

The Monitor

CASTNET

Clean Air Status and Trends Network

Spring 2009

The Newsletter for Air Quality Station Operators



National Park Service (NPS)
Gaseous Pollutant Monitoring Program
(GPMP)



Environmental Protection Agency (EPA)
Clean Air Status and Trends Network
(CASTNET) program

NETWORK NEWS

Installation update of CR3000 data loggers

As of March 1, 2009, 35 EPA CASTNET sites have received new Campbell Scientific Inc. (Campbell) Model CR3000 data loggers and associated equipment. The CR3000 has increased capabilities allowing MACTEC to poll sites and download data more frequently. The data logger has also been programmed to perform additional functions including automatic ozone zeros and spans. The upgrade often includes installation of a new ozone analyzer (Thermo Model 49i) and enhancements to the communication system. All 59 of the EPA sites are scheduled to receive a new CR3000 by mid-2009.

Station operators scheduled to receive new equipment will be contacted by MACTEC's installation team about two weeks prior to the visit. The team is generally at the site for a day and a half. After installation of the new instrumentation, the technician will verify that everything functions properly and polls correctly, then will meet with the station operator(s) for a training session. The operator must perform different steps using the CR3000 than with the previous data logger, when obtaining data and completing the weekly Site Status Report Form (SSRF). Written instructions for these new procedures are also left on-site for future reference. MACTEC's field operations group can also be reached at 1-888-224-5663, ext. 6629 or 6621 for additional assistance.

AIRNow and AQS database uploads

AIRNow is a Web site (<http://www.airnow.gov>) that allows the public to view air quality data in "real time." It offers daily forecasts of the Air Quality Index (AQI) and maps of real-time AQI conditions for over 300 cities across the U.S. Along with data uploads from monitoring agencies throughout the country, hourly ozone concentrations and meteorological measurements from CASTNET sites are uploaded to the AIRNow database. All NPS CASTNET sites have provided data to AIRNow since May 2002. EPA CASTNET sites began participation in AIRNow in May 2007, and all CASTNET sites will report data to AIRNow by mid-2009.

The real-time hourly data used for the AIRNow AQI maps and forecasts are automatically screened for major anomalies, but are not fully verified and validated through the quality assurance procedures. The full validation process used to officially submit and certify data to the EPA Air Quality System (AQS), an archive for air quality data, is performed monthly. As the EPA CASTNET sites are upgraded with CR3000 data loggers and Model 49i ozone analyzers, the data from the sites will be eligible for submission to AQS. MACTEC and EPA continue to work to prepare EPA CASTNET sites to collect and submit data to AQS. Ozone data from NPS CASTNET sites have been submitted to AQS for over 15 years.

Report wildfire impacts on ozone stations

Air quality data analysts review polled ozone and meteorological data daily. In addition to reviewing data for completeness, data are also reviewed for any operational anomalies that could affect validation. Please notify your contractor if any nearby wildfires have begun that you believe may impact your station, and provide specific information about the fire activity. This information is critical to the validation of your station's data and may also be useful in identifying causes and behavior of air quality events.

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NETWORK NEWS continued from page 1....

Being compliant with 40 CFR part 58

EPA CASTNET ozone measurements at sites that have not received the recent data logger and equipment upgrades currently do not meet the quality assurance and quality control requirements for National Ambient Air Quality Standards (NAAQS) compliance purposes. EPA is transitioning monitoring operations to meet the requirements of 40 CFR Part 58, Appendix A by the end of 2009. This involves upgrading all analyzers and data loggers to newer, more reliable models and adhering to the appropriate data validation procedures, calibration and audit frequencies, and quarterly submission of data to the AQS. These additional QA/QC requirements for the EPA CASTNET sites are summarized in Table 1. CASTNET ozone monitoring conducted at NPS sites is currently 40 CFR Part 58 compliant.

