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Mr. Tom Fidler
Pennsylvania Department of Environmental Protection
Harrisburg, PA

Dear Tom:

It has come to my attention that in your most recent Mercury workshop held November 18th that Sid Nelson, President of Sorbent Technology, was invited to discuss his company's mercury sorbent technologies. Instead, he began his presentation with a refutation of my work presented at a previous workshop on October 28th, (Sullivan, 2005). I find this unprofessional.

I want to set the record straight and discuss Mr. Nelson's comments. He structured his presentation to demonstrate why the data generated in our studies is not relevant to Pennsylvania's conditions. His major points follow.

1. **Inappropriate Sites for Pennsylvania.**
   It is true that none of the plants at which we collected data were in Pennsylvania. However, the Monticello plant is consistently one of the top five mercury emitters in the country and it emits a large fraction of reactive gaseous mercury (RGM). Our understanding of mercury deposition is that RGM is soluble in water and washes out of the atmosphere during precipitation events. Elemental mercury is not very soluble and does not deposit locally but enters the global cycle. Therefore, the Monticello plant with an estimated emissions inventory of 954 Kg/yr of which 564 Kg/yr was RGM is predicted to have a very strong local deposition pattern. With predicted deposition 4 – 5 times background levels for over 10 km and over twice background for 15 km from the plant. The fact that a strong signal was not seen at this site suggests that it will not be seen at other sites. Modeling of the deposition from the Bruce Mansfield site near Pittsburgh, which was performed as part of our work, did estimate increases in deposition by a factor of 2 within 5 km of the plant. However, data were not collected at this site and modeled deposition did not correlate well with soil Hg concentration data at the 3 sites where sampling was conducted.

   Mr. Nelson points out that the sites where we collected data were in open areas and not forested woodlands. He also correctly states that deposition is higher in woodlands than in open fields. This is believed to be due to dry deposition of gaseous elemental mercury (GEM) or Hg(0), and RGM in plant leaves. The GEM is taken into the leaves and deposited on the ground during litterfall. The RGM that deposits on plant leaves can be washed off by rainfall and this is called throughfall. These processes occur whether there is a source nearby or not. Estimates (Miller,

2005) for deposition in Northeastern North America suggest that in forested areas approximately 1/3 of deposition is from rainfall, 1/3 from dry deposition of RGM (throughfall), and 1/3 from dry deposition of GEM (litterfall). Mr. Nelson implies, but offers no proof, that mercury deposition near coal-fired power plants in forested lands will be much greater than in open areas. Based on my experience and the data we have collected I believe that there may be some near field (< 10 km from the plant) impact on deposition, however, I do not expect it to be large (>50 %). I believe that litterfall will not change substantially as this depends primarily on GEM. Emissions from coal-plants change the average GEM concentration by less than 1% more than 10 km from the plant (EPA, 1997). Dry deposition of RGM emitted from a coal plant could lead to higher deposition from throughfall. Again the impact would be greater closer to the plant and it will depend on the leaf cover near the plant. As stated in my presentation, there are data from a number of studies that suggest 20 - 30% increase in deposition due to power plant emissions over the scale of a up to 10 – 15 km (Lipfert, 2004). If the area is heavily forested, this percentage may increase. This is an open area of research that should be examined.

2. **Inappropriate Plants for Hot Spot Analysis**

Mr. Nelson shows that the plants where we sampled were in regions with coal-plants near by and there was a "fog" of mercury that prevented "hot-spots" from being seen. All of the measured and modeled data suggest that if a "hot-spot" were to occur, it would be greatest immediately adjacent to the emission source and decrease with distance. For coal-fired power plants the distance of seeing a substantial increase above background is 20 km or less depending on the plant size and environmental conditions. Near the plant, estimated deposition is often twice background and at Monticello, it was 4 – 5 times background. In performing the work for Plant A and Kincaid, the nearest plants were approximately 10 miles away and their release and deposition were modeled. Due to their locations relative to the prevailing winds, they were not predicted to impact deposition greatly (<1%). At Monticello, the nearest coal-plant was also 10 miles away to the southeast. Interestingly enough, the measured soil concentrations were lowest in this area. This I believe is due to our findings that the Hg content correlated well with soil type and not distance from the Monticello plant. The soil type to the southeast was typically dry and grey in color, while the locations with higher Hg content tended to be brown (indicating higher organic content). I am confident that if a strong signal was emitted from the plants it would have been seen and that potential increases in Hg from adjacent plants was adequately addressed.

