U.S. Department of the Interior

National Park Service

Air Quality Monitoring Protocol for

Denali National Park & Preserve, Alaska

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Please note: the Denali National Park & Preserve air quality monitoring protocol consists of this protocol narrative and the following Standard Operating Procedures (SOPs):

- SOP 1: Implementation of Nationwide Air Quality Monitoring Network Programs in Denali National Park & Preserve
- SOP 2: NADP National Trends Network Site Operation Manual
- SOP 3: Version II IMPROVE Sampler Operating Procedures Manual
- SOP 4: Site Operator Standard Operating Procedures for Ozone, Clean Air Status and Trends Network (CASTNet), and Meteorological Instruments
- SOP 5: Denali Backup Site Operator Instructions
- SOP 6: Data Review

Table of Contents

I. Background and Objectives

Air quality monitoring in Denali National Park & Preserve began in 1980, as part of the National Park Service (NPS) nationwide air quality monitoring program. Over the years, instruments were added to the monitoring station when the NPS and other agencies worked together to develop nationwide air quality monitoring networks to address specific air quality concerns. Denali currently participates in four nationwide air quality monitoring networks, three of which are interagency programs. These networks are:

1. National Atmospheric Deposition Program **(NADP)**
2. Interagency Monitoring of Protected Visual Environments **(IMPROVE)**
3. NPS Gaseous Pollutant Monitoring Network **(ozone monitoring)**
4. Clean Air Status and Trends Network **(CASTNet)**

The National Atmospheric Deposition Program (NADP), established to track acid precipitation throughout the nation, was the first program represented in Denali. NADP instruments were installed near park headquarters in June 1980. In August 1986, a stacked filter unit aerosol sampler was installed near the NADP instruments as a precursor to aerosol sampling conducted by the IMPROVE network. In July 1987 continuous ozone and meteorological monitoring began through the NPS nationwide gaseous pollutant monitoring network, and the stacked filter unit was replaced by a full set of IMPROVE aerosol samplers the following March. The EPA Clean Air Status and Trends Network (CASTNet), formerly named the National Dry Deposition Network, began sampling sulfur and nitrogen compounds in July 1998.

In 1992, when Denali became a prototype park under the NPS Inventory and Monitoring (I&M) Program, the existing air quality monitoring program was identified as one of several monitoring

components. Independent of funding, for the most part, air quality monitoring has remained a part of the I&M program as it has evolved from a single-park Inventory and Monitoring Program, to a single-park Long-Term Ecological Monitoring Program, to one of three parks in the Central Alaska Inventory and Monitoring Network.

Objectives

The specific objectives of each NPS and interagency air quality monitoring network differ somewhat, but the overall objective of each is the same: *to track the spatial and temporal trends of airborne contaminant concentrations through a nationwide array of monitoring stations.*

II. Sample Design

The Denali air quality monitoring program is fully integrated into a continental scale sample design implemented by each nationwide air quality monitoring network. Until recently, with an increase in funding through the Natural Resource Challenge, NPS monitoring stations were generally located in areas designated as Class I under the Clean Air Act, such as Denali. The station near park headquarters was the only long term NPS air quality monitoring station in Alaska for the first two decades of sampling. Spatial coverage in Alaska expanded significantly in May 2004 when a long term NPS air quality monitoring station was established in the Arctic Inventory and Monitoring Network, near Kobuk Valley National Park.

In September 2001, the interagency IMPROVE steering committee established a monitoring station in Trapper Creek, Alaska, 23 miles south of the park boundary. There are no projections at this time whether or not funding for this station will continue to be sustained in the long term by the IMPROVE program.

III. Methods

Each nationwide air quality monitoring network establishes its own standardized sampling and analytical methods, which are peer reviewed during program development. Subsequent method changes are reviewed by scientists from all agencies represented in the networks, generally through formal steering committee participation. The network protocols therefore serve as the park air quality monitoring protocols. These are included as SOPs 2 through 4. SOP 1 is an overview of nationwide network protocol implementation within the park, and SOP 5 is a park-specific document designed to enhance data collection continuity when backup site operators conduct sample changes. SOP 6 describes park-level review of air quality and meteorological data.

Nationwide Air Quality Monitoring Networks

1. NADP

Weekly precipitation samples are collected using an Aerochem Metrics collector. The samples are processed in the park laboratory, measured for pH and specific conductance, then sent to the

network laboratory in Illinois. The network laboratory remeasures pH and specific conductance, and analyzes for the following chemical species: Ca, Mg, K, Na, NH_4, NO_3, Cl, SO_4, and PO_4.

The site also contains a Belfort Recording Rain Gauge, to measure the amount of precipitation and record when the precipitation collector is in sampling mode.

A site audit is conducted once every three years by a network contractor, to calibrate instruments and observe site operator techniques. Park personnel assist with annual blind audits of the network analytical laboratory, and test park laboratory analyses twice a year through network intersite comparison checks.

2. IMPROVE

Once every three days, air is automatically pumped through filters in four IMPROVE modules, three of which sample aerosols that are 2.5 micrometers and smaller. The fourth sampler collects aerosols with a cutoff size of 10 micrometers. One set of four filters samples aerosols for 24 hours, then three days later another set of filters collects a 24 hour sample. The filters are exchanged with new ones each week. The exposed filters are shipped to the network laboratory in California, where they are analyzed for mass, elemental and organic carbon, SO_2, NO_3, elements Na - Pb, H, N, and PM10 mass.

The IMPROVE modules are calibrated and maintained once a year by network representatives.

3. Ozone Monitoring

Ground level ozone is measured continuously and averaged hourly. The following meteorological parameters are also measured: precipitation, temperature, delta temperature, relative humidity, solar radiation, wind speed, and wind direction.

Instruments are checked weekly by site operators, and calibrated twice a year by network contractors.

4. CASTNet

Weekly samples of the following chemical species are collected on filters: particulate sulfate, sulfur dioxide, particulate nitrate, nitric acid, and ammonium. Exposed filters are shipped to the contracting laboratory for chemical analysis.

Instruments are calibrated twice a year by network contractors.

IV. Data Management, Analysis, and Reporting

Data for each nationwide monitoring network are collected, validated, and archived by network personnel. Data quality assurance and quality control standards are determined at the nationwide network level. Although copies of all datasets are kept at Denali, they are not considered to be archival copies.

Each nationwide monitoring network also analyzes and reports the data. The IMPROVE network publishes data synthesis reports once every three years, and the other networks produce annual data summaries. Spatial and temporal trends are reported to varying degrees by the networks. In 2002 the NPS Air Resources Division published *Air Quality in the National Parks*, a comprehensive overview of nationwide air quality, incorporating data from each monitoring network.

Reports and validated data are available online at the following monitoring network web sites:

NADP
http://nadp.sws.uiuc.edu/

IMPROVE
http://vista.cira.colostate.edu/improve/

NPS ozone monitoring
http://www2.nature.nps.gov/ard/gas/

CASTNet
http://www.epa.gov/castnet/

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