Table 1. QA/QC requirements of 40 CFR Part 58, Apdx A for ozone

QA requirement 40 CFR Part 58	Current EPA CASTNET	New procedures for compliance monitoring
O ₃ calibration gas source (station transfer standard) 6x6 transfer standard initial verification (TAD)	Not performed	Convert to 6x6 transfer standard initial verification ¹
Zero air and O ₃ calibration gas source (station transfer standard) [6/1 calibration check] (QA Handbook)	Not performed	Convert to once every 6 months schedule to calibrate field station transfer standard ¹
One-point quality control check (40 CFR 58)	Once every 2 days	Convert to daily ¹
Annual performance evaluation (40 CFR 58)	Once every 2 years	Convert to annually ²
Multipoint verification/calibration (QA Handbook)	Once every 6 months	Maintain current practice ¹
National Performance Audit Program (NPAP) (40 CFR 58) 20% of network per year	Not performed	Join NPAP ²

¹ Performed by the EPA CASTNET contractor - MACTEC

² Performed by the third party CASTNET auditor - EEMS

Mercury monitoring within CASTNET

To monitor mercury in the atmosphere, the National Atmospheric Deposition Program (NADP) membership of federal agencies, states, tribes, academic institutions, industry, and other organizations are collaborating to establish a new network for monitoring atmospheric mercury species. The network leverages existing atmospheric mercury sites, where possible.

At present, 20 atmospheric mercury monitoring stations are participating in NADP to provide high-resolution, high-quality data. Three of these monitoring sites are collocated with CASTNET sites: HWF187, NY; BEL116, MD; and CHE185, OK. For more information, visit the NADP mercury initiative Web page at <http://nadpweb.sws.uiuc.edu/amnl>.

by Timothy Sharac, EPA

Annual reports and pollutant maps

Quality data collection begins with those who operate and maintain site monitoring instrumentation. Station operators play a large role in determining the quality of data when they visit their sites each Tuesday to perform weekly tasks. These basic tasks do not vary from week-to-week. It is important that the routine does not vary since this uniformity helps to ensure quality data are collected and are comparable from site-to-site over time, an essential component of any long-term monitoring network.

CASTNET was designed primarily to measure trends in seasonal and annual average sulfur and nitrogen concentrations and depositions over many years. Ozone is also measured at most sites. Meteorological measurements are used to gauge the transport of air pollutants and as input to the Multi-Layer Model (MLM), a numerical model used for estimating dry deposition values.

Over the course of a year, data derived from all those Tuesday site visits add up. Each CASTNET Annual Report documents the results collected for that calendar year. It also compares data across many years to track the changes in the status and trends in air quality. Annual reports are available on the CASTNET Web page, at <http://www.epa.gov/castnet/docs.html>.

Of further interest, EPA's CASTNET map Web page (<http://www.epa.gov/castnet/mapconc.html>) is organized to provide a thumbnail view of the changes in annual air quality since 1989, including a comparison of the 3-year average for each analyte measured from the first three years (1989-1991) to the most recent three years (2005-2007). These maps indicate the yearly average of pollutant concentration levels at each site. Improvements in air quality become obvious after scrolling from the bottom of the page to the top. By clicking on a map, a full-size version complete with site location indicators can be examined. And just think -- the data needed to produce these maps were collected by diligent station operators routinely performing their weekly duties, just like you, for each week of each of those years.

NETWORK NEWS continued on page 5....

Monitoring Site Assistance:

NPS CASTNET sites: contact Air Resource Specialists
telephone: 1-800/344-5423 (Mountain Time)

EPA CASTNET sites: contact MACTEC
telephone: 1-888/224-5663 ext. 6629 and/or 6621
(Eastern Time)

STATION OPERATOR FOCUS

Air monitoring is a family affair for STK138

The Stockton, IL, EPA CASTNET monitoring site (STK138) is located in the extreme northwestern part of the state. Its location is important because almost no other monitoring program has a station anywhere near Stockton. In 1993, Bruce and Steve Evans, brothers, were approached on their farm and asked if they would host and maintain a monitoring station. It has been a family affair ever since.

Bruce was the primary operator for the first 10 years of the site's operation. "He liked doing it by himself," said Steve, "he liked taking care of his 'chore' while I did the farming." Both brothers have been conscientious about the site's maintenance and operation, and attend to problems quickly. "The site has been struck by lightning five or six times, and the MACTEC staff are great about talking us through a problem to resolve it," said Steve.

Steve recently lost Bruce to cancer, and has taken on primary operator responsibilities, which involved relearning some of the servicing duties. Most of the instrumentation is the original equipment installed in 1993. "I just received a replacement ozone analyzer," said Steve, "the only other piece replaced was the tipping bucket on the NADP rain sensor. The cattle liked to rub on it and it broke."

