



Copyright © 2013, the Environmental Council of the States. Permission is granted for our members to copy for state government purposes.

A SAMPLING OF STATE ENVIRONMENTAL RESEARCH NEEDS

September 2013

By Matthew C. Jones, Senior Project Manager, Environmental Council of the States

EXECUTIVE SUMMARY

Faced with increasingly complex challenges and declining budgets, state environmental agencies are giving thought to their own research capacity and how their federal counterpart – the U.S. Environmental Protection Agency (EPA) – might bridge the gap on their research needs. Over the course of five months, the Environmental Council of the States (ECOS) solicited input from a cross-section of its members in order to determine their needs for future environmental research. The environmental directors of several states were asked to detail their agencies' existing laboratory capacity and recent research accomplishments. ECOS members and their staff provided detailed responses for publication in this report.

ECOS members also were asked to identify which research products recently provided by EPA have proven most useful for better informing their decision-making in protecting public health and the environment. In addition, respondents were asked to assess whether EPA's laboratory complex appears "right-sized," or whether the various labs should be consolidated to avoid duplication of effort or eliminate unnecessary research programs.

This report provides some insights regarding whether current state and federal programs are satisfying the environmental research needs of the nation, and how such programs could be improved in the future.

TABLE OF CONTENTS

Executive Summary.....	1
Trends and Recurring Themes.....	2
Introduction.....	7
Methodology.....	9
Case Studies.....	12
Colorado.....	12
Massachusetts.....	12
Missouri.....	23
Nebraska.....	30
Vermont.....	37
Washington.....	41
Wisconsin.....	44
Appendix- Questionnaire for ECOS Members.....	63

Trends and Recurring Themes

State Research

In the following case studies, respondents describe a myriad of environmental research initiatives conducted or planned to be undertaken by states in the near future.

One major area of crossover interest and ongoing study is the task of gaining more data to better inform toxicological standards for chemical substances. This includes various emerging contaminants, with a great deal of interest focused on pharmaceuticals and personal care products (PPCPs). A related area includes study on the effectiveness of septic systems for treating PPCPs.

States have performed or are currently undertaking work in a diversity of other areas, including focused studies for finding innovative methods to better manage mercury pollution and to assess and mitigate the impacts of wind turbines.

Much applied research is conducted to better understand the mechanisms of air pollution. In some states, extensive monitoring of air pollution and quality of water bodies occurs on a continuous basis. Examination of pollution impacts on wildlife resources also is conducted, with much work being pursued in this field by Wisconsin.

Some work has been undertaken to better understand the toxic risks of blue-green algae in Nebraska and to find ways to prevent and mitigate those impacts.

The State of Washington recently has conducted work to assess toxic loadings to the Puget Sound and to monitor mercury pollution. The state also conducts testing of various products for toxics content.

State Lab Resources

The scale of laboratory capacity and capabilities of the various respondent states is wide-ranging. Some states enjoy access to vast environmental laboratory facilities. For example, Massachusetts is reaping the benefits of a recent multimillion-dollar upgrade to its environmental lab. Wisconsin has an extensive environmental research program, and the Wisconsin Department of Natural Resources has access to significant laboratory capabilities, including biological, chemical, environmental, industrial hygiene, and fish and wildlife testing facilities.

However, other states are not so flush with laboratory capacity. In August 2011, Vermont's environmental laboratory was destroyed by flooding associated with Hurricane Irene. The state's environmental lab is now co-located with the Vermont Agency of Agriculture's lab at the University of Vermont. The state has encountered challenges in finding sufficient resources to build a new environmental lab and fix broken equipment.

A general theme expressed by many respondents is that grants and other financial resources to support research studies available to states appear to be shrinking.

States express worry that they will not be able to conduct all the environmental research needed without securing outside assistance, including federal grant support. EPA's Office of Research and Development (ORD) will be looked to for assisting states in meeting the environmental research needs of the nation.

Contracts and Collaborations

Numerous examples of contractual and collaborative environmental research works pursued by states are outlined in the following case studies. According to respondents, it appears that states most often coordinate environmental research work with local universities; private labs; and other state and federal environmental, geological, public health, and wildlife resource agencies. Collaborators frequently mentioned include EPA/ORD, the U.S. Geological Survey (USGS), the U.S. Fish and Wildlife Service, and public universities.

States indicate that they are conducting extensive work to assess water quality and pollution impacts to wildlife and other ecological resources.

In terms of collaborations with outside groups for gaining new data to inform adoption of new environmental technologies, frequent partners include EPA's Environmental Technology Verification (ETV) program and ECOS' Interstate Technology and Regulatory Council (ITRC). Unfortunately, by the end of this year, it is forecast that the ETV program will no longer receive funding or in-kind support from EPA or related industries and is expected to therefore cease operations. According to EPA's website, the program was designed to eventually become self-supporting; the program was not intended to continuously require EPA funding or in-kind support. EPA base funding for the program ceased in 2006. In 2007, ETV activities were funded by vendors and collaborators, with EPA providing only in-kind technical support, quality assurance, program evaluation, and outreach. There remain only a few scattered ETV projects scheduled to wrap up by the end of 2013. The program is expected to end at that time. More information on the ETV program is available here: <http://www.epa.gov/etv/>

ITRC enjoys widespread support from ECOS members, and the organization is seen as an ideal vehicle for reviewing new technologies to determine their effectiveness; for determining how new technologies can be integrated into state and federal environmental programming; and for exploring new solutions to environmental protection problems. In August 2012, ECOS members issued Resolution #03-11, which provides an explicit endorsement of ITRC as an important mechanism for gaining regulatory acceptance of innovative technologies.*

Research Interests

As previously mentioned, one major area of crossover interest is the task of gaining more data to better inform toxicological standards and appropriate management practices for chemical substances, including emerging contaminants, flame retardants, lead (Pb), mercury (Hg), PPCPs, PCBs, and other persistent bio-accumulative toxins (PBTs).

Another area of interest broadly shared by respondents is for research that better informs assessment and prevention/treatment of nutrient loadings and nonpoint source pollution impacts to water bodies and water resources.

* "ECOS Resolution 03-11: State Support of the Interstate Technology & Regulatory Council (ITRC)." Environmental Council of the States. Aug. 2012. Available at: <http://ecos.org/section/policy/resolution>

States express interest in further work being conducted to advance groundwater remediation strategies and to better understand and mitigate vapor intrusion.

General interest is expressed in finding testing methods that are quicker and speed up the waiting period for results. Developing quicker polymerase chain reactions and rapid tests for bacteria are two areas of shared interest expressed.

A number of state respondents also express an interest in studies which might result in Green Chemistry advances in finding more benign chemical product substitutes.

EPA Research

Several respondents describe feeling a bit overwhelmed when they sifted through the vast body of research published on EPA's Scientific Inventory website.

Many respondents express appreciation for the focus on emerging contaminants, nanomaterials, and endocrine disruptors taken on the part of EPA's Chemical Safety for Sustainability program.

EPA's CompTox, ToxCast, and IRIS programs are all identified as particularly useful by a number of state respondents. These programs are identified as valuable for helping to prioritize and assess the public health impacts of chemical substances. Many state respondents would like to see these programs receive additional funding and complete more and more chemical investigations more quickly in the future.

Many respondents express an interest in gaining additional opportunities to interact with officials from ORD and the agency's Office of Chemical Safety and Pollution Prevention (OCSPP) to learn more about the key findings of environmental research studies recently completed by EPA.

EPA Laboratories

Most respondents feel that they are not yet ready to provide informed commentary regarding whether EPA's laboratory complex is "right-sized" for effectively and efficiently satisfying the environmental research needs of the nation. But a few common themes emerged on this question:

State respondents generally acknowledge that there may be an opportunity to achieve efficiencies with EPA's laboratory complex if changes are made. However, they say EPA should continue to involve states in their laboratory review process and should

consult with host states/regions regarding any lab consolidations being considered. Respondents emphasize the importance of EPA being able to maintain adequate laboratory capacity for satisfying the myriad needs of states within the different geographic regions in the country.

The potential loss of key expert scientists and investigative staff should be seriously considered.

Any consolidation of federal lab capacity may result in additional responsibilities being pushed to the state level. Many states cite budgetary concerns and note that they will not be able to take on additional research responsibilities without being able to secure additional funding from outside groups or the federal government.

State-Federal Consultation

Due to current economic and budgetary constraints, many states express concern that they will not be able to pursue the research needed to better inform their decision-making regarding environmental and public health protection. Many respondents indicate their interest in gaining more opportunity to exchange information with ORD so that the office's plans and programming might be better focused to address state priorities in the future.

ECOS is already aware that ORD periodically conducts webinars to share information with the states regarding planned or recently completed research studies. For example, in January 2013, ORD held a webinar for states to share information about its ongoing study to assess the potential impacts of hydraulic fracturing on drinking water resources.

Before ECOS and its research arm, the Environmental Research Institute of the States (ERIS), reached out to ORD, it appears that states did not interact a great deal with ORD unless specific problems emerged upon which individual states sought ORD focus.

Respondents recommend continued and improved communication between ECOS and EPA in the future to ensure ORD's research will be focused on state priorities. A number of respondents suggest that an annual conference on state-federal environmental research be held. Considering current resource limitations, however, such a conference may not be affordable. So, it may be desirable for ECOS and ERIS to continue to hold periodic conference calls with ORD. Likewise, ORD may find it useful to continue holding periodic calls and webinars with ECOS and ERIS to exchange information on research plans and results. Respondents agree that leadership from other state environmental associations, such as the Association of State and Territorial Solid Waste Management

Officials (ASTSWMO), should also be allowed to participate in such events, as well as officials from other federal agencies, such as USGS, when appropriate.

INTRODUCTION

The Environmental Council of the States (ECOS) is the national nonprofit, nonpartisan association of state and territorial environmental agency directors.

In 2001, ECOS issued a charter creating a Cross-Media Committee to better address pollution issues that cut across multiple environmental media (air, water, and solid waste), and to serve as a clearinghouse of information for sharing innovative approaches developed by the states and EPA for more effectively and efficiently protecting human health and the environment.

Since that time, the committee has increasingly focused on toxics and chemicals management issues, with special attention on mercury and cleanup of hazardous and radiological wastes at federal facilities and other contaminated sites.

Beginning in 2008, ECOS leadership informally expanded the committee's focus to encompass contaminants of emerging concern (emerging contaminants), including endocrine disruptors and nanoscale materials (nanomaterials). The committee issued a report on emerging contaminants in January 2010.[†] Among other things, the report provided a preliminary set of recommendations on how the federal government should work with the states in the future to expand research efforts and facilitate data-sharing on the potential risks of emerging contaminants.

Over the past few years, ECOS has issued several policy resolutions supporting the notion that additional research should be conducted so that the risks posed by emerging contaminants and other chemical substances can be better understood:

<http://ecos.org/section/policy/resolution>.

Other national associations have taken similar positions. The Association of Public Health Laboratories (APHL) issued a new policy position in December 2012 recommending that labs begin testing for an increased number of emerging contaminants in drinking water.[‡]

[†] "State Experiences with Emerging Contaminants: Recommendations for Federal Action." Jan. 2010. Jones, Matthew C. and Beth Graves. Environmental Council of the States. Available: http://www.ecos.org/files/3959_file_January_2010_ECOS_Green_Report.pdf

[‡] "APHL Position/Policy Statement: Additional Drinking Water Contaminant Monitoring Essential for a Healthy Public." Association of Public Health Laboratories. Dec. 2012. Available at: <http://www.aphl.org/policy/positions/Pages/default.aspx>

In a parallel effort, the Environmental Research Institute of the States (ERIS) has engaged over the past few years with ORD to learn more about how the office's research can support the broad range of work undertaken by ECOS members. ERIS is the 501(c)(3) nonprofit that coordinates education and research initiatives which support the interests of ECOS members. The ERIS Board includes the membership of current and former ECOS members.

For some time, ERIS had been receiving occasional suggestions of problems facing the states for which ORD research might illuminate solutions. For example, PCBs have been appearing in caulking material used for building construction and maintenance of schools and other infrastructure. Not all caulking material contains PCBs, but it appears that a significant amount has been included in many caulking products based on the discovery of its widespread presence in many buildings. More information gleaned from new ORD research might provide an obvious method for addressing this matter. Similarly, states have expressed increasing interest in finding ways to use Green Infrastructure (green roofs, rain gardens, permeable road cover, riparian buffers, etc.) for better protecting water quality from runoff pollution, lessening the occurrence of sewer overflows, and providing wildlife habitat and other benefits.[§] ECOS has expressed that further research and advances in the field of Green Infrastructure may provide more effective options for policy-makers to address such costly water quality problems.**

Conversely, ERIS has been actively collecting suggestions from ECOS members on how state and federal environmental research can be better coordinated in the future. Board members of ERIS have recently been in communication with ECOS members and ORD leadership in an ongoing effort to determine the appropriate level of interaction between ECOS and ORD. The recommendations of the Cross-Media Committee and ECOS' other standing committees have been solicited to inform this effort.

ORD hosted ERIS members on a visit to their facilities in Research Triangle Park in North Carolina in the summer of 2011, and to their offices in Cincinnati, Ohio in August 2012. These visits afforded ERIS members an opportunity to learn more about the facilities' activities and capabilities.

With the aim of bolstering state-federal consultation and collaboration in these areas, in September 2011, EPA agreed to work with ECOS to establish the *State-EPA Partnership on Sustainability and Chemical Safety* through Cooperative Agreement #X5-83395401-5. This partnership is supported by grants from EPA's Office of Research and Development (ORD) and the Office of Chemical Safety and Pollution Prevention (OCSPP).

[§] "ECOS Resolution 07-10: Supporting Green Infrastructure." Environmental Council of the States. Aug. 2010. Available at: <http://ecos.org/section/policy/resolution>

** "ECOS Resolution 09-8: Advancing Green Infrastructure, Energy Efficiency and Clean Energy Production Through Wastewater and Drinking Water Facilities." Environmental Council of the States. Aug. 2012. Available at: <http://ecos.org/section/policy/resolution>

As part of this effort, ECOS agreed to assist several state environmental agencies in reviewing the components of EPA's new research plans as outlined on the agency's "Research for the 21st Century" webpage available at: <http://www.epa.gov/ord>.

ECOS proposed to draft a report identifying how EPA's planned research related to chemicals might advance the objectives articulated in ECOS' 2010 report on emerging contaminants, and how EPA's research might advance progress in other areas of interest to ECOS, including sustainability, chemicals management, life-cycle analysis, and green chemistry. The report would also provide ideas and suggestions for how states can better coordinate state environmental research programs with those at the federal level so as to preclude duplication of effort and waste of limited resources. The report would highlight some of the valuable work in "applied research" that has already been conducted by state and federal agencies, and offer recommendations on how the scope of research programs could be expanded in the future to address state priorities.

This report is the product of that effort, and took approximately one year to develop.

The primary audience of this report is ECOS' members and their staff, but secondary audiences include EPA, other state and federal agencies, academia, and the general public.

Special thanks goes to ORD and OCSPP for providing grant support for this project.

METHODOLOGY

In July 2012, Cross-Media Committee members began meeting to discuss a methodology for developing this report. Participation would be open to any ECOS and ERIS members. It was determined that a workgroup of several committee members would join ECOS staff to do the lion's share of work on the project. ECOS staff developed a questionnaire (see Appendix of this report) to solicit specific input from workgroup members. Additional volunteers were solicited in August 2012. Eventually, seven (7) states decided to contribute heavily to the project and provide information to be profiled in case studies contained in this report. Additional case studies were not prepared for this report so as to remain in compliance with the federal Paperwork Reduction Act.

Members decided to focus their review on specific portions of ORD's research program most relevant to their areas of interest, including the Chemical Safety for Sustainability (CSS) and Human Health Risk Assessment (HHRA) programs.

In August 2012, ORD official Ramona Trovato met with ECOS members during the Cross-Media Committee plenary to provide an update on ORD plans and programming, and to hear about progress being made in developing this report. Ms. Trovato expressed an interest in maintaining a continuing dialogue with ECOS to best determine which research, technologies, and tools need to be developed to help meet the nation's environmental protection needs.

Also during this meeting, EPA Deputy Administrator Bob Perciasepe mentioned the agency's ongoing effort to review its laboratory infrastructure to see whether it is "right-sized" for effectively and efficiently addressing the environmental research needs of the nation. Members of Congress have asked EPA to investigate this matter, and the Government Accountability Office (GAO) has also issued recommendations to this effect in recent reports^{††}.^{‡‡}

At the August 2012 meeting, Mr. Perciasepe noted that EPA is open to considering ways to eliminate redundancies and promote better communication between state and federal laboratories regarding the work each is doing. Mr. Perciasepe solicited the input of ECOS members into this process.

In response to this solicitation, this report makes an initial attempt on the part of ECOS to collect state comments regarding whether EPA's laboratory complex is appropriately sized. Input is reflected in the case studies that follow.

