MONITORING ATMOSPHERIC MERCURY SPECIES IN MICHIGAN: YEAR 2 ANNUAL REPORT

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Submitted to Michigan Great Lakes Protection Fund

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MONITORING ATMOSPHERIC MERCURY SPECIES IN MICHIGAN

I. ABSTRACT:

This project addresses a persistent, bioaccumulative toxic pollutant of concern – mercury (Hg). Hg is a pollutant that once released into the environment can be converted to an extremely persistent, bioaccumulative organic form, methylmercury. Methylmercury can then build up in organisms high in the food chain, such as fish, posing a risk to wildlife and humans that consume these fish. Hg continues to be targeted as a pollutant of concern for source identification, reduction and/or elimination through a variety of state, federal, and international efforts. Since 1988, the Michigan Department of Community Health has issued a statewide fish consumption advisory for Hg for all of Michigan's inland lakes, and for certain species of fish in three of the Great Lakes and Lake St. Clair. The atmosphere has been determined to be the most significant source of Hg to Michigan's inland lakes and for some of the Great Lakes (1-3). While precipitation is thought to deliver a majority of the Hg to terrestrial and aquatic ecosystems, dry deposition of Hg can exceed the wet in certain areas. Quantification of the levels of reactive gaseous mercury (RGM), currently thought to be the most important form of Hg for deposition, has yet to be accomplished in any systematic manner in Michigan or anywhere in the Great Lakes Region. Since RGM is primarily emitted from anthropogenic sources, measurements of speciated ambient Hg and Hg deposition is being conducted in three urban areas in Michigan. In addition, this project continues the long-term event-based Hg deposition record at three rural sites in Michigan to allow trend analysis and determination of background Hg levels for estimation of Hg contributions from local urban sources.

II. STATEMENT OF PROBLEM

Mercury has been recognized world wide as an environmental pollutant of concern for decades. In Michigan, elevated levels of methylmercury in fish tissue have caused the Michigan Department of Community Health to issue a state-wide fish consumption advisory, first released in 1988 and every year thereafter. Atmospheric transport and deposition of mercury has been shown to be the major pathway through which mercury enters remote ecosystems and yet there has not been any long-term commitment to fund an on-going monitoring program to determine atmospheric sources and trends for mercury deposition that is the primary cause of these fish advisories. In Michigan, thousands of pounds of Hg continue to be released into the environment, primarily into the atmosphere (5).

The purpose of this project is to assess concentrations of Hg species (elemental and reactive gaseous, particulate phase) in ambient air and in deposition in urban and rural locations. The current lack of speciated ambient Hg data hampers our ability to ground-truth atmospheric transport and deposition models and thus limits their applicability for policy applications. The specific objective is:

a. **To assess spatial and temporal trends of speciated atmospheric Hg in both rural and urban areas at six atmospheric Hg monitoring sites.** Climatological variability requires several years of monitoring data to adequately capture year-to-year changes in weather patterns and resulting Hg deposition. Three years of continuous monitoring at six sites in Michigan were proposed to allow for a meaningful assessment. Three of these sites are located in urban areas with the other three sites located in more rural locations. Mercury wet deposition is collected at all six sites using daily event precipitation sampling systems. At two of the sites, speciated measurements of ambient Hg (gaseous elemental Hg, RGM, and particulate phase Hg) are collected. Understanding the spatial and temporal trends in Hg in each of its forms is critical in elucidating the atmospheric chemistry of Hg and the source influences on the Hg deposited to sensitive ecosystems. Currently, Michigan lacks any long-term Hg data from urban

