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 State's supplement their annual ambient air monitoring network plan with a five-year network assessment.[11] 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) or to implement new technologies in their air monitoring network. To the extent that important changes in the National Ambient Air Quality Standards (NAAQS) and federal ambient air monitoring requirements are pending,[3] and air monitoring resources are limited, we think that it is more 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, we have simply reiterated the network changes as they appeared in Iowa's 2010 network plan.[4] These changes do not include any reductions to Iowa's SLAMs monitors. The department has reviewed the tools developed by EPA for the five-year network assessment and included results from some of these tools in this document.[5] 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.

Background: Local and Regional Pollutants

EPA has established NAAQS[6] for seven common ("criteria") pollutants: lead, nitrogen dioxide (NO2), 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}).[7]

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.[8]

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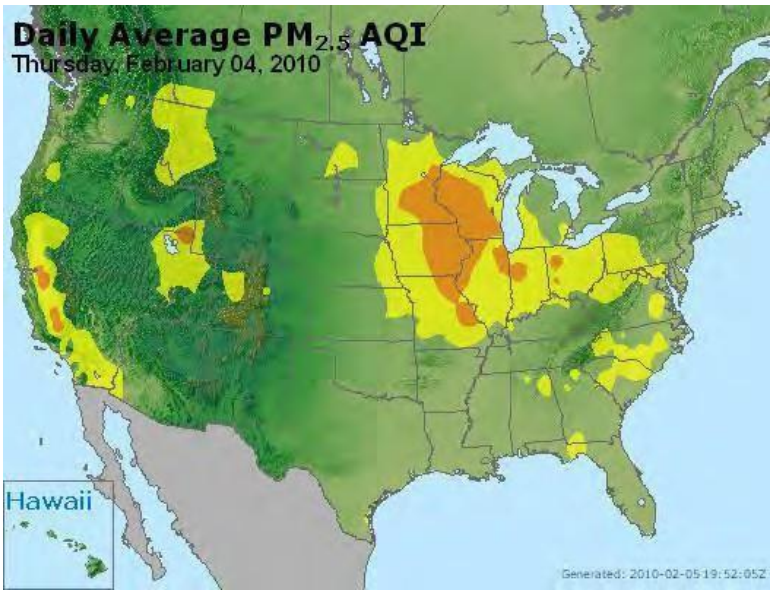
[1] The federal requirement for the five-year assessment is reproduced in Appendix A.
[2] Objectives for the federal ambient air monitoring program are indicated in Appendix B.
[3] See Appendix C.
[4] The changes in the Iowa Ambient Air Monitoring Network identified in Iowa's 2010 network plan are indicated in Appendix D.
[5] The results from the network assessment tools utilized are reproduced in Appendix E.
[6] A collection of resources concerning the NAAQS maybe be found at: http://www.epa.gov/ttn/naaqs/.
[7] A description of the Iowa criteria pollutant monitoring network is contained in Appendix F.
[8] PM_{10} background levels in Iowa have occasionally generated NAAQS exceedances during dust storms driven by extremely high winds.

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.



Regional Air Pollutant Example. PM2.5 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.[9]

- **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. To violate the NAAQS typically requires multiple exceedances at a monitoring site over several years.[10] For ozone and $PM_{2.5}$, 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 the 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 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.[11][12][13]

- **The monitoring network is designed to support permitting activities.** The department frequently conducts ambient air impact analyses as part of the permitting process.[14] 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, 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. For this reason PM10 monitoring data is currently used to compute background levels for PM_{10} ambient impact analyses. $PM_{2.5}$ monitoring data is likely to be used to obtain $PM_{2.5}$ background values in the future.

Public Availability of Iowa's Air Monitoring Data

In Iowa, the Iowa Department of Natural Resources (the department) 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 department also places reports that describe the State's air monitoring network and summarize the State's air monitoring data on its website.

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

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

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

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

[13] A discussion of population changes in Iowa is contained in Appendix K.

[14] The department's dispersion modeling procedures are available at: http://www.iowadnr.gov/air/prof/progdev/modeling.html

- **Real-time Data.** On the local level, the SHL[15], and the Local Programs in Polk[16] and Linn[17] 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 EPA's **AirNow[18]** program. EPA also provides access to real-time data to researchers via the ***AirNow Gateway[19].***

- **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 quality-assured 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[20], to establish compliance with ambient air quality standards, and emissions strategy development. AQS data is available online at EPA's ***AirExplorer*** website[21] and through the ***AQS Data Mart[22].*** Data is also available in summary format on EPA's ***AirData*** website[23]. Quality assured air monitoring data is also available upon request from the department and the Local Programs.

[15] Available at: http://www.uhl.uiowa.edu/services/ambient/realtime.xml.
[16] Available at: http://www.polkcountyiowa.gov/airquality/Pages/PollutantGraphDisplayn.aspx.
[17] Available at: http://www.linncleanair.org/Air-Monitoring/Search-By-Station.aspx.
[18] Available at: http://www.airnow.gov/.
[19] Available at: http://www.airnowgateway.org/.
[20] 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.
[21] Available at: http://www.epa.gov/airexplorer/.
[22] Available at: http://www.epa.gov/ttn/airs/aqsdatamart.
[23] Available at: http://www.epa.gov/air/data/.

Appendix A: 40 CFR Part 58[24] 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 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 multi pollutant 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.

(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.

(c) The annual monitoring network plan must document how States 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 or the creation/change to a community monitoring zone, including a description of the proposed use of spatial averaging for purposes of making comparisons to the annual $PM_{2.5}$ NAAQS as set forth in appendix N to part 50 of this chapter. 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. For $PM_{2.5}$, the assessment also must identify needed changes to population-oriented sites. 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 first assessment is due 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.

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[24] Available online at: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=cac180df2020a509d7cd15f53de73792&rgn=div8&view=text&node=40:5.0.1.1.6.2.1.1&idno=40

Appendix B: 40 CFR Part 58 Appendix D[25] – 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 multi pollutant sites, PM_{10}mass sites, $PM_{2.5}$mass sites, chemically- speciated $PM_{2.5}$sites, and O_3precursor 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.

[25] Available online at: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=053c17b5aec52aa0db307268c0cfe4a2&rgn=div9&view=text&node=40:5.0.1.1.6.7.1.3.35&idno=40.

Appendix C: New and Proposed NAAQS

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 change 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 anticipate 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 and ozone monitoring requirements. Sections 4 and 5 address the new NO_2 and SO_2 NAAQS and associated monitoring requirements.

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: [26]

MILESTONE	POLLUTANT						
	Lead	NO_2 Primary	SO_2 Primary	Ozone Reconsideration	CO	PM	NO_2 /SO_2 Secondary
Proposed	New schedule being developed	Jun 26, 2009	Nov 16, 2009	Jan 6, 2010	Oct 28, 2010	Nov 2010	July 12, 2011
Final	Oct 15, 2008	Jan 22, 2010	Jun 2, 2010	Aug 31, 2010	May 13, 2011	July 2011	Mar 20, 2012

NOTE: Underlined dates indicate court-ordered or settlement agreement deadlines.

Section 3: Proposed Ozone NAAQS and Ozone Monitoring Regulations

Ozone Exceedances Under the Proposed Range for the Primary NAAQS: An Analysis of Historical Data

The proposed ozone NAAQS[27] includes a revision to the primary NAAQS and a new secondary NAAQS. The rule proposes a level for the primary NAAQS (threshold for adverse health effects) between 60 and 70 ppb. An ozone exceedance day occurs on a day where the highest eight-hour average exceeds the level of the standard. The table below shows how many days each site in Iowa would have exceeded the standard at the low, mid, and high range of levels proposed for the primary standard, based on historical data. For comparison, over the period 2007-2009, based on the NAAQS that were effective over this time period, only 2 NAAQS exceedances were recorded; both in 2007. Had the mid-range level of the proposed NAAQS been effective over this period, 128 exceedances would have been recorded over the same period.

Ozone Exceedance Days Calculated According to the Proposed NAAQS

AQS ID	Site Name	2007	2008	2009	2007	2008	2009	2007	2008	2009
190170011	Waverly, Airport	14	8	3	5	1	0	3	0	0
190450021	Clinton, Rainbow Park	34	5	6	19	2	2	9	0	1
190851101	Pisgah, Highway Maintenance Shed	20	3	9	7	2	2	4	0	1
191130028	Cedar Rapids, Kirkwood College	20	6	3	7	0	0	6	0	0

[26] This table is from the presentation ***Update on National Ambient Air Quality Standards (NAAQS)***, by Lydia Wegman (EPA), presented at the 2010 National Air Quality Conference, March 16, 2010. Available online at: http://www.epa.gov/airnow/2010conference/naqc/plenary/naqc_naaqs_ral_march_2010_version_22.ppt.

[27] Available online at: http://www.epa.gov/air/ozonepollution/fr/20100119.pdf.

AQS ID	Site Name	2007	2008	2009	2007	2008	2009	2007	2008	2009
191130033	Coggon, Coggon Elementary	25	9	4	9	2	0	5	0	0
191370002	Viking Lake State Park	11	3	3	8	1	1	4	0	1
191471002	Emmetsburg, Iowa Lakes Community College	5	0	8	3	0	1	2	0	0
191530030	Des Moines, Public Health	13	1	0	8	0	0	3	0	0
191630014	Scott County Park	30	8	14	17	3	1	6	0	1
191690011	Slater, Slater Elementary	14	1	0	7	0	0	4	0	0
191770006	Lake Sugema	24	3	3	11	1	1	4	0	0
191810022	Lake Ahquabi	12	2	4	6	0	1	3	0	0
	Total	222	49	57	107	12	9	53	0	4

Key
Days w/ 8hr Max > 60 ppb
Days w/ 8hr Max > 65 ppb
Days w/ 8hr Max > 70 ppb

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

A violation of the primary NAAQS occurs when the primary ozone design value is greater than the level of the standard. EPA has proposed a range for the level of the ozone NAAQS between 60 and 70 ppb. The primary design value in the proposed ozone rule is the three-year average of the annual 4th highest daily maximum 8-hour ozone values. This is the same form for the design value in the current rule, however, the proposed rule eliminated data handling conventions in the old rule that truncated intermediate results in the computation of the design value, so that the new design values are often 1 ppb higher than the old design values computed with the same data. Design values are calculated below and compared to low, mid, and high values in the range proposed for the new standard. If a value at the midpoint of the proposed range for the primary standard (65 ppb) is selected for the level of the primary NAAQS, based on the most recent 2007-2009 data, all monitors located downwind of eastern Iowa cities and downwind of the Omaha-Council Bluffs area will be at or over the new primary NAAQS.

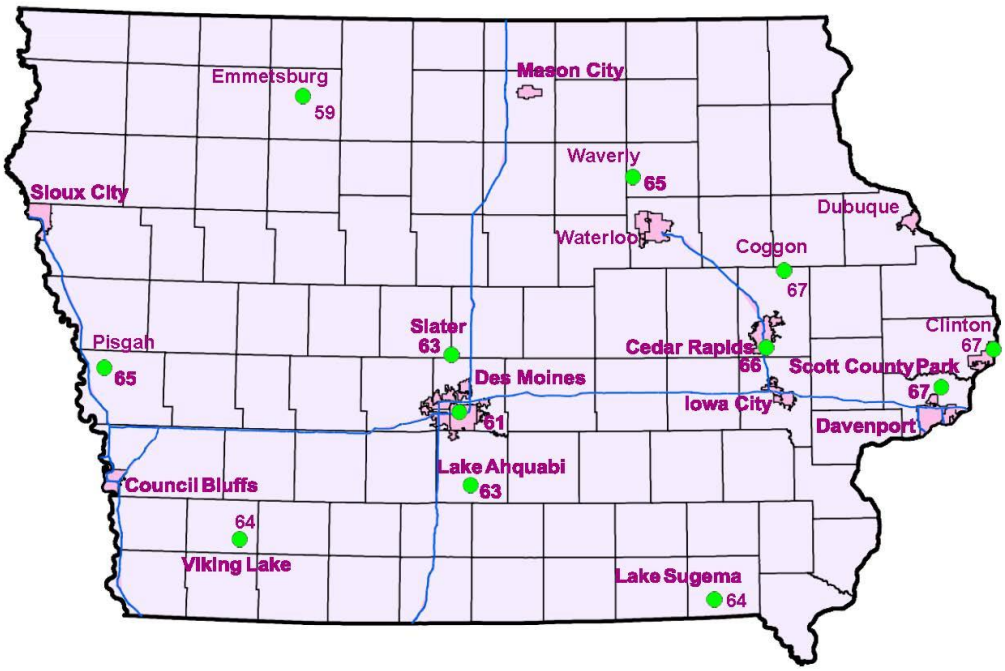
Ozone Primary Design Values (ppb) at Iowa Sites

AQS ID	Site/ 3 Year Period	2005-2007	2006-2008	2007-2009
190450021	Clinton, Rainbow Park	73	68	67
191130028	Cedar Rapids, Kirkwood College	72	69	66
191130033	Coggon, Coggon Elementary	71	68	67
190851101	Pisgah, Highway Maintenance Shed	75	68	65
191630014	Scott County Park	70	66	67
191370002	Viking Lake State Park	69	67	64
191770006	Lake Sugema	69	67	64
190170011	Waverly, Airport	68	66	65
191810022	Lake Ahquabi	69	64	63
191690011	Slater, Slater Elementary	67	65	63
191530030	Des Moines, Public Health			61
191471002	Emmetsburg, Iowa Lakes Community College	63	58	59

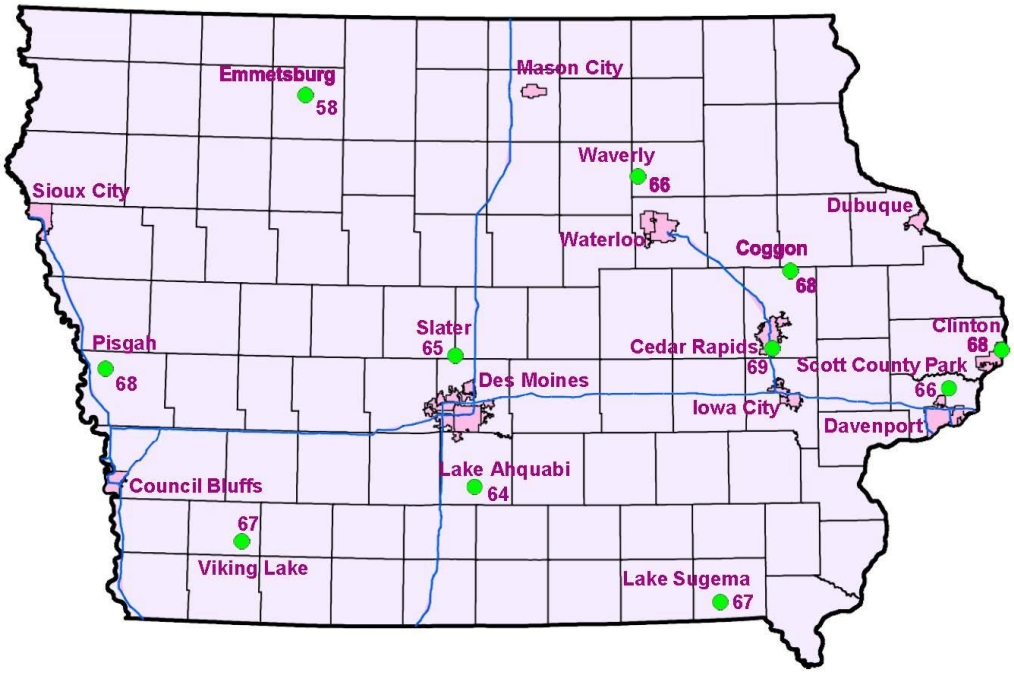
Legend	
Color	Design Value (dv) Range
	dv > 70 ppb
	65 ppb < dv ≤ 70 ppb
	60 ppb < dv ≤ 65 ppb
	dv ≤ 60 ppb

Maps of Ozone Primary Design Values

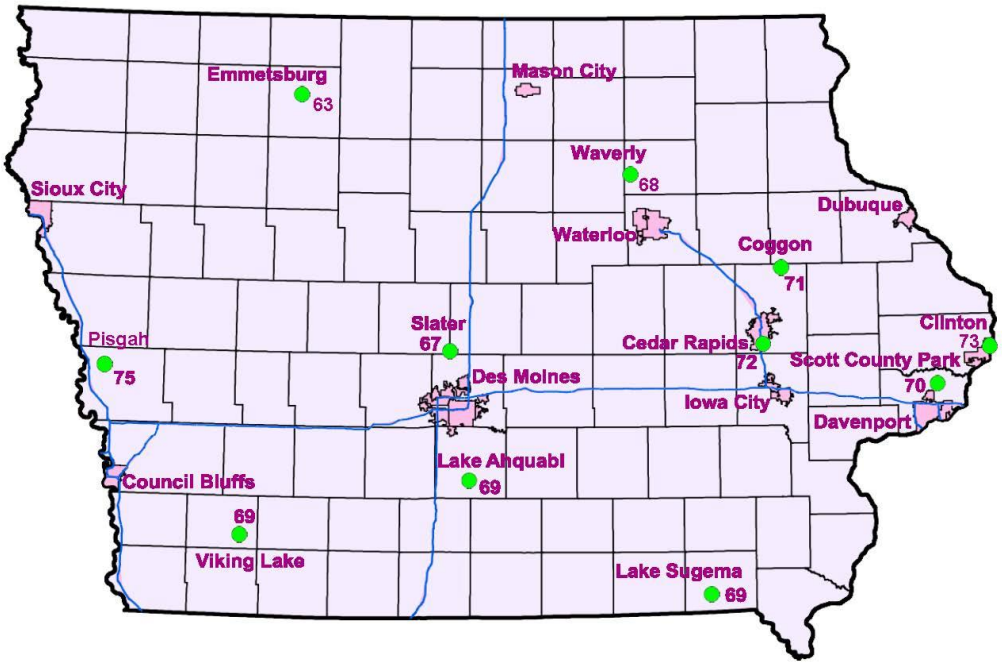
Maps of ozone design values calculated according to the proposed ozone rule are indicated below. Three years of complete data are required to compute a design value; only sites with complete data are indicated. Monitors downwind of eastern Iowa cities and downwind of the Omaha-Council Bluffs area usually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



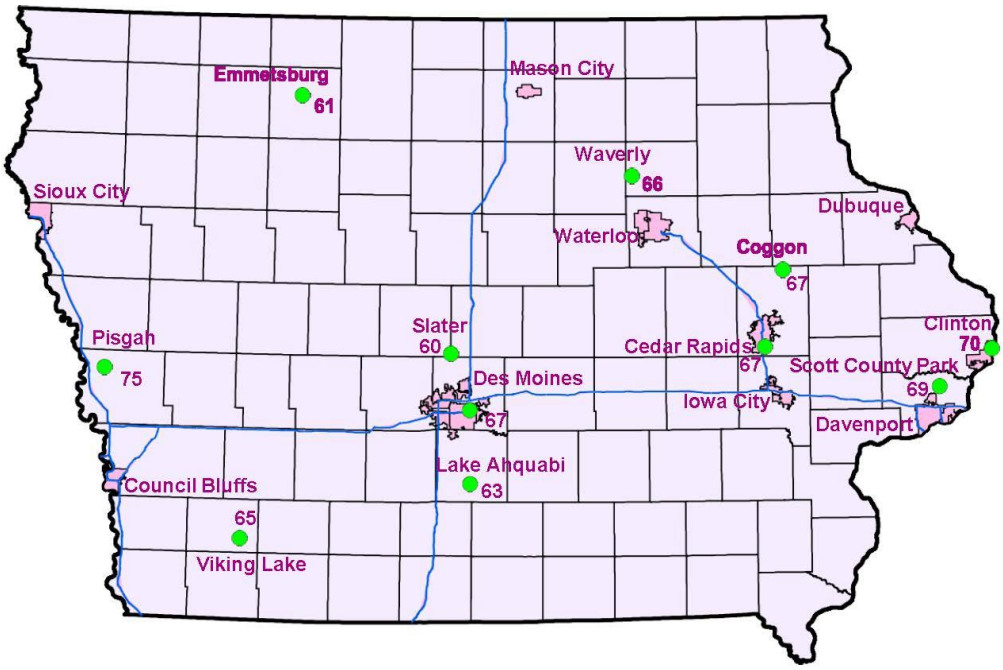
2007-2009 Ozone Design Values (ppb)



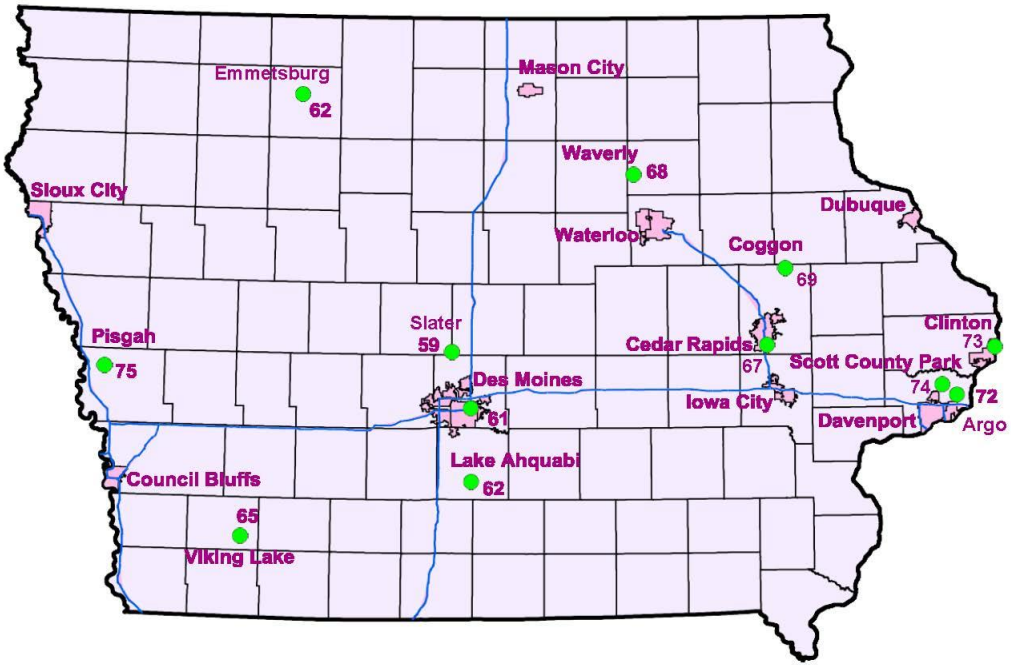
2006-2008 Ozone Design Values (ppb)



2005-2007 Ozone Design Values (ppb)



2004-2006 Ozone Design Values (ppb)



2003-2005 Ozone Design Values (ppb)

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

The proposed ozone rule contains a new secondary standard to protect ozone-sensitive vegetation. Plants are sensitive to the cumulative effect of hourly ozone concentrations during daylight that exceed a level of about 67 ppb. The level of the secondary standard has units of ppb-hr, reflecting the fact that the standard represents a cumulative dosage; details of the design value computation for the secondary standard may be found in the proposed rule.[28] The rule proposes a level for the secondary NAAQS between 7 and 15 ppb-hr. Ozone secondary design values are computed below and compared to low, mid, and high values in this range. If a value at the midpoint of the proposed range of the secondary standard (11 ppb-hr) is selected, based on the most recent 2007-2009 data, no monitors in Iowa will violate the new secondary NAAQS.

Ozone Secondary Design Values (ppb-hr) at Iowa Sites

AQS ID	Site/ 3 Year Period	2005-2007	2006-2008	2007-2009
190851101	Pisgah, Highway Maintenance Shed	12	9	7
190450021	Clinton, Rainbow Park	11	7	7
191630014	Scott County Park	10	7	8
191130033	Coggon, Coggon Elementary	9	7	7
191810022	Lake Ahquabi	8	6	5
191770006	Lake Sugema	8	6	6
190170011	Waverly, Airport	8	7	6
191130028	Cedar Rapids, Kirkwood College	8	7	6
191370002	Viking Lake State Park	7	7	6
191690011	Slater, Slater Elementary	6	6	5
191530030	Des Moines, Public Health			4
191471002	Emmetsburg, Iowa Lakes Community College	4	3	4

[28] A description of the secondary ozone design value is computation is contained in the presentation: ***Demystifying the W126 Statistic,*** by David Mintz (EPA), presented at the 2010 National Air Quality Conference, March 16, 2010, available online at: http://www.epa.gov/airnow/2010conference/naqc/communications/demystifying_the_w126_calculation.ppt.

Legend	
Color	Design Value (dv) Range
	dv > 15 ppb-hr
	11 ppb-hr < dv ≤ 15 ppb-hr
	7 ppb-hr < dv ≤ 11 ppb-hr
	dv ≤ 7 ppb-hr

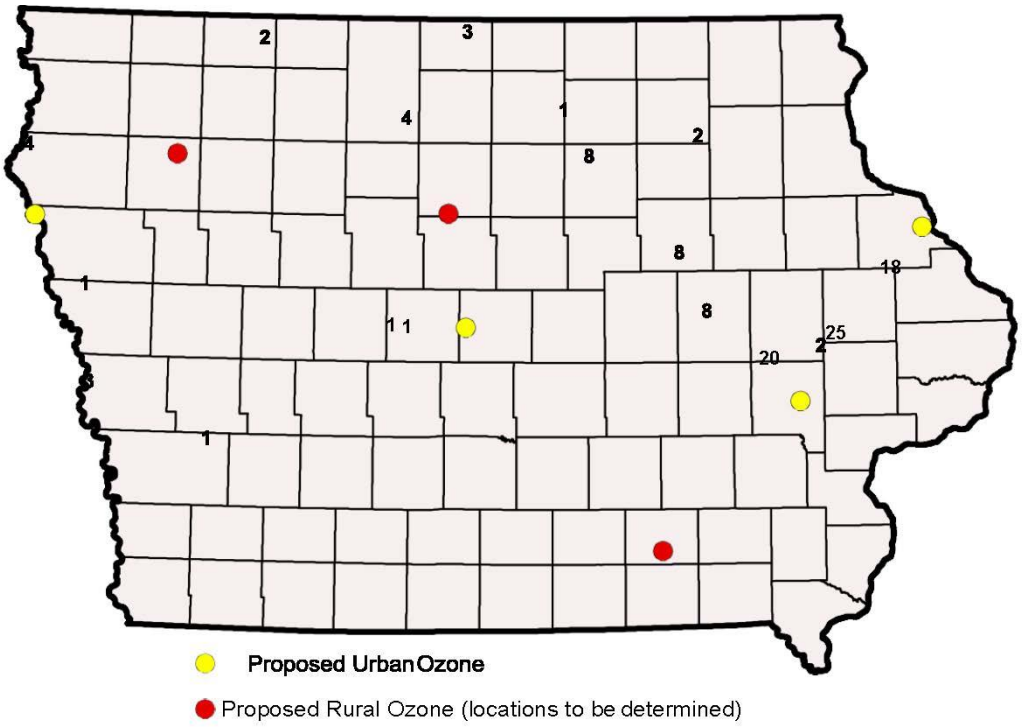
Monitoring Requirements under the Proposed Ozone NAAQS

In addition to the ozone NAAQS changes, EPA has also proposed changes to federal rules regarding ozone network design.[29] If the proposed rule is finalized, new ozone sites would need to be established in or downwind of Iowa's smaller MSA's: Sioux City, Dubuque, Iowa City, and Ames.

The proposed rule also requires states to operate ozone monitors in non-urban areas to allow for:

- Assessment of ozone concentrations in areas such as federal, state, or Tribal lands, including wilderness areas that have ozone-sensitive natural vegetation and/or ecosystems, and to determine compliance with the revised secondary NAAQS.
- Assessment of at least one smaller population center of between 10,000 and 50,000 people that is expected to have ozone concentrations of at least 85 percent of the NAAQS.
- Monitoring in the location of expected maximum ozone concentration outside of any urban area, potentially including the far-downwind transport zones of currently well-monitored urban areas.

According to the proposed rule, any monitoring sites required must be proposed in the State's 2011 network plan and operational by January 1, 2012, or the first day of the 2012 ozone season.



Monitoring Required Under the Proposed Ozone Network Rule

Section 4: New Primary NO_2 NAAQS

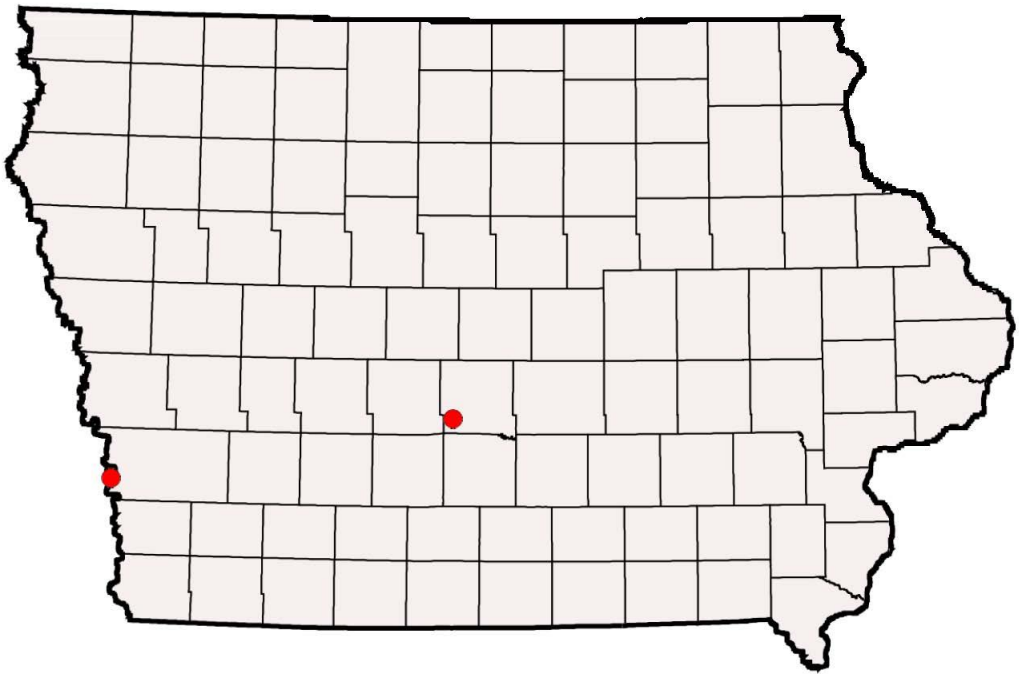
EPA finalized revisions to the nitrogen dioxide NAAQS[30] on January 22, 2010. With this rulemaking, EPA retained the

[29] Available online at: http://www.epa.gov/groundlevelozone/fr/20090716.pdf

[30] The revisions to the NO_2 NAAQS available at: http://www.epa.gov/oar/oaqps/nitrogenoxides/actions.html

annual NO_2 NAAQS and added a new one-hour NO_2 NAAQS. An hour of NO_2 monitoring data of 101 ppb or greater exceeds the threshold for adverse health effects. The design value for the new one- hour standard is the three-year average of the annual 98th percentile daily maximum one-hour NO_2 concentrations. A monitoring site with a design value of 101 ppb or greater violates the new standard.

The final rule places new emphasis on near-road monitoring in highly trafficked areas in large cities. Iowa currently has no near road monitors in its network. One new near road monitoring site is required in the Des Moines MSA and another near road monitoring site is required in the Omaha-Council Bluffs MSA. Any new monitors required by the rule must be proposed in each State's 2012 network plan and operational by January 1, 2013.



