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Executive Summary
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Measuring Vertical Fluxes of Gaseous Elemental Mercury in Wisconsin

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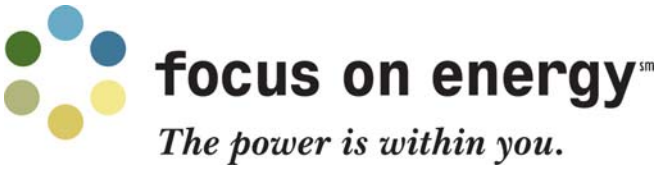

Executive summary

Increasing mercury concentrations in the environment have resulted in concern for fish

eating animals and humans. Fish consumption advisories for mercury are now common place. Most of the mercury in the aqueous environment originates in emissions to the ambient air. Efforts to reduce the mercury in the environment will first require a better understanding of mercury movement from the point of emission to the point of impact. Incorporating this knowledge and understanding will facilitate the development of improved mercury modeling. The computer models can then be used to test control strategies.

Most pollution monitoring has focused on measuring concentrations and the associated the horizontal component of the prevailing winds. The goal was to find the compass direction of the pollution source. This project was part of an effort to improve our knowledge of the vertical (up and down) movement of mercury. To this end the Wisconsin DNR conducted a study begun in July 2003 and completed in July 2005 that attempted to measure mercury flux. Mercury flux a measure of the net difference between the up and down mercury movement at the monitoring site. Mercury flux is calculated as the change in concentration (ng) over a defined area (m^2) in a defined time period (hr). This study relied primarily on the collection of a series of individual samples. Controlling conditions for sampling were selected by measurement of the direction of vertical wind. The project tasks can be summarized in the following way.

- Project staff completed background monitoring at six candidate monitoring sites. The background monitoring provided basic information on the average mercury concentration at the project monitoring sites.

- Project staff have assembled and tested a monitoring system designed to collect selective air samples based on the vertical direction of the wind (z-wind direction).

- Using the sampling system, we have collected 146 air samples which were analyzed for mercury. Data from these samples were analyzed to determine if any relationship exists between mercury concentration and vertical wind patterns.

- Using a special sonic anemometer for 3 dimensional wind monitoring and the Tekran analyzer for real-time mercury monitoring we have assembled a sixty-day (thirty days each at two sites) database that can be analyzed for mercury flux. This monitoring supplemented data from the main flux sampling project.

The study has provided a good initial database of measurements of both mercury concentrations and three dimensional wind measurements. However, the review and investigation of the study data is limited due to the brief sampling intervals conducted at all the sites. In addition, the conditional sampling methodology yielded data of mixed quality. Suspect values in turn yield some vertical transport measurements and subsequent net vertical fluxes that were so considerably large it was difficult (if not impossible) to explain the values in the context of the site's location and meteorology.

Monitoring data also showed that current commercial analyzers can measure ambient mercury concentrations and local fugitive emissions, but may be of limited use in making

direct observations of large stationary sources impacts.

Finally, the data support current ideas on the importance of re-emission of mercury from surfaces, solar radiation and wind speed on ambient mercury concentrations.

Because modeling conducted to-date has not incorporated mercury fluxes the results of this study were restricted to qualitatively looking at our knowledge of mercury movement. The data will be useful to model developers when they begin to incorporate mercury flux.

Finally the data analyses reported here are preliminary and limited. We hope to be able to continue analyses of the data with a goal of obtaining a better understanding of the movement of mercury in the ambient air. To that end we have made suggestions for how a future study might build upon and improve on the work reported here. Future studies should expand the number of monitoring parameters and include soil temperature and soil mercury measurements. In addition we recommend using Tekran analyzers for field measurement of mercury fluxes.