

ORD Recent Research Accomplishments

Highlights for the Science Advisory Board

2/27/2012

Air, Climate and Energy

- **Exposure to low concentrations of ozone** – EPA scientists found that low levels of ozone (<0.06 ppm) produced pulmonary responses in healthy young adults – this research will support future revisions to the ozone NAAQS.
- **Tested emissions for clean cookstoves** – EPA completed extensive emissions testing of 44 combinations of stoves, fuels and operating conditions. Results are being used by federal and private sector partners to select stoves for field trials and to improve testing methods.
- **New version of air quality modeling system** – In 2011, EPA released a new version of the Community Multiscale Air Quality model (CMAQ), used by EPA, states, and more than 50 countries to design emission control strategies to reduce air pollutants and protect public health. These improvements provide more accurate forecasts that reflect multipollutant interactions with weather.
- **Study of air pollution and the retina** – The joint EPA/NIH Multiethnic Study of Atherosclerosis – Air has found that air pollution is associated with changes in the fine blood vessels (the microvasculature) of the retina. These findings help explain how air pollution may be increasing cardiovascular disease risks by changes to the body's microvasculature that impair blood flow through the heart and brain.
- **New GIS-based web tool available online -- Integrated Climate and Land Use Scenarios (ICLUS)** – This web tool provides projections of county-level population and housing density to the year 2100 that have never been done before for the conterminous US. It provides maps showing changes in settlement patterns and consequent landscape effects. Projections use different combinations of assumptions, consistent with those used by the Intergovernmental Panel on Climate Change. ICLUS data have been used by EPA's Air office in its air quality benefits model; EPA's Water office as input to its stormwater runoff modeling; the National Climate Assessment to estimate combined effects of climate and land use changes; USGS as input to comprehensive land change modeling; the state of California to estimate changes in wildfire risk; and academic researchers for various analyses.

Safe and Sustainable Water Resources (SSWR)

- **Research on green infrastructure** – Unique application of advances in water infrastructure research helped resolve numerous Clean Water Act violations related to stormwater run-off and septic overflows in Cleveland by incorporating green infrastructure along with the use of gray infrastructure into a consent decree. Collaboration among EPA (Region 5, OW, OECA, and ORD),

the Courts, the City of Cleveland and others led to this innovative solution. This experience serves as a model for EPA's approach in working with other municipalities.

- **Waters of the United States Technical Support Document** - Developed science synthesis report (now in peer review) that informs agency guidance on waters protected under the Clean Water Act and will inform future rule making activities.
- **Effects of mountaintop mining on aquatic ecosystems** – Final report informed development of Agency guidance on Appalachian surface coal mining operations and assisted Regional Offices with local permitting decisions.
- **Healthy watershed integrated assessments workshop** – Proceedings published, which advanced the state of the science on conducting watershed assessments, and the role of green infrastructure in maintaining watershed health and resilience.
- **Partnership with Army on “Net Zero”** – EPA signed an MOU with the Army to provide assistance in developing and demonstrating innovative water technologies to help accomplish the Army's goal of “net zero” water, energy, and waste on 20 Army bases by 2020.
- **Partnership with DOI, DOE on multiagency collaboration on unconventional oil and gas research** – Partnership to enable the potential energy and economic benefits derived from unconventional oil and gas resources, while ensuring its safe and responsible development by reducing potential water quality impacts and reducing human and environmental risk.
- **Integrated public health evaluation of pathogens** – Developed methods to measure the exposure of humans to waterborne pathogens from source waters and drinking water.
- **PAHs from coal-tar based parking lot sealants** – In response to Congressional inquiry, a preliminary evaluation of the potential risks to human and ecological health of PAHs originating from parking lot sealants was developed and published.
- **Award of 3 STAR grants to minority academic institutions** – Development of new technologies to allow small, public water systems to control chemical contaminants in their drinking water sources and systems.

Sustainable and Healthy Communities

- **Cleaning up contaminated sites**
 - Technical support provided to more than 100 sites in all ten Regions in 2010; shown to save costs and improve the technical quality of cleanups.
 - Developed less expensive methods to test the bioavailability of lead and arsenic in soil; bioavailability is a critical factor affecting cleanup level and cost.

- **Community Focused Exposure and Risk Screening Tool (C-FERST)** – this web-based geospatial tool was successfully used in 3 case studies to assess community health risks and disproportionate impacts. Additional related tools are in development.
- **Advancing knowledge needed for strategic management of the nitrogen cascade** – Article published in Ecology Letters (Aug. 2011) that presents a framework for explicit accounting of effects of the nitrogen cascade on multiple ecosystem services, thus providing decision-makers an integrated view of N sources, damages, and abatement costs in order to better address the significant challenges associated with reducing N pollution.
- **Prenatal exposure to organophosphate pesticides associated with IQ deficits** – Three independent investigations (from three NIEHS/EPA STAR Children’s Centers) reached similar conclusions on IQ deficits in school-age children, finding some evidence of an association between organophosphate exposures in utero and negative impacts on intelligence and mental development at ~7 years. This finding is being considered by EPA’s Office of Pesticide Programs in its risk assessment for chlorpyrifos.
- **Ecosystem services and the built environment** – High-resolution land classification for Durham will enable estimation of energy use, air pollutants filtered by vegetation, and vulnerability to heat island effects; can also identify where vegetation can reduce energy costs and improve health benefits. Similar classifications now in progress for transfer to other communities.
- **“Urban” Atlas for Sustainability** – received input for selecting communities (rural, urban, or Tribal) that could benefit from receiving high-resolution data and tools for analysis.