Near Road NO_2 Monitoring Required Under New Rule (Note: Requirement applies to MSA)

Section 5: New Primary SO_2 NAAQS

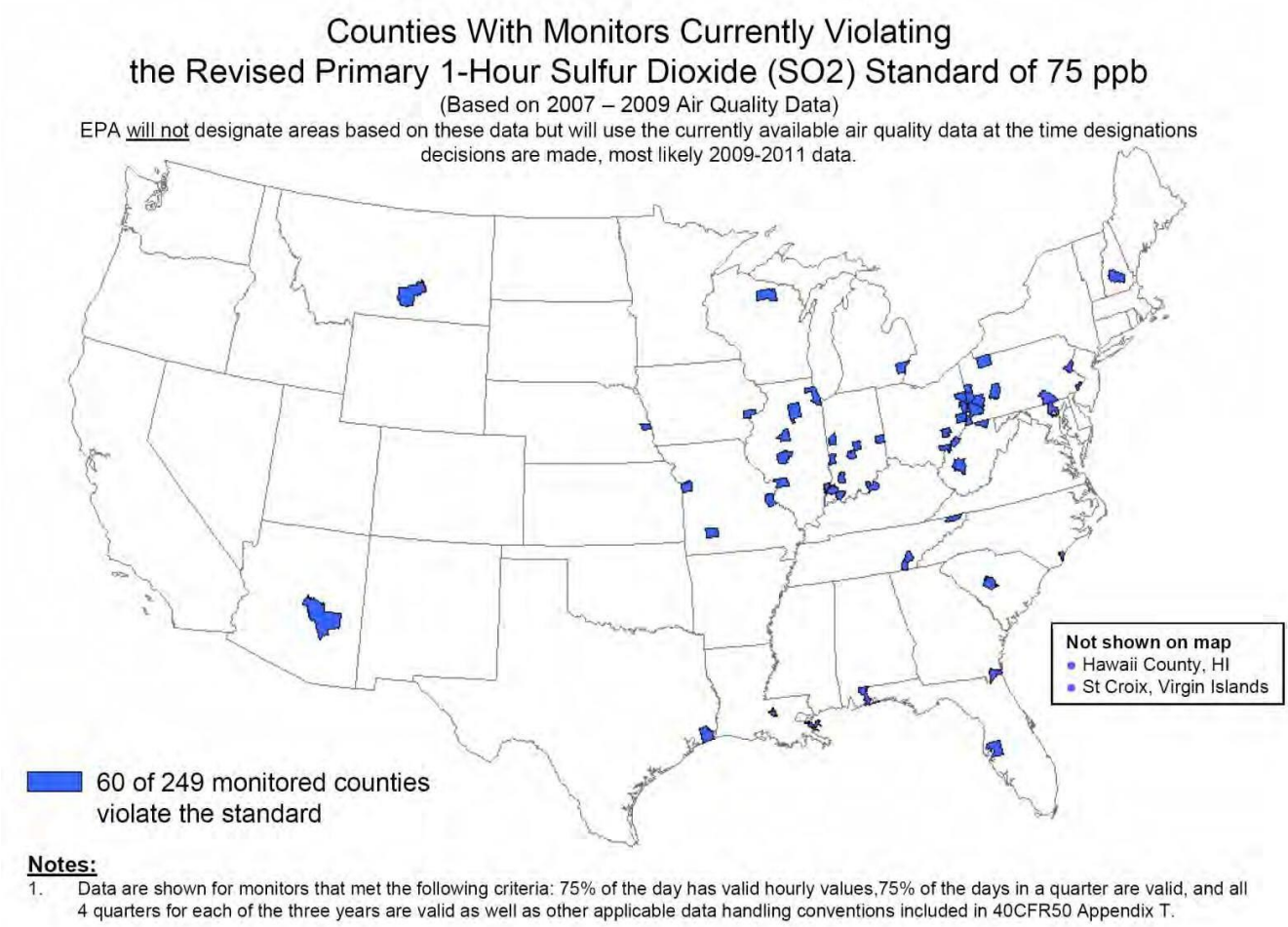
EPA finalized revisions to the primary sulfur dioxide NAAQS on June 2, 2010.[31][32] They established a new one-hour standard and revoked the previous 24-hour and annual NAAQS standards. An hour of SO_2 monitoring data of 76 ppb or greater exceeds the threshold for adverse health effects. The design value for the new one-hour standard is the three-year average of the annual 99th percentile daily maximum one-hour SO_2 concentrations. A monitoring site with a design value of 76 ppb or greater violates the new standard. Along with the rulemaking EPA published a map of counties that contained violating monitors based on the most recent 3 years of monitoring data.[33] Muscatine County in Iowa is indicated on this map, as well as Douglas County in the Omaha NE-Council Bluffs IA MSA. Calculations of county design values (the highest design value for all monitors in a county) were also provided by EPA.[34] EPA's 2007-2009 design values for counties in Iowa and counties on the Iowa border, as well as the national map of non-attainment areas are reproduced below:

[31] Information regarding the new SO2 NAAQS is available online at: http://www.epa.gov/air/sulfurdioxide/actions.html#jun10.
[32] The revisions to the SO NAAQS are available online at: http://www.epa.gov/ttn/naaqs/standards/so2/fr/20100622.pdf.
[33] EPA's map of counties currently violating the new SO NAAQS is available online at: http://www.epa.gov/oar/oaqps/sulfurdioxide/pdfs/20100602map0709.pdf
[34] EPA's table of SO2 design values for existing SO2 monitors is available online at: http://www.epa.gov/oar/oaqps/sulfurdioxide/pdfs/20100602table0709.pdf

EPA One-Hour Sulfur Dioxide Design Values by County

State	County	2007-2009 Design Value (ppb)
Iowa	Clinton	38
Iowa	Linn	59
Iowa	Muscatine	185
Iowa	Scott	13
Iowa	Van Buren	5
Nebraska	Douglas	79

Legend	
	Does not Violate
	≥ 76 ppb



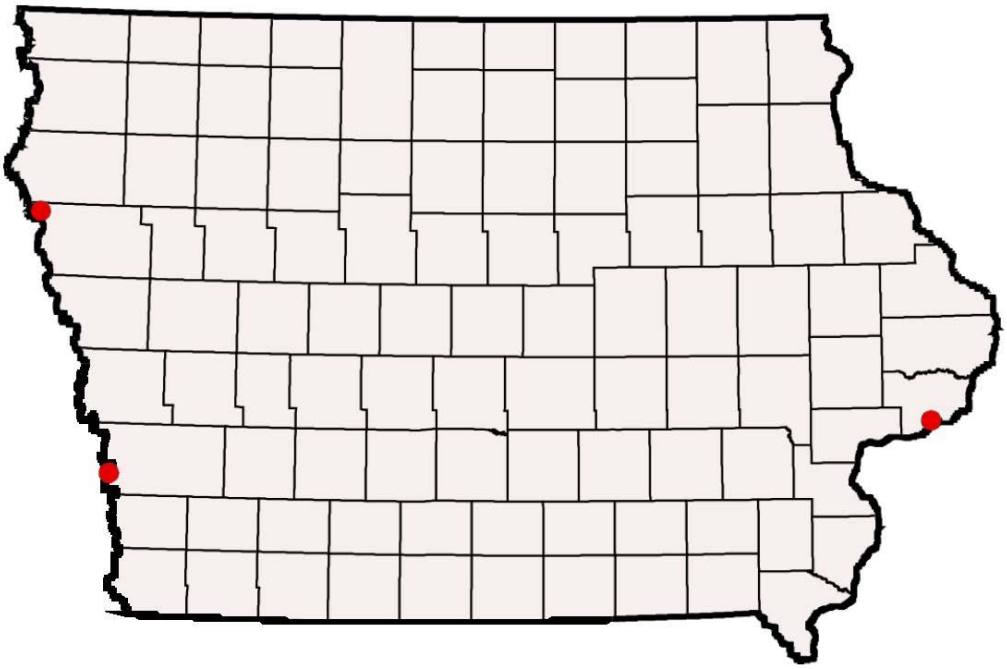
EPA Map of Counties Violating the New SO_2 NAAQS

Monitoring Requirements Associated with the New SO_2 NAAQS

The rulemaking associated with the new SO_2 NAAQS contains new SO_2 monitoring requirements. The new NAAQS requires SO_2 monitoring in the three MSA's that Iowa shares with other states: Sioux City, Omaha- Council Bluffs, and Davenport-Moline-Rock Island.[35] The required monitors may be either sited near sources or at locations that

[35] A list of MSA's where sulfur dioxide monitors are required under the new rule is available online at: http://www.epa.gov/oar/oaqps/sulfurdioxide/pdfs/20100602tablemonitor.pdf

characterize population exposure. The monitors required by the rule must be proposed in the State's 2011 network plan and must be operational by January 1, 2013.



Monitoring Required Under the New SO_2 Rule (Note: Requirement Applies to MSA)

Appendix D: Changes to the Iowa Monitoring Network

Iowa's 2010 Ambient Air Monitoring Network Plan[36] describes the following changes to the Iowa monitoring network that are scheduled to occur before the submission of the next (2011) Network Plan:

1. The Davenport, Jefferson School monitoring site will be upgraded with the addition of Pb and NO_y monitors in order to meet federal requirements of an NCore multi-pollutant monitoring site. The department will discontinue operation of an aging particulate nitrate monitor at this location to make room for the NCore expansion.
2. A $PM_{2.5}$ FRM will be added to a current site in Muscatine to help articulate the area where levels of $PM_{2.5}$ violate the NAAQS.
3. A PM_{10} monitor in Backbone State Park will be converted to a $PM_{2.5}$ FRM in an effort to better define the extent of regional P $M_{2.5}$ episodes and improve estimates of $PM_{2.5}$ background levels in northeast Iowa.

Additional details are indicated in the table below:

Planned Changes to the Iowa Monitoring Network Before July 1, 2011

Site Name	Pollutant	Monitor Type	Sampling Method	Analysis	NAAQS Comparable?	Operating Schedule	Action
Davenport, Jefferson School	Pb	NCore	High Volume FRM	GFAA or ICP-MS	Yes	1/6 day	Addition
Davenport, Jefferson School	NOy	NCore	Continuous	Chemiluminescence	No	Continuous	Addition
Muscatine, Musser Park	$PM_{2.5}$	SPM	Low Volume FRM	Gravimetric	Yes	1/3 day	Addition
Backbone State Park	PM_{10}	SPM	Low Volume FRM	Gravimetric	Yes	1/3 day	Deletion
Backbone State Park	$PM_{2.5}$	SPM	Low Volume FRM	Gravimetric	Yes	1/3 day	Addition
Davenport, Jefferson School	Particulate Nitrate	SPM	Continuous	Chemiluminescence	No	Continuous Seasonal	Deletion

[36] Iowa's 2010 Ambient Air Monitoring Network Plan is available online at: http://www.iowadnr.gov/air/prof/monitor/files/Network_Plan_2010.pdf.

Appendix E: Results from EPA's Network Assessment Tools

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 5-year network assessments.[37] These tools utilize the open source statistical analysis package R.[38] The following sections contain results obtained by applying EPA's Correlation Matrix Tool and Area Served Tool to the Iowa air monitoring network. We have not generated results for EPA's Removal Bias Tool or the New Sites Tool for this review, because neither of these tools can currently differentiate between monitoring sites with differing scales of representativeness.[39] We also feel improvements are needed in the techniques used to generate the spatial fields that describe the probability of NAAQS violations in the New Sites Tool.

EPA's Correlation Matrix Tool provides a graphical representation of the correlation coefficient, average relative percent difference, and distance between pairs of monitoring sites. Applying this tool to the Iowa data showed that as the distance between monitor pairs increased, R^2 values tend to decrease and the average 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.

EPA's Area Served Tool uses 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 current Iowa Network. It is clear from this analysis that monitors in a smaller network tend to serve more area and more people than monitors in a larger network.

Section 2: EPA's Correlation Matrix Tool

EPA's Correlation Matrix Tool provides a graphical representation of three pieces of information associated with pairs of monitoring sites. This data consists of the correlation coefficient and average relative percent difference[40] of the data gathered at the two sites, as well as the distance between the monitoring sites. For each pair of monitoring sites, these three pieces of information are represented graphically as a colored ellipse with a number inside. The more elongated ellipse, the closer R^2 is to one. The lighter the color inside the ellipse, the smaller the average relative percent difference is between the two sites. The number inside the ellipse represents the distance between the two sites in kilometers. The data is arranged in a table, with the site list appearing in both the first row, and the first column of the table, and the ellipse that summarizes the correlation between the ith monitor on the list and the jth monitor on the list is indicated in the ith row and j^{th} column of the table. The same ellipse is generated when the ith monitor on the list is compared to the jth monitor on the list as when the jth monitor on the list is compared with the ith monitor. Therefore the table is expressed in lower triangular form; ellipses are only drawn for the ith and j^{th} element of the table when $i \geq j$.

The analysis utilizes data gathered from monitoring sites with complete data records from 2005 to 2008. To improve the comparability of the results derived from different pairs of monitors, the national data was extracted on a common sampling schedule. Daily maximum 8-hour average-ozone data from May to September was selected for the ozone analysis. For $PM_{2.5}$ continuous data, twenty-four hour averages were computed for each day of the four year period. For $PM_{2.5}$ FRM (filter) data EPA created two data sets for the four year period, one that filtered out any data not taken on EPA's standardized 1 in 3 schedule, and the other removing data unless in was taken on EPA's standardized 1 in 6 sampling schedule. For PM10 FRM (filter) data, EPA created a single data set for the four year period, one that filtered out any data not taken on EPA's standardized 1 in 6 schedule. After filtering the data this way, ozone sites that did not have 75% of the possible sampling days in each of the four years were removed from the analysis, and PM sites that did not have 75% of the scheduled sampling days during each quarter of the four year period were removed from the analysis.

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[37] Available online at: http://www.epa.gov/ttn/amtic/netassess/.

[38] Available online at: http://www.r-project.org/

[39] A discussion of the strengths and weaknesses associated with applying different statistical techniques to air monitoring network design is available online at: http://www.epa.gov/air/airtrends/specialstudies/dsisurfaces.pdf

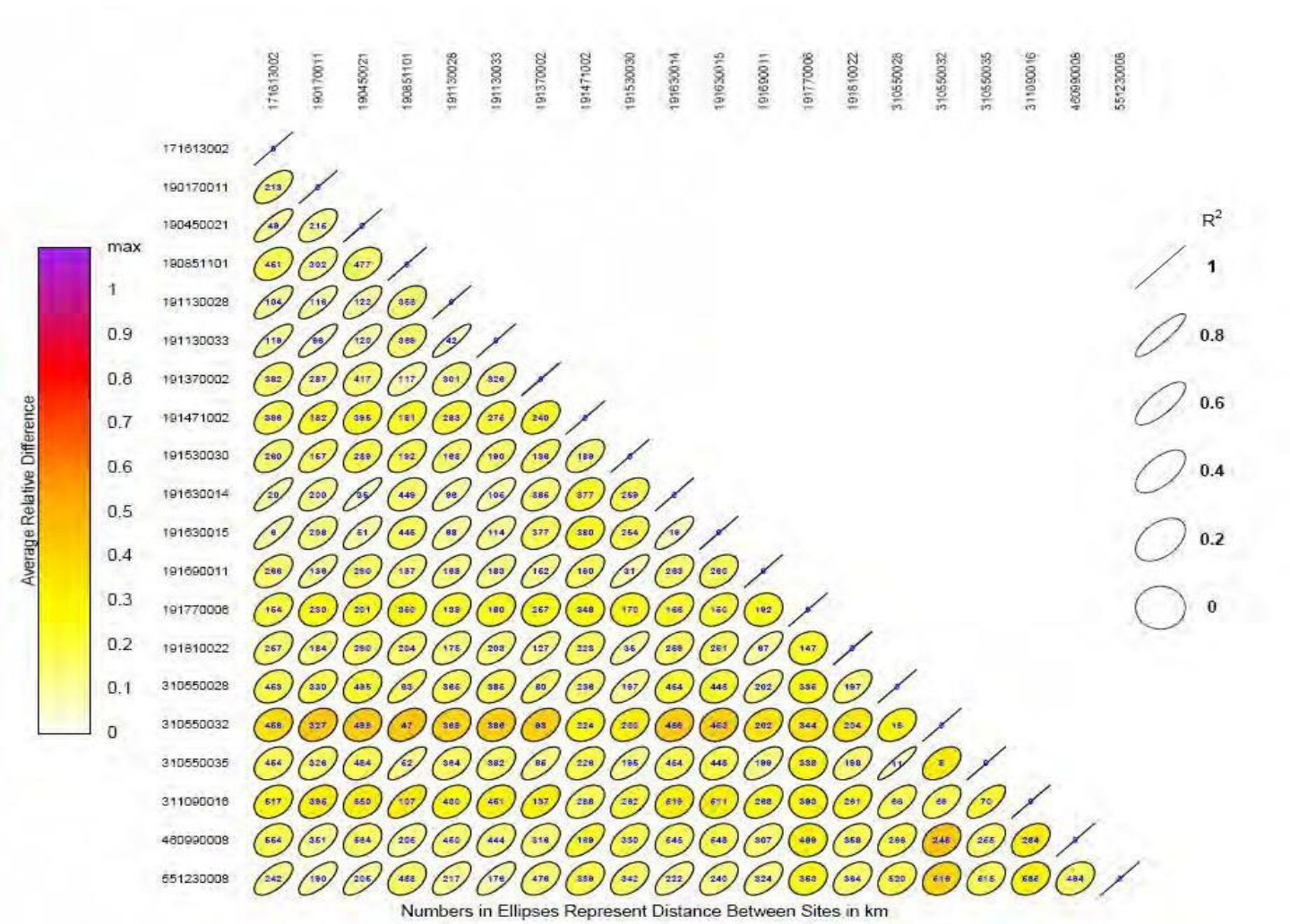
[40] The definition of the relative difference used here is: *Relative Difference* $= 2 * |c_1 - c_2| / (c_1 + c_2)$, where c_1 and c_2 are pollutant concentrations measured at the two sites on the same day.

The Iowa sites included in EPA datasets for ozone, $PM_{2.5}$ FRM and PM_{10} FRM data contain most sites in the current (7/2010) network. $PM_{2.5}$ FRM samplers in Iowa operate at a frequency of at least 1 sample every three days, so EPA's 1 in 3 data set was utilized to make the fullest use of the Iowa PM2.5 FRM data. For each of the three datasets, a rectangular region circumscribing Iowa and monitors near the Iowa border in neighboring States was used to select monitors for the summary table.

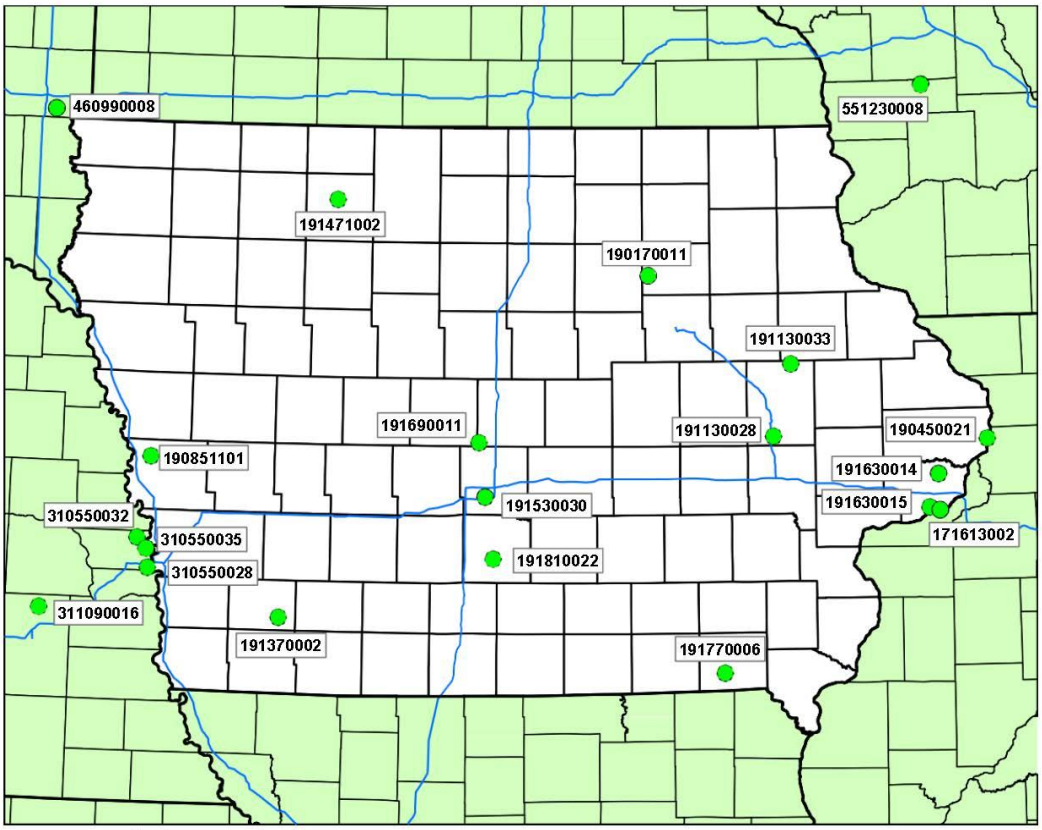
Most of the $PM_{2.5}$ continuous monitors in the current Iowa network were not contained in the EPA data set developed for use with the Correlation Matrix Tool, and graphical output for this network has not been generated for this review.

Graphical output of EPA's Correlation Matrix Tool for ozone, PM2.5 FRM and PM_{10} FRM data is indicated below, along with a map and tables describing the monitoring sites that were included in the EPA 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 relative difference between monitor pairs typically increases.

The ozone monitoring site at the National Weather Service site in Northern Omaha, Nebraska exhibits the largest number of sites with a high average relative percent difference in the ozone correlation matrix. The Blackhawk Foundry monitoring site in Davenport, Iowa exhibits the highest relative percent difference relative to other monitors in the $PM_{2.5}$ correlation matrix. Source-oriented PM_{10} monitors in Mason City, Iowa (Holcim); Buffalo, Iowa (Linwood Mining); and Omaha, Nebraska (46th and Farnam- Omaha Steel Castings) exhibit the highest relative percent difference relative to other monitors in the PM_{10} correlation matrix.



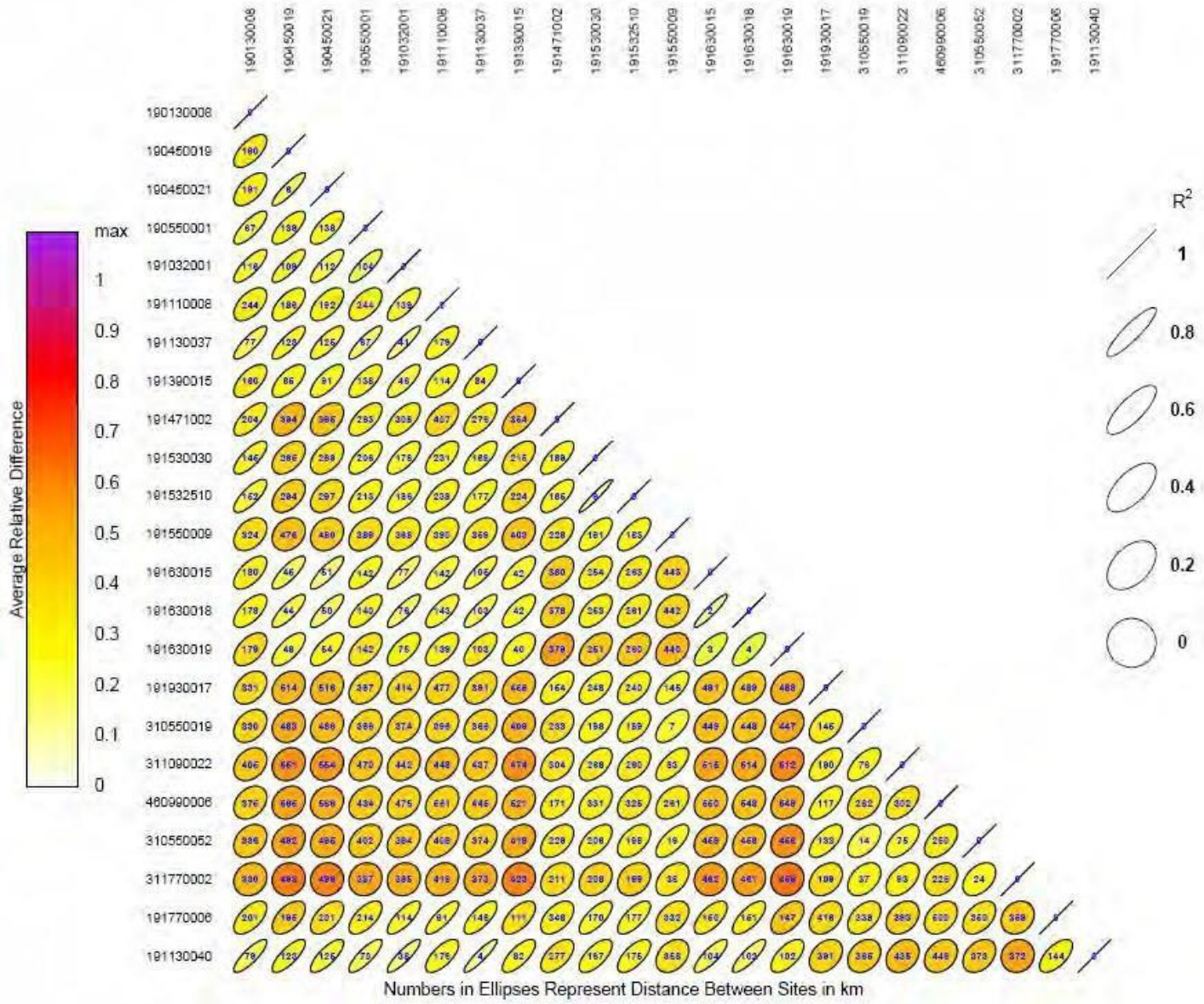
Ozone Correlation Matrix



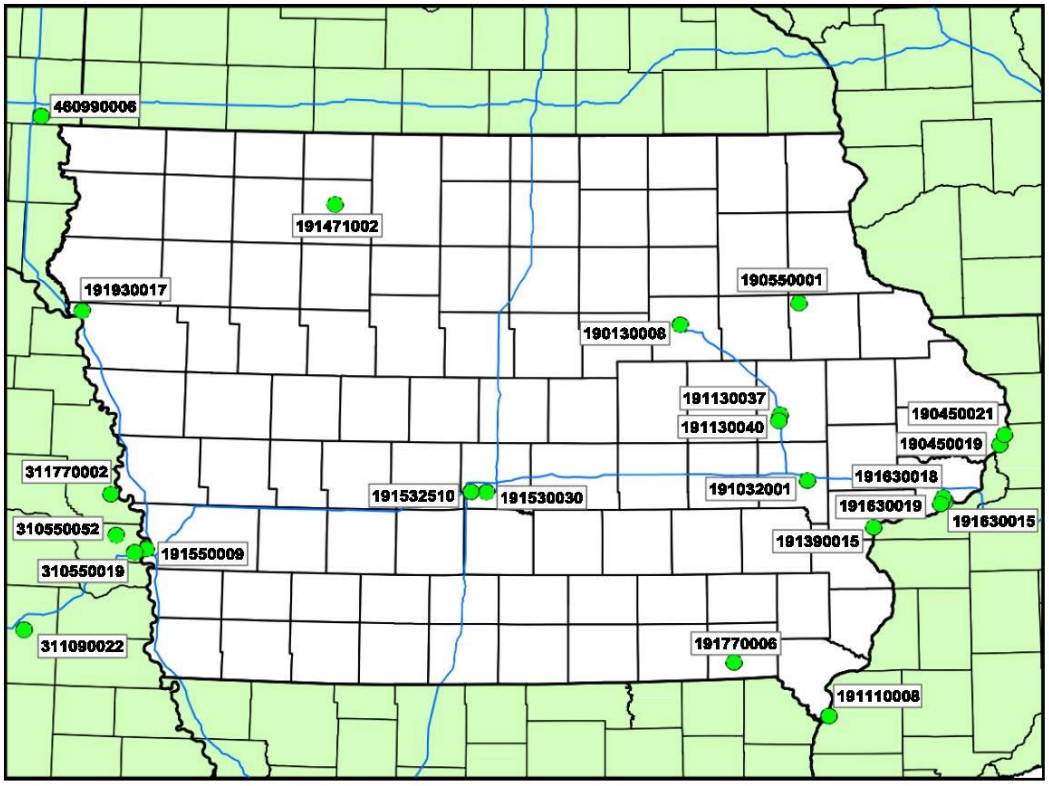
Ozone Correlation Matrix-Site Map

Ozone Correlation Matrix-Site Information

Site ID	Name	State	City	Address
171613002	Rock Island Arsenal	Illinois	Rock Island	32 Rodman Ave
190170011	Waverly Airport	Iowa	Waverly	Waverly Airport
190450021	Rainbow Park	Iowa	Clinton	Roosevelt St
190851101	Highway Maintenance Shed	Iowa	Pisgah	1575 Hwy 183
191130028	Kirkwood College	Iowa	Cedar Rapids	6301 Kirkwood Blvd SW
191130033	Coggon School	Iowa	Coggon	408 E Linn St
191370002	Viking Lake State Park	Iowa	N/A	2780 Viking Lake Rd
191471002	Iowa Lakes Community College	Iowa	Emmetsburg	Iowa Lakes Community College
191530030	Health Building	Iowa	Des Moines	1907 Carpenter
191630014	Scott County Park	Iowa	N/A	Scott County Park
191630015	Jefferson School	Iowa	Davenport	10th St & Vine St
191690011	Slater City Hall	Iowa	Slater	105 Greene St
191770006	Lake Sugema	Iowa	N/A	24430 Lacey Trl
191810022	Lake Ahquabi	Iowa	Indianola	1650 118th Ave
310550028	South Omaha	Nebraska	Omaha	2411 O St
310550032	National Weather Service	Nebraska	Omaha	11414 N 72nd St
310550035	Metro-Tech Campus	Nebraska	Omaha	30th & Fort St
311090016	Davey	Nebraska	Davey	First & Maple
460990008	SD School for the Deaf	South Dakota	Sioux Falls	2001 E 8th St
551230008	On Hill Near Park Office and Maintenance Shop	Wisconsin	Ontario	Wildcat Mtn, Hwy 33



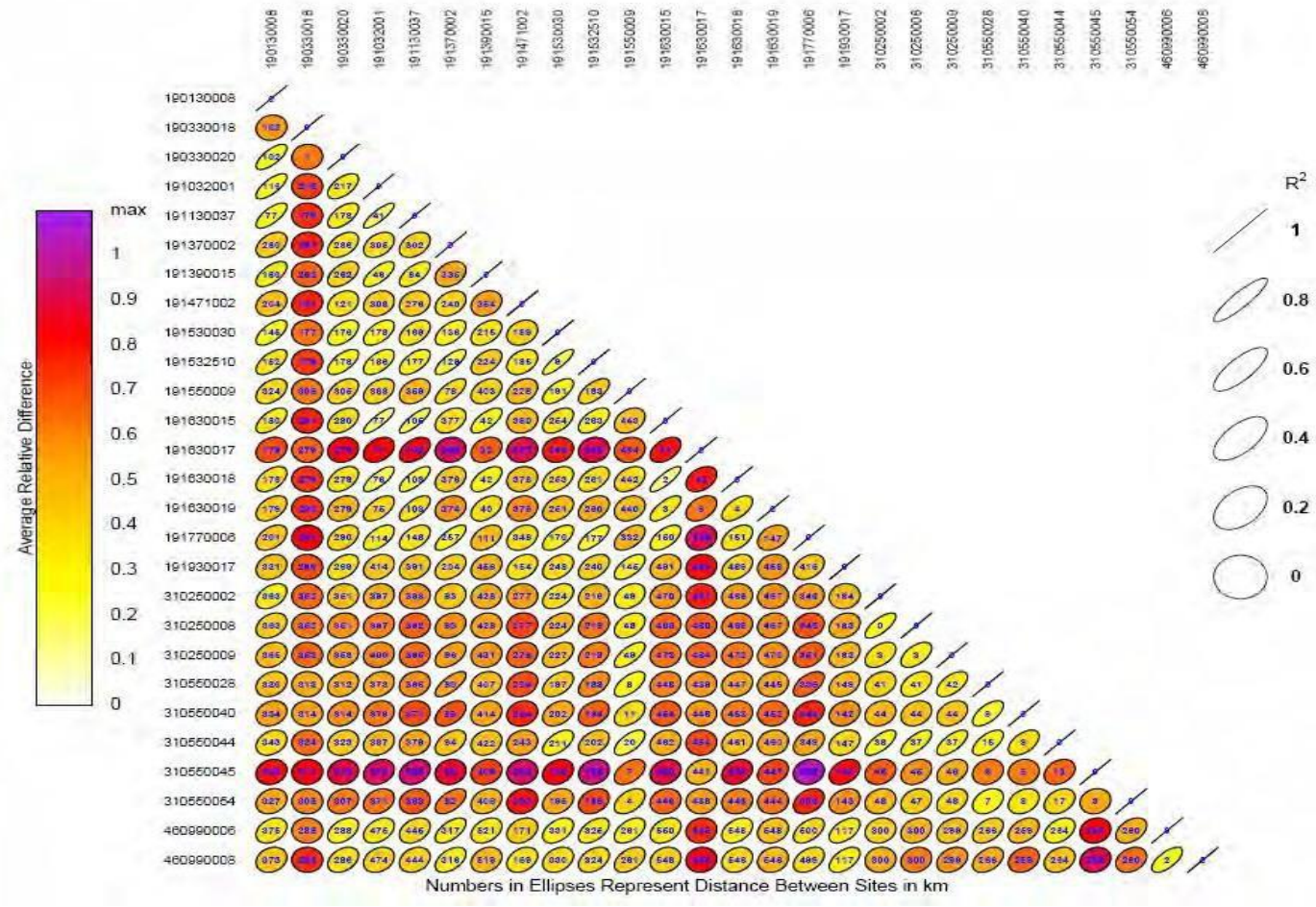
$PM_{2.5}$ FRM Correlation Matrix



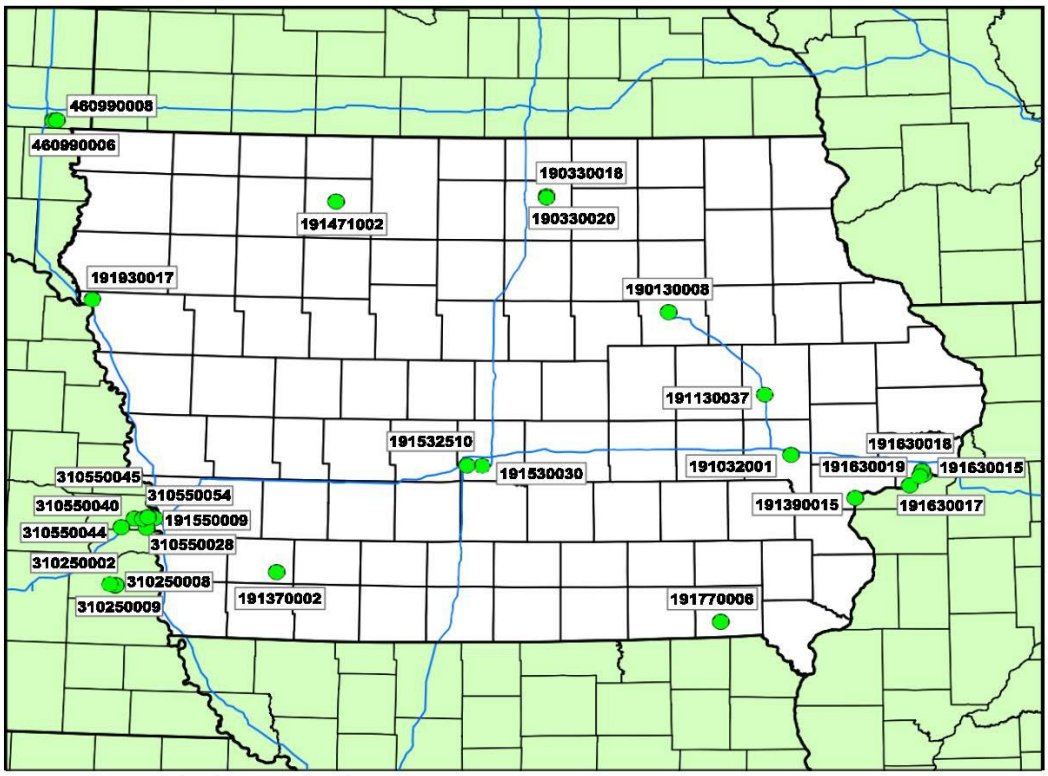
$PM_{2.5}$ FRM Correlation Matrix- Site Map

$PM_{2.5}$ FRM Correlation Matrix-Site Information

Site ID	Name	State	City	Address
190130008	Grout Museum	Iowa	Waterloo	W. Park St. & South St.
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 East Court
191110008	Fire Station	Iowa	Keokuk	111S. 13th St.
191130037	Army Reserve	Iowa	Cedar Rapids	1599 Wenig Rd NE
191130040	Public Health	Iowa	Cedar Rapids	500 11Th St NW
191390015	Garfield School	Iowa	Muscatine	1409 Wisconsin
191471002	Iowa Lakes Community College	Iowa	Emmetsburg	Iowa Lakes Community College
191530030	Health Building	Iowa	Des Moines	1907 Carpenter
191532510	Indian Hills Jr. High School	Iowa	Clive	9401 Indian Hills Drive
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.
191630019	Blackhawk Foundry	Iowa	Davenport	300 Wellman St.
191770006	Lake Sugema	Iowa	N/A	24430 Lacey Trail
191930017	Lowell School	Iowa	Sioux City	27th At Morgan
310550019	Douglas County Hospital	Nebraska	Omaha	42nd & Woolworth
310550052	Elementary School	Nebraska	Omaha	9225 Berry
311090022	Health Department	Nebraska	Lincoln	3140 N St.
311770002	Good Shepard Lutheran Home	Nebraska	Bellevue	2242 Wright Street
460990006	Kelo	South Dakota	Sioux Falls	500 S. Phillips Kelo Site



PM_{10} FRM Correlation Matrix



PM_{10} FRM Correlation Matrix-Site Map

PM_{10} FRM Correlation Matrix Tool-Site Information

Site ID	Name	State	City	Address
190130008	Grout Museum	Iowa	Waterloo	W. Park St. & South St.
190330018	Holcim Cement	Iowa	Mason City	17th St. & Washington St.
190330020	Washington School	Iowa	Mason City	700 N. Washington
191032001	Hoover School	Iowa	Iowa City	2200 East Court
191130037	Army Reserve	Iowa	Cedar Rapids	1599 Wenig Rd NE
191370002	Viking Lake State Park	Iowa	N/A	2780 Viking Lake Road
191390015	Garfield School	Iowa	Muscatine	1409 Wisconsin
191471002	Iowa Lakes Community College	Iowa	Emmetsburg	Iowa Lakes Community College
191530030	Health Building	Iowa	Des Moines	1907 Carpenter
191532510	Indian Hills Jr. High School	Iowa	Clive	9401 Indian Hills Drive
191550009	Franklin School	Iowa	Council Bluffs	3130 C. Ave.
191630015	Jefferson School	Iowa	Davenport	10th St. & Vine St.
191630017	Linwood Mining	Iowa	Buffalo	11100 110th Ave.
191630018	Adams School	Iowa	Davenport	3029 N Division St.
191630019	Blackhawk Foundry	Iowa	Davenport	300 Wellman St.
191770006	Lake Sugema	Iowa	N/A	24430 Lacey Trail
191930017	Lowell School	Iowa	Sioux City	27th At Morgan
310250002	Sanation Building	Nebraska	Weeping Water	City Sanitation Bldg (Weeping Water)
310250008	Weeping Water Park	Nebraska	Weeping Water	112 South Randolph Street
310250009	Weeping Water Lauritzen Farm	Nebraska	Weeping Water	5102 Highway 50
310550028	South Omaha	Nebraska	Omaha	2411 O St.
310550040	7717 Dodge	Nebraska	Omaha	7717 Dodge
310550044	132nd & Q	Nebraska	Omaha	132nd & Q Streets
310550045	46th & Farnam	Nebraska	Omaha	46th & Farnam
310550054	19th & Burt	Nebraska	Omaha	19th & Burt
460990006	Kelo	South Dakota	Sioux Falls	500 S. Phillips Kelo Site
460990008	SD School for the Deaf	South Dakota	Sioux Falls	2001 E 8th St

Section 3: EPA's Area Served Tool

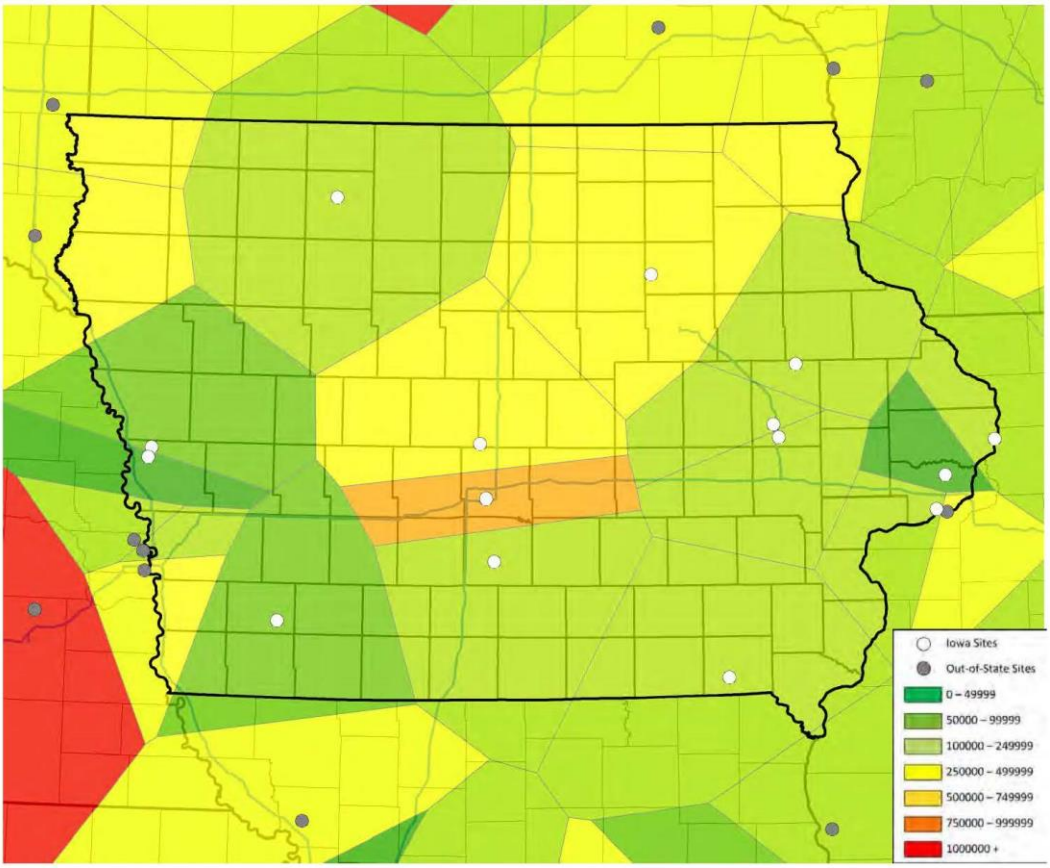
Given a group of points on a plane contained inside a boundary, one can construct the perpendicular bisector between pairs of points, and extend each bisector until it meets another bisector or meets the boundary. Proceeding in this manner, the area of the plane inside the boundary is divided into polygons. 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 Veroni polygons.[41]

EPA's Area Served Tool draws the Veroni polygons associated with the locations of a group of air monitoring sites specified by the user. The area of the Veroni Polygon is defined as the "area served" by the monitor. The population residing inside each Veroni polygon is computed by the tool from census tract data compiled from the 2000 US Census.