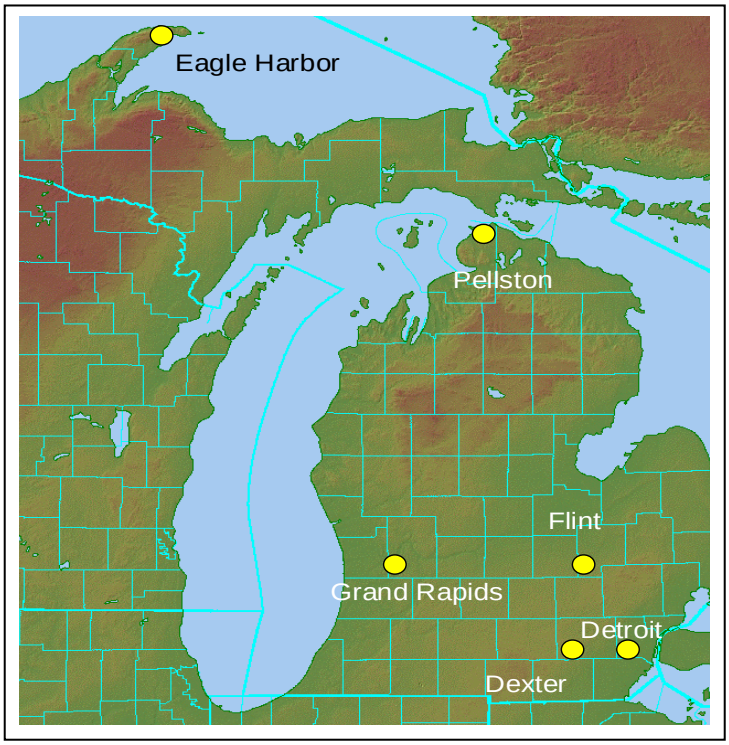

Figure 1. Location of Mercury Monitoring Sites.

areas[1]. As part of this MIGLPF project, three urban sites in Michigan have been selected that have limited or no atmospheric Hg data. These sites are located in Grand Rapids, Flint and Detroit. Data collection at three rural sites in Dexter, Pellston and Eagle Harbor provide regional background measurements and continue the long-term Hg record at these sites (Figure 1). Dexter is located northwest of Ann Arbor and is an excellent site used for investigating air mass transport into the state that impact Michigan's water bodies. Pellston is located in Michigan's northern Lower Peninsula and is representative site for Michigan's rural ambient Hg levels. Eagle Harbor is located in Michigan's Upper Peninsula on the Keweenaw Peninsula and provides a background measure of relatively clean air masses that enter the state from the north.

The long-term records at Dexter, Pellston, and Eagle Harbor are critical to the success of the project as they provide the relevant climatological context to interpret the urban levels. Currently, it is not clear how much of the Hg deposition in and downwind of urban areas is generated in those urban centers and how much is attributable to regional sources and long-range transport. Operation of the sites located at Pellston and Eagle Harbor are also critically important for temporal trends and to facilitate loading estimates for the total maximum daily loads (TMDL) determination for Michigan's inland lakes located in the upper peninsula as well as the states northern lower peninsula. Most inland lakes that have been identified by the Clean Water Act's (CWA's) 303d's list for TMDL determination are located in Michigan's Upper Peninsula and Michigan's northern Lower Peninsula.

In addition to quantifying wet deposition on a daily event basis at the six sites, enhanced speciated ambient Hg measurements are currently performed at two sites, Detroit and Dexter. Measurements of elemental Hg, RGM, and particulate Hg provide data needed to determine the total impacts of urban areas on downwind ecosystems. Methods for RGM have only become available over the past 4-5 years. Modeling estimates for the Lake Michigan Mass Balance Study (LMMBS) revealed that dry deposition of RGM resulted in Hg loadings to the lake approximately equal to the wet deposition loadings. Near large sources or urban/industrial areas, the dry deposition of RGM may exceed the wet deposition input to downwind lakes. The lack of ambient data precludes the scientific and regulatory communities from reducing the largest source of uncertainty in TMDL and mass balance studies. Furthermore, limited data collected in Detroit indicated that dry deposition of Hg bound to particulate matter also significantly contributed to the total atmospheric deposition in the city and to levels of Hg in urban runoff. This is in contrast to rural areas where particulate Hg levels are much lower and gaseous Hg, both elemental and RGM, dominate the dry deposition.

[1] Approximately nine months of Hg data was collected in Detroit as part of the Hg Minimization Program by the City of Detroit Water and Sewerage Department. RGM was not measured in that study.

Public Benefits and Implications: This project provides speciated ambient Hg data to the state and local governments for assistance in determining background levels in urban areas where multi-pathway risk assessments may be conducted. Additionally, this data will be useful to compare modeled values from national or regional programs such as the EPA's Cumulative Exposure Project that assesses ambient air concentrations for census tracts based on dispersion modeling. Finally, $PM_{2.5}$ samples collected onto Teflon filters are obtained from the ambient sites to allow for subsequent analysis by ICP-MS. This elemental data will provide additional information on the levels of other ambient toxic elements as well as providing needed data for identifying the sources of the Hg and other elements collected in the urban communities. This trace element data is required for identifying the sources and source regions of the Hg measured in Michigan with the application of meteorological and receptor modeling techniques. This understanding will help the Governor and the DEQ in the process of reducing toxics like Hg threatening our health and the environment.

