

# Increasing the Detection of Elements in the Chemical Speciation Network (CSN)

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## ABSTRACT

The Chemical Speciation Network (CSN) has used a Met One SASS/SuperSASS® sampler and 47-mm Teflon® filter for the analysis of a suite of elements since 2000. Currently, 33 elements are analyzed for the CSN by Energy-Dispersive X-Ray Fluorescence (EDXRF).

As the concentration of PM<sub>2.5</sub> has decreased (34% from 2000 to 2013)<sup>1</sup>, the percentage of non-detects for certain elements has increased. In order to increase the amount of particulate matter collected per square centimeter (cm<sup>2</sup>) and reduce the percentage of non-detects, a 25-mm Teflon® filter holder can be inserted into the existing Met One SASS/SuperSASS® sampler module.

The Teflon® filter deposit area for the 47-mm filter is 11.76 cm<sup>2</sup>. The deposit area for the 25-mm filter using the insert is 3.53 cm<sup>2</sup>, resulting in a 3-fold increase in the amount of PM deposited per cm<sup>2</sup>. Increasing the amount of particulate per cm<sup>2</sup> results in improvements in the detection limit for elements.

Preliminary results from the comparison of the 47-mm Teflon filter to those from the 25-mm Teflon filter in Montgomery, AL are shown as well as the decreasing trend in certain elements. Results from data collected at additional cities as well as an evaluation of the improvement in the percentage of non-detects will be evaluated in 2017.

## BACKGROUND

The deployment of the PM<sub>2.5</sub> ambient air monitoring network is a critical component in the implementation of the PM National Ambient Air Quality Standard (NAAQS).

The data from this network drives an array of regulatory decisions, ranging from designating areas as attainment or nonattainment, to developing cost-effective control programs and tracking the progress of such programs.

Data derived from the PM monitoring network include both aerosol mass measurements and chemical speciation data. Chemical speciation data serve the implementation needs associated with developing mitigation approaches to reduce ambient PM levels and a variety of health, research, and modeling needs.

The PM<sub>2.5</sub> Chemical Speciation Network (CSN) currently consists of approximately 50 Speciation Trends Network (STN) sites for routine speciation monitoring and another 100 or so supplemental sites for state/local driven monitoring needs.