Steve works most of the time on his 300 acre farm, which his family purchased in 1948 (the family moved to the area in 1829). He recently sold off the dairy portion of the business and now just operates the beef herd. Farming and part-time bartending keep him out of trouble, and with the dairy cows gone, he has more time to participate in a dart league, spend time with his girlfriend, or hunt and fish. Steve will be the last of his family to farm, but his and Bruce's connection to air quality monitoring are a legacy to the region.

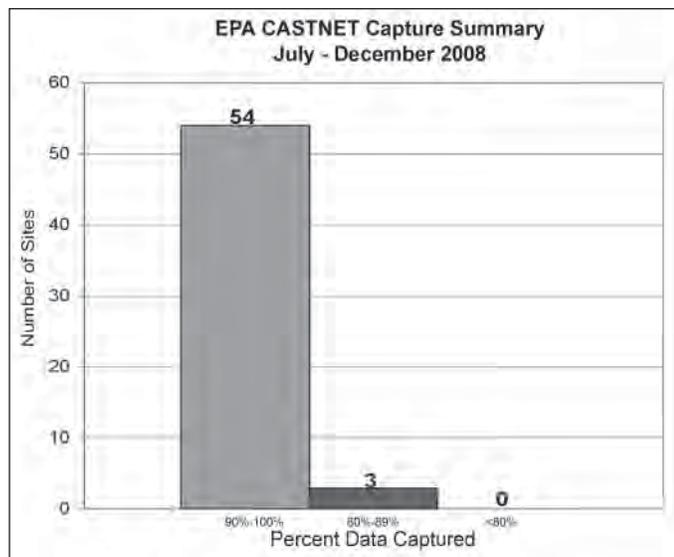


Longtime station operator Bruce Evans (inset) and brother Steve (current operator) have maintained the STK138 station on their farm since 1993.

DATA COLLECTION SUMMARY

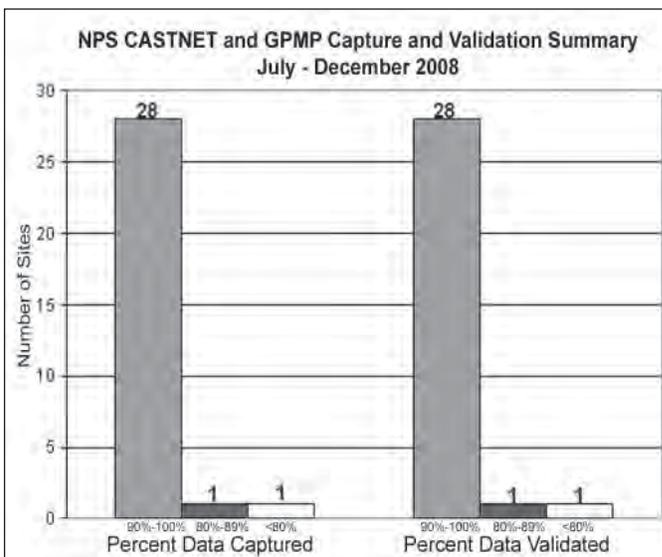
EPA site data capture summary

Ozone data capture for the EPA CASTNET sites for July through December 2008 is summarized in the graph below. The network achieved an average 98% collection for the period. Data validation statistics for the period will not be available until mid-July 2009.



NPS data capture and validation summary

Ozone data capture for the NPS CASTNET and GPMP sites for July through December 2008 achieved an average of 96% collection as illustrated in the graph below. Data validation for the same sites and period are also shown. The network achieved an average 95% final validation for the period.



FEATURE ARTICLE

The Acid Rain Program - Progress made in reducing SO₂ and NO_x emissions

Background

In 1995 the Environmental Protection Agency (EPA) created the Acid Rain Program (ARP), as directed by Congress under the 1990 Clean Air Act Amendments. The program's objective is to reduce annual emissions of sulfur dioxide (SO₂) and oxides of nitrogen (NO_x) throughout the country, the main contributors to acid rain. By reducing these emission levels, the EPA hopes to alleviate adverse health effects on humans, plants, and animals, as well as other effects such as visibility impairment in our national parks and degradation of monuments and buildings.

