

Ambient Air Quality Monitoring Plan for Congaree Swamp National Monument

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Introduction

The following ambient air quality monitoring plan for Congaree Swamp National Monument is designed to manage the long-term collection of baseline air quality information, assess trends in air quality, determine compliance with national ambient air quality standards, and identify air pollutants which may injure or damage park resources. The park's Resource Management Plan guides the overall management of cultural and natural resources within the park, this plan responds to identified air quality issues.

Background

Congaree Swamp National Monument was authorized by an act of Congress on October 18, 1976. The 22,200-acre park contains the largest intact tract of old-growth bottomland hardwood forest within North America. In 1983, the United Nations Educational, Scientific and Cultural Organization designated the park as an International Biosphere Reserve. On October 24, 1988, 15,010 acres of Congaree Swamp National Monument were designated as Wilderness and 6,840 acres were designated as potential wilderness. Combined, the area to be managed as wilderness makes up over 98% of the entire park. Congaree Swamp National Monument is designated as a Class II Floor Area under the Clean Air Act, as amended in 1977, and 1990, by recommendation of the U.S. Department of the Interior (Federal Register 43002 June 25, 1980). The Class II Floor Area designation allows for re-designation to Class I and does not allow re-designation to Class III.

The significance of Congaree Swamp National Monument lies in: (1) it's the largest tract of near-virgin bottomland hardwood forest in North America, (2) the remarkable size of its loblolly pine, bald cypress, tupelo, sweetgum, sycamore, cottonwood, oak, and holly trees, not in diameter, but especially in height; and (3) the presence of a swamp ecology of the hardwood-type, with relatively unspoiled fauna. The landscape reveals a swamp-like floodplain, with visible former river courses reflected in its topography and vegetative patterns.

The South Carolina Department of Health and Environmental Control (DHEC) has operated an ambient air quality monitoring station in the Wise Lake area of Congaree Swamp National Monument since March, 1981. The station measures ozone, sulfur dioxide, nitrogen dioxide, mercury (precipitation and ambient), particulate matter (total suspended particulates and particulate matter less than 10 microns), and precipitation chemistry. The DHEC performs: routine weekly station visits, instrument maintenance, data validation, data reporting, instrument calibrations, and periodic performance and system audits. The DHEC measures ozone throughout the designated ozone season for the State of South Carolina, currently April 1 to October 31. Other monitors that have annual National Ambient Air Quality Standards (NAAQS), i.e., sulfur dioxide, nitrogen dioxide, particulate matter, etc. are measured throughout the year.

The current Wise Lake ambient air quality monitoring station is located in a proposed wilderness area of the park. Ambient air quality monitoring was started prior to International Biosphere Reserve and wilderness designation, which now preclude modifications or improvements to the Wise Lake station. The monitoring shelter and associated instrumentation are constructed on approximately 10 to 12 foot stilts to accommodate periodic flooding of the Congaree River. During periods of flooding the site is only accessible by boat. Electrical service is provided by buried cable, however, when the line eventually fails will not be repaired because of wilderness designation. The station has limited and unreliable telephone service by cellular connection. Meteorological measurements are not made at the Wise Lake station and hinder regional analysis of source regions impacting park resources.

The park and DHEC are in the process of moving the ambient air quality monitoring station to a new location within the park that will provide a stable power supply, telephone service, and meteorological measurements. The new location will provide a more regional prospective of ambient air quality conditions than could be measured at the Wise Lake station.

Air Quality Related Values

Routine air quality related values (AQRVs) monitoring specific to air pollution effects is not currently performed at the park. The continued collection of baseline ambient air quality data is needed for trend analysis and potential research efforts that may be proposed. AQRVs are the key indicator for air pollution effects in the park. AQRVs are defined as those park values, which are dependent upon and affected by changes in air quality. AQRVs can include visibility, and scenic, cultural, biological, and recreational resources. Congaree Swamp National Monument resources that may be adversely affected by changes in air quality include archeological objects and resources, visibility, vegetation, wildlife, water quality, and soils.

A report, "Wildlife Air Quality Related Values at Congaree Swamp National Monument", was written in February, 1982, by James R. Newman and Robin Hart, Environmental Science and Engineering, Inc., under contract to the National Park Service (see appendix A). The report provides an inventory of vegetation and wildlife communities as well as an air pollution/AQVR sensitivity analysis. In view of the historical significance this report provides in documenting sensitive AQRVs in the park, the entire report is attached as an addendum. Proposed research efforts to document air pollution impacts or changes in baseline air quality conditions should utilize the attached report as a critical reference point.

Monitoring AQRVs may involve any combination of visual examination, photography, data collection on sensitive species which react to changes in air quality before hardier species, and air, water and soil sampling to establish baseline data and identify how air pollutants are affecting park resources. The following table illustrates some of the common air pollutants and their impacts:

Table 1: Air pollution effects on air quality related values

POLLUTANTS OF CONCERN	POTENTIAL AIR POLLUTION EFFECTS
Nitrogen dioxide, fine particles (especially sulfates and nitrates), photochemical smog	Visibility effects: Visible plumes, layered haze, regional haze, atmospheric discoloration, reduction of visual range
Ozone, sulfur dioxide, nitrogen dioxide, acid deposition, and metals	Vegetation effects: Superficial damage to leaves, conifer needles, changes in growth rates and/or suppression of growth, disruption of reproductive processes, increased susceptibility to disease, pests, and adverse weather conditions, loss of individuals or large numbers of a community, possible alterations in the entire terrestrial and/or aquatic ecosystem.
Ozone, sulfur dioxide, nitrogen dioxide, acid deposition, lead and other metals	Animal effects: Eye and respiratory impairment, increased susceptibility to other agents or to disease, decreased availability of necessary food sources, reduction of reproduction capacity in certain aquatic species
Acid deposition (including sulfates and nitrates), metals	Soil effects: Acidification, toxification, leaching of essential nutrients
Acid deposition, metals, phosphates, particulates	Water quality effects: Acidification, toxification, eutrophication
Acid deposition, ozone, particulates, nitrogen dioxide	Effects on natural and man-made structures: Discoloration and/or erosion of building facades, decomposition and soiling of limestone formations, Indian ruins and artifacts

Ambient Air Quality Monitoring Objectives

Ambient air quality monitoring is also addressed in the park's Resource Management Plan. Monitoring provides the basis for early identification of pollution problems and possible intervention before serious resource damage can occur. It provides for examining links between effects on park AQRVs and types, quantities, rates, and locations of air pollution emissions. It further provides critical information to park managers for making informed and effective policy decisions on air resource management issues affecting the park. The primary objectives of ambient air quality monitoring within Congaree Swamp National Monument are to:

- establish baseline concentrations of air pollutants;
- assess trends in air quality;
- determine compliance with national ambient air quality standards (NAAQS);
- provide data for the development and revision of national and regional air pollution control policies that are protective of park resources;
- provide data for atmospheric model development and evaluation;
- identify air pollutants which may damage park natural and cultural resources, measure these pollutants, and correlate observed effects on resources to ambient levels of pollutants;
- identify limits of acceptable change based upon class II standards;
- provide guidelines for violations of the NAAQSs;

The NPS has historically concentrated on determining the levels of two air pollutants, ozone and sulfur dioxide. These pollutants are particularly toxic to certain native vegetative species at or below the NAAQS established by the EPA. The EPA develops and promulgates primary and secondary standards for 6 criteria pollutants: ozone, sulfur dioxide, nitrogen dioxide, particulate matter, carbon monoxide, and lead. Primary standards are designed to protect public health, and secondary standards are designed to protect public welfare (cultural resources, forest resources, etc.). Other gaseous pollutants (e.g., photochemical oxidants, nitrogen compounds, and toxic organic compounds) are also of interest because they relate to physiological, morphological, or histological injury to park biological resources. To effectively meet these objectives the following ambient air quality monitoring and meteorological parameters should be continually monitored at the park:

Ozone

Ozone (O_3) is formed in the atmosphere in a complex reaction involving molecular oxygen, existing ozone, nitrogen dioxide, nitrogen oxide, and hydrocarbons. O_3 is found in two layers of the atmosphere, the stratosphere and the troposphere. In the stratosphere, ozone is a form of oxygen found naturally that provides a protective layer shielding the earth from ultraviolet radiation's harmful health effects on humans and the environment. In the troposphere, ozone and other photochemical oxidants can have adverse effects on plants, animals, and human health. Human effects include poor visibility, eye irritation, and respiratory problem. Ozone injury on vegetation can include necrosis, chlorosis, and a flecking of the upper leaf surface.

In November 1997, the EPA adopted a new eight hour ozone NAAQS based on scientific and medical research which indicated that extended exposure to lower levels of ozone may be as harmful as short-term exposure to elevated levels. The new standard is set at 85 parts per billion (ppb) and is exceeded when the average of the fourth maximum 8-hour average over a three year period is 85 ppb or greater. The average of the fourth maximum 8-hour average over a 3-year period will be used by the EPA to determine areas of violation of the ozone standard.

Primary O ₃ NAAQS:	8-hour concentration of 85 ppb or greater (based on a three year average of the 4 th highest daily maximum 8-hour ozone average).
Secondary O ₃ NAAQS:	Same as the primary NAAQS

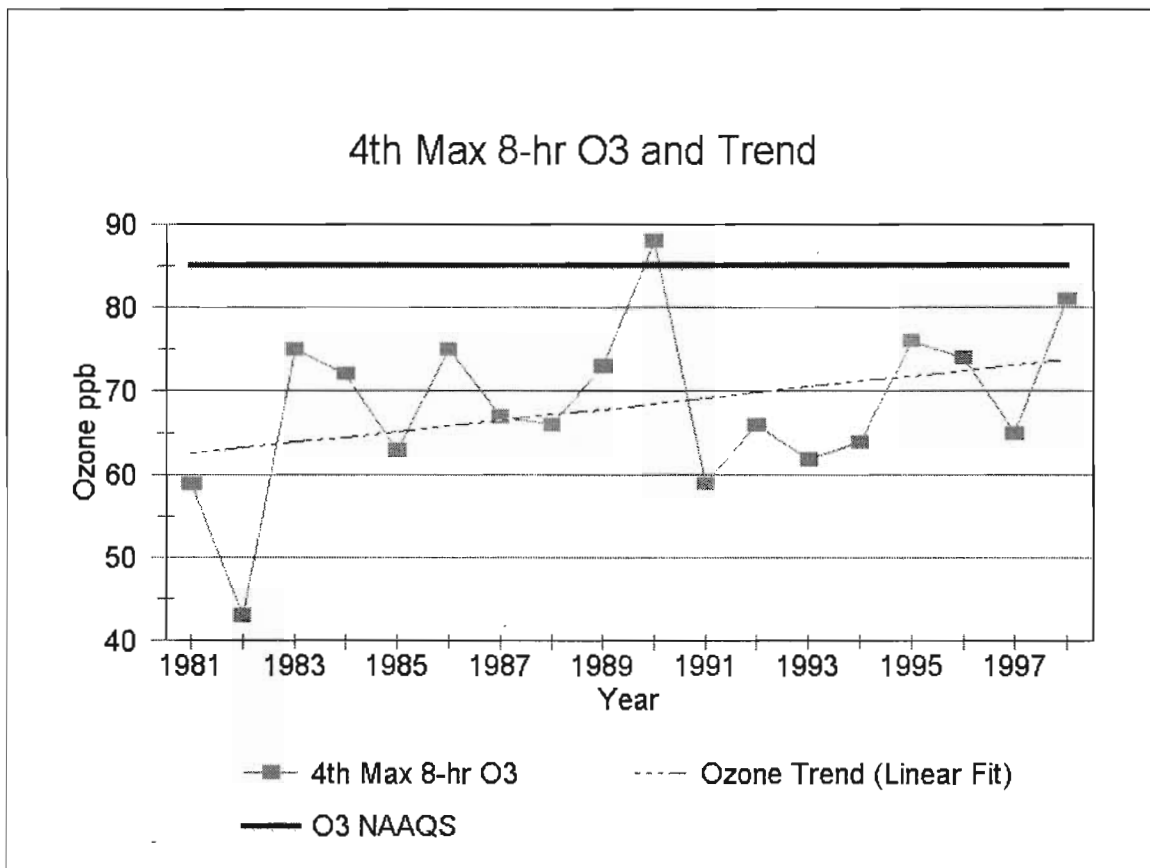
The following table shows the five maximum 8-hour ozone concentrations for Congaree Swamp National Monument since 1981. The fourth maximum 8-hour ozone concentration is presented in bold and shows that only one year, 1990, has exceeded the current ozone NAAQS. The final column shows the running 3-year fourth maximum 8-hour ozone average. The highest year on record, 1990 recorded a fourth maximum 8-hour ozone average of 88 ppb with a 3-year average (1988-1990) of 75 ppb.

