National Park Service
Gaseous Pollutant Monitoring Program

The
Monitor

For National Park Service
Air Quality Station Operators

FALL 2002

NETWORK NEWS

Monitoring network continues to expand

The NPS ARD added new monitoring locations to the Gaseous Pollutant Monitoring Program network this summer, including: Yosemite Valley, Isle Royale, and Petrified Forest. Additional instrumentation was installed at Mammoth Cave, Wind Cave, and Shenandoah (see *The Monitor,* Spring 2002). Further network expansion is planned for FY 2003 and will include:

- New sites that will receive ozone, meteorology, and CASTNet filter pack equipment are:
  - Badlands National Park, SD
  - Black Canyon of the Gunnison NP, CO
  - Lake Mead National Recreation Area, AZ/NV
- Existing sites that will receive an NADP wet deposition sampler are:
  - Redwood National Park, CA
  - Three unnamed locations
- Existing sites that will receive a mercury deposition sampler are:
  - Shenandoah National Park, VA
  - Sequoia National Park, CA
  - Glacier National Park, MT

Most of the FY2002 expansion has been accomplished. The two remaining new sites that have not yet been installed are:

- Western Arctic National Park, AK
  The meteorological, wet deposition mercury sampling, dry deposition filter pack, and IMPROVE monitoring station installation has been delayed until FY 2003. The site location has been selected and utility hook-ups are in the works.
- Zion National Park, UT
  The park is working on the final site approval.

NPS ARD hosts Air Quality Summit 2002

The National Park Service Air Resources Division hosted its second air quality summit in October, in Estes Park, Colorado, home of Rocky Mountain National Park. The four-day summit brought air resource managers and personnel from all over the U.S. Over 70 people from the NPS attended, and listened to presentations, discussions, and viewed posters and demonstrations.

The purpose of the summit was to share information about air quality issues and air resources management activities. Topics covered included Air Quality 101 (a mini-course for new staff) and PRIMENet discussion, an update on monitoring and research projects, working with inventory and monitoring networks, information for park planning and activities, impairment criteria, park-specific successes and outreach, legislative and policy update, and how the NPS can more effectively use information and resources to protect park resources.

Summit attendees also participated in several social events and field trips. The field trips included presentations on projects specific to Rocky Mountain National Park.

What's inside:

Portable air quality station now a monitoring option

At the direction of John Ray (NPS ARD), ARS has developed and constructed a portable air quality station. The station is solar and battery powered and is intended for seasonal use at locations where conventional monitoring is either not warranted or not practical.

The portable station may include any or all of the following measurement types: continuous ozone, meteorological, and CASTNet filter pack. The continuous ozone data is provided by a 2B Technology's ozone monitor (*http://www.twobtech.com*). Because this analyzer is not EPA certified, data from the instrument cannot be entered into AIRS, or used for any regulatory or compliance purposes. This continuous analyzer is a miniaturized version of a traditional photometric ozone analyzer and was designed for low power operation. A Campbell Scientific 23X datalogger provides data collection and station management.

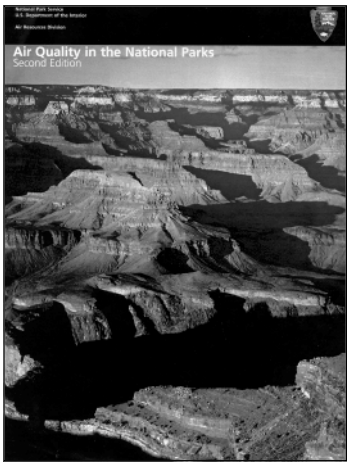
This past summer the portable air quality station has been operating alongside the traditional station at the Rocky Mountain National Park monitoring site. It has taken a full spectrum of measurements, including: ozone, air temperature, relative humidity, wind speed, wind direction, precipitation, solar radiation, and dry deposition.