Emission reductions are expected to come from the fossil-fuel burning electrical generation industry. Goals of the ARP are to reduce SO₂ emissions by 10 million tons from 1980 levels and to reduce NO_x emissions by 2 million tons below projected levels for the year 2000 (without implementation of the ARP). These reductions are to be achieved largely through a market-based cap and trade program and a rate-based regulatory system. EPA has released the ARP's 2007 summary report, which notes several key, positive findings, as summarized below.

SO₂ emissions and reductions

Electrical generating facilities are the largest single source of SO₂ emissions nationwide, accounting for nearly 70

percent of all SO₂ emissions. The approximate 3,500 facilities under the ARP have reduced these emissions by 49 percent compared with 1980 levels and 43 percent compared with 1990 levels (see Figure 1).

In 2007, sources emitted just under 8.95 million tons of SO₂, well below the emission cap of 9.5 million tons set by EPA and below the statutory cap set for compliance in 2010. From 1990 to 2007, annual emissions fell in 34 states and the District of Columbia, while they rose in 14 states. The states with the highest emitting sources in 1990 have seen the greatest reductions (IL, IN, KY, MO, OH, TN, and WV). These states combined reduced their total SO₂ emissions by more than 500,000 tons.

Wet sulfate deposition also decreased, using the 1989-1991 and 2005-2007 observation periods for comparison. A 35 percent decrease is apparent in the Northeast and a 33 percent decrease in the Midwest. These reductions have resulted in positive changes in environmental indicators, including improved water quality in lakes and streams.

Estimated public health benefits from ARP emission reductions -- over \$120 billion annually at full implementation in 2010 -- exceed program costs by a margin of more than 40:1.

