

Implications of the New National Ambient Air Quality Standard

New Ozone Standard

On March 12, 2008, the EPA issued new, more stringent NAAQS for ozone by lowering the ozone standard from 84 parts per billion (ppb) (0.08 ppm) to 75 ppb (0.075 ppm) for both the primary and secondary standard¹. The new standard is a significant enhancement to protection of both human health and for vegetation and other natural resources. The primary standard is designed to better protect human health, and the secondary standard is intended to provide protection against “welfare” effects, including harm to native vegetation in protected areas^{1,2,3}. By law, the EPA is required to base the NAAQS on science while providing an adequate margin for human safety. Economic issues related to the implementation of standards are not considered when determining NAAQS.

Current Status

Many NPS units exceed the existing ozone NAAQS, prompting concerns for human health and vegetation. Affected parks issue health advisories to visitors and employees on high ozone days because ozone harms lung tissue and can cause respiratory problems. The new lower ozone standard will result in NAAQS exceedances at more parks. Also, there will be a greater number of days considered unhealthy in parks, and thus more health advisory alerts.

Based on recent data, ozone concentrations in 11 parks operated by the NPS and state agencies violate the new standard. Data from the NPS portable stations and state monitoring near parks suggest another 73 sites have ozone concentrations that exceed the new standard. Rural counties without ozone monitoring may also exceed the standard. NPS interpolation mapping of ozone estimates that more than 150 park units may have concentrations that exceed the standard. How the EPA will structure rural monitoring and the specific requirements used to determine areas in violation are unknown at this point.

Ozone also affects vegetation. Visible plant injury and reduced growth from ozone have been documented in parks. Ozone can cause stress on entire ecosystems by

reducing the ability of sensitive plant species and genotypes to adapt to or withstand environmental stresses, including freezing temperatures, pest infestations, or root disease. In addition, because it interferes with photosynthesis, ozone decreases the potential for carbon sequestration by plants. When revising the ozone standard the EPA did not adopt a separate secondary standard to protect “public welfare”^{2,3}.

Parks That May Violate the NAAQS Based on Measurements

In all past designations of non-attainment, EPA has required a minimum of 3 years’ of ozone data collected according to EPA monitoring regulations using certified equivalent-method analyzers. Usually attainment status is determined at the county or metropolitan level based on monitors in those areas. Many natural areas and national parks are in rural areas and counties that do not have monitoring. Furthermore, when a park is in more than one county usually only the county with the direct monitoring data gets the designation status. Examples of this are Joshua Tree NP and Shenandoah NP where NPS monitoring showed a violation of the old NAAQS, but only the county in which the monitor was located received a non-attainment designation.

Table 4 lists the 11 parks that violate the new standard (greater than 75 ppb) based on direct monitoring in the parks. See Figure 5 for locations. Ozone concentrations from Rocky Mountain NP are right at the standard (75 ppb).

Park Name	Park Code	2005-2007	2004-2006
Joshua Tree	JOTR	103	103
Sequoia & Kings Canyon	SEKI	103	103
Great Smoky Mountains	GRSM	86	84
Yosemite	YOSE	86	86
Cape Cod	CACO	84	84
Death Valley	DEVA	84	82
Acadia	ACAD	82	80
Zion	ZION	79	80
Shenandoah	SHEN	77	77
Mammoth Cave	MACA	76	72
Saguaro	SAGU	76	76