The portable air quality station was tested at Rocky Mountain National Park. The inset photograph shows the inside of the datalogger box, containing two 2B ozone analyzers and a Campbell Scientific 23X datalogger.

Equipped with two 2B ozone analyzers, the station operated one analyzer in continuous mode and the other at various scheduled times as a quality assurance check.

The portable station has recently been relocated to ARS for further testing and final modifications. It will eventually be deployed at a remote park location.

National Park Service releases 10-year report



The National Park Service Air Resources Division has released a comprehensive 10-year report, *Air Quality in the National Parks - Second Edition*. This 59-page document presents current visibility and air quality conditions and trends, and summarizes National Park Service findings using visibility, atmospheric deposition, and ozone data collected during 1990-1999. It also discusses the importance of the air quality resource in our nation's parks as well as future challenges and strategies the National Park Services will have to face.

The first edition of *Air Quality in the National Parks* was released in 1988. This second edition is now available on the Internet at *http://www2.nature.nps.gov/ard/pubs/aqnps.htm*. Hard copies may be requested from:

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***NETWORK NEWS** continued on page 7....*

STATION OPERATOR FOCUS

Mark Romanski mingles with the wildlife at Isle Royale National Park

Isle Royale National Park, in Lake Superior, receives about 15,000 - 18,000 recreational visitors annually, and like most of them, station operator Mark Romanski mingles with the many species of wildlife.

Mark joined Isle Royale in the summer of 1996. His duties as a Biological Science Technician include much more than servicing the ambient air quality station. “I coordinate various wildlife and plant surveys at the park,” said Mark. “I also conduct non-native plant removal, collect and compile visitor statistics, and much, much more.”

Every Tuesday, Mark hikes up to the ambient air quality station located in the Ojibway Tower, an old fire lookout. The solar powered tower houses a 2B Technologies, Inc. ozone monitor, meteorological sensors (air temperature, relative humidity, wind speed, wind direction, and precipitation), and a CASTNet filter pack system. Upgraded instrumentation and the ozone monitor were installed this past July when Isle Royale rejoined the NPS network.

Ojibway Tower is on the main island of this wilderness archipelago containing over 400 islands. Park headquarters is on another, and some park personnel live on yet another island. The park’s remote location and severe winter make it one of the toughest monitoring sites to access. “Winter servicing of the ambient air quality site is not usually performed, however, I manage one trip each winter during the annual wolf/moose-predator/prey research program to exchange storage modules and make sure all is still intact,” said Mark, “the instruments log their data until spring when the park reopens and operations resume.”

Biological Science Technician Mark Romanski boats from one island to another to perform his park duties at Isle Royale.

Isle Royale is the only park where Mark has worked. He earned a B.S. degree in Biology from the University of Wisconsin - Stevens Point. There he also minored in Chemistry and majored in the German language.

In his off-time Mark kayaks, hikes, birdwatches, and fishes -- just a few of the favorite features that Isle Royale offers.

Ojibway Tower has housed air monitoring instrumentation since 1987.

DATA COLLECTION SUMMARY

Data collection statistics for January through June 2002 are listed below.

- Sites with at least 90% collection (final validation of ambient air quality parameters) include:
  - Acadia
  - Craters of the Moon
  - Denali
  - Death Valley
  - Everglades
  - Glacier
  - Grand Canyon
  - Great Smoky Mtns.
    - Cades Cove
    - Clingman’s Dome
    - Cove Mountain
    - Look Rock
  - Joshua Tree
  - Mammoth Cave
  - Mount Rainier
  - Olympic
  - Pinnacles
  - Rocky Mountain
  - Sequoia-Kings Canyon
    - Ash Mountain
    - Lower Kaweah
    - Lookout Point
  - Shenandoah
  - Theodore Roosevelt
  - Virgin Islands
  - Yellowstone
  - Yosemite
- Sites with at least 80% collection (final validation of ambient air quality parameters) include:
  - Big Bend
  - Canyonlands
  - Chiricahua
  - Great Basin
  - Hawaii Volcanoes
    - Observatory
    - Thurston Lava Tubes
    - Visitor’s Center
  - Lassen Volcanic
  - Mesa Verde
  - North Cascades
  - Voyageurs
- Sites less than 80% collection (final validation of ambient air quality parameters) include:
  - -- None --
- The entire network achieved an average of 91.5% final validation of ambient air quality parameters.

