National Advisory Council for
Environmental Policy and Technology

February 15, 2012

The Honorable Lisa P. Jackson
Administrator
United States Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

RE: Technologies for Environmental Justice Communities and Other Vulnerable Populations

Dear Administrator Jackson:

In May 2010 you asked us to identify the needs for technologies that can help address environmental problems experienced by environmental justice communities and other vulnerable populations (which we refer to as EJ/VP communities). Your charge was straightforward: to provide "advice … on the identification and use of existing, or needed, technologies … to better protect vulnerable populations", including "game-changing technologies" that have "potential to deliver relevant, actionable information" to all parties.

We studied the topic in detail, discussed needs for technologies in a dozen diverse communities, and prepared six community case studies that illustrate the needs for deployment of effective technologies in EJ/VP communities across the country.

Clearly most environmental justice communities and other vulnerable populations face unusually high risks to human health and the environment. We offer two broad recommendations and a number of specific suggestions to address this situation:

1. **EJ/VP communities need three kinds of technologies**:

    - **Detection, monitoring, and assessment technologies**—from portable sensors that can be used by community members to complex monitoring systems operated by specially trained personnel—are the most important technology needs at this time in most EJ/VP communities and can be true game-changers.

    - **Communication technologies** are needed to assure that residents, local agencies, and industry are fully informed about risks to the community, such as:

- real-time information about ambient pollution that may peak at dangerous levels and about steps that residents can take to reduce risks when peaks occur;
- real-time information needed by first responders and local hospitals when accidents or other factors cause spikes in pollution; and
- information that residents can use to protect themselves from localized environmental exposures in their homes, backyards, parks, and neighborhoods. This information could come from sensors of contaminated air and contaminated soils—as well as easily- understandable written, electronic, and face-to-face verbal information about what residents can do to understand and protect themselves from localized environmental threats.

- **Solution technologies,** that is, technological solutions to correct environmental problems, are also vitally important and need attention because they can be costly and difficult to identify and deploy at a particular clean-up site. There is a need to develop rapid, less expensive solution technologies that can be used to clean sites more effectively.

2. **EPA's Office of Research and Development should enter into partnerships with EJ/VP communities to develop and deploy these technologies**.

   - ORD and EPA's regional offices should work with one or two communities in each region to develop needed technologies and become a national model for deployment of technologies in other communities;
   - ORD should establish a public-private task force to engage EJ/VP leaders from around the country, technology companies, investors, and other experts to inform and guide this national partnership.

This letter includes:

A. A review of the distinctive nature of the problems facing EJ/VP communities and other vulnerable populations;

B. A discussion of needs for technologies to detect and monitor, communicate, and solve environmental problems in EJ/VP communities, including six case studies and lists of specific needed technologies. Full case studies of all six communities are available at http://www.epa.gov/ofacmo/nacept/reports/index.html.

C. Additional, detailed recommendations for a "game-changing" effort by ORD and other parts of EPA to work with EJ/VP communities, the private sector, and others to identify, develop, and deploy needed technologies.

A. PROBLEMS FACED BY ENVIRONMENTAL JUSTICE COMMUNITIES AND OTHER VULNERABLE POPULATIONS

Vulnerable populations—including children, the elderly, people in poor health, and people living in environmental justice communities—experience health effects from environmental pollutants directly and profoundly. Vulnerable populations are often exposed to more pollutants, through more environmental pathways and at higher concentrations, than populations generally. Vulnerable populations are more susceptible to being harmed, are less prepared to withstand exposure, and are less able to recover.[1] Environmental justice communities also suffer from the additional stress of living in poverty, experiencing racism, or both; and they often lack influence and institutional strengths to organize effectively for change. They often feel, and, in fact are, disempowered.

The three distinctive threats to vulnerable populations generally and environmental justice communities in particular—multiple and cumulative exposures, additional stressors, and disempowerment—often make it hard for residents, governments, and businesses to understand and address the full scope and nature of environmental problems, even when human-health risks are significant. In many cases, problems persist until residents organize to become effective advocates for change.

This letter focuses on the technology needs of environmental justice communities and other vulnerable populations (EJ/VP communities). We have identified these needs through case studies of environmental justice communities, and we highlight these case studies throughout the letter. Some of the case study communities are facing problems that have only recently been identified and are still not fully understood. Others face environmental conditions that have been causing severe damage to the health of local residents and to the economic and social vitality of the local community for far too long. In all parts of the country, there are too many communities where EJ/VP communities have been experiencing severe environmental problems for far too long.

Whether their problems are new or long-standing, EJ/VP communities need technologies to effectively detect, monitor, and assess pollutants. They also need technologies to communicate risks. And they need technologies that can solve environmental problems. The first need is particularly pressing. Data gathered by residents can start a powerful, constructive process of community-driven environmental change. (See Table 1) The most persuasive detection, monitoring, and assessment data would track pollutants to their sources, link pollution to health outcomes, and provide timely, understandable information to local communities—residents, public-health and environmental regulatory agencies, first responders, businesses, and others—about what they can do to reduce human-health and environmental risks.

Although adequate detection, monitoring, and assessment; communications; and solutions technologies may be costly, that cost is small in comparison to healthcare and other costs paid by residents and by taxpayers.[2]

B. NEEDS FOR TECHNOLOGIES

1. **The most important technology need in EJ/VP communities at this time is for better technologies to detect, monitor, and help residents and others understand ongoing environmental contamination—and for these technologies to be deployed effectively so that they can inform and drive near-term decisions about how to reduce risks on an individual as well as a community-wide basis.**

Residents of EJ/VP communities want to know:

> How much hazardous and toxic stuff is in the air my children breathe, the water they drink, the soils in the backyards and school playgrounds, the food grown in our garden, and the fish we catch in local streams? Is my family safe?

EJ/VP communities confront multiple stressors, including sources of pollution and multiple pollutants, resulting in human-health and economic impacts. "Bucket samplers" have been useful to residents of EJ communities to detect and demonstrate the presence of plumes passing through fenceline neighborhoods.[3,4] But in most cases, existing monitoring technologies typically specified and deployed do not provide robust real-time and historic data on pollution levels. They provide insufficient bases for risk analysis and response, preventing assessment of cumulative and synergistic effects of multiple pollutants in combination with other stressors. New, effectively deployed technologies to adequately detect environmental contamination could be "game-changers" for environmental justice communities and other vulnerable populations, even if the technologies don't contain all of these desired capabilities. Some such technologies are available and being deployed in a few locations.[5,6,7,8,9,10]

Two case studies illustrate the needs for credible and effectively deployed detection, monitoring, and assessment technologies.

Hartford, CT: The Need for Continuous Monitoring

Hartford, Connecticut, is home to 125,000 people, 80% of whom are African American, Latino, or mixed race. Average income is very low. A large trash-to-energy incinerator handles waste from 70 towns around the state and, previously, from other states as well. Some of the trash contains large quantities of metals or toxics, and there are more than 10 fires or explosions each year. But local emissions of air toxics are measured only once a year. Local residents have asked for both detection and communication technologies:

1. Continuous emissions monitoring of air toxics on the stack of the incinerator.
2. Communications technologies connected to the emissions monitors so that at appropriately high levels of toxic emissions it will automatically alert the public, managers of the incinerator, and local emergency response and regulatory agencies by voice or text messages on cellular telephones of monitoring readings with or without suggestions on how they should respond.
3. Hand-held sensors that local residents could use to measure and send data about ambient air quality to the local agency, managers of the incinerator, and to local residents.

Rubbertown, KY: The Need for Detection and Communication Technologies

Rubbertown is a large industrial section of west Louisville, Kentucky**,** that is home to 19 large plastics and petrochemical facilities, with low-income African American neighbors on the east and low-income whites to the south. Forty-five percent of the 3,000 people living within a half-mile of these facilities have a household income less than $25,000. This is a typical “chemical corridor” community.

Some technologies are already in place, although arguably not being used enough: warning sirens, reverse 911 calling systems, and a 24-hour complaint hotline. Communities and residents are already using Tedlar® bag grab sample “bucket brigade” technology, but it is not sensitive or quick enough and is still somewhat expensive to the community residents.

Residents of Rubbertown want improved technologies to solve the environmental problems they encounter on a daily basis, plus:

1. Handheld monitors, operated by community members, to measure VOCs at health-threatening levels during short periods of time.
2. Real-time monitoring of air toxics at the stack or fenceline, accessible on the Internet and sent to regulators.
3. Phone and text-message alerts to local residents when emissions exceed limits and may cause health problems.

The greatest need in EJ/VP communities is for technologies that residents and community groups can use to detect and monitor environmental threats, because they can spark community-driven environmental change.

The technologies that are needed extend along a continuum from relatively simple citizen-operated sensors that are geo-located and sometimes hand-held to more powerful monitoring systems that are deployed and maintained by specialists. The continuum of technology needs has multiple dimensions including:

- Low-cost to expensive
- Single-observation to continuous
- Single-parameter to multi-parameter
- Point to area
- Fixed location to mobile
- Medium-sensitivity to high-sensitivity
- Volunteer-contributed to professionally collected data

New monitoring technologies that are embedded within sensor networks—using fixed as well as portable sensors—are especially important

More complex monitoring technologies are necessary as well. Complex technologies, operated and maintained by specially trained personnel, generate technically credible data that are particularly meaningful to regulators, emitters, and elected officials at all levels. These technologies can credibly document not only the background concentrations in plumes crossing fence-lines and passing through neighborhoods but also the frequency, magnitude (or concentration), and duration of excursions, accidents, and unscheduled releases. Some such cutting-edge technologies exist[11,12,13,14] and are available for deployment, and others need to be developed. Community organizations and local residents can and should participate in the use of the full continuum of technologies. They will learn and be empowered by doing so.

Many of these needed technologies for detection and monitoring are already in use in commercial settings. For example, the construction industry is developing “smart buildings” with sensor systems that measure heat, light, and energy use and use these data to fine-tune operating systems to reduce costs. Automobile manufacturers have developed “smart cars” that sense traffic lights, other cars, and other obstacles and can steer around them. The first “smart cities” in Spain, the Middle East, and China have “smart pipes” that sense water pressure as well as the contents of the pipes, so that pipes can be repaired before they spring big leaks. Some manufacturers of aircraft engines have stopped selling them; instead they lease engines equipped with sensors that send data to the manufacturers about the need for repairs.[15]

Sensor systems are also being constructed for environmental monitoring. For example, in October 2011, the National Science Foundation (NSF) awarded $3 million to Clemson University to design, develop and deploy a basin-wide network of computerized sensors to monitor water quality along the length of the 312-mile Savannah River. The sensors will be attached to a system of buoys anchored to the river floor and will collect data on water temperature, flow rate, turbidity, oxygen levels and the presence of pollutants.[16]

Dense network observing systems are also developing rapidly for air emissions, including air toxics. Air emission inventories built from emissions factors have consistently underestimated emissions, because they often leave out small sources and leaks. New technologies might help fill some of these gaps. Also, high quality emissions data might be obtained from third party, private sector sources to supplement government observing practices.[17]

EPA should assure that all EJ/VP communities have access to and use similar smart, cost-effective state-of-practice sensor technologies to measure indoor air quality, water quality, and emissions from industrial facilities in their communities in real time.