Annual reports are generated that summarize the data collected for each of the three years. Joint peer-reviewed publications from this investigation will also be a major goal of the project. The data will be presented at scientific meetings such as the International Association of Great Lakes Researchers and other forums such as the Binational Strategy meetings that include many stakeholders in the Great Lakes Basin and Ontario. The information will also be organized in a fashion that allows it to be accessible through the MDEQ-AQD's air toxics web site. The first two years of the project have focused on purchasing and building the state-of-the-art equipment, establishing the monitoring sites, and performing chemical analysis. Years 3 and 4 are critical to this project in the data base development and data analysis phases of the grant. Continued funding is essential for this project to be a success. The goals of this project overlap with the goals of the State of Michigan, the USEPS, the IJC, and other international agreements.

III. METHODOLOGY

The collection and analysis of atmospheric Hg samples requires specific expertise and specialized laboratory facilities. The UMAQL has developed the analytical and sampling capabilities for performing ultra-trace analysis of Hg in environmental samples. All sample preparation and handling is performed in a Class 100 clean room equipped with state-of-the-art Hg and trace element analytical instrumentation. The specific collection and analysis techniques for all measurements have been described in previous reports and will not be repeated here.

IV. PROGRESS REPORT AND PRELIMINARY DATA

Summary of Accomplishments During this Period

Site installation and sample collection for Hg and other trace elements in precipitation began in October 2001 at the Dexter, Pellston, and Eagle Harbor monitoring sites, March 2002 at the Grand Rapids site, and February 2003 at the Flint and Detroit monitoring sites. Precipitation sample collection activity at these sites is ongoing at all of the sites. As discussed in previous reports, site installations were delayed at the Flint and Detroit monitoring sites due to MDEQ site reconstruction at these two locations.

Sample analysis has proceeded according to the proposed schedule and real-time air mass trajectories have been made available on the UMAQL web site each day for all of the monitoring sites. Please see http://www.sph.umich.edu/ehs/umaql/. This tool allows the public to see where the air reaching the monitoring sites was prior to arriving at the sites in Michigan.

Problems Encountered During This Period

There were no serious problems or study delays encountered over the past year.

Sample Collection, Analysis, and Preliminary Data

Table 1 provides a summary of precipitation collection and analyses for Hg and other trace elements compiled through June 30, 2003. The collection and analysis of Hg and trace element (TE) samples is progressing according to the proposed schedule.

Table 1. Summary of Precipitation Collection and Analysis.

	Dexter	Pellston	Eagle Harbor	Grand Rapids	Flint	Detroit	Totals
Samples Collected	120	91	122	101	18	18	470
Hg Samples Analyzed	120	91	122	101	18	18	470
Hg Samples Replicated	32	27	29	28	6	5	127
TE Samples Analyzed	102	81	110	58	0	0	351

In total, 940 precipitation samples have been collected from the sample start date of October 1, 2001 through June 30, 2003 across all of the study sampling sites. Of these, 100% of the samples collected have been analyzed for Hg (N=470), with about 27% of the samples being analyzed in replicate (N=127), as per the Hg analysis replication rate of 25% for this project. Also, 75% of the precipitation samples collected over this period (N=470) have been analyzed using clean techniques for trace elements (N=351) using the ICP-MS. The trace element data is an essential part of this study for source apportionment and the modeling efforts.

Figure 2 is a plot of the volume-weighted mean (VWM) Hg sample concentration in precipitation for the 16-month period of 03/01/02 to 06/30/03 at the Dexter, Pellston, Eagle Harbor, and Grand Rapids sampling sites. This time period was selected for illustration so as to compare across the four sites as of the start of sample collection at the Grand Rapids site in March 2002. The observation of a north to south increasing gradient in precipitation Hg concentrations is likely due to the difference in impact at each of the sites from regional air masses and their distances from local sources. The urban Grand Rapids site has a significantly higher VWM Hg concentration in precipitation when compared to the more rural Pellston and Eagle Harbor sites over this period. These results illustrate the importance of a network of sampling sites to perform TMDL calculations for Michigan lakes based on their geographic location. It should be noted that the Grand Rapids site was also higher for total Hg wet deposition during this 16-month period than all three rural sites. When we compare the data from Flint and Detroit over the past 6 months to those of the rural sites it is clear that the three urban sites receive consistently higher VWM Hg in precipitation and deposition relative to the three rural sites. Detroit and Grand Rapids has ~3.0 times the Hg deposition of Eagle Harbor, for example. These data suggest considerable impacts by local sources on Hg levels within the urban areas. Cleary, additional on-going data collection at the three urban sites will lend further insight into the role of urban sources and the contributions they make to Hg deposition above the regional background and to downwind ecosystems. More years of data are necessary to decouple the influence of meteorology, such as precipitation frequency, transport pathway etc., from the influence of local and regional source emissions.