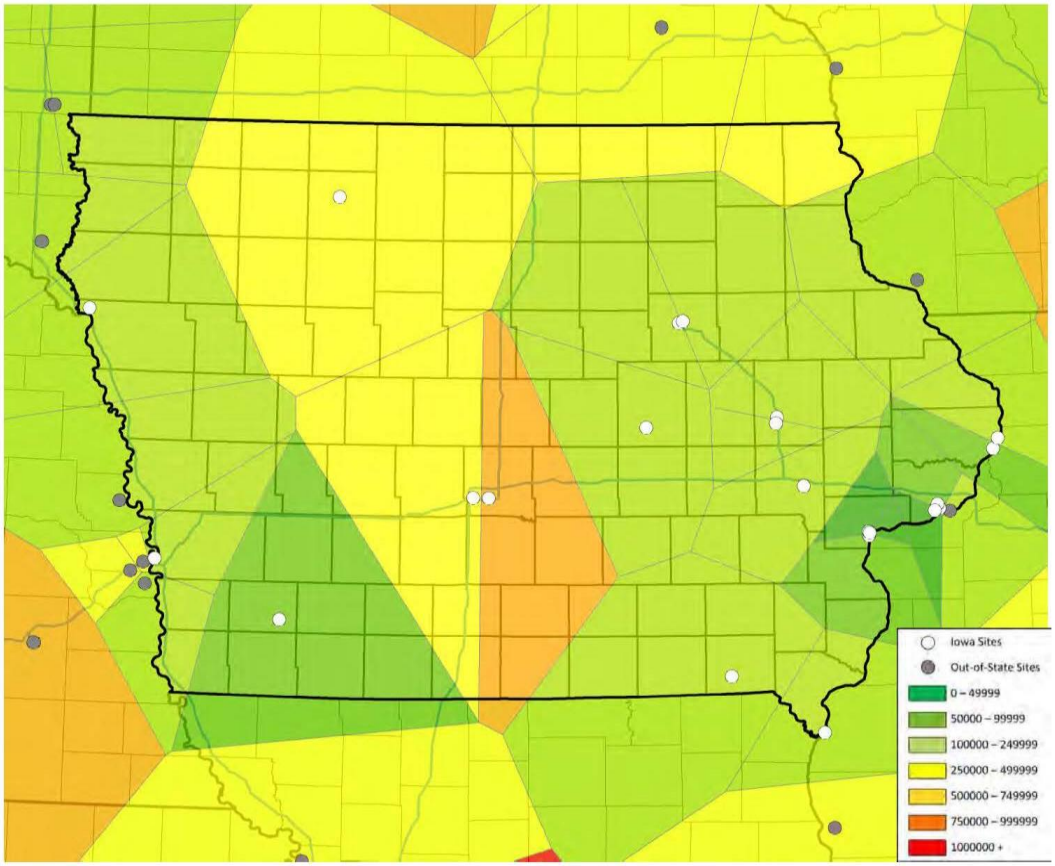
Veroni polygons and their associated populations are indicated below for each NAAQS pollutant in Iowa's current

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

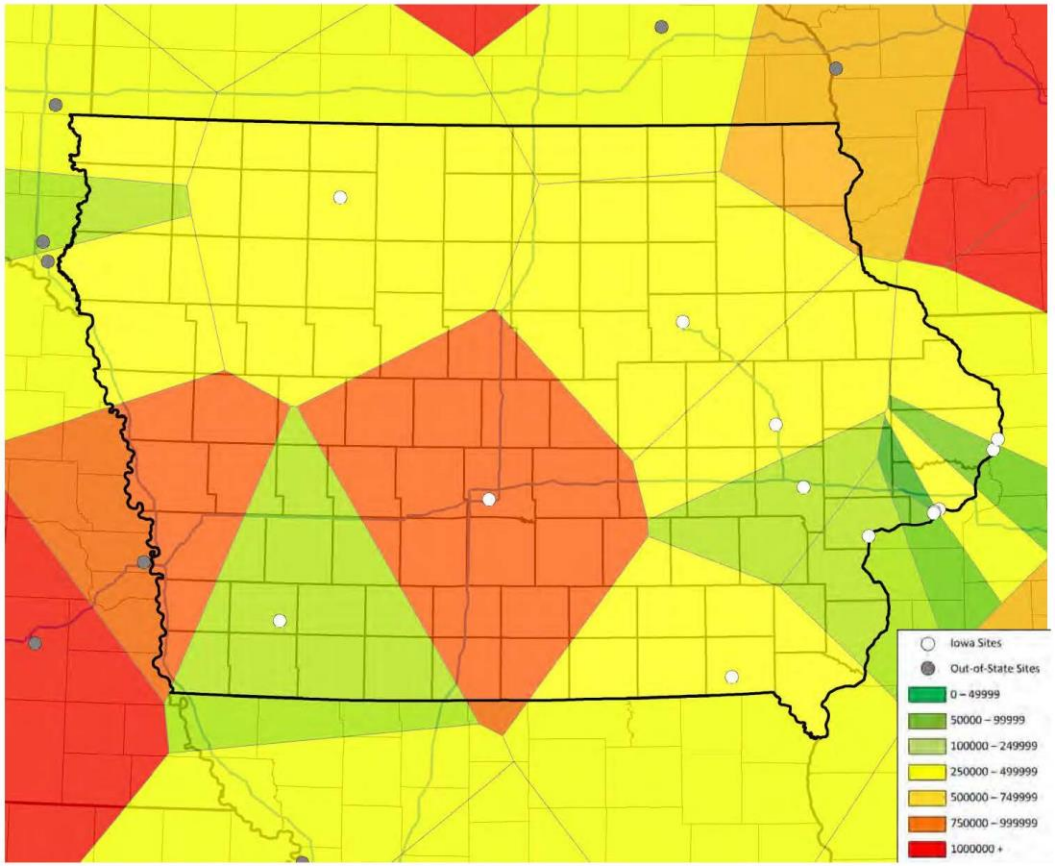
(7/2010) ambient air monitoring Network. Veroni polygons that contain counties in Metropolitan Statistical Areas tend to have the highest populations. Pollutant networks with a larger number of monitors have a greater number of Veroni polygons and smaller average populations in each Veroni polygon. It should be noted that a Veroni 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 Veroni polygon associated with the monitor.



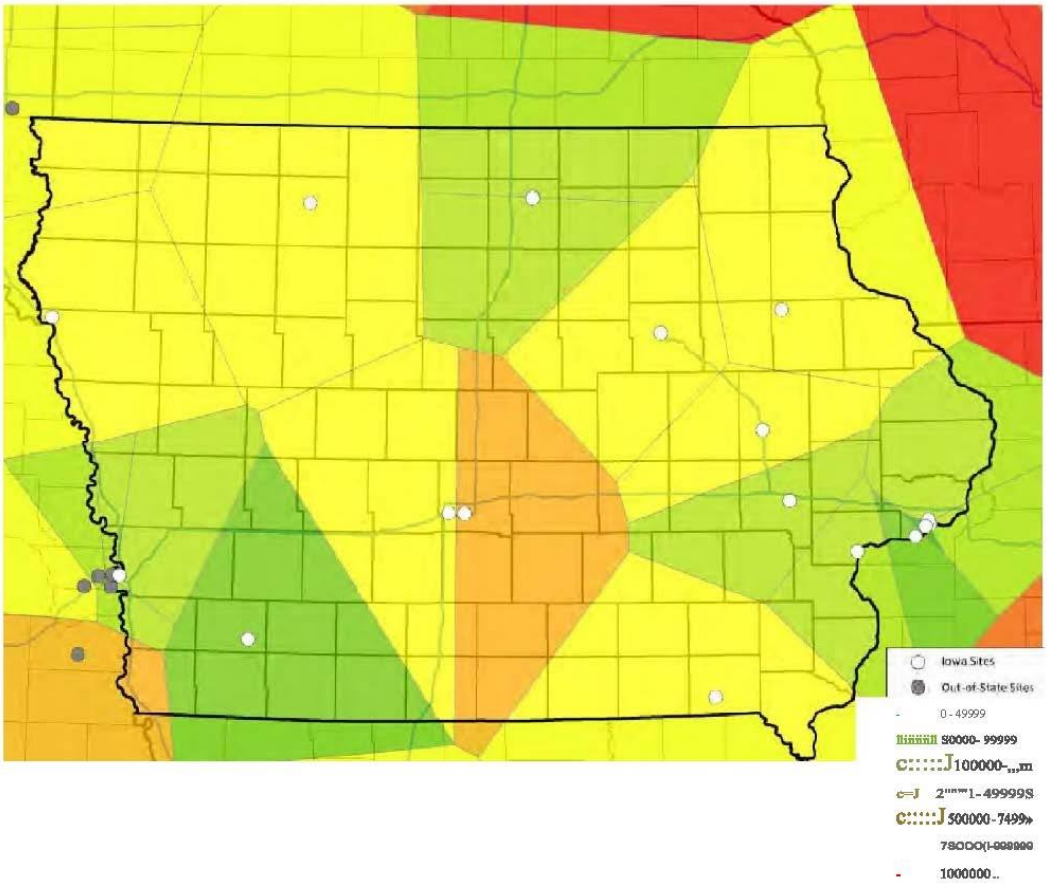
Ozone Veroni Polygons and Associated Populations



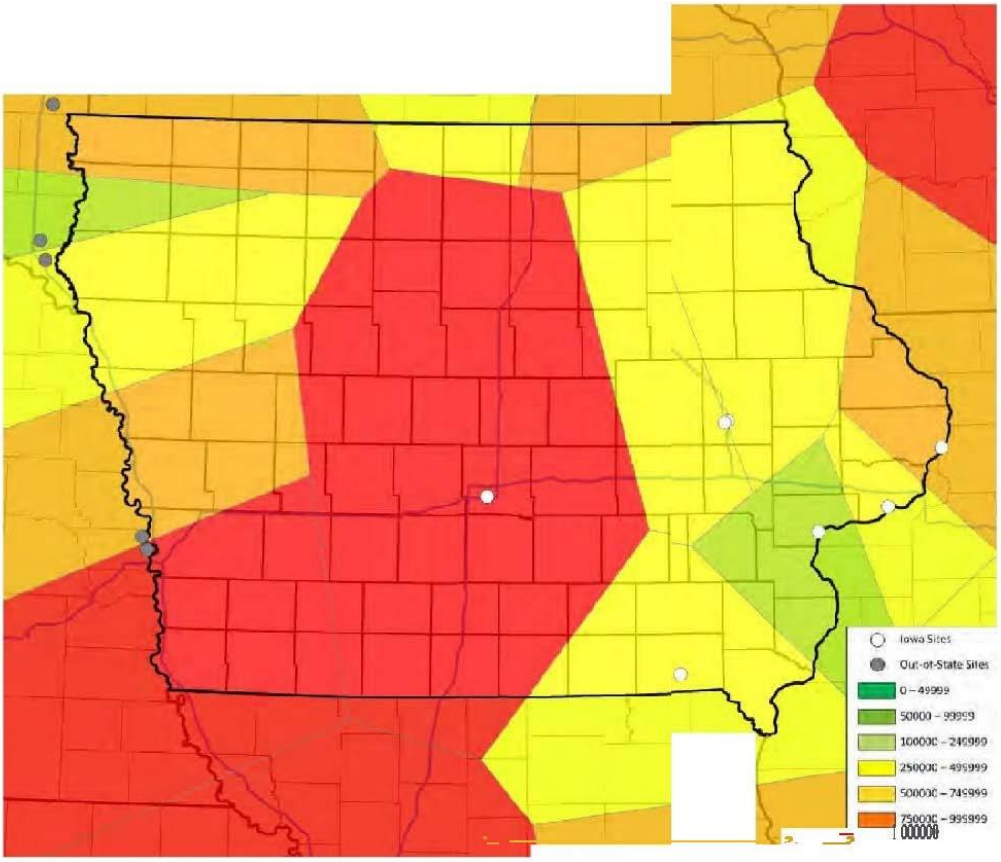
$PM_{2.5}$ FRM Veroni Polygons and Associated Populations



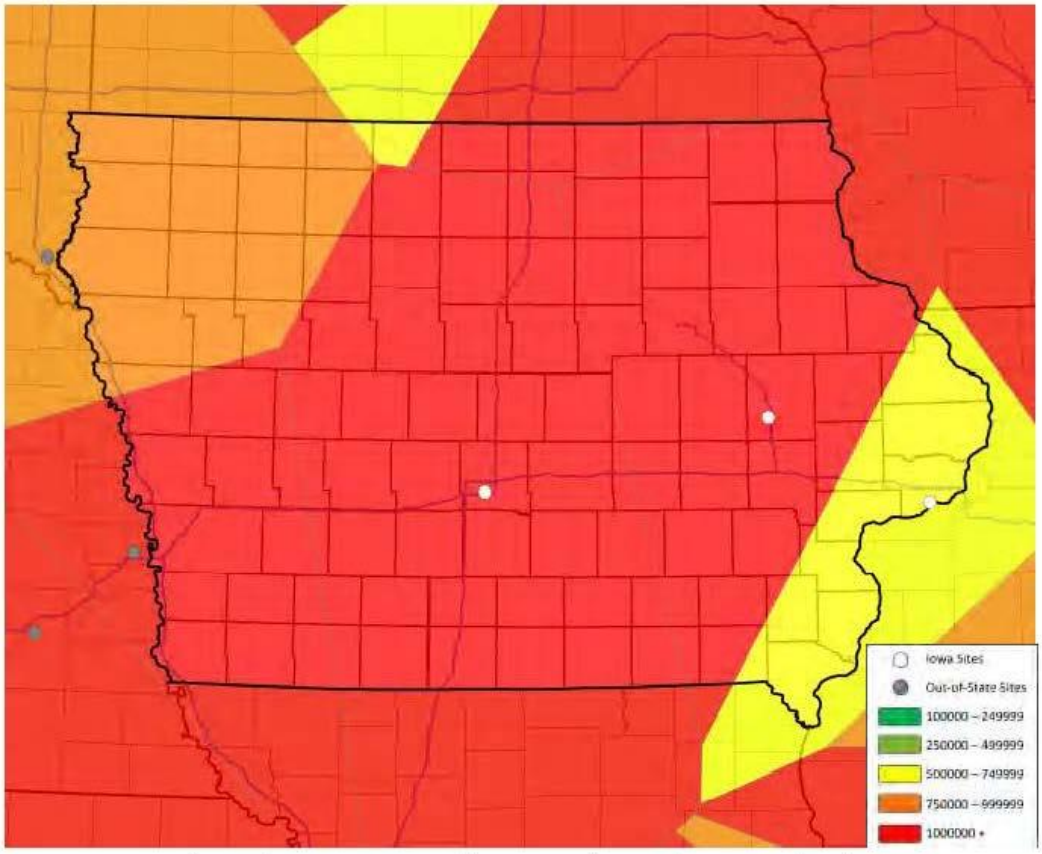
$PM_{2.5}$ Continuous Veroni Polygons and Associated Populations



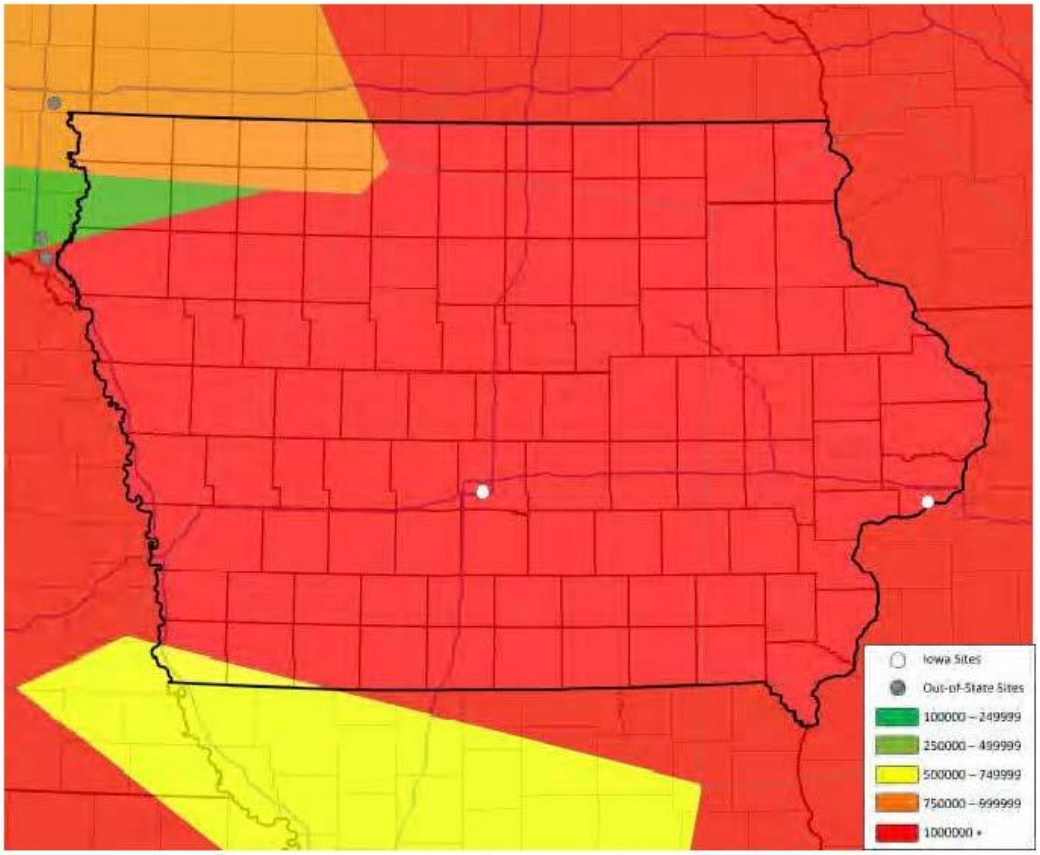
PM 10 Veroni Polygons and Associated Populations



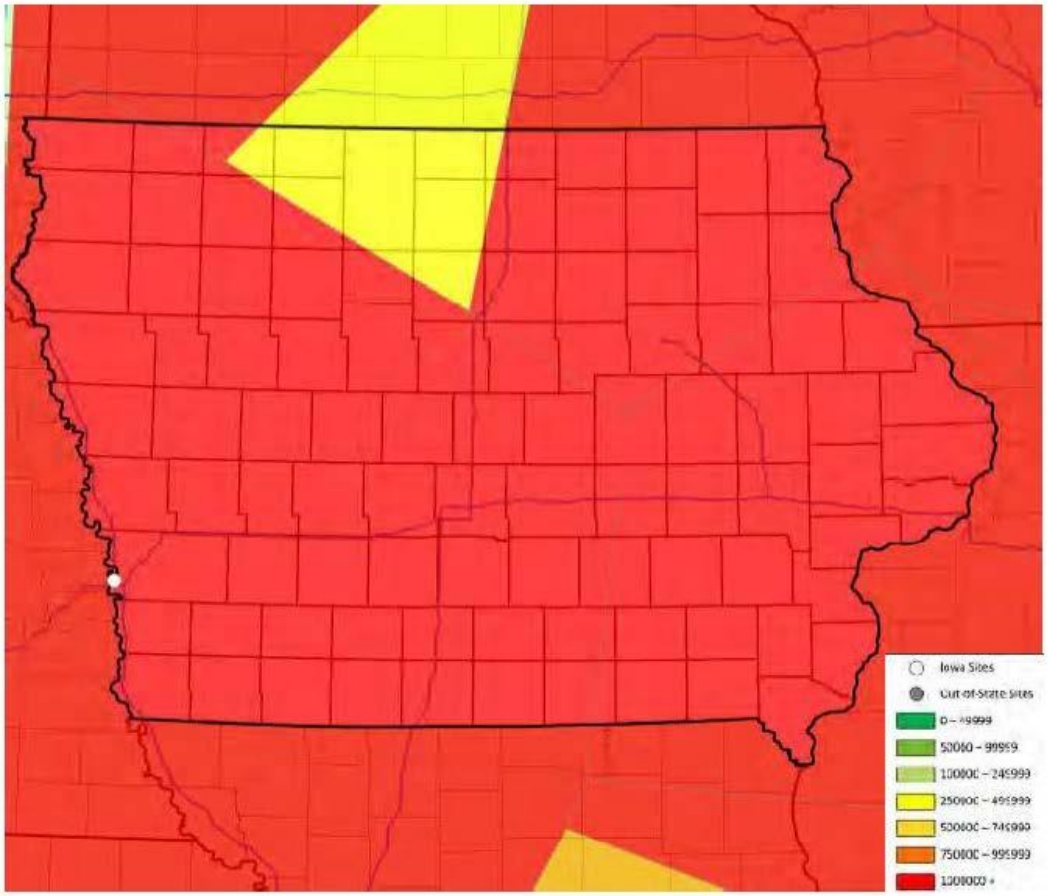
SO_2 Veroni Polygons and Associated Populations



CO Veroni Polygons and Associated Populations



NO_2 Veroni Polygons and Associated Populations



Lead Veroni Polygons and Associated Populations

Appendix F: Current Ambient Air Monitoring Network

Section 1: Summary

This appendix contains a description of the current (7/2010) 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 2010 ambient air monitoring network plan.[42]

Section 2: Current Iowa Air Monitoring Sites (July 2010)

City	Site Name	Address	County	MSA	Latitude	Longitude	AQS Site ID	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.
	Scottish Rite Temple	616 A Ave	Linn	CDR	41.98333	-91.66278	191130031	Linn Local Prog.
	Army Reserve Center	1599 Wenig Rd. NE	Linn	CDR	42.00833	-91.67861	191130037	Linn Local Prog.
	Public Health	500 11th St NW	Linn	CDR	41.97677	-91.68766	191130040	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 Ave 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
	Blackhawk Foundry	300 Wellman St	Scott	DMR	41.51777	-90.61876	191630019	DNR
	Hayes School	622 S 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.
Emmetsburg	Iowa Lakes College	Iowa Lakes Community College	Palo Alto	-	43.12370	-94.69352	191471002	DNR
Indianola	Lake Ahquabi State Park	1650 118th Ave	Warren	DSM	41.28553	-93.58398	191810022	Polk Local Prog.
Iowa City	Hoover School	2200 E Court	Johnson	IAC	41.65723	-91.50348	191032001	DNR
Keokuk	Fire Station	111S. 13th St	Lee	-	40.40096	-91.39101	191110008	DNR
Mason City	Holnam Cement	17th St & Washington St	Cerro Gordo	-	43.16944	-93.20243	190330018	DNR

[42] Available online at: http://www.iowadnr.gov/air/prof/monitor/files/Network_Plan_2010.pdf

City	Site Name	Address	County	MSA	Latitude	Longitude	AQS Site ID	Agency
	Washington School	700 N. Washington Ave	Cerro Gordo	-	43.15856	-93.20301	190330020	DNR
Muscatine	Garfield School	1409 Wisconsin	Muscatine	-	41.40095	-91.06781	191390015	DNR
	Greenwood Cemetary	Fletcher St & Kimble St	Muscatine	-	41.41943	-91.07098	191390016	DNR
	Franklin School	210 Taylor St	Muscatine	-	41.41439	-91.06261	191390018	DNR
	Musser Park	Oregon St & Earl Ave	Muscatine	-	41.40780	-91.06265	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
Sioux City	Bryant School	821 30th St	Woodbury	SXC	42.52236	-96.40021	191930019	DNR
Slater	City Hall	105 Greene	Story	AM W	41.88287	-93.68780	191690011	Polk Local Prog.
Tama	Meskwaki Tribal Center	349 Meskwaki Rd	Tama		41.98730	-92.65230	191710007	DNR
Waterloo	Grout Museum	W Park St & South St	Black Hawk	WTL	42.49306	-92.34389	190130008	DNR
	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	Linn Local Prog.
-	Scott County Park	Scott County Park	Scott	DMR	41.69917	-90.52194	191630014	DNR
-	Backbone State Park	Backbone State Park	Delaware	-	42.60083	-91.53833	190550001	DNR
-	Viking Lake State Park	2780 Viking Lake Rd	Montgomery	-	40.96911	-95.04495	191370002	DNR
-	Lake Sugema	24430 Lacey Trl, Keosauqua	Van Buren	-	40.69508	-92.00632	191770006	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 I.

Section 3: Criteria[43] Pollutant Monitors at Each Site in the Current Network

City	Site Name	$PM_{2.5}$ FRM	PM_{10} FRM	Ozone	PM2.5 Continuous	SO_2	PM2.5 Speciation	CO	Toxics	NO_2	Pb
Buffalo	LW Mining	0	1	0	0	0	0	0	0	0	0
Cedar Rapids	Kirkwood Coll.	0	0	1	0	0	0	0	0	0	0
	Scottish Rite Temple	0	0	0	0	1	0	0	0	0	0
	Army Reserve	1	1	0	0	0	1	0	0	0	0
	Public Health	1	0	1	1	1	0	1	1	0	0
Clinton	Chancy Park	1	0	0	1	1	0	0	0	0	0
	Rainbow Park	1	0	1	1	0	0	0	0	0	0
Clive	Indian Hills Jr. High Sch.	1	1	0	0	0	0	0	0	0	0
Coggon	Coggon Sch.	0	0	1	0	0	0	0	0	0	0
Council Bluffs	Franklin Sch.	1	1	0	0	0	0	0	0	0	0
	Griffin Pipe	0	0	0	0	0	0	0	0	0	1
Davenport	Jefferson Sch.	1	1	1	1	1	1	1	1	1	0

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

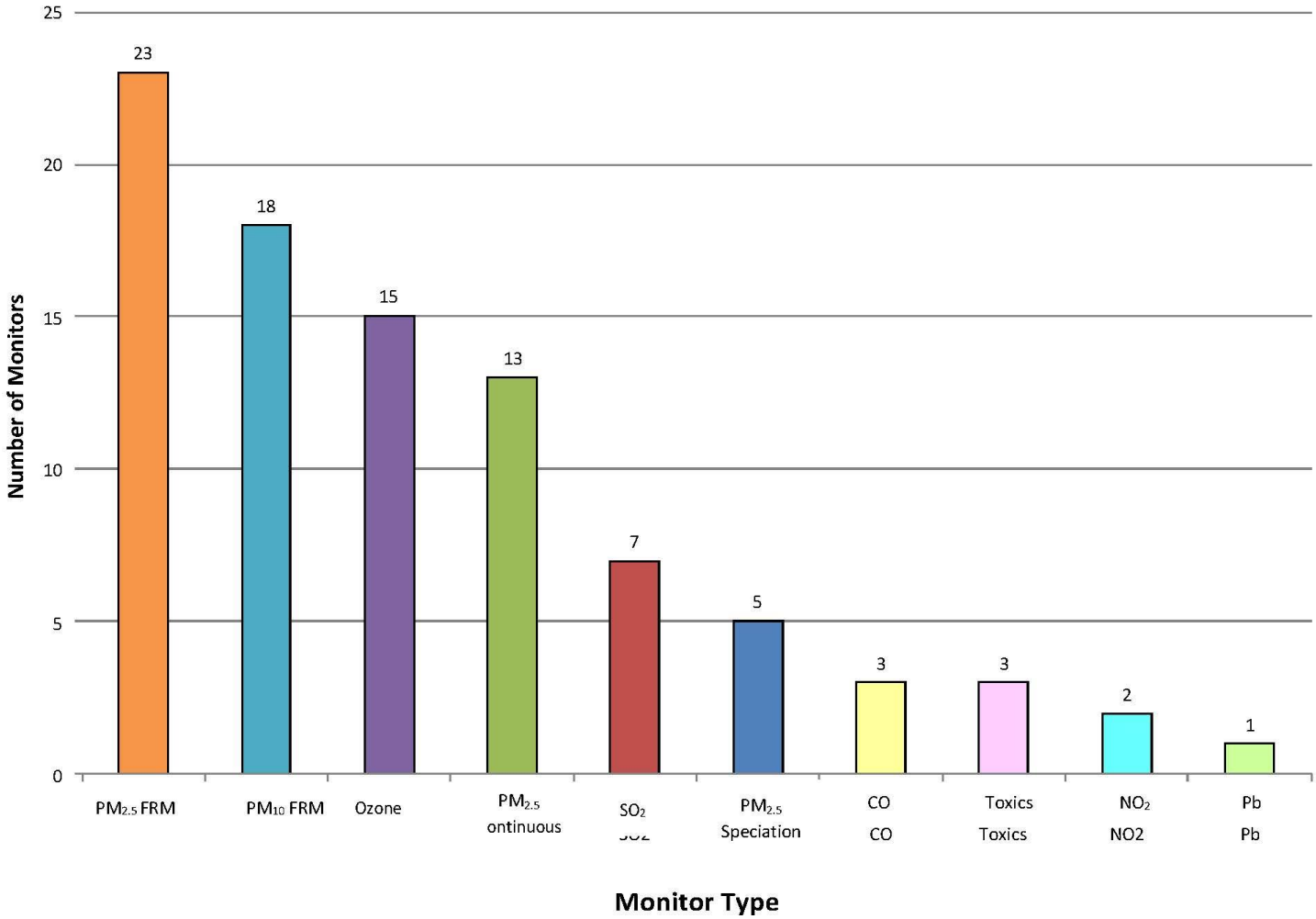
City	Site Name	$PM_{2.5}$ FRM	PM_{10} FRM	Ozone	PM2.5 Continuous	SO_2	PM2.5 Speciation	CO	Toxics	NO_2	Pb
	Adams Sch.	1	1	0	0	0	0	0	0	0	0
	Blackhawk Foundry	1	1	0	1	0	0	0	0	0	0
	Hayes Elementary	1	0	0	1	0	0	0	0	0	0
Des Moines	Health Dept.	1	1	1	1	1	1	1	1	1	0
Emmetsburg	Iowa Lakes Coll.	1	1	1	1	0	0	0	0	0	0
Indianola	Lake Ahquabi	0	0	1	0	0	0	0	0	0	0
Iowa City	Hoover Sch.	1	1	0	1	0	0	0	0	0	0
Keokuk	Fire Station	1	0	0	0	0	0	0	0	0	0
Mason City	Holnam Cement	0	1	0	0	0	0	0	0	0	0
	Washington Sch.	0	1	0	0	0	0	0	0	0	0
Muscatine	Garfield Sch.	1	1	0	1	0	0	0	0	0	0
	Greenwood Cemetery	1	0	0	0	0	0	0	0	0	0
	Franklin Sch.	1	0	0	0	0	0	0	0	0	0
	Musser Park	0	0	0	0	1	0	0	0	0	0
Pisgah	Forestry Office	0	0	1	0	0	0	0	0	0	0
	Highway Maintenance	0	0	1	0	0	0	0	0	0	0
Sioux City	Bryant Sch.	1	1	0	0	0	0	0	0	0	0
Slater	City Hall	0	0	1	0	0	0	0	0	0	0
Tama	Meskwaki Tribal Center	1	0	0	0	0	0	0	0	0	0
Waterloo	Grout Museum	1	1	0	0	0	0	0	0	0	0
	Water Tower	1	0	0	1	0	0	0	0	0	0
Waverly	Airport	0	0	1	0	0	0	0	0	0	0
-	Backbone State Park	0	1	0	0	0	0	0	0	0	0
-	Viking Lake State Park	1	1	1	1	0	1	0	0	0	0
-	Scott County Park	0	0	1	0	0	0	0	0	0	0
-	Lake Sugema	1	1	1	1	1	1	0	0	0	0
	Totals	23	18	15	13	7	5	3	3	2	1