Table 2: COSW 8-hour ozone concentrations (ppb) 1981 - 1998

YEAR	1 ST MAX 8-HR PPB	2 ND MAX 8-HR PPB	3 RD MAX 8-HR PPB	4 TH MAX 8-HR PPB	5 TH MAX 8-HR PPB	3-YR AVG 4 TH MAX 8-HR PPB
1981	70	66	62	59	57	*
1982	48	46	44	43	43	*
1983	101	95	87	75	67	59
1984	89	73	73	72	67	63
1985	69	69	66	63	60	70
1986	84	77	76	75	73	70
1987	71	69	68	67	67	68
1988	76	66	66	66	64	69
1989	98	92	90	73	73	68
1990*	94	91	91	88	87	75
1991	63	60	59	59	58	73
1992	76	74	67	66	65	71
1993	66	66	65	62	61	62
1994	76	73	68	64	62	64
1995	86	78	76	76	70	67
1996	84	76	74	74	68	71
1997	68	68	67	65	64	71
1998	82	82	82	81	80	73
AVG (ppb)	77.83	73.39	71.17	68.22	65.89	

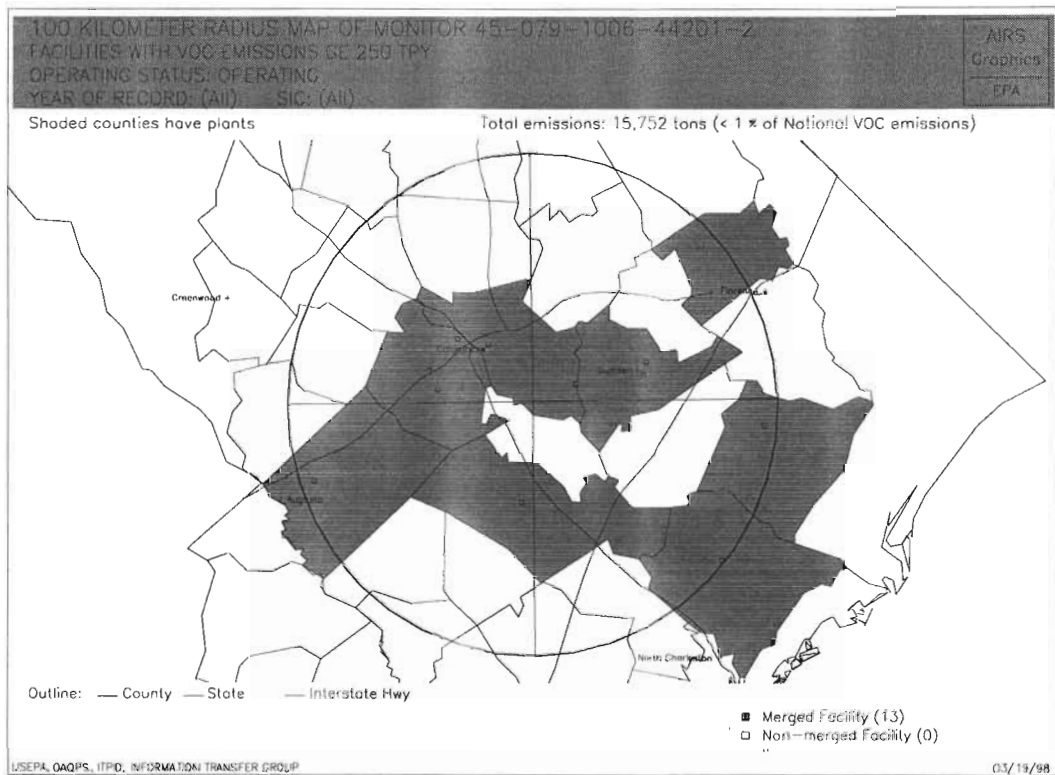
* Highest values for one year

Ambient ozone monitoring data collected at the Wise Lake monitoring is below the primary and secondary National Ambient Air Quality Standard for ozone. Graph 1, below, plots the yearly 4th maximum ozone concentration and plots the linear trend over the eighteen year monitoring history of the station. The trend line indicates a slight increase in the 4th maximum 8-hour ozone concentration.



Graph 1: COSW 4th Maximum 8-Hour O₃ Concentration, Standard and Trend

Figure 1: Facilities with VOC emissions ≥ 250 tons/year within 100 kilometers



Sulfur Dioxide

Sulfur Dioxide (SO_2) is a heavy, pungent (at concentrations exceeding 500 ppb), colorless, gaseous air pollutant formed primarily by the combustion of sulfur containing fuels, ore smelting, petroleum processing, sulfuric acid manufacturing, paper mills, and industrial boilers. Nation-wide, coal-fired power plants are the largest sources of SO_2 . SO_2 can be extremely corrosive to stone, paint, and metals and damaging to vegetation. SO_2 can also combine with moisture in the atmosphere to form sulfuric acid (H_2SO_4) which is a component of acid precipitation that causes acidification of soil and water.

Primary SO_2 NAAQS:	Annual arithmetic mean not to exceed 30 ppb. 24-hr concentration not to exceed 140 ppb more than one time per year.
Secondary NAAQS:	3-hour concentration not to exceed 500 ppb more than one time per year.

The following table is a summary of SO₂ data collected at Congaree Swamp National Monument since 1981.

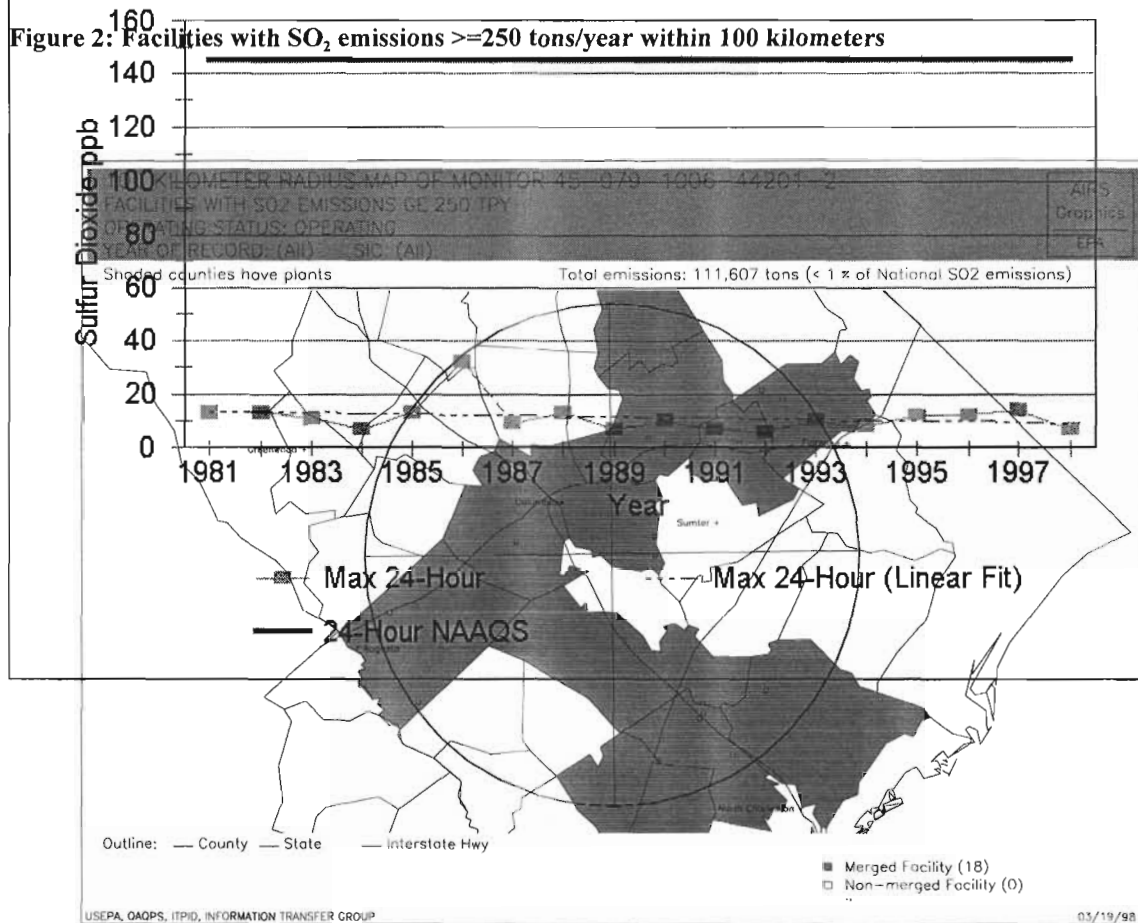
Table 3: COSW SO₂ concentrations (ppb) 1981 - 1998

YEAR	SO₂ ANNUAL MEAN PPB	SO₂ MAXIMUM 24-HR PPB	SO₂ MAXIMUM 3-HR PPB
1981	2	13	63
1982	1	13	53
1983	2	11	39
1984	1	7	22
1985	2	13	60
1986	2	32	65
1987	1	9	23
1988	1	13	25
1989	1	7	29
1990	1	10	37
1991	1	7	20
1992	1	6	14
1993	1	10	29
1994	1	8	42
1995	1	12	64
1996	1	12	48
1997	1	14	37
1998	1	7	21
AVG ppb	1.22	11.33	38.39

Graph 2: COSW Maximum 24-Hour SO₂ Standard, and Trend

The measured 24-hour SO₂ concentrations are well below the primary 24-hour NAAQS for SO₂ of 140 ppb. The trend line indicates a slightly decreasing trend in the maximum 24-hour SO₂ concentrations over the past eighteen years.