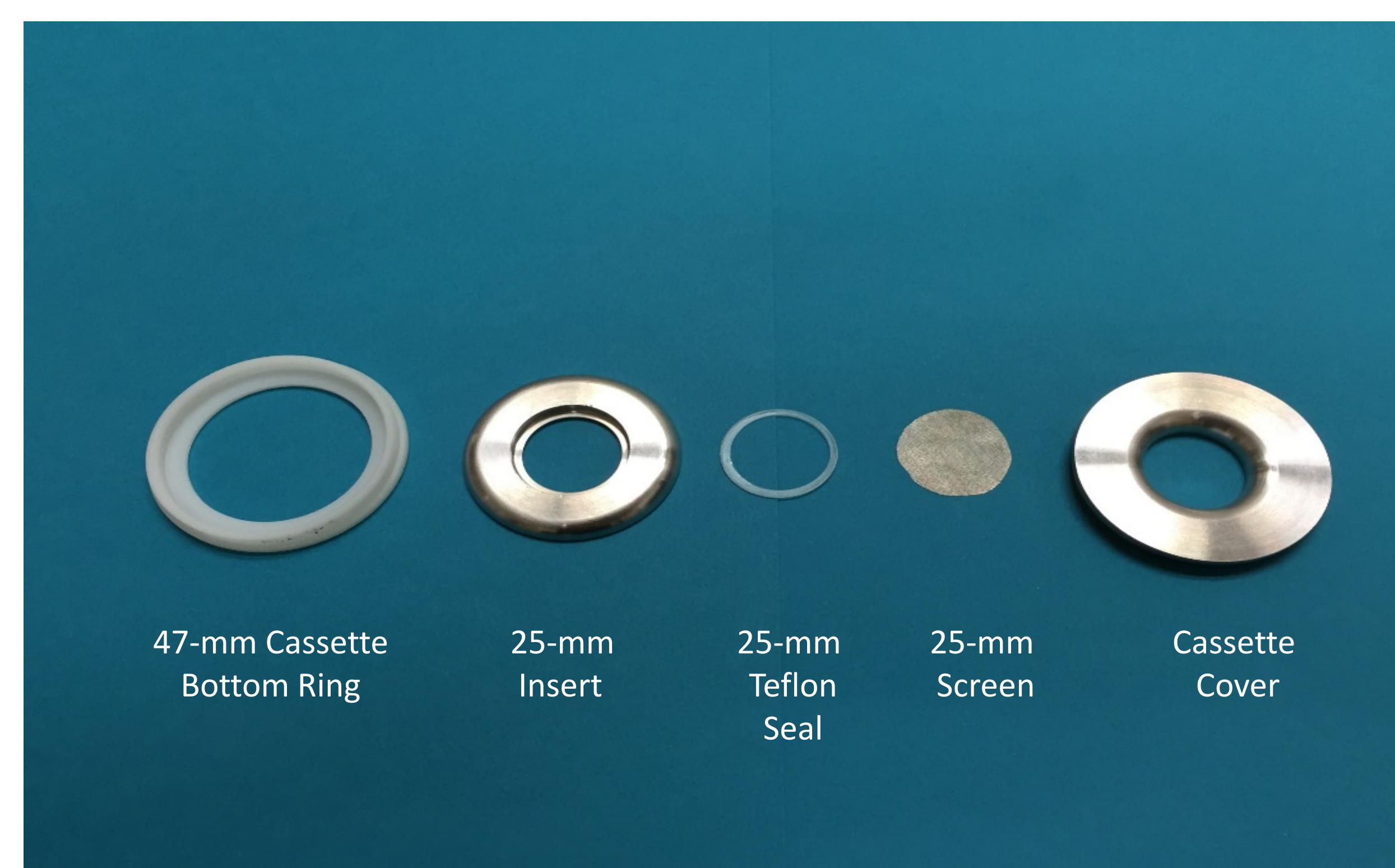
## METHOD

The CSN has been operating since 2000 with elements being analyzed by EDXRF. With the decreasing PM<sub>2.5</sub> concentrations, the percentage of non-detects for some of the elements may continue to increase. Some of the PM<sub>2.5</sub> elements of most interest for source apportionment and health effects research, such as nickel (Ni), vanadium (V), and arsenic (As), are not always detected at high percentages above the method detection limit (MDL).

The EPA has designed a sampling module insert for the Met One SASS/SuperSASS® to reduce the sampled filter size from 47-mm to 25-mm and increase the concentration of PM<sub>2.5</sub> per cm<sup>2</sup>. The insert has been evaluated in the EPA's CSN mega-performance evaluation (Mega-PE) program. Filters were collected by the EPA National Analytical Radiation Environmental Laboratory (NAREL) in Montgomery, Alabama. Performance test participants included six CSN laboratories and the EPA lab in Montgomery.

<sup>1</sup> U.S. EPA (2014). Air Quality Trends.  
<http://www.epa.gov/airtrends/aqtrends.html#airquality>