Detection and monitoring technologies can be used very effectively in tandem with sophisticated assessment technologies, which can document the multiple, synergistic risks that EJ/VP communities face. Assessment technologies can also help identify solutions that advance health and environmental quality, economic opportunity, and social benefits. The assessment technologies that are needed in EJ/VP communities include risk assessment, life cycle assessment, environmental footprint assessment, resilience analysis, integrated assessment models, and sustainability impact assessment.[18]

Examples of Needs for Detection, Monitoring, and Assessment Technologies in EJ/VP Communities

- Simple sensors, analogous to carbon monoxide or smoke detectors, that are connected to cellular data networks that may be loaned to or permanently installed in community homes, schools, or other locations of interest.
- Fixed sensors installed at multiple locations along the property fenceline around industrial facilities.
- Geo-located, personal sensors that may be carried by persons for continuous monitoring of both ambient conditions and individual exposure.
- Monitoring and warning systems of air pollution in “fenceline” communities.
- Advanced assessment technologies that can be used in tandem with geo-coded detection and monitoring data to monitor multiple sources of pollution and multiple pathways of exposure.

2. **EJ/VP communities need effective communication technologies for both data access and information sharing.**

In addition to technologies to detect, monitor and assess pollution, EJ/VP communities need technologies to communicate information about pollution. In Hartford and Rubbertown, residents have asked for relatively simple communication technologies – email and cell phone systems to alert residents to high levels of pollution. Two additional case studies suggest other communication technologies that are needed in EJ/VP communities.

Toledo, OH: The Need for Effective Communication Technologies

The Dorr-Smead Brownfields in Toledo, Ohio is an old, inner-city industrialized area with large acreages of contaminated soils located close to housing in this low-income, predominantly minority community. Local residents and environmental agencies are concerned about exposure to contaminated soils from gardening and children playing in backyards and about the possibility that gases from contaminated soils may leak into basements.

Dorr-Smead is also a leader in urban revitalization, with many abandoned lands being used for urban agriculture. Often the crops grow in "clean" soils that are trucked in, but there is always the risk that contaminants may leak from the local soils into the pots and bins where vegetables and fruits are growing. One need in Dorr-Smead is for easy-to-use soil test sensors, with clear instructions on soil test sampling, and information about crops that can be grown safely.

In addition, there is a need for communication technologies in Dorr-Smead to educate residents who are raising crops about how to construct their gardens so that pollutants in contaminated soils do not pass into the "clean" soil where the crops are growing. EPA and state and local environmental agencies should develop and deploy communication technologies in partnership with non-governmental organizations, who may be met with greater trust than government, and tailor communication to specific audiences. Even though EPA's mission is quite different from the US Census Bureau's, EPA might look to the Census Bureau's experience communicating with diverse communities. The Census Bureau has established partnerships with cell phone companies for effective messaging, used social media extensively, partnered with community-based organizations, and undertaken market segmentation research to tailor messaging to specific communities. In partnership with local professionals and lay experts and organizations, and working collaboratively with state and local environmental agencies, EPA should customize toolkits for use by residents in specific EJ/VP communities.

Graniteville, SC: The Need for Effective Communication Technologies

Graniteville, South Carolina, is a low-to-middle-income community adjacent to several old abandoned textile mills—brownfields. A major rail line runs through Graniteville which facilitated picking up products from the textile mills before they closed. In January 2005, two trains collided, five cars carrying chlorine and other toxic chemicals went off the rails, and the tanks ruptured. The result was a full-scale emergency response situation, and it did not go well because of inadequate technologies and inadequate arrangements for analyzing and communicating information about the chemicals released.

Railroads and shippers generally keep close track of rail shipments of chemicals and can check to see where rail cars with chemicals are at any given time. But this information was not available to local government agencies in Graniteville on a real-time basis. Emergency teams rushed to the scene but had no information about the gases and fluids leaking from the railcars. Local residents were overcome by the gases, but when the rescuers took them to local hospitals, the doctors did not have information about the gases.

When federal responders arrived to assess damages, most victims had already been taken to hospitals, so the responders focused most of their attention on fish in a stream that had been contaminated by liquids spilled from the rail cars. Nine people died – eight immediately – and many homes were ruined by the cloud of chlorine gas.

If there had been appropriate sensors in place in Graniteville,[19,20,21] some of the deaths and illness might have been prevented. But local sensors would not have been enough. What was needed was an information system on the railcars themselves to communicate information about the location, types, and condition of the chemicals, the rail cars, the train, and the accident to officials, rescue teams, hospitals, and community residents. The technologies needed were not just electronic. Also needed were management systems to assure that information available to the railroad and the shippers would be made available to the community immediately after the accident.

Communications technologies must be accessible and provide information that local residents and agencies – as well as businesses and other entities that are sources of pollution – can obtain at very low cost and can use effectively. This means that communications technologies may need to provide information in other languages besides English in some communities and must be easily understandable by ordinary citizens in all communities. Communications technologies must also provide opportunities for local residents to get more information about the nature of specific problems, about how these problems relate to other potential exposure, and about how to deal with these problems in specific locations. In some cases, communications technologies should also enable local residents to ask questions and get information from agency staff or other trained personnel.

Local residents, agency staff and others may also need training and education in how to use communication technologies.

Communications technologies will often be more effective when they provide geo-coded information that can be mapped. Social media may be very useful in providing opportunities for residents and small businesses that are sources of pollution to understand and learn how to manage risks. Cellular telephones are often a useful platform for such communication, as many residents of EJ/VP use them as a comparatively inexpensive way to gain access to the web and to receive text and voice messages.

The development of communications technologies must go hand-in-hand with the development of monitoring and assessment technologies. Measurements of local conditions are meaningful only when they can be compared with thresholds that are built on scientific evaluation and that take multiple causes of risk into account. Experts at EPA and elsewhere are continuing to develop a sophisticated suite of analytic tools that should be accessible to EJ/VP communities through communications technologies, such as risk assessment, cumulative exposure assessment, life-cycle analysis, environmental footprint, ecosystem evaluation, decision support tools like cost-benefit and resilience analysis, and sustainability analytics.

Examples of Needs for Communications Technologies in EJ/VP Communities

- Residents need real-time information about concentrations of localized pollution that can peak at dangerous levels and about the steps they can take to reduce risks.
- Residents need technologies that can help them to avoid exposures and to protect themselves in their homes, backyards, parks, and neighborhoods—such as information from hand-held sensors of contaminated air and contaminated soils—as well as easily-understandable written, electronic, and face-to-face verbal information about how to protect themselves from environmental threats. With geo-coded sensors, residents could download information about the steps that they could take to reduce risks from indoor and outdoor air pollution.
- Community groups and agencies need reliable, actionable data to provide real-time human-health warnings to residents about local environmental conditions and possibly notices to industry about any need for adjustments in emissions.
- First responders and local hospitals need complete, real-time information in the event of a train derailment, major highway accident, or similar emergency release or spill event – both to protect local residents and to ensure that first responders do not rush in without proper information and become contaminated themselves.

3. **EJ/VP communities need solution technologies.**

What all communities want is technologies that solve problems resulting from releases of hazardous and toxic pollutants that impact human health and the environment at low costs and in short periods of time.

In some cases, adequate monitoring and communication technologies can lead directly to the implementation of not-so-difficult solutions. Monitoring and communication may provide sufficient understanding of local problems and bring enough public as well as official attention to these problems to convince industry to take voluntary action to clean up or to persuade regulators to require cleanup to reduce human-health and environmental impacts in EJ/VP communities. Simply asking engineers to invest more energy in adjusting and managing manufacturing systems to reduce leaks and operate more efficiently can lead to big reductions in pollution emissions and operating costs. And the process of mobilizing the community to gather data and attract attention can empower residents, teaching them skills that may open doors to economic and social opportunities.

But in many communities, there are no easy answers. Many EJ/VP communities are located in brownfields where the soils, groundwater, and streams are seriously contaminated by decades of pollution. The contamination causes problems of indoor air quality in basements, backyards, parks where it is unsafe for children to play, and rivers where residents cannot safely fish or swim. Other EJ/VP communities have serious indoor air quality problems arising from substandard construction of homes and community buildings. In some communities, rising levels of groundwater cause mold and indoor air quality problems, or mobilize toxic pollution in contaminated soils. The direct dollar cost of clean-up of these properties and groundwater to safe levels is often very high. Clean-up approaching pristine levels is often unattainable. The economic and other costs to residents of EJ/VP communities and other vulnerable populations—and to state and federal taxpayers—from human-health impacts is great and should be considered by decision makers.

Some EJ communities across America are so contaminated, or so close to multiple sources of pollution, that they are not livable.[22] For example, the best permanent solution for the Norco community in the chemical corridor of Louisiana along the lower Mississippi River was determined to be for industry to finance the relocation of residents to different, safer locations. EPA can play an essential role in sites like these, both in effectively deploying monitoring and communication technologies so that local problems are fully documented and understood, and by using its regulatory authority to ensure that appropriate action is taken to protect human health in these communities.

But in other communities the challenge is to find solution technologies that are low cost and permanent. Too often, agencies and communities adopt policies that are not solutions at all - such as moving wastes from one contaminated site to another, often to another EJ/VP community.

Two of our case studies suggest ways that EPA can help develop and deploy effective solution technologies.

Indoor air quality in Pablo, MT

Salish Kootenai College (SKC) is a Tribal College located in the unincorporated community of Pablo, on the Flathead Indian Reservation in northwest Montana. SKC has about 1,100 students. About 76% of the students are Native American. The students come from 66 tribes and 20 states. SKC has a mix of traditional and non-traditional students so many of the students are older students and low income. Also, many of the Tribal students often have a family who has moved with them as they attend SKC so family members include children and sometimes elder members of the family.

