Article Portfolio Selections

Group 5

Environmental Programs, Research, and Policies

Lead Contamination of Drinking Water Extends Well Beyond Michigan's Woes
(10/2016)

Flint Water Crisis Is Likely to Remain in Media Headlines
(07/2016)

Aerial Infrared Spectral Imaging Aids in BP Oil Spill Cleanup Program
(07/2010)

EPA Assesses Data in California on Naturally Occurring Asbestos
(07/2005)

Electronic Barrier Designed to Halt Invasive Fish Is Close to Completion
(01/2005)

EPA Reviewing Options to Curb Storm Water Runoff from Project Sites
(12/2002)

Congress Backs President in Introducing Environmental Streamlining Bills
(12/2002)

EPA Addresses Health Hazards, Issues Rule on Heavy-Duty Diesel Engine Emissions
(11/2002)

California Raises the Bar for Reducing Greenhouse Gas Emissions from Vehicles
(09/2002)

Genetically Engineered Corn Not Harmful to Butterflies, Tests Show
(05/2002)

White House Offers Alternative Approach Toward Climate Change, Emissions Control
(04/2002)

Science Research from Antarctica Shows Steady Cooling Trend Across Continent
(03/2002)

Limiting Man-Made Air Pollutants Could Increase Global Warming, Research Finds
(06/2001)

Lead Contamination of Drinking Water Extends Well Beyond Michgan's Woes

By Steven J. Storts
Dublin, Ohio

IN LIGHT of the lead-in-water crisis that pervaded Flint, Mich. earlier this year, should other municipalities be concerned about possible lead contamination of their drinking water? Although the Flint controversy continues to dominate many news headlines, the Natural Resources Defense Council reports that lead contamination in other community water systems could be more prevalent than originally thought because many water systems are not flagged as having lead violations in the government database, which was designed to track and document such problems.

Research by NRDC scientists and health experts indicates that more than 5,300 community water systems serving 18 million Americans in 2015 violated federal lead and copper regulations issued by the U.S. Environmental Protection Agency. The violations included failure to mitigate lead levels, failure to monitor for lead, and failure to report test results to the public or government officials.

The NRDC report *What's In Your Water: Flint and Beyond* notes that not every person served by these systems is known to have excessive lead in their water because only a small percentage of homes were tested and lead levels can vary from home to home. However, industry estimates claim that 15 million to 22 million Americans receive their drinking water delivered through lead service lines that can release lead into tap water.

One of the prominent researchers who played a major role in exposing the lead-in-water crises in Flint last year and in Washington, D.C. in the early 2000s is Marc Edwards, Ph.D., a professor of civil and environmental engineering at Virginia Tech. More than a decade ago, the *Washington Post* published a series of articles documenting the extent of the lead problem in the nation's capital and detailing how it had been ignored.

Edwards, while studying premature pipe corrosion for the District of Columbia Water and Sewer Authority, determined that lead levels were at least 83 times higher than the accepted safe limit. His research cited the change from chlorine to chloramine as a water treatment chemical as the cause for the spike in lead levels. Regarding Flint's lead-contamination problem, Edwards says corrosive water basically "ate up every metallic pipe" in the water-delivery system, with plastic pipe being the only material immune to such corrosive elements.

Erik Olson, NRDC's health program director, contends, "Shoddy data collection, lax enforcement of the law, and cities gaming the system have created a potent brew of lead violations and unsafe drinking water from the water supplies used by millions of people across the nation." Moreover, he adds, nine out of 10 of these water rule violations never faced *any* formal enforcement and, in fact, states and EPA authorities sought penalties against only three percent of lead rule violators.

Not surprising, Olsen says the EPA's drinking water tracking data show no record of Flint as having violations for lead, suggesting that millions more Americans could be at risk of drinking unsafe water. NRDC sources further point out that EPA audits have continually found that many drinking water violations do not show up in its database.

Another issue highlighted by the NRDC peer-reviewed report is that water systems can use questionable testing methods to avoid detecting lead problems. In cities like Flint, Chicago, and Philadelphia, where localized lead spikes may put the public at risk, officials allegedly have "gamed" water testing in ways that may obscure lead contamination.

For example, systems can monitor in locations less likely to have lead problems rather than in the highest risk homes or can use water sampling methods that minimize the chance of finding higher levels of lead. After years of complaints about these questionable techniques, the EPA issued a guidance document last February discouraging these methods.

For instance, a recent August *New York Times* article reports that a review of how water testing was conducted at more than 1,500 city school buildings suggests that the amount of lead in the water consumed by students could be greater than the results indicate because of a testing practice known as "pre-stagnation flushing." This practice, which called for every water outlet in each school to be turned on fully for two hours the night before the samples were taken, cleans most soluble lead and lead particles from pipes, thus reducing lead levels temporarily.

However, the EPA's new guidance document recommends not using pre-stagnation flushing when sampling water in homes, stating that the step "may potentially lower the lead lev-

els as compared to when it is not practiced."

The *Times* article further notes that because the EPA does not regulate the testing of water in schools, its guidance on pre-stagnation flushing does not apply directly to New York's procedures. Still, the agency's voluntary guidelines for schools do not recommend such flushing and generally direct schools to mimic normal consumption patterns when taking samples.

An August *Chicago Tribune* article also backs up the premise that the testing methods for lead in drinking water "could significantly underestimate consumers' exposure to the toxic metal," as high lead levels were found in drinking water in seven of 38 Chicago homes tested by federal regulators this past spring. EPA officials are still analyzing the results, but there is concern, the *Tribune* points out, particularly in older cities and suburbs where lead pipe and solder are common.

Under federal law, local utilities must test water in a relatively small sample of homes. If lead concentrations exceed 15 parts per billion in more than 10 percent of the sampling, the utilities must alert residents and try to lower levels. The city of Chicago has not exceeded the lead limit in nearly 20 years, according to the *Tribune*. The allowable amount of lead was established in the 1990s, based on a level that utilities could feasibly monitor and treat. However, it is not a health-based standard, and many health and environment experts believe the level allowed is too high.

Not all municipalities or states are playing defense, though. The Greater Cincinnati Water Works, in light of recent lead contamination findings in Ohio and nearby states, is assuring its customers that providing and maintaining safe drinking water is the No. 1 priority.

GCWW's Ohio River treatment plant in California, Ohio, uses sand filtration, granular activated carbon, powdered activated carbon, and ultraviolet light to remove and treat for natural and man-made contaminants in drinking water. The facility is one of the first in the nation to use a combination of all four treatment methods. As an additional safeguard, the agency deploys a specific lead corrosion control treatment process to minimize the amount of lead that may leach into the drinking water through home plumbing.

And back in April, the Wisconsin Department of Natural Resources announced that it will target low-income areas statewide with $11.8 million in new grants to replace aging pipes made of lead that supply water to homes. It is estimated that at least 176,000 homes and businesses in Wisconsin receive water from lead service lines, with about 70,000 of those lines in Milwaukee alone.

