National Atmospheric Deposition Program

# Passive Ammonia Monitoring Network (AMoN)

## A Special Pilot Network

### The Importance of Ammonia

Ammonia ($NH_3$) is a gas readily released into the air from a variety of biological sources, as well as from industrial and combustion processes. It is the principal basic gas in the atmosphere. While $NH_3$ has many beneficial uses, it can detrimentally affect the quality of the environment, including the acidification and eutrophication of natural ecosystems, the associated loss of biodiversity, and the formation of secondary particles in the atmosphere.

The dominant source of $NH_3$ emissions in the U.S. is agriculture (~85%), largely from animal waste and commercial fertilizer application. Data from the National Atmospheric Deposition Program/National Trends Network (NADP/NTN), a 30+ year wet deposition network with over 250 sites across the U.S., has shown an increasing trend in ammonium ($NH_4^+$) concentration in the central U.S. (Figure 1). Yet, despite its importance in atmospheric chemistry and its impacts on ecosystems, until now there has been no routine national monitoring of ambient $NH_3$. The NADP has established a special study to determine the feasibility of operating a routine, long-term passive $NH_3$ network.

The pilot network, the NADP's passive $NH_3$ monitoring network, the AMoN, has been operating for over 2 years at approximately 20 locations. The AMoN provides land managers, air quality modelers, ecologists and policymakers critical data that will allow them to:

- *assess the long-term trends in ambient $NH_3$ concentrations and deposition of reduced nitrogen species;*
- *validate atmospheric models;*
- *better estimate total nitrogen inputs to ecosystems;*
- *assess changes in atmospheric chemistry due to $SO_2$ and $NO_x$ reductions; and*
- *assess compliance with $PM_{2.5}$ standards*

### The AMoN Network

The AMoN began operation in the fall of 2007 with 16 sites; four more were added in 2009 and another two sites are expected to begin operating in the summer of 2010. Additional sites are encouraged to join.

The NADP's Central Analytical Laboratory (CAL) assembles and ships the Radiello® passive samplers, which are deployed every 2 weeks at each site. The CAL analyzes and quality assures the samples and provides the analytical data to the NADP. The site map (Figure 2) includes active and inactive sites and sites that have agreements in place and will begin sampling soon (labeled as active). The map also shows modeled $NH_3$ emissions from the Carnegie Mellon Emissions model (http://www.cmu.edu/ammonia/).

**Figure 1 Ammonium Concentration as Measured at NTN Sites (1994 and 2008)**

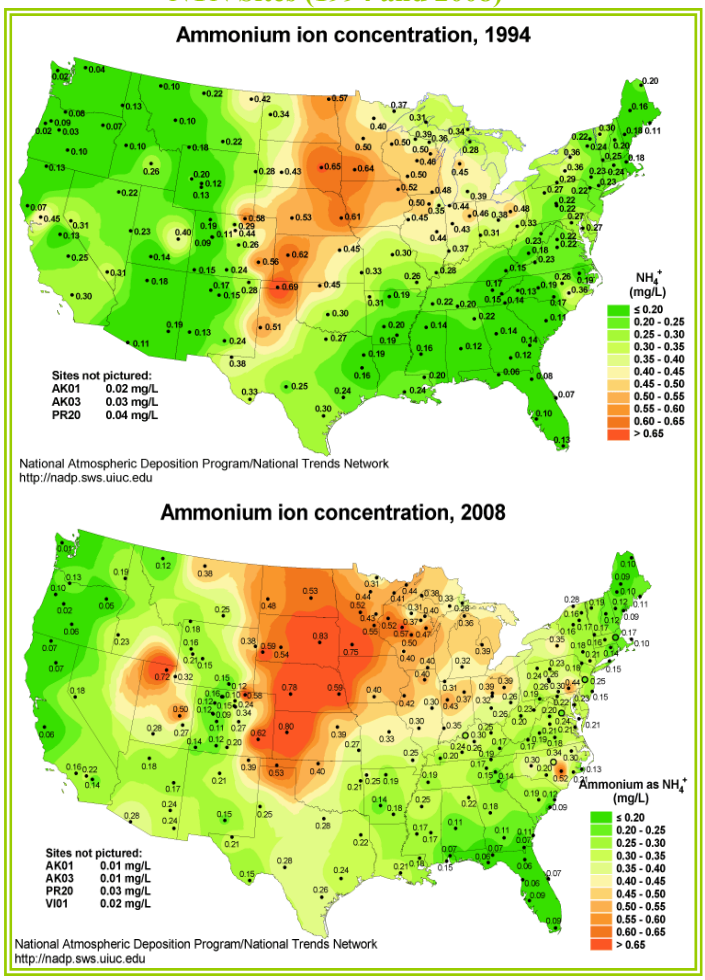
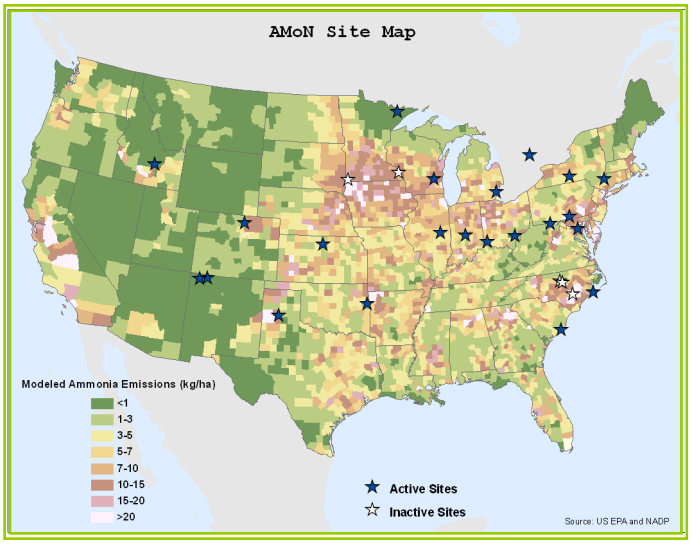


