Special Report: U.S. air monitors routinely miss pollution - even refinery explosions

(Reuters) - When explosions ripped through a Philadelphia oil refinery last year, the shock waves knocked Felicia Menna's front door frame out of place. Then came the black smoke.

FILE PHOTO: A plume of smoke emits from a fire that broke out at a Chevron refinery in Richmond, California August 06, 2012. REUTERS/Staff/File Photo

"My throat was closing shut," recalled Menna, who lives about a mile away. "My nostrils felt like they were on fire."

She went to an emergency room, where doctors put her on a vaporizer device to ease her breathing and treated her with intravenous Benadryl for allergic reactions, according to medical records she provided to Reuters. She was among several dozen people who sought treatment after the blast, according to a neighborhood group that tracked affected residents.

One of the explosions was so large that a National Weather Service satellite captured images of the fireball from space. Refinery owner Philadelphia Energy Solutions later told regulators that the blasts released nearly 700,000 pounds of hazardous chemicals, including butane, and about 3,200 pounds of hydrofluoric acid, which can cause fatal lung injury in high concentrations. The incident remains under investigation by the U.S. Chemical Safety Board.

Yet the federal air quality index (AQI) score for south Philadelphia showed that day as one of the year's cleanest, according to data from the U.S. Environmental Protection Agency (EPA). The score was based on readings from part of the federal network of air quality monitoring devices, which are operated by the city of Philadelphia with oversight from state regulators and the EPA. None recorded any significant pollution.

"To say there was no impact to air quality was crazy," said Peter DeCarlo, an environmental engineering professor at Johns Hopkins University who lived in Philadelphia at the time and studied the city's monitoring system.

The episode illustrates a much broader failure of the U.S. air-pollution monitoring system, according to a Reuters examination of data from the EPA and independent monitoring organizations, along with interviews with scientists and environmental researchers. The government network of 3,900 monitoring devices nationwide has routinely missed major toxic releases and day-to-day pollution dangers, the data show.

The network, for example, identified no risks from 10 of the biggest refinery explosions over the past decade, the Reuters review of EPA data shows, even as thousands of people were hospitalized and the refineries reported toxic emissions to regulators.

Reuters also reviewed data from 10 community-based air monitoring projects by residents worried that government air-quality assessments are inaccurate. Those efforts often revealed pollution spikes and hot spots the EPA network never captured.

About 120 million Americans live in counties that have no EPA pollution monitors at all for small particle pollution, according to agency data. That was the case when an oil refinery in Superior, Wisconsin exploded in 2018, causing a leak of 17,000 barrels of asphalt and blanketing Superior and neighboring Duluth, Minnesota in clouds of black smoke. Though Superior has Wisconsin's only refinery, the city of 27,000 people isn't big enough to require permanent government air-pollution monitors nearby, said a spokeswoman for the Wisconsin Department of Natural Resources, citing EPA guidelines.

Fine particles - measuring less than 2.5 microns - are far smaller than a grain of sand and are considered the most dangerous form of pollution because they penetrate the bloodstream and cause lung and heart disease. Major sources include power plant and industrial smoke stack emissions, as well as vehicle exhaust.

The system's failures pose a public health risk, independent scientists say. The monitors underpin the Air Quality Index that many Americans, including those with respiratory disease, rely on to determine whether the outdoor air is safe. Pollution detected - or missed - by the monitors also guides regulatory decisions on whether new or expanded industrial projects can be permitted under the National Ambient Air Quality Standard. If pollution in the area is below regulatory thresholds, the projects generally go forward.

The data also inform and justify environmental policy decisions - and have often been used by President Donald Trump to tout his environmental record. Trump has cut back on policies aimed at addressing climate change by limiting carbon emissions. In his losing re-election campaign, he referred to the AQI this year when he asserted that America has the world's cleanest air. A leading Yale University study, produced annually, ranks the nation 16th for air quality globally.

President-elect Joe Biden, a Democrat, has said he would step up prosecutions for illegal polluting; push for a worldwide ban on government subsidies for fossil fuels; tighten fuel economy standards for vehicles; and put limits on methane pollution from oil and gas facilities.

The EPA declined to comment on the monitors' performance during specific pollution events, including the refinery explosions examined by Reuters, but said the network was generally accurate and reliable. "We are confident that the monitoring network provides data that allows decision-makers - states, public health officials, etc. - to make informed decisions on public health" and the permitting of plants in polluting industries, the EPA said in a statement.

The EPA oversees the network of pollution-monitoring devices, which are maintained and operated by state and local environmental agencies, who also share the financial burden. With probes that suck in air, the devices use filters, light pulses and beta rays to detect gas and particle pollution so tiny that concentrations are measured in parts per billion.

Academics, along with current and former regulators, say the network's problems are many and varied: Monitors are sparsely and poorly placed; the program is underfunded; and the network is not equipped to meet current pollution threats. The monitoring program emerged piecemeal after the 1970 Clean Air Act, mainly to track acid rain, smog and ozone pollution. Those hazards have largely subsided, replaced by more localized threats including toxic compounds and particulate matter from a wide range of industry and natural hazards, such as wildfires.