The major environmental problem of focus is the mold in school buildings and student housing units on the SKC campus. One contributing factor to the mold problem is groundwater. In the summer of 2011 the staff at SKC began to notice mold conditions in a few buildings. They begin an evaluation of the severity of the mold condition. Samples of mold were sent to a lab for testing. The staff decided to have the student housing units tested at the same time. It was then that they discovered that there was a significant mold problem in the student housing units. Once the officials at SKC learned of the mold severity they moved the students out of the housing units and placed them in alternative housing.

In all technology categories it is recommended that community based resources be made available. Technical resources at the Tribal, County or City level would be ideal. In the absence of community based resources personal use technology is recommended. Technology needs include: Monitoring and Analysis (humidity sensors, test kits), Data Management and Communication (sending and receiving information once a problem is detected is critical. Who do you contact? How reliable is the information? Do I have to pay for it? What can I do to fix it? These are some questions a household may have. One suggestion made was a hotline. Such a hotline could be useful for a variety of indoor air quality issues.) Mitigation and Remediation (Simple inexpensive methods for fixing problems are needed as well as good reliable resources for contractors when a simple fix is not the answer.)

Lower Passaic River, NJ: The Need for Solution Technologies

The lower Passaic River flows through dozens of municipalities into Newark Bay. The residents of these communities are generally working class or low income, 80% are of various minority groups, and many are recent immigrants. The sediments of the lower Passaic include dioxins, mercury, lead, PAHs, and many other toxic industrial pollutants. Most of the fish in the river are too contaminated to be eaten.

EPA, the state of New Jersey, and the New York Academy of Sciences have been studying the river for more than 20 years; but technologies to remediate the pollution are quite expensive, and no action has been taken to clean up the river and the bay. Several years ago, a study suggested that the river should be dredged and that the sediments could be converted into a substance that would be a safe building material. The toxics in the blended "cement" would be immobilized, using a technology ready for commercialization. This technology is being reviewed by experts in the US, with the hope that it will finally open the door to cleaning up the river.

EPA can contribute to finding solution technologies in five ways.

One is to develop standards for the identification and cleanup of contamination by mold. Tribal, public, institutional, and rental housing is often not cleaned of mold that is causing health problems because there is no standard for when this should be done.

A second is to conduct research and work with industry to develop new solution technologies for different kinds of pollution—e.g. mold-resistant paints and coatings, ventilation systems and air purifiers that can capture and bind mold spores so that they are no longer airborne, and remediation technologies for older buildings as well as different construction technologies for inexpensive new homes and community facilities. EPA's Office of Research and Development (ORD) could work with EPA program offices in systematic, on-going efforts to monitor efforts to address the typical problems that EJ/VP communities face and to support the most promising ideas. For example, it might be worth focusing ORD research on technologies to manage rising levels of groundwater in contaminated soils or in places where groundwater could damage buildings or cause mold to grow and create problems of indoor air quality. (Indeed, ORD and media offices may already do things like this.)

Third, in addition to working with EPA media offices to develop new solution technologies, ORD should also work with other countries that are facing similar problems. ORD could play an active role in ensuring that technologies developed overseas are readily available to American communities by testing, publishing information about, and perhaps certifying technologies as cost-effective.

A fourth way that EPA can contribute to finding solutions is to work directly with state, local, and tribal agencies that have responsibilities for building and construction or for making decisions about the proper use of contaminated land or on wetlands. This could be done in partnership with other federal agencies that have the responsibility and legal authority for housing, construction standards, and related matters. EPA is already working with the Department of Housing and Urban Development and with the Department of Transportation, as well as with state and local governments, to encourage the development of "smart," compact, energy-efficient communities.   EPA could take the same approach to finding solution technologies for EJ/VP communities. The Federal Emergency Management Agency, HUD and DOT would be important partners in such an effort.

Fifth, EJ/VP communities will benefit not only from technologies that are targeted to meet their special needs but also from technologies that are needed by all communities, for example, cars with low (perhaps zero) emissions, healthier houses, inexpensive green infrastructure, and less polluting sources of electricity. EPA is already working on many of these technologies.

In all cases EPA should seek permanent solutions through a transparent process with a defined timeline for installation of industrial solution technologies, so that confidence can be established between the agency and the EJ community. It is not acceptable to say that the environmental problems facing EJ/VP communities cannot be solved. The search for permanent solutions technologies should continue until solutions have been developed and deployed.

Examples of Solution Technologies Needed by EJ/VP Communities

- Closed-loop sustainable solution technologies.
- Community/Soils: Technologies that can detect and confine hazardous chemicals so that edible crops can be grown on properly-designed urban farms in brownfields.
- Chemistry/Indoor Air: Technologies to ensure high standards of indoor air quality in public and institutional housing in Native American communities and generally in low-income communities across the country.
- Mold resistant and mold binding paints and coatings.

C. RECOMMENDATIONS FOR GAME-CHANGING NEXT STEPS

NACEPT was asked to develop a list of needs for technologies to address problems in environmental justice communities and other vulnerable populations. Our report can provide initial answers, but to fully understand the needs and how EPA can meet them, ORD would have to work closely with EJ/VP communities themselves.

ORD should also reach out to the business community, researchers in the private and public sector, and to other federal agencies. EPA-ORD recognizes that such an effort would be a departure from past practice. In September, 2011, ORD published an implementation plan for developing and deploying "science tools" as part of EPA's Plan EJ 14. This report says that:

> "presently, ORD lacks any mechanism for public input into its research agenda." (p. 16)

The September plan proposes greater efforts by ORD to work with EPA regional offices, the National Environmental Justice Advisory Committee, and others to reach out to EJ communities, both to inform ORD about conditions and needs in communities and to build capacity at the community level. Specifically, it says that ORD will:

- work with OSWER's Community Engagement Initiative and similar efforts that other media offices develop to engage community stakeholders in ways that will help them participate in EPA decisions on topics of special concern to EJ communities;
- establish a workgroup within the National Environmental Justice Advisory Committee to advise the administrator and ORD about scientific research and health impacts related to environmental justice;
- support community-based participatory research;
- engage EJ stakeholders in efforts like its Regionally Applied Research Effort program. (pp. 16-17)

Our recommendations are consistent with this approach and are designed to reinforce these efforts.

1. ORD should enter into partnerships with EJ/VP communities to develop and deploy these new technologies.

Working with EPA regional offices and media offices, ORD should identify one or two "pilot communities" in each region to be test beds for effective detection, monitoring, and assessment technologies that are the highest priority for "game-changing" action. (EPA's EJ Showcase Communities and Community Action for a Renewed Environment – "CARE" – communities might be possible sites.) These communities should become models for deployment of technologies in other communities. The regional offices and state agencies should assist communities in identifying needed technologies.

2. ORD should also establish a public-private task force to provide strategic advice and supplement ORD's technical expertise.

This task force should:

- Compile an inventory of specific existing, cutting-edge, available-for-deployment technologies that could effectively address the needs of EJ/VP communities and human-health and environmental regulatory agencies.
- Identify specific technologies that are ready to enter the market as well as any legal, financial, or other barriers to the deployment of these technologies.
- Provide advice on incentives to encourage private development of needed technologies.

Members of the task force might be drawn from:

- Leading technology companies with experience in R&D, commercialization, production, and deployment.
- Companies in the regulated community, as well as research institutes, academia, and state and federal human-health and environmental regulators with successful experience in effectively and transparently monitoring releases.
- NGOs with experience in effective monitoring and communication technologies.
- Staff in key EPA offices.
- Experienced leaders from EJ/VP communities.

EPA might wish to work with the National Academies to participate in or lead this effort.

3. **EPA should reach out to other federal agencies to mobilize a multi-agency federal initiative to develop and deploy needed solution technologies, similar to EPA's work with the Department of Transportation and Department of Housing and Urban Development in support of state and local efforts to build "smart communities".**
   - Several agencies in DHHS could be essential partners.

4. **ORD should publish a biennial update to EJ/VP communities about the progress of these activities.**
   - This would include providing information about the needs for technologies and the pros and cons of newly emerging technologies to EJ/VP communities, EPA regional offices, state environmental agencies, interested partners in the private sector, and others.

5. **EPA must also strengthen its own IT capabilities in order to support monitoring, reporting, and mitigation activities in EJ/VP communities.**

   A separate paper explaining these requirements in some detail is available at http://www.epa.gov/ofacmo/nacept/reports/index.html. These requirements relate to the use of open interoperability standards to streamline both collection of measurements being generated by monitoring systems, and dissemination of data products derived from those systems. These standards range from general-purpose web services based upon the REST web service model (which in turn is based upon the HTTP standard protocol), to the suite of more specific open standards from the Open Geospatial Consortium (OGC) relating to data visualization (Web Map Service - WMS), data access (Web Feature and Web Coverage Services - WFS and WCS respectively), and sensor control and communication (Sensor Web Enablement - SWE).

These services are the key components in the development of a services oriented architecture (SOA) that

- Lowers the barriers to data acquisition - decreasing the time required for collected data to be entered into the core management systems;
- Provides a logical separation between internal data management systems and the clients that consume products that are based upon the contents of that system;
- Enables publication of standards-based services that may be both used by EPA developers to provide specialized data access and visualization tools, but *also* may be used by external developers to provide custom *mashups* in support of specific user communities - particularly vulnerable populations.

EPA has initiated a number of programs that are developing these capabilities: EPA's "Apps for the Environment Challenge", "Environmental Dataset Gateway", "Geospatial Data Download Service", and the "National Geospatial Program" are all examples of programs that are making use of this SOA approach. What is needed within EPA's IT planning is a routine consideration and assessment of where interoperable services may be integrated into the development of new capabilities or updates to existing ones.

CONCLUSION

EJ/VP communities are directly impacted by multiple environmental assaults, are more likely to suffer adverse health impacts from these exposures, and lack the power to change their situations. The technologies that we have identified as needed could help these communities begin a process of community-driven environmental change. With EPA's support, that process could result in solutions that could "change the game" of environmental degradation and adverse health impacts that EJ/VP communities continue to face every day. We thank you for the opportunity to work with ORD and other EPA offices toward that end. We also wish to thank ORD, the Office of Environmental Justice, and the Office of Children's Health Protection for their assistance with this advice letter.