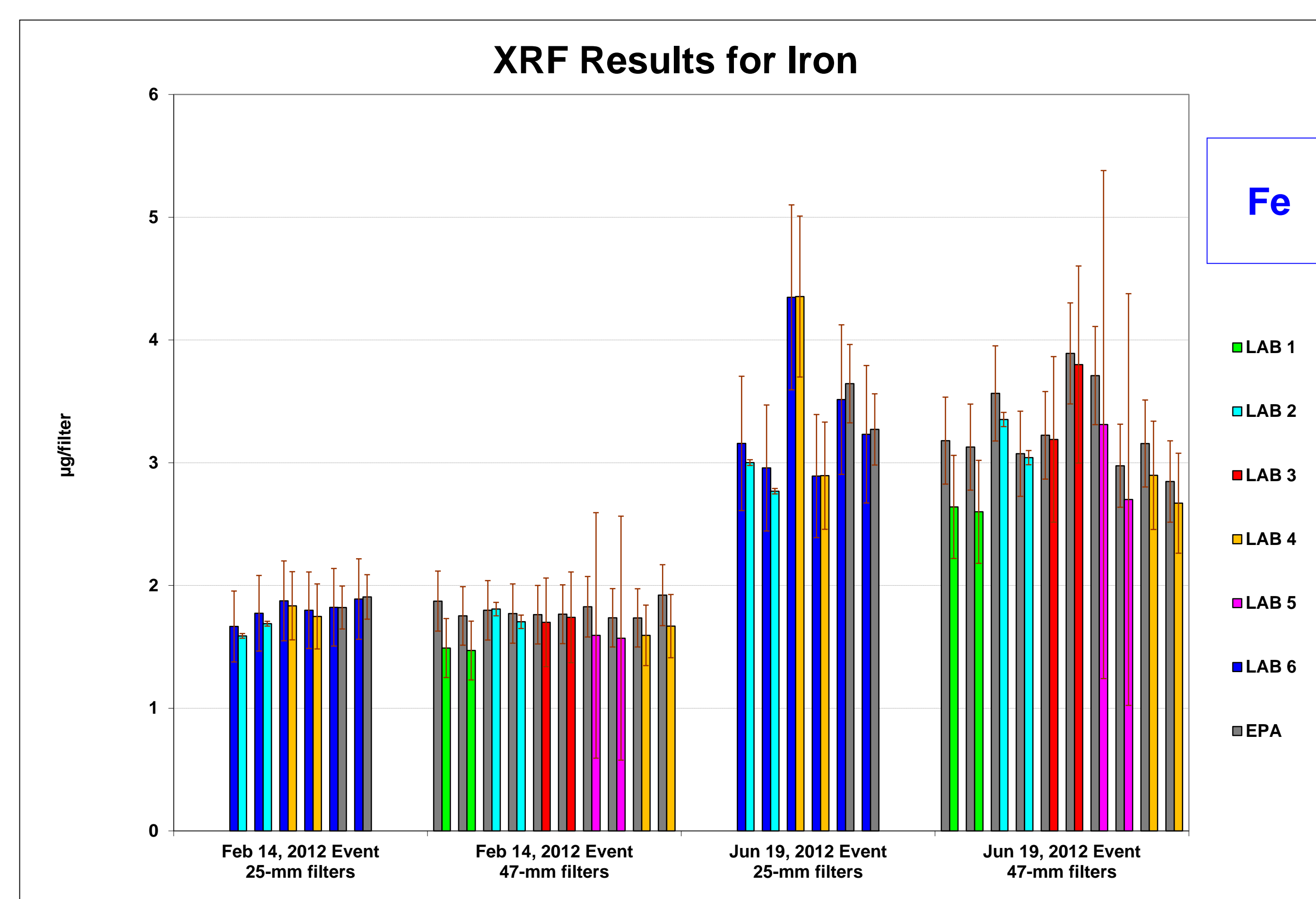
## 25-mm FILTER