October 2016

Flint Water Crisis Controversy Is Likely to Remain in Media Headlines

By Steven J. Storts
Dublin, Ohio

IT HAS now been more than six months since the lead-contaminated water crisis engulfed the city of Flint, Mich. Widely publicized, this event gained the increasing attention of public officials nationwide and continues to do so today because elevated levels of lead can cause serious health issues.

Equally disconcerting, although viable municipal water systems are engineered to provide high-quality drinking water, they cannot always control the variety (and age) of materials and components associated with service lines and home plumbing from which lead contamination can emanate. And unfortunately, even if proper lead abatement practices are in place, politics and sound engineering principles do not always meet at the water's edge.

For instance, Flint city officials and the Michigan Department of Environmental Quality (MDEQ) are under scrutiny for switching the city's drinking water source as a cost-saving move in April 2014 from Lake Huron water, treated by the Detroit water system, to Flint River water, treated locally.

According to *USA Today*, at the heart of the lead poisoning controversy was the state's failure in requiring Flint to add corrosion-control chemicals as part of the water treatment process. As a result, corrosive water caused lead to leach from pipes, joints, and fixtures. State officials issued denials of a lead-poisoning problem, only to turn around months later and acknowledge their mistake. Flint did revert back to its Detroit water source last October; however, by then, damage had already been inflicted on the city's water infrastructure system, thereby increasing the risk for further lead contamination.

This past spring in April, Michigan Attorney General Bill Schuette announced felony criminal charges against two MDEQ officials and one Flint city official in connection with the lead contamination of the city's drinking water.

However, more recently in June, Schuette filed a civil lawsuit regarding Flint's drinking water crisis against a water company, an engineering firm, and several related companies, alleging their acts, errors, or omissions constitute professional negligence, fraud, and a public nuisance. The primary parties listed as defendants in the court filings include Veolia North America; Lockwood, Andrews & Newnam Inc.; and the Leo A. Daly Co., which is LAN's parent company.

LAN issued a response statement to the allegations, reported by the *Detroit Free Press*, saying the company was "surprised and disappointed that the state would change direction and wrongfully accuse LAN of acting improperly," adding that "LAN will vigorously defend itself against these unfounded claims."

The statement notes that Schuette "blatantly mischaracter-ized the role of LAN's service to Flint and ignores the findings of every public investigation into this tragedy that the key decisions concerning the treatment of the water from the Flint River were made by the City of Flint and the Michigan Department of Environmental Quality."

The statement further says that "contrary to statements by the Attorney General, LAN was not hired to operate the plant and had no responsibility for water quality, but, and although LAN was not asked, LAN had regularly advised that corrosion control should be added and that the system needed to be fully tested before going online."

In a separate response released by Veolia, the *Free Press* reported that "the Attorney General has not talked to Veolia about its involvement in Flint, interviewed the company's technical experts, or asked any questions about our one-time, one-month contract with Flint," and that "Veolia's engagement with the city was wholly unrelated to the current lead issues." Flint didn't hire Veolia until nearly one year after the switch to the Flint River water system, and the company recommended changes "to minimize (disinfectant byproduct) formation along with risks associated with corrosion," the statement points out.

According to the *Free Press*, the attorney general's filed court documents contend that the companies had a legal responsibility to act with a level of care and competence befitting their industry's professional standard. "The defendant corporations knew or should have known that high chloride levels in the Flint River would make the water corrosive without significant treatment, and that the corrosion would result in dangerous levels of lead for residents served by the City's many lead pipes," the attorney general's office noted.

Aside from the political harangue and ensuing civil lawsuits surrounding Flint, the challenge still remains of how to address a lead-contaminated water system. A recent report shows

the average cost for replacing a water service line in Flint through a pilot project that ended in May was $7,500, which almost doubles the average cost of $4,000 for each replacement earlier estimated by MDEQ at the beginning of the water crisis last fall. However, not included in those calculations are average permit fees of $2,400 per site, the *Free Press* adds.

Sources from Michigan Gov. Rick Snyder's office additionally report that the cost for pipe replacement in Flint will likely approach $55 million, exceeding the governor's budget request by more than $27 million. The state has already allocated $2 million toward replacing about 500 water service lines in Flint. Still, other cost projections for resolving the lead-contamination issue range as high as $200 million, and it is anticipated that the governor's office will seek additional funding.

Meanwhile, in an effort to flush out lead particles in Flint's water system, elevated lead levels continue to be detected in the drinking water, so precautions are still in order for city residents. One earlier campaign advised that they freely run their water taps for 10 minutes a day for two weeks. In general, the potential for lead exposure can be minimized by flushing stagnant (not in use for several hours) tap water for 30 seconds to two minutes before using water for drinking or cooking.

From a public health standpoint, the Associated Press reports that blood-lead levels in Flint children under age 6 were significantly higher (about 50 percent) after the city switched from Detroit's water system to the Flint River in 2014, according to findings released by the Centers for Disease Control and Prevention. About 9,600 children younger than 6 years old lived in homes served by Flint's water system, the CDC study notes. Among them, about 7,300 received nearly 9,700 blood-lead tests before, during, and after the water source switch. Although agency officials admit they cannot account for all factors that may have contributed to the children's increased lead exposure, their analysis implies that the increase was due in large part to consuming contaminated water in Flint.

July 2016

Aerial Infrared Spectral Imaging Aids in BP Oil Spill Cleanup Program

By Steven J. Storts
Dublin, Ohio

FOR one engineer in public health service, addressing the BP oil spill cleanup has been anything *but* business-as-usual for the last few months. Professional engineer John Cardarelli II of Erlanger, Ky., a health physicist with the U.S. Environmental Protection Agency, has a lead role on EPA's national decontamination team in analyzing data gathered through airborne spectral photometric environmental collection technology — better known as ASPECT.

As part of the agency's response activities, the ASPECT team was deployed to the Gulf of Mexico in late April to provide aerial reconnaissance, imaging, and stand-off chemical detection and quantification. The aircraft used is equipped with several chemical and radiological sensors with imaging capabilities. "Radiological detection capabilities are not being used in this response," Cardarelli notes, "but the chemical and imagery sensors and have proven to be extremely powerful."

The aircraft's passive remote infrared spectral sensors monitor the downwind hazard of chemicals created during open-water oil burns. These infrared sensors detect and track vapor plumes using two different spectral systems.

The first sensor is a multispectral high-spatial-resolution infrared imager that provides two-dimensional images. Visible high-resolution images are also collected and geo-corrected to provide an overlay of the infrared image, the chemical plume, and a visible image of the site.

The second infrared instrument, a Fourier transform infrared spectrometer, collects a higher spectral resolution of the infrared signature from a specific plume location and then identifies and quantifies the chemical constituents in the plume.

"We have not seen any significant chemical compounds in the open-water oil burns to date that pose any public health threat to those on shore," Carda-relli reports. "This is primarily due to what appears to be a fairly efficient burn of the oil, and the fact that these burns occur more than 40 miles from shore. The black plume is predominately elemental carbon that is effectively dispersed before reaching shore."