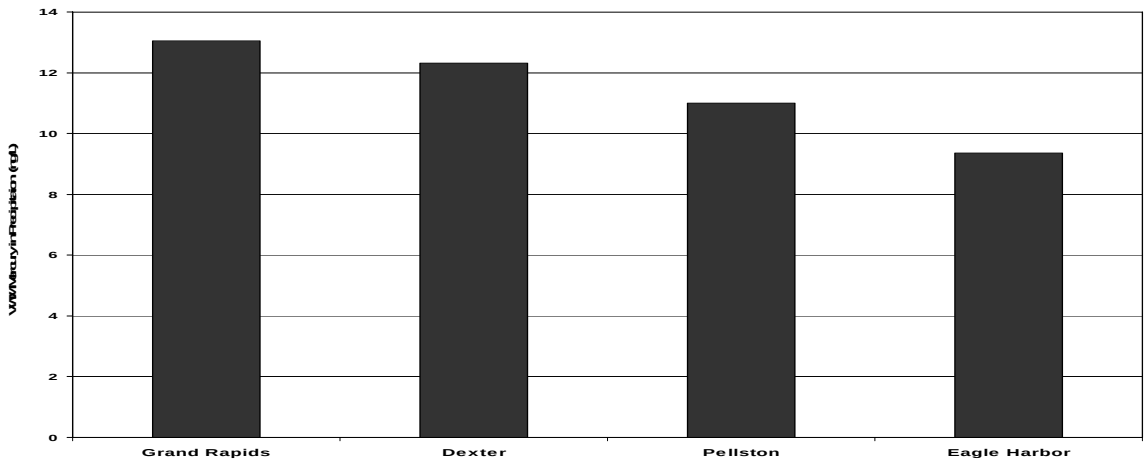

Figure 2. Volume-Weighted Mean Hg Concentrations in Precipitation

Figure 3 is a plot of the mean ambient particulate mercury (Hg(p)) sample concentrations for the 7-month period of 09/23/02 to 05/03/03 at the Dexter, Pellston, and Detriot sampling sites. This time period was selected for illustration so as to compare across the three sites as of the start of ambient sample collection at the Detroit site in September 2002. This plot clearly shows levels of Hg(p) at the Detroit site to be ~50% higher than levels at Dexter, and ~3.5 times higher than levels reported at the Pellston site. As was observed for VWM Hg in precipitation, the particulate Hg data also suggests there to be a large urban influence in Hg levels.

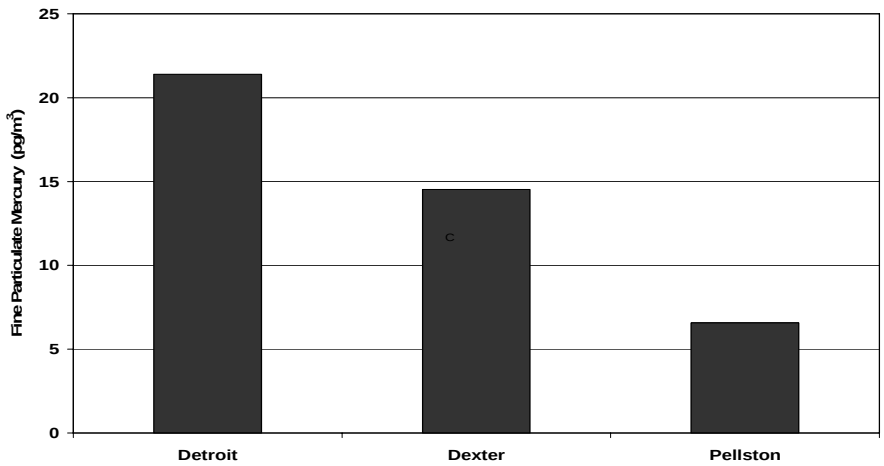

Figure 3. Mean Ambient Particulate Mercury Concentrations.