3. **Measured the Wrong Thing**.

In our studies we measured soil and vegetation from within 10 miles of a coal-fired power plant. This permitted us to collect several hundred samples form each site to develop a detailed understanding of the mercury content in these samples around a coal-fired power plant. The large number of samples provides statistical confidence in the analysis looking for deposition patterns.

Mr. Nelson believes that sampling of fish should be performed. However, sampling of fish would be problematic for a number of reasons. In our study, there was no major water body within the sample domain for one plant. For the other two plants, each was adjacent to large lake, however, there were no other water bodies in our sampling domain and thus no basis for comparison. At the Kincaid power plant in the 1970's a study looked at Hg concentration in fish from Lake Sangchris, adjacent

to the power plant, compared to other lakes in the area. The fish mercury concentrations in Lake Sangchris were lower than at the other lakes (Anderson, 1977). Another study around the Dickerson Power Plant in Maryland reviewed in Lipfert, 2004 showed a slight correlation of decreasing fish Hg as a function of distance from the power plant. However, all fish in this study were below the 0.3 mg/kg limit recommended by EPA. In general, the mercury concentration in fish is heavily influenced, if not controlled, by the characteristics of the water body (Kamman, 2005). Kamman reviewed fish Hg concentrations in northeastern North America and found "Given the high variability found earlier among waterbodies, it is not surprising that fish Hg concentrations did not display smooth spatial trends across northeast North America. Lakes in close proximity often had very different fish Hg levels, and this heterogeneity is expressed by both yellow perch and brook trout." In my presentation (Sullivan, 2005) I showed the map of large mouth bass Hg concentrations in North Carolina. The average concentration varied by more then a factor of 4, yet deposition in the state varies by less than 50%.

4. **Even so, Sullivan still found hot spots**

Mr. Nelson circled a thin line (one sample wide, with samples approximately one mile apart) which showed elevated vegetation Hg concentrations in the direction of the prevailing winds for the Kincaid plant, one of our three studies. While this thin region of elevated concentrations may be due to power plant emissions, it is not statistically certain that they are. In our definition of hot-spot we defined it as a region of several square kilometers of elevated concentration. At Kincaid, for the vegetation samples, when looking for "hot spots" we averaged all concentrations over 2 square miles. The highest average concentration was only 50% higher than the average of all samples. In general, for the sites circled by Mr. Nelson the average over 2 square miles was 20 – 30% higher than the average at all sites. An increase of environmental concentrations of 20 – 30% is consistent with other studies and most people do not consider this to be a hot spot. For example, in my presentation (Sullivan, 2005) I showed that a Mercury Deposition Network station 2 km from the Clifty Creek coal plant showed 20 – 30% increase in wet deposition as compared to other Mercury Deposition Network sites in that state.

I agree with Mr. Nelson that vegetation concentrations increase throughout the growing season. Research suggests that there is a linear increase in Hg concentration in leaves over time (Miller, 2005). It would have been useful to repeat the vegetation sampling later in the calendar year to see if a signal from the power plants could be detected.

5. **If done properly, you find hot spots**

Mr. Nelson states that there is a hot spot around the Merrimack Plant in Bow New Hampshire. He also states that it is one of the larger plants in New England. Merrimack is a 135 Mwe plant, which is actually small for a coal plant. For example, all of the plants that we examined were more than 1000 Mwe. The EPA listed the emissions of Hg from approximately 500 plants nationwide in 1999. Merrimack emitted only 0.0078 tons of Hg (15.6 lbs, 7 kg). Merrimack's mercury emissions were greater than only 10 of the almost 500 plants listed. The total emissions from Merrimack were less than 1% of the emissions from the Monticello plant that we studied. The total emissions of mercury from Merrimack are not enough to explain the high fish mercury concentrations in the region. Also, note in Mr. Nelson's figure that there is quite a lot of variability in the fish mercury concentrations suggesting

that the characteristics of the water body are the key factor. This is consistent with Kamman's findings (Kamman, 2005). Mr. Nelson's claim that his study properly demonstrates a hot spot attributable to the Merrimack plant is without merit. He has not measured deposition in the area, nor has he attempted to perform source attribution.