Individual monitors have also proven inaccurate, often recording pollution levels that can vary wildly from audit monitors placed beside them, according to government quality-assurance audits. Nearly half of the country's monitors meant to capture fine particulate matter did not meet federal accuracy standards, an EPA audit released in 2015 found.

When explosions rocked the Philadelphia refinery, the closest monitor for hazardous chemicals was programmed to operate only one of every six days - and therefore missed the incident entirely, according to EPA data reviewed by Reuters. Other Philadelphia monitors were either upwind or too far away to detect the explosion's pollution, according to the EPA data, which shows wind direction and speed. The refinery owner, Philadelphia Energy Solutions, filed for bankruptcy after the explosion and sold the property this year to a Chicago developer that plans to convert it to a mixed-use industrial park.

It wasn't the first time monitors programmed to operate sporadically missed pollution from a major explosion. When Chevron Corp's refinery in Richmond, California, caught fire in 2012, clouds of particulate matter forced 15,000 people to seek treatment, according to the U.S. Chemical Safety Board.

But the closest government monitor of hazardous chemicals recorded no problems because it was turned off. It had been programmed to work one of every 12 days, according to EPA data. The EPA and local regulators told Reuters that certain types of monitors are designed to operate only occasionally to reduce costs and labor. In 2013, Chevron agreed to pay $2 million in fines and restitution after pleading no contest to six misdemeanor criminal charges in connection to the fire.

Monitors are also sometimes programmed to limit the level of pollution recorded. A government monitor in Imperial County, California, operated by local and state regulators, recorded much lower readings of day-to-day air pollution in 2017 than were actually occurring because it had been programmed to max out at a lower level. The EPA acknowledged the issue to community organizations after the groups discovered higher readings with their own monitors.

“It’s almost unbelievable this can happen in the United States,” said Michael Jerrett, chair of the environmental health science department at the University of California, Los Angeles, and an adviser on the community monitoring project.

Researchers from the University of California San Francisco did a post-mortem on the Chevron refinery fire as part of a community health study. They concluded many of the people who suffered initial health problems continued to have worsening health in the years after, including chronic respiratory issues such as asthma.

Chevron said in a statement that it has worked since the 2012 fire to improve safety, reduce pollution and provide the community real-time data on air quality around its refinery. “Chevron recognizes the value of complete and accurate air quality data,” the company said.

In south Philadelphia, Menna said her initial symptoms from the blast’s fallout wore off in about a week, but she continued to cough for six months.

“I still don’t know if I have long-term effects,” she said.

UNDERFUNDED SYSTEM

A study conducted in 2013 during the administration of President Barack Obama, a Democrat, detailed a number of problems with the U.S. air monitoring network. The report proposed improvements including boosting monitoring near major polluting infrastructure, sampling for more pollutants, and doing more urban field studies to better understand block-to-block variability in air quality. But the weaknesses largely remain today because neither the Obama nor the Trump administration invested more in the monitoring network.

Over the past five years, the number of government monitors nationally has declined by 4% as state and local environmental agencies cut spending, according to EPA figures. Federal grants to state and local air-quality agencies have not increased in 15 years, according to testimony earlier this year by the National Association of Clean Air Agencies, a nonpartisan group based in Arlington, Virginia.

“The public’s desire for pollution data is exploding, but the government has less resources,” said Lyle Chinkin, chief scientist at environmental research firm Sonoma Technology, who has testified for the EPA in lawsuits accusing coal plant operators of Clean Air Act violations.

The EPA said it has improved the system despite what it acknowledged was flat funding for the past decade. The agency said it has replaced some labor-intensive, manual monitors with automatic monitors that provide round-the-clock, real-time data. The continuous monitors cost less to operate, but can also be less reliable than manual monitors in measuring particulate matter, according to EPA quality control audits.

Local groups worried about air quality have been trying to fill the gaps.

A community project in New York City, for example, has deployed up to 150 air monitors over the past decade. It found small particle pollution from traffic has been 50% higher in low-income neighborhoods than wealthier ones because they tend to be closer to major thoroughfares. By contrast, the EPA network run by state regulators in New York City has less than 30 monitors, preventing the EPA from providing city neighborhoods with a granular view of air quality, said Holger Eisl, director of the community project.

In Imperial County, California, the predominantly Latino community had long suspected government monitors were not giving a true reading of local pollution from agricultural burning and factories across the border in Mexico. An organization called Comite Civico del Valle installed 40 of its own monitors in 2015 to compare against the handful of government monitors. The devices detected sky-high levels of coarse particle pollution, at times exceeding the worst days in Beijing, among the world’s most polluted cities. Course particle pollution, produced by activities including wildfires and farming operations, can increase risk of heart and lung diseases.

The 24-hour maximum level of coarse particulate matter recorded by the community monitors surged as high as 2,430 micrograms per cubic meter in 2017, according to project organizers. That’s 40 times greater than the World Health Organization’s recommended level. The nearest government monitor, however, showed concentrations of only 985 micrograms per cubic meter, according to EPA data.

Researchers discovered, after consulting with the EPA, that the government monitor had been programmed to record nothing higher than 985 micrograms.