Figure 4 is a plot illustrating the **typical** magnitude of local source impacts on the ambient Hg levels in Detroit. As is seen in the figure, there were clear impacts from local Hg sources during this period as the Hg(0) concentration peaked at 10 ng/m3, the Hg(II) peaked at 75 pg/m3, and the Hg(p) peaked at 50 pg/m3. While this plot illustrates the typical magnitude of source impacts on a daily basis in Detroit, it should be noted that the maximum levels recorded during the 7-month sampling period for Hg(p) and Hg(II) were 659 pg/m3 and 356 pg/m3, respectively. The maximum levels of Hg(II) recorded in Detroit are similar to levels observed previously in downtown Baltimore during plume impaction by a nearby municipal waste incinerator (8). The site in Detroit is in close proximity to large pollutant point sources including power plants, refineries, incinerators, diesel truck traffic and other manufacturing processes. Clearly, these data in Detroit confirm the need for continued long-term monitoring of speciated ambient Hg within urban areas concurrent with monitoring in rural areas to quantify and assess the overall contributions of Hg from urban point sources on downwind ecosystems.

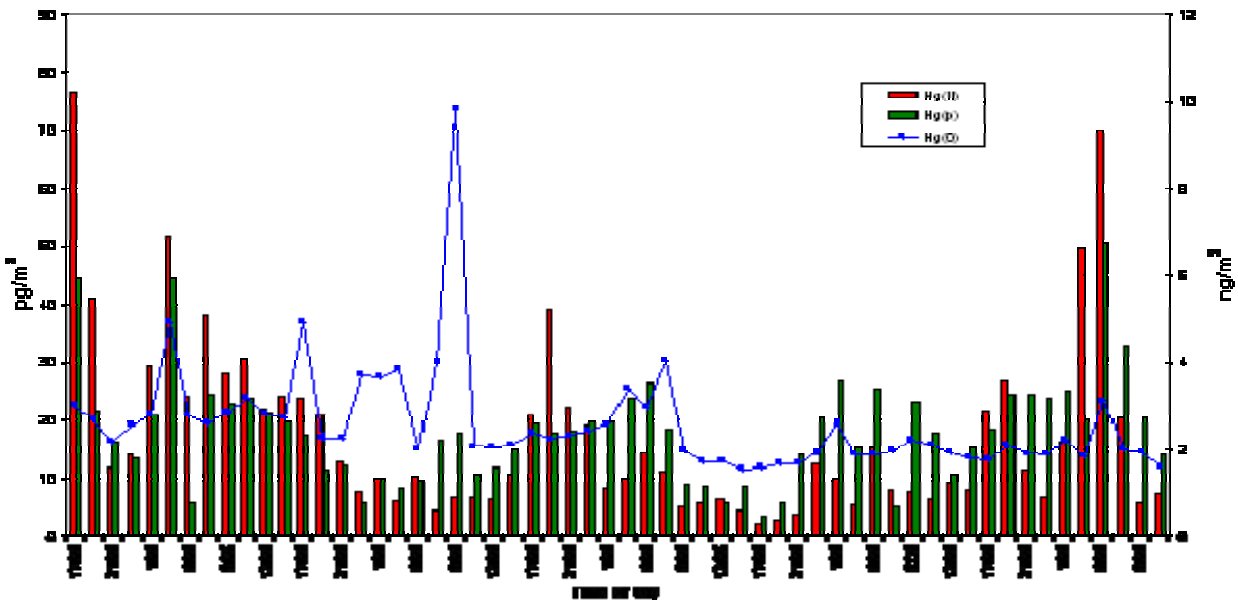

Figure 4. Speciated Ambient Mercury Collected in Detroit (9/20/02 - 9/24/02).

Figure 5 is a plot of monthly averaged elemental gaseous mercury (Hg(0)), reactive gaseous mercury (Hg(II)), and particulate mercury (Hg(p)) collected over 9 months at the Detroit site, where some seasonal effects are observed in the data. A clear increase in the levels of Hg(p) during the cooler weather months is observed with the maximum levels occurring during the winter. This is in contrast to that observed for levels of Hg(II), which are lowest during the winter and increase during the warmer months. This observed seasonal effect has direct implications for the understanding of total wet and dry Hg deposition. For example, Landis and Keeler (2002) reported on measurements which revealed the maximum Hg wet deposition to lake Michigan occur during the summer months, and estimated that the summer was the lowest period for Hg dry deposition. The dry deposition estimates were based on the assumption that the RGM levels varied as a constant percentage (3%) of the total gaseous Hg concentration. The data collected in Michigan under this project have clearly shown this assumption to be a crude one. It is clear that a proper understanding of the seasonal effects on ambient Hg speciation is critical to modeling the dry deposition of Hg to the surface and to future Michigan TMDL modeling determinations for Hg.