Sincerely,

/Signed/

James H. Johnson, Jr., Ph.D.
Chair

/Signed/ ***/Signed/***

DeWitt John, Ph.D.
Workgroup Co-Chair

Mark A. Mitchell, MD, MPH, FACPM
Workgroup Co-Chair

Attachments: Table 1: Steps in the Community-Driven Environmental Change Process
NACEPT Vulnerable Populations Workgroup Member List
Endnotes
NACEPT EJ and Vulnerable Populations Case Studies

cc: Lek Kadeli, Acting Assistant Administrator, Office of Research and Development
Fred S. Hauchman, Director, Office of Science Policy, Office of Research and Development
Cynthia D. Jones-Jackson, Acting Director, Office of Federal Advisory Committee Management and Outreach
NACEPT Members

NOTICE

This letter is the product of the National Advisory Council for Environmental Policy and Technology (NACEPT), an advisory committee created under the Federal Advisory Committee Act. NACEPT provides independent advice and recommendations on environmental policy, technology, and management issues to the Administrator and other officials of the U.S. Environmental Protection Agency (EPA). The recommendations in this letter reflect the opinions and views of NACEPT, and not necessarily the views or opinions of the U.S. EPA.

NACEPT's reports and advice letters are posted on the EPA website at http://www.epa.gov/ofacmo/nacept.

Table 1: Steps in the Community-Driven Environmental Change Process

Phase I: Problem Identification		
First Step	**Second Step**	**Third Step**
Triggers Fire, explosion, etc Smoke Odor Proposed new or expanding facility Regulatory processes with public input Unexpected releases of pollution Public notice of potential hazard	**Demonstrate Need for Change** Community test results Government or academic testing Emergency response Release of report Expert advice	**Consciousness Raising** News media coverage Leaflet/flyers Word of mouth Social structures schools/churches Social media/computer networks Public meetings

Phase II: Actions		**Phase III: Results**
Fourth Step	**Fifth Step**	**Sixth Step**
Developing strategy Information gathering Convening Planning Resource development Consensus building Communications Coalition building Logistics Publicity	**Actions/Tactics to build power** Petition Rally/protest/demonstration Meeting with public officials Letters to Editor Press Releases Give demands to polluter's reps Community forums Community learning sessions Lawsuits/legal interventions	**Responsive outcome** Negotiated change Regulatory change Legislative change Other responsive process or policy change

Note: The items that are highlighted are places where better detection, monitoring, and assessment technologies are needed and can be effective.

NACEPT Vulnerable Populations Workgroup

Dr. Karl Benedict
Director
Earth Data Analysis Center
University of New Mexico
Albuquerque, New Mexico

Dr. Ben Dysart
Principal
Dysart and Associates, Inc.
Nashville, Tennessee

Mr. Kurt Erichsen
Vice President
Environmental Planning
Toledo Metropolitan Area
Council of Governments
633 Woodbine Road
Toledo, Ohio

Ms. Ella Filippone
Executive Director
Passaic River Coalition
Morristown, New Jersey

Dr. DeWitt John
Workgroup Co-Chair
Thomas F Shannon
Distinguished Lecturer in
Environmental Studies
Bowdoin College
Brunswick, Maine

Dr. James H. Johnson, Jr.
NACEPT Chair
Professor and Dean Emeritus
College of Engineering,
Architecture and Computer
Sciences
Howard University
Washington, DC

Dr. Daniel Kammen
Professor of Energy
Energy Resources Group
University of California
Berkeley, California

Ms. Vivian Loftness
Professor of Architecture
Carnegie Mellon University
Pittsburgh, Pennsylvania

Mr. Clayton Matt
Director of Tribal Services
Confederated Salish and
Kootenai Tribes
Pablo, Montana

Dr. Mark A. Mitchell
Workgroup Co-Chair
President
Mitchell Environmental Health
Associates
Hartford, Connecticut

Ms. Jennifer Nash
Executive Director
Regulatory Policy Program
Harvard Kennedy School
Harvard University
Cambridge, MA

Ms. Arleen O'Donnell
Vice President
Eastern Research Group, Inc.
Lexington, Massachusetts

Ms. Kristie Orosco
Director of Environmental
Protection and Compliance
San Pasqual Band of Mission
Indians
Valley Center, California

Dr. Edith A. Parker
Professor and Head
Department of Community and
Behavioral Health
College of Public Health
University of Iowa
Iowa City, IA

Mr. John T. Preston
Managing Partner
C Change Investments, LLC
Cambridge, Massachusetts

<u>Acting Designated Federal Officer</u>

Mr. Mark Joyce
U.S. Environmental Protection
Agency
Office of Federal Advisory
Committee Management and
Outreach
Washington, DC

ENDNOTES

---

[1] US EPA 2003 *Framework for Cumulative Risk Assessment*, p. 39; NEJAC 2004 *Ensuring Risk Reduction in Communities with Multiple Stressors: Environmental Justice and Cumulative Risk/Impacts*; WHO 2006 *Principles for Evaluating Health Risks in Children Associated with Exposure to Chemicals*.

[2] For example, respiratory disease is a common human-health problem affecting EJ community residents and other vulnerable populations. One of these is asthma which can be caused or exacerbated by hazardous/toxic chemical releases to the air and small particulates (PM_{10}). According to a 2011 CDC report, the overall US asthma prevalence rate in 2009 was 8.2% (24.6 million persons) and was disproportionately greater among children (9.6%), poor adults (10.6%), blacks (10.8%), non-Hispanic blacks (11.1%), the poor (11.6%), poor children (13.5%), and non-Hispanic black children (17.0%). The CDC estimated total cost of asthma to society in the US, including medical expenses ($50.1 billion per year), loss of productivity resulting from missed school or work days ($3.8 billion per year), and premature death ($2.1 billion per year) was $56 billion (2009 dollars) in 2007. See: Hatice S. Zahran, Cathy Bailey, and Paul Garbe, "Vital Signs: Asthma Prevalence, Disease Characteristics, and Self-Management Education—United States, 2001-2009," Morbidity and Mortality Weekly Report, Centers for Disease Control and Prevention, May 6, 2011, vol. 60, no. 17, pp. 547-552, http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6017a4.htm?s_cid=mm6017a4_w.

[3] "Bucket Brigade: Community Monitoring Tool Kit," Global Community Monitoring website, http://gcmonitor.org/section.php?id=138.

[4] "The Bucket," Louisiana Bucket Brigade website, http://www.labucketbrigade.org/article.php?list=type&type=4.

[5] "Environmental Surveys—methane and H_2S" (Picarro's CRDS Technology Methane analysis Southeast Louisiana January 2010), Chris Rella, January, 2010, http://www.scribd.com/doc/25927927/Picarro-s-CRDS-Technology-Methane-analysis-Southeast-Louisiana-January-2010.

[6] "Community Based Odor Sampling Programs in the Bay Area," Aug. 2, 2010, Don Gamiles, Argos Scientific. http://www.baaqmd.gov/~/media/Files/Compliance%20and%20Enforcement/Compliance%20Assistance/Odor%20Conf/Community%20Based%20Odor%20Sampling%20Programs%20in%20the%20Bay%20Area.ashx.

[7] Documentation of fenceline air-quality monitoring study involving ConocoPhillips San Francisco Refinery, Bay Area Air Quality Management District, and Community Working Group, April and May 2010, pdf file, (see Exhibit 2: "Field services contract," April 29, 2010—pp. 8 through 18 of 37 and Exhibit 3: "Memorandum of understanding: Enhancements to fenceline monitoring at Rodeo Refinery," April 28, 2010–pp. 20 through 33 of 37), http://crgna.org/blog/wp-content/uploads/2009/11/NOTICE+TO+COMPLY+CONOCO+PHILLIPS.pdf.

[8] "Chevron Renewal Project Neighborhood Air Quality Monitoring: Work Plan for Monitoring," October 14, 2008, 8-pp. pdf file, http://www.chevron.com/products/sitelets/richmond/docs/work_plan_monitoring.pdf.

[9] "Chevron Renewal Project Neighborhood Air Quality Monitoring: Work Plan for Monitoring," October 14, 2008, 8-pp. pdf file, http://www.chevron.com/products/sitelets/richmond/docs/work_plan_monitoring.pdf.

[10] "Motor City Madness—How the 'Compliance' mentality is killing Southwest Detroit," Denny Larson, Air Hugger, blog sponsored by Global Community Monitor, April 22, 2010, http://airhugger.wordpress.com/2010/04/22/motor-city-madness-%E2%80%93-how-the-%E2%80%9Ccompliance%E2%80%9D-mentality-is-killing-southwest-detroit/

[11] "Quantifying Greenhouse Gases and Air Toxic Emissions: Technologies, Applications, and Verification and Validation Issues" and "Forecasting National Management Expectations for GHG and Air Toxics Measurements: New Challenges and Needs," John Bosch, June 2011, 104th Annual Conference of the Air & Waste Management Association, Orlando, Fla. Promising new technologies include cavity ring-down spectroscopy,(CRDS) and others.

[12] "EPA ORD NRMRL: Research on Detection and Quantification of Air pollutant and GHG Emissions from Fugitive and Area Sources," Eben Thoma, June 2011, 104th Annual Conference of the Air & Waste Management Association, Orlando, Fla.

[13] "Extending the Reach of Picarro's GHG Products," Eric Crosson, June 2011, 104th Annual Conference of the Air & Waste Management Association, Orlando, Fla.

[14] "Recent Applications of Open-Path Monitoring to Measure Air Toxics & GHGs," Steve Ramsey, ENVIRON, June 2011, 104th Annual Conference of the Air & Waste Management Association, Orlando, Fla.

[15] See "It's a Smart World", Special Report, *Economist,* November 6th 2010, pp. 1-2.

[16] http://www.clemson.edu/media-relations/3903.

[17] John C. Bosch, "Quantifying Greenhouse Gas and Air Toxic Emissions: Technologies, Applications, and Verification and Validation Issues", prepared by J. Bosch Ltd, Raleigh NC for ENVIRON, June 2011, 104th Annual Conference of the Air & Waste Management Association, Orlando, Fla.

[18]"Science & Technology Foundations of Sustainability," Paul Anastas, NACEPT Meeting November 14, 2011.

[19] "Graniteville, South Carolina train disaster," http://en.wikipedia.org/wiki/Graniteville,_South_Carolina_train_disaster.

[20] "Train Wreck and Chlorine Spill in Graniteville, South Carolina: Transportation Effects and Lessons in Small-Town Capacity for No-Notice Evacuation," A. E. Dunning and Jennifer L. Oswalt, *Transportation Research Record: Journal of the Transportation Research Board, No. 2009*, Transportation Research Board of the National Academies, Washington, D.C., pp. 130–135.