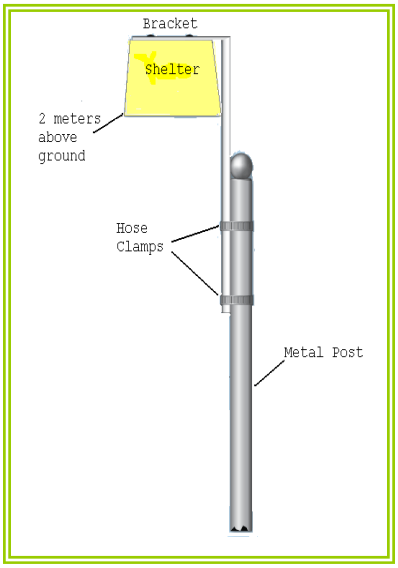
**Figure 2 AMoN Site Map**




## How You Can Start an AMoN Site

The NADP Program Office (PO) coordinates participation in the AMoN and provides the necessary materials. The AMoN uses Radiello® passive samplers (http://www.radiello.com) which do not require electricity, a data logger, or a computer. Provided that the area meets the minimal AMoN siting criteria, the site can be installed almost anywhere. An example of the site set-up is shown in Figure 3. After installation, the site operator submits photos of the site to the PO for approval.

**Figure 3 Site Installation Diagram**




All site operators comply with the Standard Operating Procedure for Monitoring Ambient Ammonia Using Radiello-Type Passive Samplers which is posted on the NADP website. The operator changes out the sampler(s) every other Tuesday (see Figure 4) and ships the samplers back to the NADP. The total time commitment of the site operator is approximately 30 minutes at the site every two weeks. Bi-annually the operator will be asked to complete a checklist about their site. Annually, the site operator will submit photos of their site to the PO. The checklist and the site photos will help the PO determine if the site continues to meet the AMoN siting criteria and to document any changes to the site.

**Figure 4 AMoN Sampler Change-out**

The AMoN data are posted to a dedicated web-site, and includes site specific information. The data will be treated with the same quality control and public availability as the other NADP networks. A confidence interval will be provided for each $NH_3$ concentration based on the precision of triplicate samplers being shipped to 5 percent of the network each sampling time period.

## What An AMoN Site Costs

The annual cost of participating in the network is estimated to be **$2,700** per site/year. A site installation kit is required ($250). The annual cost is subject to the number of participating sites. Current costs are available from the Program Office. This annual cost includes site supplies (passive samplers), shipping to and from the site, sample analysis, quality assurance activities, database and website management and laboratory supplies. In addition, the NADP will produce annual maps for both the AMoN website and the annual report using the data from sites which meet the completeness criteria. As the network grows, the cost per site is expected to decrease. The cost will be evaluated each year by the NADP's Budget Advisory Committee.

## The Future of the AMoN

Future plans for the AMoN include:

- *approval of AMoN by Executive Committee at the fall 2010 NADP meeting as an official network;*
- *growing the network to 300+ sites, covering all sensitive ecoregions of the continental U.S.;*
- *utilizing the measured $NH_3$ concentrations for validation of air quality and deposition models; and*
- *providing educational outreach materials highlighting the hands-on experience in atmospheric science that students can receive by participating in AMoN.*

If you are interested in participating in the AMoN, please contact the NADP at (217) 333-7871. For more information about the AMoN, visit the AMoN website at http://nadp.isws.illinois.edu/nh3net.