Atmospheric Cluster Sites (?)

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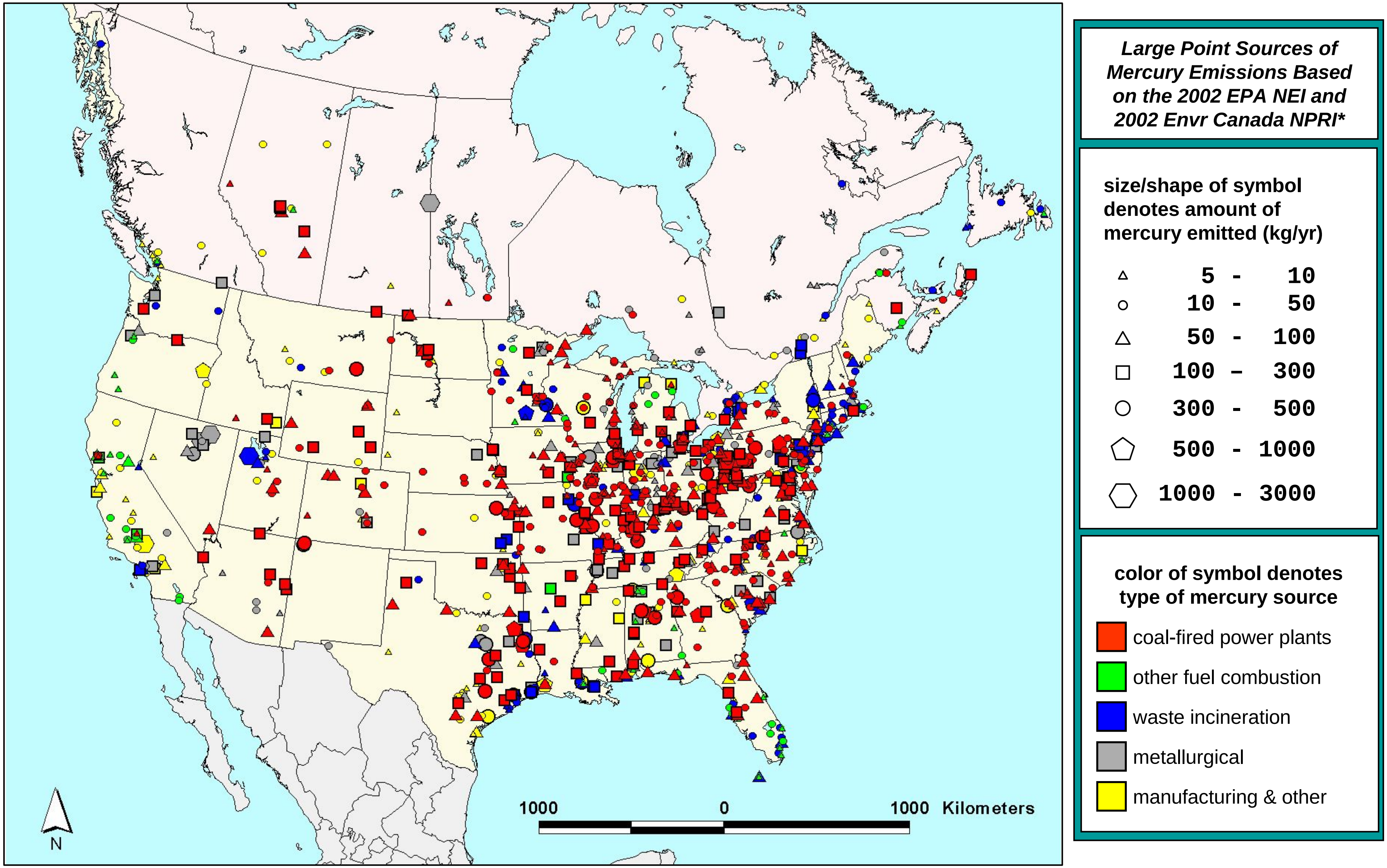
2002 U.S. and Canadian Emissions of Total Mercury [Hg(0) + Hg(p) + RGM]