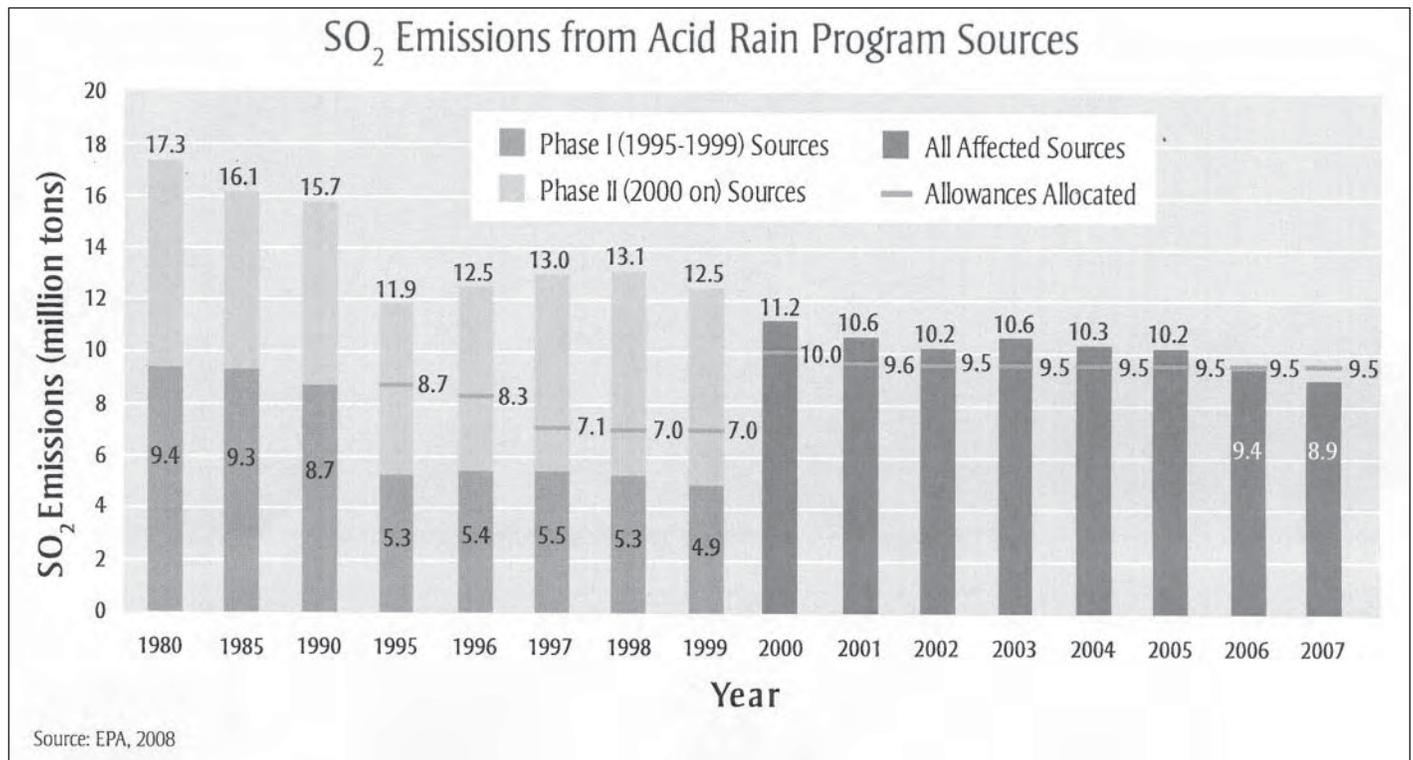
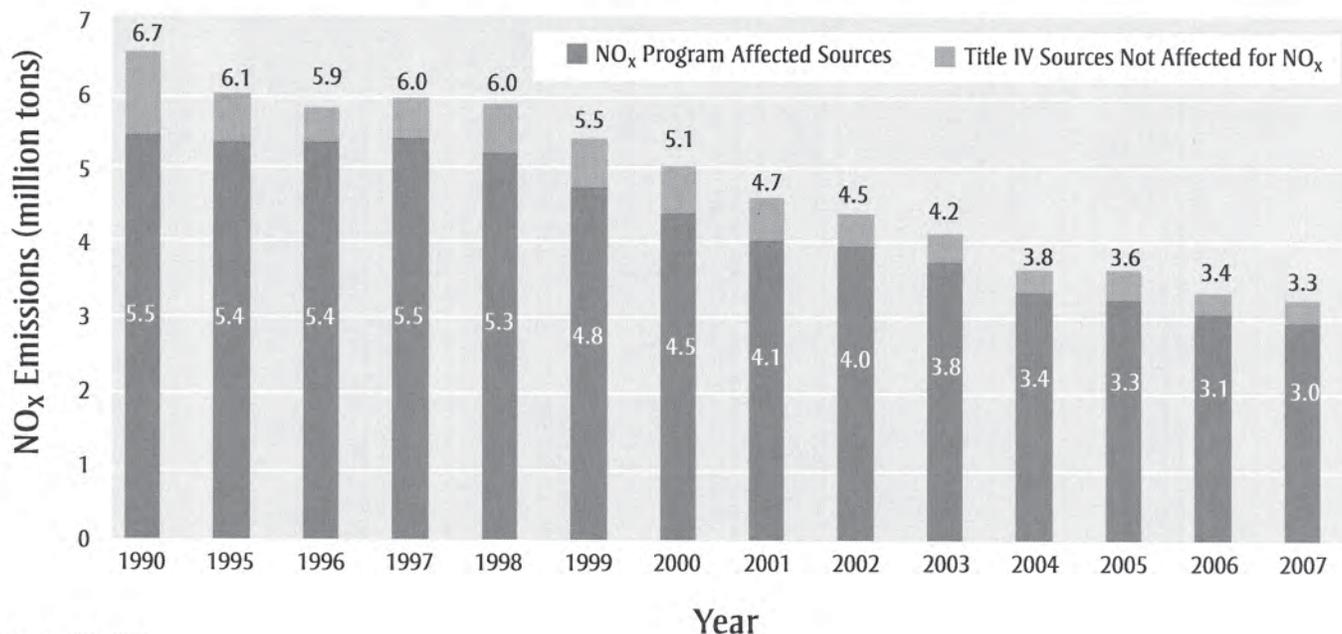


Figure 1. SO₂ emissions from Acid Rain Program sources across the United States from 1980 through 2007.

NO_x Emission Trends for All Acid Rain Program Units, 1990–2007



Source: EPA, 2008

Figure 2. NO_x emissions from Acid Rain Program units across the United States from 1980 through 2007.

NO_x emissions and reductions

Coal-fired generating facilities account for 20 percent of NO_x emissions nationwide. To achieve reductions, the ARP set rate-based limits to the facilities, which apply either to an individual facility or a group of facilities, determined by the facility owner. The reduction goal was met in 2000 and every year since. While the ARP is responsible for a large portion of the reductions, other national, regional, and state NO_x emission control programs contributed significantly to the reductions as well.