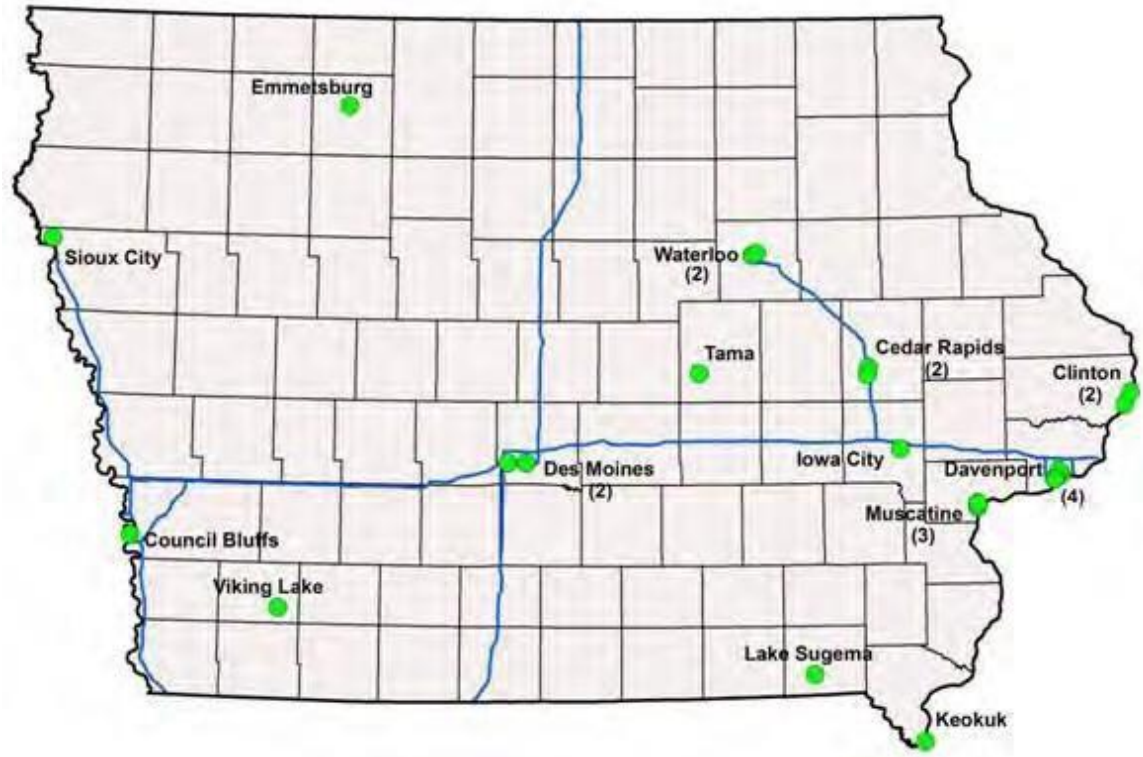
Section 4: Criteria[44] Pollutant Monitors Operated in the Current Network

Section 5: Monitoring Network Maps

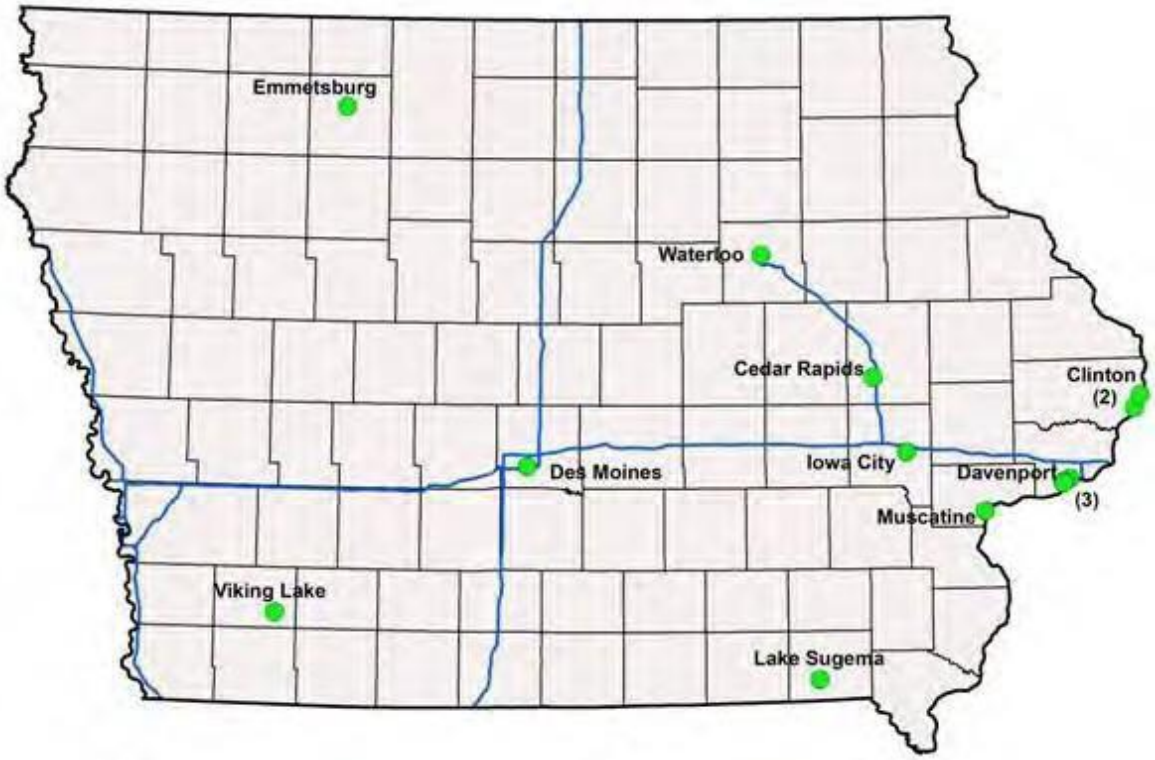
The following maps show the locations for the criteria pollutant monitors in the state of Iowa, which are current as of July 1, 2010. A map of the continuous $PM_{2.5}$ monitoring network is also included; this data is only used for real time reporting of fine particulate levels, and is not used to establish NAAQS attainment. Non-criteria pollutant maps are also included for the toxics and speciation monitoring networks.

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

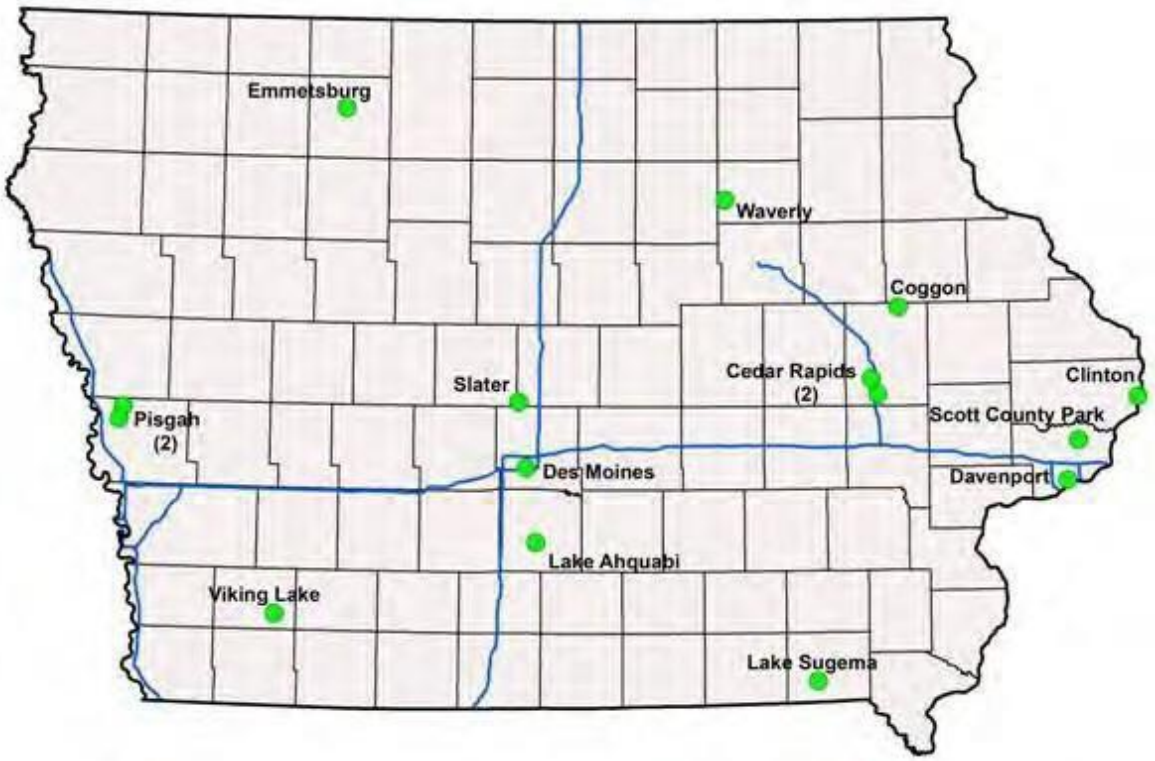




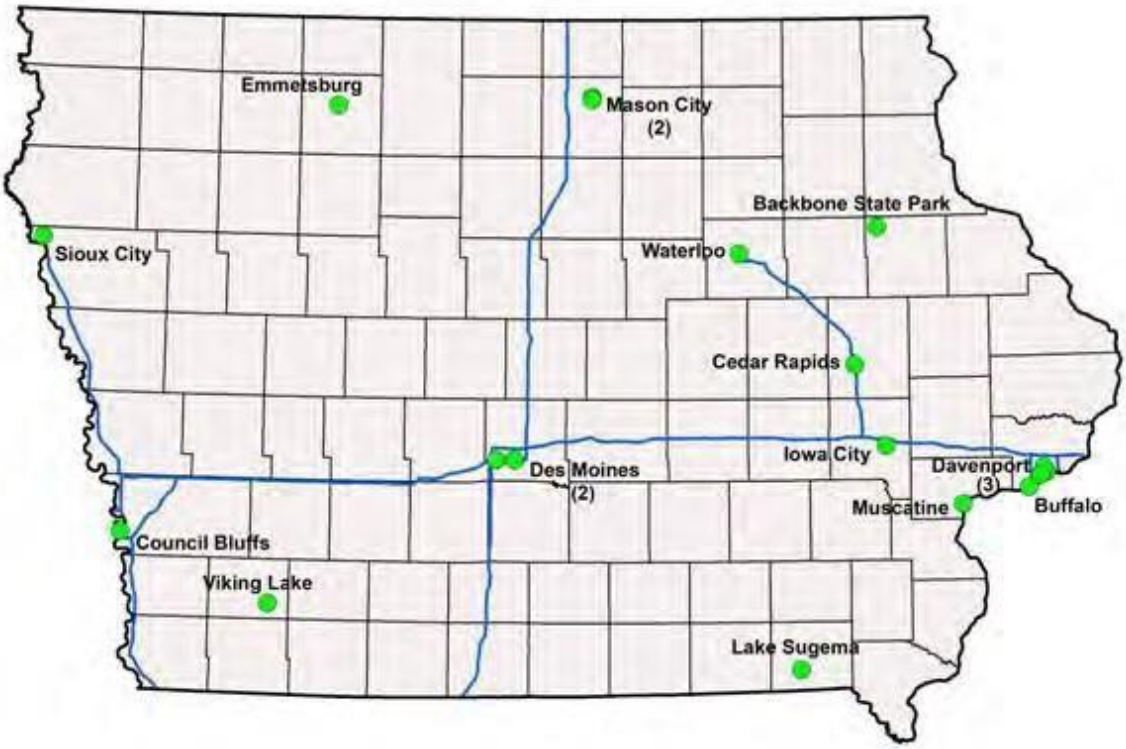
Manual $PM_{2.5}$ (FRM) Monitoring Sites



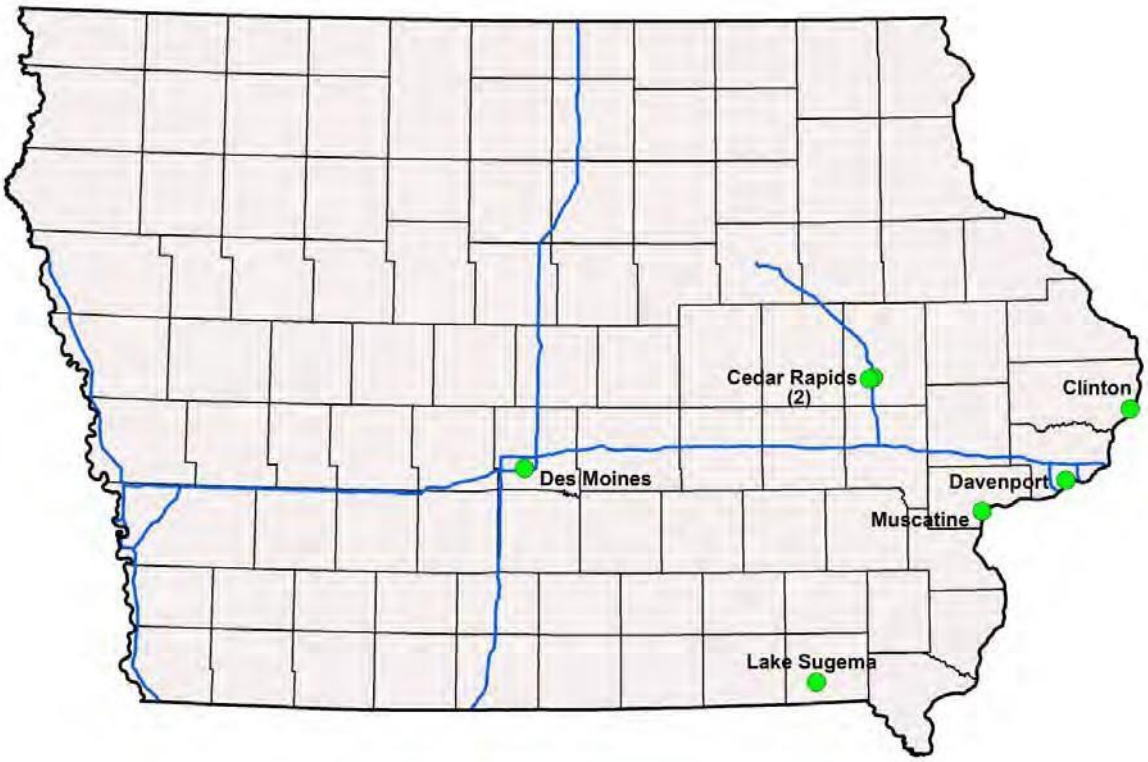
Continuous $PM_{2.5}$ (non-FRM) Monitoring Sites



Ozone Monitoring Sites

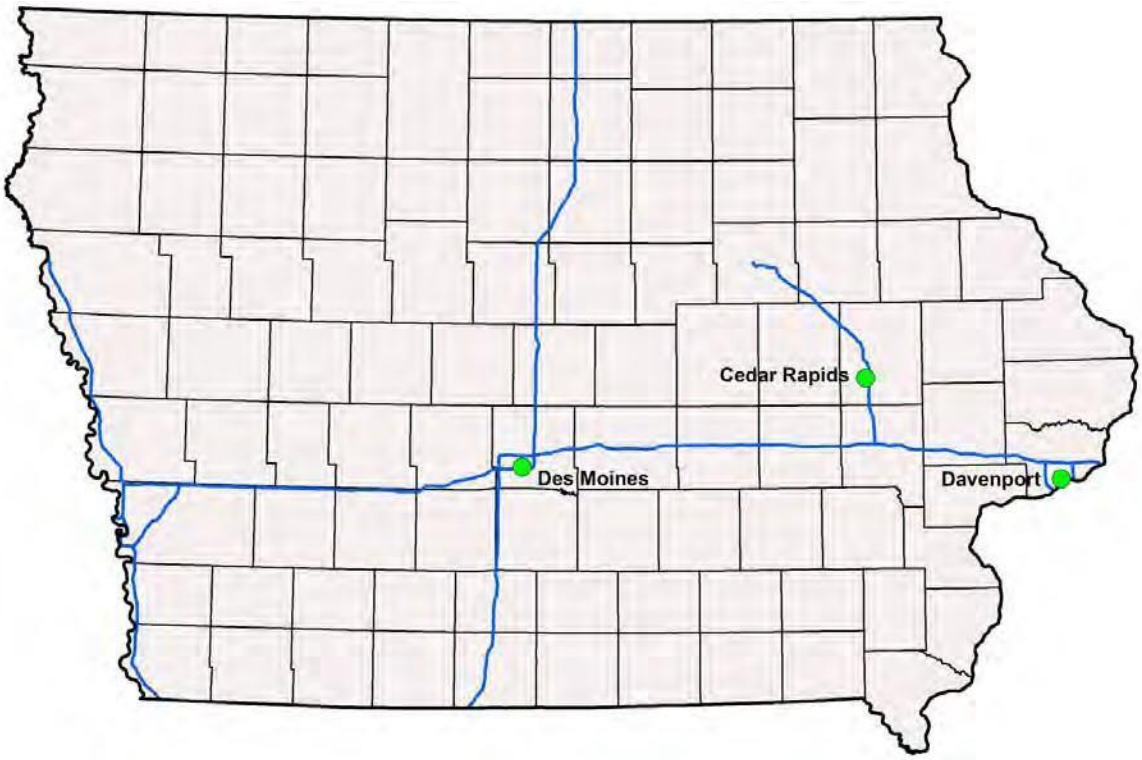


PM_{10} Monitoring Sites

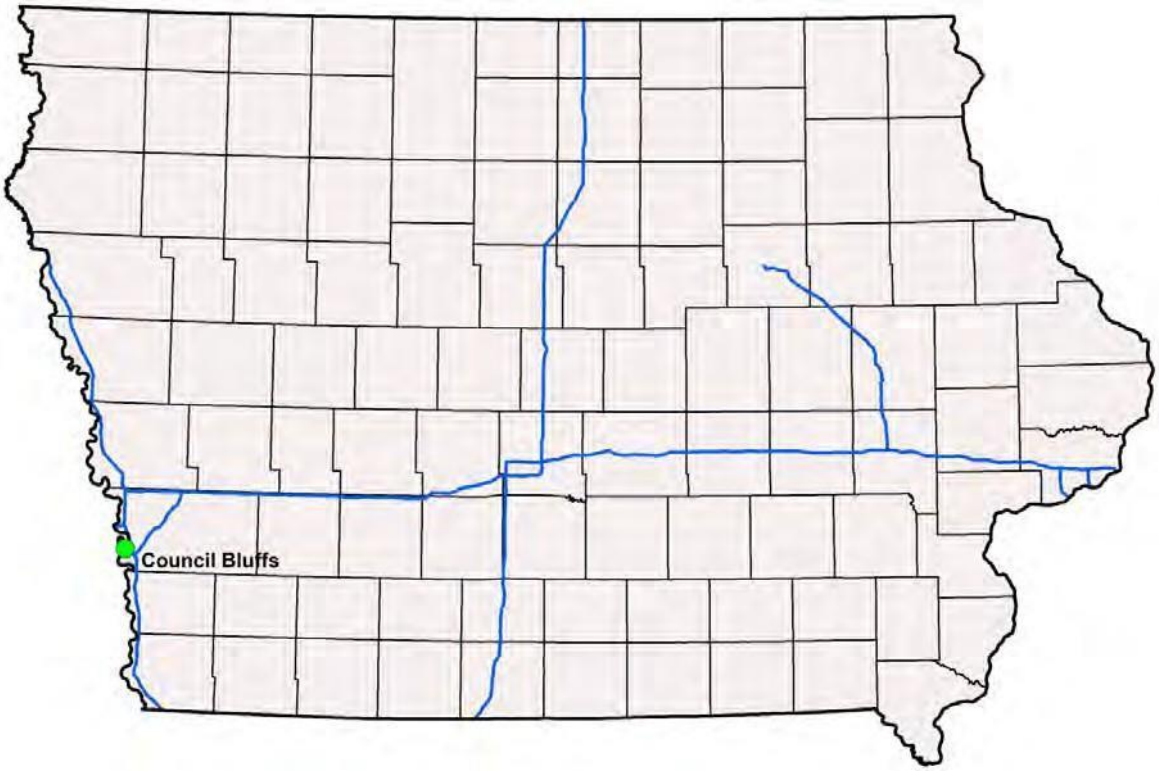


SO_2 Monitoring Sites

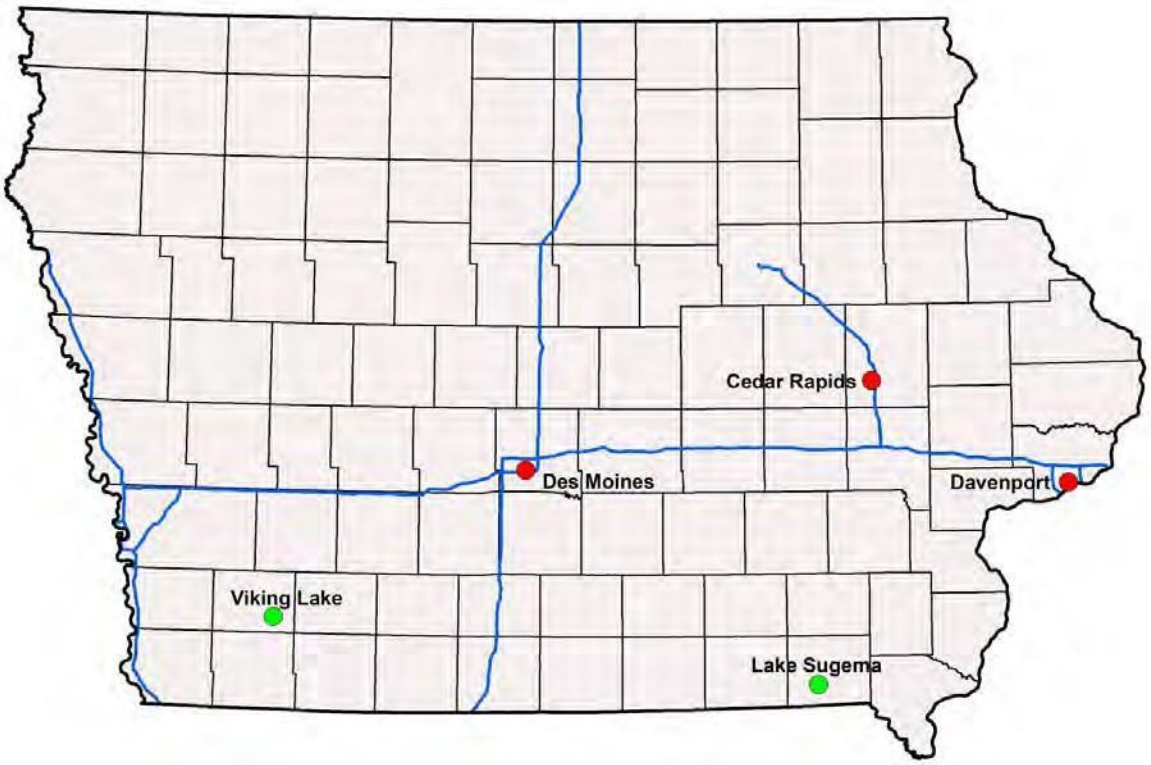
NO_2 Monitoring Sites



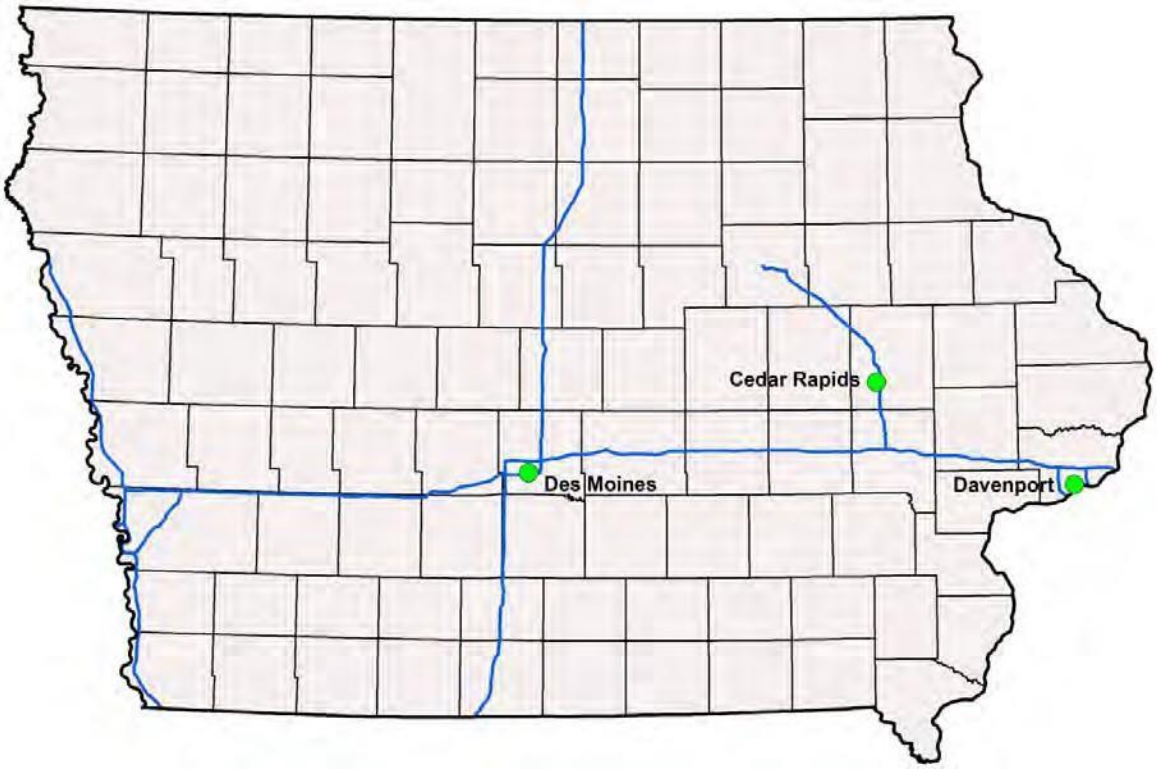
CO Monitoring Sites



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 G: NAAQS Exceedances

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.[45] 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.[46]

From 2005 to 2009, only $PM_{2.5}$, PM_{10}, and ozone exceedances were recorded in the Iowa network.[47] Sections 1, 2, and 3 contain tables detailing the sites and dates of these exceedances. Section 4 contains an exceedance chart and map.

Most of the exceedances that occurred over this period were caused by fine particulate matter ($PM_{2.5}$). 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.[48][49] 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.

Section 2: 2005-2009 $PM_{2.5}$ NAAQS Exceedance Sites and Dates

The table below provides the monitoring sites and dates of $PM_{2.5}$ exceedances measured in Iowa from 2005 through 2009. Values used to compare to the short-term primary NAAQS were 24-hour average concentrations throughout this period, but the level of the NAAQS changed from 65.5 to 35.5 $\mu g/m^3$, effective December 16, 2006. To construct the table below, 65.5 $\mu g/m^3$ has been used as the exceedance level for 2005 and 2006, while 35.5 $\mu g/m^3$ was used as the exceedance level in 2007, 2008, and 2009. $PM_{2.5}$ 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 2005-2009 (No exceedances were measured in 2005 or 2006). Monitors in Muscatine (Garfield School), Davenport (Blackhawk Foundry), and Clinton (Chancy Park) are located near industries that emit $PM_{2.5}$.

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[45] 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 2005-2009, 24-hour average PM_{10}, $PM_{2.5}$, and SO_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://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=a8968226adeeec76369f493457b02f81&rgn=div9&view=text&node=40:5.0.1.1.6.7.1.3.39&idno= 40 Additional guidance is available online at: http://www.epa.gov/airnow/aqi_tech_assistance.pdf.

[46] Note: Throughout this document, the levels quoted for the NAAQS are the lowest concentrations that exceed the NAAQS. Another common convention is to quote the highest level that attains the NAAQS. For example, for the current ozone NAAQS, the lowest value that exceeds the NAAQS is 76 ppb, and the highest level that attains the NAAQS is 75 ppb. As we are interested in the threshold for adverse health effects in interpreting our exceedance data and the threshold for non-attainment in interpreting our design values, we adopt the former convention.

[47] NAAQS exceedance counts for the Iowa monitoring network are available online at: http://www.iowadnr.gov/air/prof/monitor/monitor.html

[48] Various analyses that attempt to classify local and regional $PM_{2.5}$ exceedances in the Iowa network from 2005- 2007 are contained in appendices B-F of the Technical Support document at: http://www.iowadnr.gov/air/prof/progdev/files/NA_Response_TJD.pdf.

[49] 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

2005-2009 $PM_{2.5}$ NAAQS Exceedances

Sampling Frequency	1 in 3	1 in 3	1 in 3	1 in 3	1 in 3	1 in 3	1 in 3	daily	1 in 3	1 in 3	1 in 3	daily	1 in 3	daily	daily	daily	1 in 3	daily	daily	daily	
Monitoring Site	Sioux City, Lowell School 191930017	Sioux City, Bryant Elementary 191930019	Council Bluffs, Franklin School 191550009	Viking Lake State Park 191370002	Emmetsburg, IowaLakesCollege 191471002	Clarion, Jannsen Farm 191970004	Clive, Indian Hills School 191532510	Des Moines, Carpenter 191530030	Waterloo, Grout Museum 190130008	Waterloo, Watertower 190130009	Cedar Rapids, Army Reserve 191130037	Cedar Rapids, Public Health 191130040	Backbone State Park 190550001	Iowa City, Hoover School 191032001	Muscatine, Garfield School 191390015	Davenport, Blackhawk Foundry 191630019	Davenport, Adams School 191630018	Davenport, Jefferson School 191630015	Clinton, Chancy Park 190450019	Clinton, Rainbow Park 190450021	Count
Exceedance Date	Concentration (micrograms per cubic meter)																				
2005	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0
2006	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0
2/23/2007	-		-	-	-	-	-	-	-		-		-	-	44.0	-	-	-	-	-	1
2/24/2007	-		-	-	-	-	-	-	-		-		-	-	53.2	-	-	-	-	-	1
2/28/2007	-		-	-	-	-	-	-	-		-		-	-	54.7	-	-	-	-	-	1
3/7/2007	36.7		37.7	-	-	-	-	-	-		-		-	-	-	-	-	-	-	-	2
3/9/2007	-		-	-	-	-	-	-	-		-		-	41.9	41.5	44.2	-	42.1	-	37.3	5
5/3/2007	-		-	-	-	-	-	-	-		-		-	-	42.2	-	-	-	-	-	1
5/4/2007	-		-	-	-	-	-	-	-		-		-	-	61.0	-	-	-	-	-	1
5/5/2007	-		-	-	-	-	-	-	-		-		-	-	63.2	-	-	-	-	-	1
5/23/2007	-		-	-	-	-	-	-	-		-		-	-	-	-	-	-	37.0	-	1
5/30/2007	-		-	-	-	-	-	-	-		-		-	-	-	-	-	-	36.6	-	1
6/16/2007	-		-	-	-	-	-	-	-		-		-	-	-	35.6	-	-	-	-	1
7/25/2007	-		-	-	-	-	-	-	-		-		-	35.7	-	-	-	-	-	-	1
7/26/2007	-		-	-	-	-	-	-	-		-		-	-	-	36.0	-	-	-	-	1
9/21/2007	-		-	-	-	-	-	-	-		-		-	-	-	37.4	-	-	-	-	1
11/19/2007	-		-	-	-	-	-	-	-		-		-	-	-	39.1	-	-	-	-	1
11/20/2007	-		-	-	-	-	-	-	-		-		-	36.9	-	38.3	-	35.8	-	-	3
12/17/2007	-		-	-	-	36.4	-	-	37.5		-		-	-	-	38.2	-	-	35.6	-	4

Sampling Frequency	1 in 3	1 in 3	1 in 3	1 in 3	1 in 3	1 in 3	1 in 3	daily	1 in 3	1 in 3	1 in 3	daily	1 in 3	daily	daily	daily	1 in 3	daily	daily	daily	Count
Monitoring Site	Sioux City, Lowell School 191930017	Sioux City, Bryant Elementary 191930019	Council Bluffs, Franklin School 191550009	Viking Lake State Park 191370002	Emmetsburg, IowaLakesCollege 191471002	Clarion, Jannsen Farm 191970004	Clive, Indian Hills School 191532510	Des Moines, Carpenter 191530030	Waterloo, Grout Museum 190130008	Waterloo, Watertower 190130009	Cedar Rapids, Army Reserve 191130037	Cedar Rapids, Public Health 191130040	Backbone State Park 190550001	Iowa City, Hoover School 191032001	Muscatine, Garfield School 191390015	Davenport, Blackhawk Foundry 191630019	Davenport, Adams School 191630018	Davenport, Jefferson School 191630015	Clinton, Chancy Park 190450019	Clinton, Rainbow Park 190450021	
Exceedance Date	Concentration (micrograms per cubic meter)																				
12/19/2007	-		-	-	-	-	-	-	-		-		-	54.8	54.9	56.8	-	57.2	-	-	4
12/20/2007	45.7		49.1	-	38.4	48.0	-	-	63.0		53.4		51.5	47.4	47.6	47.5	46.0	45.3	44.3	-	13
2007	2		2	0	1	2	0	0	2		1		1	5	9	9	1	4	4	1	44
1/27/2008	-		-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	36.3	-	1
2/3/2008	37.6		-	-	-	-	-	-	37.5		-	-	36.8	-	-	-	-	-	-	-	3
2/23/2008	-		-	-	-	-	-	-	-		-	41.7	-	43.2	48.4	46.2	-	43.5	50.3	50.5	7
2/24/2008	-		-	-	-	-	-	-	41.2		-	36.3	-	37.8	38.5	35.5	-	-	49.3	43	7
3/11/2008	-		-	-	-	-	-	-	-		-	-	-	-	-	45.8	-	-	-	-	1
4/23/2008	-		-	-	-	-	-	-	-		-	-	-	-	35.6	-	-	-	-	-	1
7/4/2008	-		-	-	-	-	-	-	-		-	-	-	-	-	-	-	62.3	-	-	1
9/26/2008	-		-	-	-	-	-	-	-		-	-	-	-	-	36.8	-	-	-	-	1
10/22/2008	-		-	-	-	-	-	-	-		-	-	-	-	50.7	-	-	-	-	-	1
10/23/2008	-		-	-	-	-	-	-	-		-	-	-	-	45	-	-	-	-	-	1
12/18/2008	-		-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	35.6	-	1
2008	1		0	0	0	0	0	0	2		0	2	1	2	5	4	0	2	4	2	25
1/3/2009		-	-	-	-	-	-	-	-	-	-	-		-	54.0	-	-	-	-	-	1
1/22/2009		-	-	-	-	39.2	-	-	43.4	38.0	40.2	35.8		-	-	-	-	-	40.7	40.3	7
2/26/2009		-	-	-	-	-	-	-	-	-	-	-		-	35.7	-	-	-	-	-	1
4/4/2009		-	-	-	-	-	-	-	-	-	-	-		-	37.3	-	-	-	-	-	1

Sampling Frequency	1 in 3	1 in 3	1 in 3	1 in 3	1 in 3	1 in 3	1 in 3	daily	1 in 3	1 in 3	1 in 3	daily	1 in 3	daily	daily	daily	1 in 3	daily	daily	daily	
Monitoring Site	Sioux City, Lowell School 191930017	Sioux City, Bryant Elementary 191930019	Council Bluffs, Franklin School 191550009	Viking Lake State Park 191370002	Emmetsburg, IowaLakesCollege 191471002	Clarion, Jannsen Farm 191970004	Clive, Indian Hills School 191532510	Des Moines, Carpenter 191530030	Waterloo, Grout Museum 190130008	Waterloo, Watertower 190130009	Cedar Rapids, Army Reserve 191130037	Cedar Rapids, Public Health 191130040	Backbone State Park 190550001	Iowa City, Hoover School 191032001	Muscatine, Garfield School 191390015	Davenport, Blackhawk Foundry 191630019	Davenport, Adams School 191630018	Davenport, Jefferson School 191630015	Clinton, Chancy Park 190450019	Clinton, Rainbow Park 190450021	Count
Exceedance Date	Concentration (micrograms per cubic meter)																				
11/23/2009		-	-	-	-	-	-	-	-	-	-	35.5		36.0	52.5	40.1	-	38.4	45.5	46.5	7
12/17/2009		-	-	-	-	-	-	-	-	-	-	37.3		-	-	-	-	-	-	-	1
12/18/2009		40.2	47.0	48.4	49.2	42.4	41.5	41.3	36.3	37.9	-	35.7		-	-	-	-	-	-	-	10
12/21/2009		-	-	-	-	-	-	-	-	-	-	-		-	-	37.8	39.1	37.5	-	36.2	4
12/22/2009		-	-	-	-	-	-	-	-	-	-	-		-	74.4	-	-	-	-	-	1
12/24/2009		-	-	-	-	-	-	-	-	-	-	-		-	39.6	-	-	-	-	-	1
2009		1	1	1	1	2	1	1	2	2	1	4		1	6	2	1	2	2	3	34

	Previous NAAQS: 65.5 µg/m3
	Current NAAQS: 35.5 µg/m3

Section 3: 2005-2009 PM_{10} NAAQS Exceedance Sites and Dates

The table below provides the monitoring sites and dates of PM_{10} exceedances measured in Iowa from 2005 through 2009. Throughout this period, the 24-hour PM_{10} NAAQS did not change; a 24-hour PM_{10} concentration of 155 µg/m^3 or greater was counted as an exceedance. PM_{10} monitors sample on 1 in 3 day, 1 in 2 day, or daily schedules, with daily sampling frequencies reserved for highly populated areas or areas that have a history of elevated PM_{10} levels.

