TOXIC AIR POLLUTANTS

TRENDS IN TOXIC AIR POLLUTANT CONCENTRATIONS

Under the Clean Air Act, EPA regulates 187 toxic air pollutants. Toxicity levels, or the potential for adverse effects on human health, vary from pollutant to pollutant. For example, a few pounds of a relatively toxic pollutant may have a greater health effect than several tons of emissions of a less toxic pollutant. These toxicity levels can vary by orders of magnitude between pollutants. EPA has a recommended set of benchmark toxicity levels for estimating the effects of exposure to individual toxic air pollutants. For more information, visit http://www.epa.gov/ttn/atw/toxsource/table1.pdf.

Monitoring data are limited for most toxic air pollutants. Because ambient monitoring data is so limited for toxic air pollutants, EPA frequently relies on ambient modeling studies to better define trends in toxic air pollutants. One such modeling study, the National-Scale Air Toxic Assessment (NATA), is a nationwide study of ambient levels, inhalation exposures, and health risks associated with emissions of 177 toxic air pollutants (a subset of the Clean Air Act's list of 187 toxic air pollutants). NATA examines individual pollutant effects as well as cumulative effects of many air pollutants on human health.

Figure 25 shows the estimated lifetime cancer risk across the continental U.S. by county based on 2002 NATA model estimates. The national average cancer risk level in 2002 is 36 in a million. Many urban areas as well as transportation corridors show a risk above the national average. From a national perspective, benzene is the most significant toxic air pollutant for which cancer risk could be estimated, contributing over 30 percent of the average individual cancer risk identified in the 2002 assessment. Though not included in the figure, exposure to diesel exhaust is also widespread. EPA has not adopted specific risk estimates for diesel exhaust but has concluded that diesel exhaust is a likely human carcinogen and ranks with the other substances that the national-scale assessment suggests pose the greatest relative risk to human health.

Figure 26 shows the trends in ambient monitoring levels for some of the important toxic air pollutants