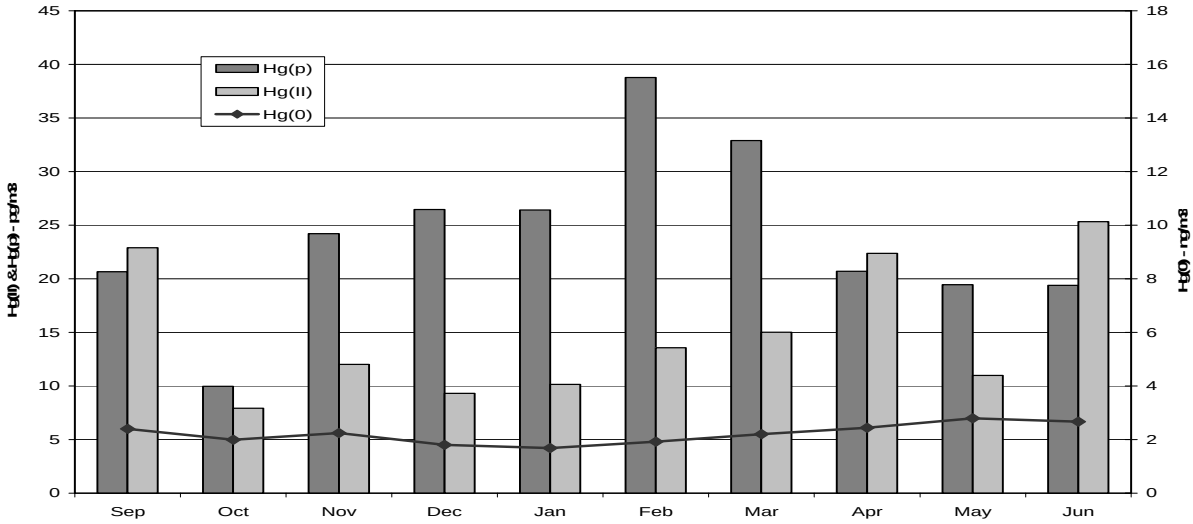

Figure 5. Speciated Ambient Mercury Collected in Detroit (9/20/02 - 6/30/03).

V. PROJECT SCHEDULE AND TIMELINE

All sampling equipment and supplies were purchased, assembled, and tested, both in the laboratory and in the field, during Year 1. All six sampling sites are fully operational and have been collecting data. For approximately 1.5 years. Sample collection will occur continuously at all sites through Years 3 & 4 of the project. Obtaining 3+ years of data will be accomplished with continued funding through Year 4.

In addition to submission of annual reports, all data collected as part of this project will be presented at the end of year 4 as part of a project final report. Peer-reviewed journal articles will be prepared and submitted to appropriate journals and results will be presented at annual scientific meetings and conferences, such as the world conferences on "Mercury as a Global Pollutant." Efforts will also be made to include a summary of the data on the MDEQ-AQD's web site. The target audience will be a combination of fellow atmospheric mercury scientists, federal, state and local governmental representatives interested in mercury pollution and the public.

VI. RELEVANCY AND LINKAGES

Prior to this project, Michigan lacks any long-term Hg data from urban areas. The long-term records at Dexter, Pellston, and Eagle Harbor are critical to the urban monitoring as it provides the relevant climatological context to interpret the urban levels. It is not clear at this point in time how much of the Hg deposition in urban areas is generated in those urban centers and how much is attributable to regional sources and long range transport. Continued operation of the sites located at Pellston and Eagle Harbor are also critically important for temporal trends and to facilitate loading estimates for the total maximum daily loads (TMDL) determination for Michigan's inland lakes located in the upper peninsula and the northern lower peninsula. Most inland lakes that have been identified by the Clean Water Act's (CWA's) 303d's list for TMDL determination are located in Michigan's Upper Peninsula and Michigan's northern Lower Peninsula.

