Abstract
A pilot study was designed to measure heavy metals in ambient air. Air samples were sent to a contracted lab for bulk analysis using ICP-MS methods for arsenic, lead, cadmium and total dust. Concentrations were below detection limits and OSHA personal exposure levels. At this time, further review of proper sampling equipment and rates is warranted to determine if levels in air are lower than EPA ambient air standards. The study justifies use of the NSLS to analyze samples to identify any heavy metal present before performing bulk analysis.

Introduction
Deposition and bioaccumulation of air toxics have multimedia effects on water bodies, soil, ecosystems and humans in urban and rural settings. Airborne dust may be spreading arsenic and other heavy metals within and between continents. It has been noted that metals especially arsenic, create cardiovascular and respiratory problems at lower levels of exposure than previously observed and recommended by agencies such as the EPA. If dust and aerosols with heavy metals serve as an exposure path to humans (in addition to what we drink and eat), there could be serious health effects. (Morman, 2010)

Anthropogenic sources such as electric utility facilities, metal mining, industrial plants, car exhausts and pesticides all contribute to releasing several air toxics into ambient air. (Kampa, Castanas 2008) The EPA has set goals to establish present air toxic levels in order to assess progress as years of monitored data becomes available. (Hagelstein, Heinzle, 2008)

Materials and Methods
To gather baseline data on heavy metals in air (arsenic, lead, cadmium) around Brookhaven National Lab, an air sampling project was begun. Using 3 JST-GAST high volume air samplers with flow rates of 15 liters per minute, PVC air cassettes (37mm, Sum pore size), ambient air from the picnic area near NSLS-II construction. Building 30 and the main security gate were collected for 24 hours on July 16th, 22nd, and 27th, 2010. A Canon digital camera was used to take photos of sites for documentation purposes. A Kestrel portable weather station was used to acquire weather data (air temperature, wind speed, relative humidity, dewpoint). A Garmin eTrex HC unit was used to mark site locations for use with Google Maps. The NCAR website was used for ozone data for sampling period.

Classroom Applications
Students can perform several inquiry experiments:
• Collect air quality data in their school district as it applies to high traffic areas or industry sites.
• Perform air quality monitoring and work with local EPA to assess particulate matter or ozone at local sites. (Air Toxics Campaign)
• Collect rainwater, snowmelt and analyze for heavy metals using NSLS X-ray spectroscopy.
• Create a GIS map of air sampling sites and look for distributive relationships among data.
• Attempt to correlate air action alerts, ozone with distributive relationships among data.
• Collect weather data in their school district as it applies to high traffic areas or industry sites.
• Attempt to correlate air action alerts, ozone with distributive relationships among data.

Results
Results from bulk analysis of air samples are summarized in Table 1. Table 2 shows weather data. Access to Ozone and upper air wind maps were used from http://www.dec.ny.gov/airmon and http://www.rap.ucar.edu/weather.

Discussion
While concentrations for heavy metals were well below OSHA PEL limits, each metal was detected at a upper limit a factor of 10 greater than EPA ambient air risk concentrations. Still, sample concentrations seem to be below detection limits thus requiring further testing with appropriate detection analysis. One would expect potentially varying results based on the below sample site descriptions.

The main security gate has a traffic flow of personal autos and construction trucks which peaks between the hours of 7 to 10am and 3 to 5pm. The NSLS II has typical construction traffic, and transport of dust from disturbed soil on site toward the Picnic sampling area based on wind patterns. Building 30 patio served as a control since it was blocked from most car exhaust, bordered by forest which could filter out particulates. It was the least disturbed area with little to no construction vehicles and automobiles.

Weather data was fairly consistent at sites for each day and the month as a whole. With only 3 samples for each site, statistical analysis was not performed. However, with further sampling, correlations could be made about traffic, weather, wind patterns and the presence, transport patterns and possible exposure pathways of heavy metals in the atmosphere.

References


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