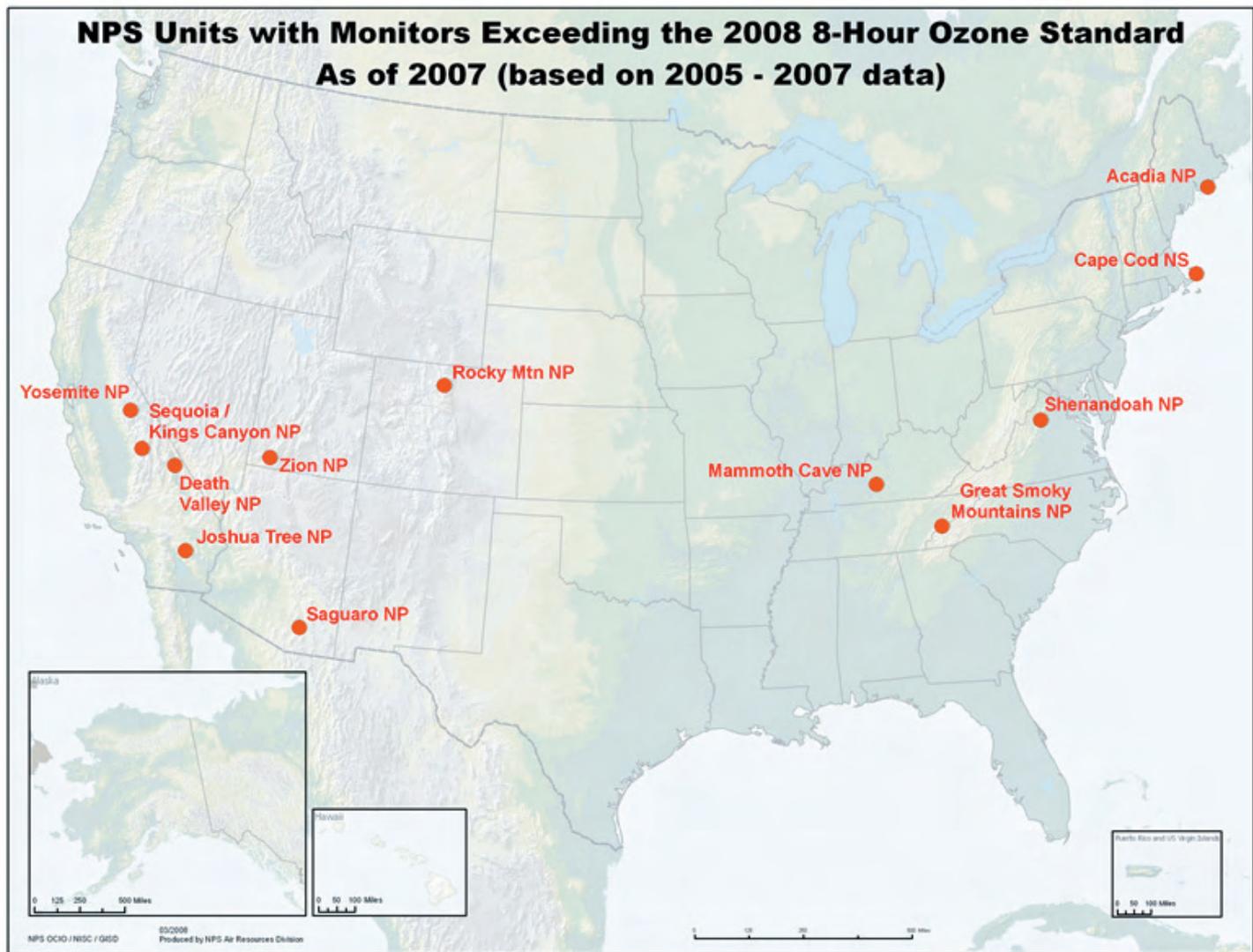


Figure 5. Park units that will violate the new ozone NAAQS based on NPS monitoring network data.

The parks in Table 5 have monitors that show ozone concentrations close to the new standard. Rocky Mountain NP and Chamizal are very close to the standard based on monitoring data.

POMS data indicate an additional eight parks with measured data that are very likely to violate the 75 ppb standard. POMS stations are temporary monitors that move after a few seasons and are intended only to provide a baseline measurement. The POMS stations in Table 6 have at least one year with a 4th highest 8-hour ozone average greater than 75 ppb. It is unlikely the EPA will designate an area as non-attainment based on these measurements since these monitors are not reference or equivalency methods. However, the data support arguments for reference or equivalency method monitoring in these areas.

Table 5. Parks with monitoring data that are close to the new NAAQS of 75 ppb.

Park Name	Park Code	4 th Highest 8-Hour Ozone	
		2005-2007 3-year avg	2004-2006 3-year avg
Chamizal	CHAM	74	73
Cowpens	COWP	73	74
Rocky Mountain	ROMO	75	74
Great Basin	GRBA	73	72
Grand Canyon	GRCA	72	73

Table 6. Portable ozone data (POMS) indicate several parks with high ozone (bold values exceed the standard).

POMS Network		Annual 4 th Highest 8-Hour Ozone Concentration (ppb)					
Park Name	Park Code	3-year avg	2007	2006	2005	2004	2003
Black Canyon of the Gunnison	BLCA	71	---	---	68	80	67
Padre Island	PAIS	75	75	80	71	---	---
Assateague Island	ASIS	78	74	84	72	---	---
Lake Mead	LAME	82	---	81	84	80	77
Joshua Tree (eastern POMS site)	JOTR	---	81	83	---	---	---
Abraham Lincoln Birthplace	ABLI	---	72	77	---	---	---
Cumberland Gap	CUGA	---	85	71	---	---	---
Gulf Islands	GUIS	---	---	---	74	78	---
Mojave	MOJA	--	88	---	---	---	---

Nearby monitors (within 5 miles of a park unit) have been found for a number of parks (Table 7). The 30 parks listed in Table 7 are projected to violate the new standard based on 2005-2007 data. If the park and the monitor are in the same county, then the violation may lead to designation of the county as non-attainment which would include the park.

In total, 92 parks with direct data measurements are likely to violate the new NAAQS. This number is based on current and recent past data, not on future predictions from modeling or projected emission changes. Figures 5 and 6 display park units that exceed and may potentially violate the new ozone standard.

Source	Park Counts	Period
NPS monitored parks	11	2005-2007
POMS monitor data	8	1-3 seasons
Nearby monitors (SLAMS)	73	2005-2007
92 parks potentially violate the new standard		

Table 7. NPS units within 5 miles of an ozone monitor and 2005-2007 average.

