, Hoover School 191032001	Keokuk, Fire Station 191110008	Muscatine, Greenwood Cemetery 191390016	Muscatine, High School E. Campus 191390015	Muscatine, Franklin School 191390018	Muscatine, Musser Park 191390020	Davenport, Hayes School 191630020	Davenport, Blackhawk Foundry 191630019	Davenport, Adams School 191630018	Davenport, Jefferson School 191630015	Clinton, Chancy Park 190450019	Clinton, Rainbow Park 190450021
2008-2010		25	22	22	28	26	31		26	31	31		29	26		37				32	29	29	31	30
2009-2011	27	25	22	23	27	26	29	29	25	30	30		28	26	30	35	30			31	29	29	30	29
2010-2012	27	27	23	22	25	25		27	25	27			27	26	28	32	28		27	29	28	27	28	28
2011-2013	23	24	21	22	21	22		21	21	24		22	23	24	24	28	24	26	25	26	24	24	25	24
2012-2014	24	24	20	21	20	21		21	20	23		21	22	24	24	29	24	27	26		23	23	26	23

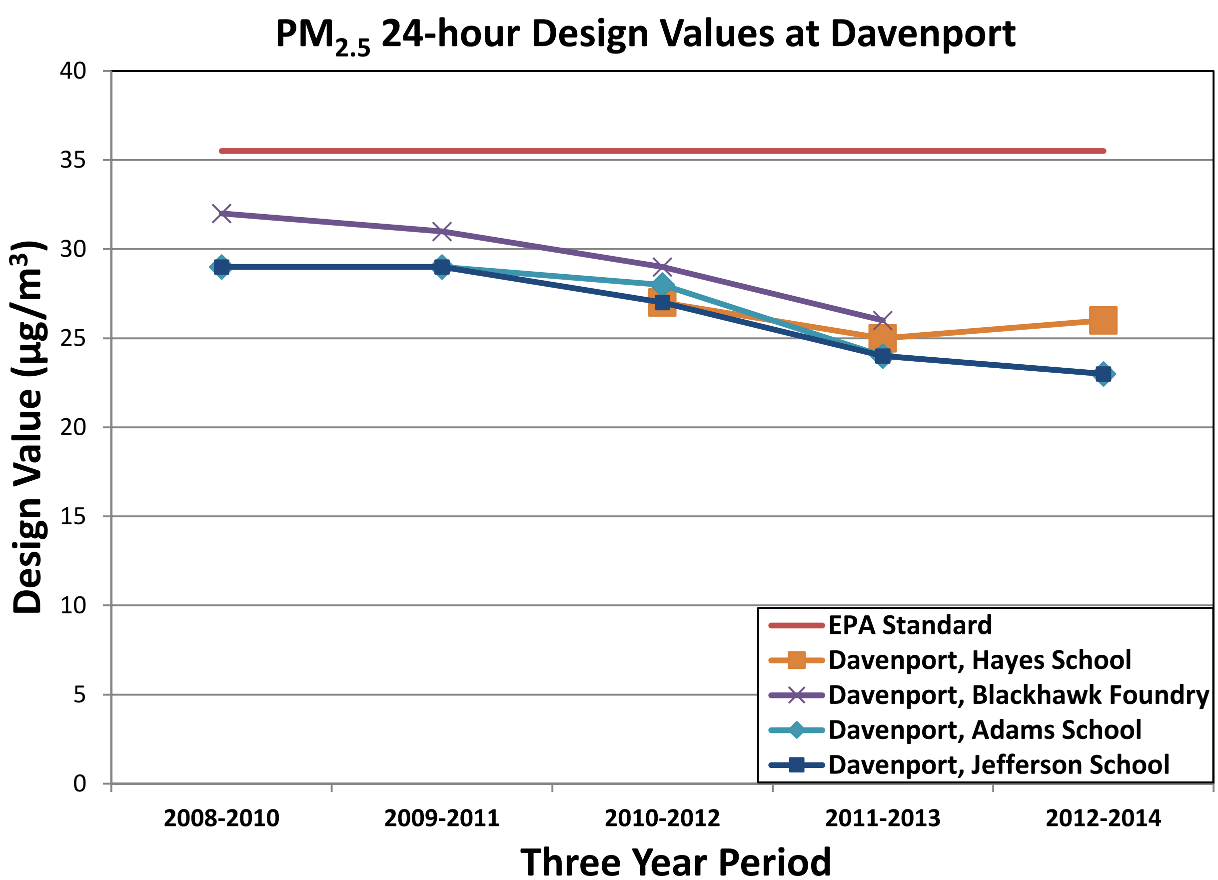
Invalid Design Value (Site was not operational or data did not meet completeness requirements.)

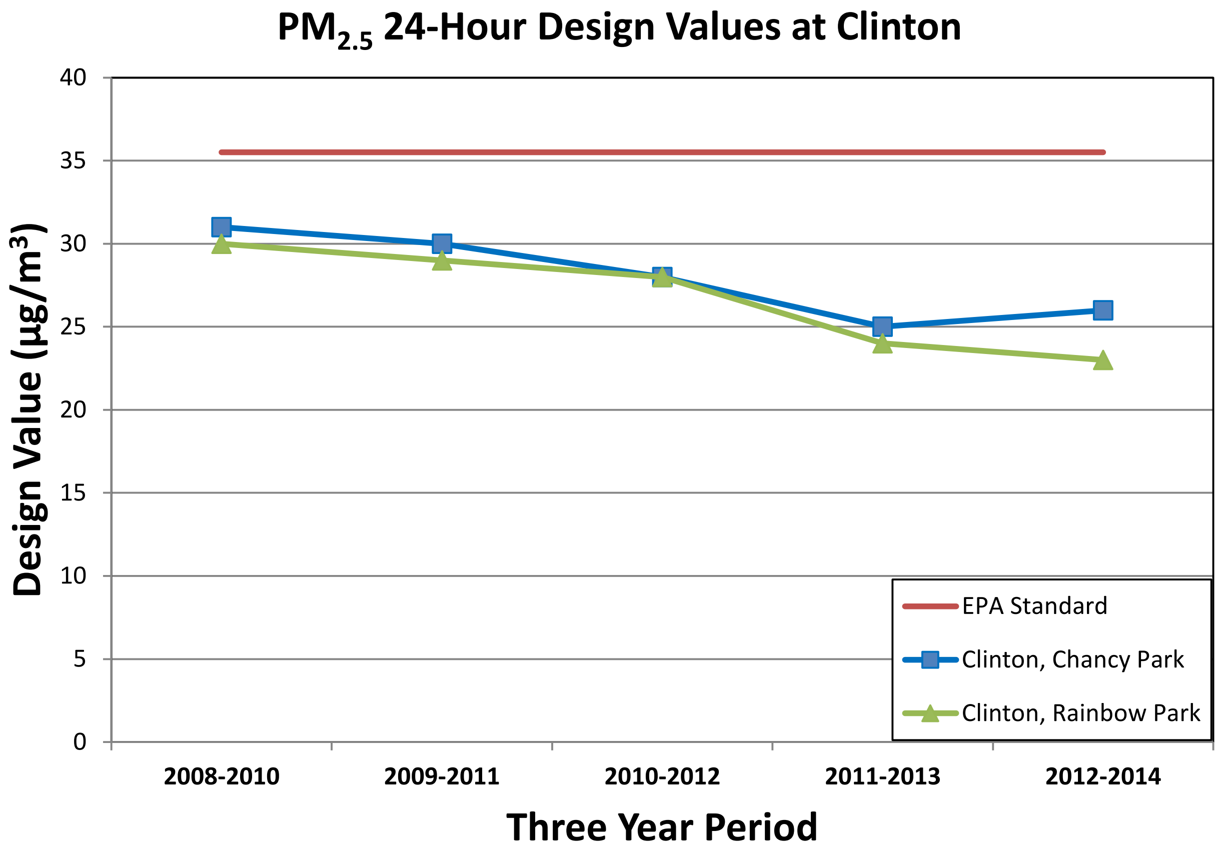
Current NAAQS is 35 µg/m³.


Median $PM_{2.5}$ 24-Hour Design Values in Iowa $PM_{2.5}$ Monitoring Network
Median
EPA Standard
Design Value (µg/m³)
50
45
40
35
30
25
20
15
10
5
0
2008-2010
2009-2011
2010-2012
2011-2013
2012-2014
Three Year Period

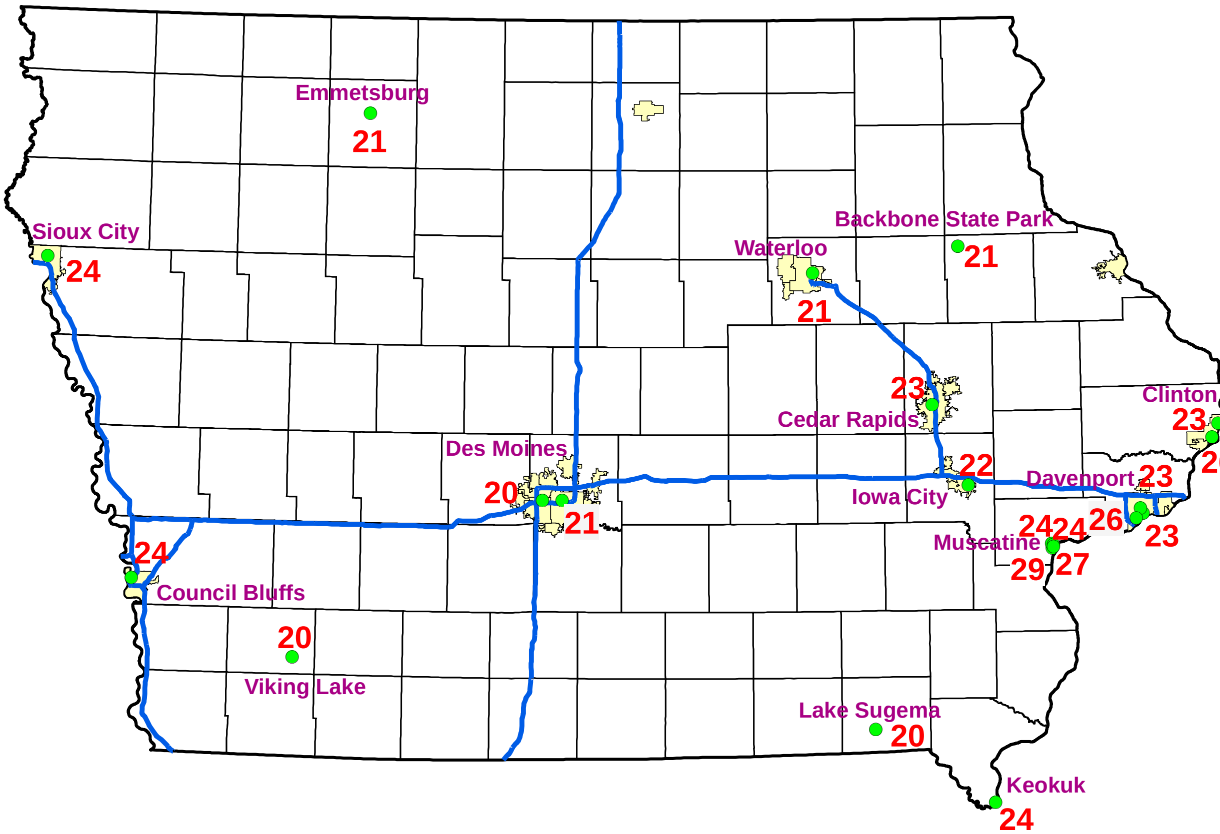

Box Plot of $PM_{2.5}$ 24-Hour Design Value Trends
Maximum
75%-tile
Median
25%-tile
Minimum
Design Value (µg/m³)
50
45
40
35
30
25
20
15
29
29
27
24
23
2008-2010
2009-2011
2010-2012
2011-2013
2012-2014
Three Year Period


PM2.5 24-hour Design Values at Muscatine
Design Value (µg/m3)
40
35
30
25
20
15
10
5
0
2008-2010
2009-2011
2010-2012
2011-2013
2012-2014
Three Year Period
EPA Standard
Muscatine, HS East Campus
Muscantine, Franklin School
Muscatine, Greenwood Cemetary
Muscatine, Musser Park

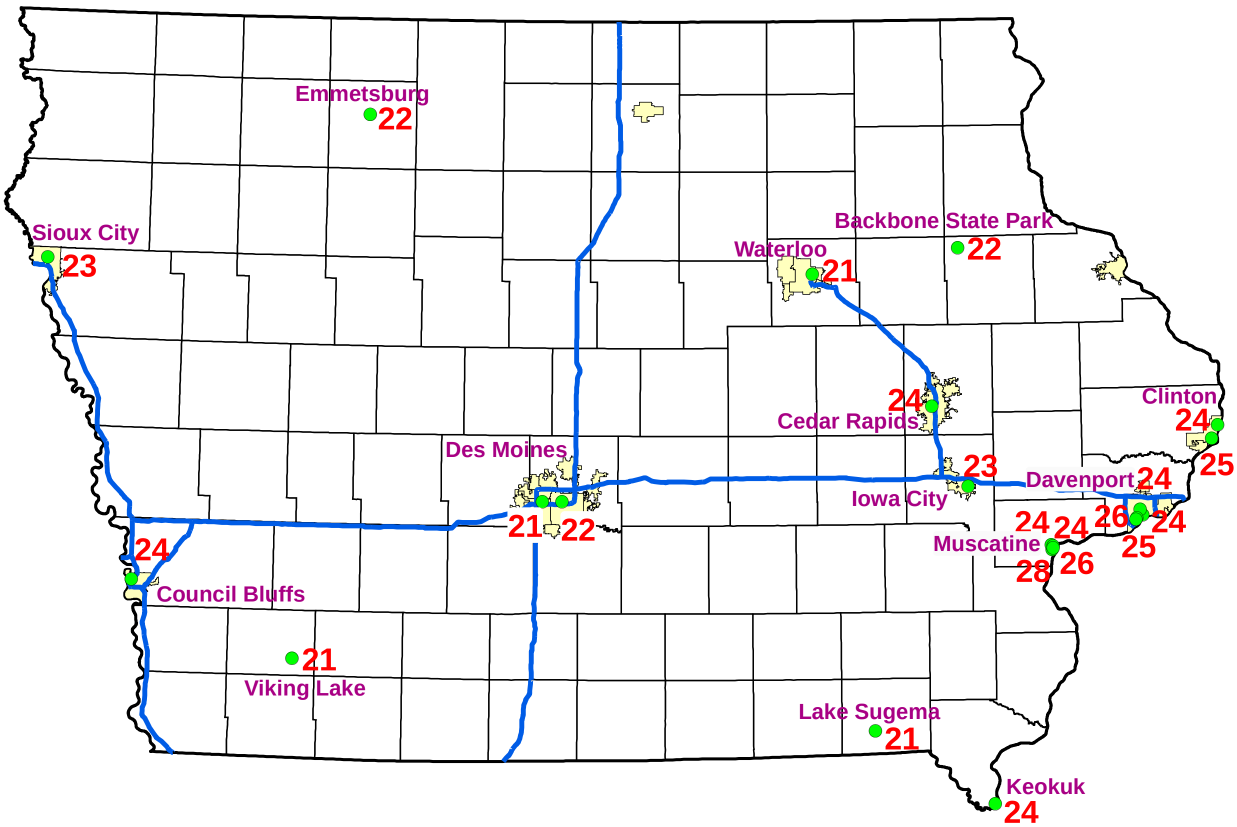

PM2.5 24-hour Design Values at Davenport
Design Value (µg/m3)
40
35
30
25
20
15
10
5
0
2008-2010
2009-2011
2010-2012
2011-2013
2012-2014
Three Year Period
EPA Standard
Davenport, Hayes School
Davenport, Blackhawk Foundry
Davenport, Adams School
Davenport, Jefferson School


PM2.5 24-Hour Design Values at Clinton
Design Value (µg/m3)
40
35
30
25
20
15
10
5
0
2008-2010
2009-2011
2010-2012
2011-2013
2012-2014
Three Year Period
EPA Standard
Clinton, Chancy Park
Clinton, Rainbow Park

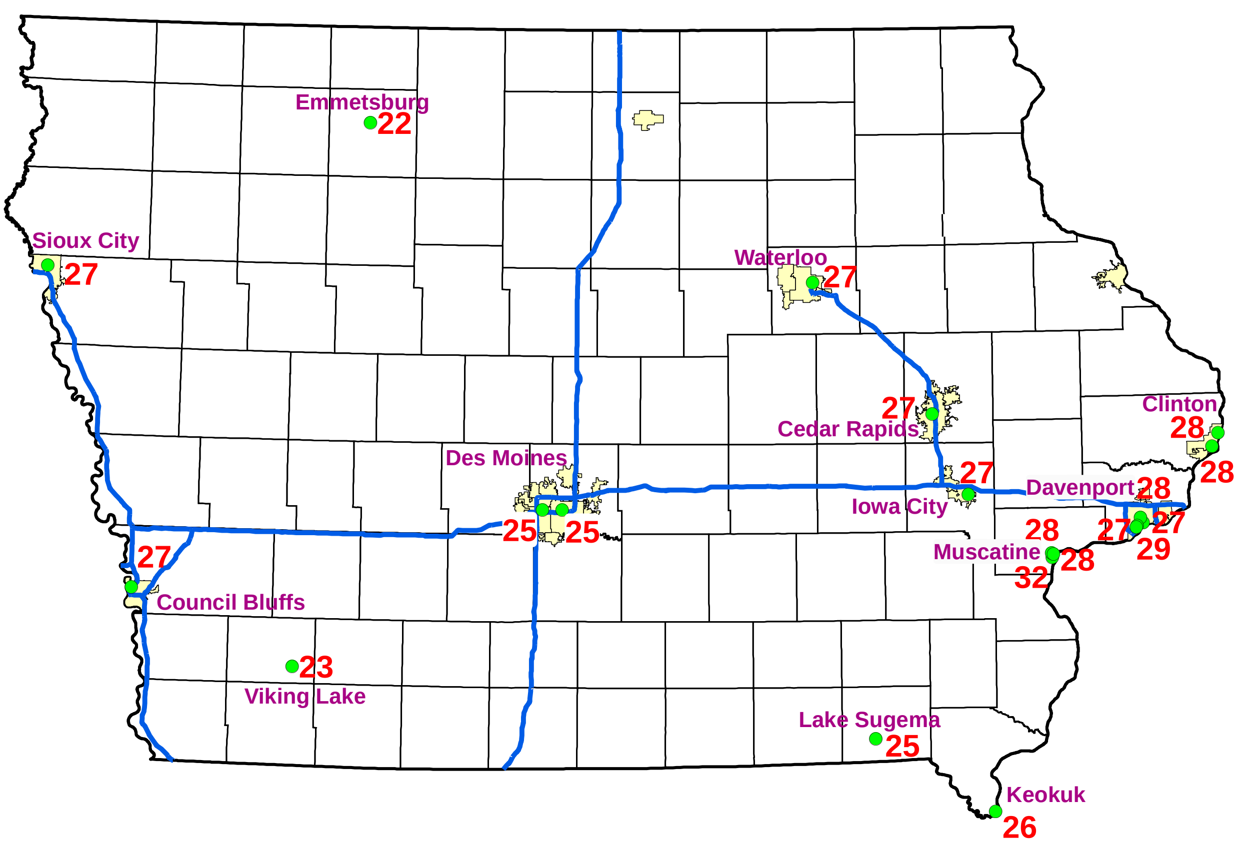
Maps of $PM_{2.5}$ 24-hour design values for the past five years are indicated below. Three years of complete data are required to compute a design value, and only sites with complete data are indicated. Monitors located near primary $PM_{2.5}$ emitters in Davenport, Clinton and Muscatine record the highest values. Monitors in the east tend to read slightly higher than those in the west. Monitors at background/ transport locations (Lake Sugema, Viking Lake, Emmetsburg) usually read less than those in more populated areas nearby.