In addition to quantifying wet deposition on a daily event basis at the six sites in Michigan, enhanced speciated ambient Hg measurements of Hg(0), Hg(II), and Hg(p) provide data critical to a development of the total impacts of urban areas on downwind ecosystems. Methods for speciated ambient Hg have only become available over the past 4 years. Modeling estimates for the Lake Michigan Mass Balance Study (LMMBS) revealed that dry deposition of Hg(II) resulted in Hg loadings to the lake approximately equal to the wet deposition loadings. Near large sources or urban/industrial areas, the dry deposition of Hg(II) may exceed the wet deposition input to downwind lakes. The lack of ambient data precludes the scientific and regulatory communities from reducing the largest source of uncertainty in the past and present TMDL and mass balance studies.

In spring of 2002, the UMAQL (PI: Gerald Keeler) was awarded a USEPA STAR grant to model the atmospheric chemistry, transport, and deposition of Hg in the Great Lakes. This modeling grant will make use of the long-term Hg deposition data collected as part of this MGLPF project at the six sampling sites in Michigan. The MGLPF grant deposition data will provide a critical means to evaluate and validate the Great Lakes modeling results from the USEPA STAR project. In addition, in summer of 2002 the UMAQL (PI: Gerald Keeler) was awarded a USEPA cooperative agreement contract to set-up a mercury super-site in southeast Ohio to monitor the direct impacts of coal combustion emissions from the Ohio River Valley and Midwest U.S. on Hg deposition. This site will begin sample collection in fall of 2002 and will provide long-term data on Hg in wet and dry deposition, speciated ambient Hg, as well as several other co-pollutants. This Ohio site will provide in a sense a "seventh" sampling site to the existing MGLPF Hg monitoring network, as it will extend the existing north/south sampling grid further south into Ohio, adding to the power of both data-sets the ability to determine anthropogenic source contributions from both regional sources as well as those from local urban sources, and their impacts on downwind Hg deposition to inland water bodies and the Great Lakes. Combined, these three projects will make-up a truly unique (worldwide) data collection/modeling network, in terms of collecting long-term event-based Hg deposition data and speciated ambient Hg data at several sites in a temperate climate with

direct application to such a sensitive ecosystem as the Great Lakes Basin. Governor Jennifer Granholm has highlighted mercury as an important pollutant of concern by pledging in her platform to reduce the worst chemical pollutants threatening our health including mercury, PCBs and dioxins so that we can have healthy communities for our families. She has also committed to reducing mercury emissions from coal-fired power plants. With adequate funding for air monitoring and modeling this source sector contribution to atmospheric deposition of mercury can be identified (**1**).

VII. BUDGET ITEM JUSTIFICATION

A. SALARIES AND WAGES	
U of M Personnel	
Keeler, P.I (1 mn each for Years 1-4)	$11,624
Dvonch, CO-PI (30% Years 2-4)	$17,160
Barres, Lab. Manager (40% Years 1-3, 10% Year 4)	$22,497
Julie Peterson, Technician (50% Year 1&4, 100% Year 2-3)	$38,799
MingHao Zhou, Technician (50% Year 1&4, 100% Year 2-3)	$41,101
Data Processor (15% Years 1-4)	$6,749
Secretarial (25% Years 1-4)	$6,760
GSRA (50% Year 2-3, 25% Year 1&4)	$21,150
AQD Personnel	
Taylor, CO-PI (40% of .5 FTE Years 1-4)	$9,100
Heindorf, CO-PI (20% of .5 FTE Years 1-4)	$4,550
Chase, Senior Associate (40 % of .5 FTE Years 1-4)	$9,100
B. Fringe Benefits	
U of M Personnel	$48,262
MI AQD Personnel	$12,250
C. Total Salaries, Wages, and Fringe Benefits (A plus B)	$245,857
D. Nonexpendable Equipment (Attach supporting data)	
E. Materials and Supplies	
Office Supplies(copying, paper, ink cartridges etc.)	$1,298
Quartz denuders for speciation unit (4)	$2,812
Laboratory gases (Ar) and coating reagents	$6,490
Field Supplies-bottles and funnels	$16,224
Analysis Supplies and costs (Ultrapure Acids, etc)	$18,495
F. Travel	
Travel for Site Maintenance/Audits	$7,000
Annual Meetings/Conferences	$3,000
G. Services or Consultants	
H. Computer Costs	
I. All Other Direct Costs	
GSRA Tuition (I Term Year 1&4, 2 Terms Year 2-3)	$11,603
J. Total Direct Costs (C through I)	$312,779
K. Indirect Costs (20% on UM Direct only)	$55,556
TOTAL AMOUNT OF THIS REQUEST (J plus K)	$368,334
TOTAL UM REQUEST	$333,334

VIII. DETAILS OF BUDGET ITEM JUSTIFICATION (SEE PREVIOUS ANNUAL REPORT)

PERSONNEL: All permanent salaries (except the Graduate Student Research Assistant) were calculated on the base salary and at a 32% fringe rate. A 4% cost of living increase has been applied to each subsequent year following the first year.