Park Name	Park Code	State	4 th Highest 8-Hour Ozone (2005-2007)	Park Name	Park Code	State	4 th Highest 8-Hour Ozone (2005-2007)
Martin Luther King, Jr. NHS	MALU	GA	89	Fredericksburg NC	FRED	VA	80
Fire Island NS	FIIS	NY	88	Jean Lafitte NPres	JELA	LA	80
Chattahoochee River NRA	CHAT	GA	87	Adams NHS	ADAM	MA	80
Kennesaw Mountain NBP	KEMO	GA	87	Chickamauga and Chattanooga NMP	CHCH	TN	80
Gateway NRA	GATE	NY	86	Boston Harbor Islands NRA	BOHA	MA	80
Statue of Liberty NM	STLI	NJ	86	Boston African American NHS	BOAF	MA	80
General Grant NM	GEGR	NY	86	Boston NHP	BOST	MA	80
Hamilton Grange NMem	HAGR	NY	86	Frederick Law Olmsted NHS	FRLA	MA	80
Saint Paul's Church NHS	SAPA	NY	85	John Fitzgerald Kennedy NHS	JOFI	MA	80
Hampton NHS	HAMP	MD	85	Longfellow NHS	LONG	MA	80
National Capital Parks - East	NACE	DC	85	Gulf Islands NS	GUIS	MS	80
National Capital Parks NRA	NACA	MD	85	James A. Garfield NHS	JAGA	OH	80
Ben Franklin NMem	BEFR	PA	85	Maggie L. Walker NHS	MALW	VA	80
Edgar Allan Poe NHS	EDAL	PA	85	Richmond NBP	RICH	VA	79
Gloria Dei (Old Swedes) Church NHS	GLDE	PA	85	Dayton Aviation Heritage NHP	DAAV	OH	79
Independence NHP	INDE	PA	85	Timpanogos Cave NM	TICA	UT	79
Thaddeus Kosciuszko NMem	THKO	PA	85	Fredericksburg & Spotsylvania NMP	FRSP	VA	79
John F. Kennedy Cntr for Performing Arts	JOFK	DC	84	Lake Mead NRA	LAME	NV	79
Lafayette Square P	WHHO	DC	84	First Ladies NHS	FILA	OH	79
National Mall & Memorial Parks	NACC	DC	84	Cuyahoga Valley NP	CUVA	OH	79
Rock Creek P	ROCR	DC	84	Saugus Iron Works NHS	SAIR	MA	79
Theodore Roosevelt NMem	THIS	VA	84	Lowell NHP	LOWE	MA	78
Arlington House Robert E. Lee	ARHO	VA	84	Little Rock Central High School NHS	CHSC	AR	78
Lyndon Baines Johnson NMem	LYBA	VA	84	Natchez NHP	NATC	MS	78
Clara Barton NHS	CLBA	MD	84	Guilford Courthouse NMP	GUCO	NC	78
George Washington Mem PKWY	GWMP	MD	84	Indiana Dunes NL	INDU	IN	78
Ulysses S. Grant NHS	ULSG	MO	84	Petersburg NB	PETE	VA	78
Jefferson National Expansion Mem NHS	JEFF	MO	83	Antietam NB	ANTI	MD	78
Wolf Trap Farm Park	WOTR	VA	83	Santa Monica Mountains NRA	SAMO	CA	77
Ocmulgee NM	OCMU	GA	82	Cumberland Gap NHP	CUGA	KY	76
New Bedford Whaling NHP	NEBE	MA	82	Tonto NM	TONT	AZ	76
Roger Williams NMem	ROWI	RI	82	Tupelo NB	TUPE	MS	76
William Howard Taft NHS	WIHO	OH	82	Allegheny Portage Railroad NHS	ALPO	PA	76
Prince William Forest Park	PRWI	VA	81	Big Thicket NPres	BITH	TX	76
Sleeping Bear Dunes NL	SLBE	MI	81	Blue Ridge Parkway	BLRI	VA	76
Monocacy NB	MONO	MD	81	Illinois & Michigan Canal NHC	ILMI	IL	75
Manassas NBP	MANA	VA	81				

Notes:
 - NPS units within 5 miles of ozone monitors used to compute 2005-2007 4th Highest 8-hour average
 - Monitors used include ozone monitors and CASTNet monitors
 - Ozone values are taken at park centroid - for parks with multiple units centroid of the largest unit was used

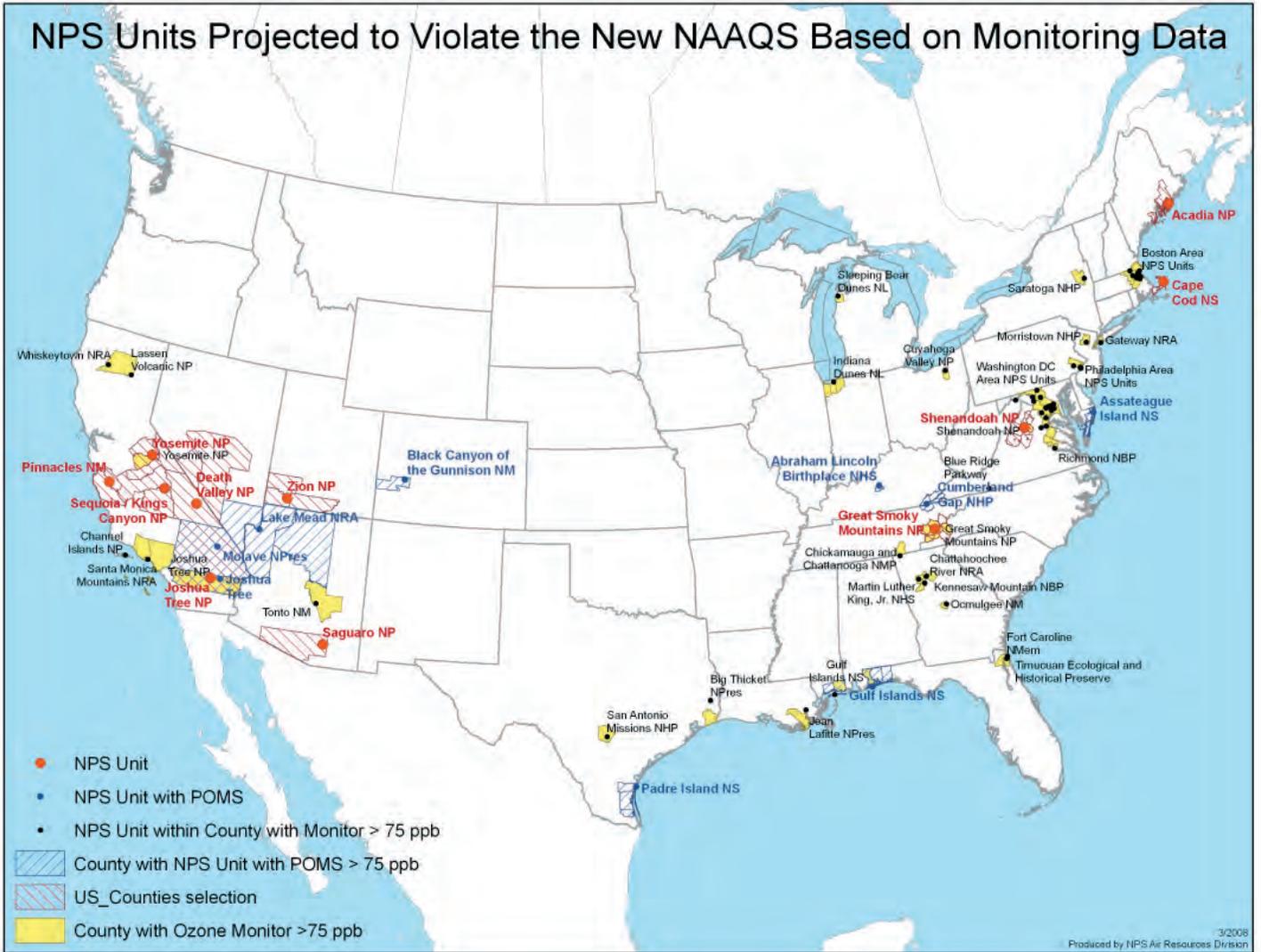


Figure 6. Counties and park units with monitoring data that support a possible violation of the new ozone NAAQS of 75 ppb. Only counties with NPS monitors or park units are shown. See Figure 9 for the urban counties EPA expects will violate the new standard.