From 1995 to 2007, annual NO_x emissions dropped by 46 percent (see Figure 2). During this period 41 states and the District of Columbia showed decreases in emissions and 7 states showed increases. Large decreases were seen in the Ohio River Basin, IN, KY, OH, PA, and WV. NO_x emission reductions in these areas account for well over one million tons from 1990 to 2007.

Wet nitrogen deposition also decreased from 1989-1991 to 2005-2007 with a 21 percent decrease in the Northeast and 7 percent in the Midwest.

Progress summary report

A complete summary of the status of the Acid Rain Program can be found in its annual summary reports. The 2007 Acid Rain Program Progress Report and reports for previous years are available for viewing or download on the EPA Web site. Visit <http://www.epa.gov/airmarkets/progress/progress-reports>.

NETWORK NEWS continued from page 2....

Multi-pollutant monitoring with MARGA

CASTNET performs ambient air sampling of particles and selected gases by drawing air at a controlled flow rate through a three-stage filter (Teflon®, nylon, and dual Whatman® cellulose filters). Although the filter pack is easy to use, reliable, economical, and provides sensitive measurements, it suffers from long sampling duration (7-day integrated average) and is subject to bias and uncertainties in species of interest such as gaseous nitric acid (HNO₃) and particle nitrate (NO₃⁻) due to reactivity and volatilization issues. In addition, concentration data may not be available for up to six months from the sample collection date.

Recent promising advancements in ambient air measurement instrumentation are providing the capability of remotely measuring pollutant species important to deposition in near real-time. The advantages of routine operation of such systems include a more timely data stream and improved air quality assessment capability. “Real-time,” multi-pollutant monitoring in rural areas will help better characterize the extent of regional transport of pollutants, provide improved regional dry deposition estimates, and help in both the development and validation of air quality models.

Monitoring with MARGA continued on page 7....

SHOP TALK

A word about your towers

Towers are a silent but very important part of your CASTNET site. The tilt-down Aluma Tower is the reliable platform for your filter pack sampler head. The Universal (or other manufacturer) tower is the platform for your wind speed and wind direction sensing system. Both keep the business end of their respective systems 10 meters above the surface.

Some towers in operation are 20 or more years old. Over time, structural degradation to your tower may have occurred. During your next site visit, take a moment to inspect and note any defects in either of your towers. Report your findings on the Site Status Report Form (SSRF) and call MACTEC or ARS to discuss what you observed. Inspect your towers only from the ground; at no time should you ever climb the towers. The field staff or auditor who come to visit your site will also perform an inspection. Some defects to look for are:

Flow Tower (Aluma Tower, tilt-down aluminum)

- **Cracks at welds** – common near the ground, and where the horizontal tubular cross braces are attached to the vertical tubular members (Figure 1).
- **Cross braces missing** – a result of cracking or using the tower as a ladder to gain access to the shelter's roof. NOTE: This is an unsafe and unauthorized use of the tower.
- **Lock plate missing or weld cracked** – the angle aluminum or plate with a hole, welded on the base and on the upper section, to lock the tower in the upright position.
- **Missing lock or bolt** – keeping the tower secured upright by any other means (e.g., rope, stick) is undesirable.
- **Twisted or torqued tower** – can happen if the tower is lowered under high winds, or if unauthorized gear is attached. Even a small amount of added weight or surface area causes a surprising amount of additional wind loading and stress. Two towers at NPS sites have failed over as a result of added wind load. Any addition of unauthorized equipment can lead to a dangerous situation. Contact us if there are other devices attached to your tower.



Figure 1. Crack at horizontal cross brace worsened to cause brace to come out.



Meteorological Tower (Universal, steel or similar tower)