FEATURE ARTICLE

Data losses happen -- the whys of data losses and data validation adjustments

In an ideal world, all stations would report 100% valid data each month. A variety of situations occur, however, that can result in periods of invalid data. Some of the reasons you may have noticed invalid data in the monthly or annual reports prepared for your site are discussed below.

Why data losses occur

The Gaseous Pollutant Monitoring Program (GPMP) continuously generates nearly 15,000 hourly averaged data points each day. All these data are retrieved daily from network sites and loaded into an Oracle database. At this point the data are available for plotting and reviewing by both ARS' Information Management Center (IMC) staff and the individual field specialists. Review personnel try to keep data invalidation to a minimum, but some losses can occur at even the most carefully attended stations.

Data losses occur due to a variety of reasons, and in some cases the losses are even planned. Approximately 3 percent data loss is due to scheduled instrument checks on gas analyzers such as automated zero and span checks, multipoints and other maintenance. Unscheduled events, such as instrument malfunctions, power failures, or operator errors account for the rest of the missing data. Unfortunately, many hours of data are invalidated weeks or months after the data are collected, due to analyzer malfunctions that are not immediately obvious or due to unacceptable conditions found during twice-annual site visits. During validation, the IMC staff at ARS code these invalid periods to identify the reason for the data loss. The most frequent reasons for unscheduled data loss are instrument malfunction, followed by power failures, temperature out of tolerance, and operator errors.

Validation philosophy

Other networks may boast a high data capture, and calculate the value to favor that end, however, the NPS network has always preferred "quality over quantity" and has guarded against compromising data just to increase data capture. The general philosophy around the IMC is, "When in doubt, throw it out". So, when data losses do occur, there is rarely much that can be done.

There are some situations, however, where "missing" data may be recovered. Obviously, data missing due to an instrument malfunction is not recoverable. Occasionally, however, substitute data is inserted where duplicate measurements exist that are known to be of high quality. It has been the philosophy of this network to invalidate data that do not meet quality control requirements. Therefore, data "corrections" or adjustments are rarely made. These quality control checks occur nightly in the case of a gas analyzer and weekly and during semiannual maintenance for meteorological and all remaining instruments. Situations that may allow data adjustment include documented evidence of when an instrument was out of tolerance and how far out of tolerance.

For example, if a wind direction sensor failed, was replaced by a site operator, and was discovered to be out of alignment during the next semiannual calibration, data from the replacement time to the twice-annual visit could be adjusted for the alignment offset. This adjustment would only occur if the site documentation and data support the adjustment. This type of data adjustment occurs only rarely and only with significant documentation for support.

Improving data capture

Generally speaking, data sets are considered acceptable when at least 80% of the gaseous analyzer data and 90% (on an annual basis) of the meteorological data are reported as valid. Overall, the NPS Gaseous Pollutant Monitoring Program had a 90% valid data for 2001 for gaseous analyzer measurements and 96% for meteorological data, with most sites achieving the 80% and 90% acceptable guidelines. Although these percentages are acceptable, there are several ways everyone can contribute to increased data capture.

ARS is simplifying the intake manifold system, and updating continuous analyzers as funds allow. These efforts may help decrease data loss due to manifold leaks and instrument malfunctions, some of which are not obvious until weeks after the loss occurs. Site operators can continue to faithfully complete station checks, review the digital stripchart record within DataView weekly, and promptly report any out of tolerance or suspicious measurements.