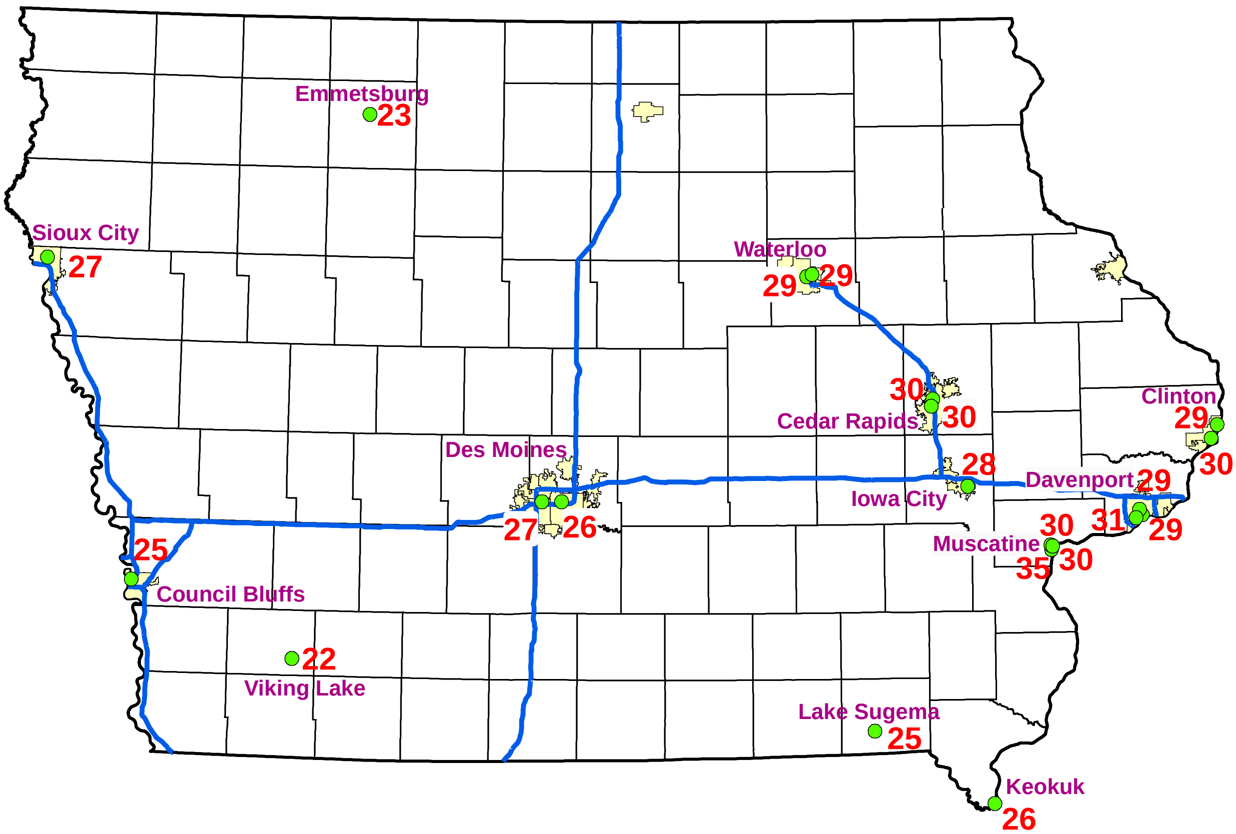
2012-2014 $PM_{2.5}$ 24-Hour Design Values ($\mu g/m^3$)



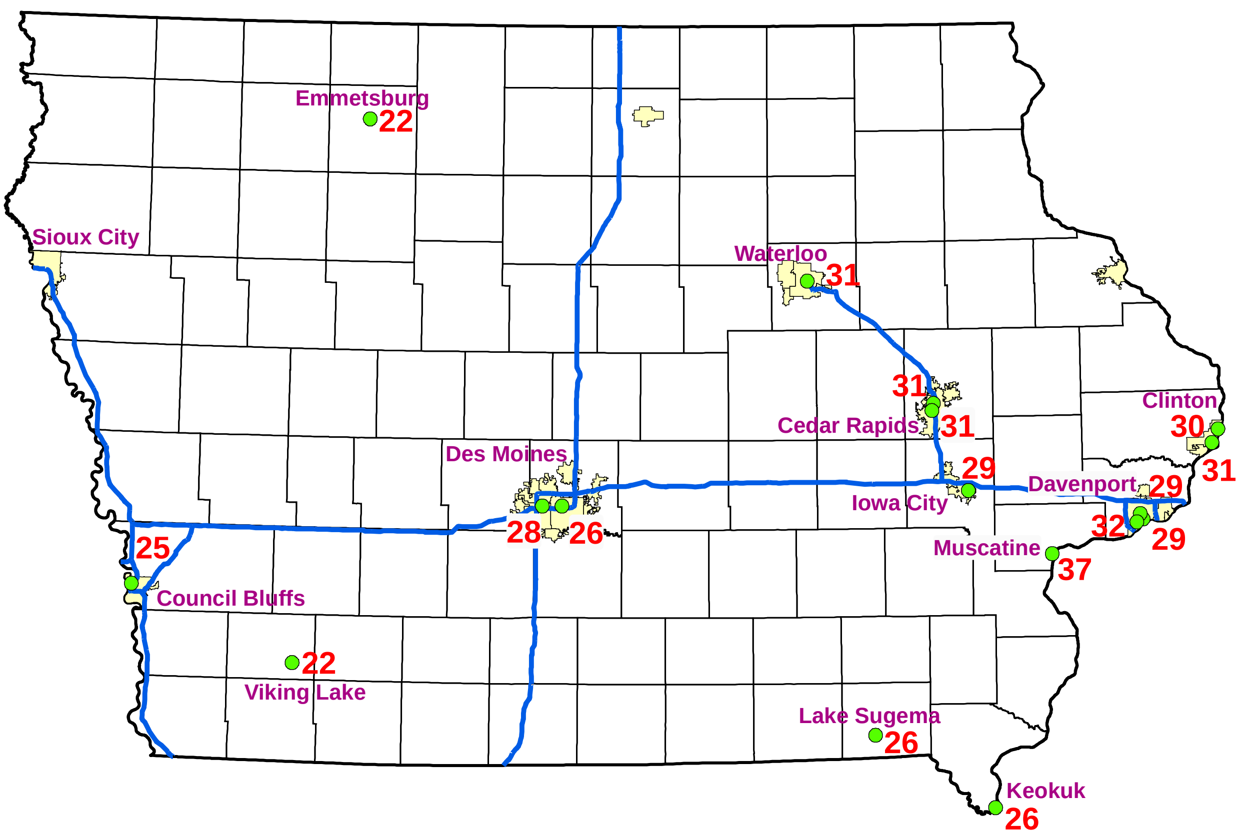
2011-2013 $PM_{2.5}$ 24-Hour Design Values (µg/m³)



2010-2012 $PM_{2.5}$ 24-Hour Design Values (µg/m³)



2009-2011 $PM_{2.5}$ 24-Hour Design Values (µg/m³)



2008-2010 $PM_{2.5}$ 24-Hour Design Values (µg/m³)

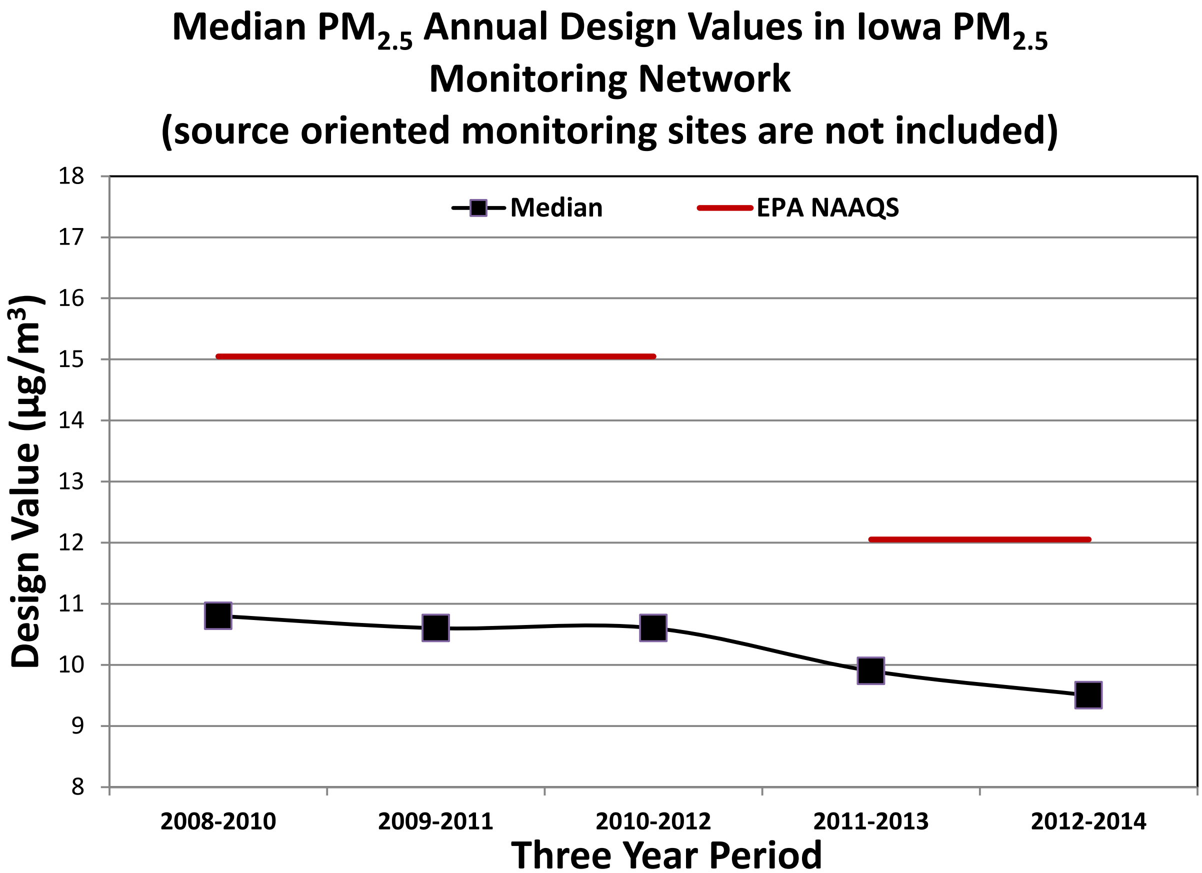
Section 4: $PM_{2.5}$ Annual Design Values

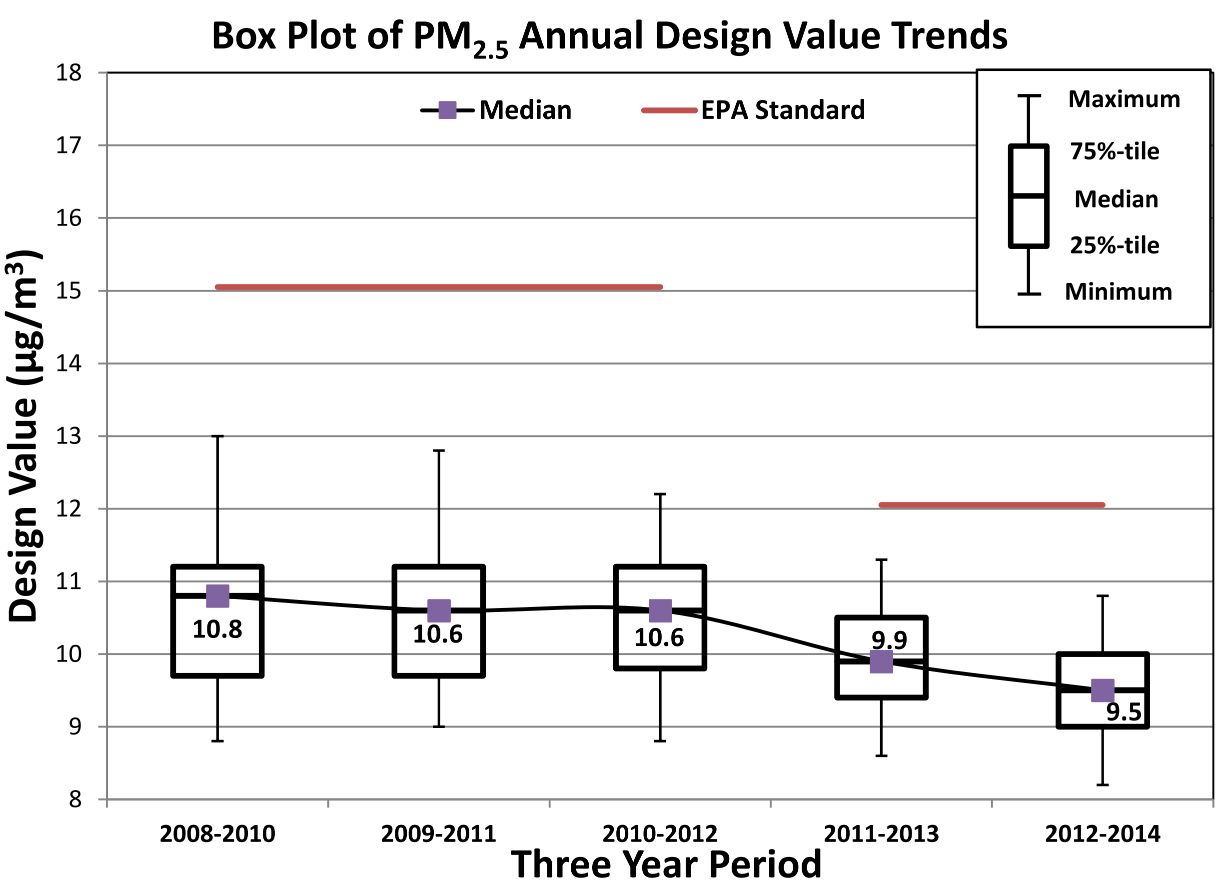
Trends and maps of $PM_{2.5}$ annual design values over the past five years are provided below. A chart of these trends for cities with monitoring sites that are closest to the standard is also provided. The median $PM_{2.5}$ annual design value in the Iowa $PM_{2.5}$ network has dropped by 1.3 µg/m^3 or about 12% over the past five years. No NAAQS violations were recorded anywhere in the network over this period. Monitors located next to industrial facilities are not eligible for comparison with the annual NAAQS as was the case with Davenport, Blackhawk Foundry from 2010-2012.

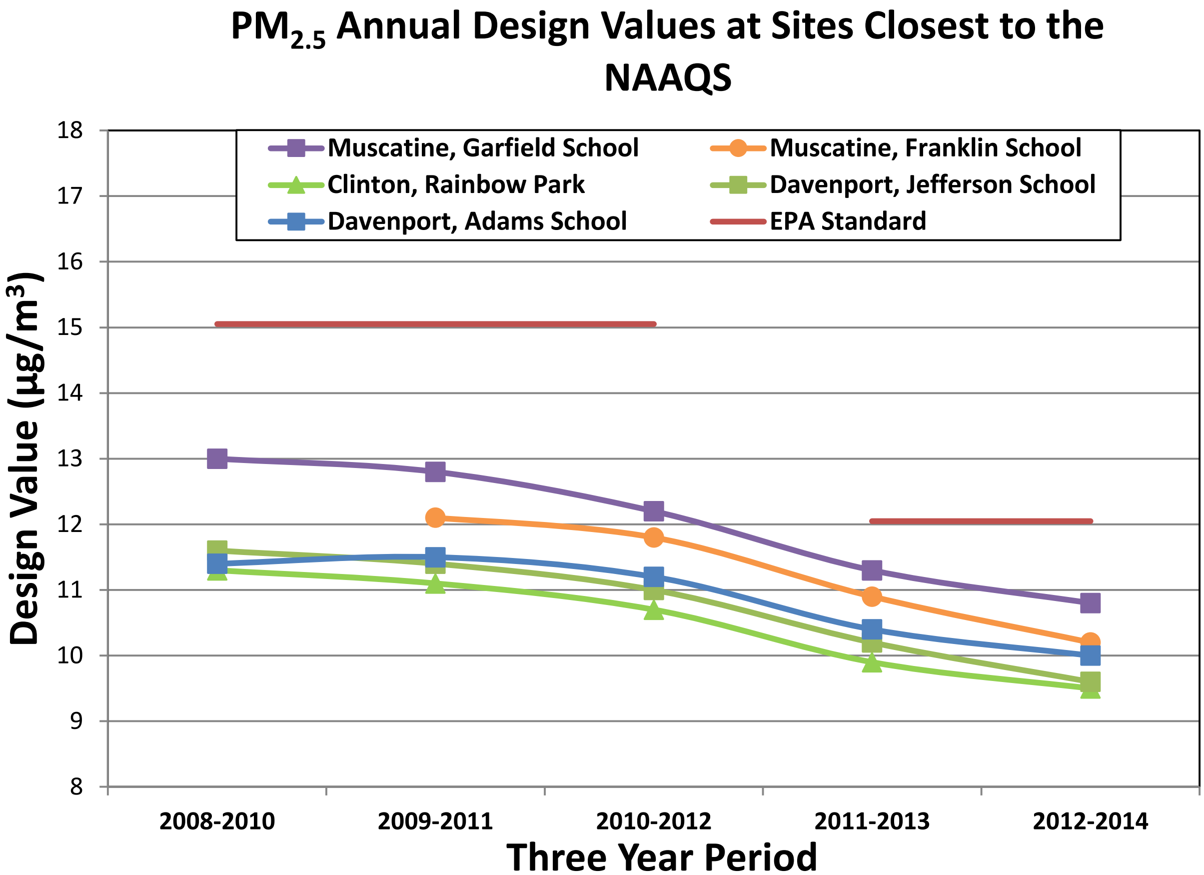
$PM_{2.5}$ Annual Design Values 2010-2014

Three Year Period	Sioux City, Bryant School 191930019	Council Bluffs, Franklin School 191550009	Viking Lake State Park 191370002	Emmetsburg, Iowa Lakes Community College 191471002	Clive, Indian Hills School 191532510	Des Moines, Health Building 191530030	Waterloo, Grout Museum 190130008	Waterloo, Water Tower 190130009	Lake Sugema 191770006	Cedar Rapids, Linn County Public Health 191130040	Cedar Rapids, Army Reserve 191130037	Backbone State Park 190550001	Iowa City, Hoover School 191032001	Keokuk, Fire Station 191110008	Muscatine, Greenwood Cemetery 191390016	Muscatine, High School E. Campus 191390015	Muscatine, Franklin School 191390018	Davenport, Hayes School 191630020	Davenport, Blackhawk Foundry 191630019	Davenport, Adams School 191630018	Davenport, Jefferson School 191630015	Clinton, Rainbow Park 190450021
2008-2010		10.9	9.3	8.8	9.6	9.8	10.6		9.3	10.8	10.0		10.9	11.1		13.0			-	11.4	11.6	11.3
2009-2011	9.7	10.9	9.4	9.0	9.6	9.7	10.6	10.6	9.6	10.6	9.9		10.8	11.1	11.3	12.8	12.1		-	11.5	11.4	11.1
2010-2012	9.9	11.1	9.2	8.8	9.6	9.7		10.4	9.6	10.3			10.5	11.4	11.1	12.2	11.8	11.3	-	11.2	11.0	10.7
2011-2013	9.4	10.2	8.7	8.6	9.2	9.2		9.9	9.0	9.7		9.4	9.6	11.0	10.4	11.3	10.9	10.7	10.6	10.4	10.2	9.9
2012-2014	9.1	9.8	8.3	8.2	8.9	8.8		9.5	8.4	9.5		9.0	9.2	10.8	9.9	10.8	10.2	10.3		10.0	9.6	9.5