Monitors in Mason City (Holnam and Washington School monitoring sites) and Buffalo (Linwood Mining) recorded exceedances over this period. The Holnam (Holcim) and Linwood mining monitors are located adjacent to industries that utilize large limestone storage piles. The PM_{10} exceedance recorded on 2/15/2007 at Washington School in Mason City was caused by the demolition of a building adjacent to the monitoring site.

2005-2009 PM_{10} NAAQS Exceedances

Sampling Frequency	1 in 2	Daily	Daily	
Monitoring Site	Mason City Washington School 190851101	Mason City Holnam Cement 190170011	Buffalo Linwood Mining 190450021	
Exceedance Date	Concentration (µg/m^3)			Count
1/13/2005	-	163	-	1
8/2/2005	-	-	164	1
2005	0	1	1	2
9/16/2006	-	-	161	1
2006	0	0	1	1
2/15/2007	157	-	-	1
11/5/2007	-	162	-	1
2007	1	1	0	2
2008	0	0	0	0
2009	0	0	0	0

Section 4: 2005-2009 Ozone NAAQS Exceedance Sites and Dates

The table below provides the monitoring sites and dates of ozone exceedances measured in Iowa from 2005-2009. The primary NAAQS utilized 8-hour average ozone values throughout this period, but the level of the NAAQS changed from 85 to 76 ppb, effective May 27, 2008. States are required to measure ozone levels during ozone season; in Iowa ozone season runs from April through October. In the table below, 85 ppb has been used as the exceedance level for 2005, 2006 and 2007, while 76 ppb was used for 2008 and 2009. Exceedances were recorded in Pisgah (downwind of Omaha-Council Bluffs), in Waverly (downwind of Waterloo), and in Clinton.

2005-2009 Ozone NAAQS Exceedances

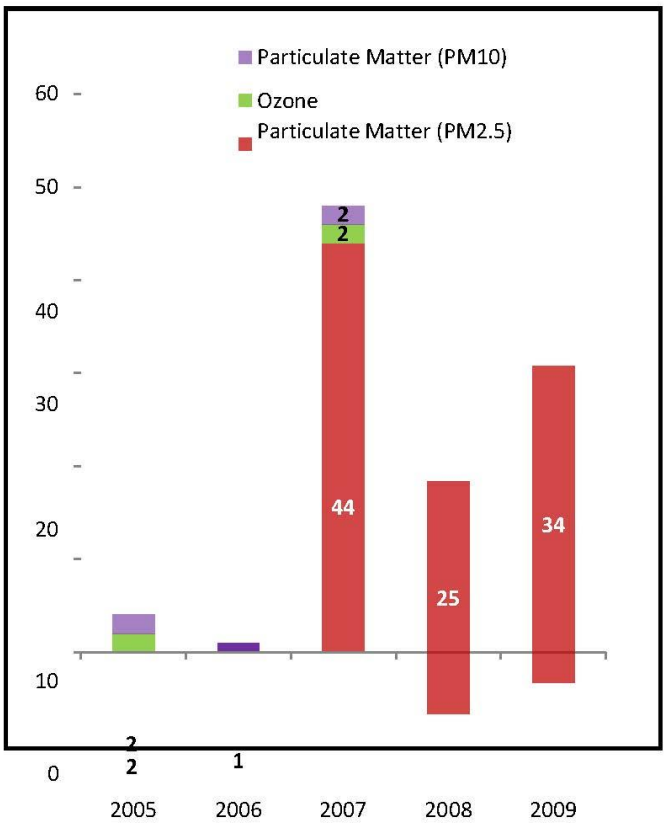
Sampling Frequency	Continuous	Continuous	Continuous	
Monitoring Site	Pisgah Highway Maintenance Shed 190851101	Waverly Airport 190170011	Clinton Rainbow Park 190450021	
Exceedance Date	Concentration (ppb)			Count
6/24/2005	-	-	85	1
7/11/2005	-	-	87	1
2005	0	0	2	2
2006	0	0	0	0

Sampling Frequency	Continuous	Continuous	Continuous	
Monitoring Site	Pisgah Highway Maintenance Shed 190851101	Waverly Airport 190170011	Clinton Rainbow Park 190450021	
Exceedance Date	Concentration (ppb)			Count
6/13/2007	-	86	-	1
6/15/2007	85	-	-	1
2007	1	1	0	2
2008	0	0	0	0
2009	0	0	0	0

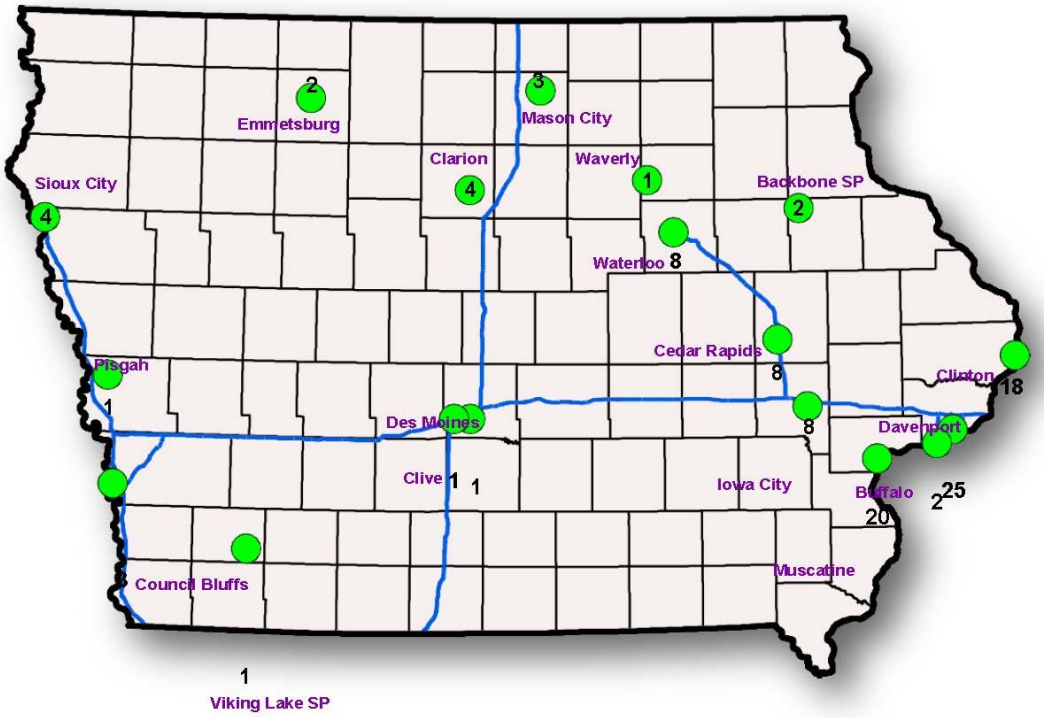
	Previous NAAQS: 85 µg/m^3
	Current NAAQS: 76 µg/m^3

Section 5: Number and Location of NAAQS Exceedances from 2005 to 2009

The number of NAAQS exceedances in Iowa from 2005 to 2009 for the different NAAQS pollutants are shown in the chart below. The map indicates the location where the exceedances were measured. $PM_{2.5}$ exceedances comprise the majority of the exceedance count, and most of these were recorded in eastern 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: 2005-2009



Location of NAAQS Exceedances: 2005-2009

Appendix H: NAAQS Violations and Design Values

Section 1: Summary

In recent years, ambient air monitoring data gathered in Iowa has shown concentrations that are considerably less than the NAAQS for all criteria pollutants with the exception of PM_{10}, $PM_{2.5}$ and ozone.[50] Appendix G provides information concerning NAAQS exceedances in Iowa for the past five years. 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[51] 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.[52]

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).[53] A PM_{10} NAAQS exceedance occurs when a 24-hour PM_{10} concentration is 155 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. The worst three year period was 2005-2007, when two monitoring sites (both near industries with large limestone storage piles) each recorded two PM_{10} exceedances. No exceedances have been recorded by any PM_{10} monitor in the State since2007.

For $PM_{2.5}$ and ozone, 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.[54][55] The 8-hour design value for ozone is the annual fourth-highest daily maximum 8-hour ozone concentration averaged over three years. The $PM_{2.5}$ 24-hour design value is the annual 98th 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 (2007-2009) median design values for ozone in the Iowa network are 84% of

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[50] Appendix G 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: ***Review of Ambient Monitoring Data*** at: http://www.iowadnr.gov/air/prof/monitor/monitor.html.

[51] 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.

[52] 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.

[53] Procedures for calculating PM 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.

[54] 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

[55] 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.

the ozone NAAQS, median $PM_{2.5}$ 24-hour design values are 78% of the $PM_{2.5}$ 24-hour NAAQS, and median $PM_{2.5}$ annual design values are 72% of the $PM_{2.5}$ annual NAAQS. The only site in the Iowa ambient air monitoring network that has recorded a violation of any of the NAAQS is a $PM_{2.5}$ monitoring site at Garfield School in Muscatine that recorded a design value of 38 $\mu g/m^3$, a violation of the 24 hour $PM_{2.5}$ NAAQS.

The remaining sections of this appendix examine design values for ozone and $PM_{2.5}$ over the five year period from 2005 to 2009. EPA changed the lowest ozone design value that violates the ozone NAAQS from 85 ppb to 76 ppb, effective May 27, 2008. The lowest $PM_{2.5}$ 24-hour design value that violates the $PM_{2.5}$ 24-hour NAAQS was changed from 66 $\mu g/m^3$ to 36 $\mu g/m^3$ effective December 18, 2006. The lowest $PM_{2.5}$ annual design value that violates the $PM_{2.5}$ annual NAAQS remained at 15.05 $\mu g/m^3$ throughout the five year period.

Section 2 examines ozone design values over the period from 2005-2009.[56] Median ozone design values have dropped by about 3 ppb (4%) over this period. The most recent (2007-2009) ozone design values are highest in Linn, Clinton and Scott counties in Eastern Iowa.

Section 3 examines $PM_{2.5}$ 24-hour design values over the period from 2005-2009. Median $PM_{2.5}$ 24-hour design values fell by 4 $\mu g/m^3$ (13%) over this period. The most recent (2007-2009) $PM_{2.5}$ 24-hour design values are highest at monitoring sites near primary $PM_{2.5}$ emitters in Muscatine, Clinton and Davenport.

Section 4 examines annual $PM_{2.5}$ design values over the period from 2005-2009. Median $PM_{2.5}$ annual design values have dropped by 0.1 $\mu g/m^3$ (1%) over this period. The most recent (2007-2009) annual design values are highest in Muscatine, Scott, Clinton, Keokuk, Black Hawk and Johnson counties in Eastern Iowa.

Section 2: Ozone Design Values

Trends in ozone design values for the period 2005-2009 are indicated below. Over the past five years, the median ozone design value in the Iowa ozone network fell by 3 ppb (4%). The largest decrease (11 ppb) was recorded at a monitor downwind of the Omaha-Council Bluffs area, and the largest increase (4 ppb) was recorded at a monitor downwind of Des Moines. No NAAQS violations were recorded anywhere in the network over the five year period.

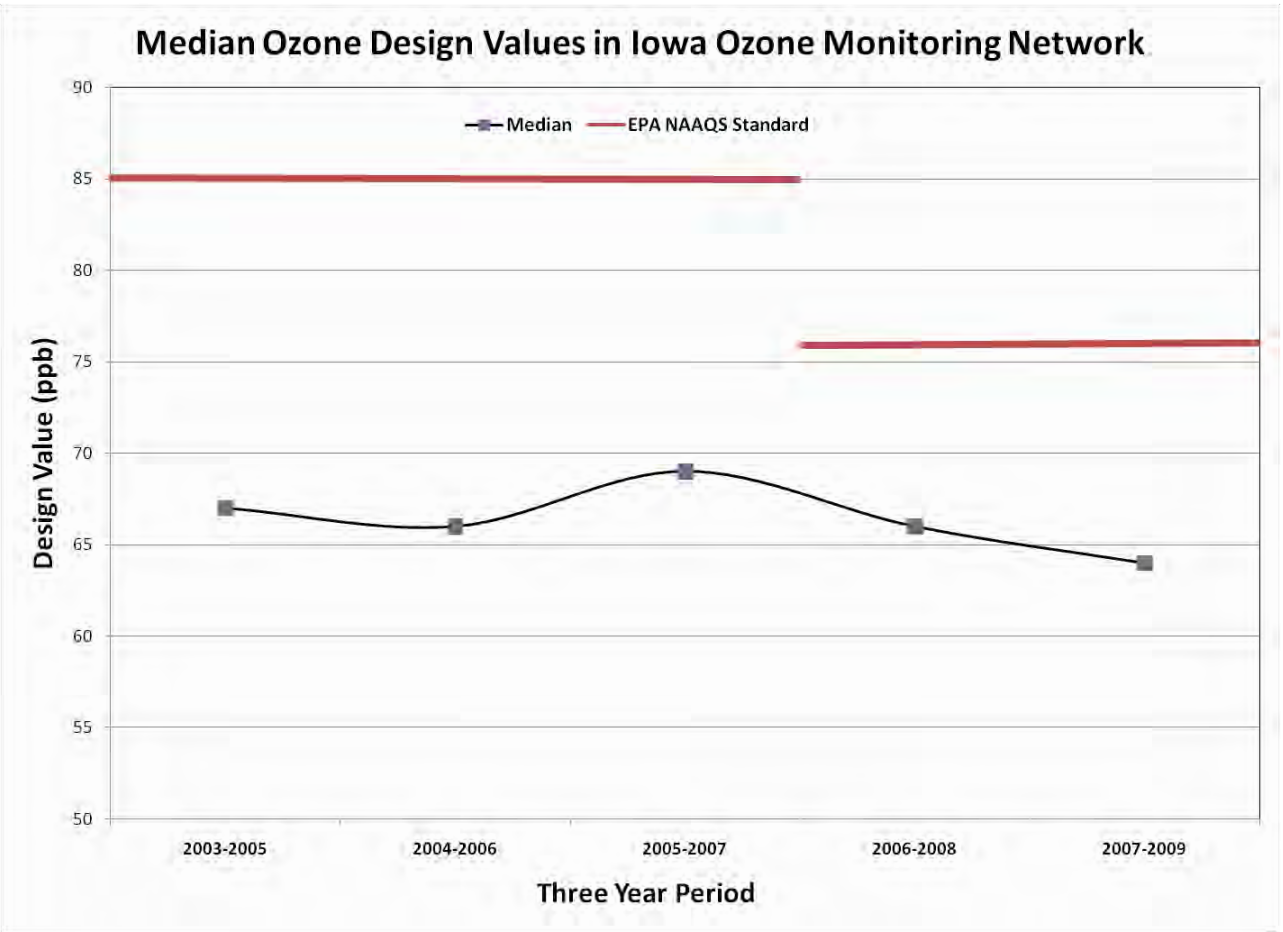
The most recent (2007-2009) monitoring data shows design values across the State ranged from 58 to 67 ppb, with a median value of 64 ppb.

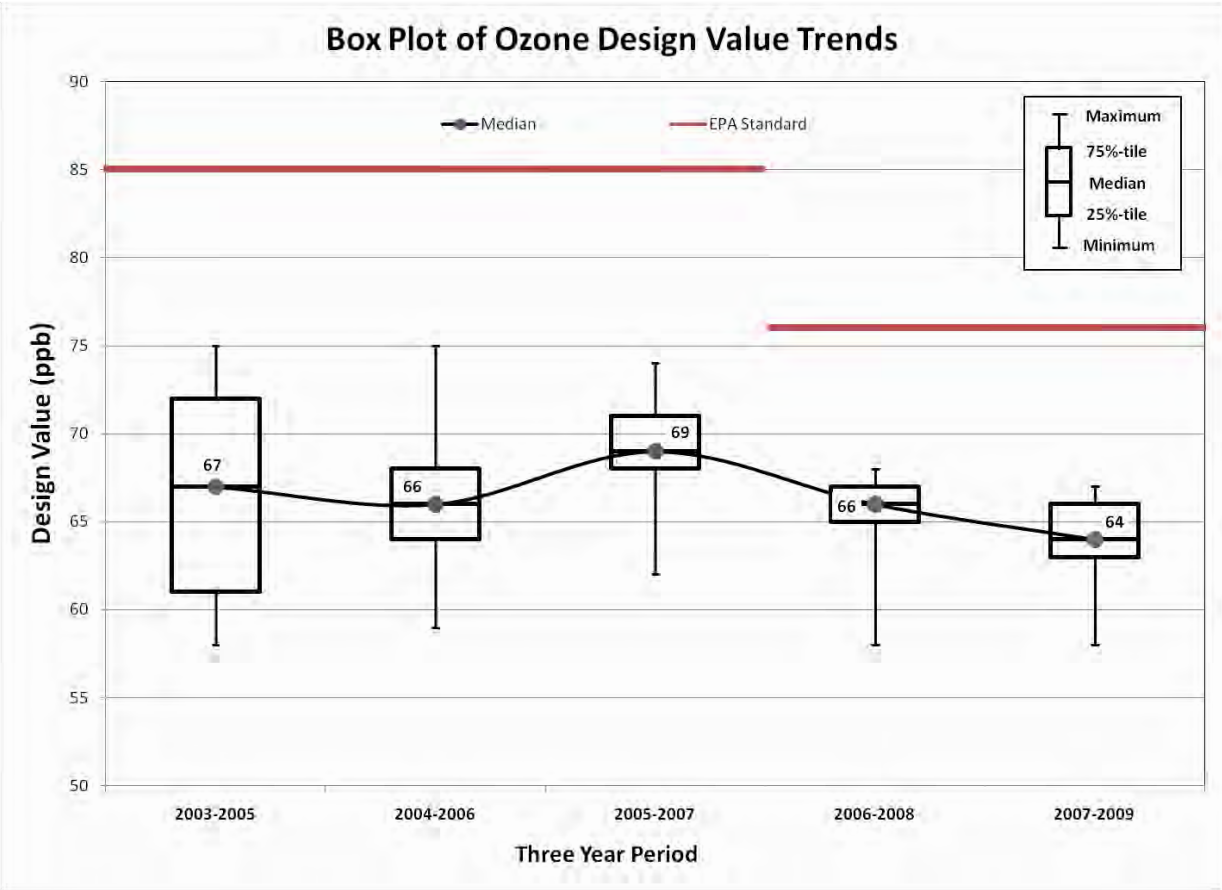
[56] Ozone design value trends for the past 10 years are available at: http://www.iowadnr.gov/air/prof/monitor/files/ozone_design_values_1999-2009.pdf.

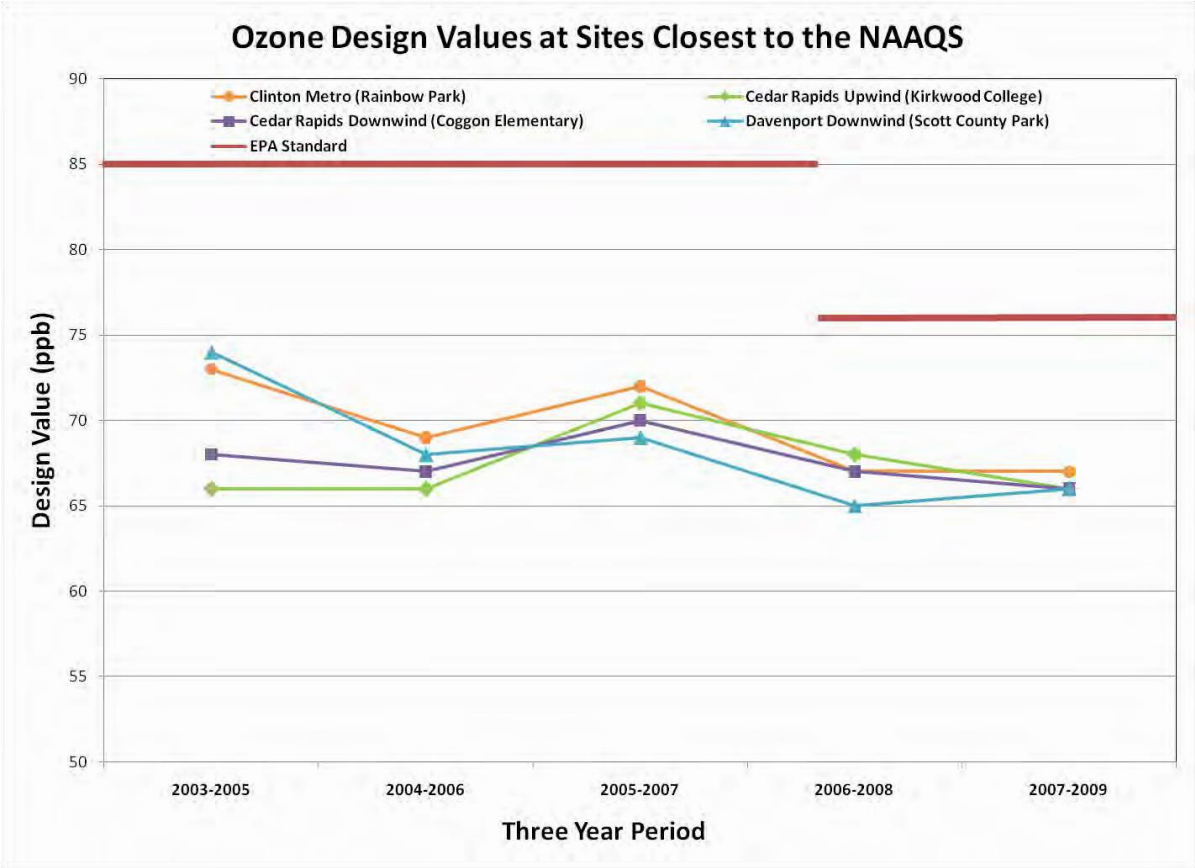
2005 - 2009 Ozone Design Values (ppb)

Three Year Period	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 Metro (Des Moines, Phillips School)	Des Moines Downwind (Slater, Elementary/City Hall)	Cedar Rapids Upwind (Cedar Rapids, Kirkwood College)	Cedar Rapids Downwind (Coggon Elementary School)	Waterloo Downwind (Waverly, Airport)	Southeast Background (Lake Sugema 2)	Davenport Downwind (Scott County Park)	Davenport Downwind (Argo, Highway Maintenance Shed)	Clinton Metro (Clinton, Rainbow Park)
2003-2005	75	65	61	61		60	58	66	68	67		74	72	73
2004-2006	75	64	60	-		66	59	66	67	65		68		69
2005-2007	74	68	62	68			66	71	70	67	69	69		72
2006-2008	67	66	58	64			64	68	67	65	66	65		67
2007-2009	64	63	58	63	61		62	66	66	64	64	66		67

	Previous NAAQS: 85 ppb
	Current NAAQS: 76 ppb

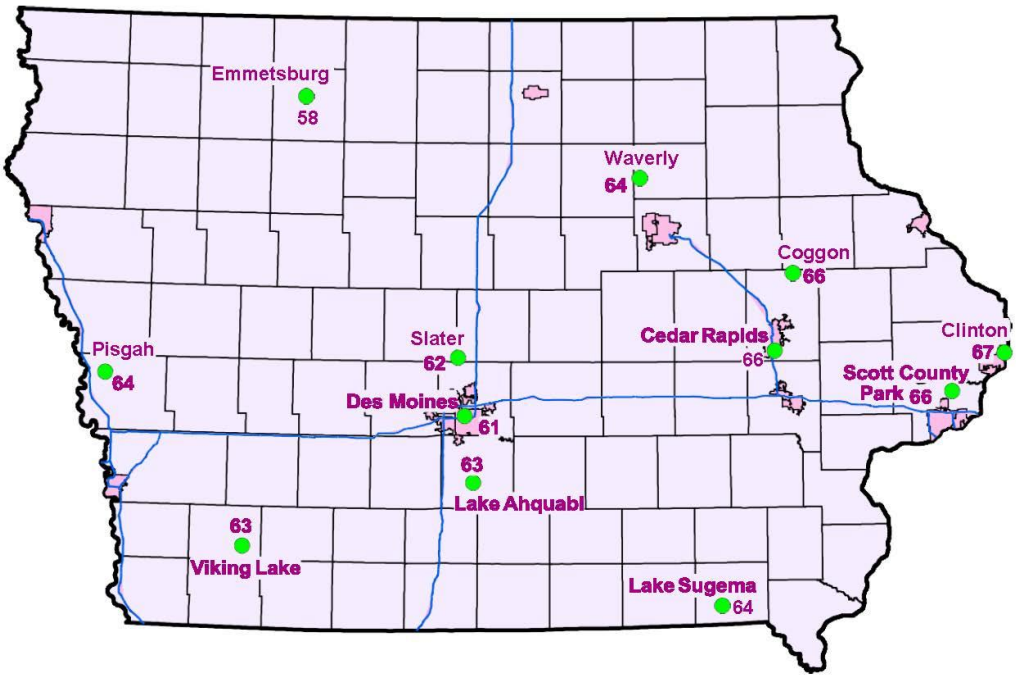




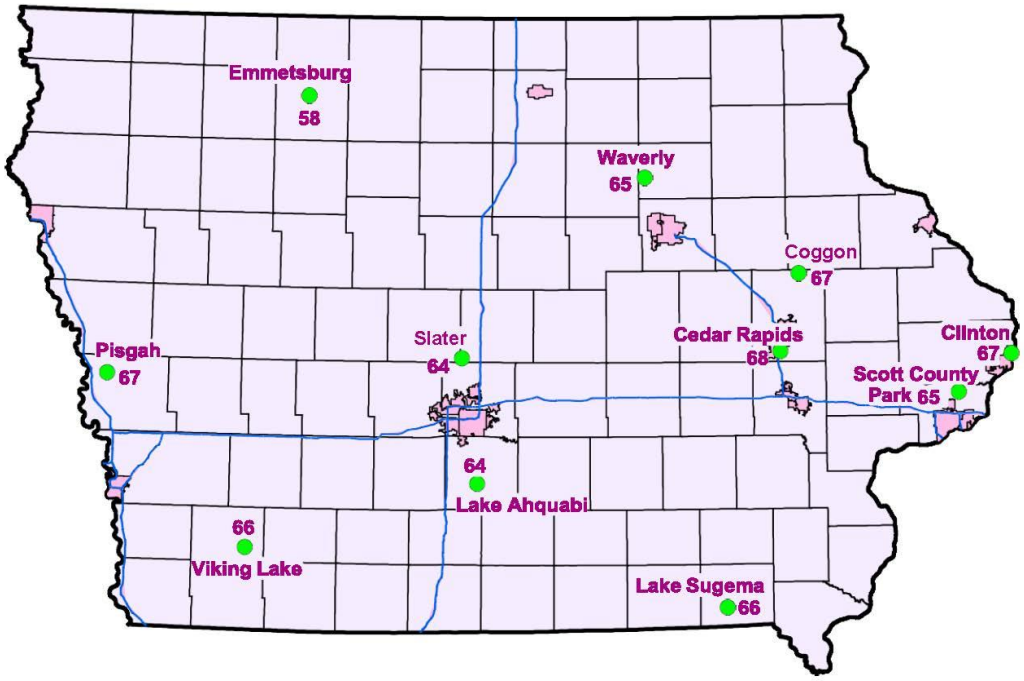


Ozone design value maps for the past five years are shown below. Three years of complete data are required to

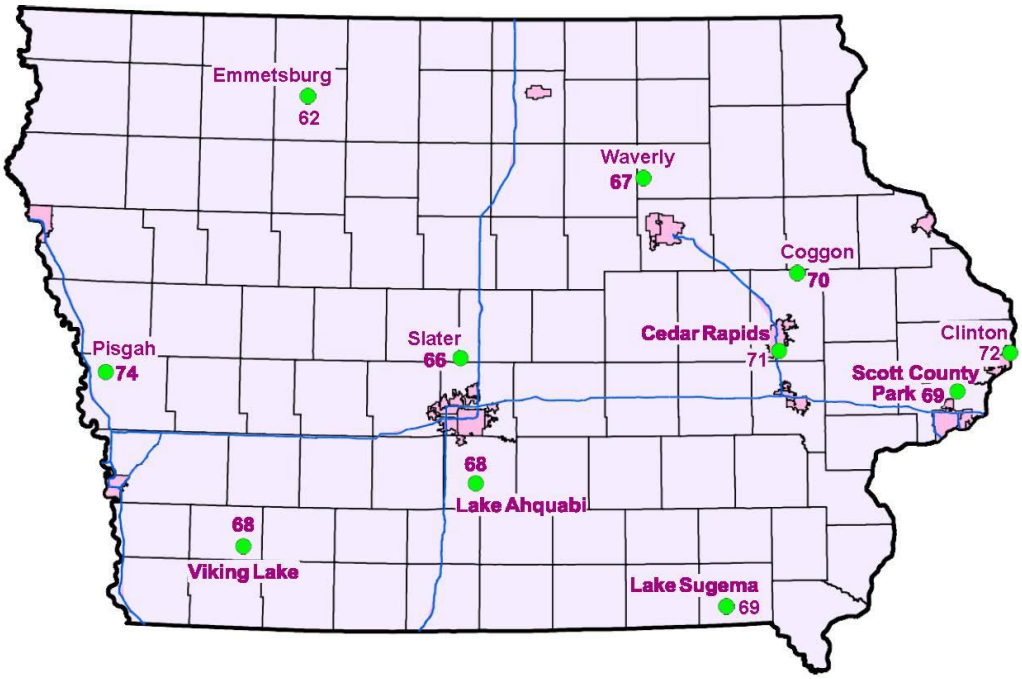
compute a design value; only sites with complete data are indicated. Ozone levels in Emmetsburg in Northwest Iowa tend to be the lowest in the network. The most recent (2007-2009) data shows ozone levels at monitoring sites in Linn County, Scott County and Clinton County to be the highest in the network.