INSERT



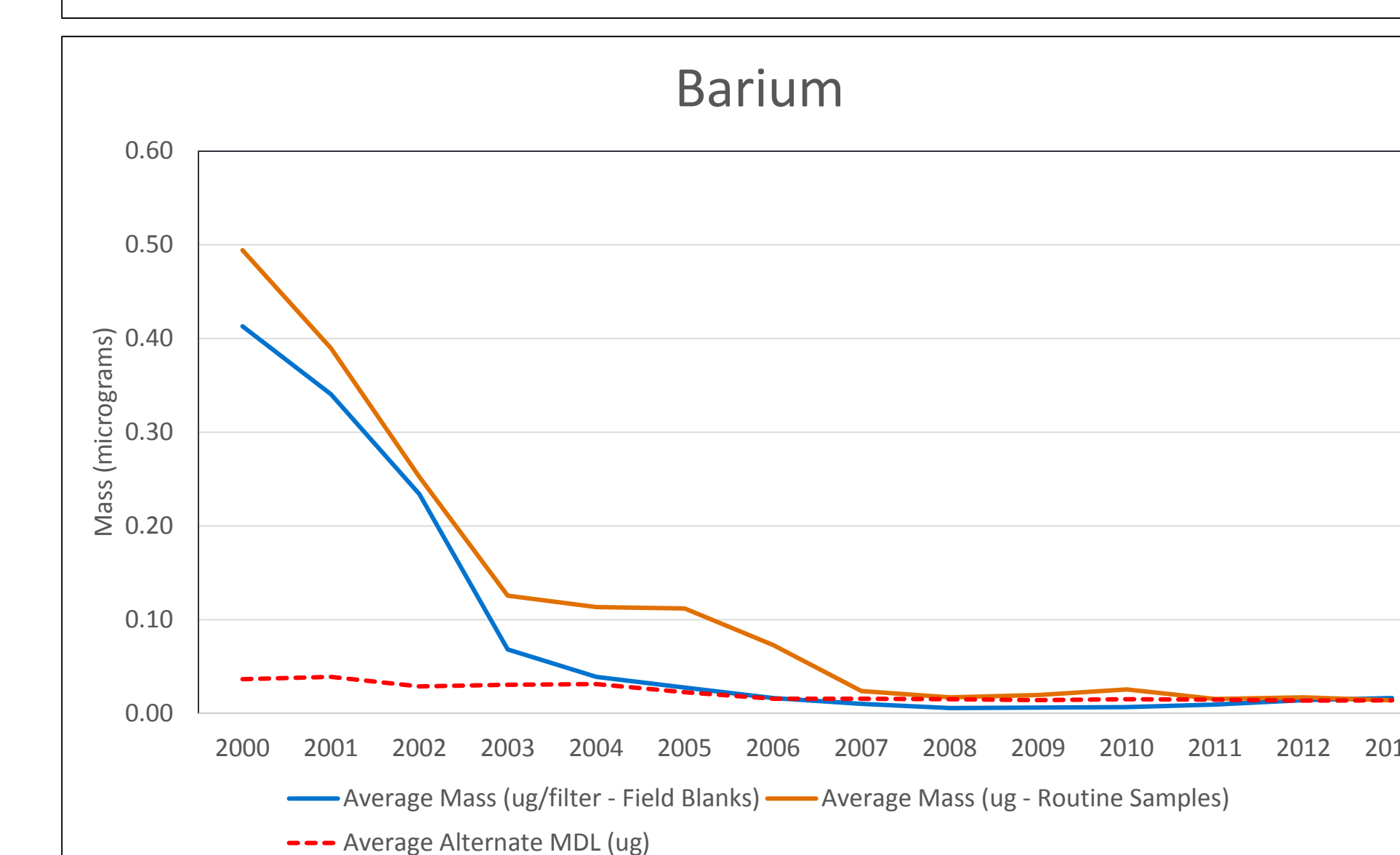