OPERATOR'S TOOLBOX
DataView system maintenance

Your DataView system does more than allow you to log your weekly station checks. It also stores an incredible amount of your station's data, and sometimes the system may bog down and respond slowly. Here's how the DataView system works, and why it may respond slowly at times.

The DataView Data Acquisition Module (DVDAS) retrieves the most recent 1-minute and 1-hour averages from the ESC8816 datalogger. These values are stored in a Microsoft Access database on the laptop. One-minute averages are stored for gases measured (including O3CAL) at ozone monitoring sites. One-hour averages are stored for all parameters acquired by the ESC8816 datalogger.

The amount of processing time required to manage the database increases as the database size increases. As the data management process takes more time, the computer will not have enough resources to handle the user interface or data acquisition. It is therefore necessary to limit the amount of data retained in the database; 100 days of data appears to be a practical limit for efficient and speedy data handling. The Database Maintenance Routine of DataView automatically deletes data older than 95 days from the database.

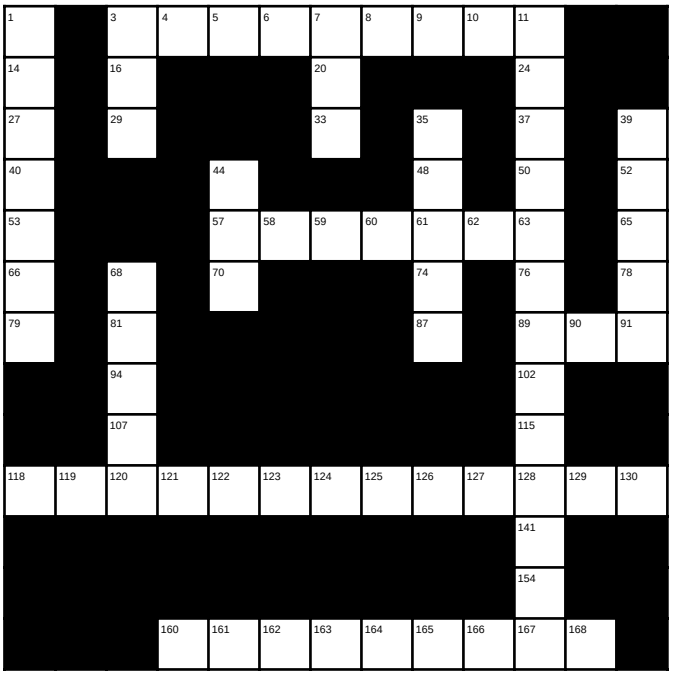
Another factor affecting the apparent speed of the DataView laptop computer is database efficiency. A Microsoft Access database becomes cluttered and fragmented over time as data are added and deleted, making it necessary to compact and reorganize the database periodically. This process is automatically done by the DataView Database Maintenance Routine as well.

An additional factor that affects the efficiency of the DataView laptop computer is the available memory (RAM). DataView laptops were originally purchased with 64MB of RAM. As the systems were deployed and data accumulated, it was determined that additional memory was required to efficiently run the computer. All air quality stations are being upgraded this year to 128MB of RAM during twice-annual site visits.

Diagnostic information from the Database Maintenance Routine is included in the DataView logs collected by IMC staff each week. IMC analysts review the logs and perform manual maintenance chores as required via dial-up PcAnywhere. IMC staff also perform a general software health check at each site at least monthly. A DataView status history database is maintained at the IMC to assist with preventive maintenance.

We will continue to track and adjust DataView to enhance its performance and welcome your comments and suggestions. Please call ARS at 1-800-344-5423 with any problem or concern you have with your DataView system.

PUZZLE PAGE



Across

3 All NPS relative humidity sensors are housed in what?

57 The AQ station at ISRO is located on what tower?

89 MEVE was evacuated how many hours after the fire was spotted?

118 What new site installation is delayed until FY2003?

160 Air Quality in the National Parks is how many pages?

Down

1 The DataView database becomes cluttered over time, making it necessary to _____ it periodically.

3 The portable AQ station was recently relocated where?

7 Who directed ARS to develop a portable AQ station?

11 The Air Quality Summit 2002 was held where?

35 _____ failures is one cause of data loss.