VII. DISCUSSION OF FUTURE FUNDING CHANGES AND OPTIONS

The State of Michigan Air Quality Division and the University of Michigan Air Quality Laboratory embarked on a four-year project to document the levels of Hg deposition across the state of Michigan. This important project was funded by the Michigan Great Lakes Protection Fund (MGLPF) with matching funds obtained from the Lake Superior Basin Trust Fund. Currently we are in the second year of the funding cycle out of the four year project. The success of this project is contingent upon the continued funding from the MGLPF for the remainder of the project. This section of the Year 2 status report is in response to the request by the Director of the Office of the Great Lakes to review the project scope of work, the proposed timeline, and the outcomes based upon the current funding and in the event that full funding is not available.

The scope of work for this project was quite ambitious stemming from the urgent need for mercury data for scientific, policy and regulatory purposes, e.g. Hg TMDLs. The first year of the study involved purchasing, testing, evaluating, and finally setting-up new instrumentation that allows us to measure the trace levels of Hg in different forms in the atmosphere and in deposition. Three new sites were established in urban areas in the state and three existing sites were upgraded and continued in key locations in both the lower and upper peninsula. The state of Michigan is one of the few that has expertise at the Michigan DEQ Air Quality Division and has a world class Hg group at the largest research university in the state. This partnership between state government and a state university has allowed this delicate research project to establish research grade monitoring sites for atmospheric Hg and to operate these sites for the past year.

There are six sites in operation as shown in Figure 1. Due to the cost of instrumentation we are only able to operate the continuous instrumentation at two sites simultaneously and the other four sites have wet deposition only. The number of sites was determined to be the bare minimum to allow us to determine the impact of urban areas on Hg deposition and to differentiate the urban influence from regional transport into the state from the other Great Lakes States and Provinces. The Eagle Harbor site was specifically requested by the MI DEQ surface water people to help them with TMDL projects that are mandated for lakes in the Upper Peninsula. In addition, the matching funds from the Lake Superior Basin (LSB) Trust stipulated that the Eagle Harbor site be maintained. Thus, to remove sites drastically changes the scope of work where it will be difficult to meet the objectives of the project, and would make it impossible to meet the agreement with the LSB Trust.

The timeline for the project has changed from the original submission. Due to the need to find matching funds, which were eventually obtained from the Lake Superior Basin Trust, the instrumentation took longer to procure than we had planned. In addition, site changes in Detroit and Flint delayed the installation of equipment at those two sites. These delays have put the sample collection about 4 months behind schedule. Since fewer samples have been collected and analyzed the personnel time for one third of a year for each technician and data manager could get shifted into the Year 4 budget and thus reduce the Year 3 budget request by $45,293. The $45K would need to get added to Year 4 of the budget as the sample analysis and processing would still be completed. While we would prefer not to reduce the budget we understand the financial constraints that the state is under at present.

The option of not continuing to fund the project is not going to be acceptable to any of the parties involved. At this point we have not collected a sufficient amount of data at the sites for us to meet the objectives of the project. The data analysis and modeling phases of the project will not commence until the end of Year 2 and they were not going to really get going until we had sufficient data for this purpose. The trajectory and meteorological analysis requires several years of data for the statistical analysis to be robust and thus shutting down the sites would limit the utility of this exercise.

Lastly, a significant amount of time and money was spent in the procuring and testing of equipment, setting up monitoring sites and in training field operators. The cost of not continuing the project to its conclusion is huge as we will not be able to meet the requirements and meet the goals of the grant. As this project provides critical information to the state for use in many different programs and this data is not available through any other means, the importance of this work is clear. We believe that the results of this project have great importance to not only the state of Michigan but to the entire Great Lakes region and to the entire Hg science community. The State of Michigan has been recognized as a leader in the past when it came to Great Lakes environmental issues and management. This project continues that tradition of excellence and by providing leadership that is truly needed in today's political climate. We welcome the chance to talk with the MGLPF Board in person and discuss with them the importance of continuing this cooperative project between the MI DEQ and the University of Michigan.

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