To assist in making viable health assessments, the ASPECT chemical identification and quantification software algorithms automatically analyze 24 chemical compounds during a mission. The team conducts further analyses on more than 500 other chemical compounds once data are downloaded from the aircraft. Results are then forwarded to toxicologists, industrial hygienists, and other scientific experts to help evaluate any potential health effects.

Cardarelli points out that advanced infrared analysis algorithms were developed in coordination with the National Geospatial Intelligence Agency and the University of Iowa to improve oil detection using infrared spectral imaging. "This technique differs from visual photography in that it eliminates glare and glint associated with the visual spectrum and discriminates oil from black water and other areas that appear to be contaminated but actually are not," he explains.

"This helps decision-makers send ground-based and water-based assets to facilitate cleanup operations in locations with known oil contamination and reduces or prevents unnecessary deployments to uncontaminated areas."

As of late June, the ASPECT team had flown nearly 60 missions logging 190 flight hours; processed more than 8,700 aerial photos, 5,300 oblique photos, and 2,000 infrared images; and collected more than 2.3 million interferograms. All data, along with daily flight paths and other geospatial information, are regularly uploaded to Google Earth (www. earth.google.com) within a few hours of a mission.

Currently active in several professional organizations, Cardarelli was lauded as Federal Engineer of the Year in 2006 by the National Society of Professional Engineers, the same year he also received Public Health Service Engineer of the Year and EPA Engineer of the Year honors. His professionalism doesn't stop with the accolades, however.

"As engineers, scientists, and researchers, we continuously challenge ourselves to make our products more intuitive with faster delivery times, but we have not spent enough time making others aware of their value to this environmental response," he emphasizes.

Although Cardarelli admits that the core ASPECT team is small — composed of about four federal employees and six government contractors, including pilots — he says that a concerted effort has been made to increase awareness of newly developed products and their utility to the overall oil spill cleanup activities.

He also contends that his team has "witnessed substantial improvement in the use of these products over time," and that the unique capabilities of ASPECT to conduct stand-off chemical

and radiological detection, combined with imaging and pattern recognition algorithms in a low-altitude environment, make it a valued national asset.

As one might expect, the ASPECT directives have changed throughout the oil spill cleanup process. "At the beginning, we provided situational awareness to the incident command by locating and imaging the oil slicks via aerial reconnaissance," Cardarelli points out. "We also conducted remote chemical detection during open-water oil burns. After the oil started to reach the beaches, our focus evolved into discriminating between contaminated locations and locations that only appeared to be contaminated."

The most recent directives, he notes, have been associated with helping to prevent the oil from reaching the beaches by mapping the oil slicks. Those data are delivered within minutes of a sortie so water-based recovery assets can be immediately deployed to clean up the oil more efficiently. "The ability to discriminate oil from water and land using infrared line scanning technology is a novel approach that improves our response capabilities and gives us an objective method to quantify our clean-up activities," he adds.

Looking toward the future, Cardarelli says improved satellite communication from reconnaissance aircraft to the ground base will increase the efficiency of transferring time-critical data. "With proper communications, information can be shared in near real-time rather than waiting for the aircraft to complete its mission" he explains. "This will allow for ground-based assets to better execute their missions."

July 2010

EPA Assesses Data in California On Naturally Occurring Asbestos

By Steven J. Storts
Dublin, Ohio

ASBESTOS, a known carcinogen, discovered only after decades of widespread use as a fire retardant and insulation material, is now offering new challenges for the environmental engineering community. But the venue has switched from the workplace and public buildings to a more natural habitat, the soil.

At a public meeting in El Dorado Hills, California, in May, the U.S. Environmental Protection Agency's Pacific Southwest regional office released the data collected during asbestos sampling in the community last fall.

What the EPA found in El Dorado Hills were asbestos fibers in almost all of the samples taken. More than 450 samples from the air and soil were collected as part of an overall assessment of asbestos levels and personal exposures to the mineral in public areas of El Dorado Hills. The request for an assessment was made in September 2003 by a community member under federal Superfund law after asbestos was found in the soil at the local high school.

Asbestos fibers occur naturally in rock and soil as the result of geologic processes, often in veins near earthquake faults in the coastal ranges and the foothills of the Sierra Nevada mountains. The mineral substance is also found in other areas of the U.S. Naturally occurring asbestos can take the form of long, thin, separable fibers. There is no health threat if asbestos fibers in soil remain undisturbed and do not become airborne. However, natural weathering or human disturbance can break the substance down to microscopic fibers, easily suspended in air.

"We conducted this study to gather data on the potential for asbestos exposure when activity creates dust," explains Dan Meer, chief of the response, planning, and assessment branch in the EPA Region 9 office. "Our hope is that the data will help to inform the decision making of agencies and groups to determine what actions should be taken."

EPA's sampling simulated the sports and recreational activities of both children and adults. The sampling occurred at the El Dorado Hills Community Park's playground and fields, the New York Creek nature trail's bicycling and jogging path, and in the Jackson Elementary School garden. The exposure of children to asbestos is of particular concern to health officials because their longer life expectancy exceeds the latency period for asbestos-related disease.

Previous EPA studies across the U.S. have indicated that the best way to measure exposure to asbestos in the air was to perform personal monitoring during dust-generating activities. This technique is called "activity-based personal air monitoring." During the assessment, EPA contractors wore air samplers to collect dust from the breathing heights of children and adults.

Asbestos fibers found in El Dorado Hills included samples collected for comparison outside the area of activity. The dominant asbestos fiber detected was amphibole. In general, personal asbestos exposures from simulated sports and play activities were significantly elevated over levels observed in the asbestos air samples taken outside the area of activity.

Meer says the long-term health effects related to intermittent, high-level environmental exposure to amphibole asbestos cannot be quantified, particularly when that exposure occurs at an early age. "However, given what these samples show, reasonable and appropriate steps should be taken to reduce asbestos exposure," he notes. "The entire community and county government, schools, service providers such as engineers and contractors, business leaders, and the public need to get involved in solving this problem."

With the release of the El Dorado Hills findings, EPA plans several next steps, including convening an independent panel of human health experts to determine the significance of elevated exposures to naturally occurring asbestos.

EPA will also be conducting limited activity-based asbestos sampling in another California area outside of El Dorado County. This sampling, in addition to some off-road vehicle activity asbestos sampling being conducted at the Clear Creek management area in San Benito County, will be used to expand the knowledge base on the significance of naturally occurring asbestos exposures in California.

July 2005

Electronic Barrier Designed to Halt Invasive Fish Is Close to Completion

By Steven J. Storts
Dublin, Ohio

LIKE many consumer products, the form, style, and function of a built structure can also be diverse, serving a variety of aesthetic and practical needs. One of the more unusual end-use projects is the current construction of an enhanced electronic barrier to keep invasive Asian carp out of the Great Lakes.

Collectively termed "Frankenfish" by sci-fi enthusiasts, Asian carp have been found in the Illinois River, which connects the Mississippi River to Lake Michigan. The fish are considered a significant threat to the Great Lakes by ecologists because they are large, extremely prolific, and consume vast amounts of food. They can weigh up to 100 pounds and grow to lengths greater than four feet.

