Supporting Information

Development, testing, and deployment of an air sampling manifold for spiking elemental and oxidized mercury during the Reno Atmospheric Mercury Inter-comparison Experiment (RAMIX)

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Pages: 3 (including cover sheet) - one page of figures, one page of text

Figure S1-1: Schematic diagram of the manifold used during RAMIX. The inlet end was attached to a heated cyclone inlet to remove particles (size cut of ~1 µm). The loops on the left are the cool-down region for the hot manifold air (115 °C) prior to reaching the blower motor. Note air moved from right to left. Refer to Gustin et al.[19] for information on each research group.

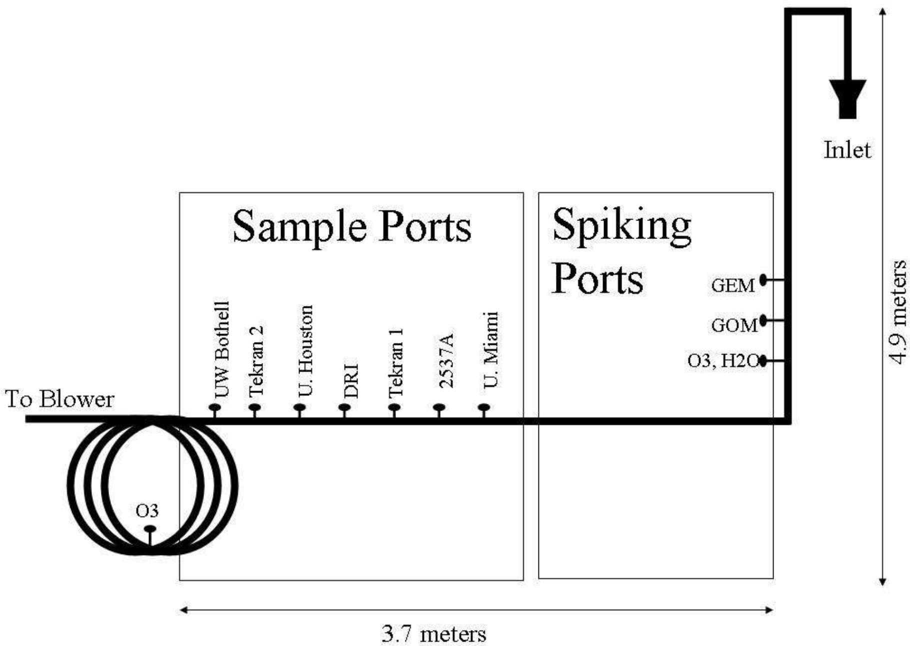

Table S1-2: Spiking tests performed during RAMIX (September 5-16) and the number of trials conducted for each combination.

Combination #	Species tested	# Trials	Range of spikes
1	GEM	5	4.8-25.4 ng m^{-3}
2	$HgBr_2$	17	0.3-0.7 ng m^{-3}
3	O_3	2	49.5-82.8 ppbv
4	GEM + O_3	3	As above
5	GEM + $HgBr_2$	8	As above
6	$HgBr_2$ + O_3	5	As above
7	$HgBr_2$ + $H_2O(g)$	3	As above (water spiked to 20 gm/kg)
8	GEM + $HgBr_2$ + $H_2O(g)$	1	As above

Site Description and Details

The RAMIX field site was located at 39.5°N, 119.7°W, 1340 meters asl, in Reno, NV. The area is semi-rural and arid. To the east of the site, native dry grasses and shrubs are the primary vegetation for approximately one km. Within one km to the southwest is farmland, including grazing animals and regular irrigation. Approximately 1.2 km to the west is a highway. There is a water reclamation facility to the northeast and during RAMIX an active facility housing 90 sheep ~100 m to the northwest. There were no significant known sources of mercury within the immediate area.

Operating procedures and protocols during RAMIX

RAMIX was divided into two periods. The first two weeks (August 22-September 4) were devoted to measurements of ambient air through the manifold with occasional 30 to 60 minute spikes of GEM. The spike concentrations were known to all investigators and were used to verify that instruments were giving reasonable results. The second two weeks (September 5-16) were devoted to intensive spiking tests using GEM, $HgBr_2$, O_3, water vapor, and combinations of these species. Table S1-2 in the supporting information lists the different combinations tested, the range of spikes for GEM, $HgBr_2$, and O_3, and the number of trials for each spike.

During the intensive spiking weeks, the manifold and spiking systems were operated as independently as possible by each research group to prevent bias in data analysis and interpretation. Discussions were held prior to intensive spiking to discuss potential concentrations and what spiking combinations would be most useful. A spiking schedule was developed and distributed to each group. The schedule was necessary to ensure groups using denuders were collecting during spikes. Groups knew *when* and *what* would be spiked, but did not know what the concentrations were. Groups were not told what the permeation rates were to prevent back-calculating concentrations. Spike concentrations were provided to all research groups after completion of the campaign and data was submitted to a common data archive.

The manifold was designed and built at the University of Washington under the direction of D. Jaffe. In the field, the manifold was operated by the UNR team during the first two weeks under the direction of M. Gustin and by the designers (B. Finley and K. Call) during the intensive spiking weeks. The manifold operators had six responsibilities during RAMIX: 1) control of the manifold temperature and flow rate, 2) measurement of GEM and $HgBr_2$ permeation rates, 3) O_3 production and delivery, 4) water vapor production and delivery, 5) controlling spike concentrations, and 6) adding/removing spikes.

Quality control was done with twice daily checks of temperature and flow rate. For the permeation sources, regular checks were carried out to verify permeation rates and stability (section 4.3 and 4.4). For the Tekran 2537B used to measure permeation rates, daily blanks and internal calibrations were done. Before and after the campaign, the Tekran operation was verified with manual injections using a Tekran 2505 calibrator. There were no significant changes observed in capture efficiency, internal permeation rate, internal calibration factors, or internal lamp operation during the entire campaign.