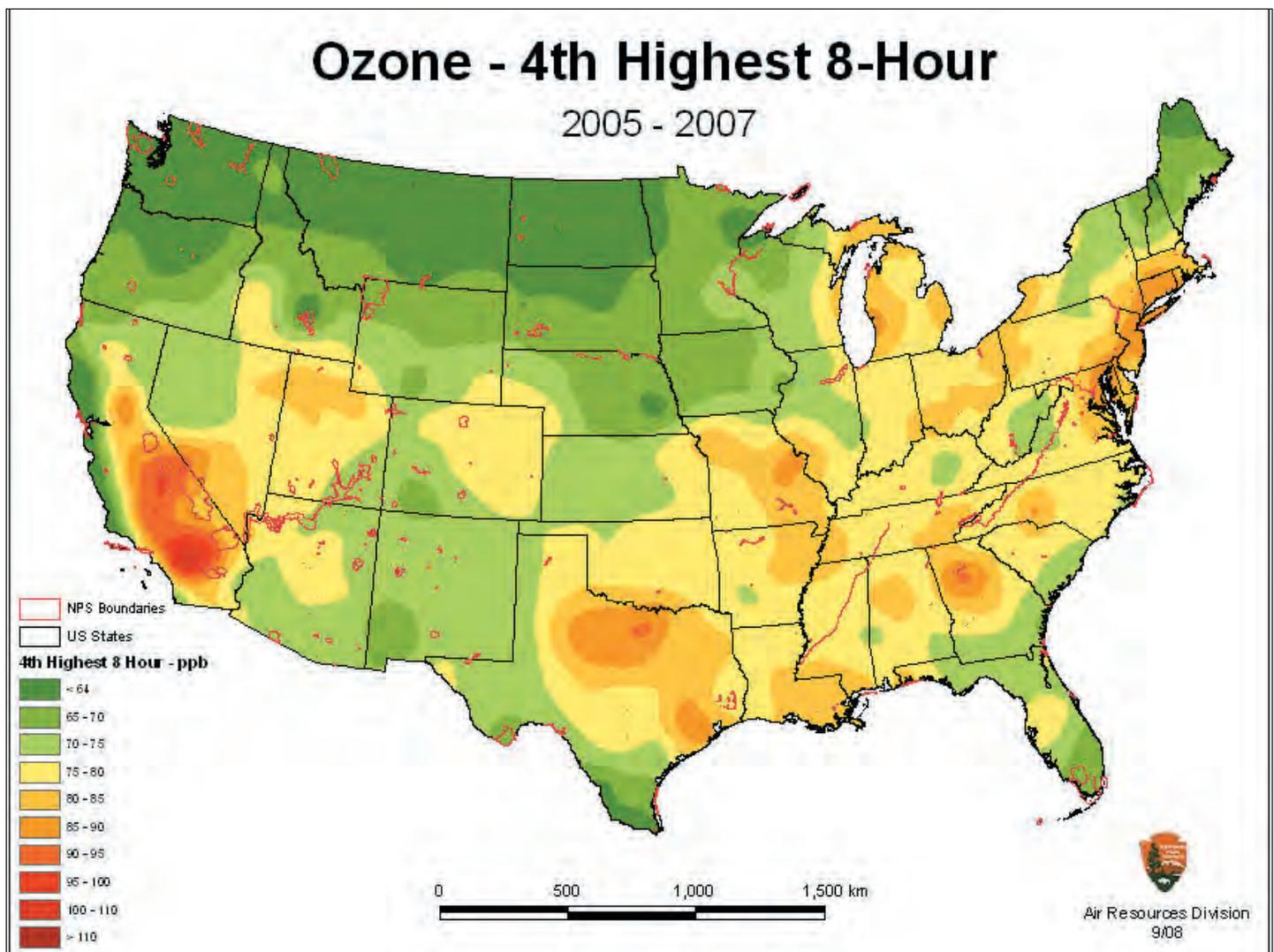
Estimates From GIS Interpolation

The NPS Air Atlas project⁴ (<http://www.nature.nps.gov/air/maps/AirAtlas/index.cfm>) has taken data reported to the EPA AQS database plus Clean Air Status and Trends Network (CASTNet) data and interpolated the ozone values over the continental U.S. Although interpolated ozone values do not translate to a violation of the standard, this analysis does suggest a broader range of high ozone concentrations than direct monitoring alone indicates. In Figure 7, the yellow through the reds have 4th highest 8-hour ozone values of 75 ppb or greater for a three-year average. These are the areas

most likely to violate the new standard. On this map, the boundary of the 75 ppb and greater areas is only approximate.

Park units with interpolation zones that project possible violations of the ozone NAAQS are shown more clearly in Figure 8. Blue square symbols are park units within the violation zone and open squares are outside. Some parks are borderline or show locally monitored concentrations that conflict with interpolations, such as Rocky Mountain NP, Pinnacles NM, and Acadia NP. Actual monitoring data will have to be used to resolve these conflicts.

Figure 7. Interpolations of monitoring data from the Air Atlas program. Yellow to red areas are projected to violate the new standard.