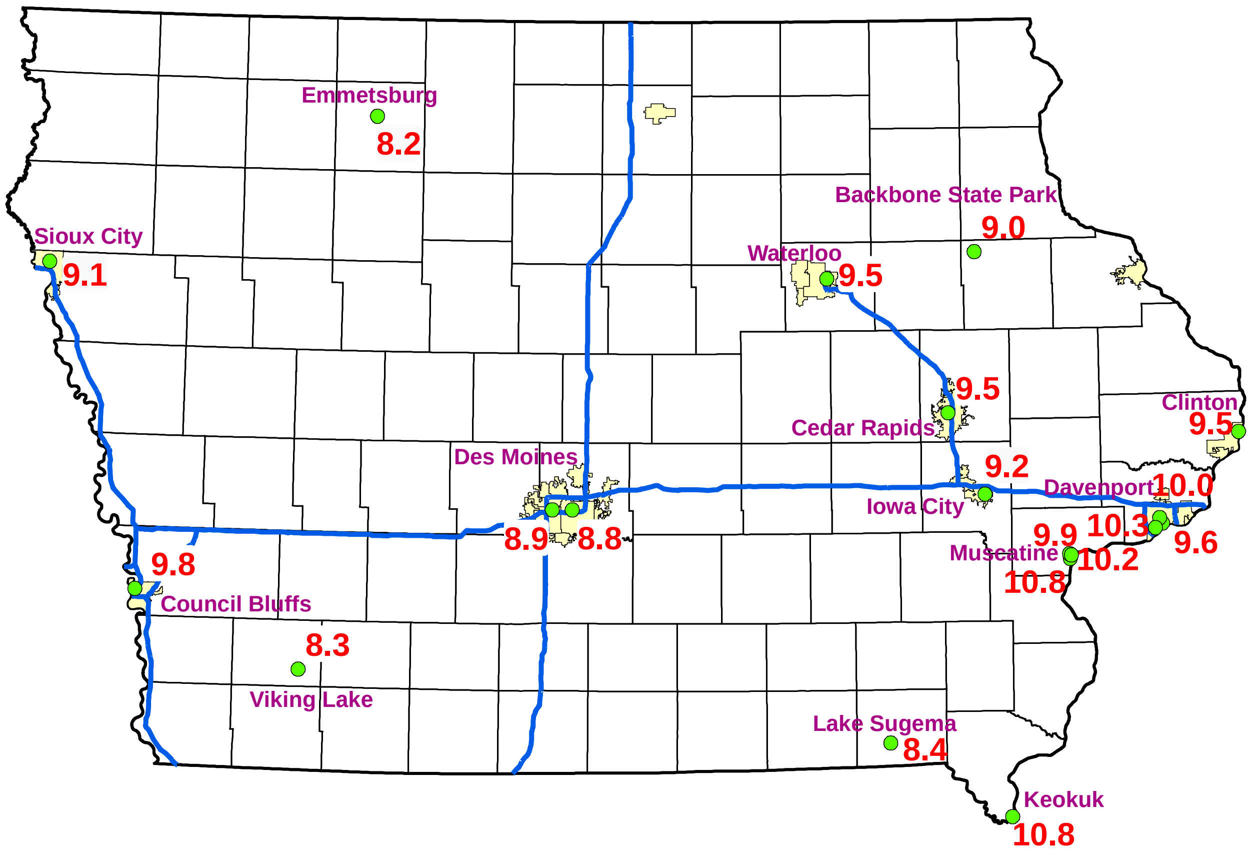
NAAQS: 15.05 µg/m^3 (yellow) **NAAQS: 12.05 µg/m^3** (green) **Invalid Design Value (Site was not operational or data did not meet completeness requirements.)** (grey)


Median PM2.5 Annual Design Values in Iowa PM2.5 Monitoring Network
(source oriented monitoring sites are not included)
Median
EPA NAAQS
Design Value (µg/m3)
18
17
16
15
14
13
12
11
10
9
8
2008-2010
2009-2011
2010-2012
2011-2013
2012-2014
Three Year Period


Box Plot of PM2.5 Annual Design Value Trends
Median
EPA Standard
Maximum
75%-tile
Median
25%-tile
Minimum
Design Value (µg/m3)
18
17
16
15
14
13
12
11
10
9
8
10.8
10.6
10.6
9.9
9.5
2008-2010
2009-2011
2010-2012
2011-2013
2012-2014
Three Year Period

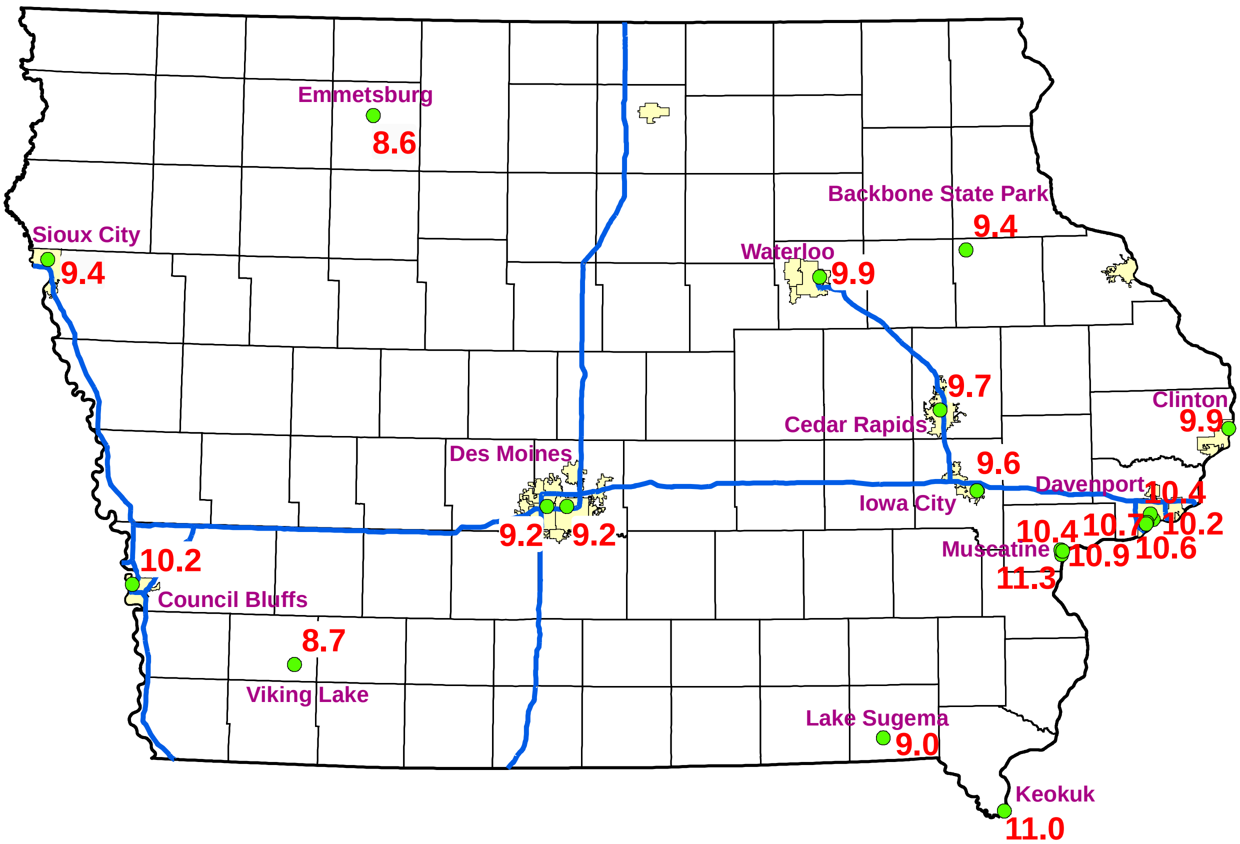

PM2.5 Annual Design Values at Sites Closest to the NAAQS
Muscatine, Garfield School
Muscatine, Franklin School
Clinton, Rainbow Park
Davenport, Jefferson School
Davenport, Adams School
EPA Standard
Design Value (µg/m3)
18
17
16
15
14
13
12
11
10
9
8
2008-2010
2009-2011
2010-2012
2011-2013
2012-2014
Three Year Period

Maps of $PM_{2.5}$ annual design values for the most recent five year period are indicated below. Three years of complete data are required to compute a design value, and only sites with complete data are indicated. Monitors in the east tend to read slightly higher than those in the west.[68] Monitors at background/transport locations (Lake Sugema, Viking Lake, and Emmetsburg) tend to read less than those in more populated areas.

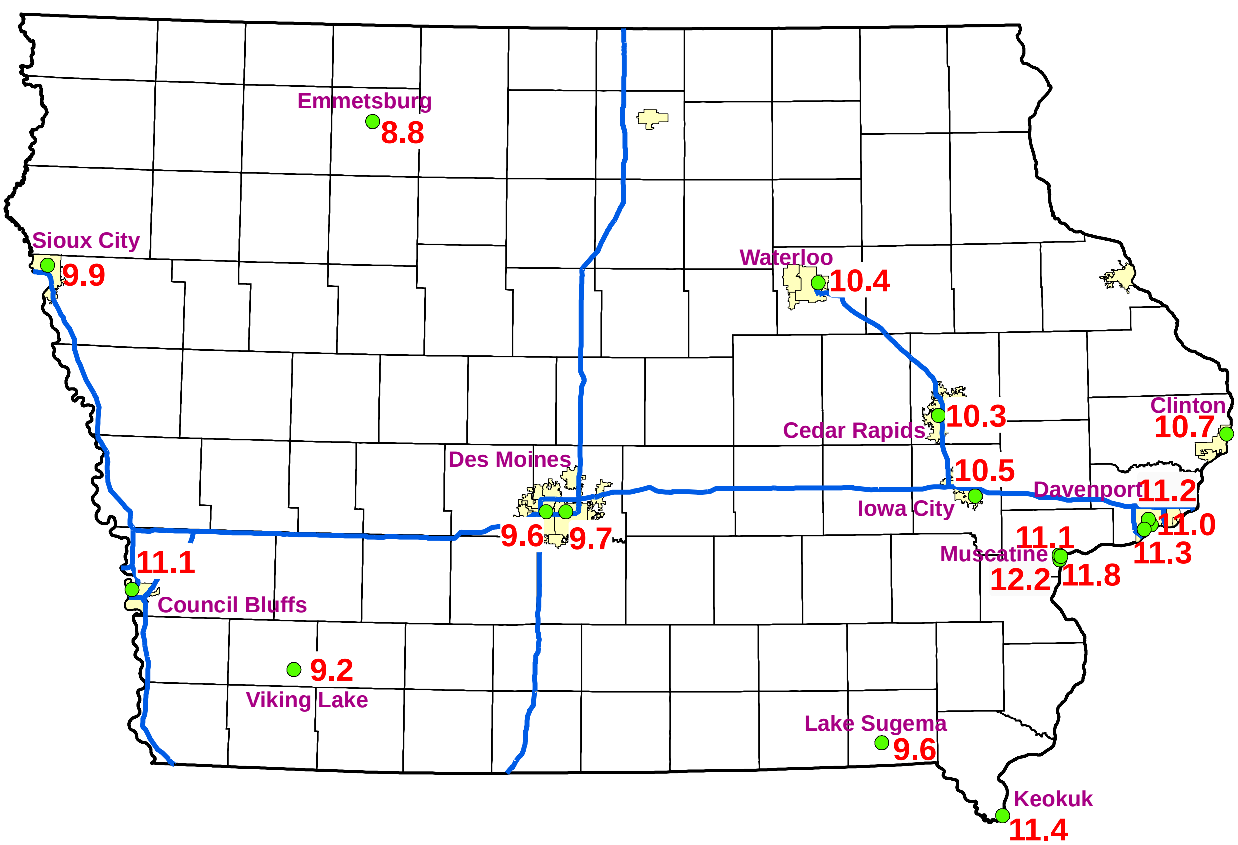


2012-2014 $PM_{2.5}$ Annual Design Values

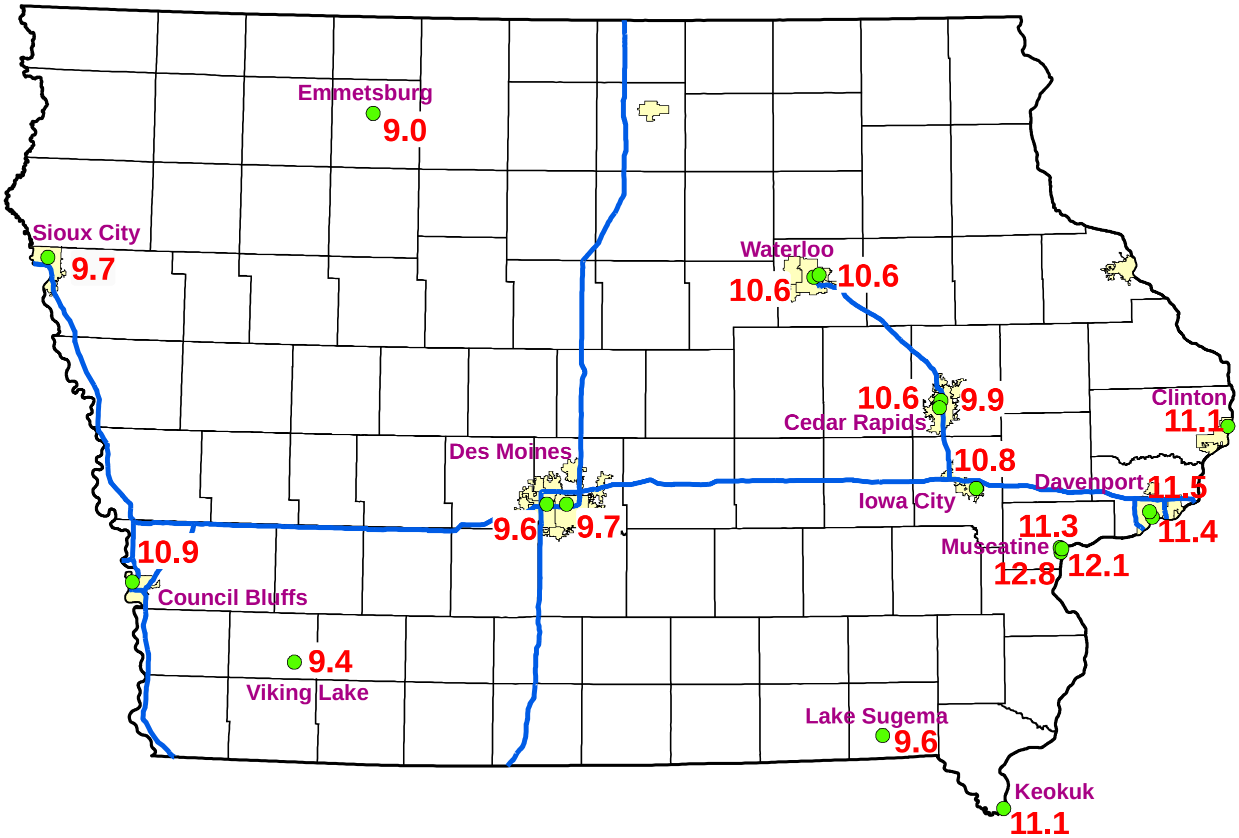
[68] The reduction in fine particle levels as one moves from the industrial Midwest to the western plains is well known; see for example: page 101 of: http://vista.cira.colostate.edu/improve/Publications/Reports/2006/PDF/IMPROVE_Report_IV.pdf.



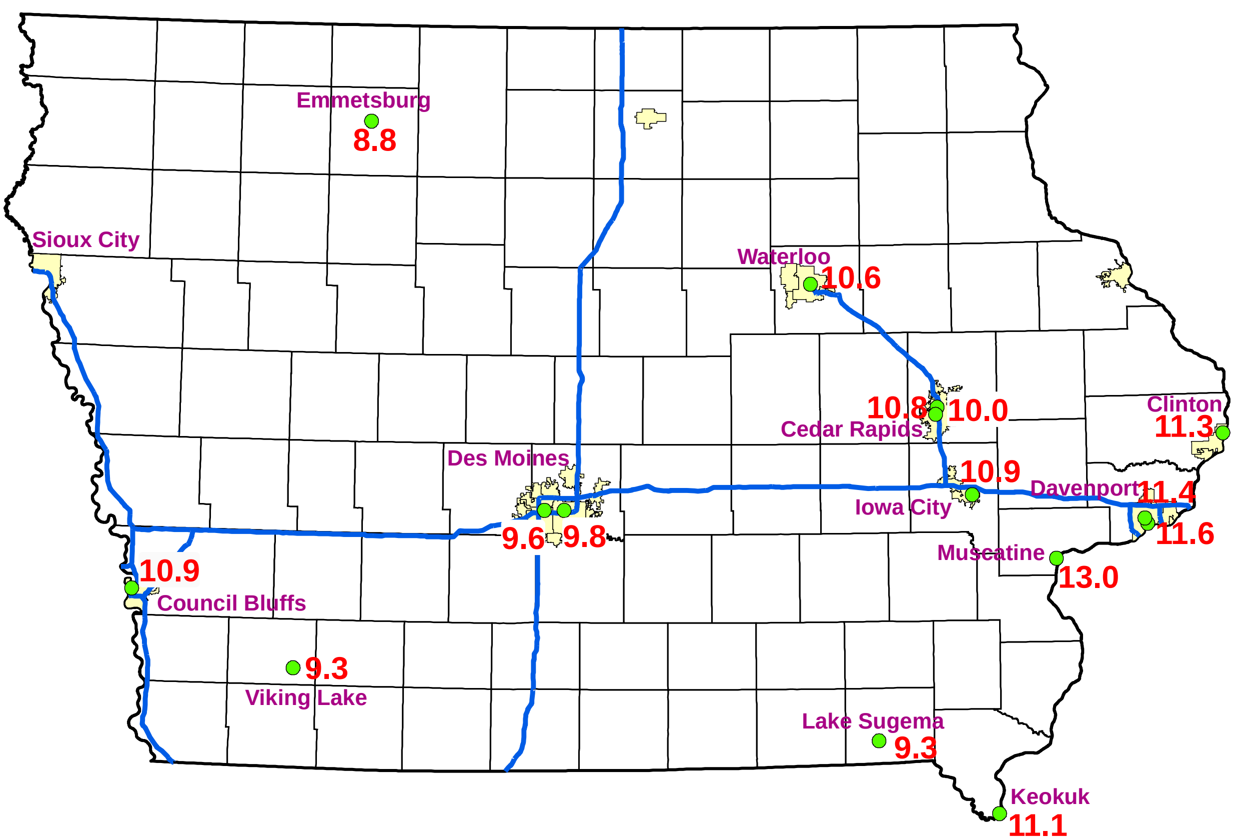
2011-2013 PM$_{2.5}$ Annual Design Values



2010-2012 PM$_{2.5}$ Annual Design Values



2009-2011 $PM_{2.5}$ Annual Design Values



2008-2010 $PM_{2.5}$ Annual Design Values

Section 5: SO_2 One-Hour Design Values

The one-hour SO_2 standard went into effect in August 2010. SO_2 one-hour design values over the most recent five years are provided below. The design values are the three year average of the annual 99th percentile daily maximum one-hour SO_2 concentrations calculated according to 40 CFR Part 50 Appendix T. A monitoring site must have a design value less than 76 ppb to attain the NAAQS.[69]

EPA declared an area of Muscatine adjacent to industrial SO_2 emitters to be in non-attainment with the SO_2 NAAQS in August of 2013.[70] Design values indicating NAAQS violations were recorded in Muscatine in 2011-2013 and 2012-2014. Iowa's State Implementation Plan (SIP) is due to EPA in April of 2015 and must contain federally enforceable provisions to return the area to attainment no later than October of 2018. A consent decree signed in 2014 will result in significant SO_2 emissions reductions beginning in July of 2015.[71]

The 2012-2014 median SO_2 one-hour design value in the Iowa SO_2 network is 24 ppb.

Years	Clinton, Chancy Park 190450019	Cedar Rapids, Scottish Rite 191130031	Cedar Rapids, Linn County Public Health 191130040	Cedar Rapids, Tait Cummins Park 191130041	Muscatine, Greenwood Cemetery 191390016	Muscatine, High School East Campus 191390019	Muscatine, Musser Park 191390020	Des Moines, Health Department 191530030	Davenport, Jefferson School 191630015	Lake Sugema 191770006	Sergeant Bluff, George Neal North 191930020
2008-2010	31	39						3	11	5	
2009-2011	27	21	28					3	13	5	
2010-2012	32	24	25					2	14	4	
2011-2013	38	22	24				217	1	15	3	
2012-2014	39		24		101		194	1	12	3	

Invalid Design Value (Site was not operational or data did not meet completeness requirements.)

Current NAAQS is 75 ppb.