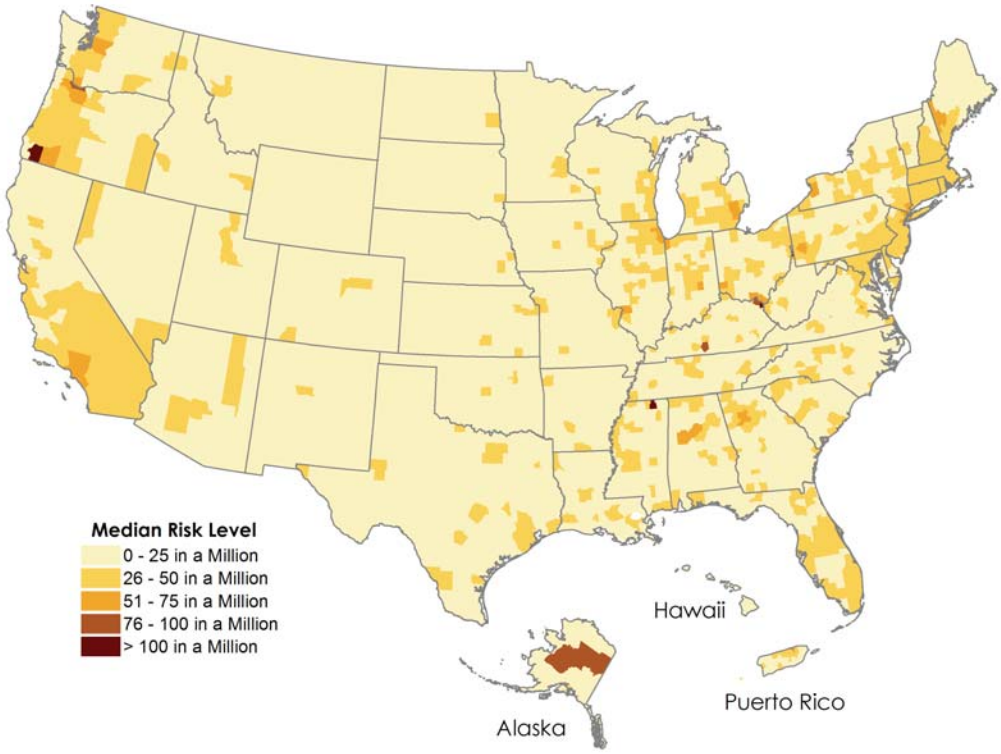

Figure 25. Estimated county-level cancer risk from the 2002 National Air Toxics Assessment (NATA2002). Darker colors show greater cancer risk associated with toxic air pollutants.

identified by NATA. When the median percent change per year (marked by an x for each pollutant shown) is below zero, the majority of the sites in the U.S. are showing a decrease in concentrations. Ambient monitoring data show that for some of the toxic air pollutants of greatest widespread concern to public health (shown in yellow), 1,3-butadiene, benzene, tetrachloroethylene, and 1,4-dichlorobenzene concentration levels are declining at most sites. Concentrations of VOCs such as 1,3-butadiene, benzene, styrene, xylenes, and toluene decreased by approximately 5 percent or more per year at more than half of all monitoring sites. Concentrations of carbonyls such as formaldehyde, acetaldehyde, and propionaldehyde were equally likely to have increased or decreased. Chlorinated VOCs such as tetrachloroethylene, dichloromethane, and methyl chloroform decreased at more than half of all monitoring sites, but decreases among these species were much less consistent from site to site than among the other VOCs shown. Lead particles decreased in concentration at most monitoring sites; trends in other metals are less reliable due to the small number of sampling sites available for analysis.

In 2003, in an effort to improve accuracy and geographic coverage of monitoring, EPA, working with its state and local partners, launched the National Air Toxics Trends Station (NATTS) program, a national monitoring network for toxic air pollutants. The principal objective of the NATTS network is to provide long-term monitoring data across representative areas of the country for NATA priority pollutants (e.g., benzene, formaldehyde, 1,3-butadiene, acrolein, and hexavalent chromium) in order to establish overall trends. The initial 23 stations were established between 2003 and 2005, two stations were added in 2007 and two more in 2008 for a total of 27 NATTS sites. In addition, the list of pollutants monitored was expanded to include polycyclic aromatic hydrocarbons (PAHs), of which naphthalene is the most prevalent.