Chemical Safety for Sustainability (CSS)

- **Developed new more efficient testing methods to screen and prioritize chemicals** – EPA screened over 1,000 chemicals in over 500 different rapid, automated toxicity tests (high-throughput assays) relevant to human health. Researchers compared assay data results to animal toxicity data to develop predictive models for reproductive and developmental toxicity. These developed models can be used to predict the potential for chemicals to lead to these two types of toxicity.
- **Advanced exposure science:** EPA developed a biomonitoring research framework based upon a tiered approach to the source-to-outcome paradigm (Sobus et al., 2011) to improve biomarker use and interpretation (Tan et al., 2011) in support of exposure and risk assessments. Also, ExpoCast, a new program aimed at developing novel approaches and metrics to screen and evaluate chemicals based on the potential for human exposures, was introduced (Cohen Hubal, et al., 2010) to serve as a companion for computational toxicology tools focused on hazard identification. Together, these activities constitute a strategy for ORD to utilize 21st century data, tools, and models to improve human exposure characterization for health risk assessment.

- **Research on the ecological effects and fate and transport of nanomaterials**
 - Completion of study assessing impact of nano Ce-doped diesel emission on a local airshed.
 - Provided studies in support of program office decisions regarding the registration of products containing silver nanoparticles.
 - Provided results on utilization of bimetallic nanomaterials for the in situ treatment of PCBs.

- **Improved Agency risk assessment tools**
 - EPA will deliver (FY12Q3) updated versions of probabilistic exposure and dose model (SHEDS) to EPA's Office of Chemical Safety and Pollution Prevention for use in ongoing risk assessments to estimate residential and dietary exposure.
 - NexGen Risk Assessment Program identified challenges and advantages in incorporating Tox21 methods and data into the risk assessment paradigm through public engagement with stakeholders. The NexGen Risk Assessment Program identified possible prototypes to use as pilots for incorporated toxicity testing in the 21st century methods into health assessments. Prototype health assessments include assessing chemicals for potential respiratory toxicity, endocrine disruption and cancer.
 - Comprehensive Environmental Assessment (CEA) identified targeted research to inform future risk assessments of nanoscale titanium dioxide used in sunscreen or water treatment.

- **Released two Request for Applications for Science to Achieve Results (STAR) awards**
 - Centers for Material Life Cycle Safety will study the life cycle of chemicals (from production to disposal) towards materials development by applying sustainability principles for chemistry and engineering across all stages of the life cycle.
 - Centers for Sustainable Molecular Design will focus on researching which chemical properties cause adverse impacts and results will help design safer chemicals without those properties.

Human Health Risk Assessment (HHRA)

- **IRIS chemical assessments**
 - Since new the IRIS process was instituted in 2009, EPA has completed 24 assessments, including major complex assessments TCE-(trichloroethylene), dichloromethane (methylene chloride), PERC- perchloroethylene/tetrachloroethylene, and dioxin.

- In FY11, EPA released seven assessments (Methanol (non-cancer), Acrylonitrile, Libby Amphibole Asbestos, Biphenyl, n-Butanol, Vanadium Pentoxide, 1, 4-Dioxane (inhalation)) for public comment and external peer review. Other assessments are at various stages of development in the new IRIS process and being revised in response to NAS recommendations.
- **Integrated Science Assessments (ISAs) support National Ambient Air Quality Standards**
 - **Lead** (critical effects are: neurodevelopmental effects, effects on aquatic and terrestrial ecosystems) final expected to be posted late in FY12.
 - **Ozone** (critical effects are: mortality and respiratory effects; reduced crop growth and visible foliar injury) final expected to be posted in early FY13.
 - Developed a Multipollutant Assessment Plan for criteria pollutants which will be reviewed by CASAC.
- **Community Risk and Technical Support (CRTS)**
 - **Final Exposure Factors Handbook** posted on website for use by programs and regions in assessing exposure in FY11.
 - **Provisional Peer Reviewed Toxicity Values (PPRTVs)** 63 chemicals updated in FY2011.
- **Modernization of risk assessment methods, models and approaches**
 - **HERO** – Health and Environmental Research Online database expanded beyond ISAs to include IRIS and PPRTVs, increasing the transparency of data used to develop the assessments.
 - Continued efforts to respond to recommendations of NAS to increase efficiency, transparency and scientific rigor (e.g., Science and Decisions, Cumulative risk for phthalates).

Homeland Security (HS)

- **HS supported EPA Office of Water's Water Security Initiative** – EPA sensor testing results and detection tools enhanced contamination warning systems at five pilot cities.
- **HS partnered with DHS, CDC, and DOE on Bio Response Operational and Testing and Evaluation (BOTE)** – EPA field study demonstrated cleanup of anthrax contaminated building.
- **HS developed *Selected Analytical Methods*** – EPA compendium of methods to analyze environmental samples of chemical, biological and radiological agents supports EPA laboratory network.

- **HS researchers developed health-based Provisional Advisory Levels** – EPA PALs quantify the risk of exposure to chemicals over acute, intermediate and longer term time periods.
- **HS products received R&D 100 Awards** – EPA’s mobile water sample concentrator and CANARY event detection software tool were recognized by R&D Magazine as among the 100 most significant new technologies of 2009 and 2010.
- **HS scientists provided technical assistance to EPA Regions** – EPA advice informed the natural anthrax clean up in Danbury, CT (2007-8) and Durham, NH (2009-10), and sampling and clean up of mustard gas canisters in New Bedford, MA.