Moreover, Asian carp are well-suited to the climate of the Great Lakes region, which is similar to their native Eastern Hemisphere habitat. If allowed to enter the lakes, researchers predict that the carp would disrupt the ecosystem with their ravenous appetites by competing for food with the valuable sport and commercial fish, becoming a dominant species in the region.

Continued monitoring by the U.S. Environmental Protection Agency shows the carp to be in large numbers in the Illinois River within 50 miles of Lake Michigan. To add to the impending threat, a fisherman recently caught a four-foot-long Asian carp in the nearby lake, although EPA and U.S. Fish and Wildlife Service officials consider this to be an isolated occurrence.

To prevent the incursion of the carp species into the Great Lakes, state and federal agencies completed construction of an electrical fish barrier in April 2002 as a demonstration project to study the effectiveness of preventing species migration between the Illinois River and Lake Michigan. The U.S. Army Corps of Engineers built the temporary electronic dispersal barrier on the Chicago Sanitary and Ship Canal near Romeoville at a cost of about $2.2 million.

Upon completion of the project, the Illinois Natural History Survey began actively monitoring the effectiveness of the temporary barrier by tagging and tracking the movements of 100 common (native) carp near the canal. Because both the field monitoring and simulated tests in a fish hatchery showed that the barrier was effective at preventing the movement of fish into Lake Michigan, the design of a more permanent structure became feasible.

After additional federal funding for the project was secured, construction began in late October 2004. Scheduled for completion next month, the permanent barrier stretches two rows of electrodes across the canal about 220 feet apart. The electrodes pulse DC current into the water, causing fish to turn back rather than pass through the electric wall. The electric current poses no health threat to people.

Changes to the design will provide a stronger, more consistent electric field in the new barrier. Also, with the construction of a second control house, two sets of electrodes—primary and backup—can now be operated simultaneously. These changes will prevent fish from being swept through by ship or barge turbulence.

The cost of the permanent barrier is $9.1 million. Congress recently voted to increase the cap on federal spending for the project, authorizing $6.825 million, which is 75% of the $9.1 million needed to complete the barrier. The state of Illinois has committed $1.7 million and the Great Lakes governors from surrounding states have committed to funding the remaining nonfederal share of $575,000.

Two species of Asian carp—the silver and the bighead—were originally imported by catfish farmers in the 1970s to remove algae and suspended matter out of their ponds. During large floods in the early 1990s, many of the catfish farm ponds overflowed their banks, releasing carp into local waterways within the Mississippi River basin. Steadily making their way northward, the Asian carp have already become abundant in some areas of the Mississippi, thinning out native fish and causing severe hardship to those who fish commercially.

In addition the Corps, the EPA, and the Fish and Wildlife Service, the following are working toward preventing the migration of Asian carp and other invasive species into the Great Lakes region: the Council of Great Lakes Governors, Commonwealth Edison, the Dispersal Barrier Advisory Panel, the Great Lakes Fishery Commission, the Great Lakes Sportfishing Council, the Illinois Department of Natural Resources, the International Joint Commission, the Metropolitan Water Reclamation District of Greater Chicago, Midwest Generation, the Mississippi Interstate Cooperative Resource Association, the New York Department of Environmental Conservation, and Wisconsin Sea Grant.

January 2005

EPA Reviewing Options to Curb Storm Water Runoff from Project Sites

By Steven J. Storts
Dublin, Ohio

NOW that the U.S. Environmental Protection Agency has finished public hearings on proposed construction site storm water runoff regulations, what lies ahead?

EPA Administrator Christie Whitman notes that the agency's plan for reducing storm water discharges aims to build on existing regulations that further promote better management of construction sites and support land management decisions by state and local governments.

The agency head further points out that any final standard will offer flexibility to builders, developers, general contractors, and government agencies ensuring that unique site-specific concerns, such as soil type, local environmental needs, and rainfall, are taken into consideration when determining how best to control construction site runoff.

Although existing national storm water regulations and permits require construction site operators to implement "best practices" to manage construction site runoff, they do not require any specific level of control, EPA officials report. Construction and development activity affecting water quality typically involves site selection and planning and land-disturbing tasks such as clearing, excavating, and grading. Disturbed soil, if not managed properly, can be easily washed off-site during storm events. With the runoff comes an increase in sedimentation, which can cause problems ranging from reduced passage in rivers and streams to higher costs for removing sediment from drinking water.

By definition, effluent guidelines are national standards for wastewater discharges to surface waters and publicly owned treatment works, such as municipal sewage treatment plants. They are developed by EPA on an industry-by-industry basis, intended to represent the greatest pollutant reductions that are economically achievable, based on the best available technologies. Although effluent guidelines don't require the installation of any particular technology identified by the agency, the regulations do require compliance to all standards that are developed according to a particular model technology.

All approved standards are incorporated into National Pollutant Discharge Elimination System (NPDES) permits issued by individual states and EPA regional offices. Currently, EPA has issued national technology-based effluent guidelines for more than 50 industries. The construction and development option now under consideration would create a new category listed in the *U.S. Code of Federal Regulations* (Title 40, Part 450).

The agency's approaches toward curbing storm water runoff address several options, including development of an industry-specific effluent guideline for operators of construction sites, specifying the types of runoff controls needed and the criteria for designing them; site inspections and certifications (regarding the proper installation of controls) to reduce storm water runoff pollution; and more effective implementation of existing effluent regulations, without establishing any new requirements.

Specifically, a new effluent guideline would cover storm water discharges from construction sites in the form of minimum standards for design and construction of erosion and sediment controls, including minimum requirements for conducting site inspections and certification as to the design and completion of controls. This option would cover project sites with five or more acres of disturbed land.

The second option would amend existing storm water permit regulations with minimum requirements for conducting site inspections and certification as to the design and completion of controls. This approach would cover project sites with one or more acres of disturbed land.

EPA officials explain that either of the two regulatory options would apply to operators of construction sites who are required to obtain NPDES storm water permits and, if promulgated, would add more requirements to the permit process for construction sites.

The schedule for the proposed rule making, included in a consent decree between EPA and the Natural Resources Defense Council, sets a signature date for final action no later than March 31, 2004. The agency estimates annual compliance costs ranging from $130 million to $505 million, resulting in reductions of pollutant discharges by as much as 11 million tons a year.

December 2002

Congress Backs President in Introducing Environmental Streamlining Bills

By Steven J. Storts
Dublin, Ohio

FOLLOWING the path of a recent White House directive, legislation has been introduced in Congress to streamline environmental reviews in transportation planning. The new measure expects to expedite the completion of high priority highway projects to reduce America's growing traffic congestion problems, without amending environmental statutes or decreasing public involvement.

Sponsored by Don Young (R-Alaska), H.R. 5455, the Expediting Project Delivery to Improve Transportation and the Environment Act, is now before a highways and transit subcommittee of the House Committee on Transportation and Infrastructure. As two of its major provisions, the ExPDITE Act defines a process to navigate projects through the National Environmental Policy Act process and sets a statutory deadline for filing lawsuits to block projects complying with this process.