[21] "Railroad Accident Report: Collision of Norfolk Southern Freight Train 192 With Standing Norfolk Southern Local Train P22 With Subsequent Hazardous Materials Release at Graniteville, South Carolina January 6, 2005," NTSB/RAR-05/04, PB2005-916304, Notation 7710A, Adopted November 29, 2005, National Transportation Safety Board, Washington, D.C. 20594, 59 pp.

[22] See, for example, (1) Steve Lerner, *Sacrifice Zones: The Front Lines of Toxic Chemical Exposure in the United States*, The MIT Press, Cambridge, 2010; (2) Ronnie Greene, *Night Fire: Big Oil, Poison Air, and Margie Richard's Fight to Save Her Town*, Amistad/HarperCollins, New York, 2008; (3) Steve Lerner, *Diamond: The Struggle for Environmental Justice in Louisiana's Chemical Corridor*, Urban and Industrial Environments series, The MIT Press, Cambridge, 2005; and (4) Barbara L. Allen, *Uneasy Alchemy: Citizens and Experts in Louisiana's Chemical Corridor Disputes*, Urban and Industrial Environments series, The MIT Press, Cambridge, 2003.

NACEPT

National Advisory Council for Environmental Policy and Technology

CASE STUDIES

Environmental Justice and Vulnerable Populations

JANUARY 2012

1. **Graniteville Train Wreck**
   Ben Dysart
   Dysart & Associates, Inc.
   Jennifer Nash
   Executive Director, Regulatory Policy Program
   Harvard Kennedy School

2. **Hartford Trash-to-Energy Incinerator**
   Mark Mitchell, M.D.
   President, Mitchell Environmental Health Associates

3. **Louisville Rubbertown Air Toxics**
   Mark Mitchell, M.D.
   President, Mitchell Environmental Health Associates

4. **Lower Passaic River & Newark Bay Restoration Projects**
   Ella Filippone
   Executive Director, Passaic River Coalition

5. **Toledo's Dorr-Smead Brownfields**
   Kurt Erichsen, P.E.
   Vice President of Environmental Planning, Toledo Metropolitan Area Council of Governments

6. **Tribal Environmental Health: Indoor Air Quality with an emphasis on Mold**
   Clayton Matt
   Director of Tribal Services
   Confederated Salish and Kootenai Tribes

GRANITEVILLE TRAIN WRECK, AIKEN COUNTY, SC

A HUMAN HEALTH TRAGEDY IN GRANITEVILLE

Early on the morning of January 6, 2005, two trains collided in unincorporated Graniteville, SC. Five tank cars containing hazardous material were derailed: three car loads of chlorine—each containing 180,000 pounds of chlorine, one car load of sodium hydroxide, and one car load of rosin residue. One tank car exploded, releasing some 60 tons of chlorine gas. No warnings were given to sleeping residents living as close as 100 feet from the collision point except to shelter in place, which left the entire neighborhood subject to dangerous exposures. The accident would result in nine deaths and 554 residents sent to the hospital for chlorine inhalation treatment.[1] Residents would be evacuated, but their homes would be ruined from the gas cloud that hovered over the community. The immediate illness would later be determined to be a permanent debilitating condition for workers. Since the textile industry had already left for lower-wage countries, there was little reason to repair or reopen the mill once the explosion occurred.

The case illustrates the inadequacies of currently deployed sensing and communication technologies for community protection and regulatory response. It also points to several immediate and actionable recommendations for the US EPA. Adequate information, communications, and low-cost, on-site, ambient monitoring would have greatly improved the Graniteville response, reduced exposure, decreased long-term health effects, and saved lives.

GRANITEVILLE AS AN EXAMPLE

Graniteville is one of three (Graniteville, Vauclause, and Warrenville) textile mill villages, collectively known as "Graniteville," abandoned by industry due to various political and economic circumstances which typify many small, rural communities throughout the Southeast and other areas of the US. These communities are typical of early industrial sites built along fall-line waterways. Six Graniteville mills in these three communities are now being assessed or cleaned up via the EPA Brownfields Program and have additional local Special Option Local Sales Tax (SPLOST) funding to supplement these federal resources. However, the consequential impacts of the train wreck left behind in Graniteville—which include devastating health, social, and economic impacts—are only partially solved by these resources.

The Graniteville, Vauclause, and Warrenville communities are examples of historic EJ and textile communities: located outside traditional community boundaries, they are left with minimal services compared with traditional communities such as police and fire protection, garbage pickup, schools, hospitals, and water and sewer service. They are isolated from shopping, schools, and the larger community. In operating mill communities, now a thing of the past, the mill itself provided most services; but as mills closed, these services disappeared. The history of disenfranchisement led to continuing isolation, as nearby communities, North Augusta and Aiken, never connected with these now-disconnected and disadvantaged neighbors. Now Graniteville is an area which can absorb suburban sprawl—which requires new infrastructure for

[1] Railroad Accident Report: Collision of Norfolk Southern Freight Train 192 With Standing Norfolk Southern Local Train P22 With Subsequent Hazardous Materials Release at Graniteville, South Carolina, January 6, 2005, NTSB/RAR-05/04, PB2005-916304, Notation 7710A, Adopted November 29, 2005, National Transportation Safety Board (http://www.ntsb.gov/publictn/2005/rar0504.pdf)

new populations—while continuing to ignore the needs of the original community. With the risk of substantial transportation-corridor exposure and substantial active or brownfield manufacturing hazardous or toxic releases, Graniteville is illustrative of thousands of other struggling, underserved, disproportionately impacted American communities and neighborhoods attempting to recover from their manufacturing history in the face of ongoing political and economic constraints.

PROBLEM OF NO, INADEQUATE, AND NON-ACTIONABLE INFORMATION

Relevant, high-quality, and accessible data are the holy grail of environmental and human-health assessment. In Graniteville, no such data were available to indicate the timing, duration, areal extent, and magnitude of the toxic release. As a result, there was no reliable basis for estimating exposure of the nearby sleeping and sheltering-in-place humans. Eight immediate deaths that resulted from the chlorine gas cloud that early morning in January 2005 were just the beginning of the continuing human-health disaster that was to come. Formal inquiries determined that the well-meaning first responders from the local volunteer fire department had protective gear but failed to use it, which delayed evacuation of residents and victims and caused additional exposure.

When federal responders arrived to assess damages to public health and environment, victims had been transported to hospitals in most cases. So regulators focused on next-available organisms: fish in the creek. The EPA utilized broad Comprehensive Environmental Response and Compensation Liability Act of 1980 (CERCLA) Emergency Response Authorities to address the environmental aspects of the spill only, concentrating on a spill to Horse Creek which caused a fish kill, rather than focusing on worker and community human exposure. Latent pollution from decades of mill operation was ignored in the EPA response, which could have created additional requirements for the past operators to clean up the facilities rather than leave it for the EJ community to figure out. The responsible party, Norfolk Southern railroad, was required to complete the necessary responses under federal law for the spill: at that point, Norfolk Southern had addressed the fish kill by providing 3,000 replacement fish in the Horse Creek and providing $100,000 worth of landscaping to address erosion problems along the stream bank as well as agreeing to some $4-million in Clean Water Act (CWA) fines and $32,500 in federal CERCLA response costs.

TECHNOLOGY THAT COULD IMPROVE OUTCOMES FOR HUMAN HEALTH

Technology should immediately *warn and advise* the adjacent or downwind community, first responders, and local hospital emergency rooms, and *document* environmental releases for residents and local governments, state environmental and health regulatory agencies, the source's local and corporate senior management. Such technology provides the basis for (a) effective first-responder emergency response or—in the case of chronic, cumulative releases—informed responses by community leaders, (b) immediate evacuation or sheltering and effective treatment of exposed humans, (c) proper long-term medical treatment, (d) immediate threat and human exposure estimates as well as post-immediate-response modeling and characterization of the release, and (e) regulatory response as appropriate.

Like flood damage due to elevated flows in a stream, risk to human health from permitted and un-permitted hazardous or toxic releases from mobile sources, regulated facilities, and other stationary sources is a function of magnitude, duration, and frequency. Inexpensive, credible, easy-to-operate, easily deployed technologies are required: technologies capable of providing solid, transparent data on the timing, frequency, severity, and duration of all unsafe and unpermitted air releases—even for only a few of EPA's top-priority hazardous or toxic air pollutants—to which communities are regularly exposed.

SENSORS AND SYSTEMS

Required are appropriate (a) sensors and (b) systems to interpret data gathered by sensors that take into account chronic long-term exposures and pre-existing health conditions common to vulnerable populations. Sensors should be reliable, cost-effective, easy to deploy, and suitable for local community residents to use and maintain.

Three levels of technology are necessary:

1. Sensors, including devices able to detect releases of local sources—e.g., VOCs or benzene—as well as sensor arrays that can sufficiently characterize releases real-time to protect human health. Sensors should be located on mobile sources and in communities of vulnerable populations.
2. Continuous monitors utilizing sensors to detect any hazardous or toxic air release above permitted and safe levels. Continuous monitors should be located with the bulk hazardous or toxic material in transit as well as between EJ communities and transportation corridors and loading, unloading (including inter-modal), and storage facilities.
3. Communication systems to share real-time air hazardous or toxic release detection, quantification, and timing information with EJ community leaders and first responders, local hospitals, and environmental and health regulatory agencies as well as, if above an acceptable level, trigger timely deployment of more sophisticated sensor arrays and monitors to thoroughly document unsafe and unpermitted hazardous or toxic air releases reaching EJ communities.

SOLUTION TECHNOLOGY

While we are emphasizing sensing and systems, we aren't ignoring the importance of solution technologies in achieving EPA's mission of "protect[ing] human health" and "ensur[ing] that … all Americans are protected from significant risks to human health … where they live, learn and work." Technically effective control technologies—in the sense of producing any specified output including air releases—have existed, now exist, and are being improved. But they must be deployed and then operated as intended. And someone—a regulator or someone else—must and does specify the expected and required level of performance which, in turn, determines the hazardous and toxic air releases and resulting human exposure.

Regulatory Issues related to EJ exposures Illustrated by Graniteville

Lack of available, reliable, timely data—at the time of an incident—creates inherent weaknesses in regulatory response on the ground. These inherent weaknesses then manifest themselves throughout the aftermath of the incident—particularly as it relates to both the environmental and human-health impacts and remedy requirements—even until more detailed environmental and human-health studies are completed.

As remedy requirements must be translated into an enforcement process, the initial inherent weaknesses due to lack of appropriate environmental and/or human-health data collection methods continue to plague the ability of the regulatory system to complete its own statutory requirements to impose duties on the responsible parties. This situation details why some agency officials are surprised when EJ communities (or other communities) attack EPA for leaving their community with continuing exposure and human-health problems.