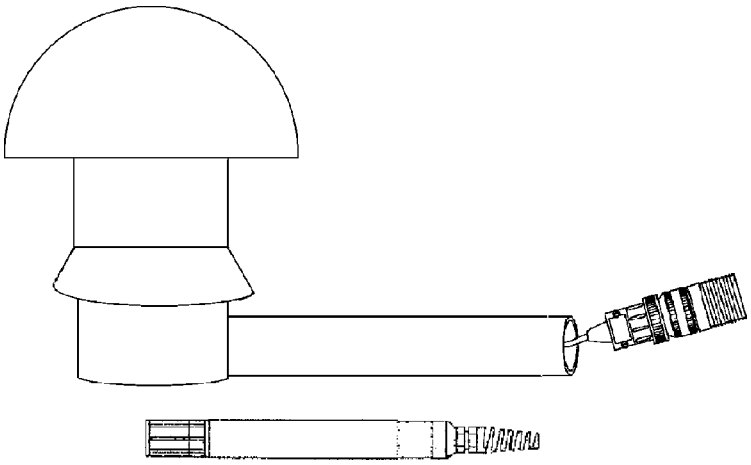
39 How many consecutive years are needed to calculate an 8-hour ozone standard?

44 Too much data on DataView may ____ down your system.

68 Data may be invalidated ____ after data collection.

HOW DOES THAT WORK?
Relative humidity sensors

The NPS network has a long history of air moisture measurements. Changes have occurred as new technology became available. Originally, the network was established with dewpoint sensors that measured air moisture by measuring the change in resistance in a cotton bobbin saturated with lithium chloride salt. As the salt absorbed or released moisture due to atmospheric conditions, the resistance within the bobbin would change. These sensors were sensitive to air pollution, and required frequent maintenance. Another generation of sensors was a relative humidity sensor built by Climatronics. Its operating principle was based upon the absorption of atmospheric moisture by a plant seed native to Africa. This organic sensor was very slow to respond to atmospheric changes. Currently, the network has converted all relative humidity measurements to Rotronics, Inc. probes. These probes utilize a variable capacitive element that reacts quickly and linearly to humidity changes. The probe is low power, and is relatively robust, however, the in-line cable connector has caused some difficulty. A similar product is made by Vaisala and is in use at some remote NPS sites. All probes are housed in an aspirator, which shields the probe from direct sunlight and precipitation. Most aspirators are powered, and continuously draw ambient air across the probe with a circulating fan. Some probes are housed in "naturally aspirated" aspirators, which rely on wind to move ambient air across the probe.



At most stations in the network, the relative humidity sensor is mounted horizontally in a domed housing, which is bolted to the meteorological tower.

How to calculate the 8-hour ozone standard

Two National Ambient Air Quality Standards (NAAQS) are established for ozone. The "primary" NAAQS is designed to protect human health while the "secondary" NAAQS is designed to protect the public welfare from adverse affects of the pollutant (e.g., affects on soils, water, crops, vegetation, human-made materials, animals, weather, visibility and climate, hazards to transportation, and effects on economic values and on personal comfort and well-being).

The primary and secondary ozone standards are identical and are set at an 8-hour average ozone concentration level of 0.08 ppm (80 ppb). These standards are attained when the annual 4th highest daily maximum 8-hour average ozone concentration, averaged over three years, does not exceed 0.08 ppm.

The 8-hour averages are computed from hourly ozone concentration data for each hour of the year; the result is stored in the start hour of the 8-hour period. An 8-hour average is considered valid if at least 75% of the hourly averages for the 8-hour period are available (i.e., at least 6 of the 8 averages). If less than 75% of the 8-hour averages are available, a day is still valid if the daily maximum 8-hour average concentrations for that day is greater than the level of the standard. There are 24 possible running 8-hour average ozone concentrations for each day of a calendar year. The daily maximum 8-hour concentration for a given day is the highest of the 24 possible 8-hour average concentrations computed for that day.

