DAS Labs | FACT SHEET

Desert Research Institute

» DRI Environmental Mercury Laboratory

Analytical Capabilities:

DRI's Environmental Mercury Laboratory has been established for trace-level analytical measurements for mercury in the environment and has the capability to analyze mercury concentrations in all major media: air, water, soils, and plants. The laboratory is equipped with the following main instrumentation:

- Three Tekran Model 2537 Vapor Mercury Analyzers for measurements of gaseous elemental mercury in the air.
- Two sets of auxiliary analyzers, Tekran Model 1130 and 1135 Speciation units: these allow for the speciation of all main atmospheric forms of mercury in the air (GEM: gaseous elemental mercury; RGM: reactive gaseous mercury; and FPM: fine-particulate mercury).
- Tekran Model 2600 Automated Water Analysis System: this analyzer allows for analysis of ultra-trace levels of total mercury in water and solutes samples according to US EPA Method 1631, to levels below 1 ppt.
- A Nippon Model MA-2000 Mercury Analyzer equipped with autosampler: this system facilitates efficient throughput of samples for thermal analyses of total mercury in solid phase (soils and plants) according to EPA method 7473.
- Micrometeorological instruments (Eddy Covariance towers, Modified Bowen Ratio systems): for the study of surface-atmosphere exchange fluxes of elements.




Pictures, from left to right: Nippon Mercury analyzer, Tekran 2537 and 1130/1135 analyzers; and water analyzer system.

The DRI Mercury laboratory also is equipped with auxiliary systems for trace-metal analytical research and sample preparations; including Water Purification Systems (Milli-Q Academic), particulate-free and laminar-flow hoods, freeze dryer, (Micromodulyo, Thermo Scientific), dishwasher, mills, and precision analytical balances.

» GROUP LEADER

Dr. Daniel Obrist, Associate Research Professor
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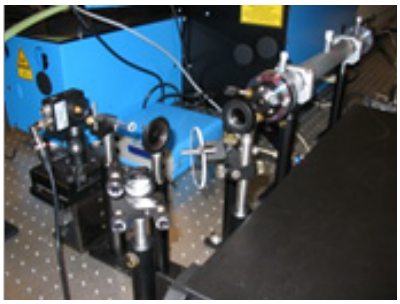

Pictures, from left to right: Atmopsheric measurements along the Dead Sea shore. Soil sampling to assess mercury loads in U.S. forests; micrometeorological set-up to quantify surface-atmosphere exchange fluxes of mercury; laboratory prototype of a new sensor to measure atmospheric mercury.

Research Activities:

Dr. Obrist's research interests include atmospheric chemistry, transport, and biogeochemistry of pollutants and quantification of surface exchange processes of atmospheric constituents between soils, plants, and the atmosphere. A special emphasis includes cycling of mercury in the environment and how global change and disturbances affect these processes. Dr. Obrist has been involved in trace-level mercury research for the past 10 years, and he and his group have implemented all necessary Standard Operation Procedures to study atmospheric, biogeochemical, and surface-atmosphere processes. A few recent and ongoing projects are highlighted as follows:

Atmospheric Mercury Oxidation and Depletion in the Dead Sea Basin: Reactive halogen compounds have been linked to oxidation of atmospheric mercury, which can lead to so-called atmospheric mercury depletion events (AMDE) and enhanced atmospheric deposition loads. This research investigates the pathways of mercury oxidation in the atmosphere at the Dead Sea, a basin that is naturally enriched in reactive gaseous bromine species and hence can be used as a natural laboratory to study atmospheric bromine-mercury interactions. The data show some of the strongest mercury oxidation on Earth at the Dead Sea, and results have been published in the journal *Nature Geoscience* in 2011.

Atmospheric Mercury Sequestration in U.S. Forests: Globally, an estimated 300,000 metric tons of Hg are stored in surface soils, and soils are often enriched in mercury due to recent atmospheric pollution loads. The stability of these large surface mercury pools have implications for future pollution loads in ecosystems and the atmosphere. The goals of this EPA-funded study were to develop a systematic inventory of Hg pools and fluxes across U.S. forest and to assess the fate and stability of mercury sequestered in soils and plants.

Bromine, Ozone, Mercury, Experiment (BROMEX) in Barrow, Alaska: As part of a NASA/JPL-funded study to assess how sea ice changes affect atmospheric chemistry, we characterized mercury dynamics along the Arctic Ocean near Barrow, Alaska. In March and April 2012, our group and researchers from Environment Canada deployed atmospheric instrumentation to assess the effect of sea ice on mercury oxidation, deposition, and re-emissions. Instrumentation were deployed at two sites, one floating on the sea ice of the Arctic Ocean, and one located inland in the Arctic Tundra. Measurements included atmospheric Hg concentrations, surface-atmosphere interactions, and snow Hg concentrations.

MRI: Development of a Cavity Ring-Down Sensor for Real-Time Measurement of Atmospheric Mercury Concentrations and Fluxes: This NSF-funded project aims to develop a new, field-usable sensor for measurement of atmospheric mercury (Hg) concentrations and fluxes at high time resolution and high sensitivity using Cavity-Ring Down (CRD) spectroscopy. The sensor is currently comprehensively tested at DRI, and first-ever surface-atmosphere exchange flux studies for Hg by means of Eddy Covariance technique are currently underway.