The legislation further specifies the U.S. Department of Transportation as the lead agency for highway and transit projects, while establishing roles and responsibilities for participating agencies in the environmental review process. As the lead agency, DOT holds the responsibility for defining the purposes and needs of any particular project, along with a range of possible alternatives and the level of analysis to be conducted.

H.R. 5455 also allows delegation of federal agency responsibilities to the states and requires DOT to work with other agencies toward improving interagency cooperation, including analyzing the causes for any delays and measuring progress toward improvement.

"Studies have clearly outlined the problems associated with America's growing highway congestion crisis, which in 1999 alone cost the nation $78 billion and led to the waste of 6.8 billion gallons of gas," Young notes. "Delays in high-priority projects have created social, economic, and environmental problems throughout the U.S."

Young says the ExPDITE Act reflects a growing consensus that the current time periods required for approving transportation projects are not acceptable anymore. "Ten to 12 years are just too long for communities to wait for necessary transportation projects," he says. "Workers and families sitting in traffic for hours, or manufacturers unable to transport cargo and inventory because of transportation bottlenecks, deserve these improved highway and transit projects."

In testimony before the House subcommittee, the American Council of Engineering Companies said H.R. 5455 provides a solution to a longstanding problem—needless delays to transportation projects caused by environmental processing. "This issue is not about weakening environmental protection," noted Hal Kassoff, Parsons Brinkerhoff vice president of highway programs, who represented ACEC at the subcommittee hearing. "It's about implementing an improved process that expedites project delivery without sacrificing environmental protection."

Expediting project delivery is one of the premier issues for members of the transportation community, Kassoff told congressional members. "And those who are experienced in delivering surface transportation projects will agree that the most difficult challenge involves coping with what has become an overly arduous and time-consuming environmental review process," he said.

John Horsley, executive director of the American Association of State Highway and Transportation Officials, cites examples of delays resulting from current project review processes. In Alaska, for instance, environmental litigation surrounding the Whittier Tunnel project has added at least two years and $8 million in expense to that project.

And in New Hampshire, the transportation department, state resource agencies, and local officials reached an agreement that to compensate for impacts on 70 acres of wetlands, New Hampshire DOT would create 650 acres of new wetlands at a cost of $15 million, plus $3 million for technical assistance for local land-use regulations. The Environmental Protection Agency then stepped in to demand a mitigation package of about 2,300 acres (30 times the amount of impact) at a cost of $50 million.

"The real impacts of such delays can mean lost lives as a result of failure to improve safety hazards on highways and loss of economic recovery as a result of inadequate access to good transportation facilities," Horsley emphasizes.

In the Senate, legislation similar to H.R. 5455 has also been introduced. Sponsors of S. 3031, the Maximizing Economic Growth for America through Environmental Streamlining Act, expect the measure will become a good starting point for reforms in the coming reauthorization of federal-aid

highway and transit programs. The MEGA Stream Act is currently before the Senate Committee on Environment and Public Works.

Sen. Max Baucus (D-Mont.), the bill's lead sponsor, says, "There's got to be a faster, easier way to do the work that needs to be done on our surface transportation system, while continuing to protect the environment. I cannot overemphasize that the planning and environmental provisions of the Transportation Efficiency Act of the 21st Century need to be implemented in a way that will streamline and expedite, not complicate, the process of delivering transportation projects."

December 2002

EPA Addresses Health Hazards, Issues Rule On Heavy-Duty Diesel Engine Emissions

By Steven J. Storts
Dublin, Ohio

THE U.S. Environmental Protection Agency has released its final assessment regarding potential health hazards associated with exposure to diesel engine exhaust, containing a mixture of gases and particulate matter. The assessment's conclusions are based on exposure to exhaust from heavy-duty diesel engines built prior to the mid-1990s.

EPA's findings conclude that long-term (chronic) inhalation exposure is likely to pose a lung cancer hazard to humans, in addition to other lung damage, depending on duration. Short-term (acute) exposures can cause irritation and inflammatory symptoms of a transient nature, these being highly variable across the population. The assessment also indicates that evidence for exacerbation of existing allergies and asthma symptoms is emerging.

Information provided by the *Health Assessment Document for Diesel Engine Exhaust* was not only useful in developing EPA's understanding of the public health implications of current exposure to diesel engine exhaust, but also provided insight into the potential health benefits of taking regulatory action to control exhaust emissions.

In fact, the agency's early draft of the assessment was part of the scientific basis that supported recently established exhaust emission standards for hydrocarbons and nitrogen oxides (NOx) in heavy-duty highway vehicles, which start becoming effective with the 2004 model year and are expected to reduce harmful emissions by as much as 90% this decade.

Prior to its release of the assessment document, EPA finalized a nonconformance penalty rule for manufacturers of heavy-duty diesel engines unable to meet 2004 and later model year emission standards. When the agency set the standards, it committed to establishing penalties if the need became apparent. Under a penalty structure established by the Clean Air Act, manufacturers that cannot meet the standards can choose to pay a penalty on a per-engine basis. The rule allows a manufacturer that might be forced from the marketplace in the absence of nonconformance penalties to continue to produce and sell engines if the manufacturer cannot meet a particular emission standard due to technological (not economic) difficulties.

The penalties also apply to engines covered under a 1998 settlement reached by the U.S. Department of Justice and EPA with six major manufacturers. The settlement resolved claims that the manufacturers had illegally installed instrumentation on heavy-duty diesel engines that turned off or overrode emission controls during highway driving. The consent decree required compliance with the 2004 NOx emission limits by October 1, 2002, and specified that manufacturers unable to meet those standards pay penalties based on their emissions level above the required 2004 standard.

In August, the White House announced that EPA would pursue the penalties on a sliding scale, depending on how close a company's new engines approach compliance. The penalties range from a few hundred dollars for an engine close to meeting emission standards to more than $12,000 for one emitting the maximum pollution allowed.

Failure To Comply

As the consent decree compliance deadline approached, Caterpillar Inc. and the Detroit Diesel Corporation asked a federal district court to modify the agreement and postpone the deadline, claiming that unanticipated cost increases had made compliance more difficult than planned. However, in September, Judge Henry Kennedy of the U.S. District Court in Washington, D.C., denied the manufacturers' motions, ruling that Caterpillar "has not met its burden to justifying revision of the decree."

Upon issuing the decision, EPA Administrator Christie Whitman said, "We will continue to work with the engine manufacturers to ensure a smooth transition to the new engine technology and expect a full range of reliable engines meeting the requirements to be certified by October 1." To date, the agency has already certified several engines that meet the consent decree guidelines, including two models produced by Cummins Inc., and more are expected soon.

Federal regulatory officials within the Office of Management and Budget noted that postponing the compliance date and any ensuing penalties would be unfair to engine manufacturers such as Cummins and Mack Trucks Inc., both of which started developing new technologies more than a year ago and said they would be in compliance by October 1.