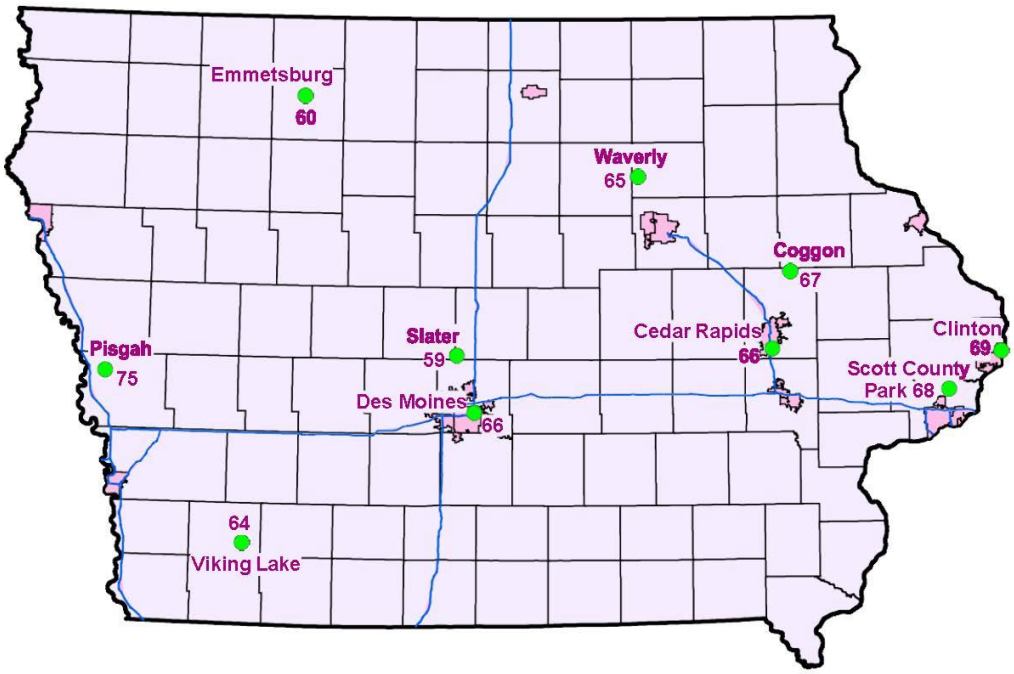
2007-2009 Ozone Design Values (ppb)



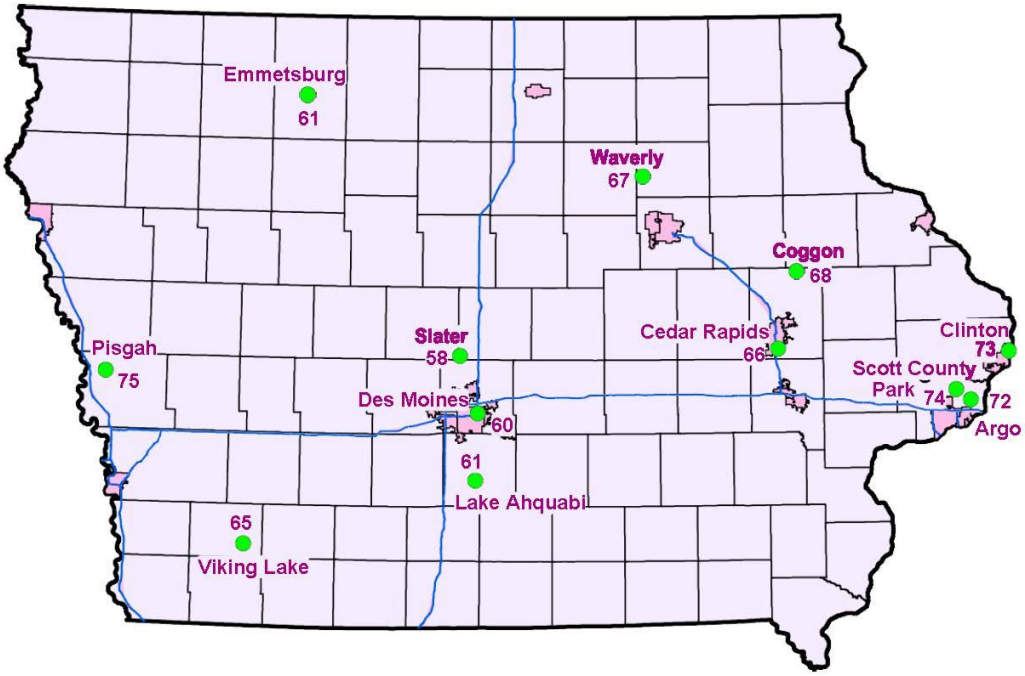
2006-2008 Ozone Design Values (ppb)



2005-2007 Ozone Design Values (ppb)



2004-2006 Ozone Design Values (ppb)



2003-2005 Ozone Design Values (ppb)

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

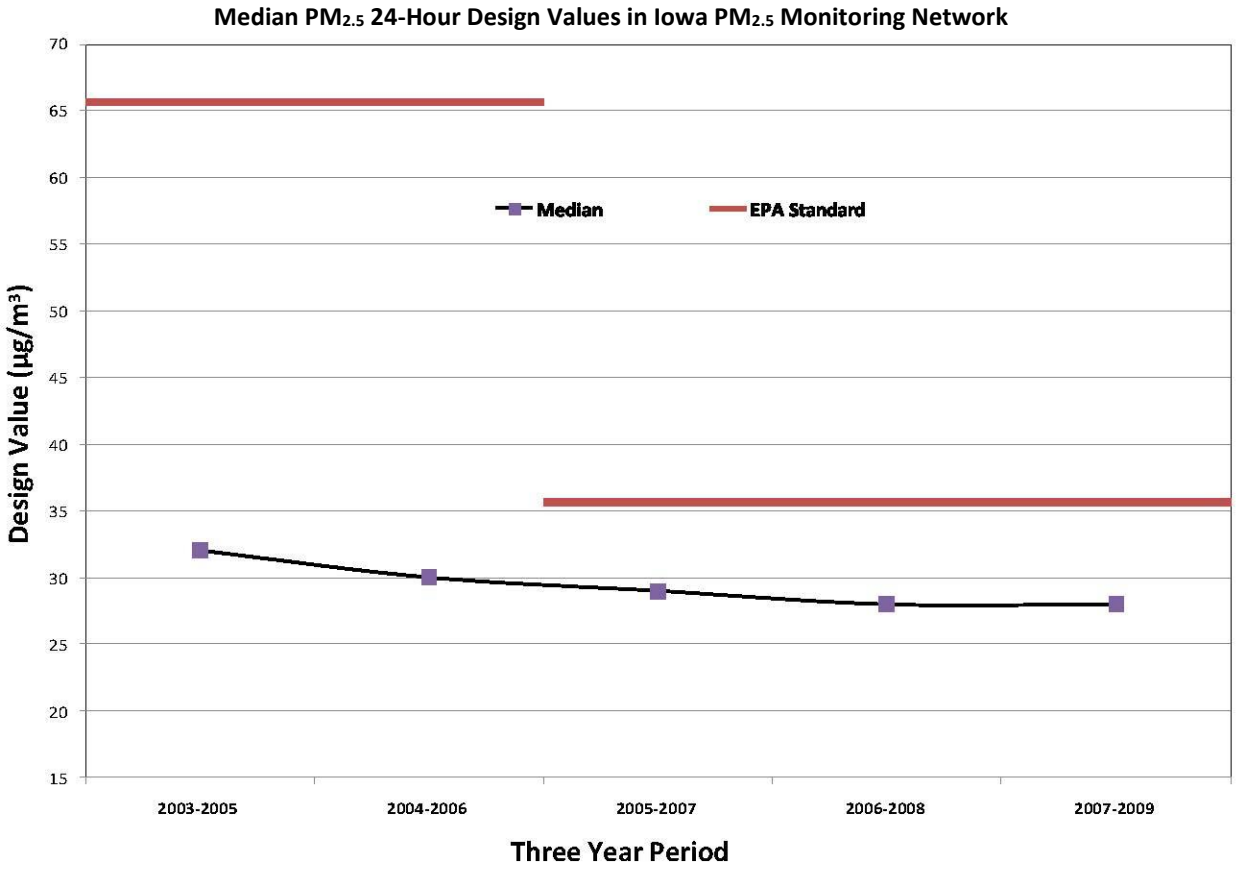
Trends and maps of $PM_{2.5}$ 24-hour design values for the period 2005-2009 are provided below. Charts of these trends for cities with monitoring sites that are closest to the standard are also provided. The median $PM_{2.5}$ 24-hour design value in the Iowa $PM_{2.5}$ network has fallen by 4 µg/m^3 or about 13% over the past five years. During the five year period, violations of the NAAQS were recorded at two monitoring sites, Garfield School in Muscatine and Blackhawk Foundry in Davenport.

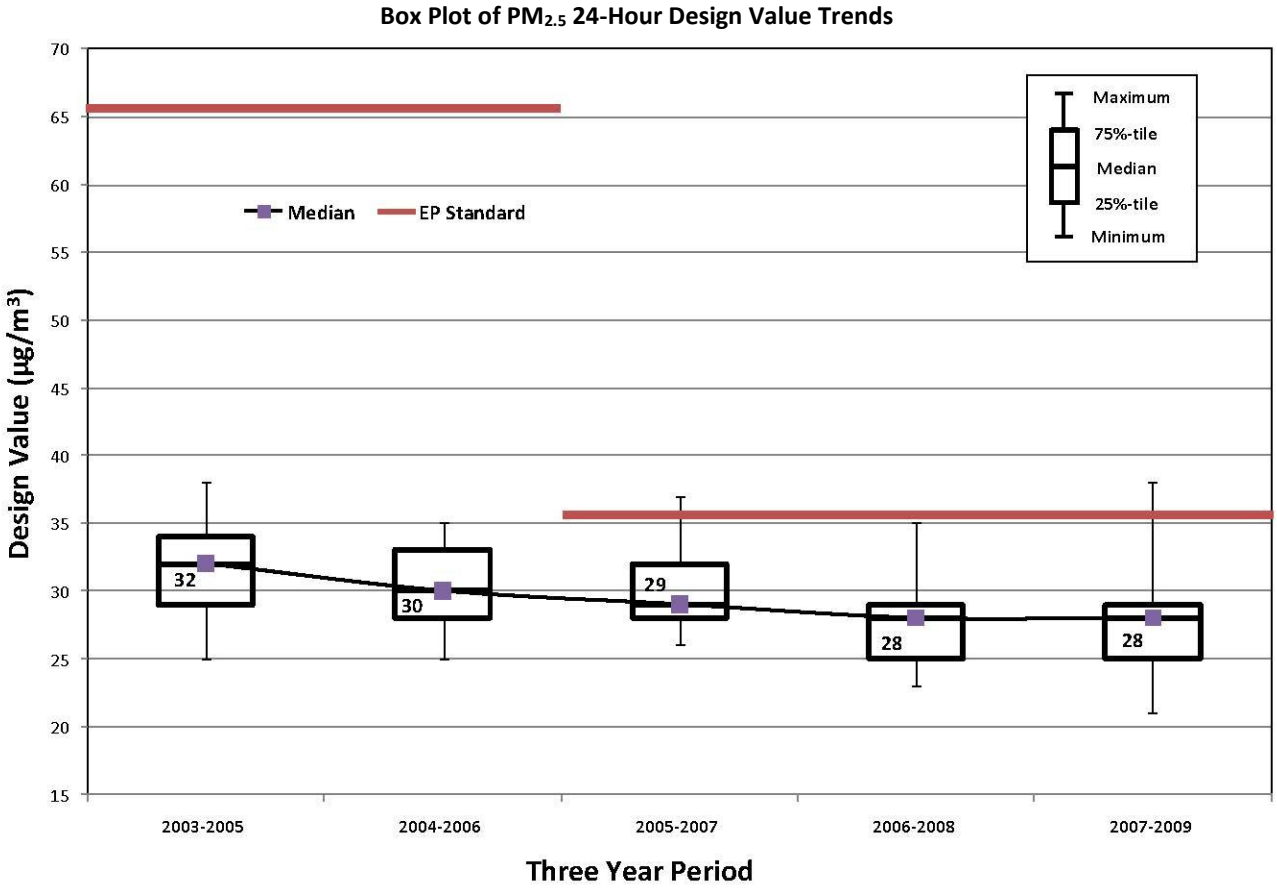
The most recent (2007-2009) monitoring data shows design values ranging from 21 to 38 µg/m^3, with a median value of 28 µg/m^3. The most recent design values in Iowa cities (at sites not influenced by emissions from nearby industries) are about 20% less than the standard in Eastern Iowa and about 30% less than the standard in Central and Western Iowa. There are three monitoring sites located in Eastern Iowa cities that are influenced by industrial $PM_{2.5}$ emitters. A monitor next to Blackhawk Foundry in Davenport recorded levels that were 8% less than violation levels, and a monitor at Chancy Park (next to the Archer Daniels Midland Plant) in Clinton recorded levels that were 11% less than violation levels. Another monitor at Garfield School (about a quarter mile from Grain Processing Corporation) in Muscatine recorded levels about 6% over the violation level.

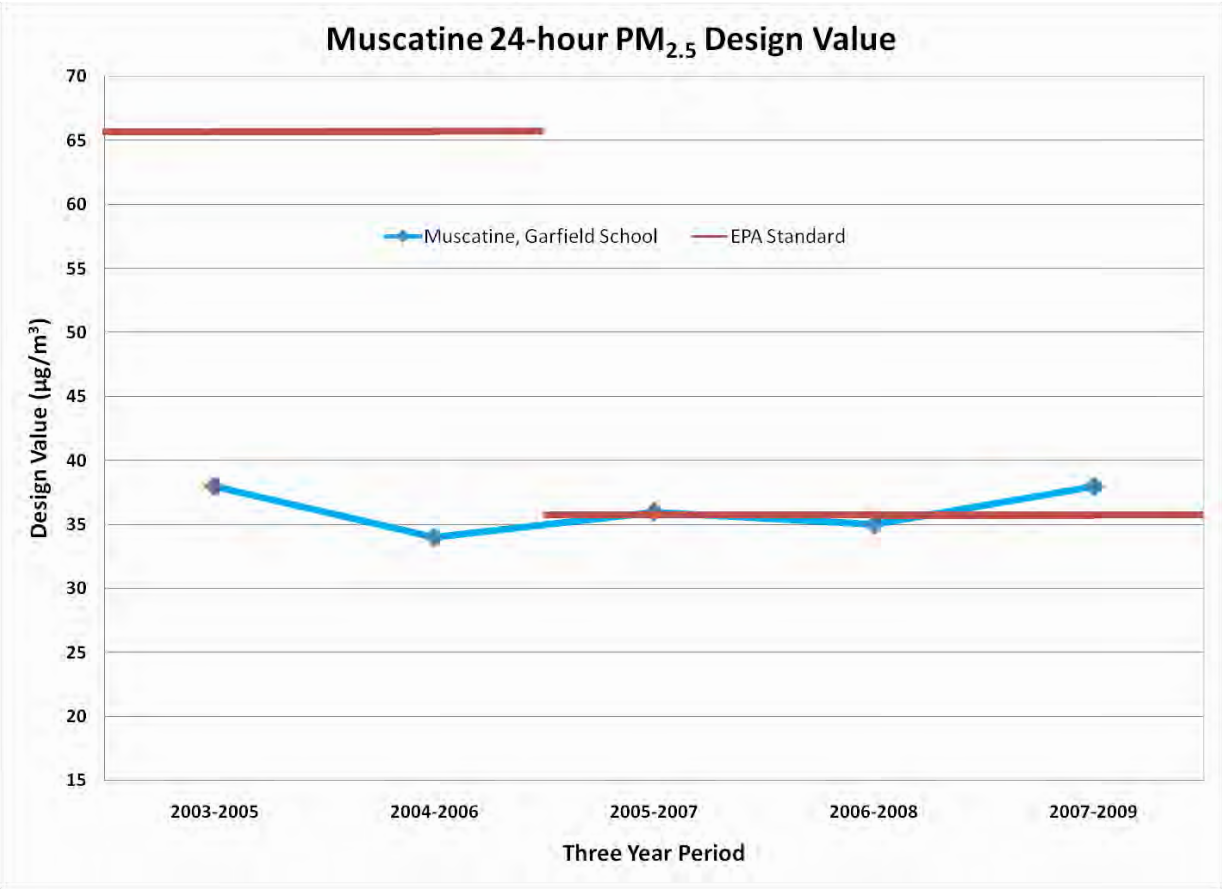
$PM_{2.5}$ 24-Hour Design Values 2005-2009 (µg/m³)

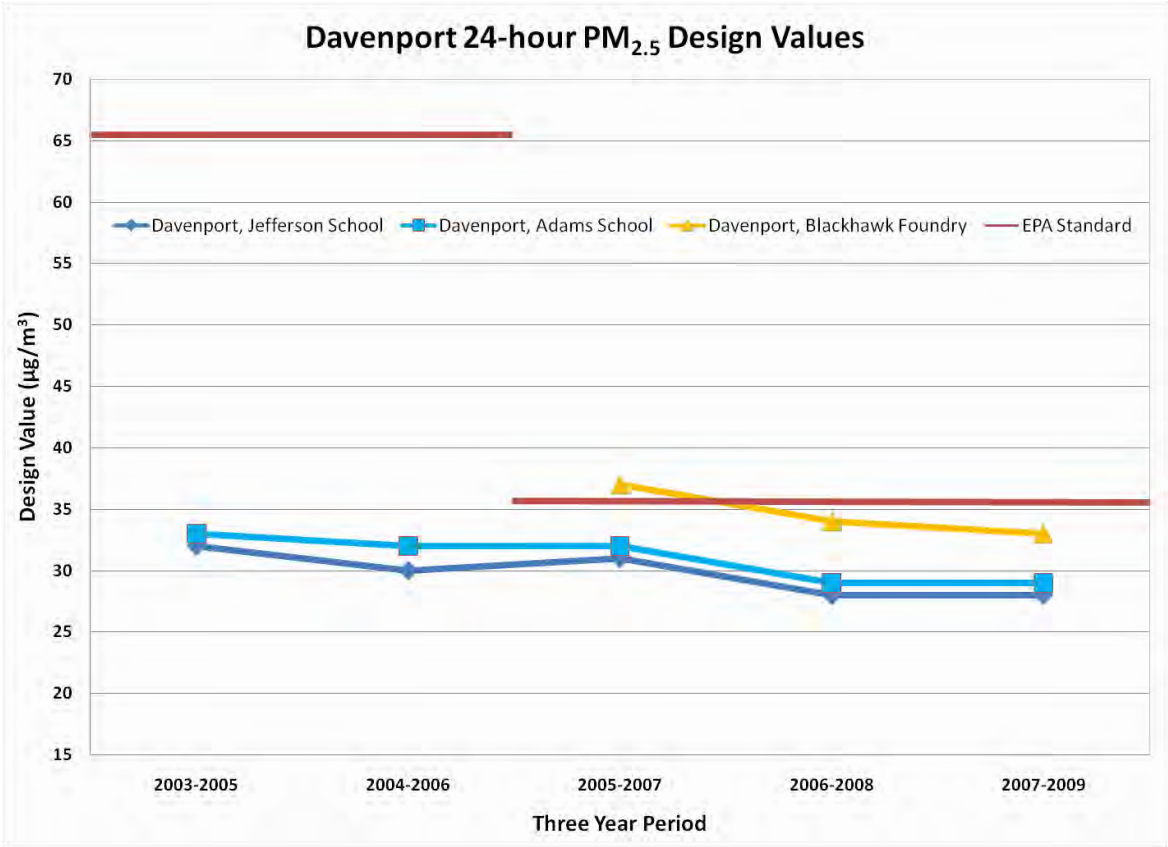
Three Year Period	Sioux City, Lowell School 191930017	Council Bluffs, Franklin School 191550009	Viking Lake State Park 191370002	Emmetsburg, Iowa Lakes Community College 191471002	Des Moines, Health Building 191530030	Clive, Indian Hills School 191532510	Waterloo, Grout Museum 190130008	Cedar Rapids, Army Reserve 191130037	Iowa City, Hoover School 191032001	Lake Sugema 191770006	Muscatine, Garfield School 191390015	Keokuk, Fire Station 191110008	Davenport, Jefferson School 191630015	Davenport, Adams School 191630018	Davenport, Blackhawk Foundry 191630019	Clinton, Chancy Park 190450019	Clinton, Rainbow Park 190450021
2003-2005	25	29	27		29	30		33	35		38		32	33			36
2004-2006	25	28	28		28		30	30	35		34		30	32			34
2005-2007	28	29	28	26	29	26	30	29	34	28	36		31	32	37		32
2006-2008	28	25	23	24	25	23	28	25	29	26	35		28	29	34	34	28
2007-2009		25	21	24	25	25	29	28	29	25	38	26	28	29	33	32	28

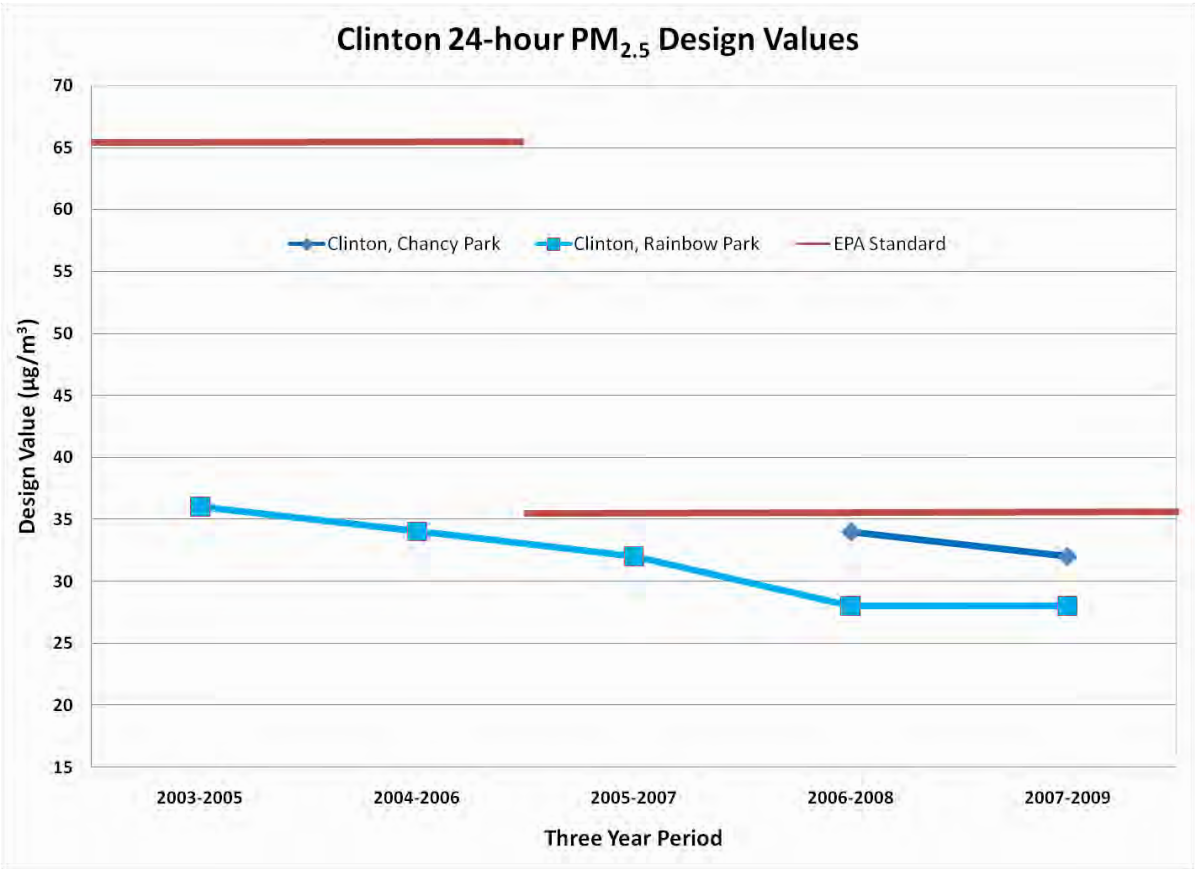
	Previous NAAQS: 66 µg/m³
	Current NAAQS: 36 µg/m³




Box Plot of PM2.5 24-Hour Design Value Trends
Maximum
75%-tile
Median
25%-tile
Minimum
Median
EP Standard
Design Value (µg/m³)
70
65
60
55
50
45
40
35
30
25
20
15
32
30
29
28
28
2003-2005
2004-2006
2005-2007
2006-2008
2007-2009
Three Year Period

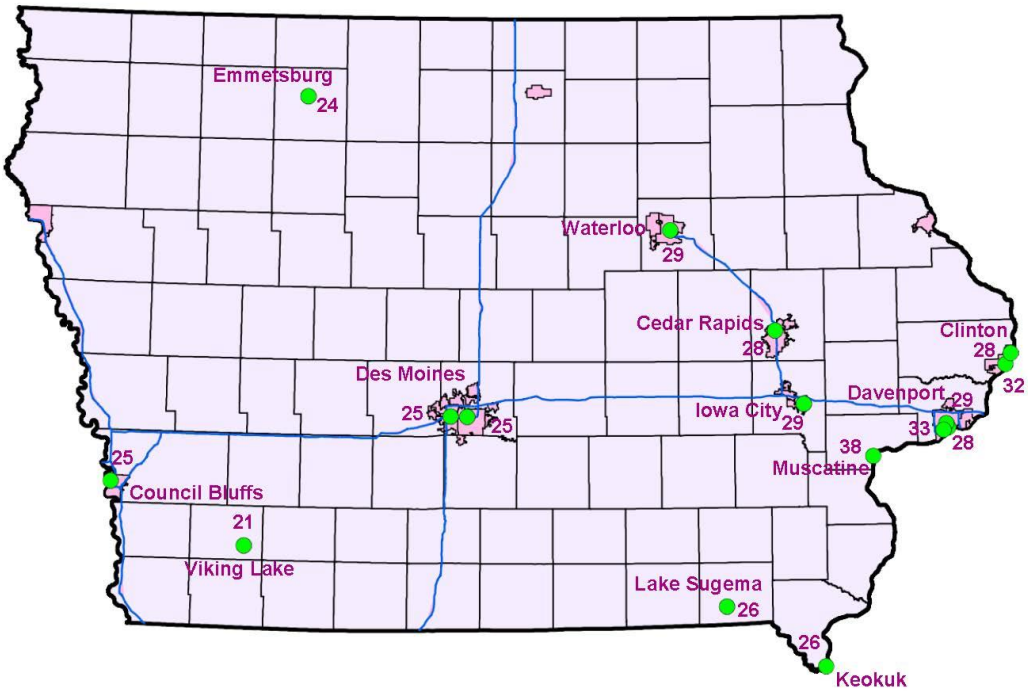

Muscatine 24-hour PM2.5 Design Value
Muscatine, Garfield School
EPA Standard
Design Value (µg/m³)
70
65
60
55
50
45
40
35
30
25
20
15
2003-2005
2004-2006
2005-2007
2006-2008
2007-2009
Three Year Period



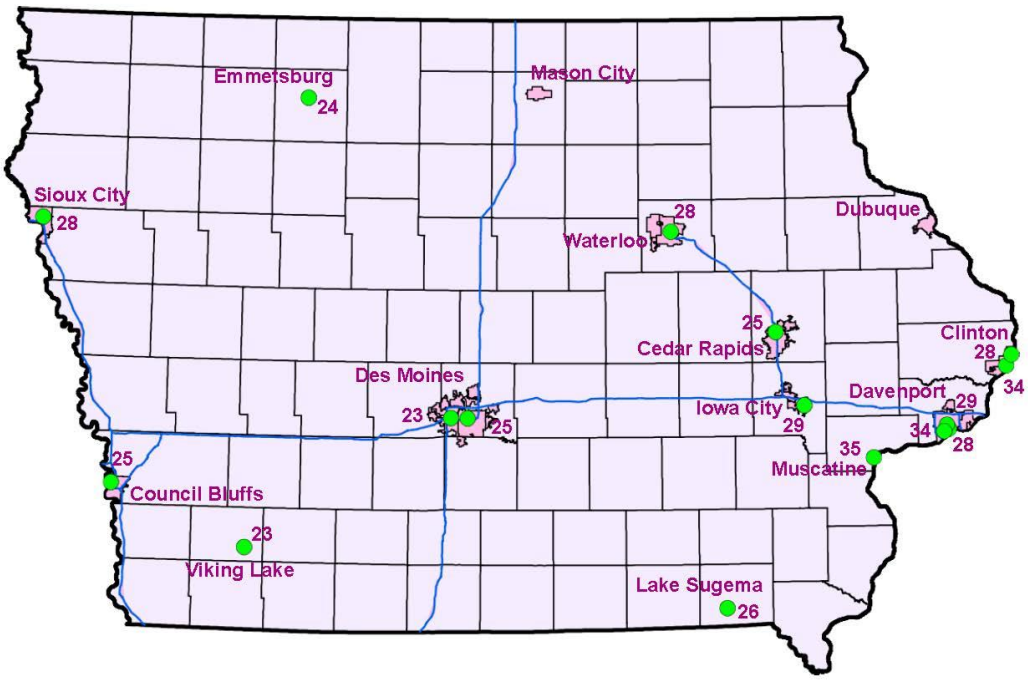


Maps of $PM_{2.5}$ 24-hour design values for the past 5-years are indicated below. Three years of complete data are required to compute a design value; only sites with complete data are indicated. Monitors located near primary $PM_{2.5}$ emitters in

Davenport, Clinton and Muscatine record the highest values. Monitors in the east tend to read slightly higher than those in the west;[57] monitors at background/ transport locations (Lake Sugema, Viking Lake, Emmetsburg) usually read less than those in more populated areas nearby.

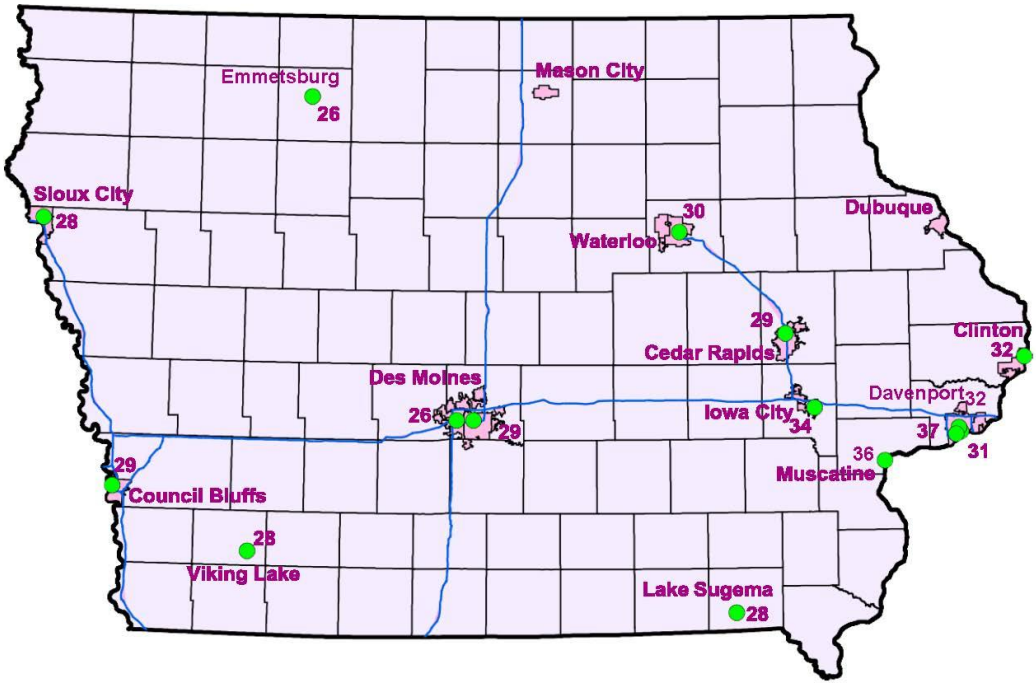


2007-2009 $PM_{2.5}$ 24-Hour Design Values (µg/m^3)

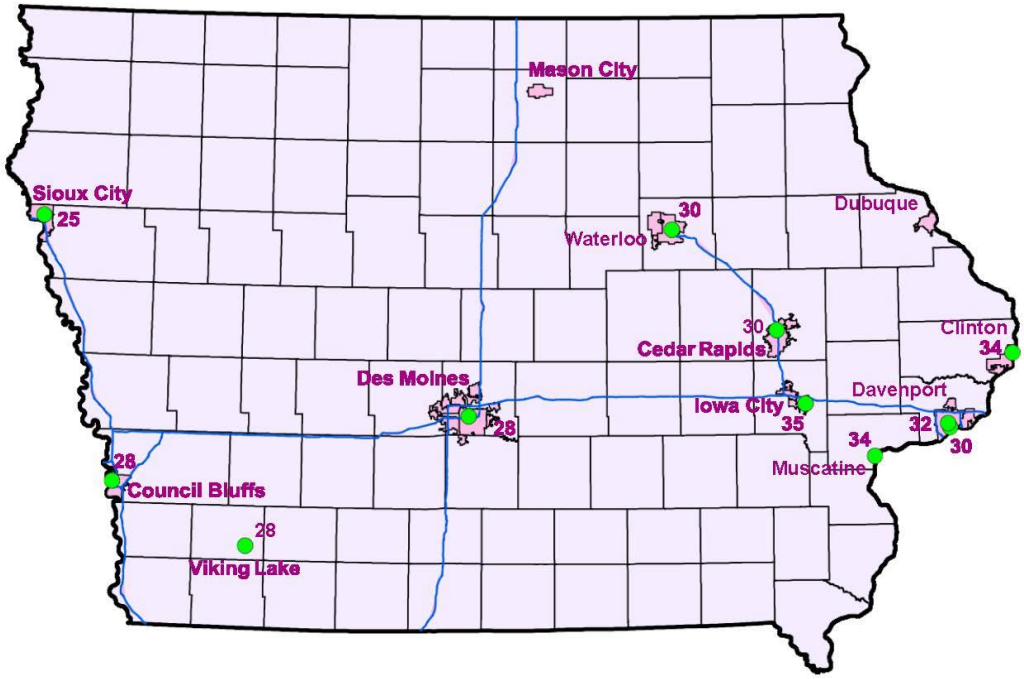


2006-2008 $PM_{2.5}$ 24-Hour Design Values (µg/m^3)

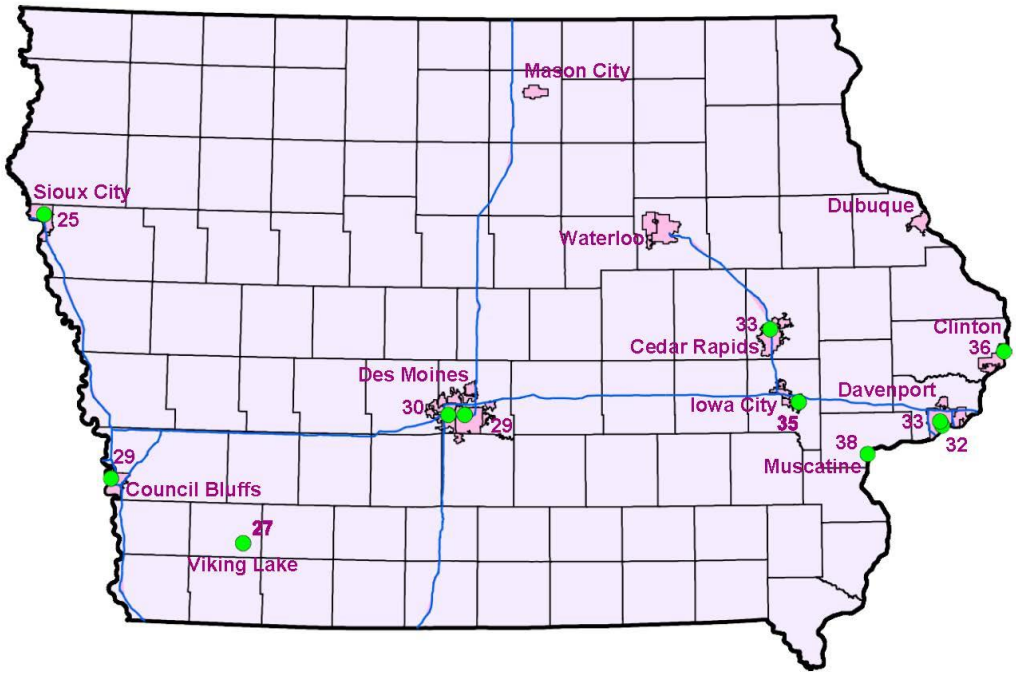
[57] A national map of 2005-2007 24-hour $PM_{2.5}$ design values that shows the fall off in $PM_{2.5}$ levels as one moves from east to west across the Midwest Region is available online at: http://www.iowadnr.gov/air/prof/monitor/files/PM25_Design_Value_Maps_2005-2007.pdf



2005-2007 $PM_{2.5}$ 24-Hour Design Values (µg/m³)



2004-2006 $PM_{2.5}$ 24-Hour Design Values (µg/m³)



2003-2005 $PM_{2.5}$ 24-Hour Design Values (µg/m^3)

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

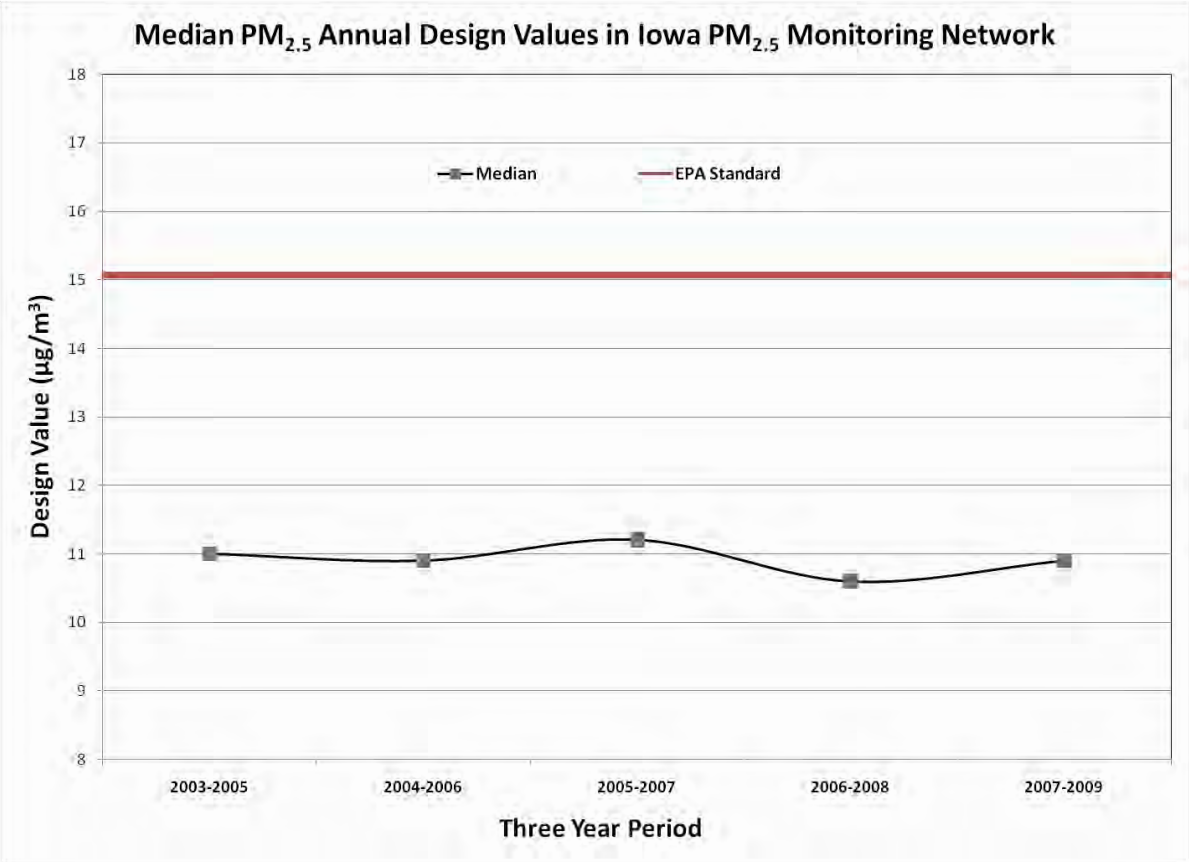
Trends and maps of $PM_{2.5}$ annual design values over the past five years are provided below. A chart of these trends for cities with monitoring sites that are closest to the standard is also provided. The median $PM_{2.5}$ annual design value in the Iowa $PM_{2.5}$ network has dropped by 0.1 µg/m^3 or about 1% 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.

