MONITORING OF AIR QUALITY IN NATIONAL PARKS

Background

Since the late 1970s, the National Park Service has maintained a network of air quality monitoring stations to monitor the conditions of visibility and ambient levels of fine particles, ozone, sulfur dioxide, and acid precipitation in national parks. The monitoring of visibility including photographic and optical monitoring and the sampling of fine particles is part of the Interagency Monitoring of Protected Visual Environments (IMPROVE), the national visibility monitoring cooperative between EPA (The U.S. Environmental Protection Agency) and the federal land managing agencies. The monitoring of acid precipitation is part of the participation by the National Park Service in the National Atmospheric Deposition Program/National Trends Network (NADP/NTN) that is coordinated by the Colorado State University. The service developed its own network for the monitoring of gaseous pollutants and meteorology, although a few states supplement them in a few locations. The data from the networks are essential for understanding the effects of air pollutants on the ecosystems in parks that were previously presumed to be relatively free of anthropogenic stresses. Before the networks were established, relatively little monitoring was conducted in national parks or in rural areas of this country. The priority of EPA and the states was the protection of public health in urban areas from unhealthy levels of air pollutants such as ozone, particulate matter (dust), and carbon monoxide. The same pollutants, however, can cause damage or injury to natural and cultural resources in parks at levels below those typically measured in urban areas.

Additional funding by the U. S. Congress in 1986 and 1987 allowed the expansion of the monitoring network of the National Park Service and the establishment of a center to process, validate, and archive data. The service complies with quality assurance requirements for the collection of ambient air data, and its data are used by EPA and states for regulatory purposes. However, since 1993, budget limitations forced the service to reduce its external quality assurance audit program, reduce the number locations in which monitoring was conducted, or eliminate some types of monitoring throughout the network. Ozone and sulfur dioxide levels and meteorological data are now entered into a national database of the EPA for use by the EPA, state agencies, and researchers. Visibility and acid precipitation data are made available on the Internet.

Current Status: Visibility

The National Park Service has monitored visibility in many parks since 1978. In fact, until 1987 when IMPROVE became operational, the visibility monitoring program of the National Park Service was the only source of information on visibility in Class I areas in the United States. Monitoring of visibility includes the monitoring of photographic vistas or scenes (photographic or scene monitoring) and of atmospheric extinction (optical

monitoring) and the sampling of fine particles. Photographic monitoring documents the conditions of vistas in parks three times a day with a 35-mm camera. Occasionally, 8-mm time-lapse photography is also used for the monitoring of vistas. The use of photographs with other data from visibility monitoring enables the National Park Service to document the effects of low, average, and high levels of air pollution on specific scenic vistas. Budget limitations forced the service to terminate the monitoring of most scenes in 1995.

Optical monitoring is performed with a transmissometer that measures total atmospheric extinction or with a nephelometer that measures only the scattering fraction of atmospheric extinction. This monitoring provides a continuous record of hourly conditions of visibility in parks.

Fine particle sampling allows the determination of the causes, i.e., the source types or the source regions, of the observed impairment of visibility in parks. Fine particle samples are collected twice weekly in each monitoring location.

Gaseous Pollutants

Because of the toxicity of ozone and sulfur dioxide to vegetation and other resources, the National Park Service monitors these pollutants throughout the National Park System. Before 1983, the service relied on state agencies for the monitoring of gaseous pollutants in parks. However, only a few states monitored ozone or sulfur dioxide, and the service therefore had little to no data on the levels of these pollutants. Since 1983, the National Park Service developed a nationwide network of stations to monitor gaseous pollutants and atmospheric and weather conditions for the evaluation of air quality in selected parks. Ozone and, in some areas, sulfur dioxide are continuously monitored according to EPA protocol and with sophisticated instrumentation in temperature-controlled shelters. In a few special cases, ozone precursors (nitrogen oxides and volatile organic compounds) are also measured in this fashion. Sulfur dioxide is measured also on a time-integrated basis. The sampling duration is either 24 hours or one week. Recently, the service experimented with passive samplers for the measurement of ozone, sulfur dioxide, and nitrogen oxides. These samplers provide weekly integrated samples, although the samplers can be used for shorter durations.

In late 1993, the National Park Service entered a partnership with EPA to merge the western portion of its gaseous pollutant network with the EPA National Dry Deposition Network. Although the merger did not increase the number of monitoring locations, it provided for the measurement of additional pollutants in eighteen areas and additional support to the service for data analysis.

Since 1993, continued erosion of its budget from inflation has forced the National Park Service to curtail its monitoring. Monitoring was terminated in fourteen parks and not initiated in seven parks.

Acid precipitation

Acid precipitation in parks has been sampled weekly with wet/dry collectors since 1978. The collectors sample precipitation by event, i.e., the wet collector opens only during precipitation. Samples are sent to a central analytical laboratory for chemical analysis of important analytes such as sulfate, nitrate, pH, sodium, calcium, and ammonium. Historically, the service has funded eighteen of the twenty-nine acid precipitation stations in national parks that are part of the NADP/NTN network (total of 200 stations in the United States). Since1993, however, the service has had to assume funding for stations in parks that were once funded by the Bureau of Land Management (three stations), the state of Maine (one station), and Indiana Dunes National Lakeshore to preserve the long-term record in these locations. A recent study by the service revealed that the stations make a significant contribution to the overall ability of the NADP/NTN network to characterize spatial trends in precipitation chemistry across the United States. Budget limitations, however, may force the service to discontinue its present level of commitment to acid precipitation sampling in parks and to the national program.

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