In order to provide additional information in this area, the case studies also detail the laboratory capacity and capabilities (or lack thereof) of respondent state environmental agencies.^{§§} It also highlights examples of contracts and collaborations undertaken between state environmental agencies and other outside groups, such as private laboratories and universities, for pursuing needed research.

Workgroup members continued holding regular conference calls in August 2012 and subsequent months to work on this paper in earnest. Several conference calls were held to expedite the necessary work. ERIS was continuously kept apprised of the progress of drafting this report.

In March 2013, Ms. Trovato joined ERIS and Cross-Media Committee leadership again by conference call to further discuss possible methods for improving communication between ORD and the states. And in May 2013, ERIS members were invited to tour ORD's facilities in Las Vegas, Nevada, including their mobile radiation emergency response unit.

^{††} "Opportunities to Reduce Duplication, Overlap and Fragmentation, Achieve Savings, and Enhance Revenue." Government Accountability Office. Feb. 2012. Available at: <http://www.gao.gov/products/GAO-12-342SP>

^{‡‡} "To Better Fulfill Its Mission, EPA Needs a More Coordinated Approach to Managing Its Laboratories." Government Accountability Office. July 2011. Available at: <http://www.gao.gov/products/GAO-11-347>

^{§§} Additional information on the laboratory capacity of state environmental agencies can be found in a separate report previously published jointly by ECOS and the Association of Public Health Laboratories (APHL): "What Your Environmental Laboratory Can Do For You." Megan Weil Latshaw. May 2011. Available at: http://www.ecos.org/files/4479_file_May_2011_Green_Report.doc

Ms. Trovato subsequently joined ECOS and ERIS for more consultations in September during the 2013 ECOS Annual Meeting.

This report tells the story of some of the environmental problems facing the states and the innovative approaches and new research that has been conducted by state and federal environmental agencies (and their collaborators) in order to solve these problems.

This report also highlights numerous problem areas which respondent states have heretofore been unable to adequately address. It also provides recommendations from respondents for how EPA might pursue new research in order to illuminate solutions to these problems.

Prior to responding to ECOS' questionnaire, participants were asked to review ORD's published studies available within EPA's searchable Science Inventory database here: <http://cfpub.epa.gov/si/>

Respondents were asked to identify which studies within the database have proven particularly useful for better informing state environmental policy-making.

The information collected through the questionnaire has been summarized and appears in narrative. Respondent states provided varying levels of detail, which is reflected in the case studies.

After compilation of the case studies, staff identified the trends and recurring themes shared between states as reflected in questionnaire responses and from workgroup discussions. These themes and trends are highlighted in the following section.

It is important to note that – in many cases – state environmental agencies pursue “applied research” instead of “basic research.” In other words, state environmental agencies will identify a problem they are facing, conduct a literature search, and then pursue a well-structured scientific study or investigation in order to better understand the problem and find a solution. Sometimes, data sampling and monitoring are also performed to inform such efforts.

Many state and federal programmatic grants are prohibited from funding basic research merely for the sake of “pure science.” But in many cases, focused studies may be supported so long as they are truly intended to be used as “applied research.” Work is pursued carefully per set guidelines so as not to violate grant conditions.

It is important to note that this report does not address many of the challenges state regulators face in adopting and implementing new technologies developed as a result of successful research. There are barriers and significant challenges in getting new technologies into everyday use. It is important to emphasize that the more these challenges are acknowledged, and the earlier in the research process that they are considered, the greater the likelihood that new technologies will be accepted and successfully utilized by state regulators.

ECOS believes that ITRC provides the appropriate process for expediting the review and acceptance of many new environmental protection technologies. ITRC secures the participation of key stakeholders (state and federal regulators, regulated industries, consultants, vendors, academia, and public interest groups) to examine new technologies, draft consensus-based guidance documents, and provide training on those documents.

This report is not intended to represent a comprehensive review of all state environmental research interests and activities. Likewise, this report should not be interpreted to be the final word on the subject. This report merely offers a sampling of state commentary regarding environmental research needs and interests; highlights achievements already made; and outlines areas where further research may yield new data that better informs the decision-making of environmental and public health agency officials. ECOS will explore whether there are opportunities for expanding and improving upon this work in the future.

CASE STUDIES

Colorado

Research Interests

In response to the questionnaire administered by ECOS, officials with the Colorado Department of Public Health and Environment (DPHE) expressed particular interest in the following two research topics.

DPHE recommends that EPA investigate which disposal methods are appropriate for safely managing radionuclides present in water treatment residuals, bio-solids, and wastes from the exploration and production of oil and natural gas (“E&P wastes”). It would be helpful if EPA could include, as part of this study, an investigation of whether land application of these materials is appropriate.

Colorado would also benefit if EPA researched additional hazardous waste listings. Few new listings have been developed over the past several years, yet many more new chemicals are developed and registered every year. There is a large backlog of new chemicals that have never been considered under the hazardous waste rubric.

Contact

More information regarding these research interests can be obtained by contacting Gary Baughman, Hazardous Materials and Waste Management Division Director (gary.baughman@state.co.us).

Massachusetts

State Research

The Massachusetts Department of Environmental Protection (MassDEP) has an active environmental research program. The department currently has a number of research programs underway. Some of these involve field or laboratory work, or both. A few examples of ongoing research include:

- **Mercury:** Research is underway or has been recently completed to assess mercury levels in fish and other biota and to evaluate temporal trends and geographic distributions in these levels. Lab, field, and data analysis are all involved.
- **Particulate Air Pollution:** A collaborative study is underway between MassDEP and the Northeast States for Coordinated Air Use Management (NESCAUM) to evaluate trends in carbon black air particulates associated with mobile sources in and around the Boston area. This work involves lab, field, and data analysis.
- **Health Impacts of Wind Turbines:** MassDEP, in collaboration with the Massachusetts Department of Public Health, convened a panel of medical and health experts to review the literature and prepare a report on the potential hazards and health impacts of wind turbines and associated noise, shadow flicker, and ice throw. The report was published in January 2012. MassDEP is currently considering the report findings towards the development of future policies on wind turbine siting.
- **Wind Turbine Noise:** MassDEP in partnership with the Massachusetts Clean Energy Center (MassCEC) is commissioning a research study on wind turbine acoustics of operational projects in Massachusetts. This study will inform a breadth of stakeholders including state agencies, local decision-makers, project developers, and the public. This study is funded by the MassCEC.
- **Toxic Chemicals Guidelines and Standards:** MassDEP's Office of Research and Standards engages in research to assess the potential risks posed by toxic chemicals in all media and to develop standards, guidelines, and methodologies to protect public health and the environment.
- **Septic System Research:** MassDEP helped establish and has supported work at the Massachusetts Alternative Septic System Test Center to assess various attributes of septic system effectiveness including system efficacy for treating pharmaceuticals and personal care products (PPCPs).
- **PPCPs in Drinking Water:** MassDEP partnered with the United States Geological Survey and EPA as part of a national study to assess raw and finished drinking water taken from the Merrimack River for more than 280 compounds including PPCPs and endocrine disrupting compounds (EDCs). MassDEP is also partnering with the University of Massachusetts-Amherst on an evaluation of PPCP and EDC levels at a number of water treatment plants. This study will provide information on the effectiveness of ozone/biofiltration in PPCP removal and provide utilities with

information on likely removals of these compounds under a broad range of water quality and treatment scenarios.

- Fecal Coliform: Polymerase chain reaction (PCR) studies are being conducted to identify the source of fecal coliform in polluted waters.

State research efforts have provided information critical to the development, optimization, and evaluation of policies, regulations, standards, and guidelines, as well as communications with the public and other stakeholders.

State Lab Resources

MassDEP operates a state-of-the art environmental laboratory, the Senator William X. Wall Experiment Station. This was the world's first research station for drinking water purification and sewage treatment and was constructed in 1887.

Throughout its history, the lab has conducted research critical to assessing and developing standards for drinking water, sewage treatment, and air pollution. From 2007 to 2009, a \$22 million expansion and upgrade of the facility was completed including the installation of state-of-the-art chemical analytical equipment and technologies. The facility now includes numerous green technologies including photovoltaic cells, rainwater recycling, stormwater management systems, green roof design, efficient new heating and ventilation systems, and "day-lighting."

The lab's Air Assessment Branch (AAB) focuses on air monitoring, special studies, quality assurance, and source monitoring. It manages 42 air quality monitoring stations located in 27 cities and towns across Massachusetts. The AAB monitors EPA's criteria air pollutants, conducts special studies (e.g. monitoring hydrocarbons and mercury, and speciating PM_{2.5} particulates), and provides up-to-the-minute air quality information to Massachusetts citizens, including ozone/smog alerts. It also determines and publishes reports on long-term trends in Massachusetts air quality; provides air monitoring expertise to all MassDEP programs; and provides air monitoring quality assurance support to the Continuous Emission Monitoring (CEM) Program and to major construction projects.

The lab's Division of Environmental Analysis (DEA) includes the state environmental reference laboratory and is also designated as the state's principal drinking water laboratory as required for delegated authority under the Safe Drinking Water Act. The Division provides technical and laboratory support to all MassDEP programs. DEA scientists analyze water, wastewater, air, soil, hazardous wastes, fish, and other samples for important environmental contaminants in support of MassDEP's resource protection, waste prevention, and waste site cleanup programs. Environmental monitoring data generated by the division are used across all MassDEP programs to: make operational and programmatic decisions; support major criminal and civil enforcement actions and investigations which result in the identification of pollution sources which may then

become the subject of regulation and/or enforcement; and measure the success and environmental impact of protection efforts.

The approximately 10,000 to 15,000 lab analyses performed by DEA annually are largely associated with enforcement cases and special environmental monitoring and research studies. The lab plays a critical role in the investigation and prosecution of environmental crimes by the MassDEP Environmental Strike Force; in water quality assessments associated with the Massachusetts Watershed Initiative; and in investigations and cleanup of hazardous waste sites and landfills. DEA is also heavily involved in the development and validation of new analytical methods that better characterize the environment and are more protective of the environment and public health. For example, the Massachusetts Volatile Petroleum Hydrocarbon (VPH) and Extractable Petroleum Hydrocarbon (EPH) Methods were developed by DEA and are now utilized by Massachusetts and numerous other states and Canadian provinces to more accurately assess petroleum-contaminated water and soil.

It is noteworthy that, in Massachusetts, the bulk of environmental samples are collected and analyzed by contractors working for those who are regulated by MassDEP. DEA does not usually analyze routine compliance monitoring samples from public water supplies and other facilities. Instead, the division certifies commercial and municipal laboratories to perform the routine compliance analyses, and focuses its own analytical capabilities on enforcement and other critical samples. The MassDEP Laboratory Certification Program for commercial and municipal environmental laboratories is part of DEA and is the largest program among the New England states. More than 160 laboratories in Massachusetts and neighboring states are certified by DEA for chemical and/or microbiological analyses of potable and/or non-potable water. Through the Laboratory Certification Program, educational outreach, and other activities, DEA plays an important role in ensuring that contractors collecting and analyzing environmental samples are producing high-quality monitoring data.

The Wall Experiment Station is funded by a combination of state funds and grants from EPA and other federal agencies.

The lab is not directly shared with officials from other Massachusetts or out-of-state agencies, but the lab does complete analyses for other Massachusetts agencies as needed. The Massachusetts Department of Labor rents space, including laboratory and personnel space, at the lab. DEA also collaborates with local universities and occasionally provides laboratory space for students to conduct a study in pursuit of a higher academic degree. The Massachusetts Department of Public Health also maintains a separate state lab focused on public health testing.

Contracts and Collaborations

MassDEP occasionally contracts out some elements of research/monitoring projects to private firms. For example, some of the fish sample collection efforts under the Massachusetts Strategic Mercury Monitoring Program have been contracted out due to

in-house staffing limitations. MassDEP also engages in collaborative efforts with academic institutions (examples include the University of Massachusetts, Boston University and Harvard University). DEA also has a contract with the Connecticut Department of Health's laboratory for support on radionuclide testing. MassDEP has also undertaken collaborative testing with the EPA Region 1 laboratory. For example, the two labs have worked together to confirm perchlorate levels in some drinking water samples.

MassDEP has collaborated with outside groups on numerous occasions to perform necessary research. In addition to the cases already highlighted for assessing particulate air pollution trends, collecting mercury in fish tissue data, and evaluating the impacts of wind turbines, MassDEP has also worked with outside groups to research alternatives to mercury-containing products.

In the past, MassDEP has also provided funding to EPA's Environmental Technology Verification (ETV) program so the group could perform some research on continuous emissions monitoring systems (CEMS) for mercury.

Massachusetts state funds in support of research have been reduced considerably in recent years. For example, state funds in support of mercury research and monitoring have been cut by approximately 70 percent over the last three years. Federal funds were secured to maintain the core elements of this effort, but looming federal cutbacks further threaten the continuation of this strategic monitoring program.

Nationwide, funding from EPA has also been reduced for a variety of research and monitoring efforts. MassDEP officials are concerned that reduced support for research and monitoring may ultimately reduce environmental agencies' abilities to gather information critical to identifying and preventing threats to public health and the environment; to make informed regulatory decisions; and to evaluate the effectiveness of efforts to protect the environment. MassDEP leadership believes that the sharing of information between agencies at the state and federal level provides synergistic benefits which allow officials to better coordinate and make cost-effective decisions, and design and implement programs.

Research Interests

The research priorities of MassDEP have varied over the years, but current issues of priority concern are as follows:

- Determining the prevalence, toxicity, and risks of emerging contaminants with a priority on persistent, bioaccumulative toxins (such as various flame retardants); nanotechnology products; and pharmaceuticals and personal care products.
- Determining approaches for assessing and addressing the potential risks associated with waste material reuse including paper and other printed materials

potentially contaminated with PCB byproducts in inks and dyes; man-made fiberglass fibers; waste pyrolysis byproducts; and wastewater.

- Gaining improved tools for lifecycle analysis— assessing cradle-to-grave impacts of products and processes to better identify environmentally preferable and sustainable options.
- Gaining improved methods, guidance, and toxicology data to assess shorter-term toxicant exposure risks to the fetus and children. Priority chemicals of concern include elemental mercury and trichloroethylene, as well as other developmental toxins.
- Obtaining methods to better assess and address nutrient loadings to water bodies, including low-cost and low energy-demand nutrient removal technologies for wastewater treatment operations.
- Obtaining better sampling/assessment technologies and methodologies for more rapid and cost effective testing of cyanobacteria and related toxins in surface waters.
- Continuing to gain better-informed assessment and mitigation techniques for addressing potential health and nuisance impacts from wind turbines.
- Continuing to learn ways to make optimal use of information and data management technologies and remote sensing to enhance program efficiencies and effectiveness.

There are additional research priorities for other agencies within the Massachusetts environmental and energy secretariat that have significant implications for clean air and climate protection. Priorities relate to the development and evaluation of low-cost, ecologically, and public health-friendly clean energy technologies for mobile and stationary applications and carbon sequestration. Toward this end, MassDEP recommends that EPA expand its collaborative work with other lead technology-development federal agencies, such as the U.S. Department of Energy, to enhance coordination and optimization of environmental and sustainability assessments of these technologies.

Developing and maintaining needed capacities at the staff, technological, and infrastructure levels, and improving efficiencies, are critical issues to MassDEP. MassDEP officials observe that, at the national and state levels, the aging workforce, together with budgetary-driven hiring freezes and reductions in workforce, as well as various impediments to recruiting highly skilled science and engineering staff (increasingly infrequent opportunities for professional development; compensation disparities vs. the private sector; etc) may jeopardize advancements in future research and environmental policy-making. Expanded federal support and opportunities for staff

training and professional development in support of state environmental programs would be helpful.

In light of scarcer resources, MassDEP officials believe that better coordination, collaboration, and communication will be critical for advancing state, federal, and academic research efforts. This will assist in identification of near-term and longer-term research priorities; aid in completing work in a more efficient manner; and ensure that research outputs provide the data needed to better inform environmental decision-making and evaluation. Efforts should seek to leverage existing projects and capacities; ensure data quality, usability, and comparability; and avoid duplication of effort. Unfortunately, current budgetary issues are limiting MassDEP efforts in these areas. Recent and looming reductions in federal support for interstate organizations as well as for scientists to participate in technical workshops, conferences, and national agenda and priority-setting efforts are negatively impacting communication, collaboration, and coordination.

Unfortunately, MassDEP officials believe that, due to current challenges, the agency will probably be unable to pursue in the near future many of the research studies deemed necessary for better informing agency policy-making. Substantial gaps appear at the national and state levels for addressing the priorities noted. With staff shortages, it is also difficult for MassDEP to respond to EPA grant opportunities.

MassDEP officials believe that opportunities should be explored for enhancing state input on what the environmental research priorities should be for ORD. And ORD should explore ways to better communicate to states their research priorities and findings, and to afford states the opportunity to better communicate to EPA what research the states have already performed or plan to perform. Expanded state-federal communication in this area would be helpful.

While ORD's work is helpful, MassDEP believes that state research and monitoring has also been very helpful for informing a variety of national, and even international, environmental issues as well.

