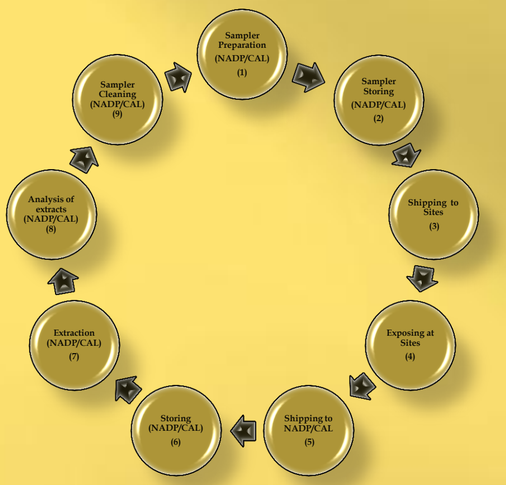

Ammonia Monitoring Network (AMoN) Blank Study

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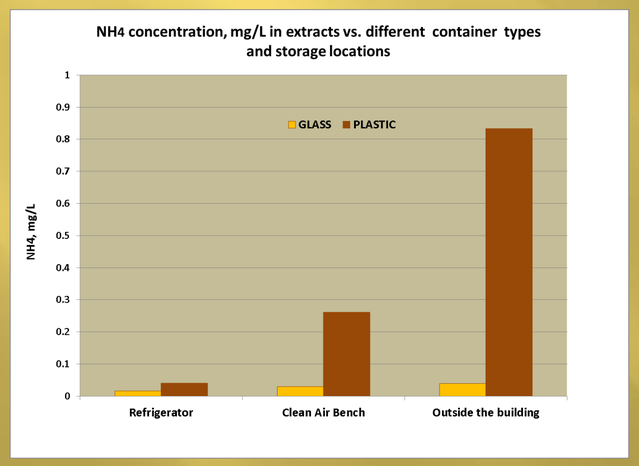
Starting in October 2007, the National Atmospheric Deposition Program (NADP) has operated the Ammonia Monitoring Network (AMoN) Study using Radiello™ type passive diffusion ammonia gas samplers. The purpose of present study is to evaluate the ammonia contamination which can occur in all stages of AMoN sampler processing: preparation, storing and transportation of Radiello™ samplers; extraction of Radiello™ samplers and final analysis of extracts. A number of blank studies were carried out: special laboratory and freezer air studies, new core blank studies, as well as blue Radiello™ bodies cleaning and storing studies. The results of above-mentioned studies will minimize the influence of potential accompanying contamination factors on the accuracy of ambient ammonia concentrations. This is important in terms of both the AMoN travel blanks, and the deployed AMoN samplers.

TRAVEL BLANK STUDY

In August 2008 a special study was carried out to evaluate the reliability of containers during transportation of Radiello™ samplers to AMoN sites and back to NADP/CAL. Two different types of containers (plastic and glass) with clean Radiello™ samplers inside were placed for 14 days in the lab refrigerator, in the Air Science Custom Laminar Flow Cabinet (Clean Air Bench) and outside the building in the car trunk. Then Radiello™ samplers were extracted, and the extracts were analyzed for ammonium ion. The data are presented in Figure 1.

Figure 1

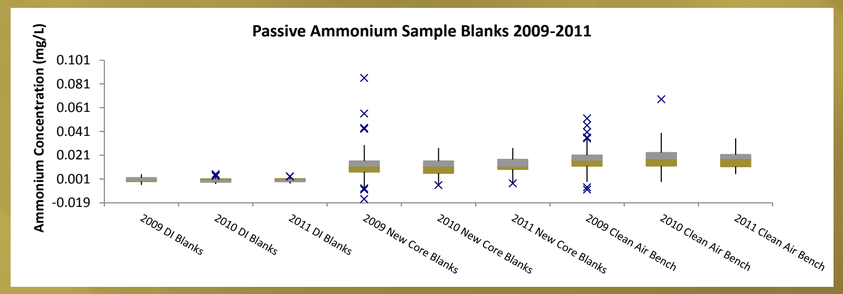


Conclusion:
Glass containers, currently used for transportation of Radiello™ Samplers to AMoN sites are adequate from the point of view of potential contamination.