Ozone - 4th Highest 8-Hour: 2005 - 2007 2008 New Ozone NAAQS: 75ppb

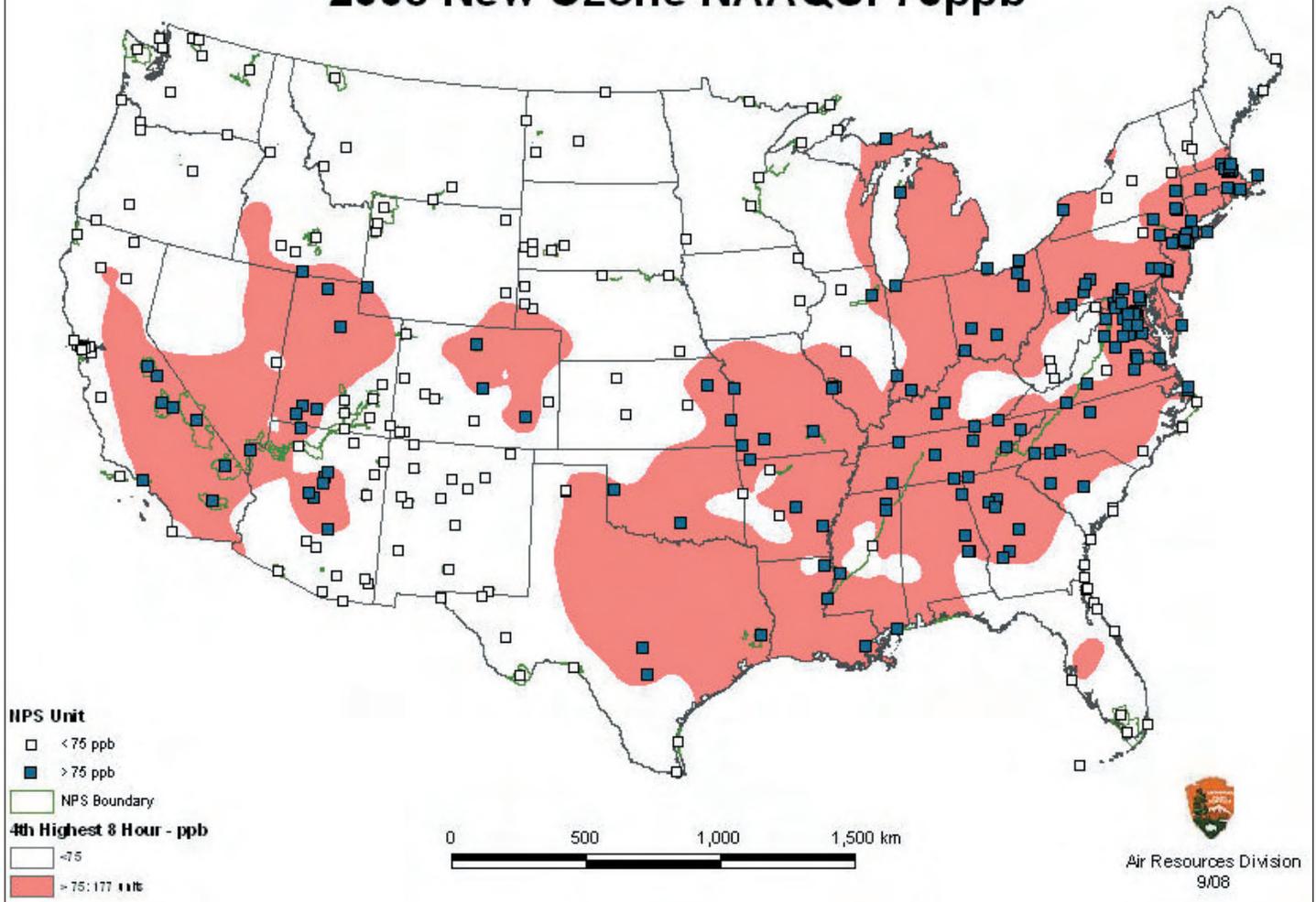


Figure 8. Violation areas are extracted from the Figure 6 map and the parks in the violation areas are shown.

In its announcement of the new standard, the EPA provided a map and list of counties it expects to violate the new standard. Combining this information with the parks that are projected to violate the NAAQS based on monitoring and the parks in the >75 ppb O₃ interpolation areas (Figure 8) another map can be generated based on counties (Figure 9). More than 150 park units fall within counties that by measurement or interpolation might violate the new standard.

Since counties are designated non-attainment based on monitors within their boundaries, Figure 9 is an estimate of which counties and parks will be represented by monitors and which ones will not. If the counties become designated as non-attainment the parks would benefit from clearer air associated with the control measures that might be implemented.

Counties Potentially in Violation

- **325** counties that could violate the standard according to interpolation intersect with a county containing an NPS unit.
- **141** NPS units in counties that could violate the standard according to interpolation of which counties have an ozone monitor (some counties have multiple park units).
- **1457** counties that could violate the standard according to interpolation of which counties do NOT have an ozone monitor.