Research priorities are not static and will vary across states and over time. Therefore, MassDEP believes that it will be key to have excellent mechanisms in place to ensure effective ongoing communications, coordination, and collaboration. And it will be key for EPA to have sufficient resources to perform the research and monitoring deemed most critical by states and EPA.

Addressing the toxicity of chemicals and pathogens should remain a priority, including exposures and risks. MassDEP believes that there is a real need for expanded and faster toxicity testing and development of guidelines to support state toxics programs. In general, before new technologies are employed, more information on the health risks they pose should be developed. An example is the use of nanotechnologies in site remediation. This research should be conducted at the national level.

Additional areas of research interest include:

- Development and evaluation of rapid testing methods, such as polymerase chain reaction-based tests for infectious agents for surface water and beach testing.
- Research into emerging diseases/infectious agents in wastewater, runoff, and other waste materials.
- Gaining improved data on approaches for reducing nonpoint source pollution impacts on water bodies is an important research area.

The study of the potential impacts of hydraulic fracturing is not a priority for Massachusetts, but officials recognize that better data on potential impacts would likely be valuable for many other states.

Regarding Green Infrastructure, this is a very broad topic, and much information already has been shared that is not being effectively implemented. MassDEP believes that this is more a matter of implementation than research.

Regarding finding ways to achieve net-zero water use, MassDEP believes that this area should include research into wastewater treatment and reuse issues pertaining to chemical contaminants, including pharmaceuticals and personal care products and other consumer and industrial products.

With regards to ultraviolet water disinfection technologies, MassDEP believes that extensive research has already been performed in this area so it is not a priority. But the impacts of treatment systems on chemical contaminants in general are less understood.

MassDEP believes that all of the following agencies/programs should be involved in coordinating the environmental research needs of the nation: EPA/ORD, DOD, SERDP, ATSDR, NOAA, and the state environmental agencies. For any specific project/issue, which groups take the lead will depend on the details and funding availability. NIOSH, OSHA, and NASA should perhaps also be involved.

Emerging Contaminants

Although some progress has been achieved in this area, the overall issues regarding emerging contaminants remain largely unresolved. Some key issues for MassDEP include: PPCPs and wastewater treatment; proper disposal of laboratory, manufacturing, and end-of-life product wastes containing nanoparticles; PBDEs in the environment; and endocrine-disrupting compounds in drinking water.

EPA Research

Within EPA's Science Inventory database, MassDEP finds particularly valuable those scientific projects and reports on the topics of mercury pollution; fate, impacts, and monitoring of PBTs; and toxicology and risk assessment.

Overall, ORD work on toxic chemicals and air pollution impacts has been of great value to MassDEP.

ORD's work has helped to advance the overall scientific knowledge base in many areas. However, the Science Inventory database provides inconsistent information regarding the projects' goals and the results or significance of the studies. MassDEP believes that having such information provided in a more consistent summary format would greatly improve accessibility and communications for EPA's research work at this site, and make the results potentially more helpful to state policy-makers and regulators.

MassDEP believes that EPA's Chemical Safety for Sustainability Strategic Research Action Plan 2012- 2016 is a comprehensive and well thought-out plan:

<http://epa.gov/research/docs/css-strap.pdf>

MassDEP appreciates the plan's focus on emerging contaminants, including endocrine disrupting chemicals and nanomaterials. Additional emphasis should be placed on efforts to address chemical exposures and risks to the fetus and children.

ORD's "ToxCast" program is very valuable for MassDEP. The program aims to develop ways to prioritize which chemicals, among the thousands that exist, most merit toxicity testing. The program also seeks to develop ways to predict the toxicity of chemicals:

<http://epa.gov/ncct/toxcast/>.

Given the huge number of potentially toxic chemicals that have not been adequately tested, and the rapid rate at which new compounds and formulations are being developed, improved tools for assessing potential impacts are needed. However, as EPA works to develop, implement, and evaluate new testing approaches, MassDEP believes that it will be important that well-established toxicity testing approaches and studies continue to be implemented.

ORD's Human Health Risk Assessment program, which includes the Integrated Risk Information System (IRIS), is very valuable for MassDEP:

<http://epa.gov/research/docs/hhra-strap.pdf>.

IRIS toxicity values are critical to state risk assessment efforts:

<http://www.epa.gov/IRIS/>.

MassDEP believes that IRIS has been fairly effective at nominating chemical compounds for upcoming reviews and assessments. But MassDEP believes that additional resources should be provided to expand the number of chemicals considered, and the pace of chemical assessments, under the IRIS program. Chemical reviews by the National Research Council (NRC), which are sometimes undertaken on controversial issues, should be improved to enhance process transparency through the inclusion of more comprehensive and clear documentation of workgroup deliberations, including non-consensus positions. MassDEP believes that EPA should not accept NRC

recommendations that reflect non-consensus positions, or are inconsistent with established EPA procedures and guidance, without independently supporting the decision.

MassDEP officials have reviewed the information regarding ORD's forthcoming National Atlas for Sustainability available at:
http://gispub6.epa.gov/projects/NATLAS_afccf43eb1f64eae56cb235db9adf7f/index.html.

At this time, it is unclear to MassDEP officials how useful the atlas will prove to be. Sustainability is critically important, but the term is so broad as to potentially limit the usefulness of guidance and assessment efforts under the rubric.

[Author's Note: Just prior to publication of this report, EPA notified ECOS and ERIS that it recently renamed this product the "EnviroAtlas." A beta test version of EnviroAtlas was recently made available to ECOS and other interested parties here: <http://www.epa.gov/research/enviroatlas/index.htm>. Individuals who wish to test-run the interface must register with the site to gain access. EPA has informed ECOS that it plans to make the service publicly available without the password requirement by December 2013. The data and information put into EnviroAtlas is specifically focused on clean air and clean and plentiful water. ECOS has been told that EPA's EnviroAtlas team recently began to work with states, local jurisdictions, and other groups to develop "use cases," which will eventually be presented in the interface to demonstrate specific uses of the data. The EnviroAtlas team is working with these groups to test the use of the service's indicators for addressing ecosystem services at meaningful scales. Due to finite resources, the team will not be able to work with every state and local jurisdiction, but EPA hopes to select enough of these jurisdictions to assist in developing "use cases" so that all other state and local communities might benefit from these examples.]

For MassDEP, ORD's forthcoming Community Focused Exposure Risk Screening Tool (C-FERST) promises to be quite valuable: <http://www.epa.gov/heads/c-ferst/>.

State agencies frequently must deal with local concerns regarding various risks. C-FERST promises to provide a valuable mechanism to assist with this work.

EPA Laboratories

MassDEP understands that EPA may be checking over the scale and capabilities of its laboratory complex to see whether it remains the proper size for satisfying the nation's environmental research priorities. EPA's laboratory complex currently encompasses a sizeable number of facilities as outlined here:
<http://www.epa.gov/aboutepa/index.html#tabsmenu=4>.

MassDEP offers the following comments regarding how EPA's lab complex might be "right-sized," and how such a process should be conducted:

- EPA should involve the states in their review process, and should consult with host states/regions regarding any lab consolidations being considered, early and often.
- MassDEP officials believe that it is important for EPA to maintain regional laboratory capacity, not only for research, but also for environmental compliance and monitoring assistance, and for disaster and homeland security issues. Any consolidation efforts should seek to maintain this capacity.
- MassDEP is concerned that consolidation could result in additional laboratory responsibilities at the state level. Massachusetts would not be able to take on additional lab responsibilities without significant additional resources being provided by the federal government or other sources.
- The potential loss of experienced scientists should be carefully considered.
- EPA's laboratory complex does not appear to be oversized at this time, but MassDEP suspects that the activities performed and the services provided could be better coordinated and leveraged nationally and regionally.

MassDEP believes that ORD (and EPA at large) needs to more effectively solicit input from states on what the environmental research priorities for ORD should be; better communicate to states ORD's research priorities and findings; better understand the research that states are performing; and play a more active role in communicating and sharing information among states and federal agencies about what research is being performed at ORD and within the individual states. In the past, mechanisms for state input on EPA's overall research agenda were sometimes rather piecemeal. States are co-regulators alongside EPA and therefore should be routinely consulted on such matters. In the past few years, ORD has made a much stronger effort to engage the state environmental agencies, and this is a promising development.

The establishment of ongoing mechanisms to more regularly elicit input from state experts on "big picture" research strategies, agendas, programs, and projects would help to improve coordination, collaboration, and communication.

If consolidations are to be considered, MassDEP believes that ORD should meet again with ECOS, in person or via conference call, in order to provide more detailed information on what activities are being conducted at their 13 office/laboratory locations. And EPA should provide ECOS additional information regarding the assessment process (criteria and timeframe to be used) and provide an ongoing mechanism for the states to provide input.

State-Federal Consultation

MassDEP believes that EPA should establish a process for better determining and coordinating the nation's research priorities, which would include the involvement of the interstate environmental organizations including ECOS, ERIS, NACAA, ASTSWMO, and others. EPA should more regularly provide information to the states, through ECOS and the other organizations, regarding the agency's research priorities and lab assessment processes, and EPA should provide – at least annually if not more frequently – updates and easy mechanisms for the states to access summary information and provide input.

MassDEP believes that EPA should better communicate to states the agency's research priorities and findings; better understand the research that states are performing; and play a more active role in communicating and sharing information among states and federal agencies about research being conducted at ORD and within the individual states. MassDEP believes that EPA engagement with the interstate associations is most appropriate for identifying the most effective method for state-federal coordination.

Contact

More information about the research activities and interests of MassDEP can be obtained by contacting C. Mark Smith, Deputy Director for the Office of Research and Standards (c.mark.smith@state.ma.us).

Missouri

State Research

The vast majority of the research conducted by the Missouri Department of Natural Resources (DNR) is applied research to measure water and air quality and determine causes of pollution, but DNR staff conducts little primary research. Most of the department staff's work combines field sampling and laboratory analysis of the samples.

State Lab Resources

DNR has an in-house laboratory. The lab is funded through a combination of dedicated state funds and state general revenue. The mix of funding for personnel is determined by the workload. Operating expenses are paid from a revolving fund that is subsequently replenished by billing per test costs back to client programs, such as the Drinking Water, Water Protection, and the Hazardous Waste programs.

Contracts and Collaborations

The agency relies heavily on outside partners to supplement DNR monitoring efforts. Some of these efforts are funded through the Department; others are independently funded.

USGS and the University of Missouri- Columbia (UMC) conduct monitoring and research useful for informing water quality assessments and standards development. In

addition to monitoring Missouri streams, USGS has provided research information regarding bacteria at the Lake of the Ozarks, and has assisted with generating draft numeric nutrient criteria for streams.

DNR's Wellhead Protection Section has contracted with private consultants to conduct water quality monitoring and stream geomorphology for recreational use attainability analyses (UAAs).

DNR is currently developing a contract with the Missouri Cooperative Fish and Wildlife Research Unit to develop reference reach habitat survey and assessment methods to aid in the agency's water classification effort.

DNR's Public Drinking Water Branch has had a long-standing partnership with the Missouri University of Science and Technology (S&T) in Rolla, Missouri. Together, they have pursued research on the occurrence and possible treatment options for newly emerging contaminants and long-term contaminants that pose compliance challenges. The research has included statewide occurrence studies and treatment options of pharmaceuticals and personal care products (PPCPs) and their degradation byproducts, nitrosamines, vinyl chloride, cyanobacterial toxins, perchlorate, and dibutyl phthalate (DBP) formation and their precursors. Sampling has included surface water systems of rivers and reservoirs. Both systems have been analyzed, and deep wells have been drilled through confining layers. Shallow wells have been drilled into unconsolidated formations. This research was conducted with the aim of gaining a well-rounded view of the occurrence of these pollutants in Missouri public water systems. Research on disinfection byproducts formation is centering on alluvial wells and the disinfection byproducts precursors that are present in alluvial wells. Alluvial wells with naturally occurring ammonia in their water chemistry are of particular concern since ammonia greatly increases chlorine demand which can lead to elevated DBPs.

Through the Clean Water Act Section 319 grant program, many local watershed groups in Missouri have conducted water quality testing. Though EPA requires a monitoring component under Section 319(h), it is noteworthy that many applicants are unable to fulfill this requirement.

Missouri has a State Health Laboratory which does some analyses similar to DNR's on bacteria and other health risks. In addition, the Missouri Department of Conservation analyzes fish and mussel tissues in support of water quality assessment.

Until recently, DNR funded four local air quality programs that collaborated with the Department in collecting air quality samples.

Many permitted facilities are required to conduct monitoring and submit those data to the Department. This supplements DNR's knowledge of environmental quality and helps the agency ensure that facilities are meeting their regulatory commitments.

Finally, Missouri has more than 4,000 Stream Teams that are active. Many of these teams have trained volunteers who conduct basic water quality sampling that can be used to assess stream health. DNR also has a Lake of Missouri Volunteer Program that conducts water quality sampling on lakes.

The Department has faced a long-term reduction in funding as a result of tighter state budgets, limited to nonexistent fee increases, and the more recent reductions in funding from EPA. This has led DNR to focus on becoming more efficient while maintaining effective protection of the environment and human health. But funding restrictions are limiting the department's ability to conduct some activities that would strengthen the scientific basis of its decision-making.

The recent economic downturn has reduced the number of applicants for some permits, compounding the budgetary challenges. As most of DNR's monitoring and research activities are paid for using federal funds, any reduction in pass-through or direct funding from EPA negatively affects the department's ability to conduct the amount of research and monitoring needed.

Research Interests

DNR officials believe that Missouri would benefit from additional studies being pursued in the following areas:

- **Chemicals:** The Department would like to see further research conducted on remediation techniques for the most common contaminants that still represent a huge cost to companies to remediate properly. A clearinghouse of data and research on chemicals that have been successfully remediated would be very useful to DNR.
- **Endocrine Disruptors:** DNR is not currently conducting research on endocrine disruptors, but the Department closely follows the research being conducted at the University of Missouri and elsewhere. DNR staff attend presentations of USGS on research they have conducted on endocrine disruptors. While the Department currently does not have lab facilities to support this research, DNR would be willing to partner with other agencies that do.
- **Nanomaterials and Hydraulic Fracturing:** DNR believes that the chemicals from hydraulic fracturing and nanomaterial manufacture/use should be identified and determined to be either listed, characteristic, or unregulated at time of disposal. EPA should take the lead on this so states do not have to develop a patchwork of regulations if a minimum national standard will suffice. However, DNR currently believes that states should retain the ability to list chemicals however they deem appropriate to protect public health and the environment based on their research and findings.

- **UV Disinfection Technology:** Missouri has a significant number of smaller communities that face difficulty in operating critical drinking water infrastructure with reasonable cost and staffing levels. Ultraviolet water disinfection technology has always been an intriguing water treatment technology but has not yet proven to be a viable option for small drinking water systems. If a treatment unit were developed that had a small footprint, was relatively inexpensive and relatively simple to operate and maintain, and provided the verified necessary inactivation of pathogens, then such a technology could fill a large void in the water industry.
- **Water Quality Standards:** DNR believes that perhaps the most universal need of all of the state environmental agencies is for new research to be performed which supports better-informed development of water quality standards. Development of proper water quality criteria and methods for assessing both lakes and streams would benefit from additional research. As a state with a pronounced geological, hydrological, and biological diversity, Missouri faces difficult challenges in creating standards that are scientifically based, defensible, and practical. As an example, it is unclear whether the 5 mg/l dissolved oxygen water quality standard should be applied to certain northern Missouri prairie streams that typically exhibit very low flows between precipitation events in the summer. Further research on this topic would best be conducted by an independent third party using a well-developed quality assurance project plan (QAPP) approved by both the department and EPA.
- **Natural Resource Damages:** Additional data on the direct effects of lead (Pb) and zinc (Zn) on mammals and birds, and the injury levels and thresholds of those species exposed to these elements, would be invaluable for Missouri. Most injury assessments are developed according to the injury. Thus, determining blood lead (Pb) levels in small mammals and birds with a correlation to a damage assessment (assessment of injury) would be helpful. DNR has already generated some helpful data and is developing additional studies and injury assessment data, but even more studies conducted on this would be helpful. This work is generally conducted in coordination with the U. S. Fish and Wildlife Service.
- **Indoor Vapor Intrusion:** The Department would benefit from further research into the dynamics of indoor vapor intrusion, which is not as mature of a field of study as others, but seems to be coming along.
- **Rapid Tests for Bacteria:** The Department currently tests for E. coli using methods that require a 24-hour incubation period. EPA's continued work on developing a rapid method for determining bacteria levels is important to DNR's efforts to protect public health and to be more responsive in responding to incidents that may pose a threat to human health.

DNR views academic institutions as an important partner and commonly works with a number of universities on projects of mutual interest.

The USGS is another valuable partner of Missouri-DNR.

The U.S. Fish and Wildlife Service is a co-trustee on Natural Resource Damages claims and the implementation of restoration activities with Missouri-DNR.