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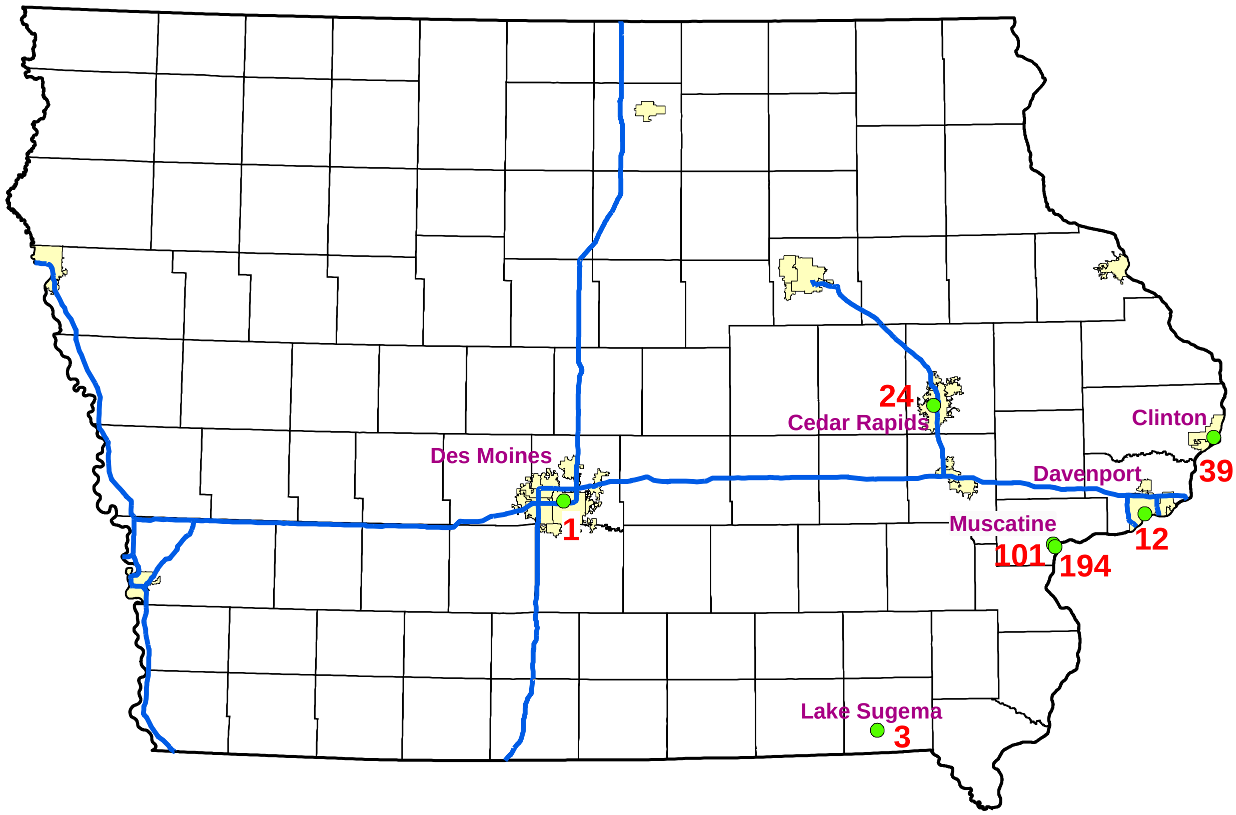
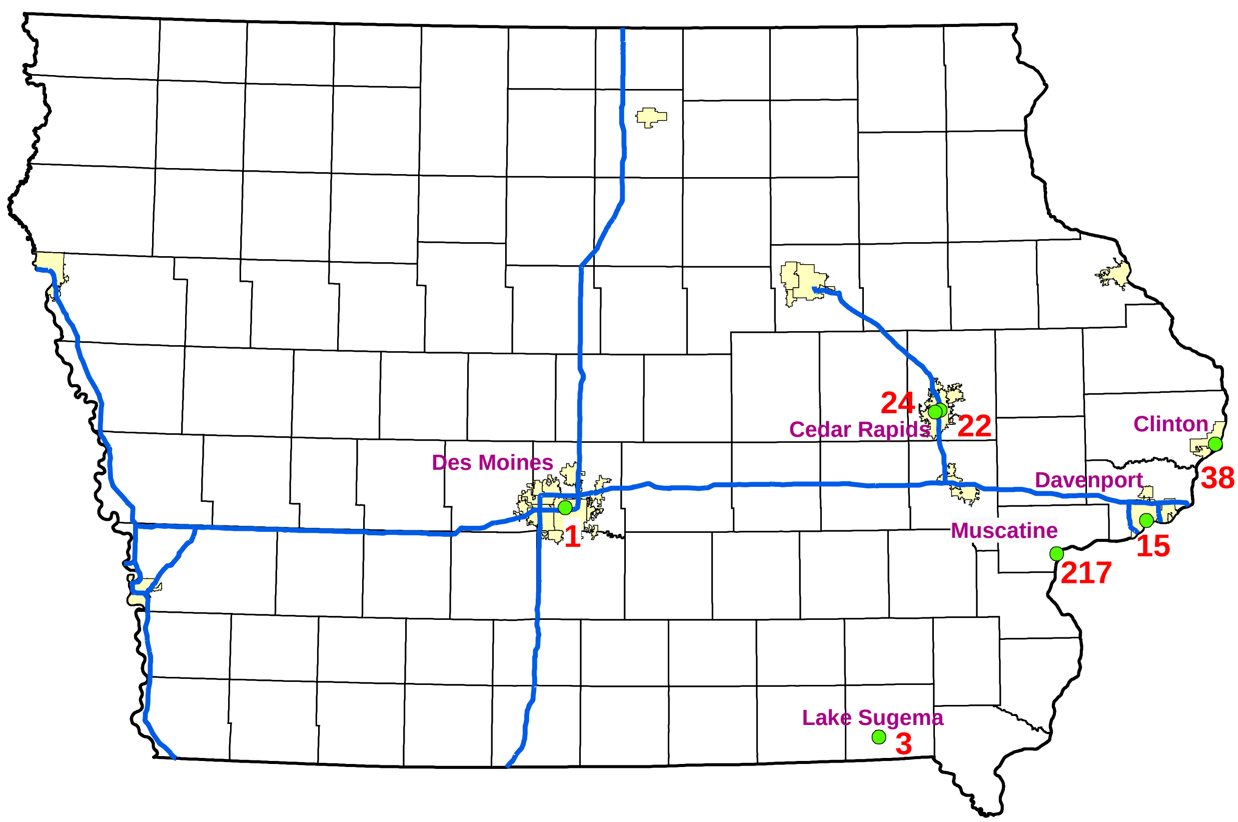
[69] Information on the SO_2 NAAQS is available at http://www.epa.gov/airquality/sulfurdioxide/actions.html.

[70] This consent decree is available at: http://www.iowadnr.gov/Portals/idnr/uploads/Enforcement%20Actions/2014/enf6239.pdf.

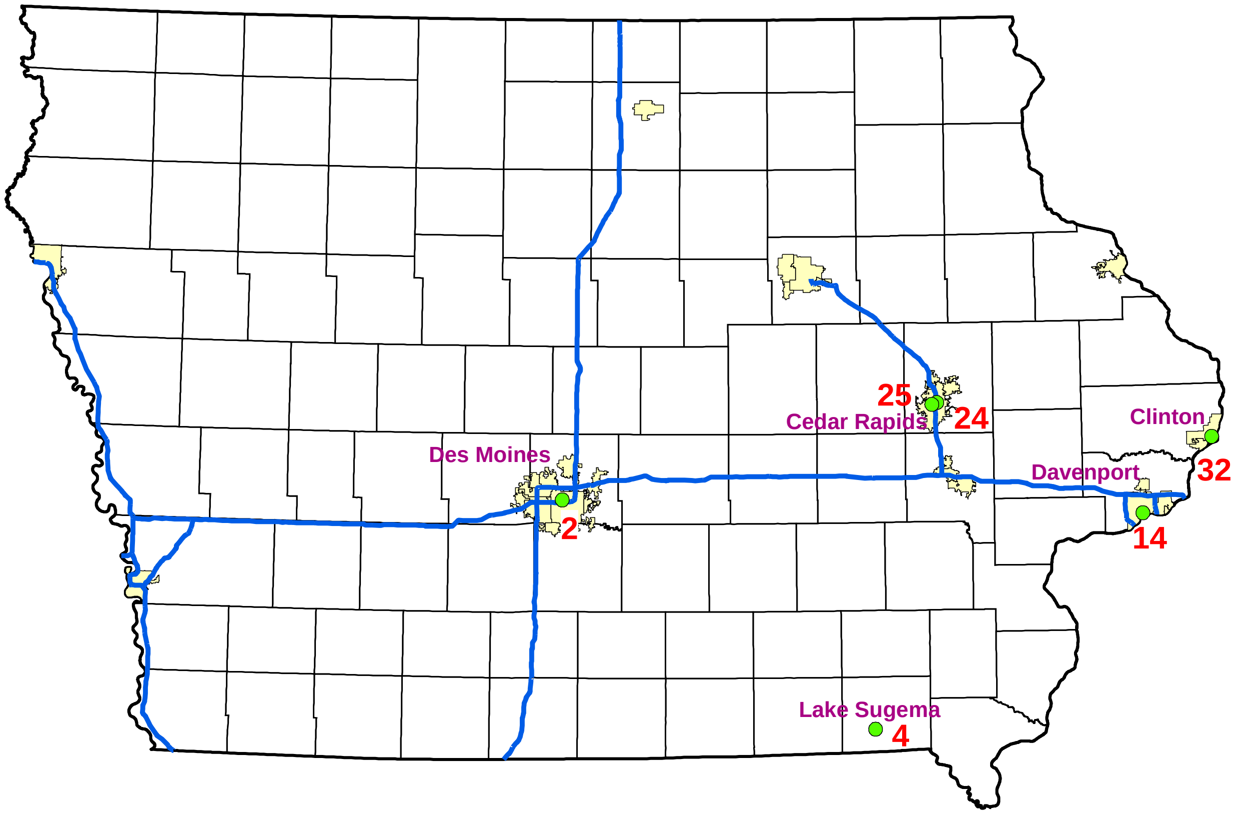
[71] Paragraph 3(d) of 40 CFR Part 50 Appendix T of allows EPA the discretion to "consider consistency and levels of valid measurements" when it evaluates monitoring data for establishing attainment. EPA argued that the dataset 2009-2011, although incomplete for the purposes of calculating a design value in accordance with Appendix T, was adequate to show that a complete dataset would have violated the NAAQS. Information on the Muscatine non-attainment designation is at: https://www.federalregister.gov/articles/2013/08/05/2013-18835/air-quality-designations-for-the-2010-sulfur-dioxide-so2-primary-national-ambient-air-quality#page-47200 and http://www.epa.gov/airquality/sulfurdioxide/designations/region7r.html.



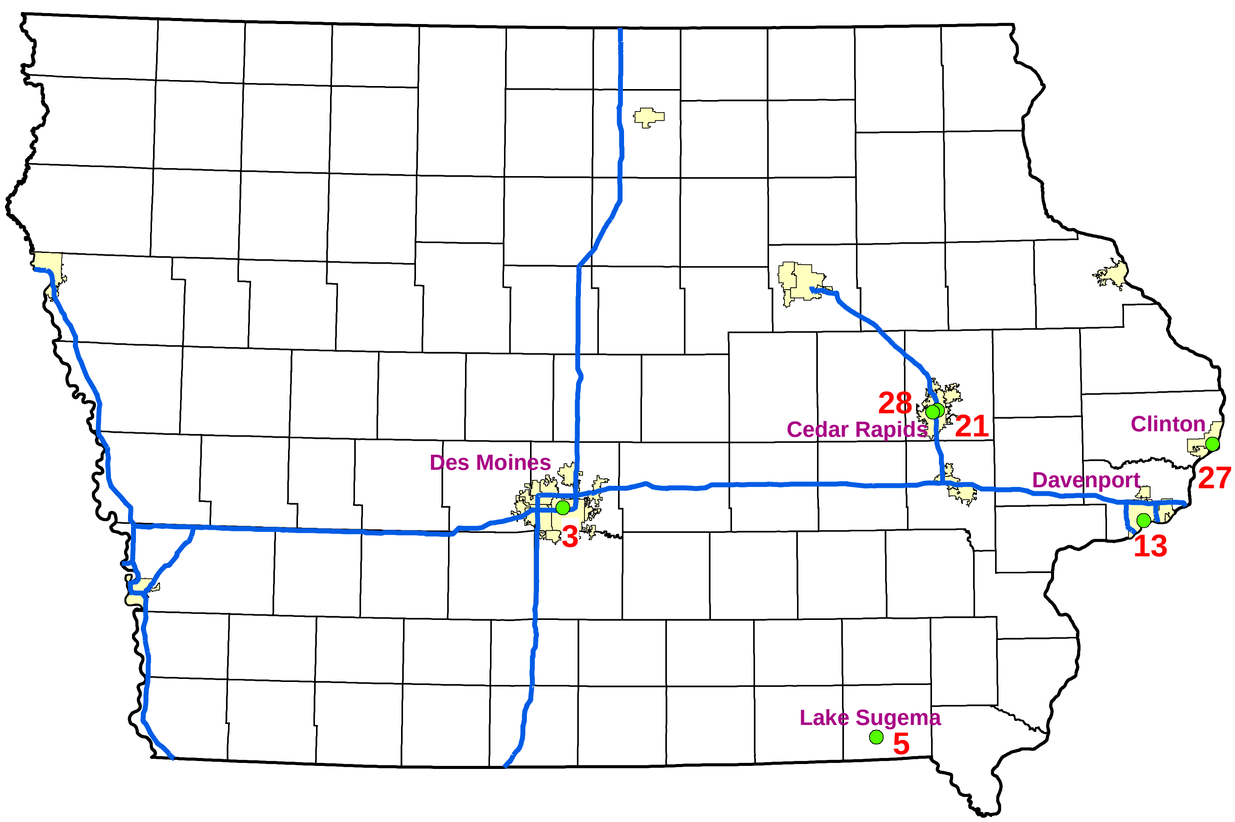
2012-2014 SO_2 One-Hour Design Values



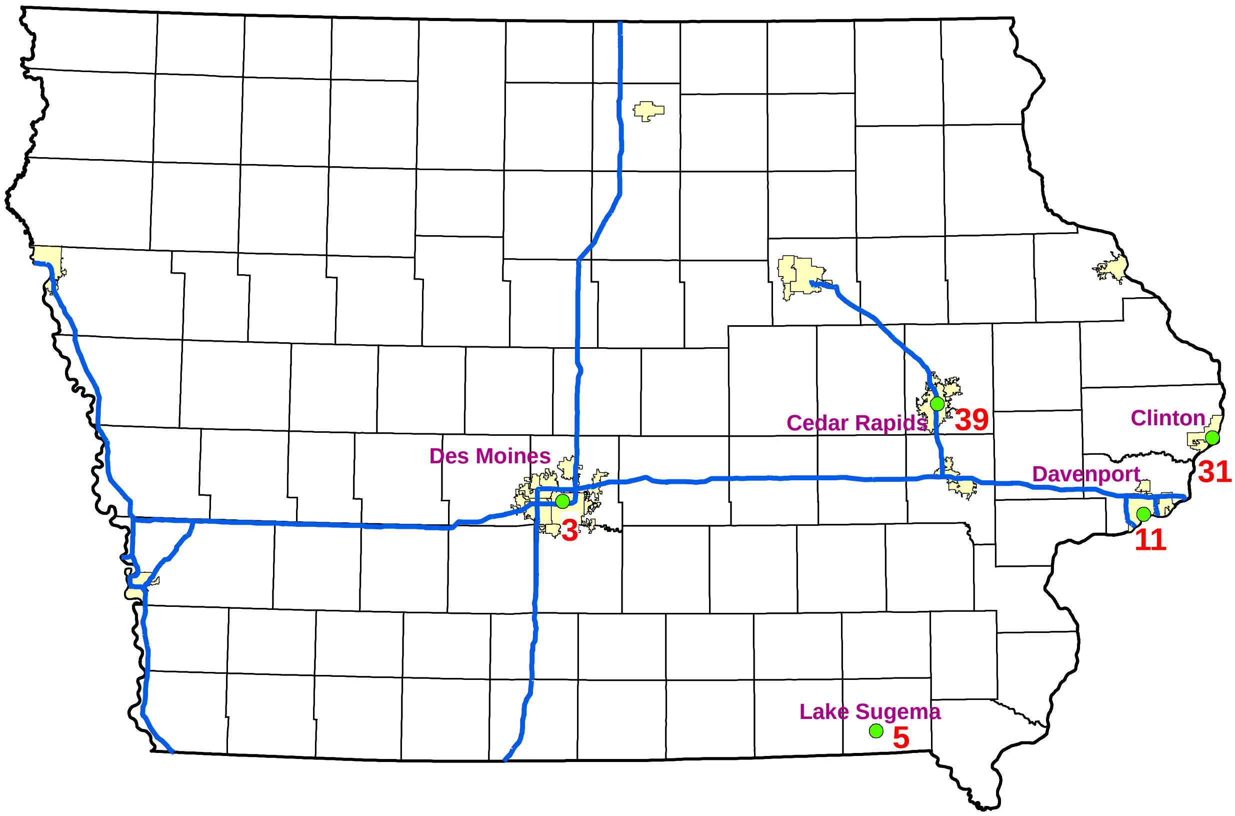
2011-2013 SO_2 One-Hour Design Values



2010-2012 SO_2 One-Hour Design Values



2009-2011 SO_2 One-Hour Design Values



2008-2010 SO_2 One-Hour Design Values

Section 6: NO_2 One-Hour Design Values

The one-hour NO_2 standard went into effect in April 2010. NO_2 one-hour design values over the most recent five years are provided below. The design values are the three year average of the annual 98th percentile daily maximum one-hour NO_2 concentrations calculated according to 40 CFR Part 50 Appendix S.[72] A monitoring site must have a design value less than 101 ppb to attain the NAAQS.[73]

The median 2012-2014 NO_2 one-hour design value in the Iowa NO_2 network is 36 ppb. No NAAQS violations were recorded.

NO_2 One-Hour Design Values

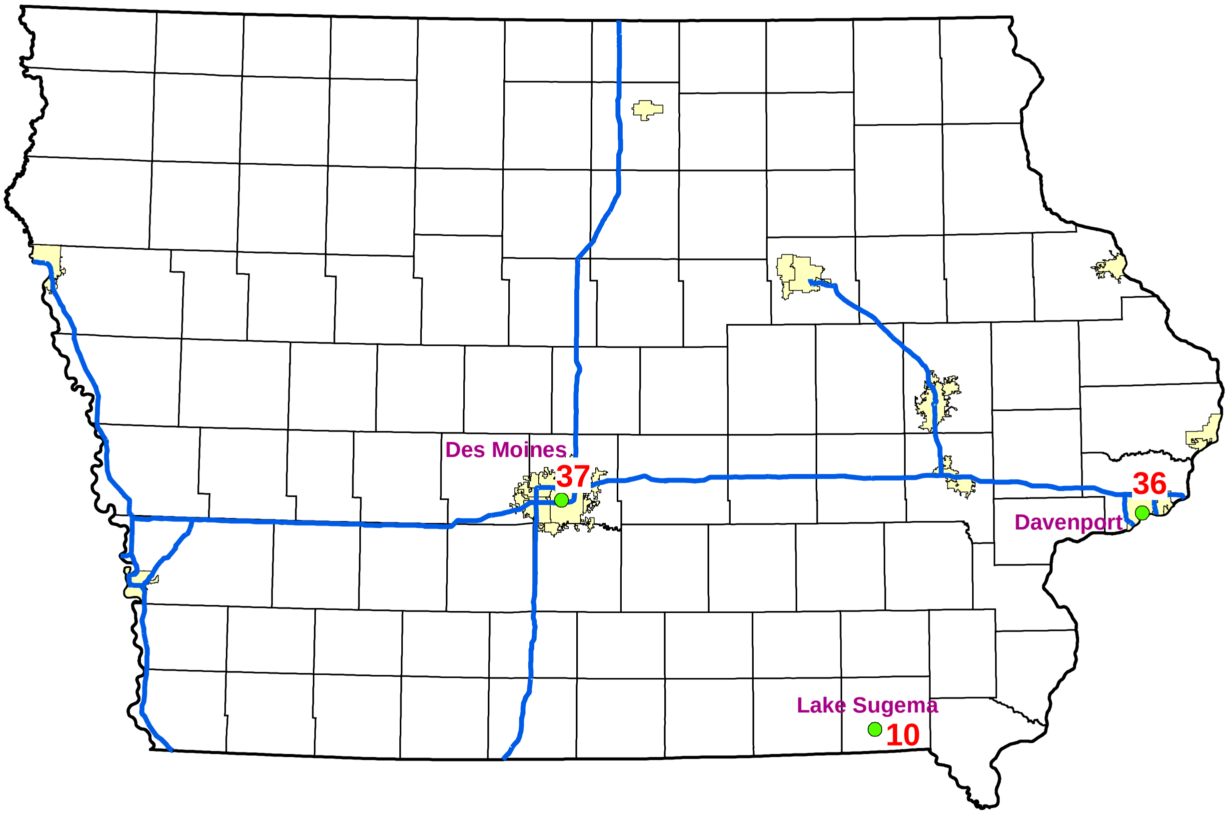
Years	Des Moines, Health Department 191530030	Des Moines, Near-Road NO_2 191536011	Davenport, Jefferson School 191630015	Lake Sugema 191770006
2008-2010	44		38	
2009-2011	44		36	
2010-2012	42		36	
2011-2013	39		37	
2012-2014	37		36	10

Invalid Design Value (Site was not operational or data did not meet completeness requirements.)