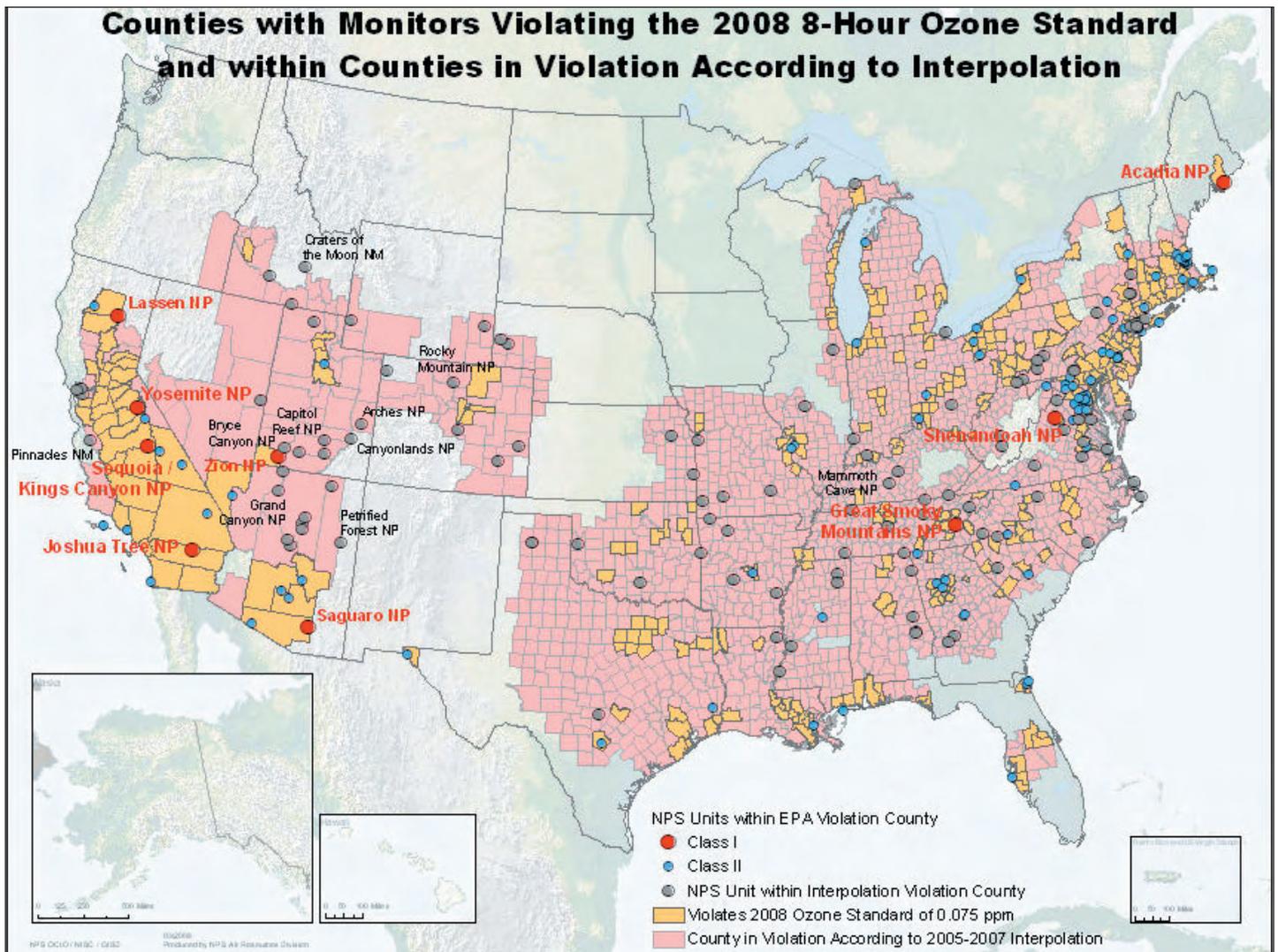


Figure 9. This map combines the counties EPA projects to violate the new standard (orange) and the counties projected from Air Atlas (rose color) as potentially in violation. The red, blue, and gray dots are park locations. Many rural counties have the potential to violate the standard.

EPA has proposed that each state should have at least two rural monitors, but a rule has not yet been promulgated. If EPA requires only two rural monitors in each state then very large areas that may exceed the 75 ppb standard will not be effectively covered. Current EPA plans (not formally announced or final) are to use the rural CASTNet monitors as the foundation for rural monitoring. Most of the CASTNet stations in the Western states are NPS monitors. At least 22 states have fewer than two CASTNet rural monitors. The EPA network (<http://www.epa.gov/ttn/amtic/ncore/networks.html>) with trace-leveling monitoring (NCORE) may fill in rural monitoring in some states. Many states also run rural monitors to get upwind or background concentrations to assist in pollutant modeling. Despite the planned rural monitoring coverage there will still be a large number of rural counties (and parks) with no monitoring data (Figure 10).

Frequency of Exceedances

The standard doesn't specifically address the number of days that exceed the standard and are therefore considered unhealthy air quality days. In many places the number of days that exceed the standard are many more than four per year. The frequency of exceedances per year, for locations where there is monitoring information, is given in Table 8 as an average number per year for the period 2005-2007. Five parks are highlighted that either already issue health warnings or might consider it because of the high number of exceedance days. In many cases, visibility and PM_{2.5} air quality is also quite poor during high ozone days. The combination of pollutants is more serious than when pollutants are considered separately and should be included in air quality advisories.

Figure 10. The counties highlighted in green have both park unit(s) and a monitor in the county (black dots) and are in areas that are potentially in violation according to interpolation.