Max 24-hr SO₂ and Trend



Particulate Matter

Particulate matter (PM) is a broad classification of non-gaseous pollutants that consists of very fine solid particles and liquid droplets or aerosols. Particulates are produced from many sources, including utility plants, wood burning stoves, leaf burning, vehicle exhaust, incinerators, rock quarries, coal processing, smelting, construction, farming, and roadways. Common forms of particulates include fly ash, soot, soil, minerals, fibers, metals, oil aerosols, and tire rubber.

Particulate matter can soil and damage building surfaces and may damage vegetation by interfering with plant photosynthesis due to the formation of a film on leaf surfaces reducing exposure to sunlight.

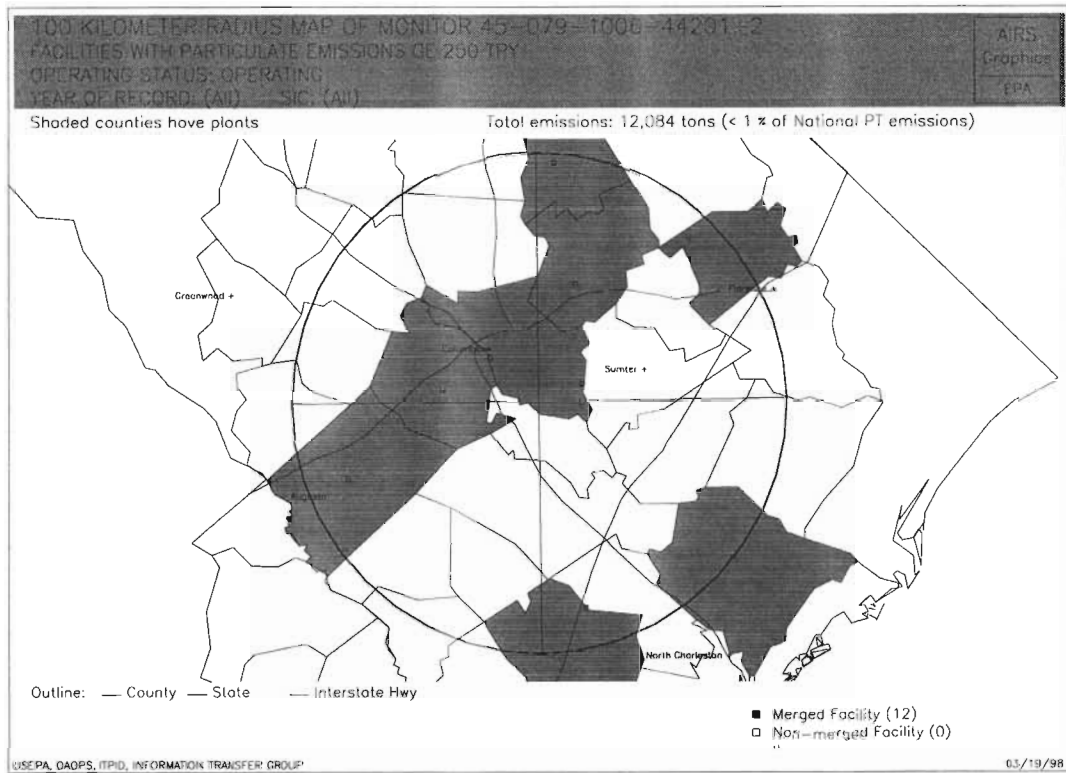
Particulate matter can also produce haze, which diminishes visibility and the amount of sunlight reaching the earth.

Particulate matter is characterized according to particle diameter. Particles that are greater than 50 microns ($50\mu\text{m}$) in diameter rapidly settle out of the atmosphere due to their mass. Particles less than $50\mu\text{m}$ in diameter remain suspended in the atmosphere for longer periods of time and are classified as Total Suspended Particulates (TSP). Particulate matter less than $10\mu\text{m}$ (PM_{10}) are respirable and contribute to regional haze and visibility impairment. Continuing scientific and medical studies now indicate that particles $2.5\mu\text{m}$ in size ($\text{PM}_{2.5}$) and smaller pose a greater threat to human health than particles in the $10\mu\text{m}$ range. In response to these findings the EPA adopted new $\text{PM}_{2.5}$ standards which became effective September 16, 1997.

Primary PM_{10} NAAQS:	Annual arithmetic mean not to exceed 50 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) (based on a three year average). Maximum 24-hr concentration of $150 \mu\text{g}/\text{m}^3$. Average number of expected exceedances per year not to exceed 1.0 over the last three year period.
Secondary PM_{10} NAAQS:	Same as the primary NAAQS.
Primary $\text{PM}_{2.5}$ NAAQS:	Annual mean not to exceed $15 \mu\text{g}/\text{m}^3$ (based on three year average of annual means). 24-hour concentration not to exceed $65 \mu\text{g}/\text{m}^3$ (based on a three year average of the annual 98 th percentile).
Secondary $\text{PM}_{2.5}$ NAAQS:	Same as the primary NAAQS.

Major point sources of particulate matter within 100 kilometers of Congaree Swamp National Monument are plotted on the following map (Figure 3) generated from the EPA Aerometric Information Retrieval System. The map plots all facilities within 100 kilometers of the Congaree Swamp National Monument air quality station with particulate matter emissions greater than 250 tons per year.

Figure 3: Facilities with particulate emissions ≥ 250 tons per year within 100 kilometers



Nitrogen Dioxide

Nitrogen dioxide (NO_2) is a reddish brown gas that is produced during the high temperature combustion of fossil fuels. During combustion, nitrogen and oxygen are combined, or oxidized, to form a family of highly reactive gases called nitrogen oxides (NO_x) which includes NO_2 and nitrogen oxide (NO). In addition to the NO_2 produced during combustion, it is also formed by the photochemical reaction of NO in the presence of sunlight. The rate of reaction is dependent upon the intensity of the sunlight. Major combustion or oxidation sources that produce NO_2 include motor vehicles, power plants, incinerators, industrial boilers, and some chemical processes.

NO_2 plays an important role in the atmospheric reactions that generate ozone. NO_2 is also a contributor to the formation of acid precipitation, which can damage plant and aquatic life and cause deterioration of stone and masonry-type buildings and statues.

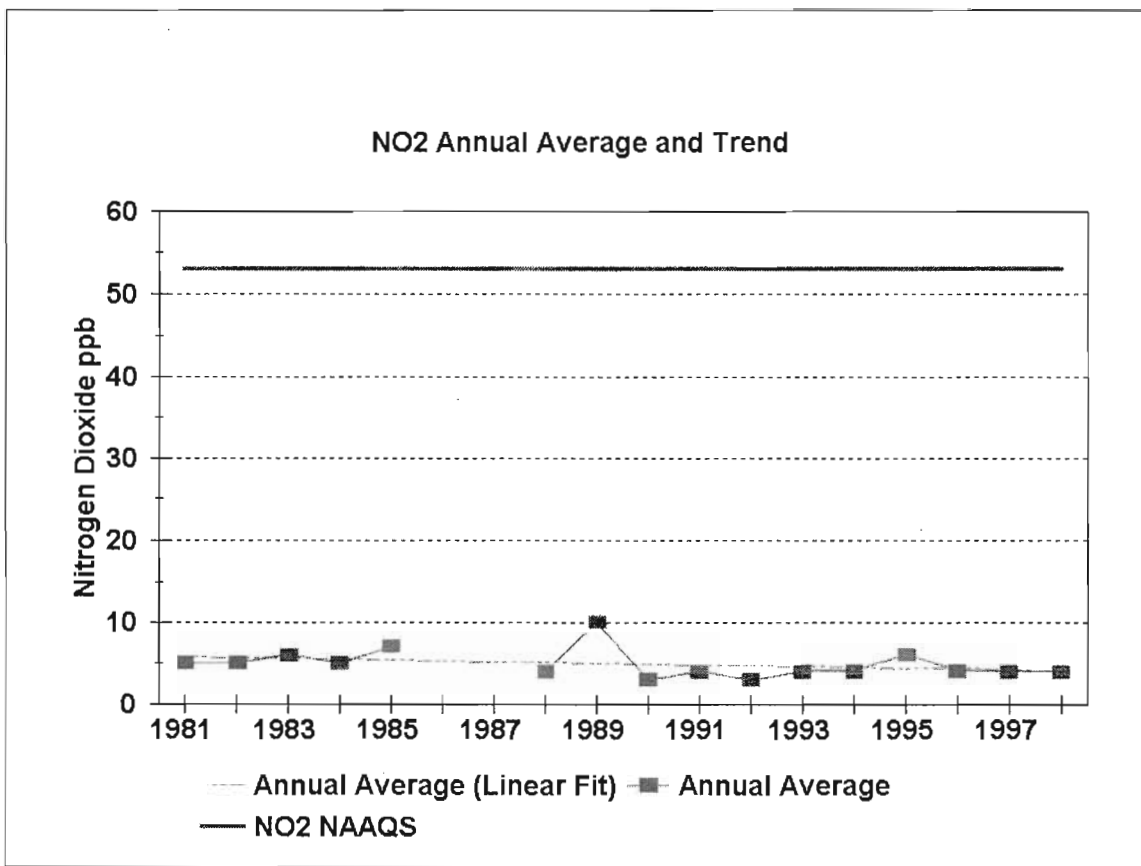
Primary NO_2 NAAQS: Annual arithmetic mean not to exceed 50 ppb.

Secondary NO_2 NAAQS: Same as the primary NAAQS.