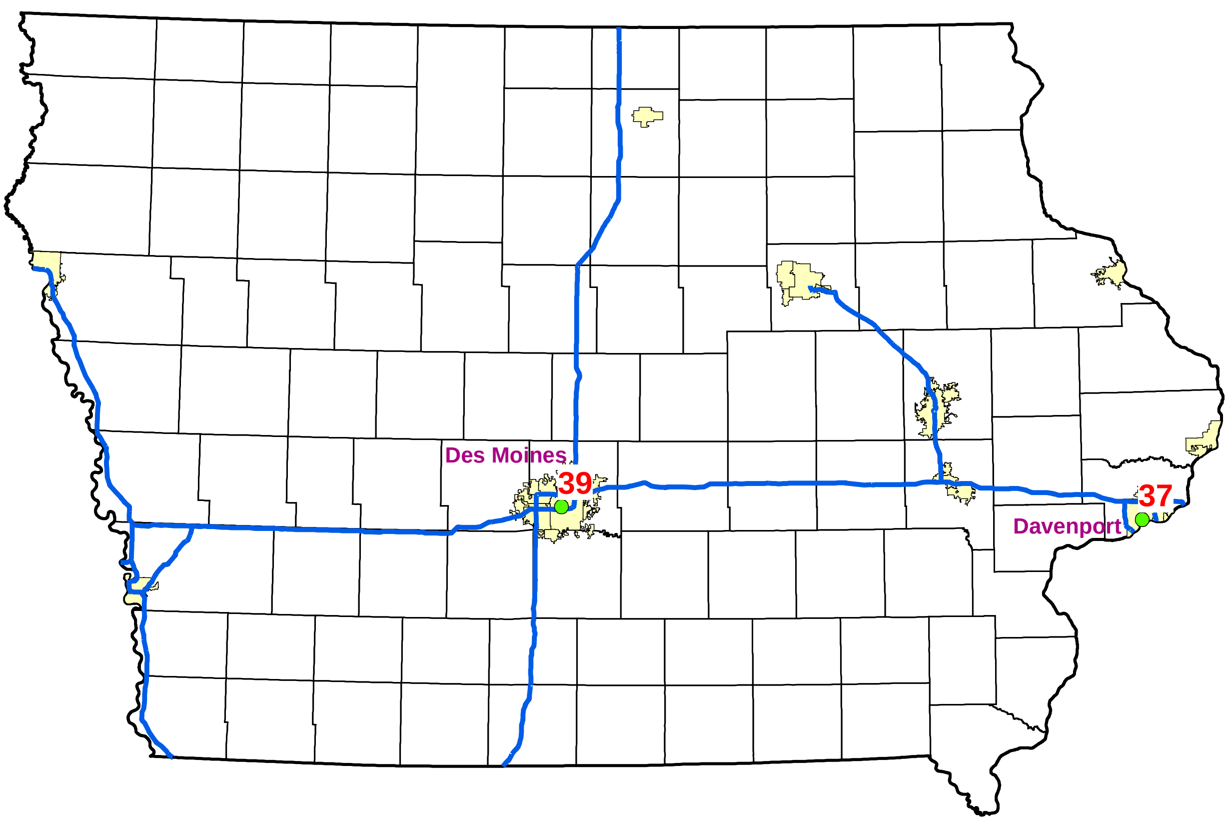
Current NAAQS is 100 ppb.

[72] 40 CFR 50 Appendix S is found at http://www.ecfr.gov/cgi-bin/text-idx?SID=b5485617895a6680744050bf6ba826d0&mc=true&node=ap40.2.50_118.s&rgn=div9.

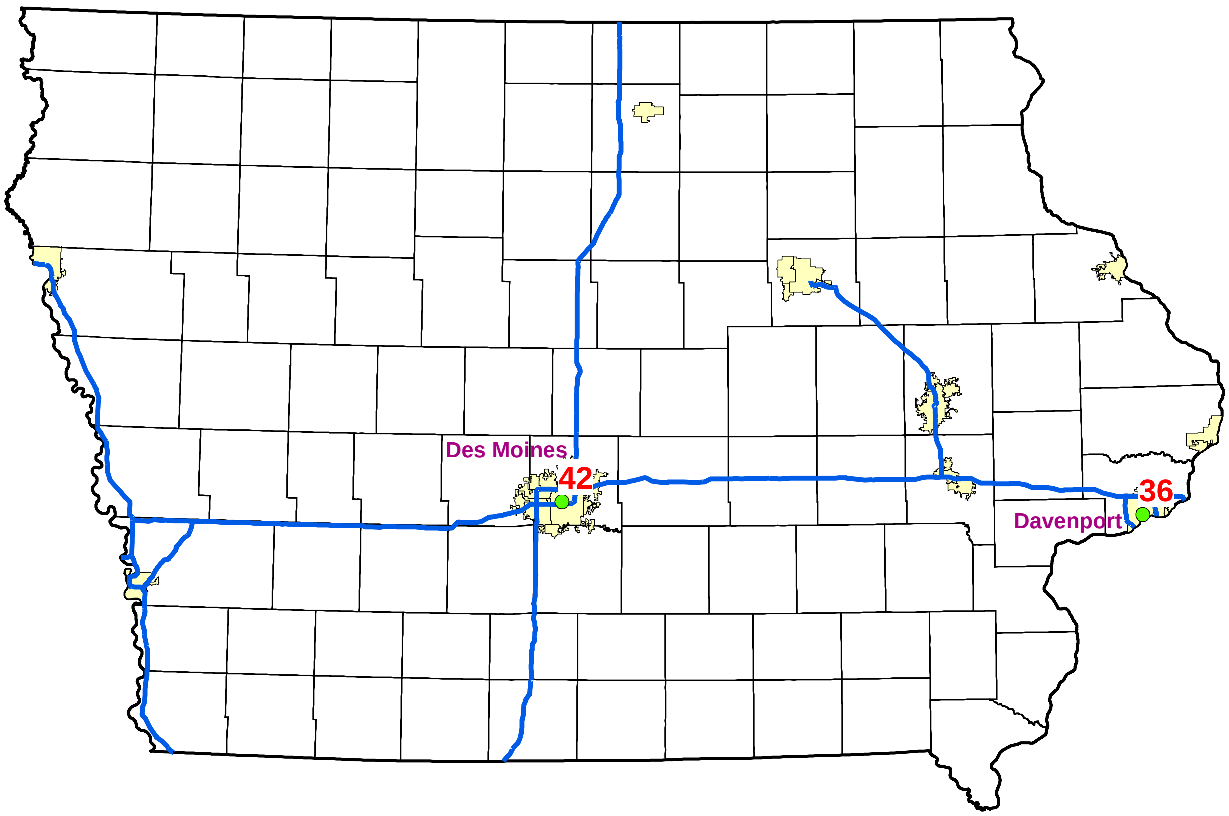
[73] Information on the NO_2 NAAQS is available at http://www.epa.gov/airquality/nitrogenoxides/actions.html.



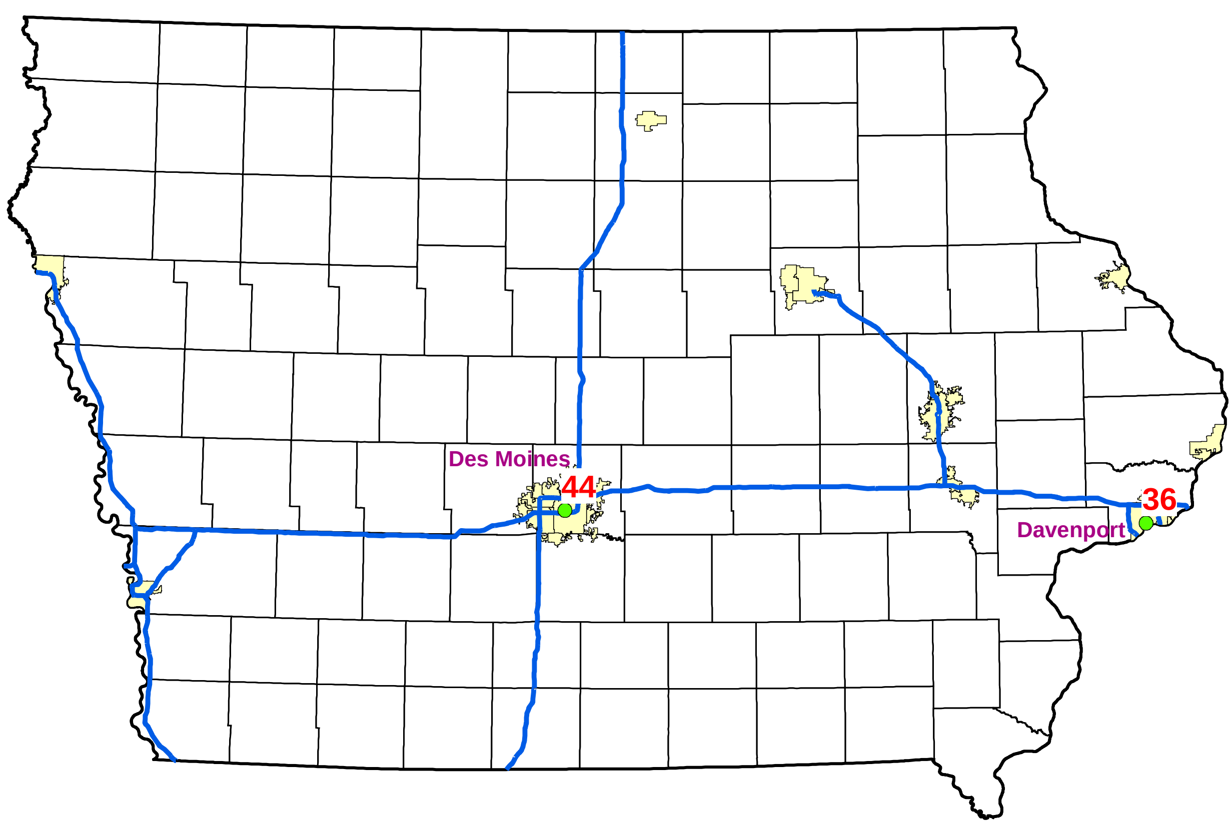
2012-2014 NO_2 One-Hour Design Values



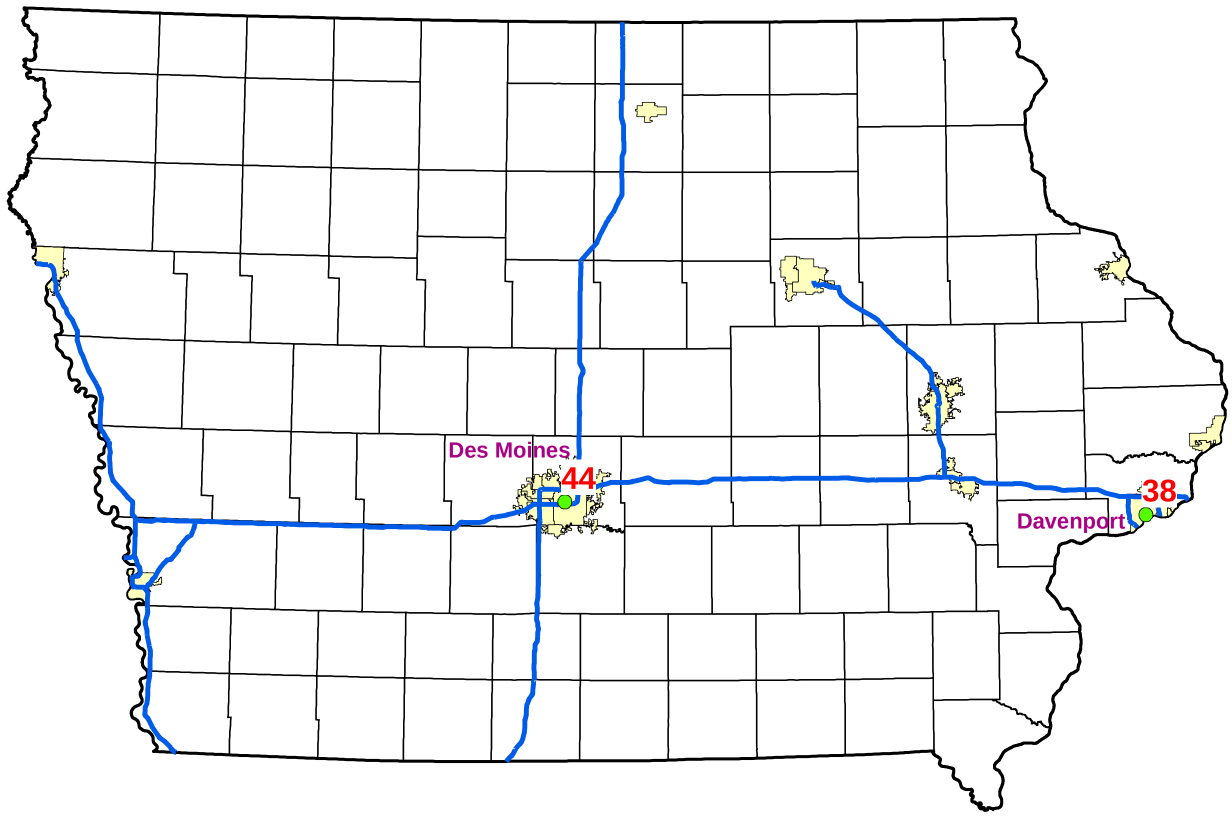
2011-2013 NO_2 One-Hour Design Values



2010-2012 NO_2 One-Hour Design Values



2009-2011 NO_2 One-Hour Design Values



2008-2010 NO_2 One-Hour Design Values

Section 7: Lead Design Values

The current lead NAAQS took effect in January 2009[74]. Trends and maps of lead design values over the past years are provided below. The lead design value at a monitoring site is the maximum 3-month rolling average over a period of 3 calendar years. A monitoring site must have a design value less than 0.155 µg/m^3 to attain the NAAQS.[75]

The only lead monitor in Iowa is located in Council Bluffs near the Griffin Pipe and Alter Metal Recycling facilities. In 2010 and 2012, violations of the National Ambient Air Quality Standards for lead were recorded at the Griffin Pipe monitoring site.[76] DNR recently completed a State Implementation Plan (SIP) to mitigate these violations.[77] This plan includes measures to pave and regularly sweep haul roads at the Alter Metal Recycling facility adjacent to Griffin Pipe. It is expected that these measures will reduce ambient lead levels near Griffin Pipe by eliminating the re-entrainment of deposited lead-laden dust by truck traffic. Griffin Pipe announced its intention to suspend production indefinitely in March of 2014[78].

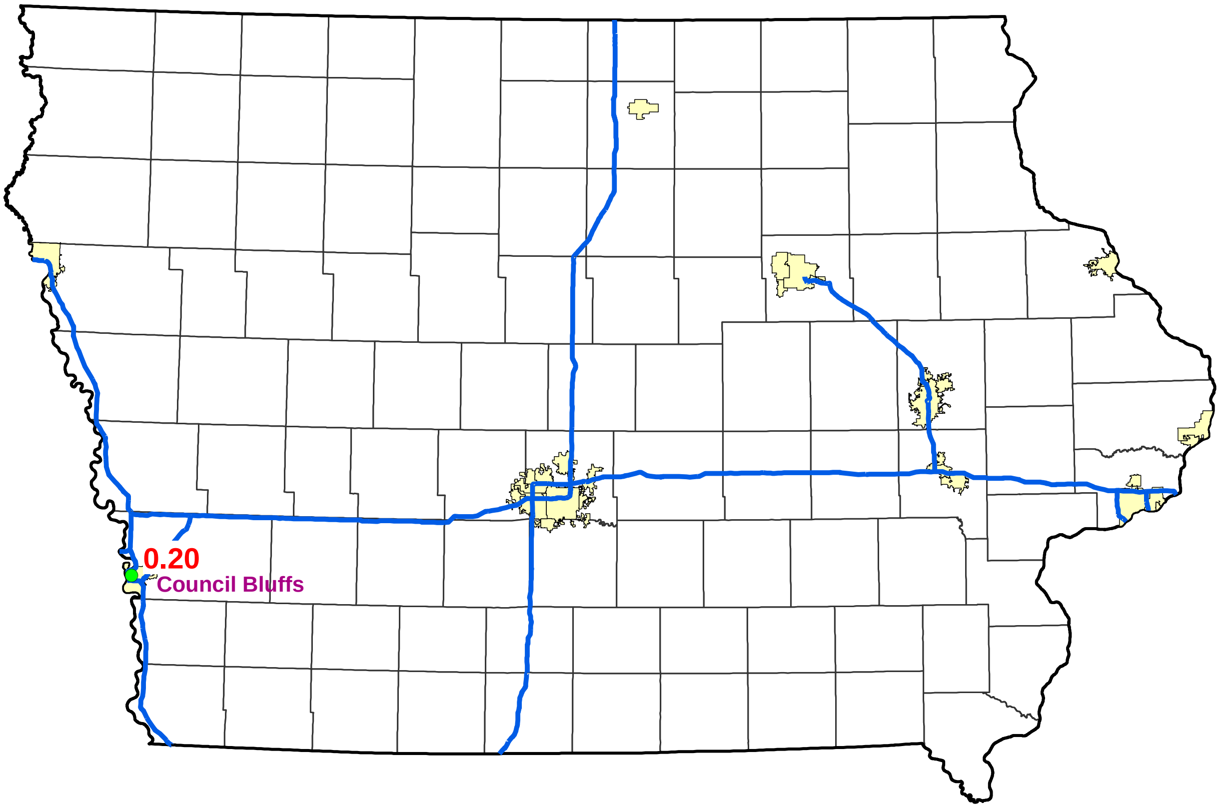
The 2014 design value for that site is 0.20 µg/m^3 which violates the lead NAAQS. If no additional NAAQS violations are recorded in 2015, the design value will indicate attainment.

Lead Design Values 2010 – 2014 (µg/m^3)

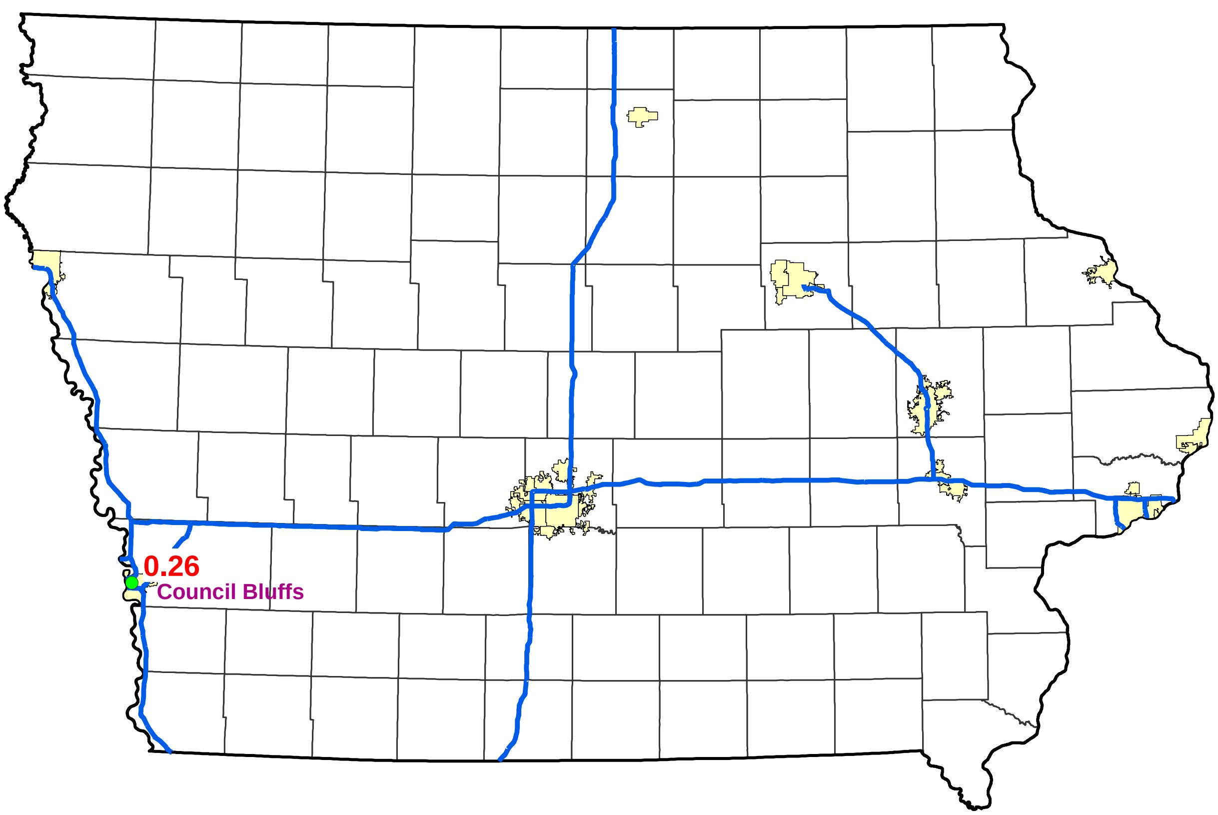
Years	2010 - 2012	2011 - 2013	2012 - 2014
Council Bluffs, Griffin Pipe 191550011	0.26	0.20	0.20

Current NAAQS is 0.15 µg/m^3.