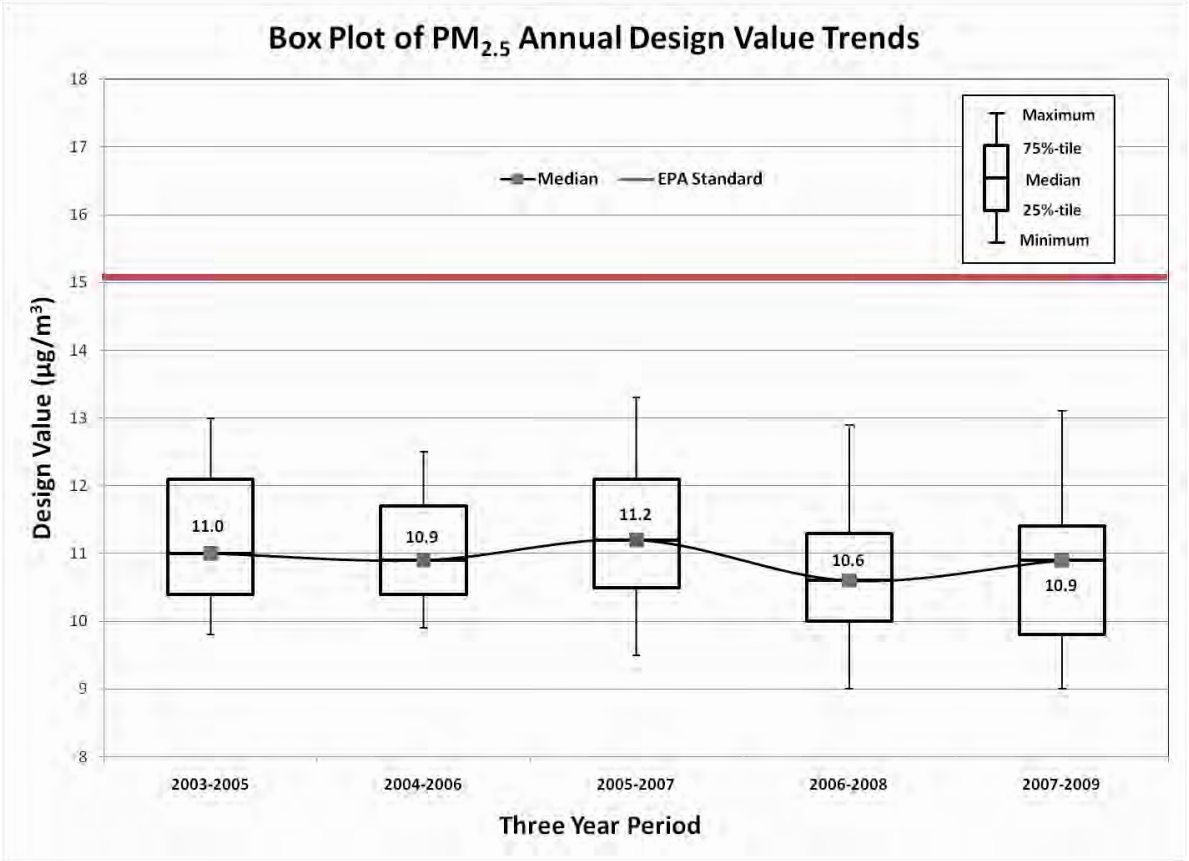
The most recent (2007-2009) monitoring data shows levels between 9.0 and 13.1 µg/m^3 across the State, with a median value of 10.9 µg/m^3.

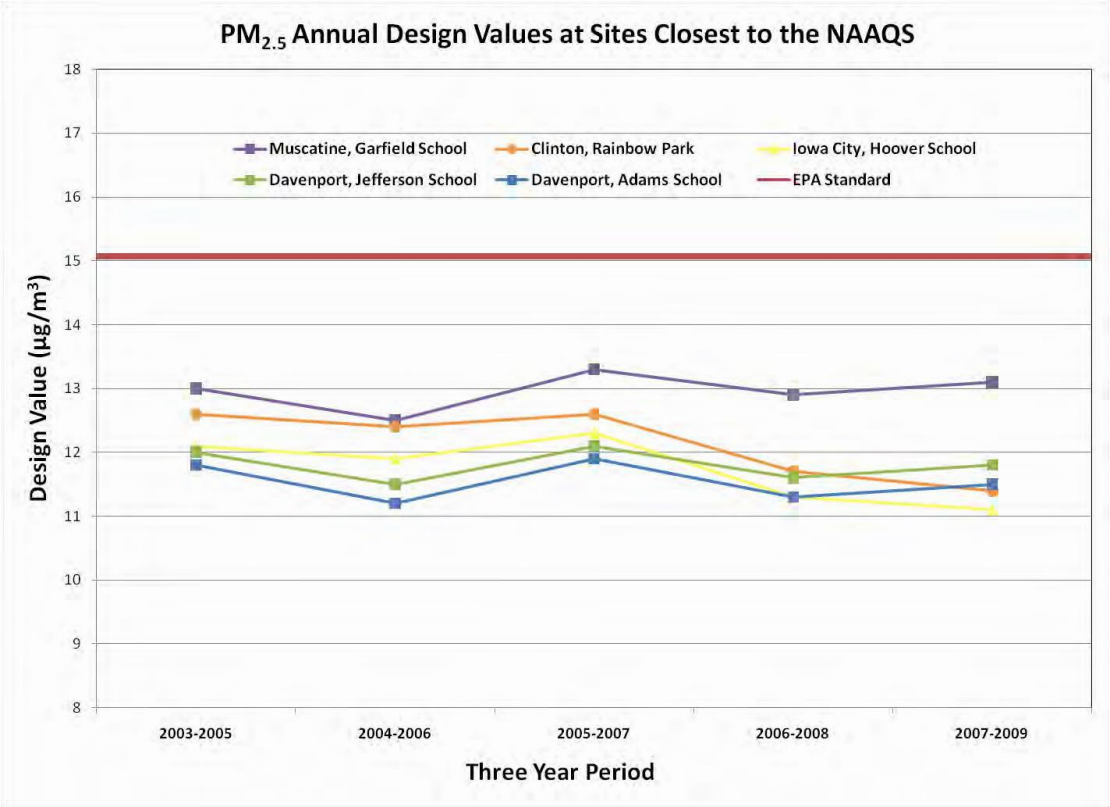
$PM_{2.5}$ Annual Design Values 2005-2009 (µg/m^3)

Three Year Period	Sioux City, Lowell School 191930017	Council Bluffs, Franklin School 191550009	Viking Lake State Park 191370002	Emmetsburg, Iowa Lakes Community College 191471002	Des Moines, Health Building 191530030	Clive, Indian Hills School 191532510	Waterloo, Grout Museum 190130008	Cedar Rapids, Army Reserve 191130037	Iowa City, Hoover School 191032001	Lake Sugema 191770006	Muscatine, Garfield School 191390015	Keokuk, Fire Station 191110008	Davenport, Jefferson School 191630015	Davenport, Adams School 191630018	Clinton, Rainbow Park 190450021
2003-2005	10.3	10.9	9.8		10.5	10.1		11.0	12.1		13.0		12.0	11.8	12.6
2004-2006	10.1	10.9	9.9		10.2		10.8	10.5	11.9		12.5		11.5	11.2	12.4
2005-2007	10.5	11.5	10.3	9.5	10.5	10.1	11.5	10.9	12.3	10.8	13.3		12.1	11.9	12.6
2006-2008	10.3	10.8	9.5	9.0	10.0	9.7	10.9	10.4	11.3	10.0	12.9		11.6	11.3	11.7
2007-2009		10.6	9.3	9.0	10.0	9.7	11.1	10.3	11.1	9.6	13.1	11.4	11.8	11.5	11.4

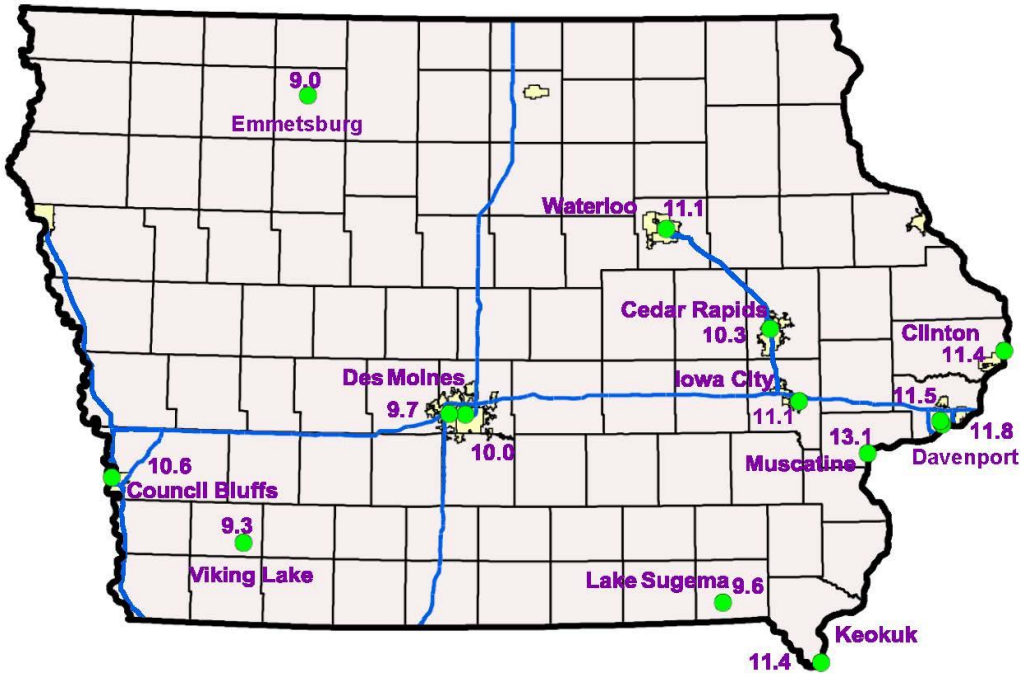
NAAQS: 15.05 µg/m^3


Median PM2.5 Annual Design Values in Iowa PM2.5 Monitoring Network
Median
EPA Standard
Design Value (µg/m³)
18
17
16
15
14
13
12
11
10
9
8
2003-2005
2004-2006
2005-2007
2006-2008
2007-2009
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
11.0
10.9
11.2
10.6
10.9
2003-2005
2004-2006
2005-2007
2006-2008
2007-2009
Three Year Period

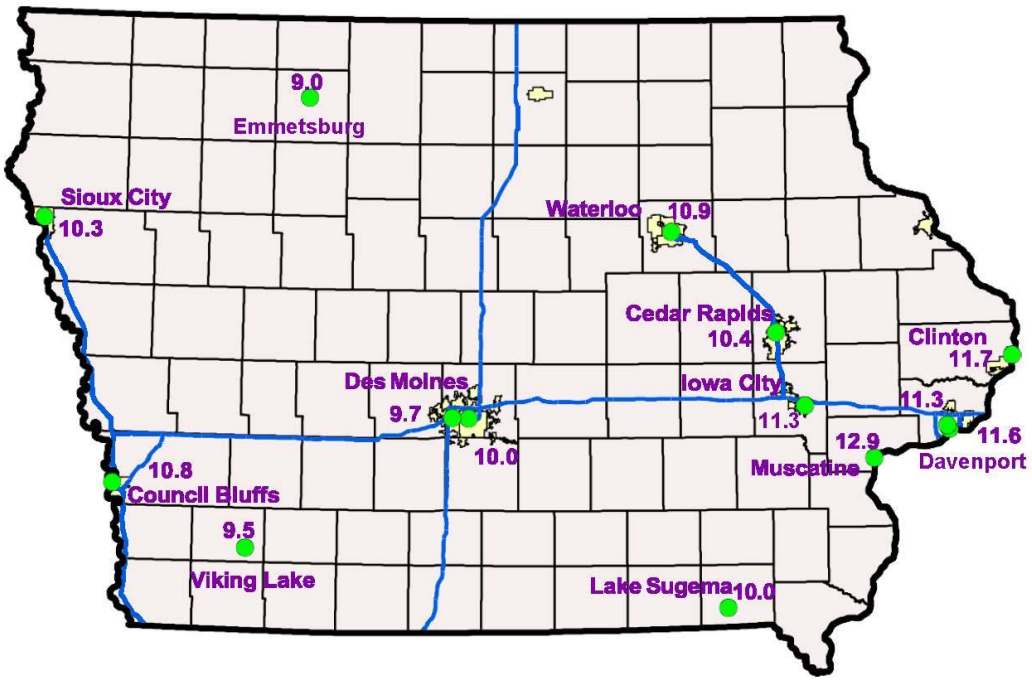


Maps of $PM_{2.5}$ annual design values for the most recent 5-year period are indicated below. Three years of complete data are required to compute a design value; only sites with complete data are indicated. Monitors in the east tend to read slightly higher than those in the west.[58] Monitors at background/transport locations (Lake Sugema, Viking Lake, Emmetsburg) tend to read less than those in more populated areas.

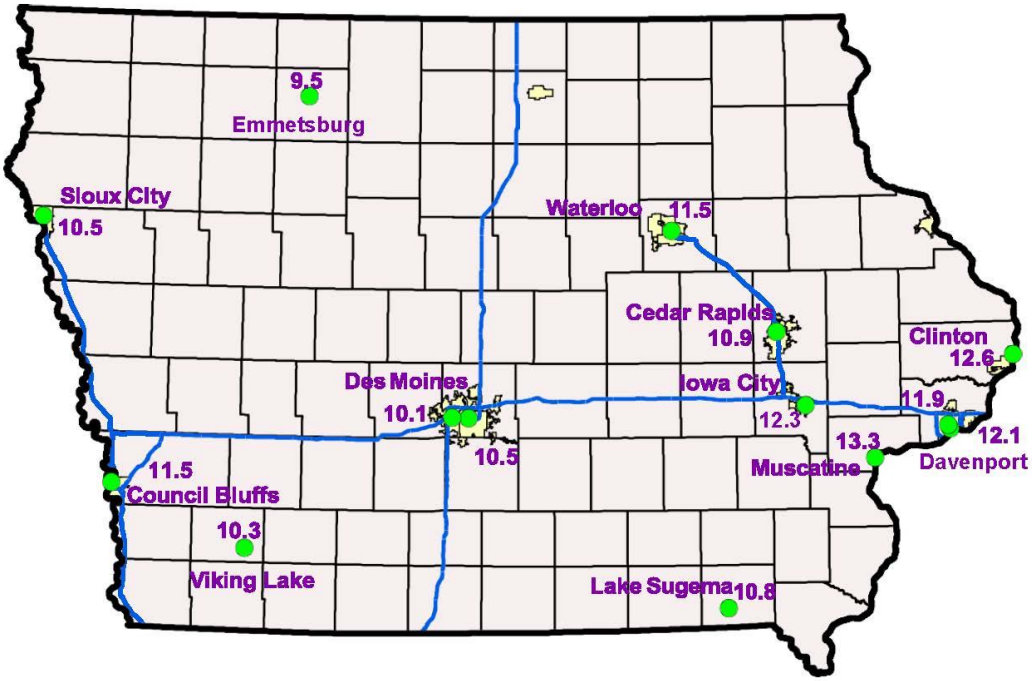


2007-2009 $PM_{2.5}$ Annual Design Values

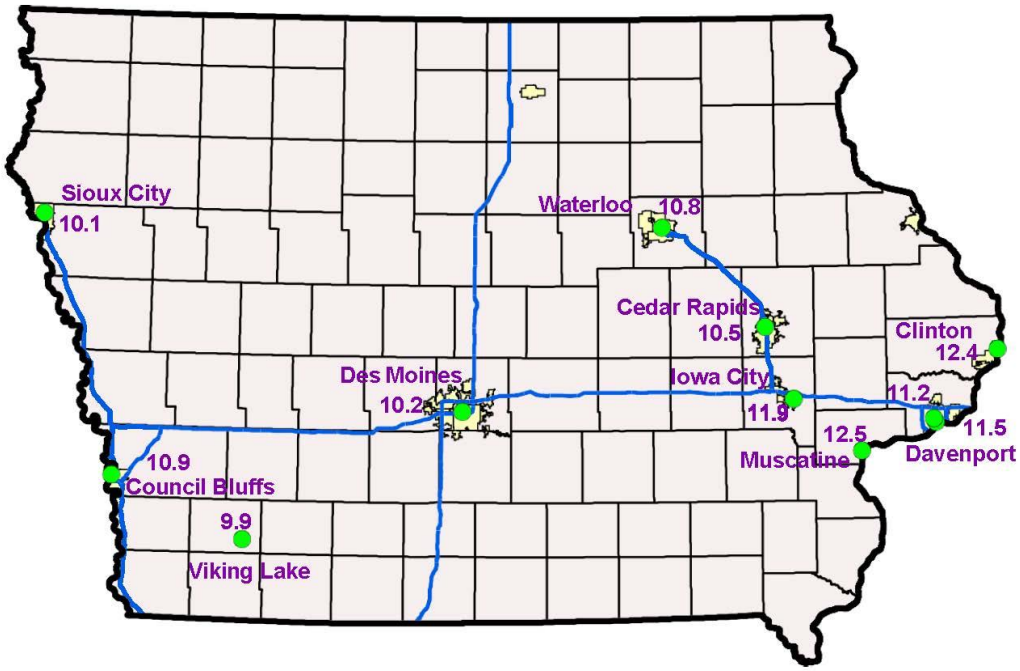
[58] The reduction in fine particle levels as one moves from the industrial Midwest to the western plains is well known; see for example: page 101 of: http://vista.cira.colostate.edu/improve/Publications/Reports/2006/PDF/IMPROVE_Report_IV.pdf.



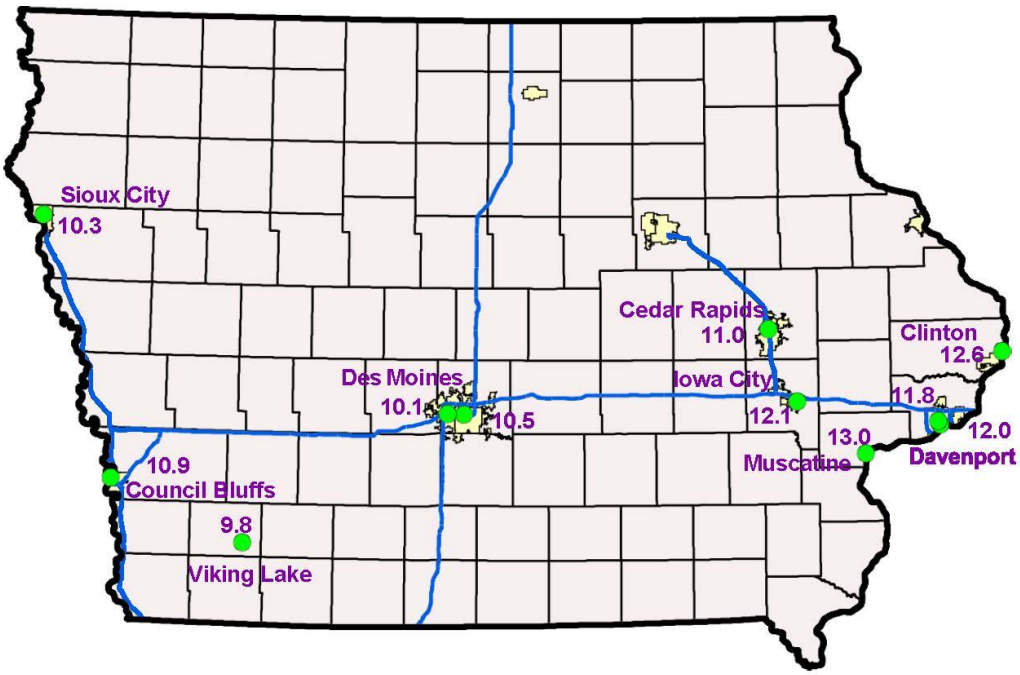
2006-2008 $PM_{2.5}$ Annual Design Values



2005-2007 $PM_{2.5}$ Annual Design Values



2004-2006 $PM_{2.5}$ Annual Design Values



2003-2005 $PM_{2.5}$ Annual Design Values

Appendix I: Iowa MSA's

Section 1: Summary

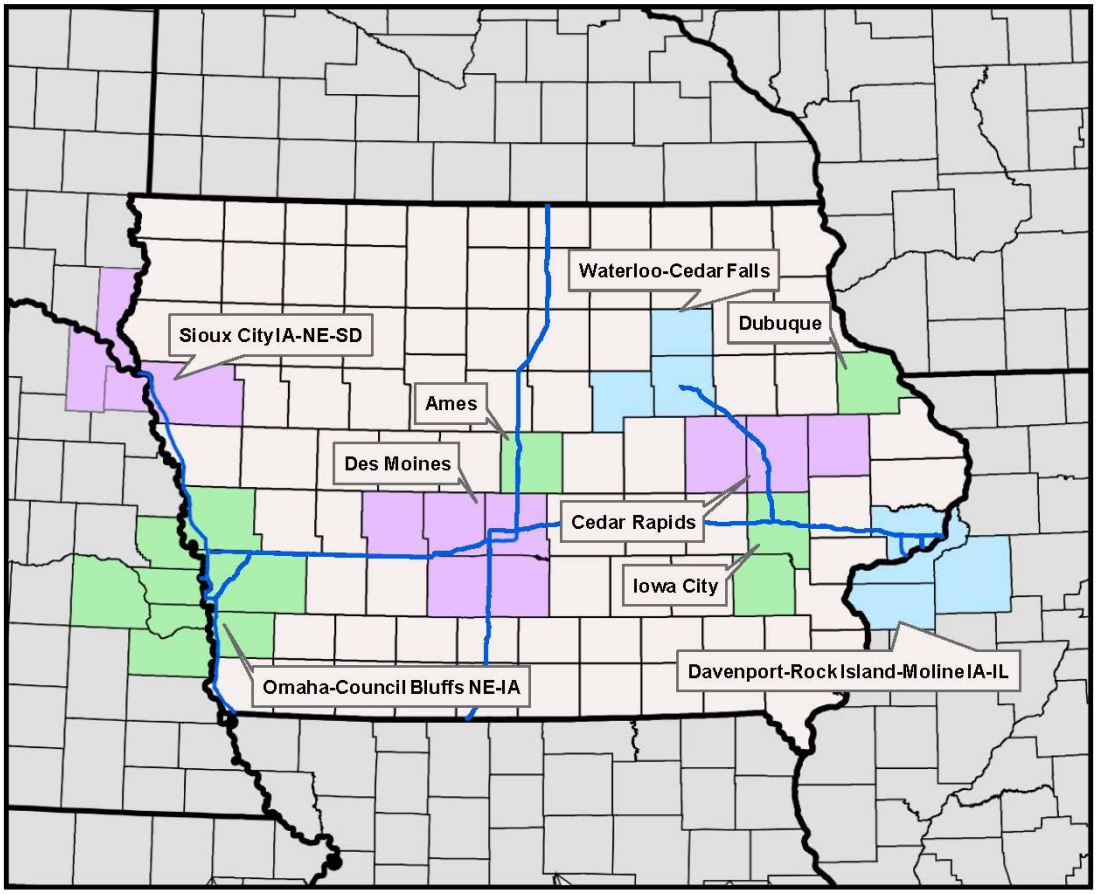
In order to protect human health, an important objective of an ambient air monitoring network is to quantify air pollution levels in heavily populated areas. Federal ambient air monitoring regulations contain minimum monitoring requirements for Metropolitan Statistical Areas (MSA's). About 57% of Iowa's population is concentrated in its MSA's, and about 64% of Iowa's ambient air monitors 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,[59] Iowa has 9 MSA's made up of twenty Iowa counties and eleven counties from other states, as indicated in the map and table below:



MSA's in Iowa

[59] United States Census Bureau maps of Metropolitan Statistical Areas are available online at: http://www.census.gov/geo/www/maps/stcbsa_pg/stBased_200411_nov.htm

MSA 's Containing Iowa Counties[60]

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, Warren, Madison	-	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	Bremer, Grundy, Blackhawk	-	Waterloo	WTL
Sioux City, IA-NE-SD	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

[60] Iowa's 2010 Network Plan utilized the most recent available census data for its assessment of compliance with federal population-oriented SLAMS monitoring requirements, but incorporated two outdated MSA definitions. (See Appendix G of http://www.iowadnr.gov/air/prof/monitor/files/Network_Plan_2010.pdf). The outdated map for the Omaha-Council Bluffs MSA included of Washington, Douglas, Sarpy and Cass counties in Nebraska, and Pottawattamie County in Iowa, but did not include Saunders County in Nebraska and Harrison and Mills Counties in Iowa. The outdated Davenport-Moline-Rock Island MSA included Scott County in Iowa as well as Henry and Rock Island counties in Illinois, but did not include Mercer County in Illinois. For each of these two MSA's, the current MSA contains all counties in the outdated MSA. Thus, the demonstration contained in the 2010 Network Plan that the minimum federal monitoring requirements are met in the outdated MSA, suffices to show that the requirements are met in the current MSA. The current MSA definitions are adopted throughout this document, and the analysis of minimum federal monitoring requirements is revisited with the current MSA definitions in Section 4.

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.

Population of Iowa Metropolitan Statistical Areas

MSA	Total Population of MSA[61]	Iowa Population of MSA[62]	Iowa Percentage of MSA Population	Percent of Iowa's Total Population Residing in MSA[63]
Des Moines-West Des Moines, IA	562,906	562,906	100%	19%
Cedar Rapids, IA	256,324	256,324	100%	9%
Davenport-Moline-Rock Island, IA-IL	379,066	166,650	44%	6%
Waterloo-Cedar Falls, IA	164,913	164,913	100%	5%
Iowa City, IA	152,263	152,263	100%	5%
Omaha-Council Bluffs, NE-IA	849,517	120,554	14%	4%
Sioux City, IA-NE-SD	144,360	102,831	71%	3%
Dubuque, IA	93,072	93,072	100%	3%
Ames, IA	87,214	87,214	100%	3%
Totals	2,689,635	1,706,727	100%	57%

Section 4: SLAMS Monitoring Requirements[64] and Distribution of Monitors in MSA's

Required Number of SLAMs Monitors in MSA's

MSA Label	$PM_{2.5}$ FRM	PM_{10} FRM	Ozone	PM2.5 Continuous	SO_2	CO	NO_2	Pb
Ames	0	0	0	0	0	0	0	0
Cedar Rapids	0	0-1	1	0	0	0	0	0
Dubuque	0	0	0	0	0	0	0	0
Davenport	1	0-1	2	1	0	0	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	2-4	2	1	0	0	0	1
Sioux City	0	0	0	0	0	0	0	0
Waterloo	0	0	1	0	0	0	0	0

[61] July 2009 MSA population estimates for are available online at: http://www.census.gov/popest/metro/CBSA-est2009-annual.html.

[62] July 2009 County Population Estimates are available online at: http://www.census.gov/popest/counties/counties.html.

[63] 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 3,007,856 people, based on the 2009 Census estimates.

[64] 40 CFR Part 58 Appendix D specifies the minimum number of SLAMS (State and Local Air Monitoring Stations) monitors for ozone, PM , and PM based on both population and the concentrations of these pollutants. This table represents the current (7/2010) 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. New SO_2, CO, and NOy monitoring requirements for NCore (multi-pollutant) sites require installation of a new site in Davenport by January 1, 2011, and changes to the NAAQS for SO_2 and NO_2 require new monitors to be operational by January 1, 2013.

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

MSA Label	$PM_{2.5}$ FRM	PM_{10} FRM	Ozone	PM2.5 Continuous	SO_2	CO	NO_2	Pb
Ames	0	0	1[65]	0	0	0	0	0
Cedar Rapids	1	1	1	1	0	0	0	0
Dubuque	0	0	0	0	0	0	0	0
Davenport	3	3	3	1	1	1	1	0
Des Moines	2	2	1	1	0	0	0	0
Iowa City	1	0	0	1	0	0	0	0
Council Bluffs	3	8	4	1	2	1	0	1
Sioux City	1	3	1	0	2	1	2	0
Waterloo	1	1	1	1	0	0	0	0

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

MSA Label	$PM_{2.5}$ FRM	PM_{10} FRM	Ozone	PM2.5 Continuous	SO_2	CO	NO_2	Pb
Davenport	2	3	2	1	1	1	1	0
Council Bluffs	0	0	1	0	0	0	0	1
Sioux City	0	1	0	0	0	0	0	0

SLAMS Monitors Operated by Surrounding States in Multi-State MSA's[66]

MSA Label	$PM_{2.5}$ FRM	PM_{10} FRM	Ozone	PM2.5 Continuous	SO_2	CO	NO_2	Pb
Davenport	1	0	1	0	0	0	0	0
Council Bluffs	3	8	3	1	2	1	0	0
Sioux City	1	2	1	0	2	1	2	0

[65] 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.

[66] §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 2009 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

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	1	0	0	0	0	0	0	0	1	1
Cedar Rapids	2	1	3	1	2	1	1	1	0	0	12	5
Dubuque	0	0	0	0	0	0	0	0	0	0	0	0
Davenport	4	4	2	3	1	1	1	1	1	0	18	6
Des Moines	2	2	2	1	1	1	1	1	1	0	12	3
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	0	0	0	0	0	0	2	1
Waterloo	2	1	1	1	0	0	0	0	0	0	5	3
Inside MSAs	13	11	11	7	4	3	3	3	2	1	58	24
Outside MSAs	10	7	4	6	3	2	0	0	0	0	32	14
Entire State	23	18	15	13	7	5	3	3	2	1	90	38

Percentage 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	9%	6%	20%	8%	29%	20%	33%	33%	0%	0%	13%	13%
Dubuque	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Davenport	17%	22%	13%	23%	14%	20%	33%	33%	50%	0%	20%	16%
Des Moines	9%	11%	13%	8%	14%	20%	33%	33%	50%	0%	13%	8%
Iowa City	4%	6%	0%	8%	0%	0%	0%	0%	0%	0%	3%	3%
Council Bluffs	4%	6%	13%	0%	0%	0%	0%	0%	0%	100%	6%	11%
Sioux City	4%	6%	0%	0%	0%	0%	0%	0%	0%	0%	2%	3%
Waterloo	9%	6%	7%	8%	0%	0%	0%	0%	0%	0%	6%	8%
Inside MSAs	57%	61%	73%	54%	57%	60%	100%	100%	100%	100%	64%	63%
Outside MSAs	43%	39%	27%	46%	43%	40%	0%	0%	0%	0%	36%	37%

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

Section 1: Summary

The Clean Air Act[67] 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).[68] 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 2000 U.S. Census.[69] 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.[70] Section 4 consolidates data from the 2000 U.S. Census, the 2009 U.S. Census estimates[71], 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 57% of Iowa's population lives in MSA's. Of the groups sensitive to the effects of air pollution, 56% of children under 5, 44% of adults over 65, 58% of children with asthma, 56% of adults with asthma, 54% of individuals with chronic bronchitis, 50% of individuals with emphysema, and 56% 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.

Section 2: Children and the Elderly

The 2000 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:

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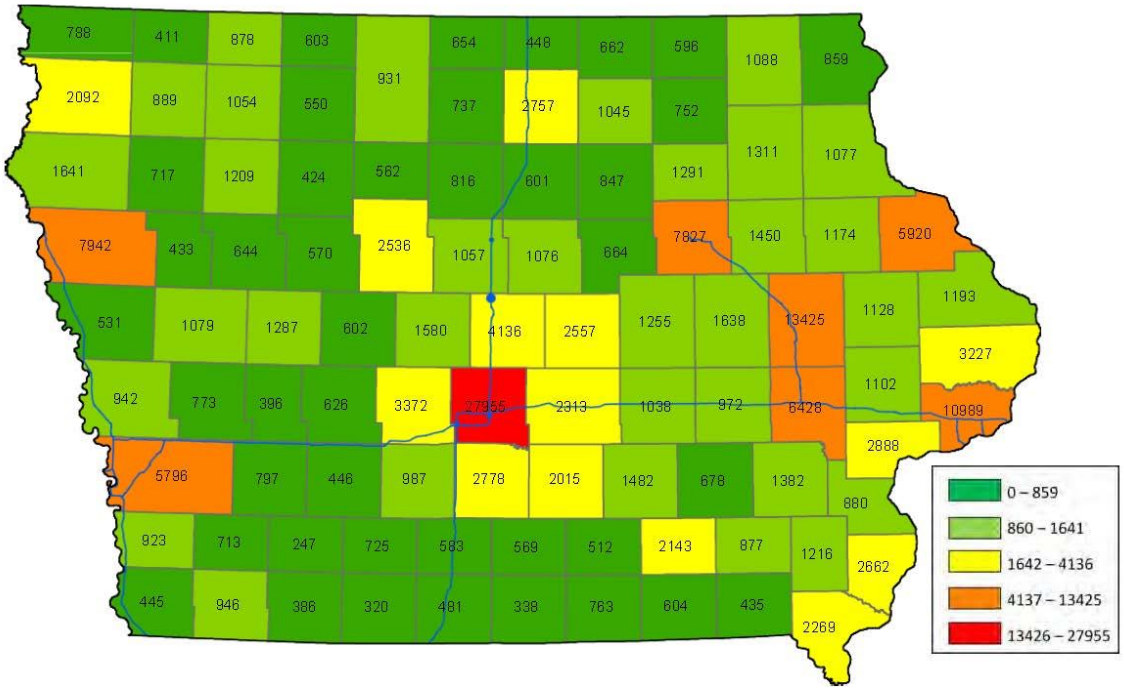
[67] See Section 109(b)(1) of the Clean Air Act available at: http://www.epa.gov/air/caa/title1.html#ia.