Missouri-DNR has benefitted from the work of the Ground Water and Ecosystems Restoration Division (GWERD) of EPA's National Risk Management Research Laboratory located in Ada, Oklahoma. GWERD's research findings have proven informative for DNR's efforts to address complex groundwater modeling issues in Missouri. DNR views the work of GWERD's Dr. Michael C. Brooks as invaluable in helping the Department and EPA Region VII discuss these issues with the U.S. Army. Without these resources, the state would not have readily been able to review Army proposals without hiring a contractor.

In years past, DNR has also utilized GWERD information for groundwater modeling opinions on the Weldon Spring site [maintained by the U.S. Department of Energy (DOE)] and for confirmation of our modeling results. This allowed the state to defend its position related to DOE's groundwater remediation efforts.

Emerging Contaminants

The work of Dr. Fred Vom Saal and his colleagues at the University of Missouri, and of other researchers in the field, raises serious concerns about the long-term effects of estrogen mimicking compounds and other endocrine disruptors. The challenges of determining the individual and cumulative impacts of endocrine disruptors are among the most significant for chemical exposures and human health. The knowledge gaps in this area remain significant and are hindering attempts to determine exposure levels and the resultant impacts on human health.

DNR believes that the EPA should coordinate with federal health agencies and state environmental and health agencies to assess the individual and cumulative impacts of these chemicals as a function of total exposure, exposure rates and periods, age at time of exposure, and compounding of impacts and risks. In addition, EPA should partner with USGS and the states to better determine the rates of these chemicals in rivers and lakes that provide water supplies, and to estimate likely exposure rates.

While Missouri does not face any specific issues with regards to endocrine disruptors, DNR believes this issue is of such high national importance that the department would be supportive of any work to determine concentrations, exposures and impacts.

There is an additional need for research on pharmaceuticals in water and how they affect biota. DNR would like to see more data generated on the effects of pharmaceuticals and their degradation byproducts on native species and how to reduce those effects. An assessment of the efficacy and key elements of pharmaceutical collection programs would help guide future programs implemented by states or other groups on a more local level.

DNR believes that additional research is also needed on industrial chemicals that have been documented to induce chemical sensitivities in humans. Such research may inform the argument that such chemicals should be regulated as wastes “from cradle to grave” to assure that they are not mismanaged or disposed of improperly. Determinations should be made on whether these chemicals should be added to EPA’s hazardous waste listings or as characteristic hazardous wastes. DNR officials are concerned that, as more and more chemical products are being manufactured, the regulations for safe management and waste disposal of these chemicals are not keeping pace for protecting public health. DNR believes that manufacturers should be required to conduct such testing (and EPA should be able to verify such testing) at time of manufacture, so that a waste determination may be made upfront on a chemical or product so it can safely be managed by employees at manufacturing plants and at time of disposal.

Missouri is facing issues with large computer dumps. Though DNR regulates the lead (Pb) in cathode ray tubes (CRTs), perhaps a greater hazard may be posed by the polybrominated diphenyl ethers (PBDEs) that are currently unregulated. The state offices of the USGS have performed research on this issue with rather alarming results. DNR believes that EPA should regulate PBDEs at time of manufacture and disposal as they have known and lasting health effects.

Some of Missouri’s university academics are quite active in nanomaterials research. But DNR officials feel that the Department will be entirely dependent on EPA and others to assess these materials with regards to their environmental and health risks and effects.

Another area of research needed by DNR is the effects of metals on human health, particularly those associated with lead (Pb). While much more work has been conducted in this area compared to endocrine disruptors, further work is needed to assess some of the metals associated with lead (Pb).

Another great challenge is the need to assess impacts to human health other than those tied to the more commonly assessed toxicity or cancer-related effects. Impacts on reproductive processes and the development or retardation of secondary sexual characteristics are difficult to determine and may require the development of new protocols for assessment.

EPA Research

Regarding EPA’s research plans and programming, DNR recommends that the agency pursue research studies in an expeditious fashion and select research topics with a link to the needs of state regulatory programs so that appropriate listings or identification of characteristics can be undertaken as soon as possible. Further, for the most practical and productive solutions and applications to be learned and utilized, strong communication links need to exist between EPA and state programs and organizations, such as ECOS and ASTSWMO. DNR views the recent increased communication efforts on the part of EPA and ECOS on these points as encouraging.

EPA Laboratories

DNR understands that EPA may be checking over the scale and capabilities of its laboratory complex to see whether it is the proper size for satisfying the nation's environmental research priorities.

But at this time, DNR officials do not feel sufficiently familiar with EPA's lab complex to offer informed comments regarding the appropriateness of its organization or size.

It seems appropriate, however, that a periodic review of the labs and their missions be conducted to ensure they are effective and responsive for addressing the nation's research needs.

DNR perhaps works most closely with EPA's laboratories in order to gain fish tissue analyses, so the department feels that this is an important component of EPA's services.

State-Federal Consultation

DNR encourages EPA to continue to work with the states through ECOS and other state environmental official organizations to set clear research priorities. Such an approach has multiple benefits including coordination of research efforts and the use of research results.

By directly tying research priorities to the scientific needs of state and national regulatory programs, EPA can ensure that its research arm is addressing the greatest needs of its regulatory partners. By informing states of priority studies, ORD can provide states with the opportunity to partner in those study fields by piggybacking on existing sampling and providing low-cost additional data.

A more universal research strategy may help to counter the growing trend of having regulatory priorities for both EPA and the states set through lawsuits rather than policy or science. By providing a clear research strategy tied to scientific priorities, EPA and states can show that they are addressing environmental and human health concerns through a science-driven deliberative process. DNR believes that states and EPA should not necessarily be expected to change their methods in response to every lawsuit filed.

Finally, DNR recommends that EPA serve as an important bridge between states and other federal agencies that conduct more fundamental research. While DNR has close relationships with USGS and many of its research efforts in Missouri, the department is less able to track the important work being conducted by USGS outside of Missouri – not to mention the many university and other scientists funded by the National Science Foundation and other federal agencies.

DNR suspects that few states have the ability to send their staff to scientific conferences where fundamental research is discussed given current budget constraints. Therefore, the

ability of states to learn about and utilize new research findings is severely hampered. This critical gap could be filled through a coordinated effort on the part of EPA, ECOS, and the states. Perhaps ORD could host webinars with USGS and other federal agencies that would provide a platform for transmitting the most important and applicable studies to those state experts responsible for turning science into policy.

DNR believes that ORD should consider expanding its use of webinars and other newer communication methods to enhance the office's interactions with the states. As travel is increasingly limited due to budget constraints, the ability of individuals to present new research findings through electronic media offers ORD increased opportunities to explain its results and engage with those most likely to implement those results through policy and practice. This would also provide state agency staff with the contacts needed to ask questions or seek clarification as they implement the research findings of ORD staff. An additional benefit of this approach is that states that cannot participate in the webinar can view it later if it is later transmitted or posted on the ORD website.

One final suggestion for ORD is that the office should provide a forum for states to share with others their successes in remediating certain chemicals, such as PCBs. While DNR often learns from the research findings of ORD staff, the states appear to lack a formal method for sharing practical information regarding remediation efforts.

Contact

More information on Missouri-DNR's research interests and activities may be obtained by contacting Joe Engeln, Assistant Director for Science and Technology (joe.engeln@dnr.mo.gov).

Nebraska

State Research

The Nebraska Department of Environmental Quality (NDEQ) does not have a specific research program. Each office within the Department is responsible for any research that may be initiated. The Department does not perform "research" according to the classic definition. The Department identifies an environmental or public health problem it is facing and then conducts studies or examinations with the aim of solving that problem.

In 2004, NDEQ was facing a serious public health problem with cyanobacteria, or blue-green algae. Algal blooms were a frequent occurrence during summer months in many Nebraska lakes and ponds. Unfortunately in May 2004 the algal blooms became more than just an aesthetic problem when two dogs died within hours of drinking water from a lake near Omaha. Necropsies revealed that the dog deaths were due to high concentrations of the cyanobacterial toxin Microcystin LR. In response to this news, NDEQ immediately began collaborating with other state agencies, as well as University of Nebraska – Lincoln (UNL) scientists, to monitor and inform the public of the microcystin problem. Unfortunately, by the end of the 2004 recreation season, three

more dog deaths had been reported, as well as numerous wildlife and livestock deaths, along with more than 50 accounts of human skin rashes, lesions, or gastrointestinal illnesses.

The experience from 2004 convinced NDEQ to begin weekly microcystin monitoring in Nebraska's major recreation lakes during the recreation season (May – September). NDEQ decided to use its own lab for microcystin analyses because the cost of using outside labs and time delays in getting results would limit the number of samples and not be conducive to quick public notifications. Each week, NDEQ staff use enzyme-linked immunosorbent assay test kits for microcystin to determine toxin levels. Any water sample above 20 ppb results in the issuance of a health alert on NDEQ's webpage, press releases to local news agencies, and signs posted at lakes and beaches warning of the toxic algae. In some cases, beaches may be closed for certain lengths of time due to the discovery of dangerous levels of microcystin toxins. Nebraska has even begun to see public and private interests take action to mitigate the conditions that can lead to cyanobacterial blooms.

More details on Nebraska's experience with cyanobacteria may be obtained in the report by NDEQ's Paul Brakhage here:

[http://www.deq.state.ne.us/Publications.nsf/a9f87abbcc29fa1f8625687700625436/dc50a548157633e786257590005cec58/\\$FILE/LakeLine-Cyanobacteria.pdf](http://www.deq.state.ne.us/Publications.nsf/a9f87abbcc29fa1f8625687700625436/dc50a548157633e786257590005cec58/$FILE/LakeLine-Cyanobacteria.pdf).

State Lab Resources

NDEQ has basic lab facilities primarily associated with its Water Quality Division. The lab is funded primarily with resources associated with the Clean Water Act (CWA) Section 106 program, with some support from the CWA §319 and Petroleum Remediation programs. Research is not conducted in the lab. The lab runs analyses for bacteria, microscystins, and pesticides.

The budget challenge related to NDEQ's ability to conduct research or focused studies is really no different than any of the other department functions; the activity would be listed with all others and a prioritization would occur to determine which are pursued.

Contracts and Collaborations

Typically the department relies on the review of research that has been conducted by others. In some instances, such as the blue-green algae effort, NDEQ works with the University of Nebraska to investigate issues. The blue-green algae effort involved collaboration with the University and other state agencies, primarily the Department of Health and Human Services and the Game and Parks Commission. The products from this effort were the establishment of levels of concern for exposure to toxins produced by the algae and an associated public warning system. To the best of their knowledge, NDEQ officials believe that this was the first time such an investigation had been conducted.

Another example is related to the determination of the potential threats posed by the decomposition of livestock carcasses. Burial is one of the most common disposal methods. Determining the composition of the resulting leachate is essential to understanding the impacts of mass burial. The department contracted with the University of Nebraska to construct a burial “facility” and measure and determine the composition of the leachate. To NDEQ’s knowledge, this is the first study of this type.

NDEQ officials anticipate that the department will continue to conduct focused studies in reaction to specific issues faced. If research in the classic sense is needed, NDEQ would contract with an entity to conduct the research – for example, the University of Nebraska – and would not use federal funds.

Research Interests

Nebraska-DEQ has not performed a prioritization of its research needs, but the following are some general comments for consideration.

Regarding Green Chemistry and the search for more benign chemical product alternatives, NDEQ believes that few states have the capability to conduct the needed research. While some chemicals are used on a regional basis, chemical use is best reviewed on a national scale.

NDEQ has been involved in an effort with ORD to explore possible uses of Green Infrastructure associated with stormwater in Omaha. NDEQ Director Mike Linder discussed Green Infrastructure and storm water with Ron Hammerschmidt of EPA Region 7, and discussions with ORD official Ramona Trovato followed. In response, ORD completed two site visits to Omaha and is now in the process of conducting research that will enhance green solutions to storm water issues.

ORD is assessing current proposals related to storm water, paying particular attention to infiltration issues. They may offer alternatives or modifications to existing plans in order to increase effectiveness. Omaha city officials have expressed interest in finding a way to rapidly treat stormwater for bacteria. The use of very large storage facilities for treating water is being considered. There would, however, be great advantages to a rapid treatment system that would negate the need for the storage facilities. The Omaha efforts were successfully initiated as a result of the collaboration of key leadership.

NDEQ believes that there is potential for Green Infrastructure to result in great benefits being realized by communities of all sizes. For example, it is estimated that small communities devote from 20% to as much as 60% of their energy budgets moving and treating drinking water and wastewater. Assuming energy conservation efforts are included under the Green Infrastructure rubric, the savings that result from energy conservation projects would free revenue for communities to pursue other critical projects.

NDEQ is interested in collaborating with ORD to determine how best to communicate the potential advancements and achievements that may be made using Green Infrastructure.

The relationships between energy and the environment are many and varied. While much is known about the environmental impacts of energy production and use, there is undoubtedly much more that can be learned. NDEQ believes that there is a national need for research to better understand, and eliminate or mitigate, the environmental impacts related to energy production and use.

Similar to energy, the environmental impacts associated with all phases of transportation are significant. Research related to alternative fuels, cleaner burning engines, alternative sources of transportation, more efficient traffic flow, and many additional areas would benefit from transportation-related research projects.

The Strategic Environmental and Development Program (SERDP) and the Environmental Strategic Technology Certification Program (ESTCP) are U.S. Department of Defense (DoD) environmental research programs. The organizations involved conduct research to assess and mitigate the environmental impact of DoD operations. There is a multitude of common issues faced by DoD and the states, and there is significant potential for states to benefit from research conducted by SERDP and ESTCP. SERDP in particular has developed a good relationship with the ITRC, which is a project of ECOS. Participants should leverage this relationship to help make states aware of relevant environmental research.

In 2012, the National Academy of Sciences published a report titled: “Alternatives for Managing the Nation’s Complex Contaminated Groundwater Sites,” which is available here: http://www.nap.edu/catalog.php?record_id=14668.

The report highlights the enormous financial resources that have already been expended for addressing contaminated groundwater sites and the huge number of challenges that remain. It notes that research and development related to developing more effective and efficient remediation methods for cleaning up contaminated groundwater sites has not kept pace with the needs of the environmental regulatory community.

The report suggests that regulators and responsible parties need to be cognizant of the following:

- Existing containment and institutional controls may not be sufficient at some sites, and new exposures may require additional work at those sites.
- Toxicological information is always changing and being updated; subsequently, drinking water standards may change, and new contaminants will likely be added.
- New pathways of exposure, such as vapor intrusion, may need to be considered.

The report concludes:

Currently, a national strategy for technology development to support long-term management of complex [contaminated groundwater] sites is lacking. It is not clear that the pertinent federal agencies will be capable of providing the funding and other support for the fundamental research and development that is necessary to meet the challenges facing complex sites. A comprehensive assessment of future research needs, undertaken at the federal level and involving coordination between federal agencies, would allow research funding to be allocated in an efficient and targeted manner.

NDEQ concurs with the conclusions of the report, particularly in relation to the lack of research on remediation for large, dilute groundwater contamination plumes. Specific concerns involve chlorinated hydrocarbon and nitrate plumes. Research is needed to address these plumes in an effective and efficient manner.

Emerging Contaminants

The Nebraska Department of Health and Human Services (DHHS) has indicated an interest in early-life exposures to chemicals in the environment; agrees that nanomaterials merit examination; and would like to see emphasis on endocrine disrupters and pharmaceuticals and personal care products. In addition, more emphasis on related epidemiological studies would be useful. It may be desirable for ORD to coordinate with the U.S. Centers for Disease Control on epidemiological efforts.

EPA Research

DHHS has primacy for the drinking water programs in Nebraska. DHHS has indicated that studies related to early-life exposures, and studies related to arsenic, nitrate/nitrite, and uranium in drinking water have been useful. Also, some indoor air studies have been helpful.

NDEQ recommends there be a greater federal effort devoted to consolidating reports on environmental research and alerting states to existing research and ongoing federal research efforts.

Over the past several years, NDEQ found the work of EPA's Environmental Technology Verification (ETV) program valuable. Operated since 1995, ETV worked as a public-private partnership between EPA and nonprofit testing and evaluation organizations to produce credible testing and verification data on the performance of nearly 500 innovative technologies.

As described on EPA's website, the ETV program was intended to become self-supporting and eventually no longer require EPA funding or in-kind support:

<http://www.epa.gov/etv>.

In 2007, ETV became a fully vendor/collaborator-paid program, with EPA providing only in-kind quality assurance and outreach support.

The ETV program is expected to cease work sometime this year. There remain only a few scattered ETV projects scheduled to wrap up by the end of 2013. It is expected that the ETV program name and logo will no longer be used except in reference to technologies verified during its active life between 1995 and 2013.

NDEQ officials report that the Nebraska emergency response community has been dealing with firms that claim to have effective degrader and disperser technologies for dealing with oil spills. Such vendors will often self-certify their products. NDEQ believes that certification of the effectiveness of such products would best be accomplished if a third party, such as ETV, conduct the verification testing.

NDEQ believes that ETV provided a good vehicle for disseminating information on the results of current environmental research through webinars and a list-serve. Hopefully this service will be continued in some form.