- **Cracks adjacent to welds** – results from water freezing inside the tubular section and/or embrittlement of metal adjacent to the welding of the steel lacing (Figure 2).
- **Rusted or bent base plate** – the base plate and tabs to which it is bolted may become rusted. If rust compromises the metal, the tower may be at risk of falling.
- **Missing pivot or lock bolts at base plate** – two pivot bolts and one lock bolt hold the tower in place. If any bolts are missing or cannot be engaged, the tower is unsafe.
- **Loose, tight, or damaged guy wires** – over time the guy wires will stretch and tightness may also vary with temperature. A rule of thumb is: if at about eye level, you can move the wire up and down more than two inches, it is too loose. Wires that are too tight can also bend or warp the tower. Rust can weaken the guy wire and cause it to fail, which could lead to the tower falling. Guy wires that are broken or frayed should be replaced.
- **Turnbuckles** – used to tighten or loosen the guy wires. If there is not enough play left in the turnbuckle bolts to properly adjust the guy wire, the guy wire must be repositioned or replaced. If the turnbuckle is rusted or otherwise inoperative, it must be replaced.
- **Gin pole and winch assembly (if installed)** – the means to lower/raise the tower. If the gin pole is loose in the ground or bent, it must be replaced or reinstalled. If the winch is not operating properly or if the cable is frayed or otherwise compromised, they must be repaired or replaced.
- **Ground anchors** – these anchor the guy wires in the ground and must be securely in place. If the anchors have been pulled out of alignment, hit by mowers, or rusted or loose, they must be replaced or reinstalled.

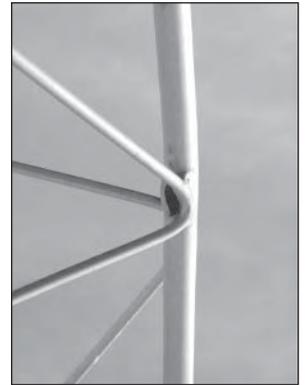


Figure 2. Crack adjacent to weld caused lacing to loosen.

Again, please check your towers for any of these defects, and describe the problem with the field support staff. Also note the problem on your next SSRF. Should you require additional information or wish to report other concerns you may have about towers on your site, please call Dr. José Martínez at jemartinez@mactec.com, 1-352-333-6629 or 1-888-224-5663, ext. 3629 for EPA sites. For NPS sites, please contact John Faust at jfaust@air-resource.com, 1-800-344-5423.

OPERATOR'S TOOLBOX

Installation of NADP-approved NOAH IV rain gauges



The National Atmospheric Deposition Program (NADP) approved the use of either of two new electronic rain gauges at NADP sites to replace the Belfort B5-7809. The ETI Instrument Systems, Inc. NOAH IV digital rain gauge was the instrument chosen to be installed at EPA and NPS NADP sites.

The following NPS sites received their new gauge last year:

Canyonlands NP	Mesa Verde NP
Cape Cod NS	Organ Pipe Cactus NM
Denali NP&P	Petrified Forest NP
Everglades NP	Pinnacles NM
Great Basin NP	Sequoia-Kings Canyon NPs
Great Smoky Mountains NP	Shenandoah NP
Joshua Tree NP	Theodore Roosevelt NP
Mammoth Cave NP	Yosemite NP

Installation will continue this spring and will be performed by park personnel.

The first EPA site to receive a new rain gauge was SUM156/FL23, which was installed in July 2008. As of March 2009, four additional EPA sites had new rain gauges installed. MACTEC field technicians install the new rain gauges during regularly scheduled calibration trips to selected sites.

The NOAH IV requires mounting on a stable base and is being installed on the existing Belfort rain gauge base (often a large concrete slab or footer). However, the NOAH IV rain gauge requires a north alignment when installed, whereas the Belfort did not. As a result, the Belfort installation studs were not installed with any particular orientation. A rotating and securable installation ring was designed to overcome the orientation problem while utilizing the Belfort installation mount.

Installation and operator training generally go smoothly. The NOAH IV is easier to operate than the Belfort and does not use charts or ink pens. A NADP-supplied handheld computer is used to communicate with the rain gauge via a wireless Bluetooth® connection (see Figure 1). The computer comes pre-loaded with NADP-specific software, which will quickly download the data collected and stored by the NOAH IV. This information is subsequently uploaded to NADP's Program Office by way of an Internet connection. Hands-on training on the operation and maintenance of the system usually takes about an hour and will be scheduled to take place while the field technician is at the site. Operation and contact information is left at the site for future reference by the station operator.

At sites that receive more than 20 percent of their precipitation in the form of snow, an Alter-type wind shield will also be installed (see Figure 1). Generally, these sites are northern and/or mountainous sites. Four EPA NADP sites (in Colorado, Connecticut, Michigan, and Wisconsin) will receive Alter-type wind shields. Three NPS sites (in Arizona, Colorado, and Utah) will also receive the shield.