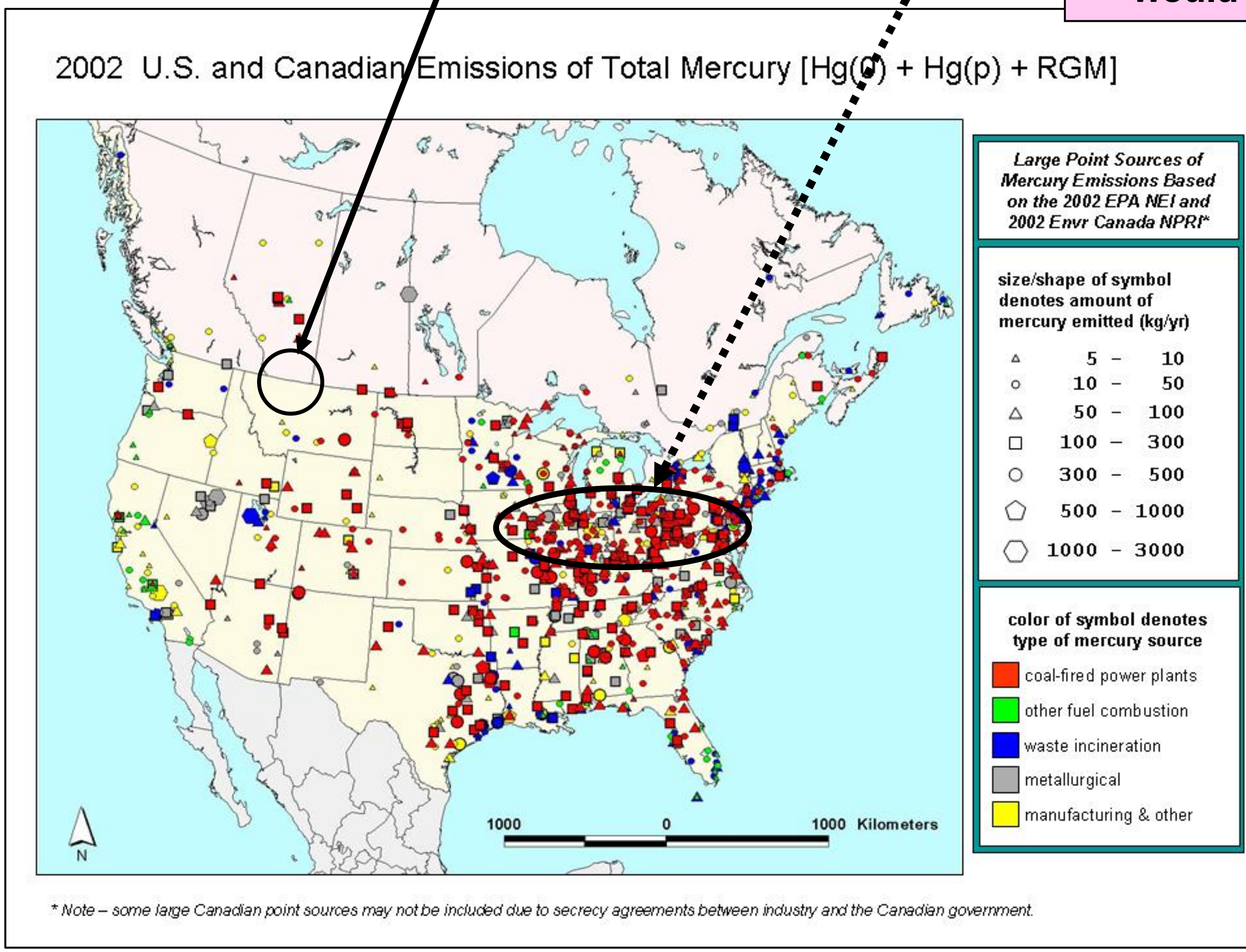
* Note – some large Canadian point sources may not be included due to secrecy agreements between industry and the Canadian government.