In July 2012, the EPA Science Advisory Board (SAB) issued a study to evaluate the practice of science integration at EPA, and to recommend how the agency might strengthen the process and capacity for integrating science into decision-making. The report was titled, “Science Integration for Decision Making at the U.S. Environmental Protection Agency,” and can be viewed here: <http://www.epa.gov/sab>.

The report recommends that:

[s]enior managers and scientists from programs and regions should continue to participate in planning ORD research activities and ORD should regularly inform them about and involve them in research at key stages of development. ORD should have a structured process to seek feedback from program and regions on the use of ORD research to support decisions. Regions and program offices should develop regular plans to identify the science needed to support upcoming environmental decisions.

NDEQ finds these recommendations relevant and potentially useful.

The SAB report also notes that the National Ambient Air Quality Standard (NAAQS) review process does well to fully integrate science in its implementation. However, the NAAQS process “focuses on single pollutants, rather than multiple pollutants.” NDEQ agrees with this assessment, and views the lack of information in this area as an important research need.

The report also identifies EPA’s Office of Solid Waste and Emergency Response (OSWER) Hazardous Waste Clean-Up Information (CLU-IN) website as particularly

useful for fostering an exchange of scientific information supporting good decision-making: <http://www.clu-in.org>.

Nebraska-DEQ agrees with this assessment and proposes that perhaps the CLU-IN website could serve as a model for providing information on the initiation, progress, and results of EPA research projects.

EPA Laboratories

NDEQ is not in a position to offer suggestions regarding the operations of EPA laboratories.

State-Federal Consultation

Communication of research that has been completed, or is in progress, is essential but challenging. ORD has been successful in summarizing the results of many of their efforts on EPA's web pages. However, it would be beneficial to explore additional outlets for that information.

ORD should continue to explore utilizing ECOS as a primary recipient of research reports. This may also be a vehicle for states to provide ORD with information as to what their particular research needs are.

In the past, ITRC has polled ECOS members to determine the environmental issues that ITRC may be equipped to address. The majority of the issues identified have related to contaminated sites. This effort could be modified to focus on a broader range of issues in need of research. Nebraska is actively participating in ERIS, which is currently examining this possibility.

Environmental research conducted by various federal agencies is of great interest to NDEQ and very important to the states. Many agencies, such as DOE, the U.S. Fish and Wildlife Service, and the National Oceanic and Atmospheric Administration (NOAA), to name a few, conduct research relevant to the interests of the states. It would be beneficial if states could rely on ORD to make them aware of the research activities of EPA and other federal agencies. This might be accomplished by providing ORD the opportunity to contribute research summaries on a quarterly basis for publication in ECOS' weekly newsletter to its membership.

Typically, other state associations – such as ASTSWMO, NACCA, and ACWA – are interested in research that is relevant to their organizations. Exploring the possibilities of presenting summaries of federal research efforts to these organizations' annual conferences should be considered. It should be noted that while a research briefing may be a good idea, time on the agenda for these busy meetings is difficult to secure. It may be challenging to put topics on the agenda that are not "hot-button" issues.

Contact

More information on NDEQ's activities and interests regarding applied research may be obtained by contacting Joe Francis, Associate Director for Field Services and Assistance (joe.francis@nebraska.gov).

Vermont

State Research

The Vermont Agency of Natural Resources (ANR) and the Vermont Department of Environmental Conservation (DEC) have been involved in a number of ad-hoc research projects related to wastewater, phosphorus and other nutrients, and air pollution transport. This work has taken place in both the laboratory and in the field.

Vermont's Watershed Management Division has an initiative called the Monitoring, Assessment, and Planning Program (MAPP). MAPP carries out a variety of research as follows:

- MAPP conducts pollution load source and allocation studies for impaired waters and to identify areas for tactical implementation to restore or protect waters. MAPP also conducts research to develop more precisely applicable criteria for use in surface water protections and in regulatory proceedings. This is funded internally, using general state funds or federal funds.
- MAPP supports long-term assessments of surface water conditions and trends in collaboration with EPA. This work is federally funded.
- MAPP also collaborates with the University of Vermont and other colleges to study the relationship between physical and biological integrity of surface waters. This work is funded by various research grants to the academic institutions.

Within Vermont's Watershed Management Division is the Lakes Section. The Lakes Section monitors the overall water quality and health of Vermont's lakes greater than 20 acres in size. Funding for these activities is provided internally and via federal funds (EPA) and the New England Interstate Water Pollution Control Commission (NEIWPPC). This monitoring data supports restoration efforts but also is mined for assessment of long-term trends, the effectiveness of restoration efforts, and ecological implications. Lake Champlain monitoring resulted in the publication of a peer-reviewed article in the Journal of Great Lakes Research by Lakes Section staff in 2012. Data generated through ANR's lakes monitoring activities have also contributed to numerous peer-reviewed research publications by scientists outside of the Agency.

Lakes Section staff participate in the National Lakes Assessment program, funded internally and by EPA. Data from these assessments have been incorporated into several research reports and presentations at national scientific meetings. Additionally, the data from the 2007 assessment and previous monitoring formed the basis for ongoing Lakes

Section research to quantify the impacts of lakeshore development on littoral/coastal habitat. In 2011, the Vermont DEC and the Maine Department of Environmental Protection cosponsored research activities to evaluate how well Maine's shoreline development regulations have protected aquatic habitat. That final report is currently under internal review.

Lakes Section staff are also part of an ongoing regional effort, supported internally and with funding from NEIWPC, to develop lake bio-criteria. Staff are also collaborating with university research scientists at several institutions to investigate the effects of climate change (<http://www.uvm.edu/~epscor/new02/?q=node/30>); the effectiveness of agricultural best management practices (BMPs) on stream water quality; the impact of zebra mussels on Lake Champlain water quality and biota; and the effects of nutrients in Missisquoi Bay. With the exception of the agricultural BMP project, which is funded through the Champlain Basin Program, there is no dedicated funding for the university collaborations.

State Lab Resources

Vermont-ANR has an "in-house" laboratory. Prior to August 2011, this lab provided a suite of services including research on phosphorus and other nutrients, metals, and organics in water, and on metals and particulates in air samples. In August 2011, the lab building was destroyed by flooding associated with the remnants of Hurricane Irene, along with other parts of the Waterbury State Office Complex. The lab was relocated to the University of Vermont. The lab currently operates there alongside the state Agency of Agriculture's lab.

One of the biggest challenges faced by the lab is the long-standing problem of expensive equipment. And if equipment breaks, the state currently has almost no resources for repairs or replacements.

The state now also has the additional challenge of financing a new building for a future permanent lab. This will almost certainly involve consolidation with the Agency of Agriculture and/or other state agencies.

The lab is currently funded in large part by state and EPA funds, and with occasional grants from other state and federal agencies.

Contracts and Collaborations

Vermont has had to outsource its research on metals because state lab equipment was damaged in the 2011 floods. Nowadays, the state's air samples are sent to an outside lab. Prior to the flood, Vermont's lab had been weighing air samples for Maine and New Hampshire.

Because the Vermont lab does work almost exclusively for "in-house" government clients, ANR's research capacity has not been insulated from the economic downturn.

Research Interests

ANR's research needs largely mirror those outlined by Massachusetts in this report. Additional interests and points of emphasis are as follows.

Work that informs the safe management of PCBs and other chemicals is a huge area of interest for Vermont and one for which ANR has little to no expertise or capacity to undertake. Vermont officials believe that such research should be conducted at a national and/or regional level.

The same goes for endocrine disruptors; Vermont is concerned about the prevalence and possible affects of these compounds but does not have the in-house capacity to perform the necessary work in this area.

Regarding hydraulic fracturing, the practice is currently banned in Vermont, and ANR officials do not plan to conduct in-state research on this topic.

Vermont is greatly interested in gaining better information for calculating the benefits of best management practices for nonpoint sources of water pollution. Advancements in this area may afford Vermont the ability to better justify the management of nonpoint source water pollution. Some work has already been conducted to identify water pollution sources within Vermont, but there have been challenges in demonstrating the benefits of the CWA §319(g) program.

Vermont is also interested in ultraviolet and other alternative water disinfection technologies. With support from EPA, Vermont recently funded an engineering study to determine the costs of such treatments, but determining more details regarding the actual efficacy of such treatments would also make for a good study.

Another research project of interest to Vermont is determining the effects of water treatment systems on domestic wastewater systems. It has been theorized, based on anecdotal evidence, that water softeners may cause detrimental effects on septic tanks. It would be useful to find out whether this is true. Various related questions should be answered:

- If water treatment processes have detrimental effects on the treatment processes of septic tanks, can the wastewater from the water treatment process bypass the septic tank and discharge directly to the wastewater system?
- Or will the salts, etc. kill the bacteria?
- Or will the salts promote bacterial growth?

ANR officials have found no white papers on this topic and are concerned that the water treatment industry may be resisting the efforts of others to study the matter. Information

that might demonstrate that water treatment wastewater is freely discharging to domestic wastewater systems could be cause for alarm for state officials.

EPA Research

EPA's Office of Research and Development (ORD) is a tremendous resource for the state of Vermont. ANR rarely seeks out ORD's assistance, but when this has occurred, it has been extremely valuable. For example, in 2004, ORD provided information which helped Vermont state officials to determine whether powdered activated carbon (PAC) installation at the Burlington Water Treatment Plant would be effective in removing the chemical lampricide when U.S. Fish and Wildlife was preparing to use the pesticide to manage the excessive eel population in the Winooski River.

ANR views ORD's Chemical Safety for Sustainability program and "CompTox" program as excellent and useful. The "ToxCast" program is also useful. These programs review chemicals to see if they exhibit similar attributes of other chemicals known to be harmful, and develop ways to prioritize which chemicals most merit toxicity testing. This work is seen as valuable because Vermont currently does not have adequate resources or capacity to address the myriad of existing concerns over the safety of chemical products.

Regarding ORD's forthcoming National Atlas for Sustainability, it is not clear exactly how this product will be used, but ANR officials suspect it will be very valuable. Vermont is interested in being kept apprised of this product's rollout and usefulness.

[Author's Note: Just prior to publication of this report-- EPA notified ECOS and ERIS that it recently renamed this product the "EnviroAtlas." A beta test version of EnviroAtlas was recently made available to ECOS and other interested parties here:

<http://www.epa.gov/research/enviroatlas/index.htm>

Individuals who wish to test-run the interface must register with the site to gain access. EPA has informed ECOS that it plans to make the service publicly available without the password requirement by December 2013. The data and information put into EnviroAtlas is specifically focused on clean air and clean and plentiful water. ECOS has been told that EPA's EnviroAtlas team recently began to work with states, local jurisdictions, and other groups to develop "use cases," which will eventually be presented in the interface to demonstrate specific uses of the data. The EnviroAtlas team is working with these groups to test the use of the service's indicators for addressing ecosystem services at meaningful scales. Due to finite resources, the team will not be able to work with every state and local jurisdiction, but EPA hopes to select enough of these jurisdictions to assist in developing "use cases" so that all other state and local communities might benefit from these examples.]

EPA Laboratories

ANR understands that EPA may be checking on whether its laboratory complex is "right-sized" for effectively and efficiently addressing the nation's environmental research priorities. For Vermont, this is a particularly important discussion with which to be involved.

Given that the Vermont-ANR laboratory is in temporary quarters now, it is an appropriate time for the state to do a more thorough review of its research needs within the national and regional context in which the lab may operate. With a relatively small state population of approximately 620,000, Vermont simply cannot afford to satisfy all of its research and monitoring needs through in-house work.

ANR officials believe that the states should be wrapped into EPA's ongoing discussion. As states, and as a nation, what research work do we think is needed? For instance, it may not be economical or desirable for all of the labs of the New England states to each perform a complete spectrum of tests. Perhaps each state could specialize in certain topical areas and perform research work in those areas for the benefit of all states in the region. States and EPA should discuss together whether six state labs and an EPA lab are needed in the relatively small geographic region of New England.

State-Federal Consultation

In recent years, ORD has worked to establish a stronger mode of communication with ECOS and ERIS, which has benefitted the states. To improve upon this, Vermont proposes that an annual "research conference" be held with state environmental officials where EPA could suggest upcoming research proposals, and in turn, states could comment on/discuss them. This could be useful for discussing proposed research a couple of years out, and would give the states a chance to provide input beforehand, and allow for better alignment of state research activities with federal research activities.

Contact

More information on Vermont-ANR's research interests and activities may be obtained by contacting Justin Johnson, Deputy Secretary (justin.johnson@state.vt.us).

Washington

State Research

The Washington State Department of Ecology (Ecology) conducts research through its Environmental Assessment Program (EAP) as well as through contracted services: <http://www.ecy.wa.gov/programs/eap/>

EAP conducts environmental monitoring services for the air, water, and waste programs by utilizing EAP technical staff and laboratory services at the Manchester Laboratory. The programs typically pay EAP for these services based on need.

Several significant research projects have been conducted over the past several years. These include statewide mercury monitoring studies and a "toxics loading" study related to the Puget Sound. Ecology recently created a portal website which highlights the results from the Puget Sound research:

http://www.ecy.wa.gov/puget_sound/toxicchemicals/index.html.

One new area of research is related to the testing of consumer products. EAP's laboratory has been conducting product testing for toxics of concern to support implementation of the state's Children's Safe Products Act and Better Brakes Legislation. This proactive approach is helping to identify problematic products that may be contributing to toxic pollution to the environment. By measuring these products, Ecology may determine the sources before widespread pollution occurs.

State Lab Resources

The Manchester Environmental Laboratory (MEL), located in Port Orchard, is used by Ecology's Environmental Assessment Program. Work at the lab is conducted to accurately determine the concentrations of environmental contaminants in air, water, and soils. Many of Ecology's regulatory decisions are based on the data provided by laboratory services.

The Ecology section at MEL currently employs 27 scientists and support staff. The lab offers a wide range of chemical and microbiological analyses, analytical method development, and other technical services ranging from project information management to logistical support for sampling events. The Ecology section is co-located with EPA's laboratory at MEL.

The lab offers a range of analytical services in general chemistry, organic chemistry, metals, and microbiology. More information about the lab's capabilities can be found here: <http://www.ecy.wa.gov/programs/eap/manchester.html>

Contracts and Collaborations

Ecology has been using EPA grant funding to support Puget Sound research through the National Estuary Grant Program. Ecology receives the grant funds from EPA Region 10 as a designated "lead agency" to disburse the funds through competitive grants and requests for proposals.

Research Interests

Ecology is conducting several interesting studies related to toxics, including a "roofing study" to determine chemicals of concern that can get into stormwater. Ecology is using EPA funds to conduct the study, including paying for a project position to oversee the project design and implementation. This project is being conducted in partnership with industry as a collaborative effort.

Ecology is also funding studies related to emerging contaminants and endocrine disrupting chemicals.

Department officials believe that it would be useful to collaborate with EPA on toxics research, including the development of computational toxicology.

Emerging Contaminants

Ecology is concerned with emerging contaminants, but research funds are limited. The department has not conducted any nanotechnology-related research due to limited resources. The states do not have the capacity to conduct bio-monitoring studies similar to those conducted by the U.S. Centers for Disease Control or other federal agencies.

EPA Research

Staff in Ecology's pollution prevention program recently became aware of the availability of EPA's Science Inventory database of completed research studies and will be reviewing the publications for their usefulness in improving the agency's decision-making.

Ecology is particularly interested in efforts to advance Green Chemistry and toxicology. The development of tools for industry is something that would be beneficial. The states are not in a position to fully fund the development of these types of services.

EPA Laboratories

The Department understands that EPA may be checking on whether its laboratory complex is "right-sized" for effectively and efficiently addressing the nation's environmental research priorities.

Ecology would be interested in following and participating in this lab evaluation effort. Rob Duff is Ecology's EAP Program Manager and may be reached at (rob.duff@ecy.wa.gov).

State-Federal Consultation

Ecology believes that it would be interesting to hold a session at an upcoming ECOS meeting to continue to explore how state-federal coordination of environmental research could be improved upon. Ecology traditionally has not had a strong link of communication with ORD, but Department officials realize that this is an important area for improvements to strengthen state-federal collaboration.

Contact

More information on the State of Washington's environmental research interests and activities may be obtained by contacting Ken Zarker, Pollution Prevention Section Manager (ken.zarker@ecy.wa.gov) or Rob Duff, Environmental Assessment Program Manager (rob.duff@ecy.wa.gov).

Wisconsin

State Research

The Wisconsin Department of Natural Resources (DNR) has an active and extensive environmental research program. In particular, staff members in the Bureau of Science Services cooperatively develop and deliver science-based information, technologies, and applications to help agency leadership make well-informed decisions for natural resource management, conservation, and environmental protection purposes.

The Bureau conducts applied research to solve environmental, public health, and natural resource problems facing the state. The research is used to help policy-makers conserve the state's fish and wildlife, maintain sustainable forest ecosystems, and safeguard air, water, and soil resources. Detailed information regarding Wisconsin-DNR's Bureau of Science Services, and how it has funded its activities in the recent past, can be viewed at: <http://ecos.org/section/publications>.