Table 4: COSW NO₂ Concentrations (ppb) 1981-1998

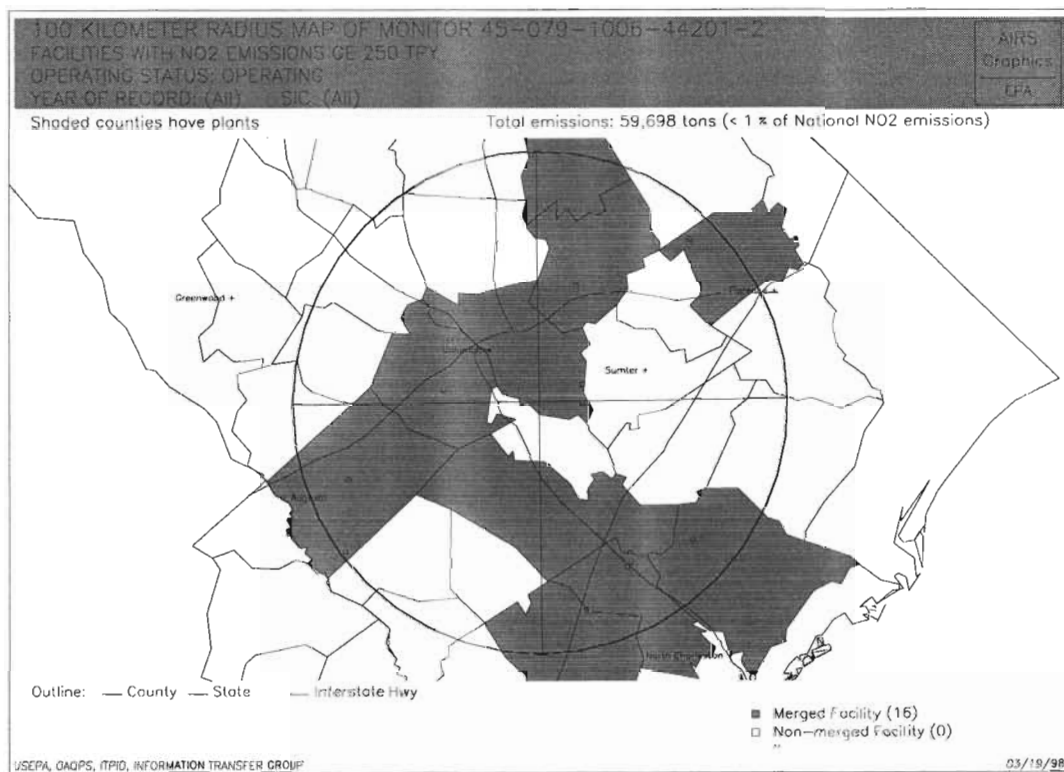
YEAR	NO₂ ANNUAL MEAN PPB	NO₂ MAXIMUM 1-HR PPB
1981	5	109
1982	5	45
1983	6	50
1984	5	32
1985	7	40
1986	*	*
1987	*	*
1988	4	35
1989	10	32
1990	3	37
1991	4	29
1992	3	31
1993	4	34
1994	4	33
1995	6	46
1996	4	39
1997	4	32
1998	4	28
AVG ppb	4.88	40.75

* - NO₂ measurements were not performed in 1986-1987.



Graph 3: COSW NO₂ Annual Average (ppb), Standard and Trend

Figure 4: Facilities with NO₂ emissions $\geq$ 250 tons/year within 100 kilometers



Wet Deposition

Precipitation chemistry provides long-term trends in concentration and deposition of major cations and anions in precipitation. In addition to measuring acid precipitation, wet deposition can determine the effectiveness of emission controls in reducing sulfur and nitrogen pollution, nitrogen cycling in ecosystems, and terrestrial, aquatic, atmospheric, and materials effects of air pollutants in rainfall. Measurements typically include, acidity, pH, conductivity, bromide, chloride, fluoride, nitrate, nitrite, phosphorus, sulfate, ammonia-nitrogen, calcium, magnesium, potassium, and sodium.

Mercury

Mercury is emitted to the ambient air from a variety of fuel combustion, incineration and industrial processes and natural sources. Mercury is deposited by wet and dry processes to forest ecosystems, from which it can ultimately be transported to and bioaccumulate in highly toxic forms in the food chain of aquatic ecosystems. The following table is a summary of available weekly mercury concentrations and deposition levels:

National Atmospheric Deposition Program/MDN
Weekly Mercury Concentrations and Depositions

Site	Date On	Date Off	Subppt	Pptrec	HgConc	HgDep	QR	SP	SL	Invalid
			mm	mm	ng/L	ng/m ²				
SC19	12/27/1995	01/02/1996	13.19	--	11.38	150.13	B			xpr
SC19	01/02/1996	01/16/1996	18.53	--	7.97	147.68	B			hze
SC19	01/16/1996	02/13/1996	55.21	--	14.35	792.37	B			xper
SC19	02/13/1996	02/20/1996	10.73	--	13.81	148.25	B			zpr
SC19	02/20/1996	02/27/1996	0.00	0.00	1.92	0.00	B			hv
SC19	02/27/1996	03/05/1996	13.06	--	6.02	78.63	B			zpr
SC19	03/05/1996	03/26/1996	80.54	--	--	--	C	U		zper
SC19	03/26/1996	04/02/1996	42.16	42.16	--	--	A			
SC19	04/02/1996	04/09/1996	11.94	11.94	8.34	99.57	B			r
SC19	04/09/1996	04/16/1996	3.81	3.81	12.62	48.08	B			r
SC19	04/16/1996	04/23/1996	4.57	4.57	25.79	117.92	B			r
SC19	04/23/1996	04/30/1996	59.30	--	7.67	454.85	B			zr
SC19	04/30/1996	05/07/1996	4.83	4.83	16.22	78.28	A			
SC19	05/07/1996	05/14/1996	16.51	16.51	17.33	286.13	B			xz
SC19	05/14/1996	05/21/1996	0.61	--	--	--	C	U		xz
SC19	05/21/1996	05/28/1996	79.53	--	14.21	1130.14	B			x
SC19	05/28/1996	06/04/1996	3.48	--	17.84	62.11	B			z
SC19	06/04/1996	06/11/1996	2.79	2.79	21.70	60.63	B			r
SC19	06/11/1996	06/18/1996	48.01	48.01	16.50	792.14	B			x
SC19	06/18/1996	06/25/1996	3.16	--	--	--	C	U		r
SC19	06/25/1996	07/02/1996	0.25	0.25	--	--	B			vr
SC19	07/02/1996	07/09/1996	18.94	--	15.02	284.43	B			xpr
SC19	07/09/1996	07/16/1996	11.18	11.18	12.94	144.62	B			r
SC19	07/16/1996	07/23/1996	0.00	0.00	1.03	0.00	B			vr
SC19	07/23/1996	07/30/1996	27.94	27.94	13.23	369.66	B			r
SC19	07/30/1996	08/06/1996	60.45	60.45	16.11	973.93	B			r
SC19	08/06/1996	08/13/1996	7.37	7.37	32.66	240.59	B			r
SC19	08/13/1996	08/21/1996	4.83	4.83	16.97	81.90	B			r
SC19	08/21/1996	08/27/1996	4.83	4.83	22.02	106.27	B			r
SC19	08/27/1996	09/03/1996	17.53	17.53	7.11	124.62	A			
SC19	09/03/1996	10/08/1996	144.23	--	--	--	C		F	fzper
SC19	11/13/1996	11/19/1996	6.86	6.86	8.40	57.61	B			r
SC19	11/19/1996	11/26/1996	13.83	--	5.48	75.80	B			zpr
SC19	11/26/1996	12/03/1996	14.99	14.99	4.43	66.39	B			r
SC19	12/03/1996	12/10/1996	8.64	8.64	7.17	61.92	B			zr
SC19	12/10/1996	12/17/1996	0.94	--	13.24	12.44	B			zr

National Atmospheric Deposition Program (NRSP-3)/Mercury Deposition Network. (1999). NADP Program Office, Illinois State Water Survey, 2204 Griffith Drive, Champaign, IL 61820.

Meteorology

Meteorological measurements are critical in characterizing air masses passing over the park. They also assist in validating air quality data. Typical parameters are wind direction, wind speed, temperature, relative humidity, solar radiation, and rainfall. Wind direction and wind speed typically represent the

average wind direction and speed at 10 meters above the ground. Temperature and relative humidity represent the air temperature at 2 meters above the ground. Solar radiation and rainfall are typically measured at 4 to 6 meters and 1 meter, respectively, and provide evidence of intense solar activity or possible frontal activity that may be impacting measured data. The primary objective is to have a meteorological system that can provide a representative measurement of the state of the atmosphere during a given sample interval.

Meteorological measurements are not made at the Wise Lake air quality station. Meteorological measurements are performed near the Dawson Cabin area of the park as part of the fire weather network. Upon relocating the air quality station, planning includes the installation of a meteorological system directly in support of ambient air quality measurements.

Monitoring History

Table 5 is a monitoring history for the Wise Lake air quality station at Congaree Swamp National Monument sorted by the date monitoring was started. The information was retrieved from the EPA Aerometric Informational Retrieval System (AIRS) and may not reflect all parameters measured at the station (e.g., ambient mercury, wet deposition, etc.).

Table 5: Monitoring history for Wise Lake AQ station, Congaree Swamp National Monument

EPA Parameter Code	Parameter Name	Start Date	End Date
42602	Nitrogen Dioxide	March 20, 1981	
42401	Sulfur Dioxide	March 24, 1981	
44201	Ozone	March 24, 1981	
42603	Oxides of Nitrogen	March 27, 1981	May 8, 1981
11101	Total Suspended Particulates (TSP)	July 9, 1981	
12102	Antimony (TSP)	April 13, 1983	December 31, 1994
12154	Selenium (TSP)	April 13, 1983	December 31, 1994
12164	Vanadium (TSP)	April 13, 1983	September 27, 1984
12165	Silicon (TSP)	April 13, 1983	November 26, 1983
12103	Arsenic (TSP)	July 5, 1983	December 31, 1994
12110	Cadmium (TSP)	July 5, 1983	December 31, 1994
12112	Chromium (TSP)	July 5, 1983	December 31, 1994
12114	Copper (TSP)	July 5, 1983	December 31, 1994
12126	Iron (TSP)	July 5, 1983	December 31, 1994
12128	Lead (TSP)	July 5, 1983	December 31, 1994
12132	Manganese (TSP)	July 5, 1983	December 31, 1994
12136	Nickel (TSP)	July 5, 1983	December 31, 1994
12140	Magnesium (TSP)	July 5, 1983	December 31, 1994
12167	Zinc (TSP)	July 5, 1983	December 31, 1994
12113	Cobalt (TSP)	January 1, 1992	December 31, 1994
12142	Mercury (TSP)	January 1, 1992	December 31, 1994

Ambient Air Quality Monitoring Strategy

The current Wise Lake air quality station will be relocated to an area of the park that will provide long-term regional measurements of ambient air quality conditions that may impact natural and cultural resources in the park. It will be critical to compare ambient air quality data measured at the Wise Lake

station with data collected at the new location. Based on historical ambient air quality data, ozone is the primary criteria pollutant of concern for the park. The trend indicates increasing 8-hour ozone concentrations that could potentially lead to future violations of the newly established primary and secondary ozone NAAQS. The ambient air quality monitoring station will provide the South Carolina DHEC and the National Park Service with the necessary documentation for future actions that may be necessary to insure that violations of the ozone NAAQS do not occur more often than is currently allowed. To validate ozone data collected in the two locations the stations will measure ozone concurrently for a minimum of one year. Following the collection of one year of ozone data the two data sets will be jointly analyzed for spatial and temporal comparability by the South Carolina DHEC and the National Park Service. In any event, the Wise Lake ambient air quality monitoring station will be completely removed following the comparability study.

The installation of a meteorological measurement system that can be integrated with the ambient air quality monitoring datalogger will be another critical element of this strategy. The meteorological measurement system will collect hourly averages for wind direction, wind speed, temperature, relative humidity, solar radiation, and rainfall. These parameters are necessary to characterize existing air masses and provide a basic idea of potential comparability with other regional measurement stations. The meteorological measurements will also assist in validating future modeling analysis of air quality data identifying potential source sectors impacting the park.