The 3-year average is computed using the three most recent, consecutive calendar years of monitoring data meeting the data completeness requirements. This requirement is met for the 3-year period if daily maximum 8-hour average concentrations are available for at least 90% of the days during the ozone monitoring season, with a minimum data completeness in any one year of at least 75% of the sampling days. But, calendar years with less than 75% data completeness shall be included if the average annual 4th maximum 8-hour

***8-hour ozone** continued on next page...*

concentration is greater than the level of the standard.

In the example at right, the primary and secondary standards are not met at this monitoring site because the 3-year average of the 4th highest daily maximum 8-hour average ozone concentrations (0.093 ppm) is greater than 0.08 ppm (the standard). Note that the ozone concentration data for 2000 is used in these computations, even though the data capture is less than 75%, because the average 4th highest daily maximum 8-hour average concentration is greater than 0.08 ppm.

Example ambient monitoring site failing to meet primary and secondary ozone standards.

Year	Percent Valid Day	Highest Daily Max 8-hr Conc. (ppm	2nd Highest Daily Max 8-hr Conc. (ppm)	3rd Highest Daily Max 8-hr Conc (ppm)	4th Highest Daily Max 8-hr Conc. (ppm)	5th Highest Daily Max 8-hr Conc. (ppm)
1999	96%	0.105	0.103	0.103	0.102	0.102
2000	74%	0.090	0.085	0.082	0.081	0.078
2001	98%	0.103	0.101	0.101	0.097	0.095
Average	89%				0.093	

***NETWORK NEWS** continued from page 2....*

Mesa Verde fire destroys deposition site

Air quality and visibility stations spared

The Long Mesa wildfire was first spotted as a wisp of smoke early in the afternoon on July 29, 2002, in Mesa Verde National Park in southwestern Colorado. Park officials gave an official evacuation order just one hour later.

While over 2,000 park visitors and employees evacuated the park, Sylvia Oliva, Mesa Verde's ambient air quality station operator, and Marilyn Colyer, biological technician at the park, responded to the National Acid Deposition Program/Mercury Deposition Network (NADP/MDN) wet deposition monitoring site to cover the instrumentation with protective fire blankets. Months earlier, Oliva and others had reduced litter and cut brush, trees, and snags here, so that site protocols concerning obstructing vegetation were met. The fire expanded from about one-quarter acre at 1:30 p.m. to 2,000 acres by early evening. Oliva believes the NADP/MDN site was one of the first developed areas the fire reached. The fire eventually consumed 2,635 acres before being extinguished.

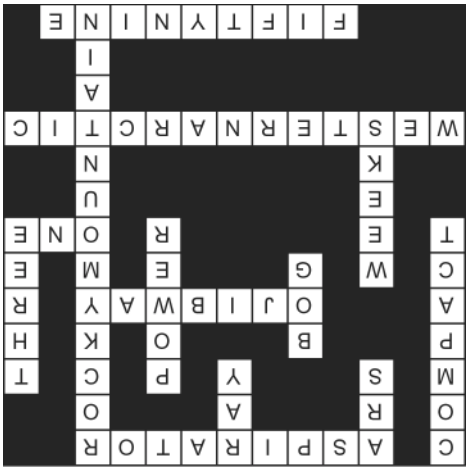
Although the fire blankets could not save the deposition instrumentation from total loss, the nearby NPS ambient air quality and IMPROVE aerosol shelters were not even scorched. Even so, the ozone, meteorology, and IMPROVE stations were down for some time because of lost power and telephone lines.