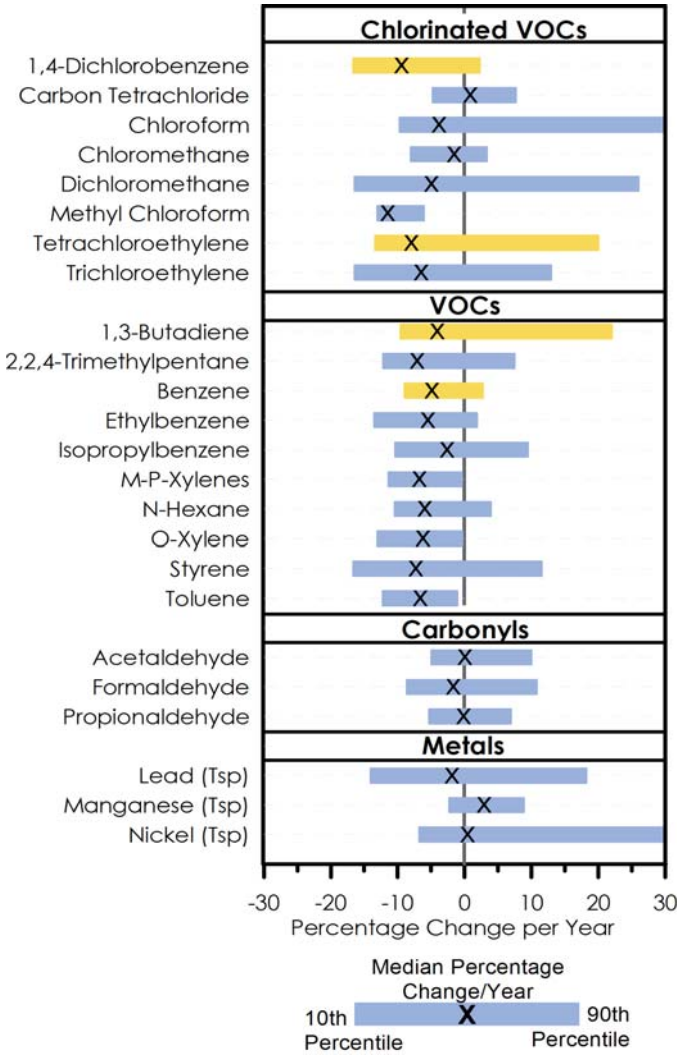

Figure 26. Distribution of changes in ambient concentrations at U.S. toxic air pollutant monitoring sites, 2000-2005 (percent change in annual average concentrations).
(Source: McCarthy M.C., Hafner H.R., Chinkin L.R., and Charrier J.G. [2007] Temporal variability of selected air toxics in the United States. **Atmos. Environ.** *41 [34], 7180-7194)*

Notes: 10th and 90th percentiles are excluded if fewer than 10 monitoring sites were available for analyses. For chloroform and nickel, the 90th percentile percent changes per year are cut off at 30.

In addition to the NATTS program, about 300 monitoring sites are currently collecting data to help air pollution control agencies track toxic air pollutant levels in various locations around the country. State, local, and tribal air quality agencies operate these sites to address specific concerns such as areas of elevated concentrations or "hot spots," environmental justice concerns, and/or public complaints.

Figure 27 shows the locations of the toxic air pollutant monitoring sites. A majority of these sites are located in or near densely populated areas. Most sampling is conducted on a 1-in-6-day schedule for a 24-hour period. For more information about ambient air quality monitoring programs, visit http://www.epa.gov/ttn/amtic/.