Although, the park is currently meeting all designated criteria pollutant NAAQSs, the continued background measurement of particulate matter, SO₂, NO₂, and wet deposition (including mercury) parameters are necessary for the long-term assessment impacts on park resources. These parameters, although meeting current criteria pollutant NAAQSs, contribute to undetermined wet and dry deposition loading on park resources. They also contribute to visibility and regional haze problems to various degrees and need to be continually documented for long-term degradation or improvement trends.

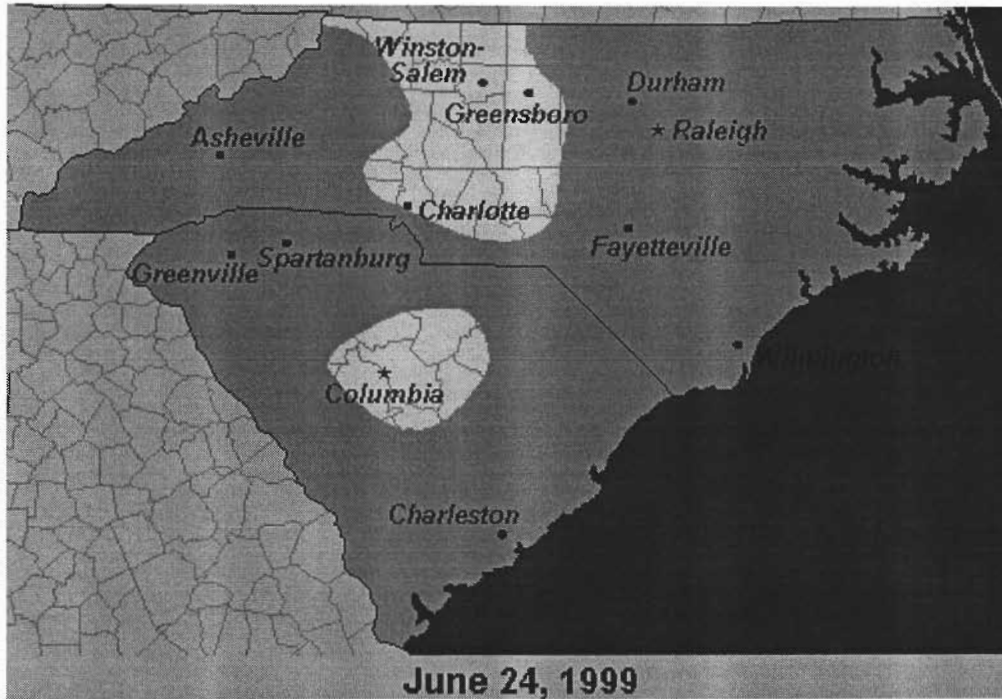
Monitoring Plan Implementation

The South Carolina DHEC will have primary responsibility to measure, maintain, validate, and report the measured air quality and meteorological parameters, which will enable the NPS to meet the monitoring objectives outlined in this plan. Data will be available for retrieval from the Environmental Protection Agency Aerometric Information Retrieval System (AIRS) primarily by SCDHEC and NPS staff from the Air Resources Division-Denver. Data may also be retrieved for acid deposition and ambient mercury from other sources, such as the National Acid Deposition Program and directly from the South Carolina DHEC.

The primary responsibilities of the National Park Service will include: providing, maintaining and securing the grounds around the air quality station; providing electrical and telephone utilities to the station; and providing periodic assistance in maintaining the meteorological instrumentation.

With the installation of a telephone line at the new ambient air quality station the South Carolina DHEC can include the hourly ozone values collected at Congaree Swamp NM into the EPA Ozone Mapping Project. The EPA Ozone Mapping Project provides near real-time ozone data on the Internet. Ozone data throughout the eastern United States is submitted five times daily throughout the eastern United States and ozone movies (see Figure 5 below) are created from these submissions. The ozone movies show the hourly change in 8-hour ozone concentrations for each day during the ozone season and are generally available for viewing in the early afternoon. The maps are archived daily for easy retrieval of past days.

Figure 5: North Carolina and South Carolina maximum 8-hour ozone map for June 24, 1999
(Source: EPA AIRNOW Web page - www.epa.gov/airnow)



Map key:

Color	Ozone Index	8-Hr Ozone Concentration (ppm)
Green	Good	0.0 to 0.064
Yellow	Moderate	0.065 to 0.084
Orange	Unhealthy for Sensitive Groups	0.085 to 0.104
Red	Unhealthy	0.105 to 0.124
Purple	Very Unhealthy	≥ 0.125

The park may participate in the NPS ozone health advisory program to alert sensitive employees and visitors to unhealthy concentrations of ozone at Congaree Swamp NM. The NPS has developed Service-wide guidelines for the implementation of an ozone health advisory program and is included in appendix C. The guidance is targeted for employees and visitors of the park and mirrors air pollution advisories issued in large urban areas.

Air quality data collected at Congaree Swamp NM will primarily be used internally to support park resource management planning, studies and potential research directions, air quality permit evaluations, interpretative projects, and determination of trends and effects. Some of the typical uses of air quality data will include: NPS annual data summary reports, NPS reports distributed internally, replies to direct NPS data requests, inclusion in periodic Service-wide Air Quality in National Parks reports, and peer-reviewed journal articles by NPS and other researchers.

Appendix A: Wildlife AQRVs at Congaree Swamp National Monument

Wildlife Air Quality Related Values at Congaree Swamp National Monument, February 3, 1982, by James R. Newman and Robin Hart, Environmental Science and Engineering, Inc., under contract to the National Park Service, Division for Air Quality, contract number CX-0001-1-0014.

Appendix B: Major Sources of Criteria Pollutants in South Carolina

Major sources of criteria pollutants located in South Carolina maintained by the Environmental Protection Agency Aerometric Information Retrieval System.

**Table 6: South Carolina facilities with Volatile Organic Compound (VOC) emissions > 100 tons/ year
(Source:EPA AIRS)**

VOC's (Tons/ Year)	% of Total Emissions	Facility Name	State	County	City	Inventory Year	Industrial Classification
16950	39.29	Amoco Chemical	SC	Berkeley Co	Cainhoy	1995	2869 - Industrial Organic Chemicals,Nec
3097	7.18	International Paper:Hampton	SC	Hampton Co	Hampton	1996	3083 - Laminated Plastics Plate And Sheet
2585	5.99	Galey&Lord:Society Hill	SC	Darlington Co	Society Hill	1996	2262 - Finishing Plants, Synthetics
1860	4.31	Anchor Continental	SC	Richland Co	Columbia	1996	2672 - Paper Coated And Laminated, Nec
1276	2.96	Carolina Eastman Co	SC	Lexington Co	Columbia	1995	2824 - Organic Fibers, Noncellulosic
842	1.95	Westvaco-Kraft Div	SC	Charleston Co	North Charleston	1995	2611 - Pulp Mills
686	1.59	Albemarle Corp	SC	Orangeburg Co	Orangeburg	1995	2869 - Industrial Organic Chemicals,Nec
598	1.39	Avondale Mills:Woodhead	SC	Aiken Co	Graniteville	1996	2295 - Coated Fabrics, Not Rubberized
551	1.28	Tenneco-Beech Island	SC	Aiken Co	Beech Island	1996	3086 - Plastics Foam Products
490	1.14	International Paper:Georgetown	SC	Georgetown Co	Georgetown	1996	2611 - Pulp Mills
464	1.08	Michelin:Spartanburg	SC	Spartanburg Co	Spartanburg	1995	3011 - Tires And Inner Tubes
441	1.02	Vulcraft:Joist Plant	SC	Florence Co	Florence	1996	3441 - Fabricated Structural Metal
418	0.97	Bowater Inc Paper/Pulp	SC	York Co	Catawba	1996	2611 - Pulp Mills
401	0.93	Alliedsignal:Fibers	SC	Lexington Co	Columbia	1995	2821 - Plastics Materials And Resins
384	0.89	Stone Container:Florence	SC	Florence Co	Florence	1996	2611 - Pulp Mills
376	0.87	Michelin:Lexington Us5	SC	Lexington Co	Lexington	1995	3011 - Tires And Inner Tubes
365	0.85	3m:Tape Plant	SC	Greenville Co	Greenville	1995	2672 - Paper Coated And Laminated, Nec
346	0.8	Cryovac-Simpsonville	SC	Greenville Co	Simpsonville	1996	3081 - Unsupported Plastics Film And Sheet
345	0.8	Vb/Williams Furnitur	SC	Sumter Co	Sumter	1996	2511 - Wood Household Furniture
343	0.8	Korn Plant 1	SC	Sumter Co	Sumter	1996	2511 - Wood Household Furniture
331	0.77	Clariant:Leeds	SC	Chester Co	Leeds	1996	2819 - Industrial Inorganic Chemicals
316	0.73	Delta Mills:Delta #2	SC	Marlboro Co	Wallace	1996	2269 - Finishing Plants, Nec
304	0.7	Delta Mills:Delta #3	SC	Marlboro Co	Wallace	1996	2261 - Finishing Plants, Cotton
290	0.67	Hartsville Oil Mill	SC	Darlington Co	Darlington	1996	2074 - Cottonseed Oil Mills
279	0.65	Rm Engrnd:N Charlstn	SC	Charleston Co	North Charleston	1991	2399 - Fabricated Textile Products
269	0.62	Santee Print Works	SC	Sumter Co	Sumter	1996	2261 - Finishing Plants, Cotton
267	0.62	North Safety Products:Plant 1	SC	Charleston Co	Charleston Hts	1996	3069 - Fabricated Rubber Products, Nec
264	0.61	Marathon Ashland:Belton	SC	Anderson Co	Belton	1995	5171 - Petroleum Bulk Stations & Terminals