[74] *Federal Register* entry: http://www.gpo.gov/fdsys/pkg/FR-2008-11-12/html/E8-25654.htm.
[75] Information on the lead NAAQS is available at http://www.epa.gov/oar/oaqps/lead/.
[76] Iowa Lead Design Values 2010-2012.
[77] State Implementation Plan Lead Non-Attainment Council Bluffs, Iowa.
[78] KETV: Griffin Pipe goes to skeleton crew.



2011-2013, 2012-2014 Lead Design Values



2010-2012 Lead Design Value

Appendix J: Iowa MSA's

Table of Contents

Section 1: Summary

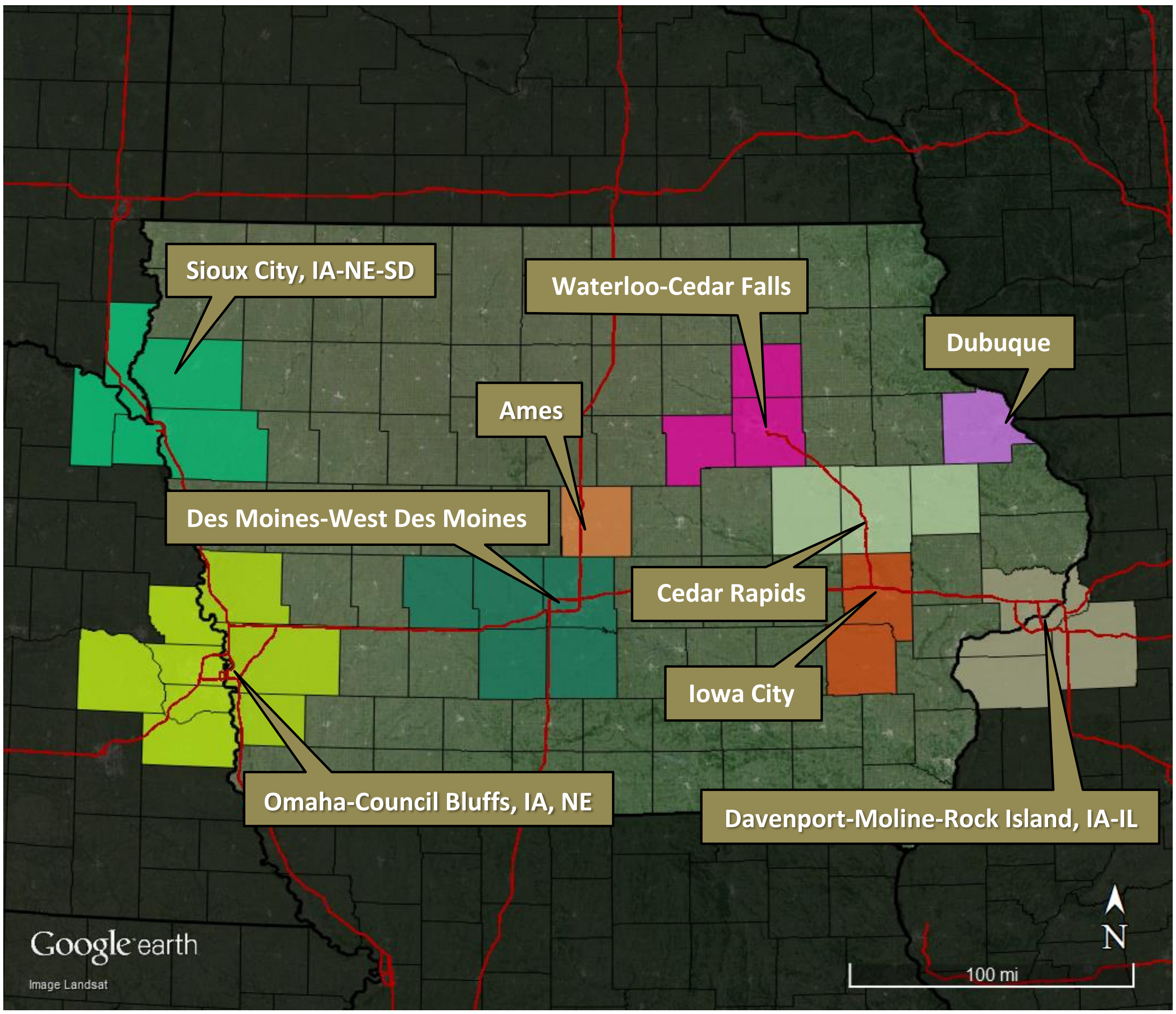
In order to protect human health, an important objective of an ambient air monitoring network is to quantify air pollution levels in heavily populated areas. Federal ambient air monitoring regulations contain minimum monitoring requirements for Metropolitan Statistical Areas (MSA's). About 59% of Iowa's population is concentrated in its MSA's, and about 54% of Iowa's ambient air monitoring sites are located in these areas.

Section 2 defines the counties in Iowa and other states that comprise these MSA's. Section 3 provides estimates of the total population of the MSA's along with the number of Iowans living in the MSA's. State and Local Air Monitoring Stations (SLAMS) monitors are important, long-term components of the state's air monitoring network. Section 4 indicates the minimum number of SLAMS monitors required by EPA for each MSA, and the number of SLAMS monitors in each MSA. Section 5 enumerates total number of Iowa monitors (SLAMS and non-SLAMS) in each MSA.

Section 2: Metropolitan Statistical Areas in Iowa

The federal Office of Management and Budget establishes and maintains the definitions of Metropolitan Statistical Areas (MSA's). Each MSA includes at least one urbanized area of 50,000 or more population. Each MSA may include adjacent counties that have a minimum of 25 percent of workers commuting to the central counties of the metropolitan statistical area.

According to the U.S. Census Bureau[79], Iowa has 9 MSA's made up of twenty-one Iowa counties and eleven counties from other states, as indicated in the map and table below:



MSA's in Iowa

[79] United States Census Bureau maps of Metropolitan Statistical Areas are available online at: http://www2.census.gov/geo/maps/metroarea/stcbsa_pg/Feb2013/cbsa2013_IA.pdf.

MSA 's Containing Iowa Counties

MSA	Iowa Counties	Counties Outside Iowa	MSA Label (Largest Iowa City)	Abbreviation
Omaha-Council Bluffs, NE-IA	Pottawattamie, Mills, Harrison	NE: Cass, Douglas, Sarpy, Saunders, Washington	Council Bluffs	OMC
Des Moines-West Des Moines, IA	Guthrie, Dallas, Polk, Madison, Warren	-	Des Moines	DSM
Davenport-Moline-Rock Island, IA-IL	Scott	IL: Henry, Mercer, Rock Island	Davenport	DMR
Cedar Rapids, IA	Benton, Linn, Jones	-	Cedar Rapids	CDR
Waterloo-Cedar Falls, IA	Blackhawk, Bremer, Grundy	-	Waterloo	WTL
Sioux City, IA-NE-SD	Plymouth, Woodbury	NE: Dakota, Dixon SD: Union	Sioux City	SXC
Iowa City, IA	Johnson, Washington	-	Iowa City	IAC
Dubuque, IA	Dubuque	-	Dubuque	DBQ
Ames, IA	Story	-	Ames	AMW

Section 3: Population Estimates for Iowa MSA's

The U. S. Census Bureau provides updated population estimates each year. These estimates are utilized in the table below to provide estimates of the Iowa percentage of the population in multi-state MSA's. The table also contains the percentage of Iowa's total population that resides in each MSA.

MSA	Total Population of MSA[80]	Iowa Population of MSA[81]	Iowa Percentage of MSA Population	Percent of Iowa's Total Population Residing in MSA[82]
Des Moines, IA	611,549	611,549	100%	20%
Cedar Rapids, IA	263,885	263,885	100%	8%
Davenport, IA	383,030	171,387	45%	6%
Waterloo, IA	169,993	169,993	100%	5%
Iowa City, IA	164,357	164,357	100%	5%
Council Bluffs, IA	904,421	122,283	14%	4%
Sioux City, IA	168,806	127,145	75%	4%
Dubuque, IA	96,370	96,370	100%	3%
Ames, IA	94,073	94,073	100%	3%
Totals	2,856,484	1,819,375	64%	59%

Population of Iowa Metropolitan Statistical Areas

[80] July 2014 MSA population estimates for are available online at: http://www.census.gov/popest/data/metro/totals/2014/CBSA-EST2014-alldata.html.

[81] July 2014 County Population Estimates are available online at: http://www.census.gov/popest/data/counties/totals/2014/index.html.

[82] The percentages in this column represent the Iowa population of each MSA divided by the total population for the State of Iowa. Iowa's population is 3,107,126 people, based on the 2014 Census estimates.

Section 4: SLAMS Monitoring Requirements[83] and Distribution of Monitors in MSA's

MSA Label	$PM_{2.5}$ FRM	PM_{10} FRM	Ozone	$PM_{2.5}$ Continuous	SO_2	CO	NO_2[84]	Pb
Ames	0	0	0	0	0	0	0	0
Cedar Rapids	0	0-1	0	0	0	0	0	0
Dubuque	0	0	0	0	0	0	0	0
Davenport	1	1-2	1	1	0	1	0	0
Des Moines	1	1-2	1	1	0	0	0	0
Iowa City	0	0	0	0	0	0	0	0
Council Bluffs	1	4-8	2	1	1	0	0	1
Sioux City	0	0	0	0	1	0	0	0
Waterloo	0	0	0	0	0	0	0	0

Required Number of SLAMs Sites in MSA's

[83] 40 CFR Part 58 Appendix D specifies the minimum number of SLAMS (State and Local Air Monitoring Stations) monitors for ozone, $PM_{2.5}$, and PM_{10} based on both population and the concentrations of these pollutants. This table represents the current (1/2015) minimum monitoring requirements. It should be noted that these requirements change with time, and 40 CFR Part 58 also contains the schedules for implementation of new population-based minimum monitoring requirements.

[84] One near-road NO_2 site in the Des Moines and Council Bluffs MSAs are required to begin operating by January 1, 2017.

MSA Label	$PM_{2.5}$ FRM	PM_{10} FRM	Ozone	$PM_{2.5}$ Continuous	SO_2	CO	NO_2	Pb
Ames	0	0	1[85]	0	0	0	0	0
Cedar Rapids	1	1	1	1	2	0	0	0
Dubuque	0	0	0	0	0	0	0	0
Davenport	3	3	3	1	1	1	0	0
Des Moines	2	2	1	1	0	0	0	0
Iowa City	1	0	0	1	0	0	0	0
Council Bluffs	3	6	4	2	2	2	0	2
Sioux City	0	2	1	1	2	0	1	0
Waterloo	1	1	1	1	0	0	0	0

SLAMS Monitors operated by Iowa and Surrounding States in MSA's

MSA Label	$PM_{2.5}$ FRM	PM_{10} FRM	Ozone	$PM_{2.5}$ Continuous	SO_2	CO	NO_2	Pb
Davenport	2	3	2	1	1	1	0	0
Council Bluffs	0	0	1	0	0	0	0	1
Sioux City	0	1	0	0	1	0	0	0

SLAMS Monitors operated by Iowa in Multi-State MSA's

MSA Label	$PM_{2.5}$ FRM	PM_{10} FRM	Ozone	$PM_{2.5}$ Continuous	SO_2	CO	NO_2	Pb
Davenport	1	0	1	0	0	0	0	0
Council Bluffs	3	6	3	2	2	2	0	1
Sioux City	0	1	1	1[86]	1	0	1	0

SLAMS Monitors Operated by Surrounding States in Multi-State MSA's[87]

[85] This monitor is sited to capture the maximum downwind concentration from the Des Moines MSA, and is located downwind of Des Moines in the Ames MSA.

[86] The monitor operated at the Union County #1 Jensen site in South Dakota is a continuous monitor used for attainment.

[87] §58.16 of the 40 CFR Part 58 establishes that data collected during the period January 1-March 31 does not have to be uploaded to EPA's Air Quality System (AQS) until June 30. Given this provision in federal monitoring rules, and anticipating some reasonable additional delays, it is difficult to precisely establish if monitors were shut down at the end of 2014 or are still operating. This table contains best estimates based on review of the AIRNow, Air Data, and AQS EPA databases. Network plans and other publicly available information on state websites have also been used to establish these monitor counts.

Section 5: Total (SLAMS and non-SLAMS) Monitors Operated by Iowa in its MSA's

MSA Label	$PM_{2.5}$ FRM	PM_{10} FRM	Ozone	$PM_{2.5}$ Continuous	SO_2	$PM_{2.5}$ Speciation	CO	Toxics	NO_2	Pb	Monitors	Sites
Ames	0	0	1	0	0	0	0	0	0	0	1	1
Cedar Rapids	1	1	3	1	2	0	1	1	0	0	10	4
Dubuque	0	0	0	0	0	0	0	0	0	0	0	0
Davenport	3	4	2	2	1	1	1	1	1	0	16	5
Des Moines	2	2	2	1	1	0	1	1	2	0	12	4
Iowa City	1	1	0	1	0	0	0	0	0	0	3	1
Council Bluffs	1	1	2	0	0	0	0	0	0	1	5	4
Sioux City	1	1	0	0	1	0	0	0	0	0	3	2
Waterloo	1	1	1	1	0	0	0	0	0	0	4	2
Inside MSAs	10	11	11	6	5	1	3	3	3	1	54	23
Outside MSAs	11	7	4	6	5	2	0	2	1	0	38	14
Entire State	21	18	15	12	10	3	3	5	4	1	92	37

Number of Iowa Monitors by MSA

MSA Label	$PM_{2.5}$ FRM	PM_{10} FRM	Ozone	$PM_{2.5}$ Continuous	SO_2	$PM_{2.5}$ Speciation	CO	Toxics	NO_2	Pb	Monitors	Sites
Ames	0%	0%	7%	0%	0%	0%	0%	0%	0%	0%	1%	3%
Cedar Rapids	5%	6%	20%	8%	20%	0%	33%	20%	0%	0%	11%	11%
Dubuque	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Davenport	14%	22%	13%	17%	10%	33%	33%	20%	25%	0%	17%	14%
Des Moines	10%	11%	13%	8%	10%	0%	33%	20%	50%	0%	13%	11%
Iowa City	5%	6%	0%	8%	0%	0%	0%	0%	0%	0%	3%	3%
Council Bluffs	5%	6%	13%	0%	0%	0%	0%	0%	0%	100%	5%	11%
Sioux City	5%	6%	0%	0%	10%	0%	0%	0%	0%	0%	3%	5%
Waterloo	5%	6%	7%	8%	0%	0%	0%	0%	0%	0%	4%	5%
Inside MSAs	**48%**	**61%**	**73%**	**50%**	**50%**	**33%**	**100%**	**60%**	**75%**	**100%**	**59%**	**62%**
Outside MSAs	**52%**	**39%**	**27%**	**50%**	**50%**	**67%**	**0%**	**40%**	**25%**	**0%**	**41%**	**38%**

Percentage of Iowa Monitors by MSA

Appendix K: Distribution of Groups Sensitive to Air Pollution by County and MSA

Table of Contents

Section 1: Summary

The Clean Air Act[88] specifies that the primary National Ambient Air Quality Standards are set to protect public health with an adequate margin of safety. This protection includes groups that are sensitive to the effects of air pollution including the elderly, children, and individuals suffering from respiratory ailments. EPA has minimum monitoring requirements that apply to large urban areas, known as Metropolitan Statistical Areas (MSA's).[89] The analysis contained in this section shows that a significant fraction of the individuals that are sensitive to the effects of air pollution reside in these MSA's.

Section 2 contains maps of populations of the elderly and children in Iowa counties. The data was obtained from the 2010 U.S. Census.[90] Section 3 contains maps of the populations of individuals in Iowa counties suffering from specific respiratory illnesses. The data was obtained from the American Lung Association.[91] Section 4 consolidates data from the 2010 U.S. Census, the 2013 U.S. Census estimates[92], and the data on sensitive groups from the American Lung Association to provide a breakdown of groups known to be sensitive to air pollution by Metropolitan Statistical Area (MSA).

About 58% of Iowa's population lived in MSA's in 2013. Of the groups sensitive to the effects of air pollution, 59% of children under 5, 48% of adults over 65, 59% of children with asthma, 58% of adults with asthma, 55% of individuals with COPD which includes chronic bronchitis and emphysema, and 58% of individuals with lung cancer live in MSA's.

This relationship holds for individual MSA's; the ratio of the population in any MSA to the total state's population is roughly equivalent to the ratio of the population of any sensitive group in that MSA to the total population of that sensitive group in the state.

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[88] See Section 109(b)(1) of the Clean Air Act available at: http://www.epa.gov/air/caa/title1.html#ia.

[89] 40 CFR Part 58 Appendix D available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=55b956bb0b7b668e4a05bf1672f1d208&node=ap40.6.58_161.d&rgn=div9.

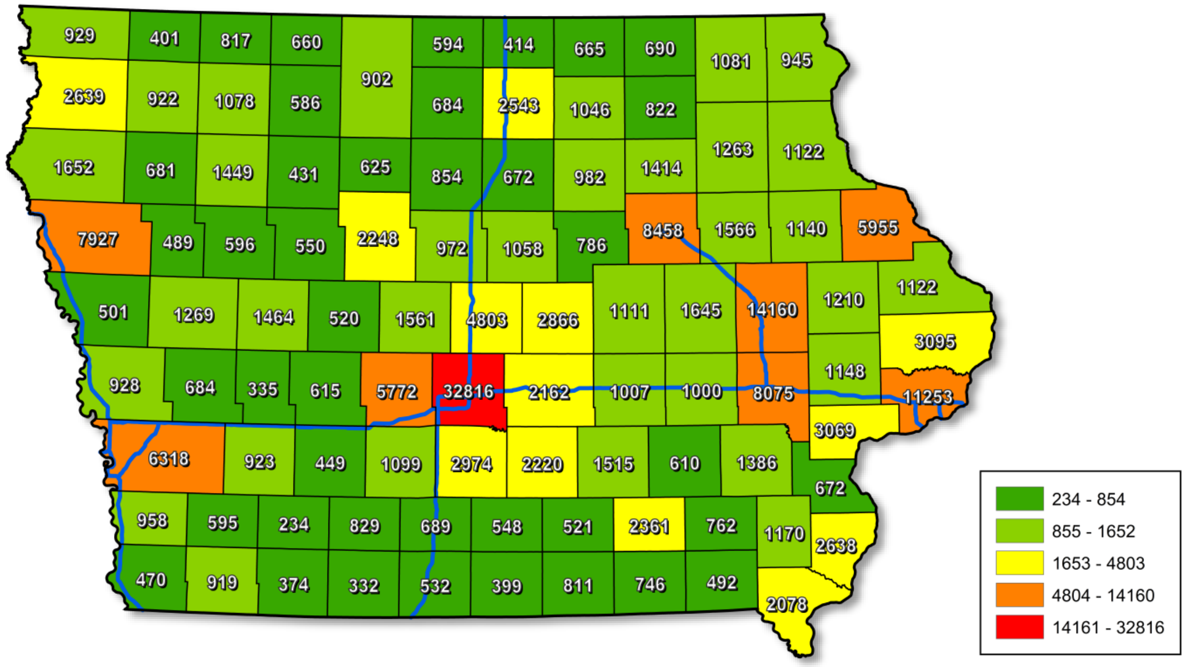
[90] 2010 U.S. Census Data is available at: http://www.census.gov/prod/www/decennial.html.

[91] *Estimated Prevalence and Incidence of Lung Disease by Lung Association Territory* available from the American Lung Association at: http://www.lung.org/finding-cures/our-research/epidemiology-and-statistics-rpts.html.