Through its Brownfield Program, EPA has had a role in addressing contamination issues that were not addressed appropriately during the regulatory phase. It was likely not intentional that they were not addressed: EPA just did not understand what should be addressed. On the dark side of the moon where EJ communities tend to be co-located with sources of hazardous or toxic air releases, if there are no data, there is no problem.

There are three areas that need closer examination to illustrate both the long-standing problem and the solution: (a) how the lack of data weakens the technical human-health and environmental impact assessment, (b) how a weakened technical assessment then further weakens the regulatory response, and (c) how data improvements and procedural improvements eliminate weaknesses and create a more scientific, rational, and fair approach for all communities—especially citizens who live in EJ and other disenfranchised communities.

Conclusion

An important challenge for EPA is the lack of low-cost, reliable, easily deployable technologies capable of providing real-time data about accidental and other non-permitted hazardous or toxic air releases to residents, first responders, and local governments in EJ communities. In Graniteville, the direct consequences of the lack of timely, actionable data included deaths of nine people, long-term health effects on many citizens, and severe economic dislocation resulting from the last operating mill's closure. Those consequences underscore the vulnerability of disenfranchised EJ communities that have experienced decades of environmental exposures. Adequate real-time monitoring resulting from low-cost, simple, easily deployed sensors and systems will reduce the severity of the impacts of accidents and other non-permitted hazardous or toxic air releases when they occur and make possible more appropriate legal and regulatory remedies.

While the technologies described here are indeed critical, the will to effectively deploy these technologies and act on the information they generate is even more important.

HARTFORD TRASH-TO-ENERGY INCINERATOR

ENVIRONMENTAL PROBLEMS

There are variable emissions of toxins, including metals from burning of household trash, depending on what is being burned at a given moment, as well as how well the facility is operating. In addition, there are 10 or more fires and explosions each year. Even though peak emissions are the greatest health threats, emissions testing is only conducted once annually at the stack, presumably at times of ideal steady state conditions, and averaged over a period of several hours. These measurements are projected to be the same year-round to get annual emissions rates. Emissions variability with possible permit violations are not identified and communicated to the public or to regulators. There is no community monitoring of the emissions. The monitoring process and emissions results are suspect.

EJ/VPS AFFECTED

Hartford, Connecticut is a city of 125,000 people, about 80% of whom are Black or Latino. It is one of the lowest income cities over 100,000 in the U.S. It is only 18.4 square miles in size and is the capital of Connecticut, the wealthiest state in the Union. The trash-to-energy facility, the Connecticut Resources Recovery Authority's Mid-Connecticut facility, ranks in the top five largest facilities in the country, burning 2,850 tons per day of municipal solid waste. This waste is brought to Hartford from 70 municipalities to burn.

NEEDED TECHNOLOGIES

Technologies for problem identification; technologies for problem assessment, analysis and communication; and/or solution technologies)

- The community would like to have continuous emissions monitoring installed on the stacks of the incinerator that would have continuous readings of toxins including metals and dioxins over the internet and would indicate when permit standards are exceeded and provide text alerts to those who request it when there are major violations that may be an immediate threat to health.
- They are looking for low cost soil testing of dioxins surrounding the incinerator,
- They want portable ambient air monitoring devices for emissions tests that can be carried out by community residents and give immediate results.
- There could be a way to email or text information and photos of complaints and potential violations to regulators and other community members where they can be stored on public databases.
- They are looking for human biomonitoring testing of neighborhood residents of these metals and dioxins that is cost effective.

- There is a need for the ability to test for the potential health effects of the multiple and cumulative mixture of chemicals to which people are exposed who live near this facility, the sewage sludge incinerator, oil fired power plants, highways, and other sources of air toxins.

Relevant Cross-Cutting Issues

- Communications technologies that could send alerts to email subscribers may be new applications of technology that would be useful in the other cases. Low cost monitoring of dioxins in soil could be used in other Brownfields situations.

LOUISVILLE RUBBERTOWN AIR TOXICS

EJ/VPs Affected

Rubbertown is an industrial zone in west Louisville, KY along the Ohio River composed of 19 large plastics and petrochemical facilities in close proximity to low-income African American neighbors on the east and low-income whites to the south. 45% of the 3000 people living within a half-mile of these facilities have a household income less than $25,000. These facilities have a large number of accidental releases and mishaps with various colored smoke plumes, fires, odors, and explosions. The releases are of 35 or so mostly VOC's, but also inorganic chemicals, metals, acids and bases.

Needed Technologies

The companies and the City/County have a system of responses to releases. These include warning sirens, reverse 911 calling systems, and a 24 hour complaint hotline. Residents complain that these systems are often times not used or are used too late to be of use to the public.

Residents want handheld monitors to measure their neighborhood's VOCs at low levels for short periods, i.e. over a few seconds in order to identify the chemical being released, identify the level of chemical exposure, interpret the health threat from each chemical release, be able to know what kind of health protective actions to take, and have information to hold government and industry accountable for any health threats.

The technologies needed are:

- Real time air monitoring of air toxics - either at the fenceline or stack monitoring, that can be accessible on the internet and sent to regulators
- Communications - allow alerts to be sent by phone and by text message to people at various levels and durations of releases to allow people to know when there are potential air toxics violations and when there are potential health threats.
- Pollution control technology - need improved technologies for process management and end-of-stack controls to reduce toxics.
- Biomonitoring to identify pollutants from local source exposure
- Handheld low-cost monitors for VOC's that can be operated by community members

Possible Technology Solutions

Develop new technologies; adapt technologies to address situations in EJ/VP communities; address barriers to the deployment of needed technologies.

There is a need to develop low-cost portable immediate sensing devices that can be used by the community. Current tedlar bag grab sample “bucket Brigade” technology is not sensitive enough, is not immediate with its results, and is still a bit expensive, although the price has declined recently.

RELEVANT CROSS-CUTTING ISSUES

Cross cutting issues include needs for portable air toxics monitors, communications technologies, and biomonitoring

LOWER PASSAIC RIVER & NEWARK BAY RESTORATION PROJECTS

LOCATION

Densely populated urban area in northeastern New Jersey

SPECIFIC ISSUE AND POLLUTANTS OF CONCERN

Northeastern New Jersey has been at the epicenter of economic activity since the start of the Industrial Revolution over two centuries ago because its waters provide shipping access to the world. However, these activities have left a legacy of contaminants in the sediments of the Lower Passaic River and Newark Bay, which persist today. The most hazardous are dioxin, PCBs, and mercury. Dioxin has gotten into the shellfish and fish, and eating these fish can be very hazardous. Furthermore, most of the Lower Passaic River has not been dredged since the 1950s, and dredging Newark Bay has become very expensive because of problems with disposing of the contaminated sediments. This means that many recreational, ecological, and economic benefits of the river and bay have been lost. Also, the river and bay have been filling up with more sediment, and flooding is worsening, and will get even more hazardous in coming years as sea level rises due to global warming.

KEY PLAYERS INVOLVED

The following agencies are directly involved in carrying out these projects: US Environmental Protection Agency, US Army Corps of Engineers, US National Oceanic and Atmospheric Administration (NOAA), US Fish and Wildlife Service, NJ Department of Transportation, NJ Department of Environmental Protection, and Tierra Solutions, Inc. The residents and workers in sixteen or more municipalities in Bergen, Essex, Hudson, Passaic and Union Counties are being impacted by this pollution. Large percentages of this vulnerable population have low incomes, are African Americans or Hispanic, and are uninformed about how to protect them from the pollution. Some even eat crabs and fish from the river and bay.

TECHNOLOGY APPLIED

In 1984, a quarter century ago, the "Diamond Alkali" site, which includes the properties at 80-120 Lister Avenue in Newark as well as the contaminated Lower Passaic River and Newark Bay, was declared a Superfund Site. Although contaminants on the land side of the site have been partially contained, the sediments in the river and bay are still badly contaminated. Part of the Lower Passaic River Restoration Project (LPRRP), planning for an Early Action program for cleaning up the contaminated sediments in the lower eight miles of the Passaic River, has been ongoing since 2003.[2] (See <www.OurPassaic.org> and <www.OurNewarkBay.org>.) Many

[2] Malcolm Pirnie, Inc. 2007. Lower Passaic River Restoration Project, Draft Source Control Early Action Focused Feasibility Study. Prepared for US Environmental Protection Agency, US Army Corps of Engineers, New Jersey Department of Transportation. June 2007. Executive Summary, page x.

studies have been conducted and more are ongoing. Currently, the data collected in recent years is being modeled to estimate the distribution of dioxins and PCBs in sediments and biota in the river, bay and harbor under alternative clean up scenarios. In June 2009 a revised list of alternative scenarios for the Early Action program was suggested.

The highest levels of dioxin are found in the sediments immediately adjacent to the shore of the old Diamond Alkali site. Occidental Chemical Corporation and Tierra Solutions, Inc., which have taken responsibility for the Diamond Alkali site, reached an agreement with EPA in June 2008 to remove about 200,000 cubic yards of dioxin-laden sediment from the river in the vicinity of the site.[3]

For ten years the New York Academy of Sciences Harbor Consortium had studied contaminants in the New York/New Jersey Harbor. Four years ago the Consortium's recommendations include the following statement:[4]

> Cleanup of PCB-contaminated sites – particularly along the Passaic River – as well as the dioxin-contaminated Diamond Alkali Superfund site and its effects on the nearby Harbor, remains a (if not the) major priority. The Consortium has urged all litigating parties to focus their efforts on achieving early and effective action.

TRANSFERABLE TOOLS/STRATEGIES

Actions to clean up the contaminated sediments in the Lower Passaic River and Newark Bay have long been delayed for lack of a publically acceptable technology for dredged material management. However, today there is the Cement-Lock tool. Cement-Lock is a virtually odorless thermal-chemical technology that converts contaminated sediment and hazardous waste to Ecomelt®, a non-leachable, harmless beneficial-use product. When combined with cement it exceeds the ASTM requirements for Portland cement and concrete. Air pollution equipment for Cement-Lock facilities can meet or exceed the EPA's 2014 compulsory air quality regulations. Demonstration of the effectiveness of this technology for these sediments could lead to cleaning up other sites in the US. An added high benefit is that the facility will also supply energy to the grid, establishing a significant beneficial use.