The NADP/MDN equipment was demolished for two reasons: the high BTU content of the pinyon-juniper woodland, and the fact that the equipment was set upon wood stands. Expanded metal scaffolding may have saved the samplers. The equipment stands were warped, melted, and vaporized to various degrees. The MDN glassware was 2/3 nonexistent and there was minuscule evidence of the fire blankets. Electric cabling on the ground surface was burned to bare copper wire in some places.

Fires are not new to Mesa Verde National Park. In the summer of 2000, a wildfire in the park pressured park managers into clearing a large area with a bulldozer that, coincidentally, was next to the park's air quality monitoring station. Mesa Verde is a Class I airshed under the Clean Air Act, and has operated an air quality station

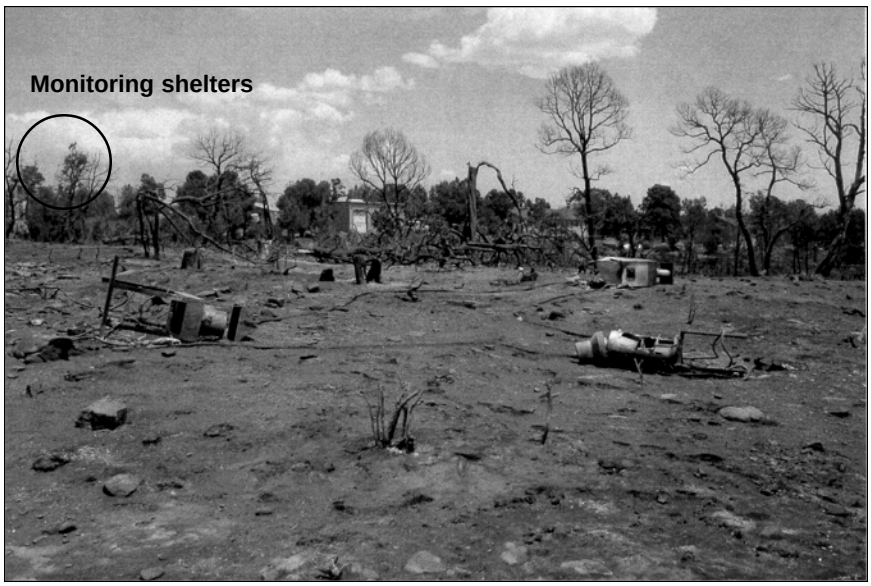
Mesa Verde Fire continued ....

Puzzle answers...



since 1981. The station measured ozone, particulates (IMPROVE), meteorology, dry deposition, precipitation events, and wet deposition of acids (NADP) and now mercury (MDN).

After the 2000 fire danger was over, park management converted the clearing into a paved parking lot for automobiles. When this happened, it resulted in three of the monitoring units being out of compliance with site placement standards. (Automobile exhaust fumes from the adjoining parking lot would affect the data). Therefore, the park's natural resource office was forced to move three units: MDN, NADP, and the Belfort gage, to a distance of 100 meters from the parking lot, out away from the previously cleared area where they had stood before. These were the three units destroyed in the 2002 fire.



Mesa Verde's atmospheric deposition monitoring site was destroyed by fire, but the ambient air quality and IMPROVE aerosol shelters were not even scorched. Park personnel previously thinned vegetation in this area, which may have helped save the shelters.

The Long Mesa wildfire, probably caused by a lightning strike, was contained August 5 and the park reopened to visitors August 9. The summer of 2002 has brought extremely dry weather and record breaking low fuel moisture content in the region. In the last six years, four large wildfires have occurred at Mesa Verde National Park. Visit the park's fire Web site at *http://www.nps.gov/meve/fire f*or complete information.

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The
Monitor

is published biannually (Spring and Fall) by Air Resource Specialists, Inc. under Contract C2350010840, for ambient air quality site operators in the National Park Service. For address corrections relating to this newsletter, or for assistance with operational site problems, contact:

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The Monitor is also available on the Internet at http://www2.nature.nps.gov/ard/gas/network.htm

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NPS Gaseous Pollutant Monitoring Program Network
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