(Follow link to this report, and click on "Wisc-DNR Science Services Overview Feb 2013 Final"). If you have trouble accessing the link, then the document can also be obtained by contacting Dreux Watermolen, Science Information Services Section Chief (dreux.watermolen@wisconsin.gov).

Wisconsin-DNR currently has a number of research projects underway. Some of these involve field work, some involve laboratory work, and some involve both.

Representative examples of ongoing environmental research include:

- *Cladophora* and Water Quality of Lake Michigan: A Systematic Survey of Wisconsin Nearshore Areas. In recent years, *Cladophora*, a filamentous macroalga, has increased its presence along the Lake Michigan coast and has been deposited in large quantities on Lake Michigan beaches. In spring 2004, the DNR initiated a working group to develop a monitoring program to observe the density, distribution, and associated water quality of *Cladophora* along Wisconsin's Lake Michigan shoreline. This continuing investigation is intended to test sampling techniques and inform long-term monitoring plans and research needs; assist with developing long-term management plans; identify short-term beach clean-up and odor mitigation options; and address public information needs.
- Evaluation in Wisconsin's Lake Michigan Areas of Concern. In this study, benthos (benthic invertebrate) and plankton (phytoplankton/zooplankton) communities in Wisconsin's four Lake Michigan Areas of Concern (AOCs) (lower Menominee River, lower Green Bay and Fox River, Sheboygan River, and Milwaukee Estuary) and six non-AOCs will be quantified. The inclusion of non-AOC sites will allow comparison of AOC sites to relatively non-impacted or less-impacted control sites with natural physical and chemical characteristics that are as close as possible to that of the AOCs.

- Efficacy of Early Spring Harvesting or 2,4-D Treatment as Management Tools for Eurasian Water-milfoil in Wisconsin Lakes. A repeated block design was employed in Turville Bay, Lake Monona, Dane County, in order to assess the impact of early season 2,4-D treatment and early season harvesting on the frequency and density of aquatic macrophytes. Each treatment was applied to two 5-acre plots; point-intercept and biomass data were collected bi-annually and compared to reference plots to assess the use of these approaches in managing Eurasian water-milfoil. In addition, two northern lakes separated by a sandbar in Bayfield County are being used as control and experimental basins to evaluate the effects of early-season 2,4-D treatment on Eurasian water-milfoil and native plant populations. Annual point-intercept and biomass collection of aquatic plants will be used to assess early-season 2,4-D treatment as a tool for managing EWM.
- Reducing Carp Densities for Increasing Water Clarity and Native Aquatic Plants in a Shallow Turbid Lake: the Lake Wingra Restoration Project. This project began as an outgrowth of the carp exclosure demonstration study (2005-2008) that garnered local support to remove carp from Lake Wingra. Since the carp removal, water clarity has increased dramatically due to a significant decline in blue-green algae. As a result, submersed aquatic macrophyte growth has increased substantially. While Eurasian water milfoil responded rapidly to the greater clarity, both in the exclosure experiment and the lake since the carp removal, native plants are slowly extending their area of coverage and depth range throughout the lake. The decrease in blue-green algae has also improved swimming conditions at Vilas Beach where beach closures due to algae are no longer a problem. The lake continues to be studied to determine the long-term response to the carp removal including an evaluation of water clarity and aquatic macrophyte growth.
- Long-term Trends in Water Quality of Wisconsin Rivers. The objective of this project is to evaluate trends over time in selected water quality parameters at 42 sites on Wisconsin rivers. Results will provide an overall picture of how water quality has changed in Wisconsin rivers over the last 30- 50 years. The project report will explore reasons for changes, including agricultural and urban land management practices and wastewater discharges.
- Evaluation of the Effects of Nitrogen on Stream Biological Communities. The objective of this project is to evaluate relationships between nitrogen (N) concentrations in streams and biological community composition, including fish, macroinvertebrates, and diatoms. Sampling of streams with high N to Phosphorous (P) ratios will augment an existing dataset and allow the effects of N and P on biota to be distinguished from one another and from physical characteristics of streams. Results from this project will provide the scientific basis for determining N criteria for Wisconsin streams.
- Evaluation of Forestry Management Practices for Water Quality Protection and Ecological Integrity of Fish Communities in Timber Harvest Units. Best

management practices (BMPs), like the establishment of riparian management zones, are practices chosen to reduce erosion and prevent or control pollution resulting from forestry operations. Riparian management zones have existed for many years in the areas of forestry, agriculture, and urban development, but no quantitative evaluation has been made by direct measurements of in-stream flow and water quality. This investigation will provide an understanding of the efficacy of current riparian management zones and serve as the basis for future evaluations of potential modifications to the recommended zone width and management activities allowed within the zones.

- Sentinel Lakes: Tracking Long-term Trends in Acid Rain and Mercury Pollution. As part of the Northern Wisconsin Long Term Ecological Research Program (LTER), a number of lakes are routinely monitored for a number of parameters. Since 1984, this project has yielded key knowledge which has informed mercury legislation and the agency's work on air deposition challenges. The project is the foundation for other projects, with the monitoring data interwoven into a larger network of monitoring sites and research studies.
- Assessing the Impact of Mercury Exposure on Wisconsin's Common Loon Population. This project evaluates the cost of mercury exposure to the common loon population in Wisconsin, as well as estimates the benefits new mercury reduction rules will provide. Field and laboratory studies were conducted to identify the threshold of exposure associated with negative population consequences. Population modeling will be used to quantify the population-level benefits to be anticipated from the new mercury emission rules in Wisconsin.
- Assessing the Population Effects of Lead Fishing Tackle on Fish-eating Wildlife in Wisconsin. The Wisconsin-DNR Wildlife Management Health Team is working to quantify the population-level effects of lead (Pb) fishing tackle ingestion on common loons breeding in Wisconsin. The team is necropsying all loons found dead in Wisconsin and Minnesota to quantify the proportion succumbing to lead toxicity. The Team will evaluate the potential population-level effects via simulations of the Wisconsin Loon Population Model previously published in the *Journal of Wildlife Management*.
- The Use of Satellite Remote Sensing for Monitoring Wisconsin Lakes. Satellite remote sensing offers an unbiased sampling approach to simultaneously monitor water clarity in a large number of lakes—essentially sampling the entire population (lakes greater than 10 hectares statewide). This technique provides spatial coverage ranging in scale from within lake variation to statewide coverage. Water quality parameters quantified from space platforms include suspended solids, chlorophyll-a, temperature, and water color. Remote sensing provides a cost-effective alternative to traditional in-situ monitoring methods.
- U.S. Environmental Protection Agency National Lakes Assessment Design Support: Developing a Rapid Assessment Protocol for Macrophytes. Wisconsin-

DNR developed and tested a macrophyte sampling method to be used by individuals with no aquatic plant taxonomic background. The method is designed to detect large-scale impacts to aquatic plant communities and was adopted by EPA as a research indicator for the 2012 National Lakes Survey. The method can be used to quickly screen macrophyte communities and will be tested against the current baseline protocol in 2012 to determine its suitability as a Tier I monitoring protocol for macrophytes.

- Potential Effects of Climate Change on Inland Glacial Lakes and Implications for Lake-dependent Biota in the Great Lakes Region. Loons and other sensitive aquatic species may be particularly sensitive to climate change, especially if changes in climate result in changes in the trophic status of waters. Through hydrologic modeling and paleolimnological investigations, this study assesses potential impacts of climate change on loons and other sensitive species. This study will also test a groundwater model that indicates seepage lakes in northern Wisconsin will become more alkaline if climate change results in warmer and drier conditions. This model will be tested by using the historical diatom community to reconstruct the alkalinity levels during the mid-Holocene when the climate was warmer and drier than it is today.
- Carbon Sequestration. The objective of this study is to quantify, compare, and track carbon pools in various components of forest stands during stand development under traditional and alternative management techniques. Results of this study will provide data that can inform policy development on the use of woody biomass for energy production, where carbon gains and losses are important. Results could also potentially inform carbon policies for cap-and-trade systems and provide information for use in developing state-level policies for forest management that would help mitigate climate change.
- Historic Trends in Flows of Wisconsin Rivers. This project examined recent trends in stream flows of Wisconsin rivers in the context of climatic drivers. Trends in flow over the past 57 years were determined for 48 USGS stations across the state. Four annual metrics (mean flow, base flow, one-day maximum flow, and Julian day of center of spring flow) were tested for trends using the non-parametric Kendall test as well as linear regression, incorporating an autoregressive parameter. Stations having significant trends in mean and base flow were not randomly distributed throughout the state but were generally correlated with precipitation patterns.
- Developing Wireless Radio-sensor Networks to Monitor Climate Change Impacts on Lakes and Wetlands. Using mote technology (a mote is a very small radio-sensor computing device), wireless monitoring networks have been designed and deployed to detect changes in water and solute fluxes in northern Wisconsin wetlands. Each network of sensors can monitor water table fluctuations, precipitation, evaporation, dissolved organic carbon, and bulk ionic solutes at 30-minute intervals throughout the ice-free season. The data are transmitted via low-

power radio to a remote base station that is affiliated with the University of Wisconsin-Madison Global Lake Ecology Observation Network (GLEON). Two prototype networks using alternative technologies have been operating in tandem since 2009 in Vilas County wetlands. The high frequency data are essential in assessing the impact of extreme events, such as intense rainfall or extremely hot, dry weather. Regional climate models indicate that the frequency of such extreme events will increase during future decades.

- Predicted Effects of Climate Change on Wisconsin Stream Fishes. This project is working to increase the sensitivity of existing computer models that predict stream suitability for 50 fish species to variation in climate and groundwater inputs. The researchers will predict the response of stream fishes to Wisconsin-specific climate change scenarios over the next 25-50 years and identify streams particularly vulnerable to climate fluctuations. The results will provide tools for managers and policy-makers to plan for and to adapt to future climate changes more efficiently.
- An Assessment of the Vulnerability and Adaptation Strategies of Wisconsin's Wildlife to Climate Change. The goal of this project is to develop risk assessments and white papers for the impact of global climate change on Wisconsin's wildlife resources as part of the Wisconsin Initiative on Climate Change Impacts (WICCI). WICCI is a collaboration between scientists at the University of Wisconsin campuses and the Wisconsin-DNR to prepare for the impacts of climate change in Wisconsin. The goal of the WICCI Wildlife Working Group is to collaboratively synthesize existing climate research as it pertains to Wisconsin; set priorities for research; and generate management strategies to address future climate change impacts utilizing applied research, modeling, and adaptive management. The initial project of the WICCI Wildlife Working Group will be to synthesize information on the direct and indirect impacts of climate change on Wisconsin's wildlife resources that are likely to occur over the next 1, 5, 10, 20, 50, 100, and 200 years.
- Ashland/ Chequamegon Bay Shoreland Restoration Project 2010- 2012. Wisconsin-DNR received a grant from the Great Lakes Restoration Initiative in 2010 to conduct a 4,100' shoreland restoration project on Chequamegon Bay in the City of Ashland. Projects are ongoing in Memorial and Bayview Parks where invasive species have been removed and native trees, shrubs, and groundcover has been planted. Restoration work is scheduled for completion by December 2012 and biotic surveys to measure habitat quality and wildlife response to the restorations will continue through 2022. This project will provide guidance to efforts to restore degraded shorelines on the southern shore of Lake Superior.
- Assessing the Potential Population Effects of Botulism E Toxin and Gulf Oil Exposure on Migrating Wisconsin Waterbirds. Wisconsin-DNR received a grant from the Great Lakes Fish and Wildlife Recovery Initiative to investigate the impact of Type E botulism (BotE) on migrating waterbirds in Wisconsin. Funds

are used to survey for dead birds along the Lake Michigan shoreline in the autumn as well as to document the annual return rates of color-banded common loons which are at risk to the toxicity. Thirteen satellite transmitters and 78 geolocators have been placed on adult loons breeding in Wisconsin. The goal is to identify migration routes, foraging patterns in the Great Lakes, and wintering areas in the Gulf of Mexico and Atlantic Coasts. These data will be used to evaluate the proportion of Wisconsin loons using regions of Lake Michigan impacted by BotE as well as Gulf of Mexico coastal areas impacted by the 2010 BP oil spill.

- Evaluating the Impact of Legacy Polychlorinated Bioaccumulating Toxic Substances (PCBs, DDE, PBDE, PFOS, PFOA) on Wisconsin's Great Lakes Bald Eagle Population: The Wisconsin Bald Eagle Biosentinel Project. Wisconsin-DNR initiated the Wisconsin Bald Eagle Biosentinel Project in 1990, and has since tracked the dramatic increase in abundance and productivity of Wisconsin's Great Lakes population, as well as the concurrent decline in exposure to toxic substances such as PCBs and DDT. This eagle population was seriously impacted by contaminant exposure in the 1960s and 1970s when the Wisconsin Great Lakes population declined to fewer than 10 breeding pair. The number now exceeds 50 breeding pair, and contaminant exposure levels, primarily PCBs and DDE, have declined dramatically.

DNR has conducted numerous studies over the past several decades. This work has supported the resource management and environmental protection objectives of the agency and its partners. Research projects are summarized biennially in section progress reports. Representative recent (2011-2012) publications resulting from some of this work include:

- Lyons, J. 2012. Development and validation of two fish-based indices of biotic integrity for assessing perennial coolwater streams in Wisconsin, USA. *Ecological Indicators* 23:402-412.
- Sass, G.G., S.R. Carpenter, J.E. Gaeta, J.F. Kitchell, and T.D. Ahrenstorff. 2012. Whole-lake addition of coarse woody habitat: response of fish populations. *Aquatic Sciences-Research Across Boundaries* 74:255-266.
- Garrison, P.J. and G. LaLiberte. 2012. Paleocological Study of Shell Lake, Washburn County. PUB-SS-1088 2011. Wisconsin Department of Natural Resources. 19 pp.
- Garrison, P.J. 2012. Paleocological Study Dunes Lake, Door County and Water Quality Assessment of 3 Nearby Streams. PUB-SS-1093 2012. Wisconsin Department of Natural Resources. 16 pp.
- Mitro, M. G. In Press. Statistical methods for determining significant change. Chapter 5 in C. Jones, editor. *Fishers and Farmers Monitoring Protocol*.

- Spacapan, M., C.A. Miller, and G.G. Sass. 2012. An evaluation of river usage in the Mississippi River basin following the invasion of Asian carp. Northeast Recreation Research Symposium, Cooperstown, New York, USA.
- Ruebush, B.C., G.G. Sass, J.H. Chick, and J.D. Stafford. 2012. *In situ* tests of sound-bubble-strobe light barrier technologies to prevent range expansions of Asian carp. *Aquatic Invasions* 7:37-48.
- Nault, M., A. Mikulyuk, J. Hauxwell, J. Skogerboe, T. Asplund, M. Barton, K. Wagner, T. Hoyman, and E. Heath. 2012. Herbicide Treatments in Wisconsin Lakes. *NALMS LakeLine* 32:21-26.
- Mednick, A.C. 2012. *Building Operational "Nowcast" Models for Predicting Water Quality at Five Lake Michigan Beaches*. Miscellaneous Publication PUB-SS-1098. Bureau of Science Services, Wisconsin Dept. Natural Resources, Madison.
- Mednick, A.C., T.M. Possley Nelson, and D.J. Watermolen. 2012. *Assessing Long-term Hydrologic Impacts of Climate Change across Wisconsin*. Final Report. Environmental and Economic Research and Development Program, Wisconsin Focus on Energy, Madison, WI. Available online at www.focusonenergy.com/Research/Research-Reports/.
- Watermolen, D.J. 2010. *A Web-based Decision-Support System for Watershed Management: Progress towards Data Exchange, Data Analysis, and Model Calibration*. Bureau of Science Services, Wisconsin Dept. Natural Resources, Madison. 82 pp. [Miscellaneous Publication PUB-SS-1083 2010 REV].
- McClelland, M.A., K.S. Irons, G.G. Sass, T.M. O'Hara, and T.R. Cook. 2011. A comparison of two electrofishing programmes used to monitor fish on the Illinois River, Illinois, USA. *River Research and Applications* DOI:10.1002/rra.1590
- Pomplun, S., R. Lathrop, A. Coulson, and E. Katt-Reinders. 2011. Managing our future: Getting ahead of a changing climate. *Wisconsin Natural Resources* (February):20-25.
- Weigel, B.M., and J.J. Dimick. 2011. Development, validation, and application of a macroinvertebrate-based index of biotic integrity for nonwadeable rivers of Wisconsin. *Journal of the North American Benthological Society* 30:665-679.
- Wang, L., D. Infante, J. Lyons, J. Stewart, and A. Cooper. 2011. Effects of dams in river networks on fish assemblages in non-impoundment sections of rivers in Michigan and Wisconsin, USA. *River Research and Application* 27:473-487.