VOC's (Tons/ Year)	% of Total Emissions	Facility Name	State	County	City	Inventory Year	Industrial Classification
248	0.57	Transmontaigne:Belton	SC	Anderson Co	Belton	1993	5171 - Petroleum Bulk Stations & Terminals
248	0.57	Albright & Wilson	SC	Charleston Co	Charleston	1995	2819 - Industrial Inorganic Chemicals
235	0.54	American National Can	SC	Lee Co	Bishopville	1996	3411 - Metal Cans
232	0.54	Donnelley,Rr & Sons	SC	Spartanburg Co	Spartanburg	1996	2751 - Commercial Printing Letterpress(1977)
231	0.54	Crown Cork&Seal:Cheraw	SC	Chesterfield Co	Cheraw	1991	3411 - Metal Cans
228	0.53	Southern Soya Corp	SC	Hampton Co	Estill	1996	2075 - Soybean Oil Mills
206	0.48	Union Camp:Eastover	SC	Richland Co	Eastover	1996	2621 - Paper Mills Exc Building Paper
206	0.48	Korn Plant 2	SC	Sumter Co	Sumter	1996	2511 - Wood Household Furniture
204	0.47	Basf:Anderson	SC	Anderson Co	Anderson	1995	2824 - Organic Fibers, Noncellulosic
201	0.47	Wilson Sportng Goods	SC	Greenville Co	Fountain Inn	1996	3949 - Sporting & Athletic Goods Nec
198	0.46	Goodyear:Spartanburg	SC	Spartanburg Co	Spartanburg	1996	3011 - Tires And Inner Tubes
197	0.46	Bard,Cr Inc	SC	Berkeley Co	Moncks Corner	1996	3841 - Surgical & Medical Instruments
192	0.45	Avx:Myrtle Beach	SC	Horry Co	Myrtle Beach	1996	3679 - Electronic Components, Nec
191	0.44	Carolina Furniture	SC	Sumter Co	Sumter	1996	2511 - Wood Household Furniture
189	0.44	Archer Daniels MdInd	SC	Lancaster Co	Kershaw	1995	2075 - Soybean Oil Mills
181	0.42	Springs Ind:Screen Print	SC	Lancaster Co	Lancaster	1991	2261 - Finishing Plants, Cotton
180	0.42	Avery Dennison-Spd	SC	Laurens Co	Clinton	1991	2754 - Commercial Printing, Gravure
178	0.41	Willamette:Bennettsville Pulp	SC	Marlboro Co	Bennettsville	1996	2611 - Pulp Mills
176	0.41	Ccx Fiberglass Prod	SC	Colleton Co	Walterboro	1996	2221 - Weaving Mills, Synthetics
175	0.41	H&R Florasynth	SC	Berkeley Co	Goose Creek	1996	2899 - Chemical Preparations, Nec
172	0.4	Tranter Inc	SC	Edgefield Co	Edgefield	1996	3433 - Heating Equipment, Except Elec
171	0.4	Owens Corning:Anderson	SC	Anderson Co	Anderson	1995	3229 - Pressed And Blown Glass, Nec
162	0.38	Moore Drums Inc	SC	Charleston Co	Charleston	1996	3412 - Metal Barrels, Drums & Pails
160	0.37	Consolidated Systems	SC	Richland Co	Columbia	1996	3441 - Fabricated Structural Metal
159	0.37	Alcoa Building Prod	SC	Cherokee Co	Gaffney	1996	3089 - Plastics Products, Nec
152	0.35	Westvaco-Chemical	SC	Charleston Co	North Charleston	1996	2861 - Gum And Wood Chemicals
147	0.34	Sonoco:Hartsville	SC	Darlington Co	Hartsville	1996	2631 - Paperboard Mills
146	0.34	Decolam	SC	Orangeburg Co	Orangeburg	1996	2435 - Hardwood Veneer And Plywood
141	0.33	Wells Aluminum Corporation	SC	Anderson Co	Belton	1996	3354 - Aluminum Extruded Products
139	0.32	North Safety Products:Plant 2	SC	Charleston Co	Charleston	1991	3069 - Fabricated Rubber Products, Nec

VOC's (Tons/ Year)	% of Total Emissions	Facility Name	State	County	City	Inventory Year	Industrial Classification
138	0.32	Amerada Hess:Belton	SC	Anderson Co	Belton	1996	5171 - Petroleum Bulk Stations & Terminals
136	0.32	Gp:Hollyhill Mdf	SC	Orangeburg Co	Holly Hill	1996	2421 - Sawmills & Planing Mills General
134	0.31	Milliken Magnolia	SC	Cherokee Co	Blacksburg	1995	2261 - Finishing Plants, Cotton
128	0.3	Federal Mogul:Summerton	SC	Clarendon Co	Summerton	1996	3053 - Gaskets, Packing And Sealing Devices
127	0.29	Vytech	SC	Anderson Co	Anderson	1996	2295 - Coated Fabrics, Not Rubberized
126	0.29	Michelin:Sandy Springs	SC	Anderson Co	Anderson	1996	3011 - Tires And Inner Tubes
123	0.29	3m:Film Plant	SC	Greenville Co	Greenville	1991	3081 - Unsupported Plastics Film And Sheet
123	0.29	Reeves Bro:Fairforst	SC	Spartanburg Co	Spartanburg	1996	3069 - Fabricated Rubber Products, Nec
121	0.28	Jw Aluminum	SC	Berkeley Co	Mount Holly	1996	3353 - Aluminum Sheet Plate & Foil
120	0.28	Cone Mills:Carlisle	SC	Union Co	Carlisle	1996	2261 - Finishing Plants, Cotton
118	0.27	Bayer Corp	SC	Berkeley Co	Goose Creek	1996	2865 - Cyclic Crudes And Intermediate
113	0.26	Amoco Polymers:Greenville	SC	Greenville Co	Piedmont	1995	2824 - Organic Fibers, Noncellulosic
111	0.26	Nucor Steel:Darlington	SC	Darlington Co	Darlington	1996	3312 - Blast Furnaces And Steel Mills
111	0.26	Kohler Co	SC	Spartanburg Co	Spartanburg	1995	3261 - Vitreous Plumbing Fixtures
109	0.25	Mack Trucks	SC	Fairfield Co	Winnsboro	1996	3713 - Truck And Bus Bodies
108	0.25	West Point Stevens:Clemson	SC	Oconee Co	Clemson	1996	2261 - Finishing Plants, Cotton
106	0.25	Georgetown Steel	SC	Georgetown Co	Georgetown	1996	3312 - Blast Furnaces And Steel Mills
102	0.24	Arrow Automotive Ind	SC	Spartanburg Co	Spartanburg	1996	3429 - Hardware, Nec
101	0.23	Bosch Braking Systems	SC	Sumter Co	Sumter	1996	3714 - Motor Vehicle Parts & Accessories
100	0.23	Transcontinental Gas Pipe Line	SC	Spartanburg Co	Moore	1996	4922 - Natural Gas Transmission

Table 7: South Carolina facilities with SO₂ emissions >100 tons/year (Source: EPA AIRS)

SO ₂ (Tons/ Year)	% of Total Emissions	Facility Name	State	County	City	Inventory Year	Industrial Classification
37668	18.25	Sce&G:Wateree	SC	Richland Co	Wateree	1996	4911 - Electric Services
18767	9.09	Sce&G:Williams	SC	Berkeley Co	Goose Creek	1996	4911 - Electric Services
15992	7.75	Santee Cooper:Jeffries	SC	Berkeley Co	Moncks Corner	1996	4911 - Electric Services
15955	7.73	Santee Cooper:Winyah	SC	Georgetow n Co	Georgetown	1996	4911 - Electric Services
14181	6.87	Sce&G:Canadys	SC	Colleton Co	Canadys	1996	4911 - Electric Services
12212	5.92	Sce&G:Mcmeekin	SC	Lexington Co	Lexington	1996	4911 - Electric Services
11347	5.5	Santee Cooper:Cross	SC	Berkeley Co	Cross	1996	4911 - Electric Services
10735	5.2	Sce&G:Urquhart	SC	Aiken Co	Beech Island	1996	4911 - Electric Services
9486	4.6	Westvaco-Kraft Div	SC	Charleston Co	North Charleston	1995	2611 - Pulp Mills
7876	3.82	Cp&L:Robinson	SC	Darlington Co	Hartsville	1996	4911 - Electric Services
6687	3.24	Celanese Acetate:Rockhill	SC	York Co	Rock Hill	1996	2823 - Cellulosic Man-Made Fibers
4185	2.03	Holnam:Holly Hill	SC	Orangeburg Co	Holly Hill	1996	3241 - Cement, Hydraulic
4051	1.96	Duke Energy:Lee	SC	Anderson Co	Pelzer	1996	4911 - Electric Services
3661	1.77	Santee Cooper:Grainger	SC	Horry Co	Conway	1996	4911 - Electric Services
3535	1.71	Stone Container:Florence	SC	Florence Co	Florence	1996	2611 - Pulp Mills
3335	1.62	Union Camp:Eastover	SC	Richland Co	Eastover	1996	2621 - Paper Mills Exc Building Paper
3172	1.54	Alumax Of S Carolina	SC	Berkeley Co	Goose Creek	1996	3334 - Primary Aluminum
2776	1.34	Giant Cement Co	SC	Dorchester Co	Harleyville	1996	3241 - Cement, Hydraulic
2410	1.17	Carolina Eastman Co	SC	Lexington Co	Columbia	1995	2824 - Organic Fibers, Noncellulosic
2181	1.06	Springs Ind:Grace	SC	Lancaster Co	Lancaster	1995	2262 - Finishing Plants, Synthetics
1958	0.95	Sonoco:Hartsville	SC	Darlington Co	Hartsville	1996	2631 - Paperboard Mills
1655	0.8	Sce&G:Cope	SC	Orangeburg Co	Cope	1996	4911 - Electric Services
1355	0.66	International Paper:Georgetown	SC	Georgetow n Co	Georgetown	1996	2611 - Pulp Mills
1182	0.57	Bowater Inc Paper/Pulp	SC	York Co	Catawba	1996	2611 - Pulp Mills
1168	0.57	Blue Circle Cement	SC	Dorchester Co	Harleyville	1996	3241 - Cement, Hydraulic
1074	0.52	Dupont,Ei:Cooper River	SC	Berkeley Co	Berkeley	1996	2821 - Plastics Materials And Resins
819	0.4	Showa Denko Carbon	SC	Dorchester Co	Ridgeville	1995	3624 - Carbon And Graphite Products
739	0.36	Galey&Lord:Society Hill	SC	Darlington Co	Society Hill	1996	2262 - Finishing Plants, Synthetics

SO ₂ (Tons/ Year)	% of Total Emissions	Facility Name	State	County	City	Inventory Year	Industrial Classification
560	0.27	Avondale Mills:Stevens	SC	Aiken Co	Graniteville	1996	2211 – Weaving Mills, Cotton
535	0.26	Cone Mills:Carlisle	SC	Union Co	Carlisle	1996	2261 – Finishing Plants, Cotton
460	0.22	Milliken:Magnolia	SC	Cherokee Co	Blacksburg	1995	2261 – Finishing Plants, Cotton
385	0.19	Dupont,Ei:Florence	SC	Florence Co	Florence	1996	2821 – Plastics Materials And Resins
354	0.17	Wellman Ind:Palmetto	SC	Darlington Co	Darlington	1996	2824 - Organic Fibers, Noncellulosic
338	0.16	Michelin:Sandy Springs	SC	Anderson Co	Anderson	1996	3011 - Tires And Inner Tubes
337	0.16	Savannah R Pl:Main	SC	Aiken Co	Aiken	1996	2819 - Industrial Inorganic Chemicals
305	0.15	Clemson University	SC	Pickens Co	Clemson	1996	8211 - Elementary And Secondary Schools
289	0.14	Allied Terminal:Greenleaf	SC	Charleston Co	Charleston	1991	4226 - Special Warehousing & Storage
278	0.13	Amoco Chemical	SC	Berkeley Co	Cainhoy	1995	2869 - Industrial Organic Chemicals,Nec
251	0.12	Owens Corning:Anderson	SC	Anderson Co	Anderson	1995	3229 - Pressed And Blown Glass, Nec
207	0.1	Milliken:Pendleton	SC	Anderson Co	Pendleton	1996	2261 - Finishing Plants, Cotton
205	0.1	Guardian Industries	SC	Chester Co	Richburg	1996	3211 - Flat Glass
189	0.09	Reeves Bro:Bishopvl	SC	Lee Co	Bishopville	1996	2261 - Finishing Plants, Cotton
185	0.09	Us Finishing	SC	Greenville Co	Greenville	1996	2261 - Finishing Plants, Cotton
179	0.09	Delta Mills:Delta #3	SC	Marlboro Co	Wallace	1996	2261 - Finishing Plants, Cotton
163	0.08	Owens Corning:Aiken	SC	Aiken Co	Aiken	1995	3229 - Pressed And Blown Glass, Nec
150	0.07	Us Airforce:Charleston	SC	Charleston Co	Charleston Afb	1996	9711 - National Security
146	0.07	Basf:Clemson	SC	Pickens Co	Central	1996	2824 - Organic Fibers, Noncellulosic
141	0.07	York Printing & Finishing	SC	York Co	Rock Hill	1996	2262 - Finishing Plants, Synthetics
140	0.07	Amoco Polymers:Greenville	SC	Greenville Co	Piedmont	1995	2824 - Organic Fibers, Noncellulosic
137	0.07	Foster Wheeler	SC	Charleston Co	North Charleston	1996	4953 - Refuse Systems
114	0.06	Milliken:Gayley Mill	SC	Greenville Co	Marietta	1991	2258 - Warp Knit Fabric Mills
109	0.05	Johns Manville Inc:Spartanbg	SC	Spartanburg Co	Spartanburg	1996	2824 - Organic Fibers, Noncellulosic
104	0.05	Vytech	SC	Anderson Co	Anderson	1996	2295 - Coated Fabrics, Not Rubberized