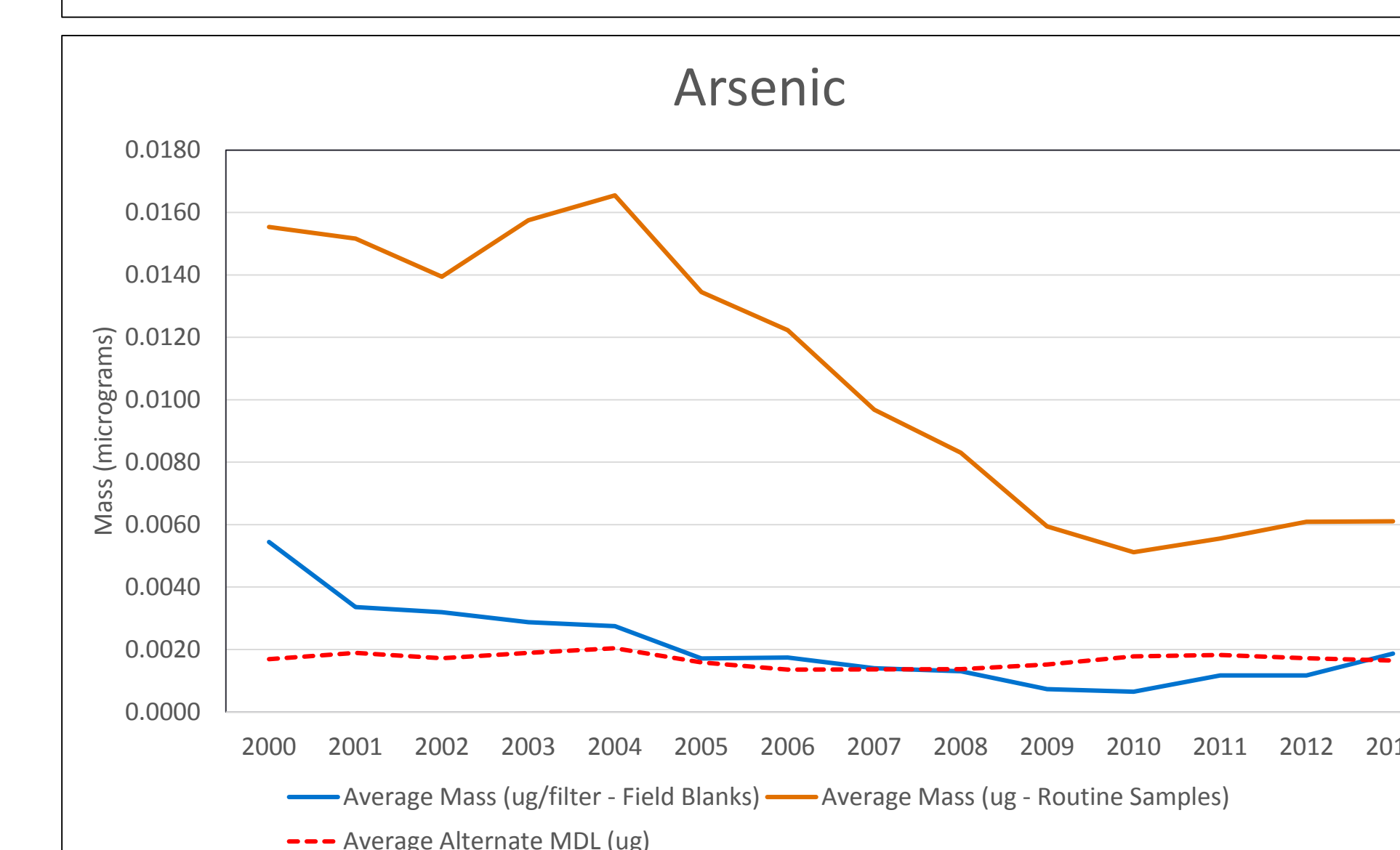
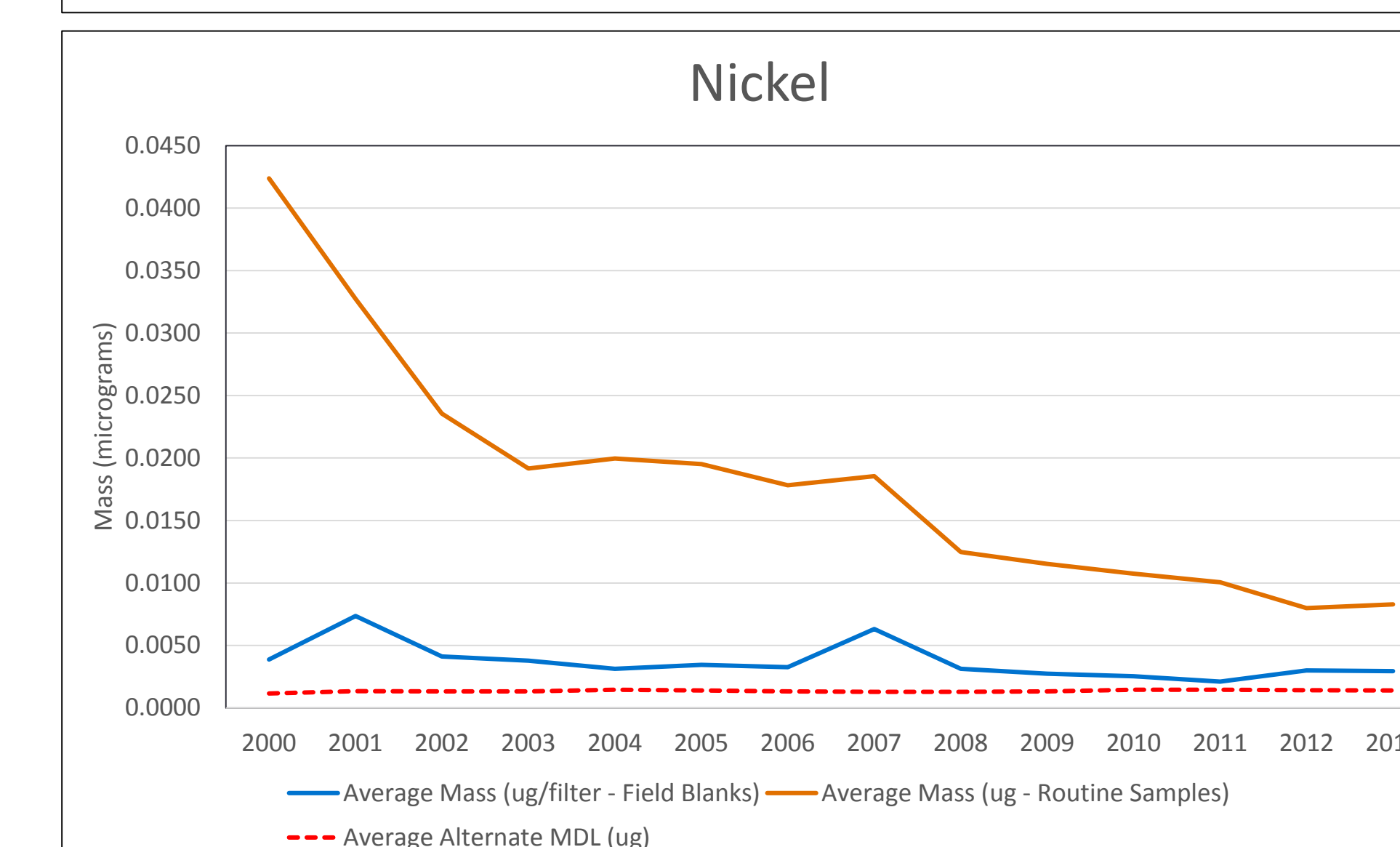