- Gaeta, J.W., M.J. Guarascio, G.G. Sass, and S.R. Carpenter. 2011. Lakeshore residential development and growth of largemouth bass (*Micropterus salmoides*): a cross-lakes comparison. *Ecology of Freshwater Fish* 20:92-101.
- Sharma, S., M.J. Vander Zanden, J.J. Magnuson, and J. Lyons. 2011. Comparing climate change and species invasions as drivers of coldwater fish population extirpations. *PLoS ONE* 6(8):e22906.
- Watras, C. J., P.C. Hanson, T.L. Stacy, K.M. Morrison, J. Mather, Y-H Hu and P. Milewski. 2011. A temperature compensation method for CDOM sensors in freshwater. *Limnology and Oceanography, Methods* 9:296-301.
- Meyer, M.W., P.W. Rasmussen, C.J. Watras, B.M. Fevold and K.P. Kenow. 2011. Bi-phasic trends in mercury loon concentrations in blood of Wisconsin loons during 1992-2010. *Ecotoxicology* 20(7):1659-1668.
- Mikulyuk, A., S. Sharma, S. Van Egeren, E. Erdmann, M.E. Nault, J. Hauxwell. 2011. The relative role of environmental, spatial, and land-use patterns in explaining aquatic macrophyte community composition. *Canadian Journal of Fisheries and Aquatic Sciences* 68:1778-1789.
- Benson, T.J. , J.D. Brown, Nicholas M. Anich, and J.C. Bednarz. 2011. Habitat availability for bottomland hardwood forest birds: the importance of considering elevation. *Wilson Journal of Ornithology* 123(2):199–205.
- Van Herk, I.G., S.T. Gower, Dustin R. Bronson, and M. Tanner. 2011. Effects of climate warming on canopy water dynamics of a boreal black spruce plantation. *Canadian Journal of Forest Research* 41(2):217-227.
- Bronson, D.R. and S.T. Gower. 2010. Ecosystem warming does not affect photosynthesis or aboveground autotrophic respiration for boreal black spruce. *Tree Physiology* 30(4):441-449.
- Hull, S.D., C. Bleser, A. Crossley, R. Jackson, E. Lobner, L. Paine, G. Radloff, David W. Sample, J. Vandenbrook, S. Ventura, S. Walling, J. Widholm, and C. Williams. 2010. Wisconsin Sustainable Planting and Harvesting Guidelines for Nonforest Biomass. Wisconsin Department of Natural Resources, Wisconsin Department of Agriculture, Trade and Consumer Protection, and University of Wisconsin. 98 pp.
- Custer, T.W. , C.M. Custer, W.E. Thogmartin, P.M. Dummer, R. Rossmann, K.P. Kenow, and M.W. Meyer. 2012. Mercury and other element exposure in tree swallows nesting at low pH and neutral pH lakes in northern Wisconsin USA. *Environmental Pollution* 163:68-76.

Evers, D.C. , K.A. Williams, M.W. Meyer, A.M. Scheuhammer, N. Schoch, A.T. Gilbert, L. Siegel, R.J. Taylor, R. Poppenga, and C.R. Perkins. 2011. Spatial gradients of methylmercury for breeding common loons in the Laurentian Great Lakes region. *Ecotoxicology* 20:1609-1625.

Kenow, K.P. , M.W. Meyer, R. Rossman, A. Gendron-Fitzpatrick, and B. Gray. 2011. Effects of injected methylmercury on the hatching of common loon (*Gavia immer*) eggs. *Ecotoxicology* 20:1684-1693.

Dykstra, C. , M.W. Meyer, W. Route, and P. Rasmussen. 2010. Contaminant Concentrations in Bald Eagles Nesting on Lake Superior, the Upper Mississippi River, and the St. Croix River. *Journal of Great Lakes Research* 36:561-569.

State Lab Resources

DNR's Bureau of Science Services maintains functioning laboratories at the Wisconsin DNR Science Operations Center. These include biological and chemical laboratory facilities, including fish and wildlife health facilities.

A large portion of the laboratory services supporting DNR is provided by the Wisconsin State Laboratory of Hygiene. The Wisconsin State Laboratory of Hygiene provides clinical, environmental, and industrial hygiene analytical services, specialized public health procedures, reference testing, training, technical assistance and consultation for private and public health agencies. In addition, the lab is part of the University of Wisconsin, through which it performs research and instruction related to public and environmental health protection.

The DNR Bureau of Science Services labs are funded by a combination of state funds and various grants, including grants from federal agencies. Services from the State Laboratory of Hygiene (about \$4 million annually) are provided for by two means: the State Laboratory's general purpose revenue through an annual agreement with DNR, and through DNR funding secured from various other sources.

Despite its collaborative arrangement with the State Laboratory of Hygiene, DNR runs its own laboratory and does not share laboratory facilities with other agencies.

DNR happens to employ a Scientific Integrity Handbook. The Handbook contains guidelines for use by agency officials in conducting scientific studies. Intended as an internal agency document, the Handbook is not posted on the DNR website. However, a copy of the Handbook may be viewed by contacting Dreux Watermolen, Science Information Services Section Chief (dreux.watermolen@wisconsin.gov).

Contracts and Collaborations

Wisconsin-DNR forges strong partnerships with scientists working for academic institutions, federal agencies (including EPA/ORD), and private corporations to meet its research needs. The Bureau of Science Services assists agency programs by establishing partnerships to address identified priorities.

DNR regularly contracts for some elements of research/monitoring projects and actively engages in collaborative efforts with academic institutions. Of particular note, DNR collaborates closely with the Cooperative Wildlife Research Unit at the University of Wisconsin-Madison and the Wisconsin Cooperative Fisheries Research Unit at the University of Wisconsin-Stevens Point. DNR also contracts with USGS for various water-related research and monitoring services.

On a continuous basis, DNR seeks to pursue whatever research is needed to address the agency's priority information needs. But the approach and timing of the agency's research efforts are influenced by state budgetary constraints as well as the Department's success or failure in obtaining outside/competitive funding and federal agency support. The more funding that is secured in the future, the better the agency will be able to address its research priorities moving forward.

Research Interests

Wisconsin's Natural Resources Board requires that natural resource management decisions be based on sound science. The DNR undertakes a biennial process to integrate research needs across the agency and to formulate a Biennial Research Agenda that addresses its highest priority science needs.

In April 2013, DNR issued its latest biennial research agenda for the period 2013- 2015. Research Themes identified in the agenda provide an organizing framework for more detailed planning to address a broad range of management questions. Further, Priority Research Focus Areas identified under each theme provide a snapshot of research already being conducted by the Department, for the Department, or by the Department's partners, and provide guidance for prioritizing future investments. Staff and program managers use this framework to evaluate new and emerging needs, opportunities, and proposals, and to ensure research informs short- and long-term management and policy decisions. As a result, all research undertaken by the Wisconsin-DNR specifically addresses management problems.

The agency's current research needs are described in detail in the 2013- 2015 Biennial Research Agenda. The full 49-page document can be viewed at:

<http://ecos.org/section/publications>.

(Follow link to this report, and click on "Wisc-DNR 2013-2015 Research Agenda April 2013 Final"). If you have trouble accessing the link, then the document can also be obtained by contacting Dreux Watermolen, Science Information Services Section Chief (dreux.watermolen@wisconsin.gov).

Highlights from Wisconsin-DNR's 2013-2015 Research Agenda are summarized as follows.

Theme: Research to Manage & Sustain Ecosystems

- **Priority Research Focus: Great Lakes** – Management of the Great Lakes is complex and involves multiple jurisdictions. Wisconsin's *Great Lakes Strategy* details plans for addressing Lake Michigan's and Lake Superior's most pressing environmental issues. To do so, we focus at scales ranging from basins to sub-watersheds to shorelines and nearshore zones. Indicators established under the *State of the Lakes Ecosystem Conference* (SOLEC) process have been used to identify basin-wide monitoring needs. Policy guiding withdrawal of Great Lakes water is covered by the *Great Lakes Compact*. Coastal wetlands provide multiple environmental services, including their importance to the biodiversity of the state, their ability to filter water, and flood storage, fish spawning, stopover habitat for migratory birds, etc. Research priorities have been identified for Wisconsin's National Estuarine Research Reserve. Research is needed to better characterize nearshore health (particularly in the Areas of Concern), predict bacteria and algae problems, and understand impacts of riparian and watershed land use. The "mixing zone" concept currently used for wastewater discharge permit limits is based primarily on riverine systems. There is a need to develop large lake models to better ensure resource protection. Finally, additional work is needed to fully assess the impacts of climate change to the Great Lakes.
- **Priority Research Focus: Mississippi River** – Management of the Mississippi River is complex and involves multiple jurisdictions. There is a need to continue ongoing research involving other state, federal, and university partners related to developing and interpreting results of water quality monitoring of the Mississippi, nutrient evaluations on Pool 8 backwaters, lead (Pb)-related impacts on wildlife in the La Crosse River Marsh, proliferation of free-floating plant mats, cyanobacteria blooms, shifts from a vegetated to un-vegetated stable state and its effects on biota and recreational opportunities, and the effects of PFCs on river biota. Additional work is needed to fully assess the impacts of climate change to ecosystems in and along the Mississippi.
- **Priority Research Focus: Groundwater, Drinking Water, and Water Use** – Adequate supplies of uncontaminated groundwater are crucial not only to the health of Wisconsin citizens but also for the continued growth of agricultural production and cutting-edge industries in the state. By statutory authority, the Groundwater Coordinating Council advises and assists state agencies in the coordination of groundwater research activities and the appropriation and allocation of state funds for research. Current groundwater research needs are presented in the Council's Joint Solicitation document and, in particular, the excerpted DNR priorities.

Theme: Research to Address Pollutants/Stressors and Protect Human Health

- **Priority Research Focus: Nutrient Impacts to Surface Water and Groundwater** – Stormwater carries solids, nutrients, and other contaminants into receiving waters. Runoff from agricultural operations and lands remains a major source of sediments, nutrients, and pesticides. Many BMPs have been developed to reduce these loads, but BMPs have yet to be implemented on a large-scale basis, and their efficacy has not been fully evaluated. The relationship between phosphorus and water quality is an area of continued research. Implementation of the state’s new phosphorus rule will require sound science for issuing permits; setting site-specific criteria; adaptive management; pollution trading; and development, implementation, and evaluation of total maximum daily loads (TMDLs). Additional research is needed to evaluate the impacts to air and water from concentrated animal feeding operations (CAFOs) and spray irrigation systems; develop a nutrient targeting and tracking tool; understand baseline nutrient conditions of lakes; understand the factors that lead to excessive blooms of cyanobacteria; and evaluate the effectiveness of water quality improvement practices. The role of nitrogen in lakes, streams, and wetlands is less well known. There is a need to evaluate agricultural nitrogen BMPs; refine indices of biotic integrity to incorporate nitrogen; develop a nitrogen transport and fate model; and understand nutrient dynamics of manure and various treatment strategies. Wisconsin-DNR is in need of a field-based hydrogeological method for evaluating nitrate concentrations below fields following BMPs. There is general need for research support in revising the agency’s monitoring strategy and assessment protocols for CWA reporting and documentation of success stories. The Groundwater Coordinating Council advises and assists state agencies in the coordination of groundwater research activities and the appropriation and allocation of state funds for research. Current groundwater research needs are presented in the Council’s Joint Solicitation document and, in particular, the excerpted DNR priorities.
- **Priority Research Focus: Contaminated Sediments** – The Great Lakes, the Mississippi River, and the rivers that feed them have been historically important centers of trade and industry. As cities grew around these economic hubs, river and harbor sediments were polluted by chemicals. Important fish and wildlife habitat was lost. Nowadays, the pollution and habitat loss cause problems for fish and wildlife and diminish the ability of Wisconsin citizen’s to fully use and enjoy the rivers and lakes. Some monitoring of contaminated sediments is currently done on a limited basis and the Department has produced a number of guidance documents which describe a multi-tiered approach to site assessment. Research into cleanup/restoration methods and sediment disposal options, however, remains an important priority.
- **Priority Research Focus: Vapor Intrusion** – Chemicals used in commercial activities (ex. dry cleaning chemicals, chemical degreasers, petroleum products like gasoline) are sometimes spilled or leaked into soil and groundwater. These chemicals, known as volatile organic compounds (VOCs), often become gases or

vapors, which can escape from contaminated groundwater and soil and enter buildings. While we understand the risks associated with vapor intrusion and have preventative measures that can be implemented, research is needed to better understand how widespread this problem is in Wisconsin.

- Priority Research Focus: **Pesticides** – All types of pesticides (insecticides, herbicides, and fungicides) have been used in Wisconsin agriculture for a long time. These pesticides can reach groundwater when spilled at storage, mixing, and loading sites, when over-applied to fields, or when improperly disposed of. Preliminary studies by the Wisconsin Department of Agriculture, Trade, and Consumer Protection show that over 35% of private wells tested contained detectable levels of herbicides or their metabolites. In addition, the state permits the application of pesticides for algae and aquatic plant control, requiring research to address efficacy and effects on non-target organisms, as well as persistence in the environment.
- Priority Research Focus: **Mining Impacts** – There is a need to develop methods for predicting, assessing, and mitigating the direct and indirect impacts to air, surface water, and groundwater quality and water levels from various mining activities (industrial sand mining, ferrous mining, sulfide mining, etc.). Impacts to plant and animal populations and communities will also need to be evaluated. It will be necessary to develop a monitoring strategy for newly permitted mines.
- Priority Research Focus: **Beach Pathogens** – Wisconsin’s beaches provide wildlife habitat, recreation areas, and tourist destinations. Unfortunately, beaches are especially vulnerable to agricultural, urban, and industrial land uses, and many of our beaches are showing the effects. Real-time modeling has been shown to be an effective means of providing public notification, but federal BEACH Act funding for monitoring and modeling activities remains uncertain. There is a need to assist local public health agencies with model development, operation, and refinement in the face of declining funds.
- Priority Research Focus: **Harmful Blue-green Algae** – Concerns associated with blue-green algae (cyanobacteria) include discolored water, reduced light penetration, taste and odor problems, dissolved oxygen depletions during die-off, and toxin production. There are no quick or easy remedies for the control of blue-green algae once they appear in a waterbody. DNR will continue to invest in monitoring for the occurrence of cyanobacteria in partnership with the Wisconsin Department of Health Services, as well as efforts to better understand factors that affect the frequency and intensity of blooms, and the effectiveness of various mitigation practices.
- Priority Research Focus: **Fish and Wildlife Contaminants** – Fish and wildlife may take in pollutants from the water they live in and the food they eat. Some pollutants can build up in their tissues to levels that can be harmful to predators, including humans. Research is needed to assess the impact of toxins on wildlife

and fish populations and how regulations and management can ameliorate negative impacts to both humans and natural ecosystems. Areas requiring attention include fish consumption advisories, mercury and PCBs in loons, and the effects of lead (Pb) shot to fish and wildlife.

- Priority Research Focus: **Emerging Pollutants** – See more detail on Wisconsin’s interests in emerging contaminants below.

Theme: Research to Improve Assessment, Monitoring, and Modeling

- Priority Research Focus: **Landfill Organic Stability** – The science and technology governing the achievement of organic stability in landfills encompasses a wide range of methods, including innovations that are not practiced routinely in waste management system design and operation in Wisconsin. When the state’s landfill organic stability rule was adopted in 2006, the Wisconsin Natural Resources Board directed DNR to convene a panel of independent experts to conduct a statewide review of the effectiveness of this rule and to recommend ways to improve the efficiency and effectiveness of the rule. It will be important for the department to review the panel’s findings and recommendations.
- Priority Research Focus: **Biological Criteria and Designated Uses** – Water quality standards rely heavily on chemical parameters that may or may not have biological relevance. Research is needed to support revisions to water quality standards, especially in the area of nutrients and biological response to nutrient and habitat impairments (ex. NR 102, 104, 105, 217).
- Priority Research Focus: **Baseline Assessment and Monitoring** – There is a need to assess and refine surface water sampling and field protocols and to develop a broad-scale standardized approach to monitoring the health of rivers, streams, lakes, and wetlands through comparing data/results yielded from multiple monitoring approaches that have been implemented historically in Wisconsin. DNR can also improve consistency and statistical rigor in our assessments for CWA integrated reporting. Wisconsin is in a position to provide key leadership for development and implementation of EPA’s national assessment of lakes, rivers, Great Lakes coastal zones, and wetlands.

Theme: Research to Understand Social and Economic Values

- Priority Research Focus: **Resource Valuation and Ecosystem Services** – Economic theory predicts that the optimal allocation of a private good occurs in a competitive market environment, assuming property rights are well-defined/enforceable, transaction costs are low, private rates of discount mirror social rates, and external economic impacts are absent. When it comes to natural resources, however, these assumptions often break down due to the public good aspects of the resources. In addition, resource management is greatly affected by

socio-political issues that arise when the use of resources by one constituency collides with the needs of another. As such, the department would benefit from efforts to assess the value of resources in particular contexts. An understanding of the market and non-market values of natural resources (ex. ecosystem services) can aid decisions at the field, business, and landscape level, and can also be a helpful indicator of how selected management prescriptions are performing (ex. water quality impacts on land values; effects of wetland conditions on the public's valuation of wetlands; benefits of ample outdoor recreational opportunities). Understanding the full context for market structures/trends would better support the Department's sustainable forestry approach.