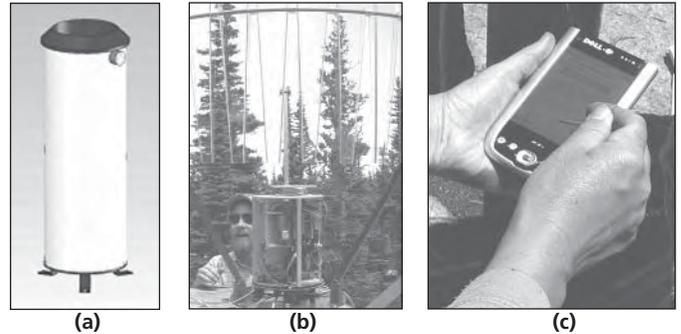


Figure 1. (a) The ETI NOAH IV rain gauge, (b) with cover removed and clear Alter-type windscreen, and (c) a wireless PDA used to read the gauge data.

Monitoring with MARGA *continued from page 5...*

To facilitate real-time, multi-pollutant monitoring, Applikon's Monitor for Aerosols and Gases in Ambient Air (MARGA) is being developed. Development of the MARGA is ongoing; specific details can be found at: http://www.epa.gov/oamhpod1/admin_placement/0614054/index.htm.

The MARGA makes "continuous" measurements of gas and particle phase air pollutants including sulfur dioxide (SO_2), nitric acid (HNO_3), and ammonia (NH_3) gases and nitrate (NO_3^-), sulfate (SO_4^{2-}), ammonium (NH_4^+), chloride (Cl^-), potassium (K^+), magnesium (Mg^{2+}), calcium (Ca^{2+}), and sodium (Na^+) particles. The MARGA results (from the 30-day trial assessing precision of two MARGAs, and assessing accuracy as compared to the EPA Compendium Method IO-4.2) will be available on the Environmental Technology Verification (ETV) Program Web site (www.epa.gov/etv) during First Quarter 2009. The next phase of the MARGA contract will be a 12-month development period (option period I). This period will be utilized to modify the instrumentation to best suit the objectives of CASTNET monitoring.

After the conclusion of option period I the MARGA will have a second 30-day trial (option period II). If the MARGA meets the criteria delineated in the contract for option period II, the EPA will exercise additional option periods (III – V). The additional options involve the purchase of MARGAs for deployment at selected CASTNET sites as well as an option for Applikon to operate the deployed MARGAs.

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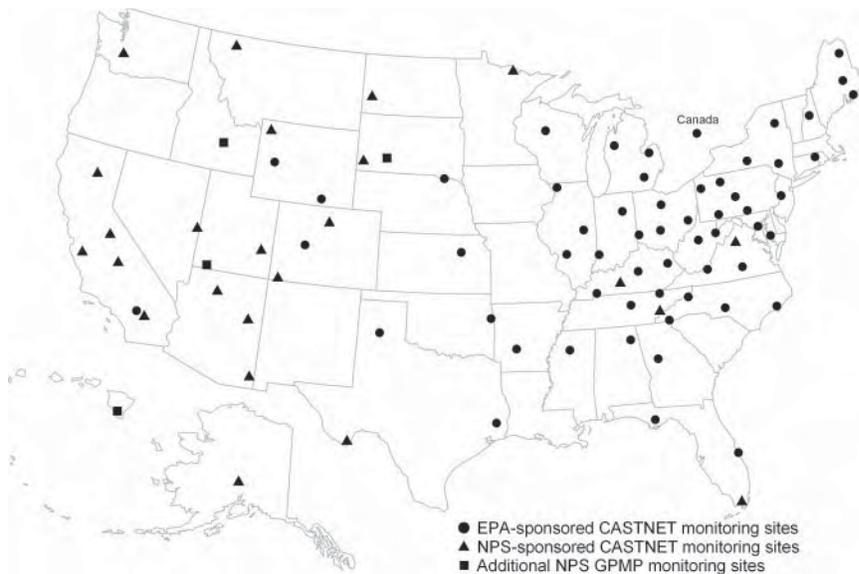
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CASTNET Monitoring Program Locations



EPA Clean Air Status and Trends Network
(<http://www.epa.gov/castnet>)

NPS Gaseous Pollutant Monitoring Program Network
(<http://www.nature.nps.gov/air/monitoring/index.cfm>)