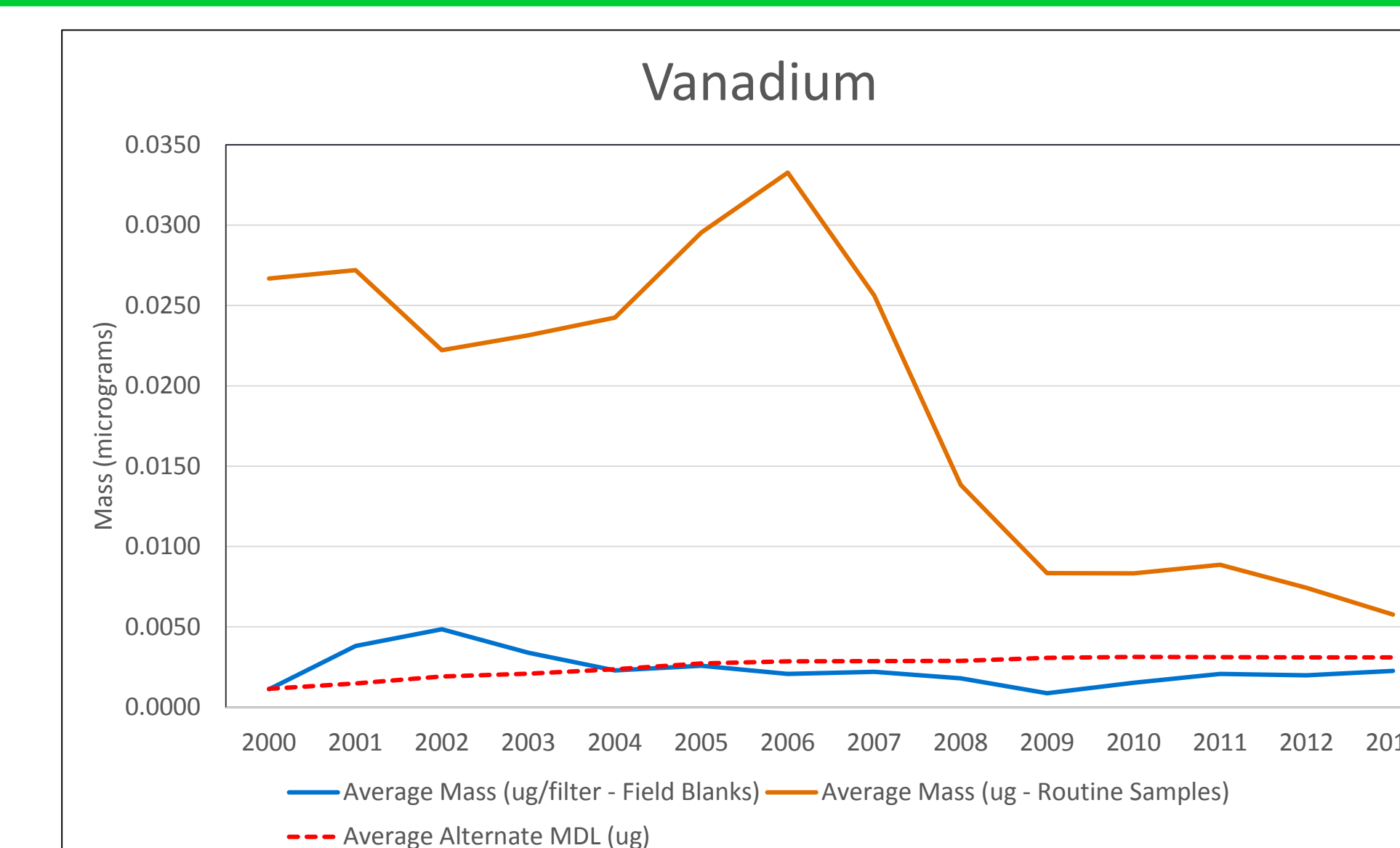
## RESULTS

