



## The Smokestack Effect: Toxic Air and America's Schools

### Methodology

Children are uniquely susceptible to the dangers posed by many sorts of toxic chemicals because they breathe more deeply than adults, and because their bodies are still developing<sup>1</sup>. That's why USA TODAY worked with the researchers and scientists at the University of Massachusetts-Amherst, Johns Hopkins University in Baltimore, and the University of Maryland in College Park to analyze exposure to industrial pollution at schools across the nation. The goal: To determine what sort of toxic chemicals children breathe when they go to school.

### Schools List

USA TODAY gathered information on about 127,800 public and private schools from the National Center for Education Statistics and more than two dozen state education agencies<sup>2</sup>. While we attempted to make the list as comprehensive as possible, it may not include some recently opened buildings. It also includes some schools that have closed since 2005. We also excluded some schools whose locations we could not map. If you don't find your school among those listed in our database, let us know by sending the school's name and address to [smokestack@usatoday.com](mailto:smokestack@usatoday.com).

### Toxicity Assessments

Toxicity assessments for each school are based on emissions data collected by the U.S. Environmental Protection Agency as part of its Toxics Release Inventory program, also known as TRI. More than 20,000 industrial and government facilities are required to tell the agency about their emissions of hundreds of chemicals that are known to harm humans or the environment. Most facilities do not measure their emissions; rather, their reports to the TRI are estimates (PDF). It is difficult to verify the accuracy of those estimates, but some critics have complained that TRI reports generally understate emissions<sup>3</sup>. Generally, only large industrial and government facilities are required to report to the TRI, meaning there are many other potential sources of pollution that are not included in the agency's data. As a result, those sources also are not included in toxicity assessments for schools.

To assess how those emissions affect the air outside nearby schools, USA TODAY partnered with researchers from the University of Massachusetts-Amherst's Political Economy Research Institute. After more than two years of effort, the researchers obtained data from an EPA model known as the Risk-Screening Environmental Indicators, which scores chemicals based on their potential danger. The model also uses information about industrial facilities – such as the height of its smokestacks and the way each chemical disperses in the air – to estimate where concentrations of the chemicals they release will be highest. The model allows the EPA to assess pollution's impact on every square kilometer of the nation, and the agency uses that information to help identify potential problems spots. The University of Massachusetts researchers used those findings to produce lists of chemicals that contributed to the air toxicity at each of the nation's 127,800 schools in 2005, the most recent year for which the EPA has completed its model. With the help of the University of Massachusetts researchers and other experts, and after consulting with the EPA, USA TODAY used those records to create three measures of a school's exposure to industrial toxics:

- **Overall toxicity:** This is the primary measure of toxicity from industrial pollution outside a school. It reflects both the concentration of chemicals the EPA's model shows impacted the school in 2005, as well as the potential harm associated with those chemicals. That measurement is ranked against each of the other 127,800 schools for which USA TODAY developed toxicity information, and is displayed as a percentile. For example, if you see a school whose overall toxicity shows up in the second percentile, you'll know only 1% of the nation's schools had higher toxicity levels.
- **Exposure to cancer-causing chemicals:** This ranking is similar to the overall toxicity measure, but includes only those chemicals known or thought to cause cancer<sup>4</sup>. The measure shows how one school ranks relative to all of the nation's other schools.
- **Exposure to other toxic chemicals:** This ranking shows the potential severity of exposure to chemicals that do not cause cancer. For each chemical thought to cause health problems other than cancer, we compared the likely concentration of that chemical at each school to the EPA's reference concentration, the agency's exposure threshold. In other words, the higher a school ranks on this scale, the more likely it is that non-carcinogens could exceed that threshold.

Because these measures are based on a model and estimates of emissions, they are subject to some limitations. For example, the model makes certain assumptions about topography, the height of smokestacks and the toxicity of certain chemicals, any of which could influence the assessment of toxicity in a particular location. In some cases, the EPA model appeared to underestimate exposure to toxic chemicals<sup>5</sup>. In others, it appeared to overstate it<sup>6</sup>. Also, the model is not meant to assess risk – your chances of getting sick.

Because it is based on reports from 2005 and includes only some potential sources of pollution, the model may not fully reflect the current situation at each school. For example, some facilities have closed since 2005, and others have opened. Also, large industrial sites account for only a fraction of the nation's toxic air pollution. The EPA estimates that in 2002, cars, smaller businesses and other sources accounted for 85% of the toxic chemicals in the nation's air.

## Monitoring

Under the guidance of scientists from Johns Hopkins University and the University of Maryland School of Public Health, USA TODAY monitored air quality near 95 public and private schools throughout the nation. We placed monitors mainly – but not exclusively – near schools the EPA model suggests face higher exposure to industrial pollution. To make the most complete assessment possible, we used three main types of monitors, depending on the types of chemicals the model suggested would be present:

- **Badges:** We hung simple badge-like monitors near 95 schools in 30 states. The badges collect a class of chemicals known as volatile organic compounds. We also used a similar badge to detect ethylene oxide, a known carcinogen, near 23 schools. We left the badges in place for between four days and a week before returning them to the University of Maryland for analysis.
- **Active monitors:** Because some chemicals, such as metals, cannot be picked up on badge monitors, USA TODAY employees set up pumps to collect samples of metals near 17 schools and polycyclic aromatic compounds near 23 schools. At those schools, we monitored the air for between 72 and 96 hours. Filters that picked up metals were analyzed by Johns Hopkins; the rest were analyzed by the University of Maryland.
- **Ultraviolet monitors:** To find chemicals that cannot be easily measured either by badges or

active samplers, we used an ultraviolet detection system made by Cerex Monitoring Solutions to conduct additional monitoring near eight schools in Ohio, Pennsylvania and Texas. That monitor delivers its findings in real time and does not require laboratory analysis.

The monitoring work was conducted by employees of USA TODAY and other affiliated newspapers and television stations. In every case, we attempted to place the monitors within about 100 yards of a school, though a few had to be placed slightly farther away. Scientists at the University of Maryland and Johns Hopkins analyzed each sample, and interpreted those results.

Because USA TODAY was able to monitor near schools only for a comparatively short period of time, our findings may not reflect the extent of long-term exposure to pollutants at a particular location. For example, changes in wind direction or activity levels at a particular industrial facility can significantly influence the concentration levels near a school on any given day.

<sup>1</sup> See, for example, *A Framework for Addressing Health Risks of Environmental Exposure to Children* by the EPA's National Center for Environmental Assessment, published in 2006.

<sup>2</sup> Includes Alabama, California, Colorado, Georgia, Hawaii, Illinois, Kansas, Kentucky, Massachusetts, Michigan, Missouri, Montana, New Jersey, North Dakota, Ohio, Oklahoma, South Carolina, Tennessee, Texas, Utah, Wisconsin, and Wyoming.

<sup>3</sup> For example, Houston Mayor Bill White asked the EPA this year to adjust its emissions estimates for petrochemical and refining plants, pointing to studies showing their emissions were under-reported.

<sup>4</sup> For chemicals that are linked to both cancer and other health effects, we used the severity weighting the EPA assigned to the cancer-causing attributes of the chemical.

<sup>5</sup> At Salina Elementary in Dearborn, Mich., for example, the EPA model did not suggest students were exposed to acrolein, but an air monitoring station near the school detected high levels of the chemical.

<sup>6</sup> At Cesar Chavez High School in Houston, for example, the EPA model suggests students were exposed to levels of 1,3-butadiene significantly higher than the levels detected by an air monitoring station about a block away.

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