LABORATORY ROOM BLANK STUDY

To evaluate the background levels of ammonia, Radiello™ samplers were exposed for two week periods in the analytical lab (where sampler extracts are measured for NH4), in the sampler preparation lab (where the clean air bench is located), and inside of the clean air bench. This testing was repeated multiple times.
We found that ammonia levels inside of the clean air bench (when it is not in use) are about 2 times lower than levels measured inside of the sampler preparation laboratory. During the extraction process the clean air bench is always in use to create a positive clean air flow through the filters. We always check the background levels in the clean air bench during the extraction process. The results from these checks are about 26 times lower than the background levels measured inside of the clean air bench when it is not in use.
Figure 2 depicts ammonium measured in all sample blanks processed from 2009 through 2011.

Figure 2



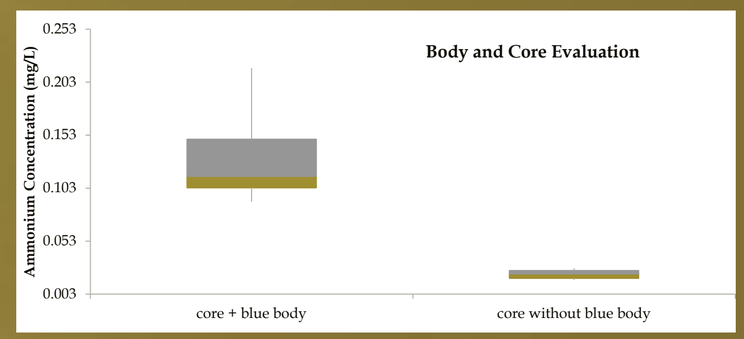
Ammonium levels measured inside of the cover for FIA instrument autosampler are on average 1.2 ppm. We placed a citric acid impregnated filter Whatman™ paper filter under the FIA autosampler cover and found that the background levels of ammonium were cut in half. Then we placed two Radiello™ NH_3 cartridges (cores) in the covered area of our instrument autosampler and found the background levels of ammonium had dropped to 0.040 ppm. This suggests an alternative use for the Radiello NH_3 cartridges, as a sink for the removal of ammonia from the background to prevent potential contamination during processing and sampling.

Conclusions:
- NH_3 concentration in the air around FIA under the plastic cover over the instrument significantly (almost 20 times) decreases when using Radiello core as an NH_3 absorbing material inside of the cover.
- The ammonia level inside of the Clean Air Bench (when it is not in use) is approximately twice lower than in the sampler preparation laboratory. This level decreases even more when the Clean Air Bench is in use.
- Even though the background levels measured in the laboratories for processing and sampling were relatively high (1.1 – 2.7 μg/m³), we suspect that sampler results are not significantly affected by them.

SAMPLERS PREPARATION BLANK STUDY

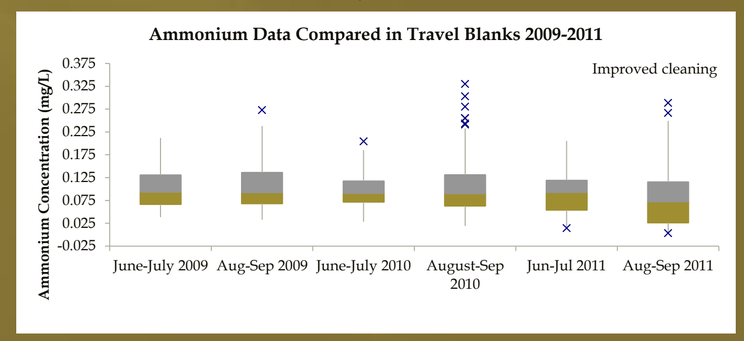
The assumption was made that during repeated use Radiello™ blue bodies could accumulate trace amount of NH3 due to their high porosity. This was confirmed by the following experiment. Along with regular travel blanks (core inside blue body in glass container), special travel blanks (just core in glass container) were shipped to the site IL11. They stayed at the site during 14 days not being deployed. Then core were extracted, and the extracts were analyzed. The ammonium concentration in extracts from cores which did not have any contact with blue bodies was significantly lower than the concentration in extracts from cores in blue bodies (NH4 values are comparable to the extracts from new unused cored). See Figure 3.

Figure 3



Starting in July 2011 the new way of cleaning cores was proposed. Instead of single sonication and following rinsing with DI water, bodies were sonicated three times (during one hour each time in fresh DI water), rinsed carefully and dried in desiccator. Ammonium concentration of all AMoN travel blanks, cleaned in a new way, became noticeable lower (see Figure 4).

Figure 4



Conclusions:
- The process of cleaning of used blue bodies should include multiple (three times) sonication, careful rinsing, drying and storing in desiccator.
- It is recommended to use some absorbing NH_3 material inside the desiccator during drying and storing of blue bodies (it can be a new core or a sponge, impregnated with citric acid). This recommendation needs further verification.

Acknowledgements

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