CHALLENGE

The Lower Passaic River and Newark Bay are critical parts of the New York/New Jersey Harbor Estuary, a hub of economic activity on the east coast of the United States. By dredging contaminated sediment from the river and harbor, and treating it on land so it can be used beneficially, both the ecologic and economic vitality of the region can be reinvigorated. A Regional Sediment Management (RSM) Plan, prepared under the auspices of the New York/New

---

[3] Kluesner, David, U.S. EPA, Region 2, Public Affairs Division. June 2008. EPA Signs Agreement with Companies to Remove Major Source of Passaic River Contamination.

[4] New York Academy of Sciences Harbor Consortium. January 2008. "Safe Harbor: Bringing People and Sciences Together to Improve the New York/New Jersey Harbor. Page 47.

Jersey Harbor Estuary Program, was released in October 2008, and makes the following observations:[5]

> The RSM Plan is a long-term Plan with anticipated near-term economic returns. The Dredged Material Management Plan for the Port of New York and New Jersey estimates that achieving the goal of clean sediments throughout the harbor can save at least $25,000,000 per year in costs of maintaining our water transportation infrastructure. Other economic drivers for implementing the RSM Plan also include increased and improved opportunities for recreation, tourism, and fisheries – industries valued at over $20 billion per year that depend on a clean Harbor Estuary.

These expectations are justified by the observation that elsewhere in the United States and in Europe significant cost savings and other benefits have resulted from RSM efforts. The implementation of projects to restore the ecologic vitality of the Lower Passaic River and Newark Bay is critical for restoring economic prosperity to this region!

STATUS

Studies after study after study confirm earlier findings, but no action has been taken to "restore" the Lower Passaic River and Newark Bay. The technologies are available to dredge most of the most hazardous legacy pollutants from the river and bay, and to decontaminate these sediments so they can be used beneficially. A land based treatment facility within the region would significantly lower costs and establish beneficial uses from the contaminated sediments. While this recommendation has been made frequently, the opportunity to pursue such a facility as a priority disposal project requires EPA's attention now. The demonstration of the efficacy of the Cement-Lock process in New Jersey would encourage clean-ups in several parts of the United States where toxic pollutants are challenging the nation. The Corps of Engineers, Engineer Research and Development Center, published a report on dredging and environmental research entitled Mass Balance, Beneficial Use Products, and Cost Comparisons of Four Sediment Treatment Technologies Near Commercialization by Trudy J. Estes, Victor S. Magar, Daniel E. Averett, Nestor D. Soler, Tommy E. Myers, Eric J. Glisch and Damarys A. Acevedo., March 2011. I strongly suggest that EPA take over where the Corps left off and contact the Cement-Lock people to examine the commercial viability of their process. (W.A. Hendricks, 407-492-9731) This case study should be brought to the attention of Administrator Jackson.

[5] New York/New Jersey Harbor Estuary Program. 2008. Regional Sediment Management Plan, October 2008, page iv.

TOLEDO'S DORR-SMEAD BROWNFIELDS

DESCRIPTION

Toledo has had a strong industrial base for the past century. The city grew rapidly due to its Lake Erie port, industrial resources, and proximity to Detroit. Toledo's economy was based on manufacturing, especially automotive.

Toledo's population peaked at 383,818 in 1970. By then the city was losing industrial jobs, a process that has since continued. By 2010 the population had dropped to 287,208. With departing jobs, the factories were abandoned. The remaining inner city is lower income with a high proportion of minority residents.

Many of the abandoned factories are now brownfields. The City of Toledo identifies 410 brownfield sites covering a total of 1,927 acres, the majority which are concentrated in the inner-city area.

The subject of this case study is a group of three brownfield sites located near Dorr Street and Detroit Avenue. The largest brownfield was the Doehler-Jarvis Plant #1, a producer of die-cast automotive parts. The others are Craft House and Fernwood, which we identify as the Dorr-Smead brownfields. The abandoned buildings at several of the sites have been razed; other nearby abandoned or underutilitized buildings remain.

EJ/VP STATUS

A third of Toledo's population resides in brownfield-impacted area, representing half of the impoverished population, and an unemployment rate 50% higher than the rest of the city. From 1970 to 2000, 94% of the city's population decline was in this area.

Several vulnerable populations are affected by the Dorr-Smead brownfields.

- Lower income and/or minority neighborhood residents are vulnerable to exposure by hazardous materials. House fire sites are often contaminated by metals and PAHs, posing neighborhood exposure risks.
- Children may have been particularly vulnerable to physical hazard at the sites.
- Homeless persons: before demolition, abandoned buildings were occupied as shelter. Homeless persons taking refuge were subject to exposure to hazardous materials, to physical hazards from unsafe structures, and fires set for warmth.
- Building material thieves: abandoned buildings and properties are subject to stripping for hardware and other salvageable materials. Those undertaking this activity are subject to the site's hazards.
- Food Deserts, which lack access foods necessary for a healthy diet, form in areas of low income households; households without cars; and without access to grocery stores. Urban agriculture can create a "Food Hub" in that desert.

Pollutants

Asbestos, arsenic, TCE, VOCs, lead, and PAHs on brownfield sites pose risks to vulnerable populations. In Toledo, ambient arsenic levels often exceed soil standards for residential use. Asbestos containing building materials were utilized when the factories were constructed. PAHs are associated with heavy end petroleum products, such as diesel fuel and oils, and are even components of asphalt. On some sites there were abandoned drums, which once contained undetermined materials.

Potential human health exposure pathways include direct exposure to materials or soils; through ingestion of vegetables or fruit grown in contaminated soils (see discussion below), through site runoff into streams; or through groundwater. A building constructed on a contaminated site could have indoor air contamination.

Indirect pollutants include: nonpoint source pollution, increasing phosphorus in streams, leading to Lake Erie harmful algal blooms. The difficulties of redeveloping brownfield sites creates an economic incentive to develop greenfield sites instead. Failure to redevelop brownfields encourages urban sprawl and nonpoint source stormwater pollution.

Key Players

City of Toledo, the Lucas County Improvement Corporation (LCIC), Toledo Community Development Corporation (CDC), US EPA Region V, HUD, Ohio EPA, the Ohio Department of Development Clean Ohio Fund, the Center for Innovative Food Technology, the University of Toledo (UT), Toledo Grows, and Kansas State University.

Of the Dorr-Smead brownfields, Toledo CDC owns Fernwood, LCIC owns Doehler-Jarvis, and the City of Toledo owns Craft House. Toledo and LCIC coordinate site remediation and beneficial redevelopment with EPA and HUD; the Center for Innovative Food Technology, the University of Toledo (UT), and Toledo Grows are partners in developing urban agriculture for the site.

Mechanisms

Brownfield assessment and remediation: conduct property assessments and remedial activities, including excavation and off-site disposal of contaminated materials.

Ohio VAP: Ohio's Voluntary Action Program (VAP) sets risk-based cleanup standards. While the VAP has not been fully utilized for Dorr-Smead, the program facilitates many cleanup agreements between property owners and Ohio regulatory agencies. Cleanup standards based on the end use: commercial/industrial, residential, or construction. The residential standard, based on physical contact with the soil, is the most protective.

Beneficial Redevelopment – Urban Agriculture: The industrial jobs in the area are not likely to return. Doehler-Jarvis had good rail access, but today freeway access is more important. The land must be used to benefit a changing community. EPA provides resources for agriculture projects through brownfield. The agency website offers numerous resources.

The Toledo CDC is redeveloping a brownfield as an urban agriculture business called the Fernwood Growing Center:

- Promotes community revitalization and eliminates the attractive nuisance of abandoned buildings.
- Provides the community with access to, and foster understanding of, healthy food.
- Promotes stewardship for the environment and neighborhood.
- Provides 25 jobs for community residents, in addition to supporting local businesses.
- Makes the neighborhood a more attractive setting for additional redevelopment and new job creation.

Foster communications with lower-income and minority communities. There are wide gaps in understanding environmental issues between the federal level, state and local governments and their consultants, and the impacted EJ communities. Bridging these gaps of understanding is a challenge for any agency, but EPA may benefit from the experience of the US Census Bureau. The common thread is similarity in communities EPA and the Census Bureau strive to reach. Low income, minority, homeless, non-English speaking, or disenfranchised communities that are a challenge for the Census Bureau to enumerate may often be the same communities impacted by EJ issues. The Census Bureau found that outside partners could communicate more effectively than the agency. Examples include partnerships with cell phone companies for effective messaging; extensive and easy-to-understand use of social media, partnership with community-based organizations, and market segmentation research to tailor messaging to various communities. The Census Bureau has conducted extensive audience research[6] and developed toolkits with materials culturally and linguistically targeted to specific audiences.[7]

TECHNOLOGIES

Identification Technologies

- Develop brownfield data tools as cell phone apps to streamline and standardize data management site assessments. This tool could take better advantage of local knowledge for brownfields whose assessments call for neighbor interviews.
- Develop risk-based cleanup standards of soils for urban agriculture
- Develop and deploy community-based programs for soil and groundwater contaminant testing. Emphasize low-cost and broad-capability mobile monitors. Use the results to empower residents to protect themselves.

[6] http://2010.census.gov/partners/research/

[7] http://2010.census.gov/partners/toolkits/toolkits-take10.php

Communication Technologies

- Promote effective communication between the community and local / state / federal agencies on safe urban agricultural practices.
- EPA offers toolboxes throughout its website to provide resources and information on a wide variety of environmental issues. While they are useful, they are passive, depending on the community find out that they exist and use them. They tend to be top-down: they promote EPA goals and recommendations, and provide information EPA thinks the affected community needs. Interactive approaches could improve the effectiveness of providing information the affected community wants, and encourage broader use.
- Inventory groups that have equipment and experience with these issues on the local level and among similar grassroots organizations nationwide. Facilitate training opportunities through video conferencing with two-way communication, and developing and deploying visually-oriented phone apps.
- Focus training on community capacity building to help residents use technologies and run the small business urban agriculture
- Establish overarching urban area brownfield / agricultural plans, identifying potential sites and community leadership.

Solution Technologies

- Promote redevelopment of the community
- Develop urban agriculture to provide safe and nutritious food to the community and establish a beneficial use for contaminated properties
- Develop phytoremediation for remediation. Vegetation may be grown to uptake contaminants from soil; when harvested, the plant material removes contaminants from the site.
- Multipurpose environmental benefit of remediation: clean surface and ground water, clean air, recycling neighborhood compost, and proving safe and healthful food.

Status

Successful with challenges for continued implementation.