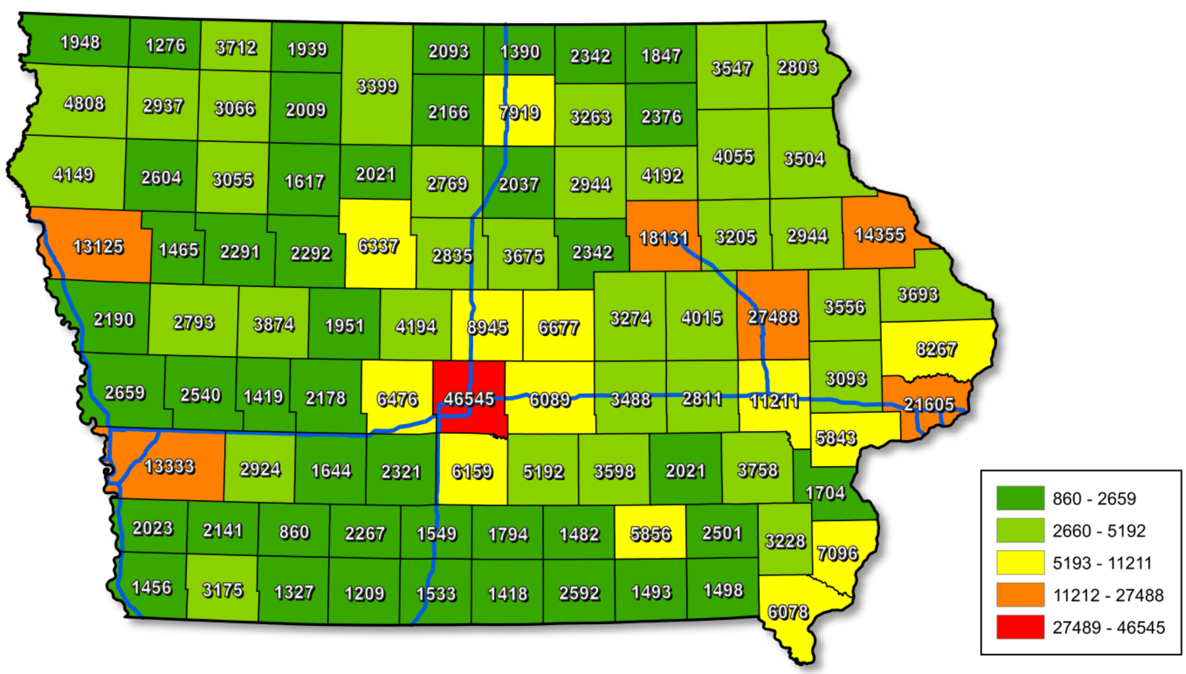
[92] 2013 Census estimates available at: http://www.census.gov/popest/data/historical/2010s/index.html.

Section 2: Children and the Elderly

The 2010 U.S. census data contains demographic breakdowns of the population including defined age groups. Among those groups are children under the age of five and adults over 65 years of age. These two age groups represent those individuals in the population who are at greater risk of health issues related to poor air quality. The distribution of these groups is displayed in the maps below:



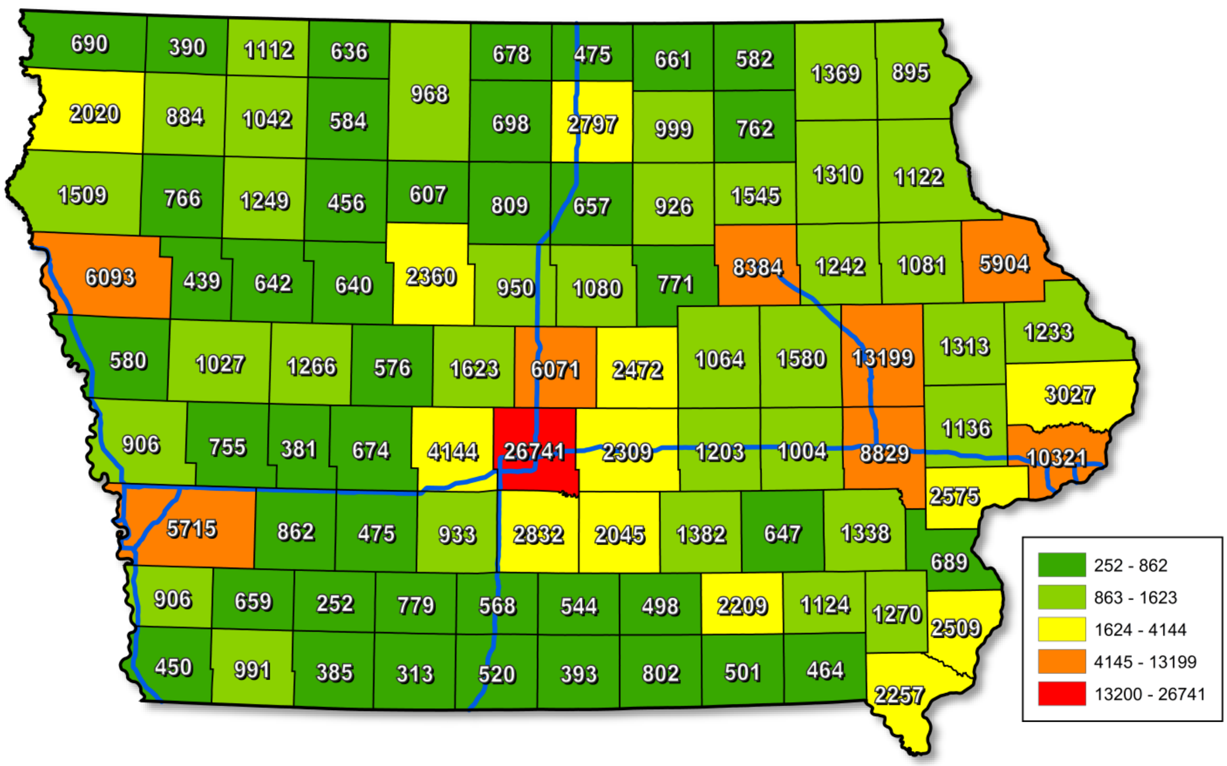
Iowa Population Under the Age of 5 by County – 2010



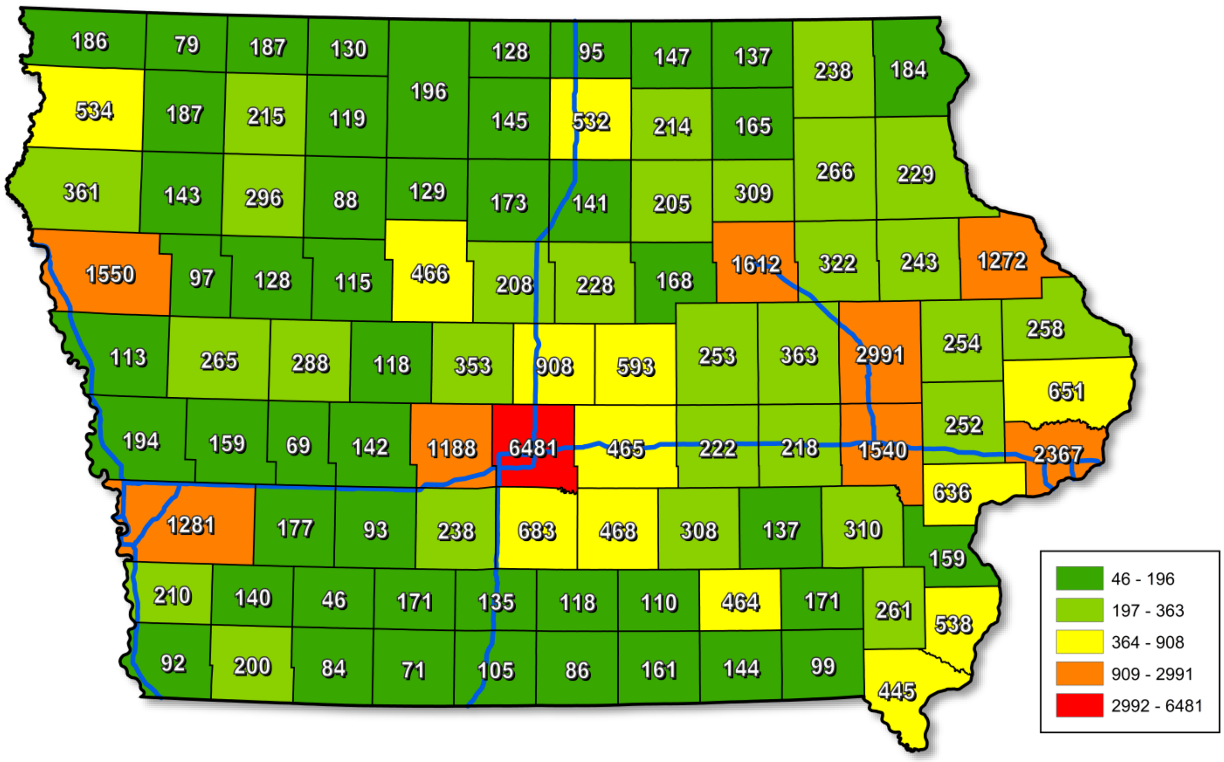
Iowa Population Age 65 and Older by County – 2010

Section 3: Respiratory Diseases

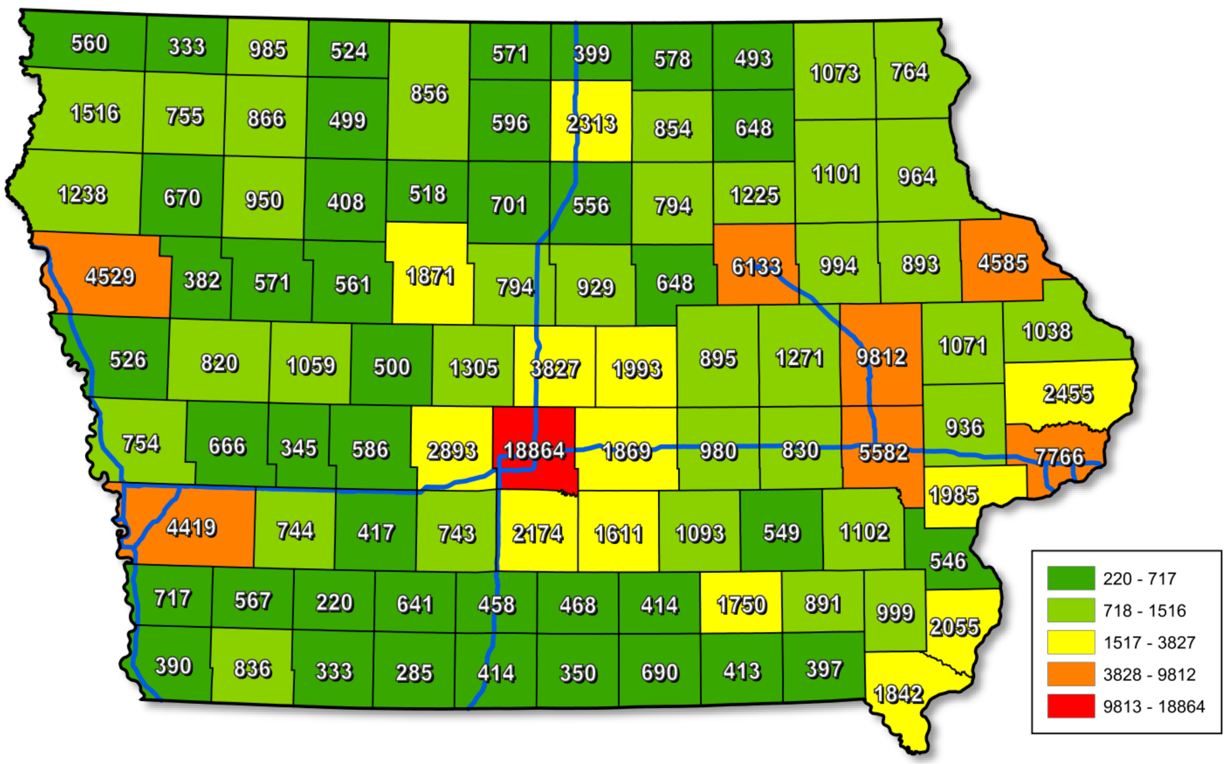
In May of 2014 the American Lung Association's Epidemiology and Statistics Unit published a document entitled "Estimated Prevalence and Incidence of Lung Disease by Lung Association Territory" based on data gathered from 2012 surveys and the 2012 joint report from CDC's National Program of Cancer Registries, NCI's SEER program, and state-based cancer registries. The document estimates the incidence of lung diseases at the county, state, and regional levels. The county estimates are used in the following maps to display where large numbers of individuals with respiratory diseases reside.



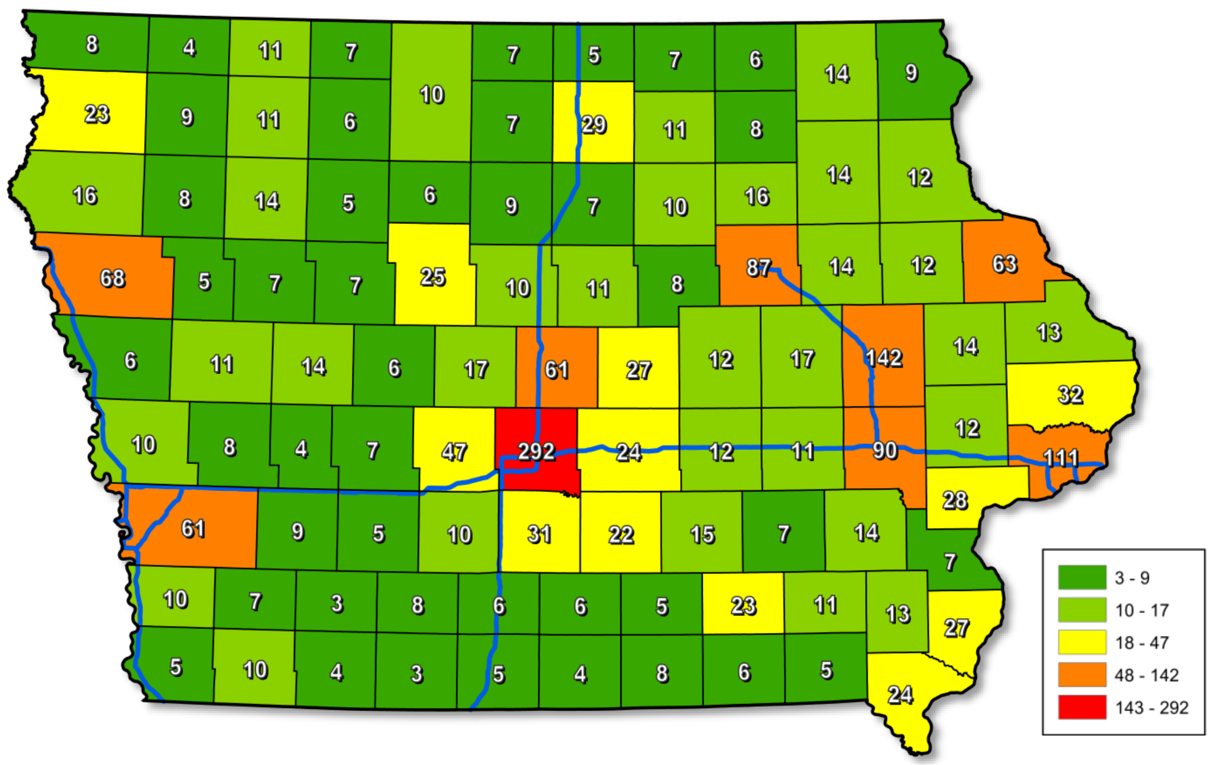
Number of Adult Asthma Cases by County



Number of Pediatric Asthma Cases by County



Number of COPD (Includes Chronic Bronchitis and Emphysema) Cases by County



Number of Lung Cancer Cases by County

Section 4: Breakdown of Groups Known to be Sensitive to Air Pollution by MSA

MSA Label	Population 2013	Population Under 5 2010	Population Over 65 2010	Pediatric Asthma 2012	Adult Asthma 2012	COPD 2012	Lung Cancer 2012
Ames	89542	4803	8945	908	6071	3827	61
Cedar Rapids	257940	17015	35059	3608	16092	12154	173
Dubuque	93653	5955	14355	1272	5904	4585	63
Davenport	165224	11253	21605	2367	10321	7766	111
Des Moines	571132	43447	63843	8758	35421	25322	388
Iowa City	152586	9461	14969	1850	10167	6684	104
Council Bluffs	123145	8204	18015	1685	7527	5890	81
Sioux City	127158	9579	17274	1911	7602	5767	84
Waterloo	167819	10658	24665	2089	10700	8006	111
Inside MSAs	1748199	120375	218730	24448	109805	80001	1176
Outside MSAs	1299655	81919	234322	17191	80397	66415	853
Entire State	3047854	202294	453052	41639	190202	146416	2029

Iowa Population in MSA's

MSA Label	% Population 2013	% Population Under 5 2010	% Population Over 65 2010	% Pediatric Asthma 2012	% Adult Asthma 2012	% COPD 2012	% Lung Cancer 2012
Ames	2.94%	2.37%	1.97%	2.18%	3.19%	2.61%	3.01%
Cedar Rapids	8.46%	8.41%	7.74%	8.66%	8.46%	8.30%	8.53%
Dubuque	3.07%	2.94%	3.17%	3.05%	3.10%	3.13%	3.10%
Davenport	5.42%	5.56%	4.77%	5.68%	5.43%	5.30%	5.47%
Des Moines	18.74%	21.48%	14.09%	21.03%	18.62%	17.29%	19.12%
Iowa City	5.01%	4.68%	3.30%	4.44%	5.35%	4.57%	5.13%
Council Bluffs	4.04%	4.06%	3.98%	4.05%	3.96%	4.02%	3.99%
Sioux City	4.17%	4.74%	3.81%	4.59%	4.00%	3.94%	4.14%
Waterloo	5.51%	5.27%	5.44%	5.02%	5.63%	5.47%	5.47%
Inside MSAs	57.36%	59.50%	48.28%	58.71%	57.73%	54.64%	57.96%
Outside MSAs	42.64%	40.50%	51.72%	41.29%	42.27%	45.36%	42.04%

Percent of Iowa Population in MSA's

MSA's	MSA Label*
Ames, IA	Ames
Cedar Rapids, IA	Cedar Rapids
Dubuque, IA	Dubuque
Davenport-Moline-Rock Island, IA-IL	Davenport
Des Moines-West Des Moines, IA	Des Moines
Iowa City, IA	Iowa City
Omaha-Council Bluffs, NE-IA	Council Bluffs
Sioux City, IA-NE-SD	Sioux City
Waterloo-Cedar Falls, IA	Waterloo

*In multi-city MSAs the largest Iowa City has been used to label the MSA

Iowa Metropolitan Statistical Area Labels

Appendix L: Population Trends

Table of Contents

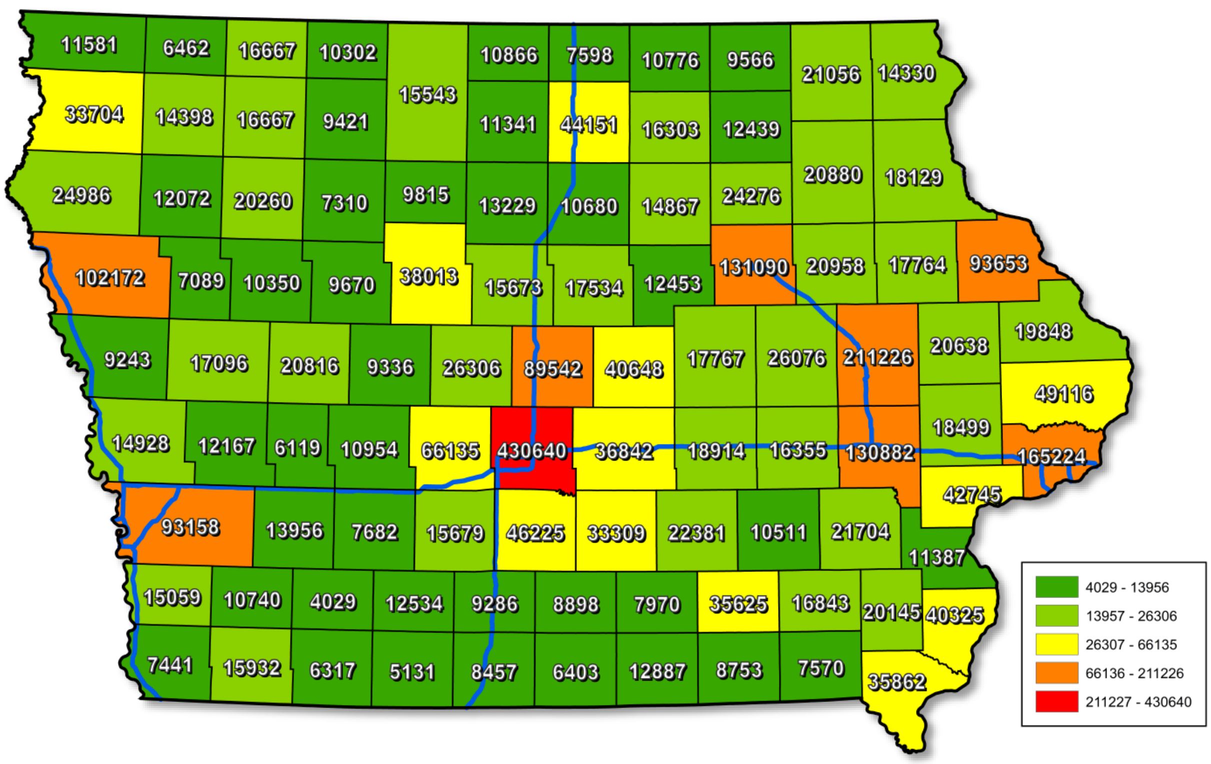
Section 1: Summary

The U.S. Census is conducted every ten years. For the years between actual censuses the U.S. Census Bureau provides population estimates.[93] The maps in Section 2 below show county populations for 2010 and 2013, as well as the population change in each county from 2010 to 2013. Over this period, populations around Iowa's major cities (associated with MSA's) have increased, and populations in most rural areas have decreased. Section 3 contains population changes for counties at the national, Midwest and Iowa levels.