Table 8: South Carolina facilities with PM₁₀ emissions >100 tons per year (Source: EPA AIRS)

PM ₁₀ (Tons/ Year)	% of Total Emissions	Facility Name	State	County	City	Inventory Year	Industrial Classification
2063	20.13	Sce&G:Wateree	SC	Richland Co	Wateree	1996	4911 - Electric Services
1830	17.86	Sce&G:Urquhart	SC	Aiken Co	Beech Island	1996	4911 - Electric Services
1536	14.99	Sce&G:Canadys	SC	Colleton Co	Canadys	1996	4911 - Electric Services
931	9.09	Celanese Acetate:Rockhill	SC	York Co	Rock Hill	1996	2823 - Cellulosic Man- Made Fibers
691	6.74	Westvaco-Kraft Div	SC	Charleston Co	North Charleston	1995	2611 - Pulp Mills
377	3.68	Santee Cooper:Winyah	SC	Georgetown Co	Georgetown	1996	4911 - Electric Services
371	3.62	Santee Cooper:Jeffries	SC	Berkeley Co	Moncks Corner	1996	4911 - Electric Services
365	3.56	Bowater Inc Paper/Pulp	SC	York Co	Catawba	1996	2611 - Pulp Mills
277	2.7	Union Camp:Eastover	SC	Richland Co	Eastover	1996	2621 - Paper Mills Exc Building Paper
265	2.59	Archer Daniels Mdlnd	SC	Lancaster Co	Kershaw	1995	2075 - Soybean Oil Mills
259	2.53	Owens Corning:Aiken	SC	Aiken Co	Aiken	1995	3229 - Pressed And Blown Glass, Nec
207	2.02	Santee Cooper:Cross	SC	Berkeley Co	Cross	1996	4911 - Electric Services
188	1.83	Owens Corning:Anderson	SC	Anderson Co	Anderson	1995	3229 - Pressed And Blown Glass, Nec
165	1.61	Greenwood Foundry	SC	Greenwood Co	Greenwood	1996	3321 - Gray Iron Foundries
144	1.41	International Paper:Sampit	SC	Georgetown Co	Georgetown	1996	2421 - Sawmills & Planing Mills General
140	1.37	Blue Circle Cement	SC	Dorchester Co	Harleyville	1996	3241 - Cement, Hydraulic
131	1.28	Devro-Teepak	SC	Calhoun Co	Sandy Run	1996	3999 - Manufacturing Industries, Nec
106	1.03	Delta Mills:Delta #3	SC	Marlboro Co	Wallace	1996	2261 - Finishing Plants, Cotton
101	0.99	Gp:Hollyhill Mdf	SC	Orangeburg Co	Holly Hill	1996	2421 - Sawmills & Planing Mills General
100	0.98	Sce&G:Williams	SC	Berkeley Co	Goose Creek	1996	4911 - Electric Services

Table 9 : South Carolina facilities with NO₂ emissions >100 tons/year (Source: EPA AIRS)

NO ₂ (Tons/ Year)	% of Total Emissions	Facility Name	State	County	City	Inventory Year	Industrial Classification
17095	12.81	Sce&G:Wateree	SC	Richland Co	Wateree	1996	4911 - Electric Services
12559	9.41	Santee Cooper:Winyah	SC	Georgetow n Co	Georgetown	1996	4911 - Electric Services
12272	9.2	Santee Cooper:Cross	SC	Berkeley Co	Cross	1996	4911 - Electric Services
9756	7.31	Sce&G:Mcmeekin	SC	Lexington Co	Lexington	1996	4911 - Electric Services
8401	6.3	Sce&G:Williams	SC	Berkeley Co	Goose Creek	1996	4911 - Electric Services
8282	6.21	Sce&G:Canadys	SC	Colleton Co	Canadys	1996	4911 - Electric Services
7949	5.96	Transcontinental Gas Pipe Line	SC	Spartanbur g Co	Moore	1996	4922 - Natural Gas Transmission
6892	5.16	Sce&G:Urquhart	SC	Aiken Co	Beech Island	1996	4911 - Electric Services
6542	4.9	Santee Cooper:Jeffries	SC	Berkeley Co	Moncks Corner	1996	4911 - Electric Services
4094	3.07	Westvaco-Kraft Div	SC	Charleston Co	North Charleston	1995	2611 - Pulp Mills
3779	2.83	Holnam:Holly Hill	SC	Orangebur g Co	Holly Hill	1996	3241 - Cement, Hydraulic
3555	2.66	Celanese Acetate:Rockhill	SC	York Co	Rock Hill	1996	2823 - Cellulosic Man-Made Fibers
3501	2.62	Stone Container:Florence	SC	Florence Co	Florence	1996	2611 - Pulp Mills
2961	2.22	Cp&L:Robinson	SC	Darlington Co	Hartsville	1996	4911 - Electric Services
2638	1.98	Blue Circle Cement	SC	Dorchester Co	Harleyville	1996	3241 - Cement, Hydraulic
2505	1.88	Giant Cement Co	SC	Dorchester Co	Harleyville	1996	3241 - Cement, Hydraulic
2076	1.56	Carolina Eastman Co	SC	Lexington Co	Columbia	1995	2824 - Organic Fibers, Noncellulosic
2000	1.5	Guardian Industries	SC	Chester Co	Richburg	1996	3211 - Flat Glass
1967	1.47	Union Camp:Eastover	SC	Richland Co	Eastover	1996	2621 - Paper Mills Exc Building Paper
1563	1.17	Duke Energy:Lee	SC	Anderson Co	Pelzer	1996	4911 - Electric Services
1403	1.05	Santee Cooper:Grainger	SC	Horry Co	Conway	1996	4911 - Electric Services
1212	0.91	Springs Ind:Grace	SC	Lancaster Co	Lancaster	1995	2262 - Finishing Plants, Synthetics
1210	0.91	Owens Corning:Aiken	SC	Aiken Co	Aiken	1995	3229 - Pressed And Blown Glass, Nec
1124	0.84	Bowater Inc Paper/Pulp	SC	York Co	Catawba	1996	2611 - Pulp Mills
1097	0.82	Sonoco:Hartsville	SC	Darlington Co	Hartsville	1996	2631 - Paperboard Mills
664	0.5	International Paper:Georgetown	SC	Georgetow n Co	Georgetown	1996	2611 - Pulp Mills
603	0.45	Willamette:Bennettsvil le Pulp	SC	Marlboro Co	Bennettsvill e	1996	2611 - Pulp Mills
430	0.32	Galey&Lord:Society Hill	SC	Darlington Co	Society Hill	1996	2262 - Finishing Plants, Synthetics
388	0.29	Georgetown Steel	SC	Georgetow n Co	Georgetown	1996	3312 - Blast Furnaces And Steel Mills

NO ₂ (Tons/ Year)	% of Total Emissions	Facility Name	State	County	City	Inventory Year	Industrial Classification
373	0.28	Foster Wheeler	SC	Charleston Co	North Charleston	1996	4953 - Refuse Systems
326	0.24	Savannah R Pl:Main	SC	Aiken Co	Aiken	1996	2819 - Industrial Inorganic Chemicals
318	0.24	Owens Corning:Anderson	SC	Anderson Co	Anderson	1995	3229 - Pressed And Blown Glass, Nec
295	0.22	Dupont,Ei:Cooper River	SC	Berkeley Co	Berkeley	1996	2821 - Plastics Materials And Resins
292	0.22	Cummins Engine:Old	SC	Charleston Co	Charleston	1996	8731 - Commercial Physical Research
290	0.22	Delta Mills:Delta #3	SC	Marlboro Co	Wallace	1996	2261 - Finishing Plants, Cotton
229	0.17	Avondale Mills:Stevens	SC	Aiken Co	Graniteville	1996	2211 - Weaving Mills, Cotton
227	0.17	Cone Mills:Carlisle	SC	Union Co	Carlisle	1996	2261 - Finishing Plants, Cotton
209	0.16	Wellman Ind:Palmetto	SC	Darlington Co	Darlington	1996	2824 - Organic Fibers, Noncellulosic
200	0.15	Milliken:Magnolia	SC	Cherokee Co	Blacksburg	1995	2261 - Finishing Plants, Cotton
191	0.14	Amoco Chemical	SC	Berkeley Co	Cainhoy	1995	2869 - Industrial Organic Chemicals,Nec
187	0.14	Johns Manville Inc:Spartanbg	SC	Spartanbur g Co	Spartanbur g	1996	2824 - Organic Fibers, Noncellulosic
184	0.14	Dupont,Ei:Florence	SC	Florence Co	Florence	1996	2821 - Plastics Materials And Resins
168	0.13	Us Mc:Recruit Depot	SC	Beaufort Co	Parris Island	1996	9711 - National Security
155	0.12	Amoco Polymers:Greenville	SC	Greenville Co	Piedmont	1995	2824 - Organic Fibers, Noncellulosic
141	0.11	Richtex Corp:Columbia	SC	Richland Co	Columbia	1996	3259 - Structural Clay Products, Nec
124	0.09	Sce&G:Hagood	SC	Charleston Co	Charleston	1996	4911 - Electric Services
124	0.09	Smi Steel Sc	SC	Lexington Co	Cayce	1995	3312 - Blast Furnaces And Steel Mills
124	0.09	Santee Print Works	SC	Sumter Co	Sumter	1996	2261 - Finishing Plants, Cotton
122	0.09	Us Finishing	SC	Greenville Co	Greenville	1996	2261 - Finishing Plants, Cotton
114	0.09	Orangeburg Util Dept	SC	Orangebur g Co	Orangeburg	1996	4911 - Electric Services
113	0.08	York Printing & Finishing	SC	York Co	Rock Hill	1996	2262 - Finishing Plants, Synthetics
110	0.08	Clemson University	SC	Pickens Co	Clemson	1996	8211 - Elementary And Secondary Schools
108	0.08	Willamette:Chester	SC	Chester Co	Chester	1996	2436 - Softwood Veneer And Plywood
105	0.08	Allied Terminal:Greenleaf	SC	Charleston Co	Charleston	1991	4226 - Special Warehousing & Storage
103	0.08	International Paper:Hampton	SC	Hampton Co	Hampton	1996	3083 - Laminated Plastics Plate And Sheet