In not meeting the deadline for stricter emission standards, Caterpillar, the world's largest maker of construction equipment based in Peoria,

Illinois, and Detroit Diesel could incur millions of dollars in noncompliance penalties. Caterpillar has already said it would cut 290 temporary workers hired before October 1 and lay off more than 450 full-time hourly workers during the fourth quarter, forecasting fewer orders for heavy-duty truck engines because of the new federal emission standards.

Reuters reports that similar job cuts have been announced by several other engine manufacturers, including Detroit Diesel, Navistar International Corp., and PACCAR Inc. The news service further notes that orders for diesel engines and heavy-duty trucks have risen sharply this year as trucking companies rushed to obtain existing engines rather than wait for the new models.

Caterpillar does admit, however, that it's unclear how overall production will be affected by the new emission standards, given the slower-than-expected U.S. economic recovery. The company also says that retirements expected in the fourth quarter will offset the need for some layoffs, and some idled workers may be transferred to other business units.

The company further reports that it expects to have an engine available this fall based on existing technology that has lower emissions than its existing models, although not low enough to totally comply with federal standards. However, Reuters says that Caterpillar does plan to have an engine ready by early January or February, one based on its new ACERT technology that does comply with the new standards.

Improved Air Quality

Amid concern over diesel exhaust emissions, there's still good news, however. According to EPA's annual summary report of national air quality trends, air quality in the U.S. continues to improve steadily. Emissions of six air pollutants nationwide have been cut by 25% over 30 years, despite growth factors such as a 161% increase in gross domestic product, increased energy consumption of 42%, and an increase of 149% in vehicle miles traveled on U.S. roadways. The six tracked pollutants include NOx, sulfur dioxide, ozone, particulate matter, carbon monoxide, and lead.

"Despite great progress in air-quality improvement, approximately 133 million people nationwide still live in counties with pollution levels above the National Ambient Air Quality Standards in 2001," EPA notes in its summary report *Latest Findings on National Air Quality: 2001 Status and Trends*. "There are still 130 nonattainment areas out of the 230 originally resulting from the 1990 Clean Air Act Amendments designation process."

The agency further reports that it will propose more stringent national standards for ozone and particulate matter, the two pollutants most frequently implicated in findings of unhealthful air quality. EPA officials contend that reducing emissions from on-road transportation and stationary combustion sources will achieve better air quality over the next few years. The agency also expects to propose off-road vehicle (construction and recreational equipment and diesel-powered vehicles) regulations to help reduce harmful levels of NOx, ozone, and particulate matter.

Measurements in recent years have determined that the Southeast, Mid-Atlantic, and Midwest regions and California have unhealthful air quality due to fine particles suspended in air. And of the six pollutants tracked, progress has been slowest for ground-level ozone, which is formed when volatile organic compounds and NOx react in the presence of heat and sunlight. Although emissions of the organic compounds have decreased 16% over the past 20 years, NOx emissions have not been cut significantly. These can contribute to ozone formations hundreds of miles downwind from NOx sources.

The report points out that the Northeast and West have exhibited the greatest improvement in reducing ozone concentrations, while the South and North Central regions have been the slowest. Despite progress in most regions of the country, the average ozone levels measured over eight-hour periods in 33 national parks have still increased over the past decade.

November 2002

California Raises the Bar for Reducing Greenhouse Gas Emissions from Vehicles

By Steven J. Storts
Dublin, Ohio

CALIFORNIA Gov. Gray Davis has signed legislation that will force U.S. automakers to reduce the amount of carbon dioxide and other greenhouse gas emissions from vehicles sold in California. The auto industry, which says it will challenge the regulations in court, claims that the new law will limit consumer choice, drive up costs, and do little to reduce global warming.

As written, the measure directs the California Air Resources Board power to set "maximum" but "economically feasible" emissions standards for greenhouse gases, principally CO_2, in new vehicles beginning in 2009.

But although the new regulations must be written and put into effect by 2005, the law doesn't specify the levels of reduction or what steps will be taken to meet the standards. Critics of A.B. 1493 say its language is so vague that the legislation's long-term impact on motorists and vehicle sales in seven years can only be speculated.

California is the only state that is allowed under a 1967 law to set its own, tougher regulations for emissions, a loophole that exists because of the previously extreme levels of smog around Los Angeles. However, the new law doesn't address the gases that cause smog, but the invisible, odorless emissions that some scientists say contribute to higher global temperatures.

Although the legislation covers all passenger vehicles sold only in California, it is expected to have a nationwide effect because the state, with 35 million residents, represents 10% of the national car market. Last year alone, more than two million vehicles were sold in California. The legislation does not affect large commercial trucks.

Davis, who touts the new law as historically significant, says California is leading the way in the U.S. with the first legislation designed to fight global warming. In signing the legislation, he said he was "putting California at the forefront of a worldwide effort to reduce greenhouse gases." He also predicts that other states and the federal government will follow California's example.

"This is the first law in America to substantively address the greatest environmental challenge of the 21st century," Davis declared upon signing the new law. "In time, every state—and hopefully every country—will act to protect future generations from the threat of global warming. For California, that time is now."

The auto industry argues that while catalytic converters can reduce pollution from cars and trucks, the only way to reduce CO_2 emissions is to drive less. "There is no device you can add to a vehicle to reduce carbon dioxide," says Gloria Bergquist, a spokeswoman for the Alliance of Automobile Manufacturers, which represents Ford, General Motors, DaimlerChrysler, and Toyota.

The alliance contends that federal fuel economy regulations would preempt any stringent actions taken by California. Environmentalists disagree, however, noting that vehicle improvements can be made with more efficient engines and tires, less-polluting fuels, and by encouraging more public transportation.

Claiming victory with California's new law, Daniel Becker, director of global warming for the Sierra Club, says, "The world's largest auto market is about to begin controlling global warming pollution from automobiles, and that puts an enormous amount of pressure on Congress and the auto industry."

Still, Bergquist points out that automakers, who expect a drop in sales and face declining profits, having to possibly lay off workers, are not eager for new regulations. "It's a very big issue," she adds, "and based on prior experience, we fear the worst."

September 2002

Genetically Engineered Corn Not Harmful to Butterflies, Tests Show

By Steven J. Storts
Dublin, Ohio

AN economic slowdown notwithstanding, there's still good news to report in the industrial community. At the end of 2001, industry was credited with having substantially decreased air pollutant emissions over the last three decades. Unemployment is tapering off. Consumer confidence is rebounding. And the latest, Bt corn poses no harm to monarch butterflies.

What! Are you kidding?

Admittedly, on a global scale, news about butterflies may tilt the balance very little, but U.S. researchers claim that this recent finding may be a significant first step toward dispelling some of the environmental myths about genetically engineered products. Following two years of research, a consortium of federal, university, and industry scientists led by the U.S. Agricultural Research Service has found that Bt (Bacillus thuringiensis) corn poses "no significant risk" to monarch butterflies. Bacillus thuringiensis is a soil bacterium used as an effective alternative to chemical insecticides for controlling moth pests.