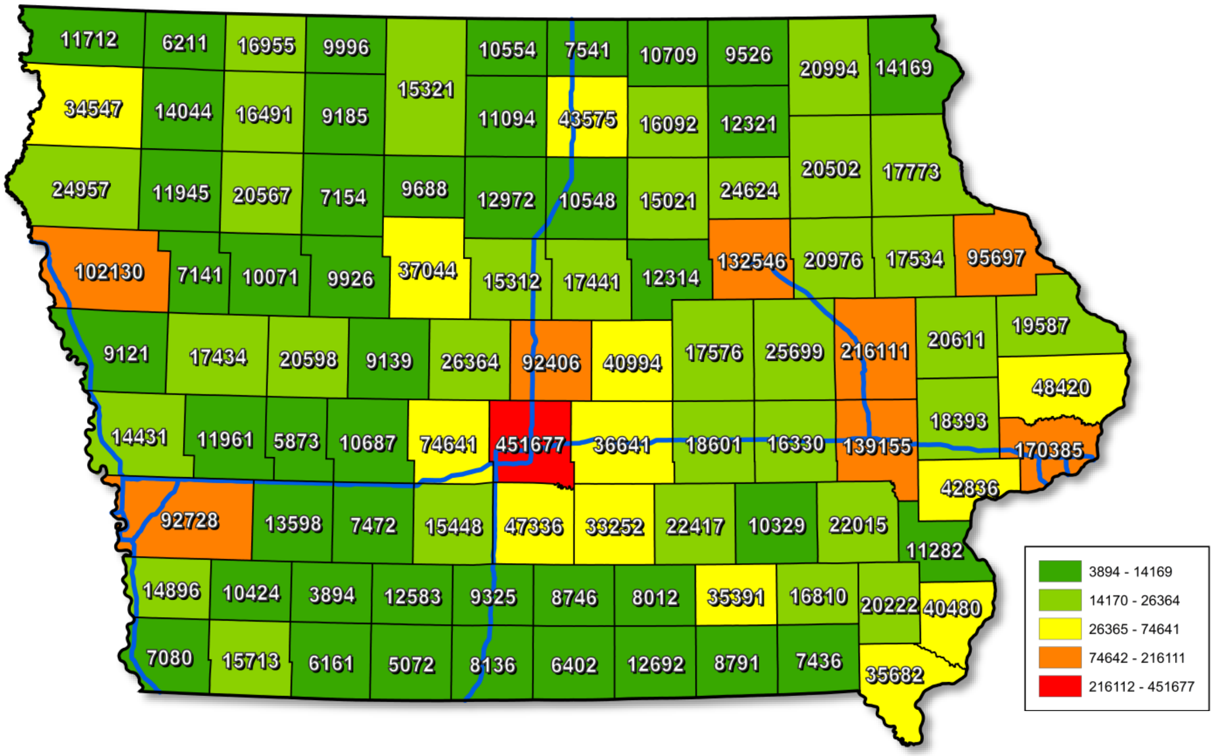
[93] The data summarized in Section 2 of this appendix is from the U.S. Census Bureau and is available at: http://www.census.gov/popest/data/counties/totals/2013/index.html.

Section 2: Iowa County Population Maps

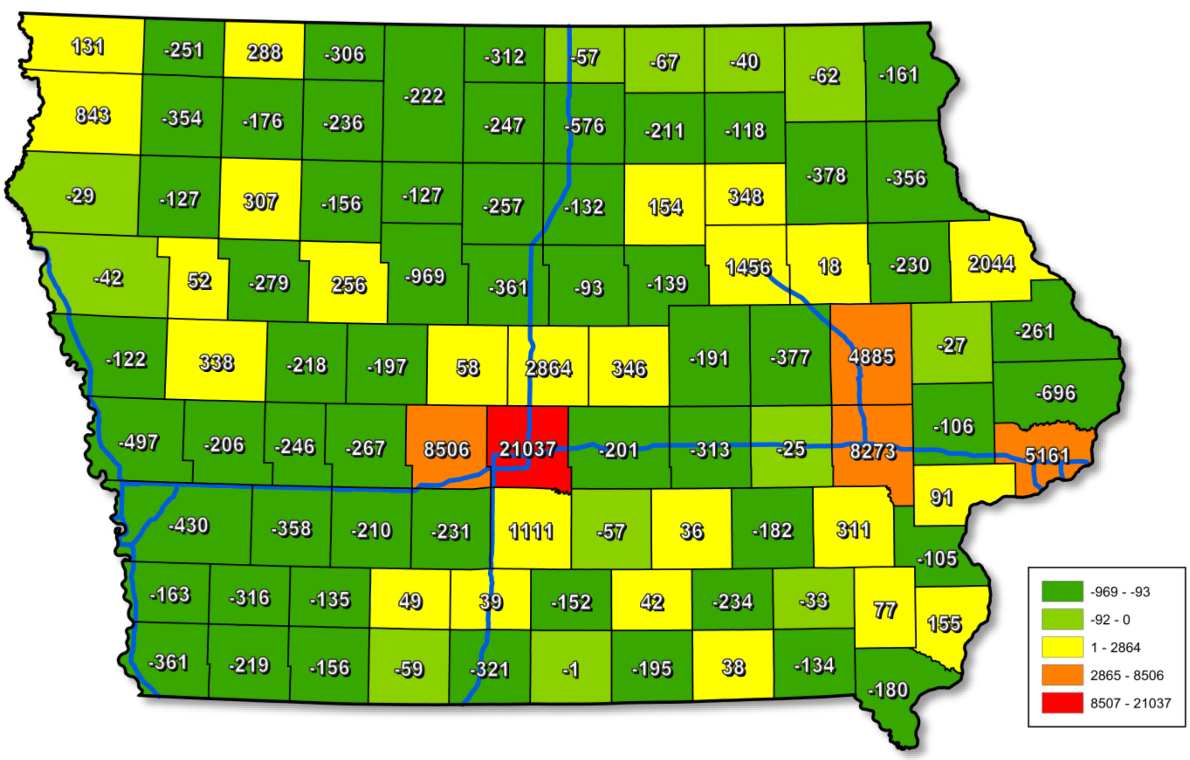
The maps below are derived from US Census estimates and indicate county populations for 2010 and 2013 as well as the difference between these estimates. The counties containing large cities (Des Moines, West Des Moines, Ames, Iowa City, Cedar Rapids, Waterloo, Dubuque, and Davenport) showed the largest increases in population over this period. The exceptions were counties containing Sioux City and Council Bluffs which saw decreases. Most of the declines were noted in rural counties.



2010 Iowa Population by County



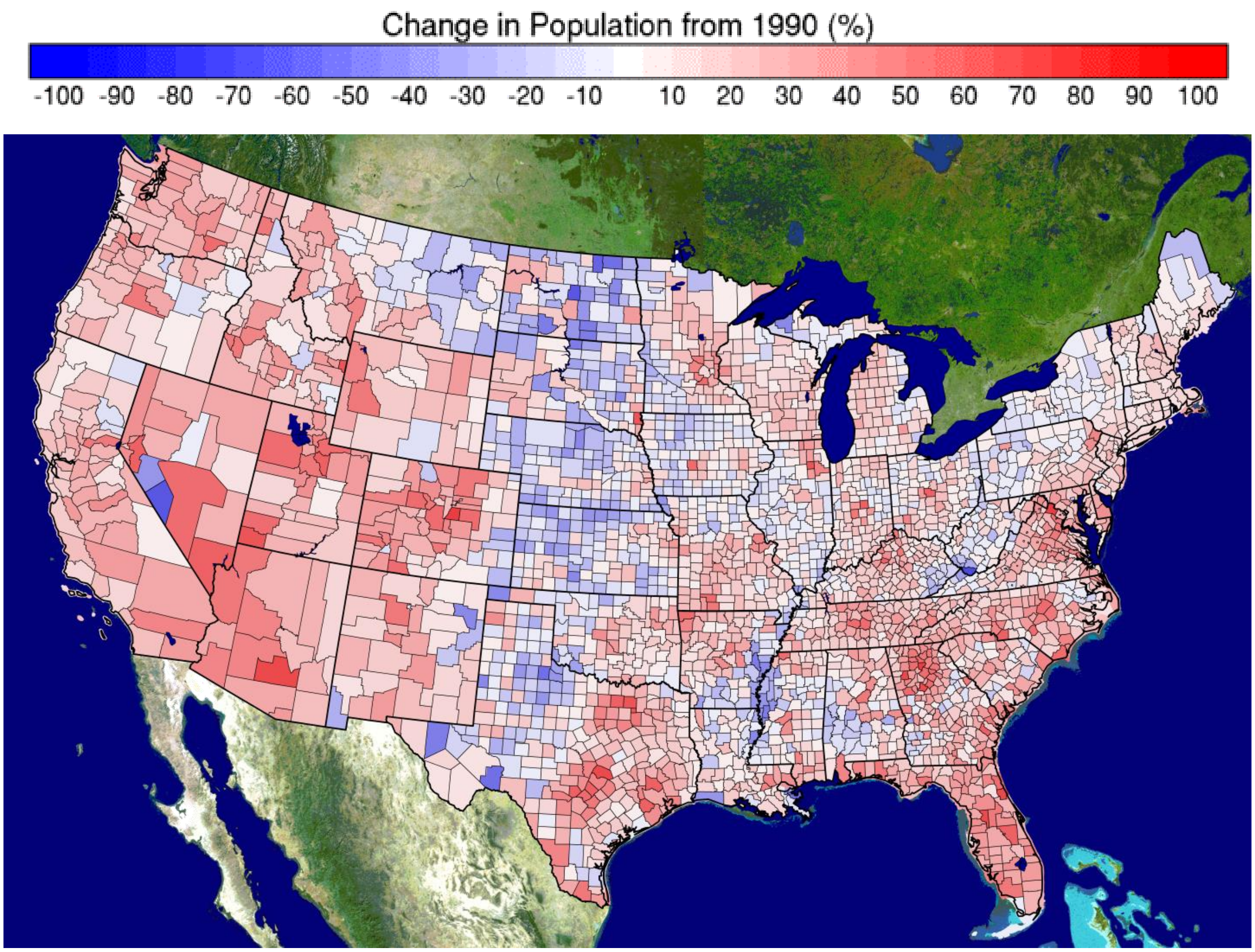
2013 Iowa Population by County



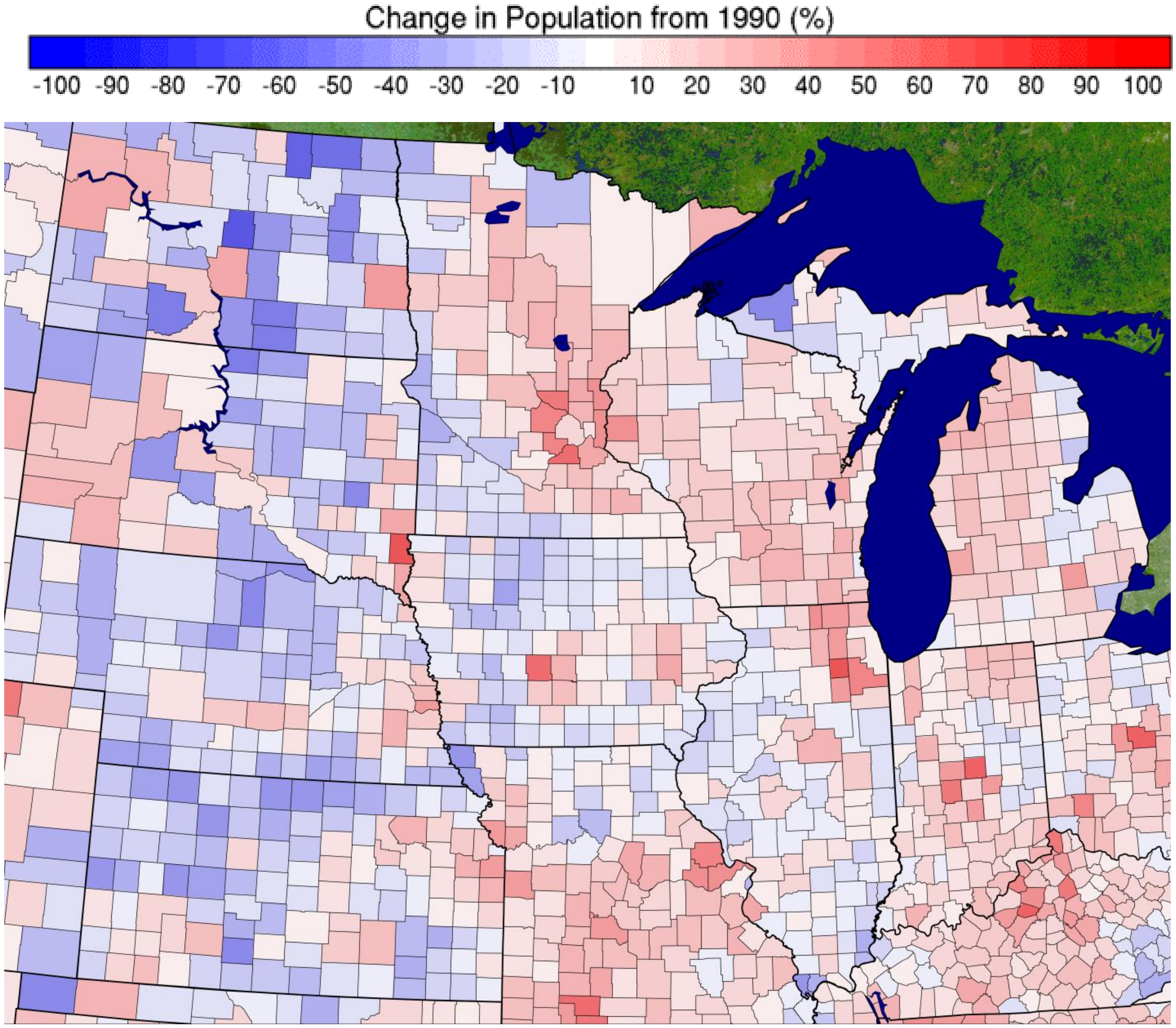
Population Difference of Iowa Counties from 2010 to 2013

Section 3: Maps of Changes in National and Midwestern Populations from 1990 to 2013

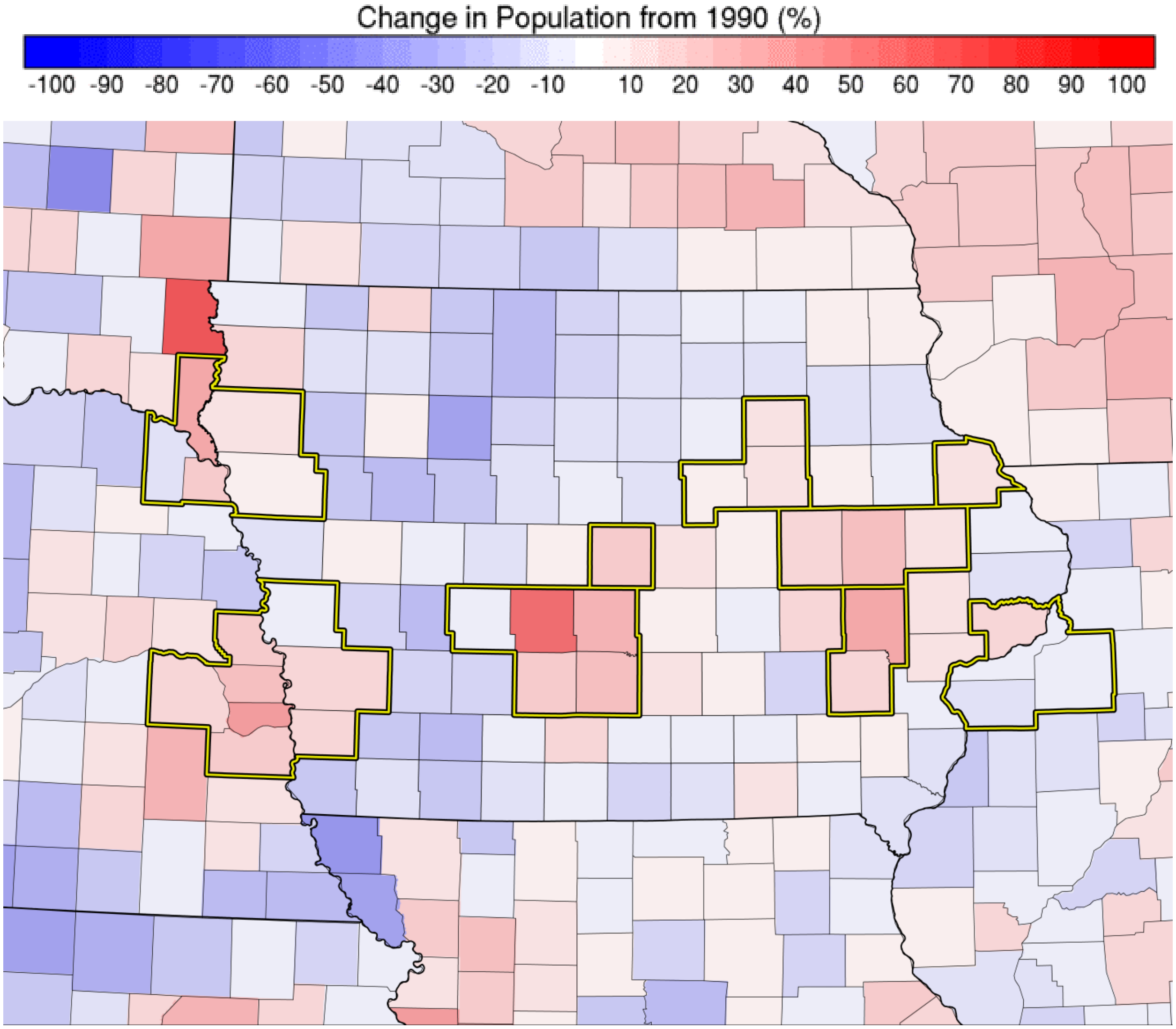
The maps below show population changes within counties at national, Midwest and Iowa levels. Considerable population growth has occurred west of the Rockies over this period, while populations in the western plains states have declined. In the east, population has typically increased in suburban areas and remained stable in outlying areas. Florida and coastal areas in the southeast have increased in population. In states bordering Iowa, there was considerable population growth in the western Chicago (Illinois) suburbs, the Madison (Wisconsin) suburbs, the Minneapolis-St Paul (Minnesota) suburbs, the Omaha (Nebraska) area, the Sioux Falls (South Dakota) area, and in the Kansas City and northern St. Louis suburbs (both in Missouri). Within Iowa, the areas of major population growth were in the suburbs north and west of Des Moines, as well as the Cedar Rapids and Iowa City suburbs.



Changes in National Population from 1990 to 2013



Changes in Midwestern Population from 1990 to 2013



Changes in Iowa Population from 1990 to 2013 with CBSAs outlined