“We exposed them many times by finding things the government monitors were not finding,” said Luis Olmeda, executive director of Comite Civico del Valle.

The EPA acknowledged the monitors’ default setting was capped. It said the manufacturer warned that using higher settings can impair readings of lower pollution levels. After learning of the high readings on the community monitors in Imperial County, state and county environmental officials adjusted the area’s monitors to capture pollution levels up to 10,000 micrograms. The EPA detailed the change of settings in September when it ruled that the county’s air had improved enough to comply with federal regulations on coarse particle pollution.

Overall, between October 2016 and February 2017, the community monitors detected 1,426 episodes of elevated levels of particulate matter, or 12 times what government monitors recorded. The EPA ruled in October that Imperial County meets clean air standards. The agency excluded nearly 100 days of excessive pollution between 2014 and 2018, saying sand and dust storms in the desert area were “exceptional events.”

Community groups in Baltimore; Albany, New York; and East Oakland, California, have also independently found pollution missed by the EPA system. In Baltimore’s Curtis Bay neighborhood, community monitors revealed 24% higher fine particle pollution than government monitors, according to 2015 results published by the nonprofit Environmental Integrity Project.

Even small increases in exposure to particle pollution within a city can significantly increase the progression of heart disease, even if the levels remain below federal standards, according to Joel Kaufman, a physician-epidemiologist at the University of Washington and editor-in-chief of Environmental Health Perspectives.

The EPA acknowledged that community monitoring programs had been useful in identifying hot spots. But the EPA added that the low-cost monitors sometimes used by community groups have cheaper components and can have higher error rates than government monitors, and may not operate as well in harsh climates.

Government monitors also have problems. EPA performance evaluations have identified a long-running trend of imprecision and a bias toward undercounting pollution levels, according to the agency’s 2015 audit report. The audit covered about 1,000 government fine particulate matter monitoring sites, operated by nearly 100 environmental agencies. It found that 46% of the agencies had monitors that failed to

meet the EPA's standard for precision and 44% of agencies had devices that failed the bias standard.

In a statement, the EPA said the network's accuracy has since improved, and that 21% of agencies had monitors that failed to meet its precision standard between 2017 and 2019 and 39% had monitors that failed its bias goal.

TOSSING RESULTS TO HELP INDUSTRY

When EPA monitors capture pollution that exceeds regulatory limits, the EPA sometimes throws out those results for the purposes of its air-quality assessments - clearing the way for industrial development.

Trump's economic agenda has included fast-tracking the re-designation of areas of the country that are out of compliance with pollution standards, sometimes redrawing maps to exclude certain air monitors. Nationally, the administration has re-designated 54 out-of-compliance areas since 2017. Some of its decisions have been thrown out by the courts as arbitrary.

In Sheboygan, Wisconsin, for example, a court rejected the EPA exclusion this year of a monitor recording high ozone levels near the shoreline of Lake Michigan so that part of the surrounding county could be reclassified as complying with federal clean air standards. The EPA justified the move by arguing the monitor was unduly influenced by pollution coming from elsewhere via "lake breezes."

The EPA said the re-designations reflect greater progress toward cleaner air.

Industry can also benefit from the placement of monitors - a process that polluting companies can influence, said Corbett Grainger, a University of Madison-Wisconsin environmental economics professor who led a study of monitor site selection.

The EPA provides guidance on where monitors are placed, but state regulators have wide discretion. The Wisconsin researchers found that state regulators in counties that are close to exceeding pollution standards often place monitors in cleaner areas when they have the option, a conclusion based on a study of years of EPA monitor data and pollution estimates from satellites.

"We found that, on average, newly sited monitors are placed in relatively clean areas," said Grainger, the Wisconsin environmental economist. The positioning, he said, suggests that local regulators strategically avoid pollution hot spots.

The EPA declined to comment on the study.

In 2015 and 2016, Missouri regulators allowed St. Louis-based utility Ameren Corp to select sites to install four sulfur dioxide (SO2) monitors around its Labadie coal plant. The plant is ranked by the EPA as the second largest SO2 polluter in the country. The EPA and state regulators signed off on the monitoring sites as accurately capturing the plant's pollution - over the objections of environmental groups that argued the locations would prevent monitors from picking up the coal plant's peak SO2 concentrations.

Ameren told state regulators it followed EPA guidelines in locating the monitors. The company declined to comment for this story.

The Missouri Department of Natural Resources said choosing the locations was a collaborative effort with the company and the EPA, and that regulators reviewed and verified Ameren's analysis of the sites. "It's not unusual for facilities to submit their own analysis," the department said.

In August, the EPA told Missouri's governor that it plans to move ahead with redesignating the area around Labadie as in compliance with pollution standards.

But pollution from the plant travels far beyond the surrounding area, said Chinkin, the atmospheric scientist. Based on a computer simulation, he said in court testimony in 2019 that Labadie's SO2 output converts to fine particulate matter because of the heat and humidity during summer in St. Louis.

The result, Chinkin testified, is particulate pollution that extends across the entire eastern half of the United States. The worst impacts, he said in a phone interview, can be seen "hundreds of miles beyond Missouri."

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