Moreover, the recent research findings reported by the National Academy of Sciences indicate that Bt corn pollen levels usually have to be more than 1,000 grains per square centimeter to have any negative impact at all on monarch caterpillars, let alone mortality. The studies also found monarch caterpillars are not very sensitive to pollen from most types of Bt corn, and that caterpillar exposure to Bt pollen overall is low. ARS scientists and engineers have concluded that less than 1% of the time are monarch caterpillars in the environment exposed to levels that even come close to that magnitude.

Today, about 60% the soybeans, 50% of the cotton, and 35% of the corn grown in the U.S. have been genetically engineered in some manner. The genetic composition of seeds from these plants has been modified to include genes from bacteria, viruses, other plants, and animals. This is done to impart a desired characteristic on the plant, such as resistance to disease or harmful pesticides. In recent years, though, extreme environmentalist groups have been opposing the scientific advancements made through biotechnology, and, in fact, have launched assaults on anything genetically modified, particularly the foods on grocery store shelves.

However, as more and more scientific studies begin to corroborate findings similar to those from the Bt corn pollen research, advocates of biotechnology contend that environmental groups may have to settle for a declining audience. Nationwide, the biotech industry is growing, and it's gaining a presence on Wall Street, too.

Instead of succumbing to environmentalist pressures, major industrial companies are expanding their research and development activities, including Monsanto, Pfizer, DuPont, American Cyanamid, DeKalb Genetics Corp., AgrEvo, Mycogen, Genencor International, Calgene, Optimum Quality Grains, DNAP Holding Corp., Garst Seed Company, and Zeneca Plant Sciences.

The environmental risk of Bt corn first became a matter of scientific and public concern when a small, preliminary study conducted at Cornell University in 1999 indicated that monarch caterpillars, under laboratory conditions, might be harmed by eating pollen from Bt corn plants. The experiment used a small number of caterpillars and gave them no other choice but to feed on milkweed leaves heavily dusted with Bt corn pollen, which are the exclusive diet of monarch caterpillars. However, critics of the study point out that the laboratory experiment did not attempt to duplicate real-world environmental conditions.

In conducting the new research in actual field studies, entomologist Richard Hellmich of the ARS Corn Insects and Crops Genetics Research Unit in Ames, Iowa, notes that caterpillars were found on milkweed in cornfields during the one to two weeks that pollen is shed by corn. But the pollen levels on these plants were found to average only about 170 pollen grains per square centimeter—not even close to a level of harmful toxicity.

Additionally, reports from several field studies showed concentrations much lower than the average 170 pollen grains per square centimeter. In Maryland, the highest level of pollen deposition was inside and at the edge of the cornfield, where pollen was found at about 50 grains per square centimeter. In the Nebraska study, pollen deposition ranged from six grains per square centimeter at the field edge to less than one grain per square centimeter beyond 10 meters. Samples collected from fields in Ontario, immediately following the period of peak pollen shed, showed pollen concentrations averaged 78 grains at the field's edge.

However, one variety of Bt corn—Bt 176—did have a toxic effect with pollen doses as small as 10 pollen grains per square centimeter. Bt 176 is one of the earliest forms of Bt corn and has never been planted on more than 2% of corn acreage. It will be completely phased out by 2003.

April 2002

White House Offers Alternative Approach Toward Climate Change, Emissions Control

By Steven J. Storts
Dublin, Ohio

AS the U.S. alternative to the Kyoto Protocol, President Bush recently unveiled his approach to curbing industrial facility emissions, teamed with a new strategy for addressing global climate change.

By 2010, the new "Clear Skies Initiative" aims to reduce power plant emissions of the three worst air pollutants—sulfur dioxide, nitrogen oxides, and mercury—by as much as 70% through use of proven, market-based approaches. The plan also calls for an aggressive approach to cutting greenhouse gas intensity by 18% over the next 10 years. While the president's proposal supports vital climate change research, it also ensures that American workers and citizens of developing nations are not unfairly penalized.

Bush emphasizes that government must also act in a serious and responsible way, given the scientific uncertainties. "While these uncertainties remain," he admits, "we can begin now to address the human factors that contribute to climate change. Wise action now is an insurance policy against future risks. I'm confident that the environmental path that I've announced will benefit the entire world." The president further touts the new approach as one that will harness the power of markets and the creativity of entrepreneurs and draw upon the best scientific research.

Specifically, the Clear Skies Initiative would cut SO_2 emissions from current levels by 73%; NOx emissions by 67%; and for the first time ever, cap emissions of mercury by reducing them by 69%. The reductions would be completed over two measured phases, with one set of emission limits scheduled for 2010 and the other for 2018.

As one of its most ambitious air quality provisions, Clear Skies proposes a market-based cap-and-trade approach that rewards innovation, reduces cost, and guarantees results. "Instead of the government telling utilities where and how to cut pollution, we will tell them when and how much to cut," Bush explains. "We will give them a firm deadline and let them find the most innovative ways to meet it."

To meet this challenge, each industrial facility will be required to have a permit for each ton of pollution it emits. By making the permits tradable, the cap-and-trade approach makes it financially worthwhile for companies to pollute less, giving them an incentive to make early and cost-effective emissions reductions.

The cap-and-trade program, which has been used since 1995 to curb SO_2 emissions, has reduced more air pollution in the last decade than all other programs under the 1990 Clean Air Act combined. Clear Skies advocates note that because the cap-and-trade approach gives businesses an incentive to create and install innovative technologies, reductions in emissions have cost about 80% less than expected.

"The legislation I propose is structured on this approach because it works," Bush says. "It will replace a confusing, ineffective maze of regulations for power plants that has created an endless cycle of litigation. Today, hundreds of millions of dollars are spent on lawyers, rather than on environmental protection. The result is painfully slow, uncertain, and expensive programs on clean air. Clear Skies legislation will put less money into paying lawyers and regulators, and money directly into programs to reduce pollution, to meet our national goal."

Overall, the White House budget allocates $4.5 billion toward addressing climate change—more than any other nation's commitment. "Our nation will continue to lead the world in basic climate and science research to address gaps in our knowledge that are important to decision makers," the president emphasizes. "When we make decisions, we want to make sure we do so on sound science, and not what sounds good, but what is real. And the U.S. leads the world in providing that kind of research."

To help climate change issues more effectively, Clear Skies calls for a comprehensive range of new and expanded domestic and international policies, including:

- Expanded research and development of climate-related science and technology;
- Expanded use of renewable energy;
- Business sector challenges;
- Improvements in the transportation sector;
- Incentives for sequestration; and
- Enhanced support for climate observation and greenhouse mitigation in the developing world.

Bush notes that the approach taken under the Kyoto Protocol would have required the U.S. to make deep and immediate cuts in the economy to meet an arbitrary target, costing up-

wards of $400 billion and resulting in the loss of an estimated 4.9 million jobs.