Parameter Code	Parameter Description	Percent of Records Above MDL <sup>2</sup>
88102	Antimony	5.7%
88103	Arsenic	29.5%
88107	Barium	21.9%
88110	Cadmium	4.9%
88112	Chromium	32.1%
88113	Cobalt	9.7%
88117	Cerium	4.6%
88118	Cesium	4.8%
88128	Lead	37.1%
88131	Indium	4.4%
88136	Nickel	47.6%
88140	Magnesium	25.1%
88152	Phosphorus	7.5%
88154	Selenium	17.1%
88160	Tin	10.5%
88164	Vanadium	39.0%
88166	Silver	4.9%
88168	Strontium	20.6%
88176	Rubidium	4.7%
88185	Zirconium	8.2%

<sup>2</sup> Parameters with less than 50% of records >MDL (2001 – 2012)



## RESULTS



## SUMMARY

The measured concentration of elements in PM<sub>2.5</sub> is approaching, and in some cases has dropped below, the MDLs in CSN.

The EPA has designed a sampling module insert for the Met One SASS/SuperSASS® to reduce the sampled filter size from 47-mm to 25-mm and increase the concentration of PM<sub>2.5</sub> per cm<sup>2</sup> by a factor of three.

The insert has been evaluated through the EPA's CSN mega-PE program.

Initial results show that the 25-mm insert had no detrimental impact on the amount of particulate collected on the filter.

Results from data collected at additional cities as well as an evaluation of the improvement in the percentage of non-detects will be evaluated in 2017.