[68] 40 CFR Part 58 Appendix D available at: http://ecfr.gpoaccess.gov/cgi/t/text/text-http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=e97596e46c7b600cb34b0b84852efbfd&rgn=div5&view=text&node=40:5.0.1.1.6&idno=40#40:5.0.1.1.6.7.1.3.32

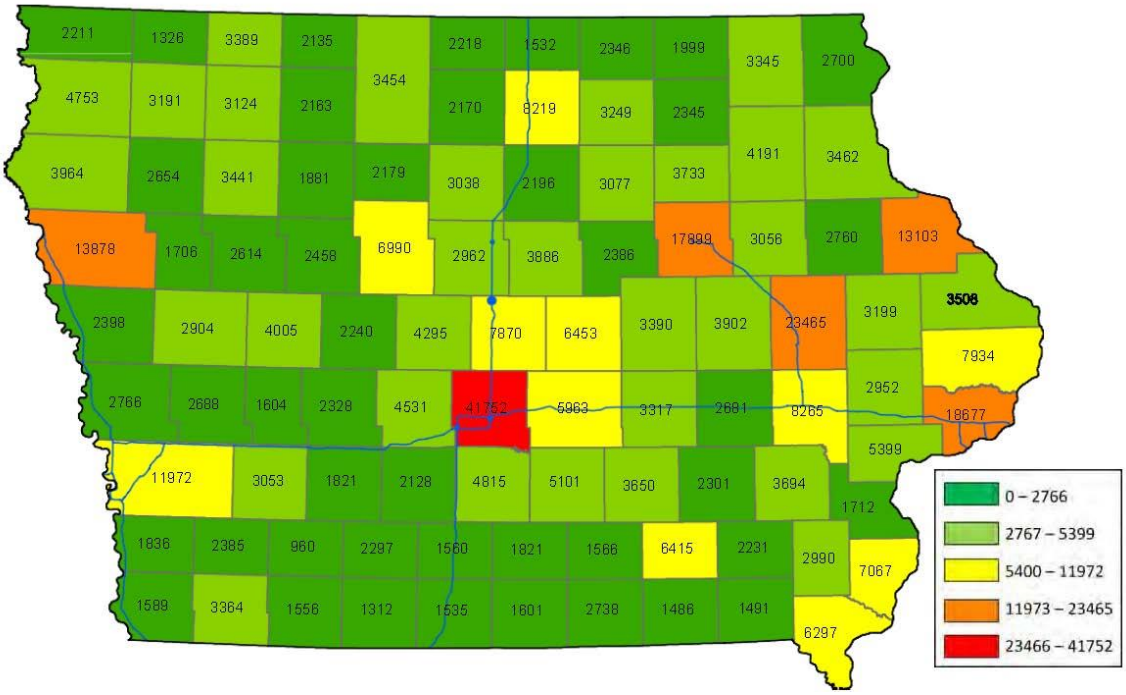
[69] 2000 U.S. Census Data is available at: http://www.census.gov/prod/cen2000/dp1/2kh19.pdf

[70] *Estimated Prevalence and Incidence of Lung Disease by Lung Association Territory* available from the American Lung Association at: http://www.lungusa.org/.

[71] 2009 Census estimates available at: http://www.census.gov/popest/counties/CO- EST2009-popchg2000_2009.html.



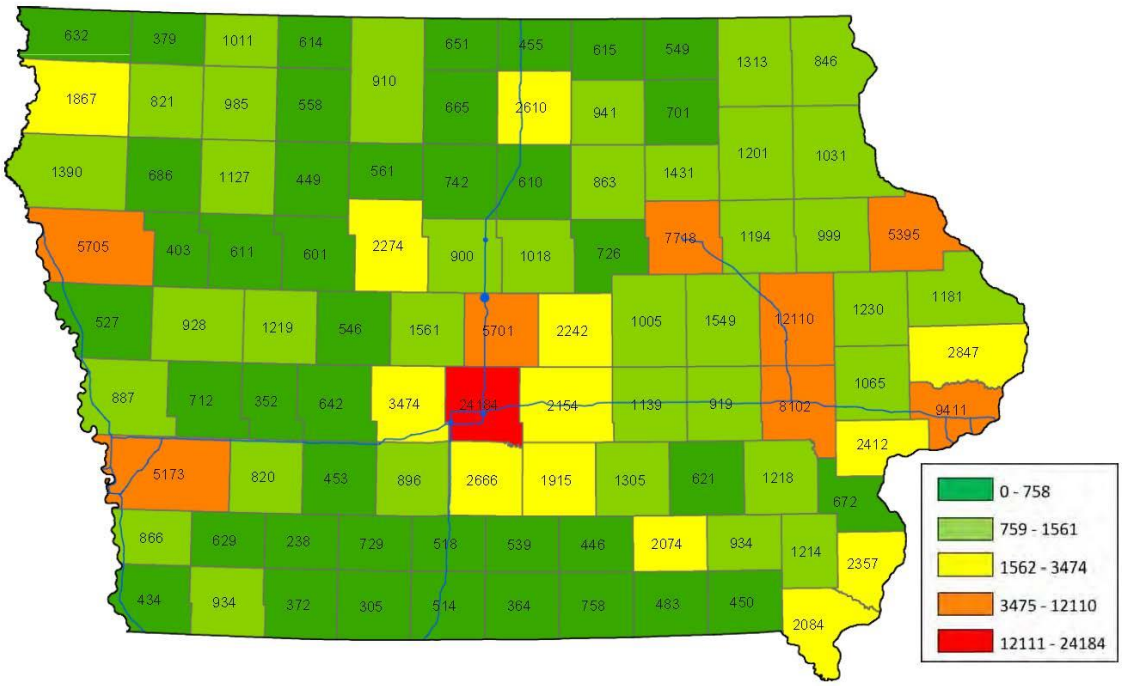
Iowa Population Under the Age of 5 by County – 2000



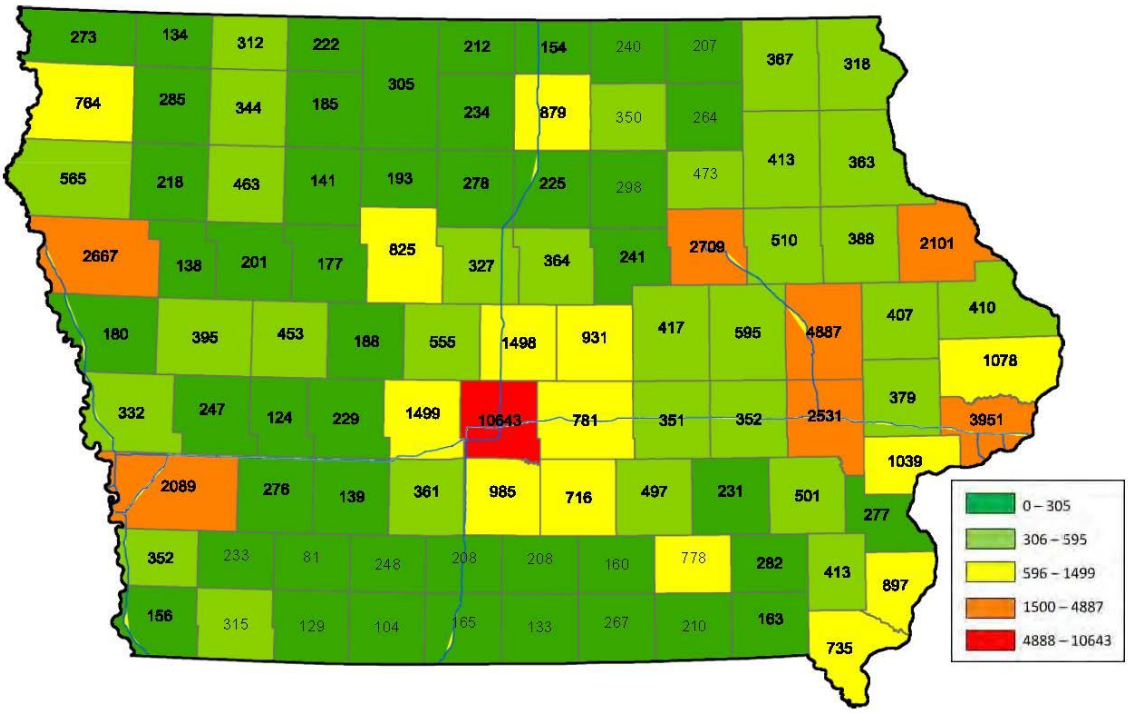
Iowa Population Over Age 65 by County – 2000

Section 3: Respiratory Diseases

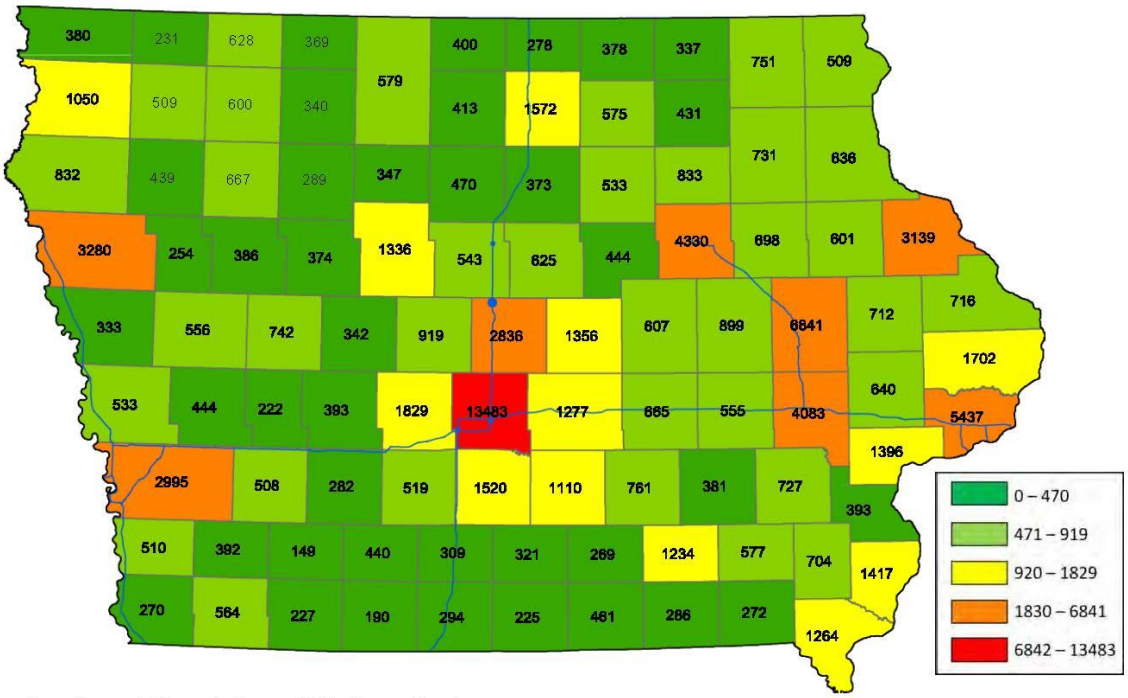
In January of 2010 the American Lung Association's Epidemiology and Statistics Unit published a document entitled "Estimated Prevalence and Incidence of Lung Disease by Lung Association Territory" based on data gathered from 2008 surveys and the 2009 joint report from CDC's National Program of Cancer 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.



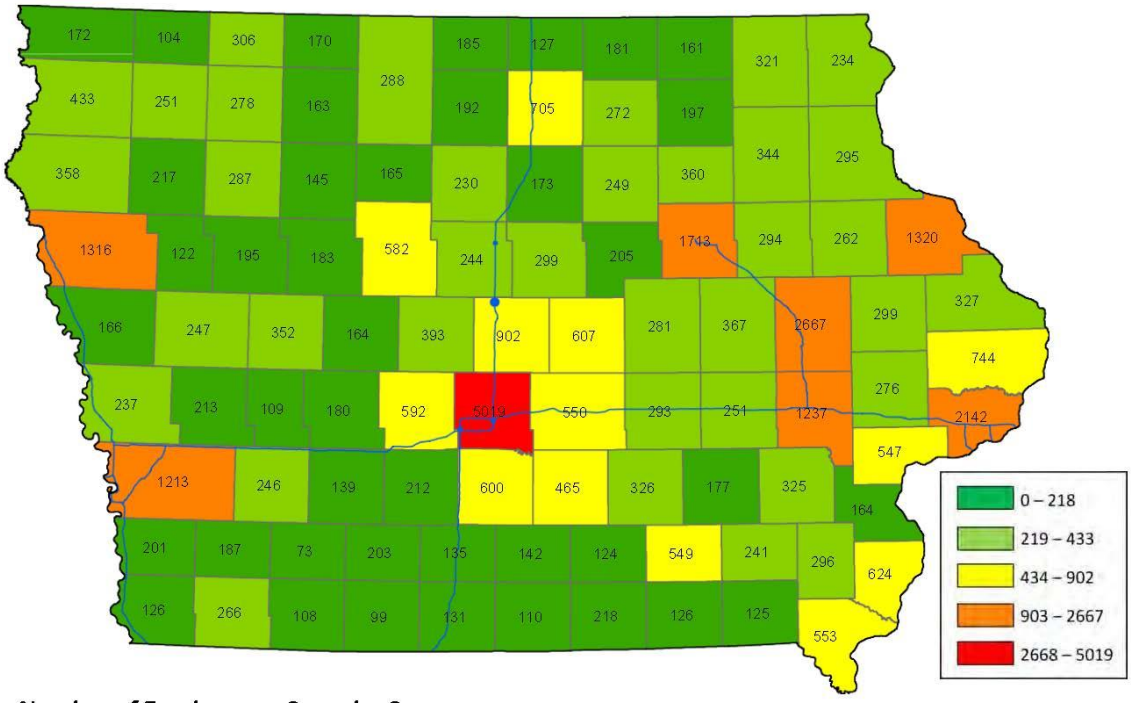
Number of Adult Asthma Cases by County



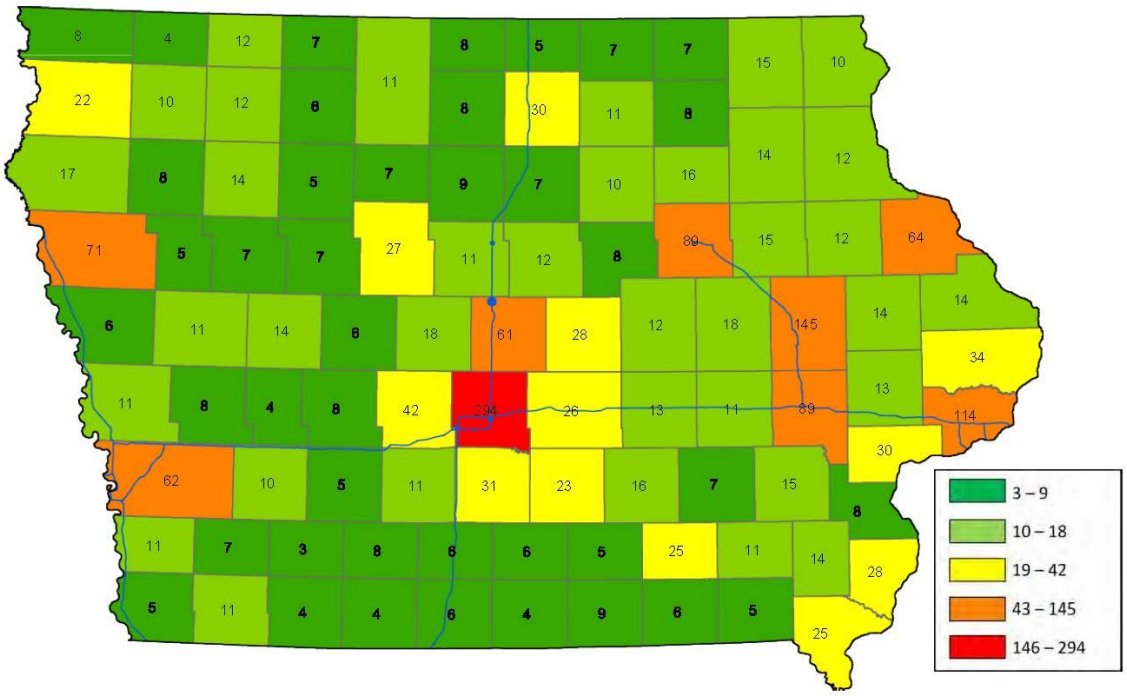
Number of Pediatric Asthma Cases by County



Number of Chronic Bronchitis Cases by County



Number of 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

Iowa Population in MSA's

MSA Label	Population 2009	Population Under 5 2000	Population Over 65 2000	Pediatric Asthma 2008	Adult Asthma 2008	Chronic Bronchitis 2008	Emphysema 2008	Lung Cancer 2008
Ames	87,214	4,136	7,870	1,498	5,701	2,836	902	61
Cedar Rapids	256,324	16,191	30,566	5,889	14,889	8,452	3,333	177
Dubuque	93,072	5,920	13,103	2,101	5,395	3,139	1,320	64
Davenport	166,650	10,989	18,677	3,951	9,411	5,437	2,142	114
Des Moines	562,906	35,718	55,554	13,717	31,862	17,744	6,603	386
Iowa City	152,263	7,810	11,959	3,032	9,320	4,810	1,562	104
Council Bluffs	120,554	7,661	16,574	2,773	6,926	4,038	1,651	84
Sioux City	102,831	7,942	13,878	2,667	5,705	3,280	1,316	71
Waterloo	164,913	9,782	24,018	3,423	9,875	5,607	2,278	113
Inside MSAs	1,706,727	106,149	192,199	39,051	99,084	55,343	21,107	1,174
Outside MSAs	1,301,129	82,264	244,014	28,037	76,754	46,236	20,857	909
Entire State	3,007,856	188,413	436,213	67,088	175,838	101,579	41,964	2,083

Percent of Iowa Population in MSA's

MSA Label	% Population 2009	% Population Under 5 2000	% Population Over 65 2000	% Pediatric Asthma 2008	% Adult Asthma 2008	% Chronic Bronchitis 2008	% Emphysema 2008	% Lung Cancer 2008
Ames	3%	2%	2%	2%	3%	3%	2%	3%
Cedar Rapids	9%	9%	7%	9%	8%	8%	8%	8%
Dubuque	3%	3%	3%	3%	3%	3%	3%	3%
Davenport	6%	6%	4%	6%	5%	5%	5%	5%
Des Moines	19%	19%	13%	20%	18%	17%	16%	19%
Iowa City	5%	4%	3%	5%	5%	5%	4%	5%
Council Bluffs	4%	4%	4%	4%	4%	4%	4%	4%
Sioux City	3%	4%	3%	4%	3%	3%	3%	3%
Waterloo	5%	5%	6%	5%	6%	6%	5%	5%
Inside MSAs	57%	56%	44%	58%	56%	54%	50%	56%
Outside MSAs	43%	44%	56%	42%	44%	46%	50%	44%

Iowa Metropolitan Statistical Area Labels

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

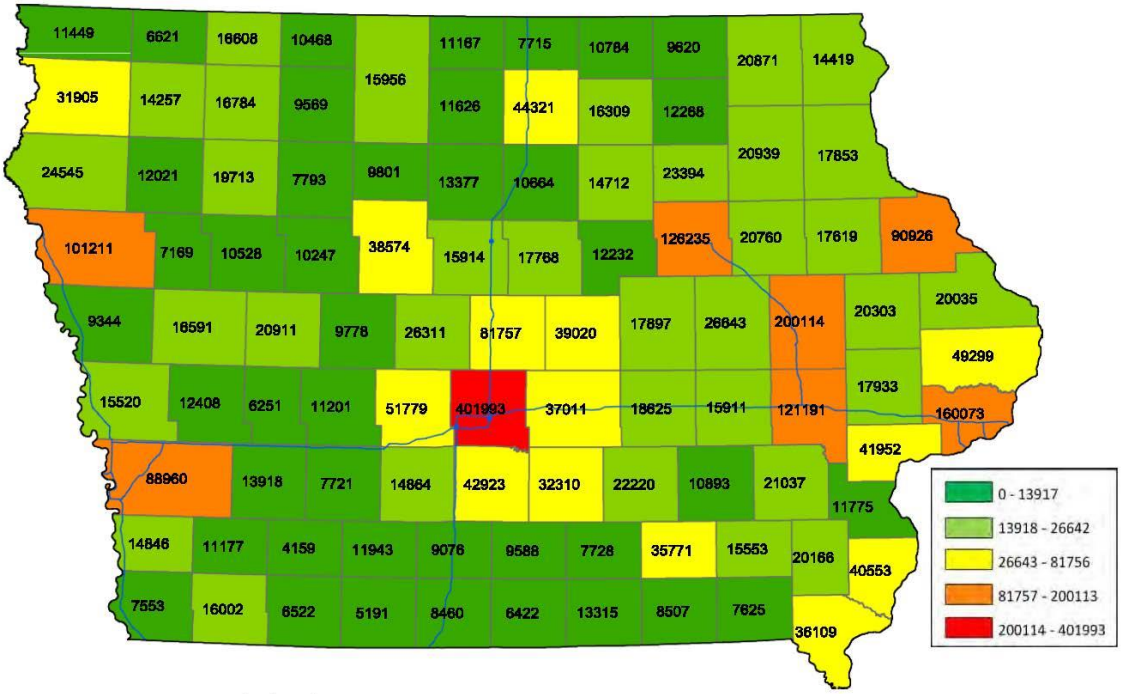
Appendix K: Population Trends

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.[72] The maps in Section 2 below show county populations for 2005 and 2009, as well as the population change in each county from 2005 to 2009. 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 graphical output from a tool developed by EPA to examine population changes over the period 1990-2008. Most of the population growth in the Midwest has occurred in the suburbs of its large cities over this period.

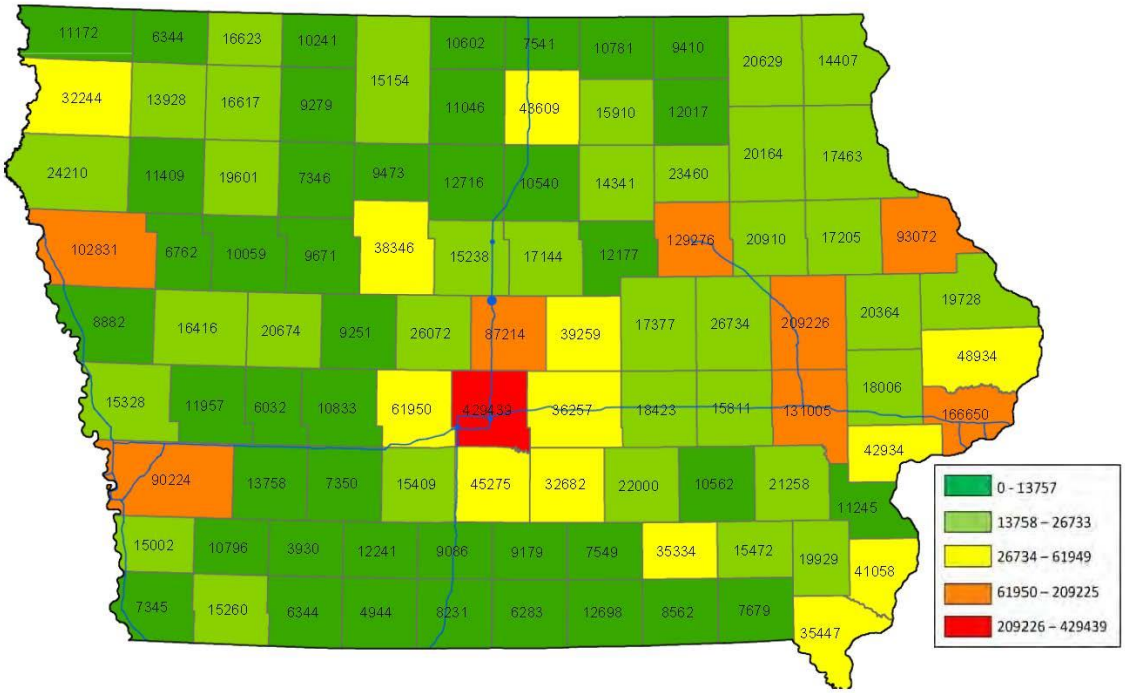
Section 2: Iowa County Population Maps

The maps below are derived from US Census estimates, and indicate county populations for 2005 and 2009 as well as the difference between these estimates. The counties containing large cities (Sioux City, Council Bluffs, Des Moines, West Des Moines, Ames, Iowa City, Cedar Rapids, Waterloo, Dubuque, and Davenport) showed the largest increases in population over this period, while declines were noted in most rural counties.

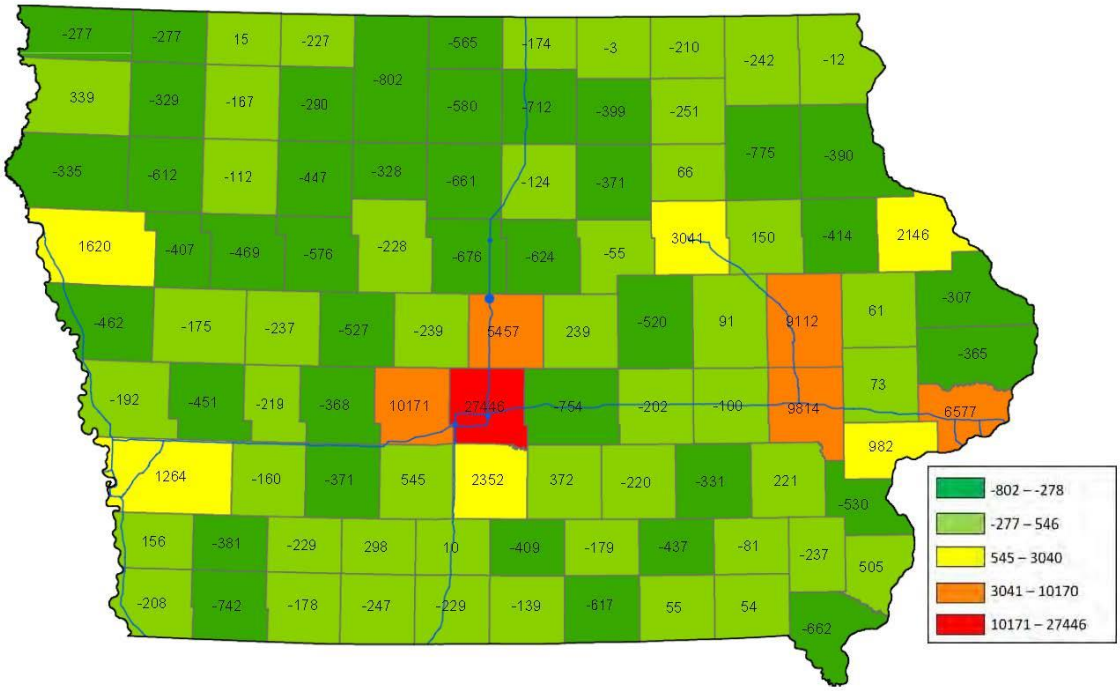


2005 Iowa Population by County

[72] 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/counties/CO-EST2009-popchg2000_2009.html.



2009 Iowa Population by County



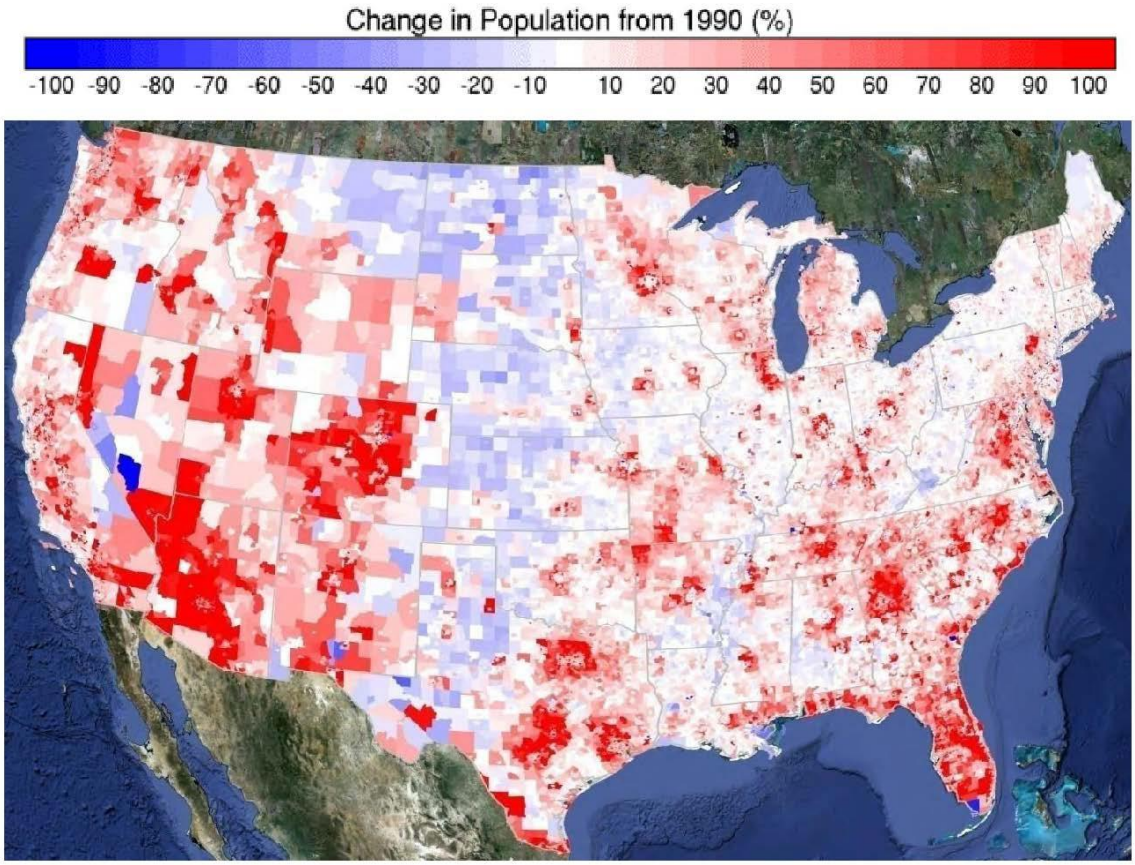
Population Difference of Iowa Counties from 2005 to 2009

Section 3: Maps of Changes in National and Midwestern Populations from 1990 to 2008

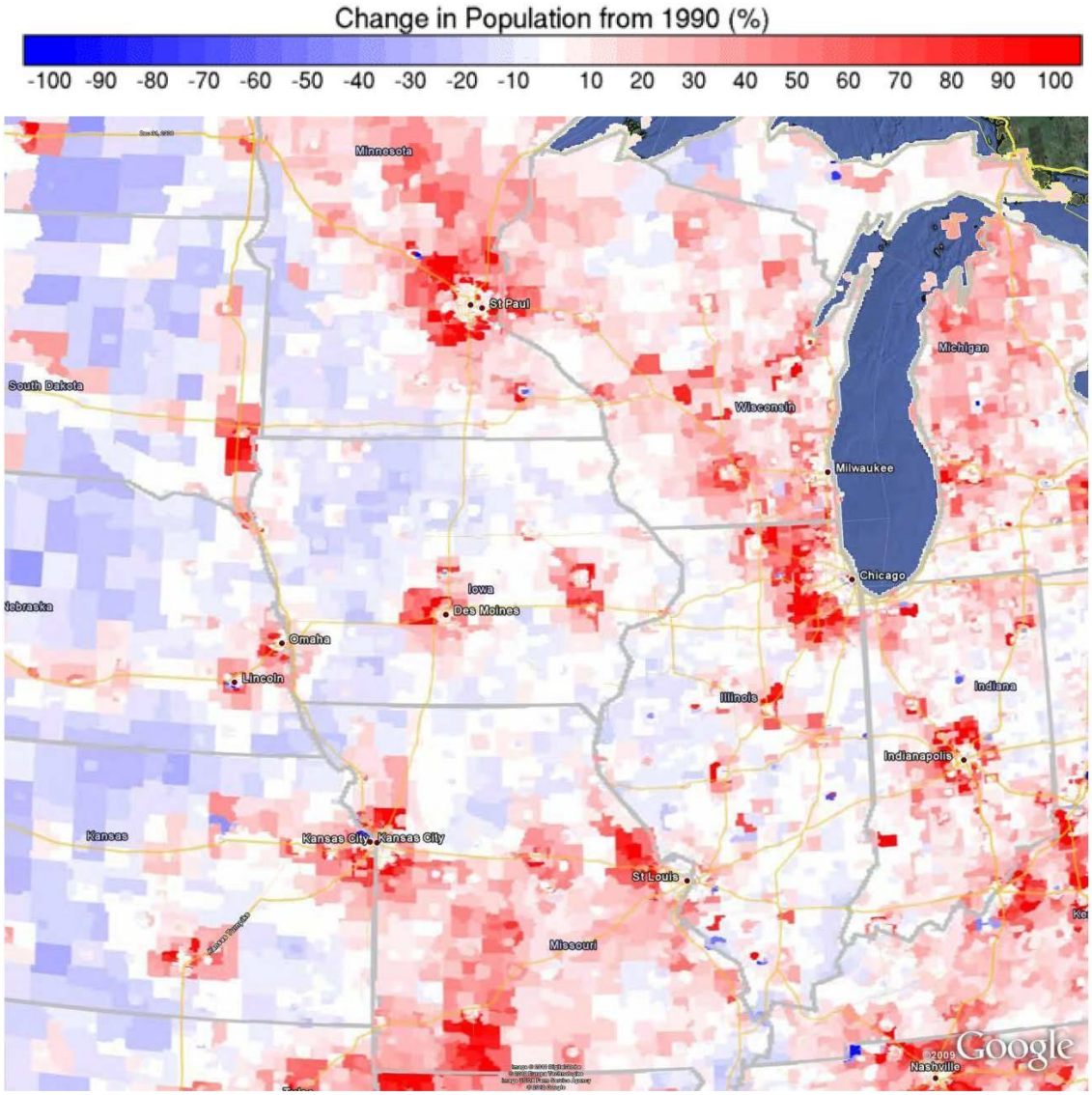
The maps below are Google Earth snapshots from EPA's population trends analytical tool.[73] Considerable population growth has occurred west of the Rockies over this period, while populations in the western plains states have declined. In the east, population has typically increased in suburban areas 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)

[73] Available online at: http://www.epa.gov/ttn/amtic/netassess/population animation/

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 2008



Changes in Midwestern Population from 1990 to 2008