APPENDIX C: NPS GUIDANCE FOR OZONE HEALTH ADVISORY PROGRAM

NATIONAL PARK SERVICE (NPS) GUIDANCE FOR OZONE HEALTH ADVISORY PROGRAMS (March 1999)

In July 1997, the Environmental Protection Agency (EPA) established a new federal public health standard for ozone. The new standard is based on an 8-hour average concentration set at 0.08 parts per million (ppm), which is significantly more stringent than the old standard based on a 1-hour concentration set at 0.12 ppm. (Note: due to rounding, EPA considers an exceedance of the 8-hour standard when the ozone concentration reaches 0.085 ppm, or 85 parts per billion (ppb).) The EPA has also proposed rules for air quality index reporting (Federal Register Notice Volume 63, Number 236, 12/9/98). The EPA proposes to change the uniform air quality index used by States, and includes a sub-index for 8-hour ozone concentrations. The following guidance is generally consistent with the changes EPA is proposing for notifying the public about air pollution conditions.

Ozone is formed by chemical reactions between volatile organic compounds (VOCs) and oxides of nitrogen in the presence of sunlight and elevated temperatures. The primary manmade sources of VOCs and nitrogen oxides are industrial and automobile emissions. Ozone is a colorless gas that exists naturally in the stratosphere where it shields the Earth from the sun's harmful ultraviolet rays. However, ozone close to the Earth's surface is an air pollutant. Ozone concentrations can be transported hundreds of miles and affect remote areas of the country. High concentrations of ozone can cause inflammation and irritation of the respiratory tract, particularly during heavy physical activity. The resulting symptoms may include pain when taking a deep breath, coughing, throat irritation, and breathing difficulties. High concentrations of ozone can affect lung function and worsen asthma attacks. Exposure to ozone can damage lung tissue and increase the susceptibility of the lungs to infections, allergens, and other air pollutants. Medical studies have shown that health problems caused by ozone may continue long after exposure has ended. Because many NPS areas have exceeded, or are approaching, the health-based ozone standard, the following guidance is provided to ensure Servicewide consistency in dealing with this pervasive problem.

Guidance for NPS Areas with Ozone Monitors

This guidance describes procedures for notifying park visitors and employees of unhealthy ozone levels at NPS areas with ozone monitoring equipment. When hourly or 8-hour ozone averages are 0 to 84 ppb, conditions are good or moderate and no advisories are necessary. In most cases it is well into the late afternoon or evening before the calculated 8-hour average ozone concentration exceeds the standard. The objective is to provide employees and visitors timely notification of when the ozone is reasonably expected to reach unhealthy conditions. Therefore, the advisory procedures include three

consecutive hourly values as an indicator of when the 8-hour level would likely be exceeded. An advisory should be issued when any one of the following conditions occurs:

- ✓ When three consecutive hourly ozone values measured in the NPS area are 85 ppb or greater, issue an advisory for ozone sensitive group. (See Table 1.)
- ✓ When an 8-hour average ozone value measured in the NPS area is 85–104 ppb, issue an advisory for ozone sensitive group. (See Table 1.)
- ✓ When three consecutive hourly ozone values measured in the NPS area are 105 ppb or greater, issue an advisory for the general public. (See Table 1.)
- ✓ When an 8-hour average ozone value measured in the NPS area is 105 ppb or greater, issue an advisory for the general public. (See Table 1.)

Certain groups may be sensitive or particularly at-risk to the effects of ozone due to inherent sensitivity, medical conditions and exposure conditions. Therefore, EPA recommends ozone sensitive groups be notified when the 8-hour average ozone concentration is 85 to 104 ppb. Therefore, in NPS areas, an advisory should be issued for sensitive groups when the 8-hour average ozone values are 85 to 104 ppb. In addition, an **advisory** should also be issued when three consecutive hourly indicator values of 85 ppb or greater occur. Sensitive groups include active children and outdoor workers who regularly engage in outdoor activities and people with preexisting respiratory disease (e.g., asthma, chronic obstructive lung disease). Some individuals within these groups are unusually responsive to ozone and may experience much greater functional and symptomatic effects from exposure to ozone than the average person in the group. When 8-hour average ozone values of 105 ppb or greater or three consecutive hourly indicator values of 105 ppb or greater occurs, an advisory should be issued for the general public. See Table 1.

Park staff should coordinate the ozone advisory program during the average ozone season (April 1 through October 31) each year. Ozone conditions should be checked daily from the monitors located in the park and advisories issued as detailed below. If more than one ozone monitor is located within an NPS area and only one of the monitors measures one of the four occurrences listed above, the entire area should be included in the health advisory. Although ozone concentrations can reach unhealthy levels anytime during the day or night, tracking and reporting of unhealthy ozone conditions should be done during the day because visitor activity is highest and most park employees are at work. If any of the four ozone levels is measured in the morning, the advisory should be issued for the entire day. If any of these conditions are measured late in the afternoon and the forecasted weather includes high temperatures and air stagnation, such that unhealthy ozone concentrations could be anticipated, the advisory should then be issued for the evening and next day. The advisory should remain in effect until park staff cancels it due to

improved conditions. On weekends/holidays, park dispatch or other extended hour employees may be advised to review ozone conditions and follow procedures for initiating an advisory. All park supervisors and staff should be aware of how ozone affects people (pain when taking a deep breath, shortness of breath, coughing, wheezing, and scratchy eyes, nose and throat) and the different types of people at risk (people with pre-existing respiratory disease, such as asthma, and active children and adults). Park staff responsible for the ozone advisory program should be familiar with the operation and maintenance of the ozone monitoring equipment in the park. Park staff responsible for the advisory program should be able to read and interpret the data collected by the monitor and provide information to park managers concerning unhealthy ozone levels and the need for a health advisory. These individuals should respond to public inquiries and inform the State health department, State air quality regulatory authorities, and the Air Resources Division (ARD), of the issuance of the health advisory at the NPS area.

In issuing an advisory the following procedures should be initiated.

- ✓ Park staff should notify park communications and the advisory should be broadcast in a parkwide administrative message, advising affected groups of employees of unhealthy ozone conditions. See Table 1 for sample message to employees. Supervisors should advise staff of appropriate precautions to take while at work during the ozone health advisory. Options available to Supervisors include rescheduling physical activities and limiting the types and intensity of work (e.g. more frequent rest breaks, easy to moderate exertion activities that do not require accelerated heart rates and heavy breathing). Restricted activities will depend in part on the physical and medical conditions of individual employees.
- ✓ Public notification should be provided through notices at entrance stations and visitor centers. See Table 1 for sample messages to park visitors.
- ✓ Park staff should also notify the Public Affairs Officer at the park, State health department, and the ARD of the unhealthy levels. A press release may also be issued to the media, with information concerning the reason for the advisory at the park and anticipated duration of the advisory. Park staff may also send out electronic mail to park employees, informing them that a health advisory was issued.

Guidance for NPS Areas without Ozone Monitors

This guidance describes procedures for notifying park visitors and employees of unhealthy ozone levels at NPS areas without ozone monitoring equipment. The park should contact the State health department or air quality regulatory authority and determine if the park is included in the area covered by the State ozone health advisory. If so, the park should issue an advisory for the applicable group (i.e., sensitive group or general public). The attached map shows those areas most likely to require

coordination with the State health department. Park staff should coordinate the ozone advisory program during the average ozone season (April 1 through October 31) each year. If ozone levels reach unhealthy levels, health advisory notifications should be posted during the day to coincide with highest visitor activity and normal working hours of most park employees. If the average ozone level is unhealthy in the morning, the advisory should be issued for the entire day. If the average ozone level is unhealthy late in the afternoon and the forecasted weather includes high temperatures and air stagnation, such that unhealthy ozone concentrations should be anticipated, the advisory should then be issued for the evening and next day. On weekends/holidays, park dispatch or other extended hour employees may be advised to follow procedures for initiating an advisory. When the State discontinues its health advisory the park should also cancel their advisory.

When an advisory is issued follow the same procedures identified above in the Guidance for NPS Areas with Ozone Monitors section. (See Table 1.)

The ARD will be available for consultation and review of ozone health advisory programs developed by NPS areas.

Table 1. National Park Service Ozone Health Advisory Guidance

Ozone Value	Descriptor	Group Notified	Sample Message
0 – 64 ppb (hourly or 8-hour average)	Good	None	None
65 – 84 ppb (hourly or 8-hour average)	Moderate	None	None

85 – 104 ppb (8-hour average) or if three consecutive hours of 85 ppb or greater occurs	Unhealthy for Sensitive Groups	Sensitive Groups	Employees: “Ozone pollution conditions in the park have reached or are expected to reach unhealthy levels for sensitive groups. An ozone health advisory has been issued for today (or tomorrow). Sensitive groups at increased risk to ozone effects include outdoor workers who regularly engage in outdoor activities and people with preexisting respiratory diseases (e.g., asthma, chronic obstructive lung disease). This sensitive group should avoid strenuous or prolonged moderate outdoor activities and should limit their exposure until levels have dropped below unhealthy levels. Please consult your supervisor for guidance on work activities.” Visitors: “Unhealthy ozone levels for sensitive groups have or are expected to occur today. Sensitive groups at increased risk to ozone effects include active children and people who regularly engage in outdoor activities and people with preexisting respiratory diseases (e.g., asthma, chronic obstructive lung disease) This sensitive group should limit their exposure by reducing the duration or intensity of physical exertion or by rescheduling activities until levels have dropped below unhealthy levels.”
105 ppb or greater (8-hour average) or if three consecutive hours of 105 ppb or greater occurs	Unhealthy	General Public	Employees: “Ozone pollution conditions in the park have or are expected to reach unhealthy levels. An ozone health advisory has been issued for today (or tomorrow). All park employees should avoid strenuous or prolonged moderate exertion outdoors. All employees should limit their exposure and outside physical activities until levels have dropped below unhealthy levels. Please consult your supervisor for guidance on work activities.” Visitors: “Unhealthy ozone levels have or are expected to occur today. This may cause irritation to lungs and discomfort in breathing for healthy individuals and more pronounced symptoms in people with respiratory disease, such as asthma. Individuals should limit their exposure by reducing the duration or intensity of physical exertion or by rescheduling outside physical activities until levels have dropped below unhealthy levels.”