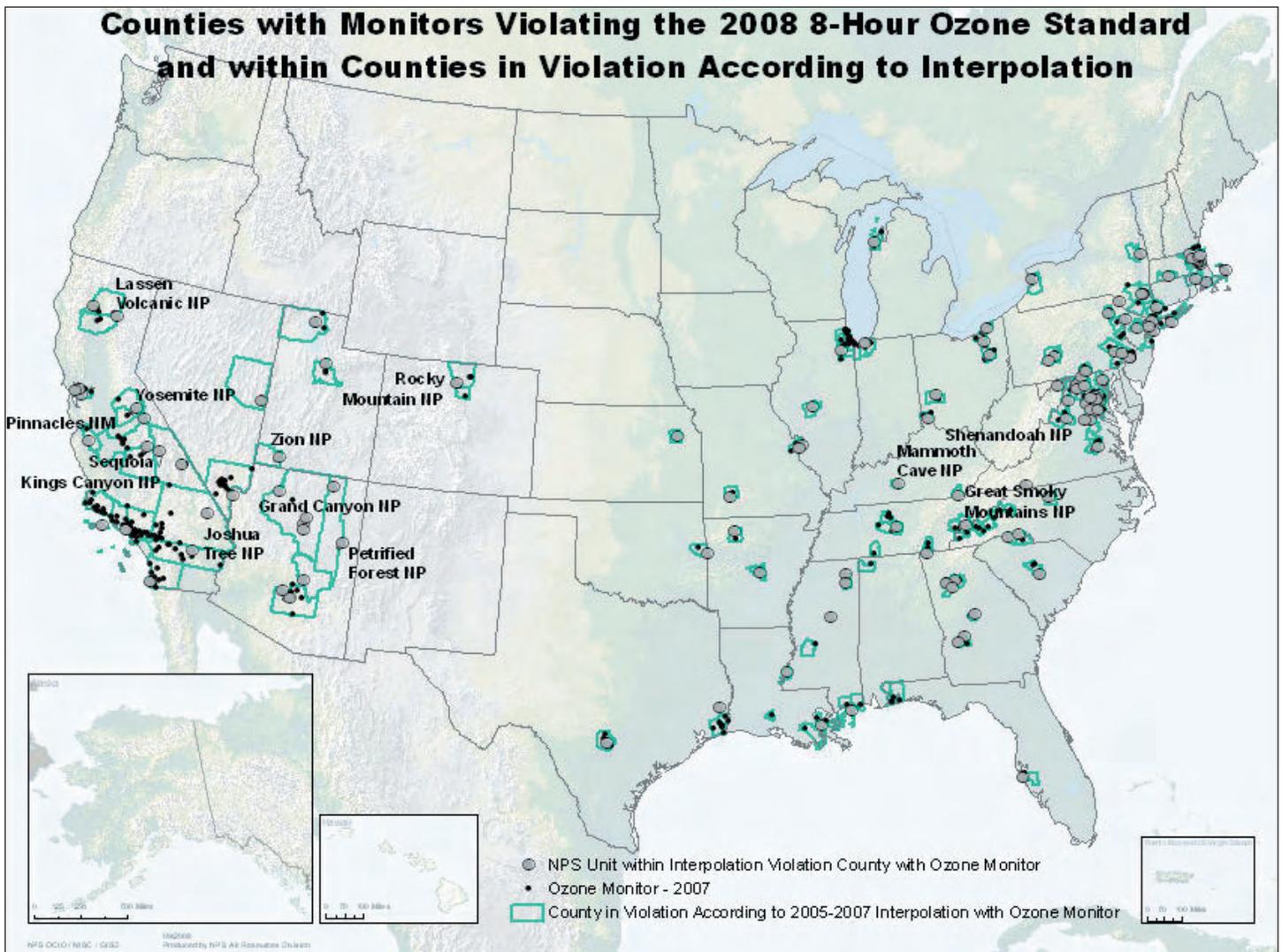


Table 8. Frequency of exceedances (mean number of days) where the daily maximum 8-hour average was greater than 75 ppb based on 2005-2007 data. This mean is based on a simple count of the days. No annual completeness criteria (such as a minimum number of valid daily 8-hour maximums) were applied.

Park Name	Site Code	Park Code	Average Exceeds/Year	Number of Years	Park Name	Site Code	Park Code	Average Exceeds/Year	Number of Years
Abraham Lincoln Birthplace	ABLI-VC	ALBI	2	1	Indiana Dunes	INDU-GS	INDU	5	3
Acadia	ACAD-CM	ACAD	8	3	Indiana Dunes	INDU-WT	INDU	8	3
Acadia	ACAD-MH	ACAD	3	3	Isle Royale AQS Comparison Site #1	ISRO-X1	ISRO	0	3
Agate Fossil Beds	AGFO-RA	AGFO	0	1	Isle Royale AQS Comparison Site #2	ISRO-X2	ISRO	8	3
Appalachian Trail	APTR-MG	APTR	8	3	Joshua Tree	JOTR-BR	JOTR	68	3
Assateague Island	ASIS-MA	ASIS	3	1	Joshua Tree	JOTR-CC	JOTR	5	3
Badlands	BADL-VC	BADL	0	3	Joshua Tree	JOTR-PW	JOTR	6	1
Big Bend	BIBE-KB	BIBE	0	3	Lake Mead AQS Comp. Site #1	LAME-X1	LAME	6	3
Big South AQS Comparison Site	BISO-XX	BISO	2	3	Lake Mead AQS Comp. Site #2	LAME-X2	LAME	1	3
Blue Ridge Parkway	BLRI-75	BLRI	1	3	Lassen Volcanic	LAVO-ML	LAVO	2	3
Blue Ridge Parkway	BLRI-BK	BLRI	5	3	Mammoth Cave	MACA-HM	MACA	6	3
Blue Ridge Parkway	BLRI-BR	BLRI	6	2	Mesa Verde	MEVE-RM	MEVE	2	3
Blue Ridge Parkway	BLRI-FP	BLRI	8	3	Mississippi	MISS-AC	MISS	1	3
Blue Ridge Parkway	BLRI-RO	BLRI	3	3	Mississippi	MISS-ST	MISS	2	3
Blue Ridge Parkway	BLRI-RS	BLRI	0	3	Mississippi	MISS-WC	MISS	2	3
Blue Ridge Parkway	BLRI-VE	BLRI	5	3	Mojave	MOJA-KM	MOJA	26	1
Boston Harbor Islands	BOHA-NM	BOHA	6	3	Mount Rainier	MORA-JV	MORA	0	3
Canyonlands	CANY-IS	CANY	0	3	Mount Rainier	MORA-TW	MORA	0	3
Cape Cod	CACO-XX	CACO	13	3	Natchez Trace	NATR-DR	NATR	0	1
Carlsbad Caverns	CAVE-MA	CAVE	0	1	North Cascades	NOCA-MM	NOCA	0	3
Chamizal	CHAM-XX	CHAM	4	3	Olympic	OLYM-BL	OLYM	0	1
Chiricahua	CHIR-ES	CHIR	0	3	Olympic	OLYM-HP	OLYM	0	1
Colorado	COLM-MY	COLM	0	1	Padre Island	PAIS-MV	PAIS	2	1
Congaree	COSW-BL	COSW	2	3	Petrified Forest	PEFO-SE	PEFO	1	3
Cowpens	COWP-SM	COWP	4	3	Petroglyph	PETR-WT	PETR	1	3
Craters of the Moon	CRMO-VC	CRMO	0	3	Pinnacles	PINN-ES	PINN	4	3
Cumberland Gap	CUGA-HS	CUGA	16	1	Rock Creek	ROCR-AP	ROCR	10	3
Cuyahoga Valley	CUVA-PA	CUVA	16	3	Rocky Mountain	ROMO-LP	ROMO	4	3
Death Valley	DEVA-PV	DEVA	17	3	Saguaro	SAGU-PU	SAGU	4	3
Denali	DENA-HQ	DENA	0	3	Saratoga	SARA-ST	SARA	7	3
Dinosaur	DINO-WE	DINO	0	1	Saugus Iron Works	SAIR-LW	SAIR	10	3
Everglades	EVER-CR	EVER	1	3	Sequoia and Kings Canyon	SEKI-AS	SEKI	82	3
George Washington	GEWA-AH	GEWA	12	3	Sequoia and Kings Canyon	SEKI-LK	SEKI	63	3
Glacier	GLAC-WG	GLAC	0	3	Shenandoah	SHEN-BM	SHEN	5	3
Grand Canyon	GRCA-AS	GRCA	2	3	Theodore Roosevelt	THRO-VC	THRO	0	3
Great Basin	GRBA-MY	GRBA	2	3	Voyageurs	VOYA-SB	VOYA	1	3
Great Smoky Mountains	GRSM-CC	GRSM	1	3	Wind Cave	WICA-VC	WICA	1	3
Great Smoky Mountains	GRSM-CD	GRSM	21	3	Yellowstone	YELL-WT	YELL	0	3
Great Smoky Mountains	GRSM-CM	GRSM	18	3	Yosemite	YOSE-M2	YOSE	0	1
Great Smoky Mountains	GRSM-LR	GRSM	26	3	Yosemite	YOSE-MO	YOSE	1	1
Great Smoky Mountains	GRSM-PK	GRSM	8	3	Yosemite	YOSE-MR	YOSE	0	1
Guilford Courthouse	GUCO-MM	GUCO	14	3	Yosemite	YOSE-SY	YOSE	0	1
Gulf Is. Port. AQS Comparison Site	GUIS-XX	GUIS	12	3	Yosemite	YOSE-TD	YOSE	23	3
Indiana Dunes	INDU-AB	INDU	7	3	Zion	ZION-DW	ZION	4	3