- The City of Toledo and LCIC have used a $2 million brownfield revolving loan fund and other grants to remediate sites in Toledo.
- Abandoned structures have been razed at all three of the Dorr-Smead Brownfields; remediation at Fernwood is complete. Numerous urban agriculture programs are benefiting Toledo neighborhoods; construction of the Fernwood Growing Center is planned.

- Planned food production includes aquaponics farming, where tilapia and an assortment of greens and herbs year-around will be produced in raised beds and vertical growing systems.
- Studies are planned for the Craft House site to test the soil for contaminants, and whether vegetables take up any legacy chemicals. The study will aid understanding of conditions under which these soils might be used for food production. Remediation standards exist for residential, commercial, and construction reuse, but not for urban agriculture. Urban agriculture standards are needed; such use may involve lower risk than residential. Safe levels of contamination for soils used for urban agriculture could be developed through a risk assessment.
- Another outstanding question urban agriculture centers and brownfields sites is whether plants can absorb contaminants that may be in shallow perched groundwater. Groundwater may be deep enough that plants with shallow root systems — including most vegetables — would not be affected. However, plants such as fruit trees and some fruit bushes, which have deeper root systems.
- Under an EPA grant, Vita Nuova is developing an Urban Farming Planning Tool. Its purpose is to provide a business planning framework for distressed communities that surround brownfield sites, and provide TCDC with a business model.

CONCLUSIONS

Beneficial land redevelopment provides the driving force for brownfield remediation. EPA can set standards for cleanups, but economic factors make it happen. Redevelopment provides the economic incentive for remediation. Redevelopment creates jobs by putting property back into productive use. Job growth raises residents' income, directly addressing the main cause of its being an Environmental Justice community.

Partner with communications experts. EPA's mission is to protect the environment, and should use strategic partnerships with state and federal agencies, local communities, and private companies who have closer ties to EJ populations or greater communications expertise. For example, EPA may benefit from the experience of the Census Bureau. The census faces obstacles communicating with disenfranchised communities; EPA faces similar obstacles communicating with EJ communities.

Communication is two-way. EPA should communicate with EJ communities to help these populations understand how the environment impacts them, and how citizens can protect themselves. But EPA should also use communication to understand EJ communities better, and fashion environmental programs and policies to meet those needs.

Programmatic cross cutting strategies with outside agencies can support EPA goals.

Residents may perceive that they belong to an EJ community, but not view environmental issues as key problems. Chronic environmental contamination that causes harm over a period of years is a lower priority than immediate, acute problems like crime, drugs, and unemployment. This case study illustrates the use of urban agriculture to address acute concerns by revitalizing the community while raising awareness of chronic environmental issues, and ultimately supporting brownfield remediation. Interagency agreements and coordination, and interagency staff assignments between EPA, CDC, and USDA can extend the effectiveness of EPA programs.

TRIBAL ENVIRONMENTAL HEALTH
INDOOR AIR QUALITY WITH AN EMPHASIS ON MOLD

INTRODUCTION

This case study is an example of a problem that can be extrapolated to many Tribal settings and could easily be extended to many low income and minority housing environments. Additionally, while the emphasis is on mold, there are potentially several other issues that could follow from this example that are sometimes characterized as indoor air quality issues including lead, radon, CO_2, pesticides and asbestos. Consequently, the National-EPA Tribal Science Council (TSC) has identified mold as a priority (http://www.epa.gov/osp/tribes/key.htm) and further links mold to health problems associates with asthma, also one of the TSC priorities.

LOCATION

Salish Kootenai College (SKC) is a Tribal College located in the un-incorporated community of Pablo, on the Flathead Indian Reservation in North West Montana. The census area for Pablo shows a population of about 2,000. The surrounding area has more people and is generally considered to be the "Pablo" area of the reservation. Pablo is the location of the headquarters of Tribal Government of the Confederated Salish and Kootenai Tribes. There are also two other schools, one elementary school that is part of the Ronan School District, and one Tribal high school that also has a small middle school component. Also in Pablo, are two Early Childhood (head start and daycare) facilities, one located on or near the SKC campus, very near the location of the mold problems at SKC.

SKC has about 1,100 students. About 76% of the students are Native American. The students come from 66 tribes and 20 states. SKC has a mix of traditional and non-traditional students so many of the students are older students. Also, many of the Tribal students often have a family who has moved with them as they attend SKC so family members include children and sometimes elder members of the family.

ENVIRONMENTAL PROBLEM

The major environmental problem of focus in this example is the mold in school buildings and student housing units on the Salish Kootenai College campus. As will be discussed below, one contributing factor to the mold problem in this example is groundwater.

For years officials at SKC have been aware of and have dealt with the problem of a groundwater table that is on the average 10 – 20 feet below ground level. They are also aware, and have monitored the seasonal fluctuation of the groundwater level. It comes up in August and September each year. However the winter of 2010 brought more snow and it snowed longer into the season than has been usual for the past decade or more and it also brought more spring moisture. This condition caused the water table to rise higher than recorded levels and it stayed up for a longer period. The higher than normal groundwater table flooded basements and crawl spaces in buildings at SKC and in homes around the Pablo area.

Prior to the flooding conditions SKC had also been noticing high moisture conditions in some of the building on campus. In the summer of 2011 the staff at SKC began to notice mold conditions in a few buildings. They begin an evaluation of the severity of the mold condition. Samples of mold were sent to a lab for testing. The staff decided to have the student housing units tested at the same time. It was then that they discovered that there was a significant mold problem in the student housing units. Once the officials at SKC learned of the mold severity they moved the students out of the housing units and placed them in alternative housing. At the same time that the mold condition was being discovered by the staff a few students were getting sick.

The SKC student housing units were built in about 1994/1995. The units were built as energy efficient units. However during the mold investigations it was discovered that the wood walls of the units were built on the inside of the cement "foundation" walls, which apparently are not foundation walls at all. This fact coupled with the high water table has, over the years, caused significant mold conditions and rotting of some of the wood walls that are in the ground, not on top of a cement foundation wall. During the assessment process SKC learned that for their situation the humidity levels in the housing units should be no more than 10 times the surrounding outside air. The actual humidity levels in some of the housing units were 30–50 times the recommended levels.

Testing led to further analysis and a determination that the mold condition had to be cleaned up. SKC had to engage a contractor to help with remediation. The process is costing the school thousands of dollars and at the same time the school is being hit with an even larger expense associated with the remediation of the groundwater from campus buildings. At least one building has had groundwater in its basement most of the summer. In this building it was discovered that, when built, only part of the basement floor, the center part, was finished with cement. The ends were left exposed to the dirt. When the ground water levels came up this summer, continuing into the fall, the basement began to fill with water. The school has been pumping water at great expense since the start of the problem in August. This building also houses the school's IT operations and many of the electrical units for this building are located in the basement. This has caused severe stress on the staff and the budget.

EJ/VPs Affected

Salish Kootenai College student housing has low income, Native American students, many with families. The families include children and in some cases elder members of the family. A facility like SKC, which is one of the best Tribal Colleges in the nation, attracts Indian and non-Indian students from all around the country. Because it is a Tribal College, it is relatively low-cost, attracting relatively low-income students.

Needed Technologies

An SKC official who is working to resolve the problems gave a good assessment of the processes that they have had to go through, that they are going through, and that they anticipate.

Monitoring and Analysis

One suggestion that came out of this process was the need for humidity sensors. With the potential for mold in campus building and student housing, in an environment that may be conducive to mold, monitoring could be beneficial. If it is made simple and inexpensive it could be useful in households with similar potential problems.

SKC has had to pay for expensive and time-consuming testing. The school is considering how they may use their on-campus environmental lab to assist with the testing in the future. They believe that they will need to do ongoing monitoring and testing as long as there is a potential problem. The problem is the expense of such testing. A normal household will not have the ability to afford it. One suggestion is a community-based approach to such testing such that a Tribe, county, city, state or federal program provides testing at the local level. Alternatively, it was suggested that a simple and inexpensive (or free) test kit might be useful at the school and in households to assist in identifying the problem. Maybe a test kit could be coupled with some kind if humidity sensor calibrated to a specific setting would provide the monitoring and analysis tools needed at the household scale.

Data Management and Communication

Gathering data was critical to people living in student housing and students and staff in the class rooms. Data analysis gave SKC the ability to provide accurate information to students, staff and the public who might be concerned. Part of the process included learning about the various kinds of mold and how some are harmful and how some are not and how to communicate that information. At the household scale, a family may not have the ability to fully interpret such information and will need fast, reliable and accurate sources. This again should be localized. National-level data made available on the internet may be useful for some people but it will not be useful for most people who perceive a serious, possibly health-threatening situation. They will want to rely on local sources of information. In the absence of a community based solution, one suggestion that came out of this discussion was a hotline that someone can call to get fast, accurate and reliable information or suggestions for what to do, much like a poison hotline. Of course this could be applied to a variety of indoor air quality problems.

Mitigation and Remediation

Mitigation and remediation begins with proper analysis. If the problem is properly and accurately identified then the proper techniques and methods can be identified. If the analysis shows that the particular mold is not a threat then, quite possibly, little or no mitigation or remediation would be needed. On the other hand if the analysis shows a more dangerous mold then more specific methods can be used.

In this example SKC hired a contractor to clean the mold that had grown in the housing units and in the other campus buildings. They also have installed or they are planning on installing ventilation fans and air purifiers in the housing units. They are looking at replacing some of the material that the mold is growing on because some of the material is found to be a good source of food for mold. Humidity and food sources are key elements that must be considered.

In a household setting, most families in an EJ/VP community will not be able to afford expensive contractors. Education about how to avoid mold growth and how to deal with it once it is found will be critical. There is information, for example, on EPA web sites but a community based approach could be more affective in addressing local issues. Also in the absence of a community based approach, households will need to have access to inexpensive methods to mitigate or remediate for mold, and at the very least they need access to accurate and reliable information that can be easily applied to their particular circumstance.

LESSONS LEARNED

SKC has learned that proper construction techniques are critical in helping to avoid the conditions for mold growth. Prevention should be added to the list of categorical conditions. Building contractors should be concerned with such conditions and advise clients on proper construction techniques to avoid the problem.

All activities associated with managing mold or other indoor air quality scenario begins with accurate data and the ability to understand it. Detection and analysis contribute to a final solution. Proper solution methods depend on knowing exactly what kind of problem is at hand. For most EJ/VP communities, much of the process is cost prohibitive. These communities need access to local sources for monitoring, analysis, mitigation, and remediation. In the absence of local assistance each household needs access to inexpensive tools and information that can assist them in all phases.