Mr. Nelson provides some figures which he cited Kamman, 2005. These figures are not in that document. Nor does that document cite the Merrimack plant as a cause for the high mercury concentrations in fish near the plant. In fact, the plant is never discussed.

6. **Erroneous Assumptions = Erroneous conclusions.**

Mr. Nelson circled my assumption that a 90% reduction in coal emissions would lead to a 15.5% reduction in deposition and implied this is in error. In fact, it is the highest estimate of the reduction in deposition I could find in the literature. Dr. Leonard Levin presented information to your working group in October showed that under CAIR and CAMR, mercury deposition will drop by only 2.6% in Pennsylvania. The EPA in their Regulatory Impact Analysis claim on average an 8% decrease in deposition in the Eastern U.S. Thus, the best current modeling suggests that my use of 15.5% is an overestimate of the impact on deposition.

On his next slide he shows that a decrease in emissions in mercury led to approximately a 50% decrease in concentration in wildlife in Florida. What he does not tell you is that studies conducted in Florida providing estimates of deposition suggested that deposition from local sources (primarily from municipal waste incinerators) ranged from 30 -46% (Guentzel, 2001) to 73% (Dvonch, 1999). Mr. Nelson omitted to let you know that these studies may not be directly applicable to Pennsylvania. I agree that a decrease in mercury emissions will lead to a decrease in environmental concentrations in wildlife. However, Pennsylvania is unlikely to see the large drop in concentrations seen in Florida.

7. **Concludes a low probability of health effects, but again Sullivan is looking in the wrong place.**

Mr. Nelson than makes the claim that autism is linked to a sensitive subpopulation that can not excrete Hg properly and therefore, have low hair Hg concentrations that are the issue. None of the epidemiological studies of the impacts of environmental levels of mercury cited in the National Research Council report suggest that an endpoint of mercury exposure is autism (NRC, 2000). Mercury being responsible for autism from medical vaccines is a controversial issue within the medical community which I will not undertake to refute. However, in general, the medical community does not believe that mercury from vaccines leads to autism. The following is from the Report by the Institute of Medicine for the National Academy of Sciences, May, 2004.

Vaccines and Autism

This eighth and final report of the Immunization Safety Review Committee examines the hypothesis that vaccines, specifically the measles-mumps-rubella (MMR) vaccine and thimerosal-containing vaccines, are causally associated with autism. The committee reviewed the extant published and unpublished epidemiological studies

regarding causality and studies of potential biologic mechanisms by which these immunizations might cause autism.

The committee concludes that the body of epidemiological evidence favors rejection of a causal relationship between the MMR vaccine and autism. The committee also concludes that the body of epidemiological evidence favors rejection of a causal relationship between thimerosal-containing vaccines and autism. The committee further finds that potential biological mechanisms for vaccine-induced autism that have been generated to date are theoretical only.

The committee does not recommend a policy review of the current schedule and recommendations for the administration of either the MMR vaccine or thimerosal-containing vaccines. The committee recommends a public health response that fully supports an array of vaccine safety activities.

In addition, the committee recommends that available funding for autism research be channeled to the most promising areas. The committee makes additional recommendations regarding surveillance and epidemiological research, clinical studies, and communication related to these vaccine safety concerns.

http://www.iom.edu/report.asp?id=20155

In summary, I do agree that coal-plants will cause increases in deposition on a scale of ten to twenty kilometers. These increases will be highest near the plant and decrease with distance. Decreases in deposition will lead to lower environmental concentrations. Literature data along with my data suggest around a 30% increase. On a regional scale, the latest modeling analysis suggests that existing regulations this will lead to a 2.5 to 8% decrease on average for Pennsylvania. I do not believe that hot spots exist as defined by EPA (utility hot spot will cause an increase in fish mercury concentration of 0.3 ppm) nor does our data suggest that large increases (>50%) in mercury concentrations will occur over large areas (tens of square kilometers) within 20 km of a coal fired power plant. While my data suggest this, they were not conducted in forested regions and this is an area that should receive further investigation. As independent researchers we do not have anything to gain or lose by requiring controls of mercury emissions from coal fired power plants. However, we do object to the sometimes exaggerated claims of the benefits of these controls.

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