Severity of the NAAQS violation can be judged by both high concentrations of the 4th highest 8-hour values and by the number of exceedances per year. Parks can assess the severity based on frequency of exceedances during the summer season. Table 9 is a proposed scale that defines and categorizes violation severities.

The years 2006 – 2008 will be the 3-year basis for designating non-attainment based on the new ozone standard. The current non-attainment areas will remain in effect and must progress towards attainment until new designations in 2010 and new plans in 2013. EPA modeling has projected that ozone concentrations will continue to decrease during that time. If that happens, then the number of locations that might violate the new standard, based on 2004-2006 and 2007 data, may be an overestimate.

Table 9. Ozone violation severity can also be judged by the frequency of events.

Number of exceedances per year	Severity
4	Borderline, likely to violate standard
20	Serious, average of once per week
50	30% of days unhealthy
> 75	> 50% of days unhealthy

Timelines for Implementation of the New Standard

The following is the EPA schedule for implementation of the new standard if the final rule is not challenged and delayed by court action¹.

The Clean Air Act requires EPA to designate areas as attainment (meeting the standards), nonattainment (not meeting the standards), or unclassifiable (insufficient data to classify) after the Agency sets a new standard, or revises an existing standard. The following schedule will apply to the revised ozone standards:

- *States must make recommendations to EPA no later than March 2009 for areas to be designated attainment, nonattainment or unclassifiable.*
- *EPA will issue final designations of attainment, nonattainment and unclassifiable areas no later than March 2010, unless there is insufficient information to make these designation decisions. In that case, EPA will issue designations no later than March 2011.*
- *States must submit State Implementation Plans outlining how they will reduce pollution to meet the standards by a date that EPA will establish in a separate rule. That date will be no later than three years after EPA’s final designations. If EPA issues designations in 2010, then these plans would be due no later than 2013.*
- *States are required to meet the standards by deadlines that may vary based on the severity of the problem in the area.*

Conclusions

The new ozone standard of 75 ppb is more protective and will result in significantly more rural park units being included in the regulatory process for air quality improvement. Best information at this time indicates 92 parks have measured ozone concentrations that could put them in violation of the 75 ppb ozone NAAQS. There will be many more cultural and battlefield park units in urban areas classified as non-attainment. Some of these, like Rock Creek in Washington DC, do have significant natural resources. Potentially, more than 150 parks highlighted in this analysis could violate the ozone standard.

Many of the park units that would violate the new NAAQS are rural or in low population areas. Based on this, two challenges present themselves:

1. Notify visitors and staff of the ozone health risks.
2. Assure that all park units that violate the ozone standard actually get designated as non-attainment so that State Implementation Plans are revised to specifically address control measures to improve the ozone in these parks.

Although current EPA rules specify that monitoring data must be used to designate a county non-attainment, for rural counties in the future, some combination of monitoring and modeling is more likely to be used, but is currently not specified by the EPA. The secondary ozone standard has not been used much in the past since the primary and secondary standards have been the same values. At the new standard of 75 ppb many more rural and natural areas without significant emission sources will have to be considered for non-attainment designation and some form of control strategies be implemented.