"remote", far from strong emissions sources* –

- **spatial gradients in atmospheric concentration & deposition may be relatively small**
- **in such a region, the need for "atmospheric cluster sites" may be relatively minimal**

In regions with strong sources –

- **there may be large spatial gradients around any given "intensive" site**
- **If want to characterize these gradients with <u>measurements</u>, then "atmospheric cluster sites" would appear to be necessary**



**** In this example, have considered current anthropogenic sources… if there are strong "natural" or "re-emission" sources, then gradients may be present***

Atmospheric Measurements at At Cluster Sites (?):

- **Wet deposition measurements (e.g., MDN sites)**
  - relatively inexpensive (~$15-20K/yr per cluster site)
  - only represents part of the deposition
  - also, wet deposition not as useful for model evaluation

- **To estimate dry deposition (or surface exchange) with *measurements*, need speciated ambient concentration measurements and meteorological measurements**
  - relatively expensive ($100-200K/yr per cluster site)
  - with current technology, probably impractical to have a large number of routine “cluster sites” around an intensive site that can estimate dry deposition
  - perhaps new techniques can be developed that are cheaper and easier, e.g., some sort of passive RGM sampler? Or some sort of inexpensive dry deposition measurement system *(but this is a lot more difficult to develop than you might think…)*

- It is difficult to apply the “cluster site” idea to the atmosphere.

- We can imagine taking periodic water, fish, soil and other related samples from a number of cluster sites in a region, *but we can’t measure comparably fundamental key atmospheric parameters at a comparable number of sites*

- Basically, for the atmosphere, you <u>really</u> can’t measure even the basic things you need to measure everywhere you need to measure them.

- The need for models to fill in the gaps between measurements is thus critical for the atmosphere – perhaps even more critical for the atmosphere than for other media…

In sum, for atmospheric “cluster sites”:

- ❑ A few strategically placed comprehensive atmospheric sites in a region may be preferable to a larger number of lesser sites...
  - -- In some cases, long-term deployments
  - -- In some cases, campaign-based (i.e., short-term) comprehensive measurement deployments in a region
- ❑ Atmospheric models are going to be needed – even to interpret the data regarding other indicators at cluster sites
- ❑ For the atmosphere, decisions about “intensive” and “cluster” sites should strongly consider the value of the measurements for developing, evaluating and improving atmospheric models

(included in Tab 4 of your binder)

Issues relating to ability to use data from the site for atmospheric model evaluation

(a) Degree to which the **terrain is atmospherically "simple"** -- at least for initial sites -- so that uncertainties in meteorological data do not overwhelm models. For example, if there are sub-grid scale weather phenomena important to the Hg model that cannot be resolved practically by a meteorological model, then it will be difficult if not impossible to use the data at the site for model evaluation or improvement

(b) Nature and extent of **existing efforts to simulate meteorology** in the local and regional environment, e.g., if some one is already running, say, MM5 on a fine grid in the region and is willing to collaborate and share data

(c) Degree of **ability to characterize emissions sources in region** contemporaneously with the measurements. Since an atmospheric model relies on emissions inventories as an input, preferred sites are those where the local and regional sources are -- or can be -- well characterized. An example of this would be a site in the region of a coal-fired power plant that has elected to install a continuous, speciated mercury emissions monitor

Issues relating to ability to use data from the site for atmospheric model evaluation … continued

(d) Tendency to get **well defined "episodes”**, including source-related episodes. In general, good to have a wide range of concentrations of each atmospheric mercury form to evaluate the model against, as opposed to a site with relatively constant concentrations of atmospheric mercury

(e) Relative tendency to get **"simple" plume impact episodes** -- e.g., from one single well defined source at at time -- as opposed to getting "complex" plume impact episodes from multiple, diverse sources.

(f) **Not too close to sources** (e.g., less than 5-10 km and meteorological uncertainties may be too dominant). And, if too close to tall-stack source, plume will not even have hit the ground yet.

(g) **Not too far from sources**. At distances greater than ~100 km or so, may be difficult to "see" a source, even if wind blowing directly from the source to the site.

(h) Degree of **atmospherically relevant interfering activities** at site, e.g., amount / proximity of onroad or offroad traffic

(i) **Ability to erect a stable tower**, e.g., at least 10 meters tall. Ability to erect or existence of taller tower for the possibility of making measurements aloft (e.g., 100 m tower).