Emerging Contaminants

Another Priority Research Focus area for Wisconsin-DNR is the subject of **Emerging Pollutants**. Some pollutants have only recently been discovered in the environment. Examples include endocrine disruptors resulting from organic compound degradation, pharmaceuticals, steroids and hormones, surfactants and surfactant metabolites, flame retardants, industrial additives and agents, gasoline additives, and nanoparticles. A priority need is developing information on these compounds for evaluation of their potential threat to environmental and human health. Research is needed to develop analytical methods to measure these contaminants in water, sediment, and waste streams; to determine the occurrence of these contaminants; to characterize their sources and source pathways; to define and quantify processes that determine their transport and fate through the environment; and to identify potential ecologic effects from exposure. This is pursued under the theme of Research to Address Pollutants/Stressors and Protect Human Health previously mentioned.

EPA Research

Wisconsin-DNR has had a solid working relationship with various parts of ORD, particularly those staff and teams working on National Lakes Assessment, National Wetlands Assessment, and Beach Pathogen Forecasting. DNR officials hope that these relationships will continue. Such effective relationships can be maintained when agencies share their research interests, needs, and priorities, jointly plan their efforts, and communicate regularly regarding their progress and findings.

Overall, ORD work on beach pathogens, toxic chemicals, and air pollution impacts has been of greatest value to Wisconsin. ORD work has helped to advance the overall scientific knowledge base in these and other areas.

The following EPA/ORD products have been identified as particularly useful by Wisconsin-DNR staff:

ADE, T. J., R. L. Calderon, E. A. Sams, M. Beach, K. P. Brenner, and A. P. Dufour. A Faster Method of Measuring Recreational Water Quality for

Better Protection of Swimmer's Health. Presented at National Beaches Conference, Niagara Falls, NY, October 11 - 13, 2006.

Chernoff, N. Algal toxins and human health: A brief overview and notes on needed research directions. Presented at Society of Toxicology and Chemistry (SETAC) Annual Meeting, November 11 - 15, 2012.

Cantwell, M., M. Perron, J. Sullivan, and D. Katz. Assessing Changes in Contaminant Fluxes Following Dam Removal in an Urbanized River. Presented at Society of Environmental Toxicology and Chemistry (SETAC) North America 33rd Annual Meeting, November 11 - 15, 2012.

Iton, D., T. Collette, D. Martinovic-Weigelt, G. Ankley, D. Villeneuve, AND D. Ekman. Characterizing Exposures of Fish to Wastewater Treatment Plant Effluent: An Integrated Metabolite and Lipid Profiling Approach. Presented at SETAC 33rd North American Annual Meeting, Long Beach, CA, November 11 - 15, 2012.

Johnson, M. G. and R. Smernik. Effects of elevated CO₂ and temperature on forest floor litter decomposition and chemistry. Presented at Soil Science Society of America, Long Beach, CA, October 31 - November 03, 2010.

Cohan, D. and S. Napelenok. Air Quality Response Modeling for Decision Support. *Atmosphere*. MDPI AG, Basel, Switzerland, 2(3):407-425, (2011).

Stander, E., S. Gilchrist, M. Borst, T. P. Oconnor, and A. A. Rowe. Bioretention Design to Improve Nitrogen Removal . Presented at Philadelphia Low Impact Development Symposium: Greening the Urban Environment, Philadelphia, PA, September 25 - 28, 2011.

Jackson, A. K., D. C. Evers, M. Etterson, A. M. Condon, S. B. Folsom, J. Detweiler, J. Schmerfeld, and D. A. Cristol. Mercury Exposure Affects the Reproductive Success of a Free-living Terrestrial Songbird, the Carolina Wren, (*Thryothrus ludovicianus*). *The Auk*. American Ornithologists' Union, Shipman, VA, 128(4):759-769, (2011).

SOBUS, J., Y. TAN, J. D. PLEIL, AND L. S. SHELDON. A Biomonitoring Framework to Support Exposure and Risk Assessments. *Science of the Total Environment*. Elsevier Science Ltd, New York, NY, 409(22):4875-4884, (2011).

Cho, S., J. Thornburg, J. Portzer, R. W. Vanderpool, J. Richmond-Bryant, J. Rice, and K. Cavender. A Literature Review of Concentrations and Size Distributions of Ambient Airborne Pb-Containing Particulate Matter.

Atmospheric Environment. Elsevier Science Ltd, New York, NY, 45(28):5005-5015, (2011).

ORD's Chemical Safety for Sustainability program and "CompTox" program are viewed as valuable by Wisconsin-DNR:

<http://epa.gov/research/docs/css-strap.pdf>

CompTox reviews chemicals to see if they exhibit similar attributes of other chemicals known to be harmful. DNR officials appreciate EPA's approach of integrating advances in molecular biology, chemistry, and computational science to more effectively and efficiently rank chemicals based on risk.

DNR also appreciates the focus on emerging contaminants, including endocrine disrupting chemicals and nanomaterials.

DNR supports the focus on efforts to address chemical exposures and risks to the fetus and young children, and would recommend that additional emphasis be placed on these efforts.

EPA's Chemical Safety for Sustainability 2012- 2016 Strategic Research Action Plan notes that "[c]ollaboration with EPA internal partners (program and regional offices) and external stakeholders [will be] vital to the success of CSS." DNR agrees with this assessment, but notes that state and tribal regulatory agencies are not mentioned. The document indicates that an external stakeholder engagement plan has been developed, but after a careful search, DNR officials were unable to find/access this. DNR would like to emphasize that it is critical that states and tribes be consulted when EPA is working to identify research needs and priorities.

Wisconsin-DNR also views ORD's "ToxCast" program as quite valuable. The program aims to develop ways to prioritize which chemicals, among the thousands that exist, most merit toxicity testing. The program also seeks to develop ways to predict the toxicity of chemicals: <http://epa.gov/ncct/toxcast/>.

Given the huge number of potentially toxic chemicals that have not been adequately tested, and the rapid rate at which new compounds and formulations are being developed, it is clear that improved tools for assessing potential impacts are needed. However, it is important that as EPA develops, implements, and evaluates new testing approaches, well-established toxicity testing approaches and studies continue to be implemented. DNR supports efforts to prioritize chemicals for evaluation as a significant component of this program, particularly for future drinking water contaminants.

ORD's Human Health Risk Assessment program, which includes the "IRIS" system, is seen as valuable by Wisconsin-DNR officials. DNR supports the outcome-based approach outlined in the Human Health Risk Assessment 2012- 2016 Strategic Research Action Plan: <http://epa.gov/research/docs/hhra-strap.pdf>.

IRIS toxicity values are critical to state risk assessment efforts and provide a scientific foundation for decision-making on site-specific cleanups, rules, regulations and health policy determinations. DNR believes that additional resources should be provided to expand the number of chemicals considered and the pace of chemical assessments under the IRIS program.

Wisconsin-DNR has not yet evaluated ORD's forthcoming Community Focused Exposure Risk Screening Tool (C-FERST), but it appears to hold promise for providing valuable assistance for addressing local concerns regarding various risks:

<http://www.epa.gov/heads/c-ferst/>

It is unclear to Wisconsin-DNR officials how useful ORD's forthcoming National Atlas for Sustainability will be for aiding the Department's mission:

http://gispub6.epa.gov/projects/NATLAS_afccf43eb1f64eae56cb235db9adf7f/index.html

It is the understanding of DNR officials that a prototype for the Atlas online decision support tool has been developed and has been populated with approximate indicators spanning multiple ecosystem services for the national effort and for the first pilot community of Durham, North Carolina. However, as of February 2013, the Atlas was inaccessible to DNR officials, and Atlas investigators had not adequately collaborated with state and local jurisdictions to use the indicators to address ecosystem services at meaningful scales.

[Author's Note: Just prior to publication of this report-- EPA notified ECOS and ERIS that it recently renamed this product the "EnviroAtlas." A beta test version of EnviroAtlas was recently made available to ECOS and other interested parties here: <http://www.epa.gov/research/enviroatlas/index.htm>.

Individuals who wish to test-run the interface must register with the site to gain access. EPA has informed ECOS that it plans to make the service publicly available without the password requirement by December 2013. The data and information put into EnviroAtlas is specifically focused on clean air and clean and plentiful water. ECOS has been told that EPA's EnviroAtlas team recently began to work with states, local jurisdictions, and other groups to develop "use cases," which will eventually be presented in the interface to demonstrate specific uses of the data. The EnviroAtlas team is working with these groups to test the use of the service's indicators for addressing ecosystem services at meaningful scales. Due to finite resources, the team will not be able to work with every state and local jurisdiction, but EPA hopes to select enough of these jurisdictions to assist in developing "use cases" so that all other state and local communities might benefit from these examples. ECOS has been told that Milwaukee will be completed as one of the pilot communities within several months, and the EnviroAtlas team would welcome the opportunity to work with the Wisconsin state government and the local Milwaukee community in the future.]

EPA Laboratories

DNR understands that EPA may be checking on whether its laboratory complex is “right-sized” for effectively and efficiently addressing the nation’s environmental research priorities. But DNR officials will not be in a position to offer constructive commentary regarding this matter without first gaining considerable additional information.

There are two primary areas of concern that DNR would have related to any laboratory consolidation proposals. First, EPA’s regional laboratory capacity is important, not only for research, but also for environmental compliance and monitoring assistance, and for disaster and homeland security issues. Any proposed consolidation efforts should seek to maintain this capacity. Second, consolidation cannot result in additional laboratory responsibilities at the state level. DNR would not be able to take on additional laboratory responsibilities without first gaining significant additional federal resources.

State-Federal Consultation

As previously described, DNR forges strong partnerships with scientists working for academic institutions, federal agencies, and private corporations in order to meet its research needs. The agency remains committed to fostering such partnerships as opportunities arise.

It would be helpful if EPA had a consistent and ongoing mechanism for states to provide input on EPA’s overall research agenda/priorities. States should be viewed as regulatory and research partners, not simply involved as another stakeholder. The “in-the-trenches” experience of states can greatly inform needs identification and the priority setting process.

Collaboration in research should be the rule rather than the exception. Ongoing mechanisms to elicit state input regarding “big picture” research strategies and agendas, as well as input from state subject matter experts regarding specific research programs and projects would help to improve coordination, collaboration, and communication. It would also enhance the credibility of EPA science.

Contact

For more information on Wisconsin-DNR’s environmental research interests and activities, or to obtain clearer copies of the following attachments, individuals may contact Dreux Watermolen, Science Information Services Section Chief (dreux.watermolen@wisconsin.gov).

APPENDIX –
Questionnaire for ECOS Members

Questionnaire
for ECOS Members

[Administered between Oct. 12, 2012 and March 22, 2013]

Instructions:

Please read the Questionnaire and provide responses to as many of the questions listed below as are of interest to your agency. Please submit responses to Matt Jones (mjones@ecos.org) by October 25 [2012].

Brief Description:

ECOS is writing a report on the status of state and federal environmental research programs. The report aims to comment on how well such programs are satisfying the research needs of states and how such programs might be improved upon to better inform state decision-making for environmental protection. We are soliciting input from several members of the ECOS Cross-Media Committee in an effort to collect material for the report. ECOS staff will compile the report to reflect the input of ECOS members. The report is intended to provide a sampling of state perspectives and will not purport to be a definitive comprehensive document.

Question 1:

Does your agency periodically conduct research to better inform your decision-making for protecting human health and the environment? What work has been done in a laboratory, or in the field? What research studies has your state conducted? Were you able to use the research findings to solve various problems? Please share as much information as is relevant.

Question 2:

Does your agency have an in-house laboratory? What sources of funding are drawn upon to support the lab's activities? Or do you share lab facilities with other state agencies? Have you contracted with academia and/or private firms/labs to conduct research for your agency? Please briefly summarize any research projects that were "farmed out." How do you see the current economic downturn and related budget dynamics influencing your state's ability to conduct research in the near future?

Question 3:

What are the research needs of your agency? Do you think your agency will be capable of pursuing whatever research studies are anticipated to be necessary in the near future? Or should EPA's Office of Research and Development pursue specific research projects to better inform themselves and your agency about particular environmental problems facing your state or the nation? Are there particular technologies you would like to see further developed which hold the promise of reducing pollution or saving resources? Are there particular research studies you would like to see conducted? By whom? Ideas may include: monitoring; field analyses; risk research; life-cycle analyses; sustainability benefits; alternatives assessments; Green Chemistry; and Design-for-the-Environment studies. Please provide as detailed a response as possible on whatever areas you deem important. Please emphasize which areas are of highest priority to your agency. At a minimum, please provide any thoughts you might have for the following areas:

- Chemicals (PCBs for example)
- Endocrine Disruptors
- Nanomaterials
- Chemical Products Alternatives Assessments/ Green Chemistry
- Hydraulic Fracturing

- Calculation of Benefits of BMPs for Non-Point Sources of Water Pollution
- Green Infrastructure
- Ways to achieve “net zero” water use
- Ultraviolet water disinfection technology

Potential researchers may include:

- Your state agency
- EPA/ORD
- DOD or SERDP
- ATSDR, NOAA, Others?

Question 4:

In March 2012, ECOS reissued Policy Resolution #08-1 which urges that “appropriate resources be directed to understanding the emerging risks associated with emerging contaminants in order to address their human and environmental impacts as expeditiously as possible.” The resolution also expresses support for collaboration and continued exchange of information to occur between states, DOD, EPA, and ATSDR to address emerging contaminants. In a report released in January 2010, the ECOS Cross-Media Committee identified “emerging contaminants” as a broad term that may encompass various chemicals of emerging concern, including endocrine disruptors and nanomaterials^{***}. Is your state facing any particular issues with emerging contaminants that remain unresolved? Are there any knowledge gaps regarding environmental or human health risks you would like to see filled? What studies should be conducted to help fill these gaps? Who should conduct the studies, and why?

^{***} “State Experiences with Emerging Contaminants: Recommendations for Federal Action.” Jan. 2010. Environmental Council of the States. Available: http://www.ecos.org/files/3959_file_January_2010_ECOS_Green_Report.pdf

Question 5:

What work has ORD recently conducted that your agency found particularly valuable?

All of ORD's published studies are available within EPA's searchable Science Inventory database here: <http://cfpub.epa.gov/si/>

Question 6:

Which components of ORD's planned research program ("Research for the 21st Century") do you think will be valuable for addressing your state's current needs? In particular, please provide your thoughts regarding the usefulness (or expected usefulness) of:

- ORD's Chemical Safety for Sustainability program (which includes the "CompTox" program which reviews chemicals to see if they exhibit similar attributes of other chemicals known to be harmful). See links: <http://www.epa.gov/ncct/>
<http://epa.gov/research/docs/css-strap.pdf>
- ORD's "ToxCast" program (which aims to develop ways to prioritize which chemicals, among the thousands that exist, most merit toxicity testing. The program also seeks to develop ways to predict the toxicity of chemicals):
<http://epa.gov/ncct/toxcast/>
- ORD's Human Health Risk Assessment program (which includes the "IRIS" system). See links: <http://www.epa.gov/IRIS/>
<http://epa.gov/research/docs/hhra-strap.pdf>
- ORD's forthcoming National Atlas for Sustainability:
http://gispub6.epa.gov/projects/NATLAS_afccf43eb1f64eaeb56cb235db9adf7f/index.html
- ORD's forthcoming Community Focused Exposure Risk Screening Tool (C-FERST):
<http://www.epa.gov/head/c-ferst/>

Question 7:

EPA Deputy Administrator Bob Perciasepe recently solicited ECOS' input regarding whether the agency's laboratory complex is "right sized," or whether the various labs should be consolidated to avoid duplication of effort or eliminate unnecessary research programs. We want to provide him a response to this question. ORD has 13 office locations throughout the nation (10 of which have a laboratory onsite). EPA has additional research facilities serving other agency programs as well as its regional offices. A complete map and rundown of these facilities is here:

<http://www.epa.gov/aboutepa/index.html#tabsmenu=4>

Please provide any specific recommendations you might have for how EPA's laboratory complex could be consolidated but still provide satisfactory services. Should EPA's laboratory complex be re-arranged in a way that would provide services that are more useful for EPA and the states? How might federal *and* state research programs be better coordinated to increase their usefulness or avoid duplication of effort? If you think EPA's laboratory capabilities are appropriately sized, you may respond to that effect. Or do you need more information before you can answer these questions? Should ORD meet again with ECOS (in person or via conference call) in order to provide more-detailed information on what activities are being conducted at their 13 office/laboratory locations?

Question 8:

ORD official Ramona Trovato met with ECOS members in August [2012] to discuss the status of environmental research in the U.S. And last year [2011], ORD hosted ERIS members on two separate visits to their facilities in Cincinnati, Ohio and Research Triangle Park in North Carolina. Please provide any recommendations you might have for how EPA could better coordinate its research programming with the states. How should EPA/ORD interact with ECOS, ERIS, and ITRC in the future? Do you have ideas for future collaboration between EPA, ECOS, ERIS, ITRC or others?