"It would be unfair—indeed, counterproductive—to condemn some developing nations to slow growth or no growth by insisting that they take on impractical and unrealistic greenhouse gas targets," the president says. "Yet, developing nations such as China and India already account for a majority of the world's greenhouse gas emissions, and it would be irresponsible to absolve them from shouldering some of the shared obligations."

The president explains that his Clear Skies Initiative gives developing countries a yardstick for progress on climate change that recognizes their right to economic development and shows poorer, developing nations that a better approach that can build upon future prosperity exists.

April 2002

Science Research from Antarctica Shows Steady Cooling Trend Across Continent

By Steven J. Storts
Dublin, Ohio

RECENTLY released findings from the National Science Foundation have confirmed that Antarctica has cooled measurably during the last 35 years—despite a slight average increase in global air temperature during the 20th century. Data show that air temperature has steadily dropped each decade across the continent, with the cooling trend most evident during the summer and autumn.

Researchers with the NSF Long-Term Ecological Research site in Antarctica's Dry Valleys contend that long-term data from weather stations across the continent, coupled with a separate set of measurements from the Dry Valleys, confirm each other and corroborate the continental cooling trend.

The Dry Valleys, a large, mountainous area adjacent to McMurdo Sound, is mostly snow-free. It is a desert region that encompasses perennially ice-covered lakes, ephemeral streams, arid soils, exposed bedrock, and alpine glaciers. All life there is microscopic.

"Our 14-year continuous weather station record from the shore of Lake Hoare reveals that seasonally averaged surface air temperature has decreased by 0.7° Celsius per decade," the researchers report. "The temperature decrease is most pronounced in summer and autumn. Continental cooling, especially the seasonality of cooling, poses challenges to models of climate and ecosystem change."

The new findings regarding earth's southernmost continent are puzzling because many climate models indicate that the polar regions should serve as bellwethers for any global warming trend, responding first and most rapidly to any increase in temperatures. An ice sheet many kilometers thick in places perpetually covers most of Antarctica. Still, the researchers point out that temperature anomalies also exist in Greenland, the largest ice sheet in the Northern Hemisphere, with cooling in the interior concurrent with warming at the coast.

Peter Doran, of the University of Illinois at Chicago, the lead author of a paper published in the online version of *Nature*, acknowledges that other studies conducted in Antarctica have deduced a warming trend elsewhere in the continent. However, Doran and his coauthors note that the data indicate that the warming occurred between 1958 and 1978. They also note that previous claims of Antarctica's warming may have been skewed because the measurements were taken largely on the Antarctic Peninsula, which extends northwards toward South America.

The peninsula itself is warming dramatically, the authors report, and there are many more weather stations on the peninsula than elsewhere on the continent. Averaging the temperature readings from the more numerous stations on the peninsula has led to the misleading conclusion that there is a net warming across the continent.

"Our approach shows that if you remove the peninsula from the data set and look at the overall spatial trend, the majority of the continent is cooling," writes Doran.

He emphasizes that documentation of the continental cooling presents a challenge to climate modelers. "Although some do predict areas of cooling, widespread cooling is a bit of a conundrum that the models need to start to account for," Doran observes.

The research team also contends that the cooling trend could adversely affect the unique ecosystems in the region, which live in a niche where a delicate balance between freezing and warmer temperatures allows them to survive, and where liquid water is only available during the very brief summer.

March 2002

Limiting Man-Made Air Pollutants Could Increase Global Warming, Research Finds

By Steven J. Storts
Dublin, Ohio

CLIMATE researchers are warning that poorly designed efforts to reduce air pollution could actually expand the "greenhouse" effect. Recent quantified research suggests that strictly limiting emissions of man-made nitrogen oxides, a strategy advocated by environmentalists to control ozone in earth's lower atmosphere, would result in increased methane abundance and enhanced global warming.

Nitrogen oxides, commonly abbreviated NOx, are shorthand for the combination of nitric oxide and nitrogen dioxide that are produced by aircraft and automobile emissions, biomass burning, and some industrial processes, in addition to such natural events as lightning.

"Traditionally, atmospheric chemistry research has focused on processes in the natural and polluted atmosphere, while climate modeling has investigated the impact of greenhouse gases," says Anne-Marie Schmoltner, director of the National Science Foundation's atmospheric chemistry program, which funded the research along with NASA.

"However, it is important to recognize the interplay between the chemistry and the distribution of greenhouse gases," she adds. "Increasingly complex models such as the one employed in this study are now able to look at these important interactions."

The research, which was conducted by Oliver Wild and Hajime Akimoto of the Frontier Research System for Global Change in Yokohama, Japan, and Michael Prather of the University of California at Irvine, appeared in the May 1 issue of the journal, *Geophysical Research Letters*, published by the American Geophysical Union.

The reason not to concentrate only on reducing NOx emissions, the researchers explain, is that there is a marked difference in the short- and long-term effects of doing so. Increased NOx emissions do lead—as is commonly expected—to short-term warming from increased short-lived ozone in the troposphere, the lower part of earth's atmosphere. Over the following decade, however, these same emissions lead to reductions in methane and even ozone and, thus, to a cooling trend.

The scientists note that overall, the net impact is actually a slight cooling for a wide range of locations of NOx emissions. Consequently, reductions in these emissions, such as from pollution-control measures, will eventually add to global warming.

However, the scientists also emphasize that when emissions of carbon monoxide, which usually result from the same processes that produce NOx, are added to the equation, the net result is back to global warming. Therefore, the scientists contend that efforts to address issues of urban air quality and global warming must involve combined emission controls and not just the "quick fix" of reducing local air pollution by controlling emissions of NOx.

It has been difficult for scientists to quantify the greenhouse effect of short-lived pollutants, such as NOx and CO, which in themselves do not have a significant impact on climate. But, scientists point out that these gases do control the major greenhouse gases—methane, ozone, and the hydrofluorocarbons—through tropospheric chemistry. Their work adds further evidence to the role of such urban pollutants as indirect greenhouse gases, which was also reported in the recent assessment report of the Intergovernmental Panel on Climate Change.

Wild and his colleagues have developed a new method of quantifying the effect of these short-term chemical interactions that expands on their previously published research describing a tropospheric chemical transport model (CTM) developed at the University of California at Irvine.

The model determines the impact of short-lived regional emissions on the long-term global climate effect of the methane-carbon monoxide-ozone combination. By calculating separately the short-term regional effects of those gases and the long-term global trends of greenhouse gases in general, the scientists are able to determine their combined impact on climate change patterns.

Using the Irvine CTM, the research concludes that man-made surface emissions of NOx alone consistently cause cooling through their impact on ozone and methane. The amount of cooling varies greatly, depending on the region in which the emissions occur. The model shows, however, that combined industrial emissions of NOx and CO always yield a positive result—broadly increased atmospheric warming.

As a result, the scientists further conclude that "decisions to control global atmospheric ozone and, hence, greenhouse warming by cutting NOx emissions alone would produce the opposite effect when the long-term global changes to both methane and ozone are considered."

The researchers admit that more research must be conducted on specific regional impacts of man-made emissions, which may require the development of more regional models to compare with the CTM.

June 2001