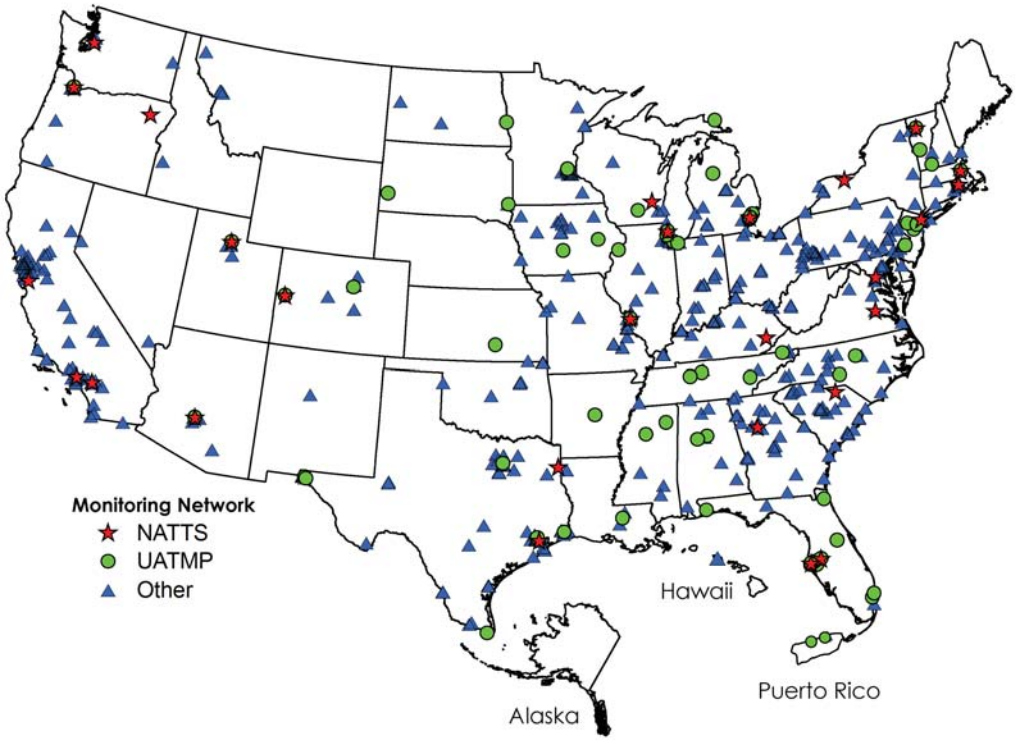

Figure 27. Toxic air pollutant monitoring sites operating in 2007 (by monitoring program).

Note: Some agencies use EPA-contracted sampling and laboratory analysis support services at the sites that are not NATTS program sites; these sites collectively are referred to as the Urban Air Toxics Monitoring Program (UATMP). At other monitoring sites, agencies perform their own laboratory analyses or use non-EPA contracted laboratories.

Local Short-term Toxic Air Pollutant Monitoring Projects

Due to the local nature of toxic air pollutant problems in 2004, EPA began funding local-scale monitoring projects. Typically these projects collect one to two years of monitoring data. To date, EPA has funded 51 projects and 25 have been completed. The goal of local monitoring is to provide more flexibility to address middle- and neighborhood-scale (0.5 km to 4 km) issues that are not handled well by national networks. Objectives for these projects include:

- characterizing the degree and extent of local toxic air pollutant problems
- identifying and profiling local toxic air pollutant sources
- developing and assessing emerging measurement methods
- verifying the success of toxic air pollutant reduction activities

Results from these efforts are used to identify emission reduction options to be implemented at the local level.

Woodson site for the Hopewell Urban Air Toxics special study currently in progress located at Carter G. Woodson Middle School in Hopewell, Va. Apartment complexes can be seen in the background.

Detroit Exposure and Aerosol Research Study (DEARS)

A research study that the U.S. Environmental Protection Agency conducted in Detroit, Michigan, named the Detroit Exposure and Aerosol Research Study (DEARS), will help develop data that improves our understanding of human exposure to various air pollutants in our environment. The primary objective of DEARS was to compare air pollutant concentrations measured at central or community air monitoring stations with those measured in various neighborhoods in the Detroit, Michigan, area.

The study collected air quality samples over a three-year period (2004 through 2007) involving roughly 120 adults, randomly selected from among seven neighborhoods. These neighborhoods were selected because they represent a variation of potential industrial and regional source influences, housing type/age, and proximity to mobile emissions sources. Sampling included personal, indoor, backyard, and community monitors. Data were collected on particle pollution and toxic air pollutants.

These are the key questions to be addressed:

- How do air pollutant concentrations measured at community sites relate to those from residential indoor, outdoor, and personal monitoring?
- Can air pollutant concentrations monitored at community sites adequately represent estimates of what local residents are exposed to and the sources of these pollutants?

Participants engaged in five days of summertime monitoring and five days of wintertime monitoring per year. The summer and winter data collections provide important information on seasonal influences on pollutant concentrations and personal exposures to various sources.

Early findings indicate pollutant exposures may vary greatly among individuals living in the same area. The indoor air environment often highly influences individual exposures to some pollutant species, including those associated with volatile organic compounds and particle pollution. The movement of air into and out of the home was determined to be highly seasonal (nearly twice as high in the summer). This resulted in much higher exposures of individuals to particle pollution formed outside during the summer as compared to the winter. And, while the outdoor environment was a significant contributor of pollutants to local air quality outside homes close to major roadways, the impact of mobile-source related pollutants on air quality as a function of distance to the roadway was clearly evident. The impact of mobile-source related pollutants on air quality fell to near-background levels as distances from the roadway approached 300 meters.

(Source: http://www.epa.gov/dears/, photos courtesy of EPA)

Monitoring Methods

Personal Monitoring

Indoor Monitoring

Backyard Monitoring

Community Monitoring