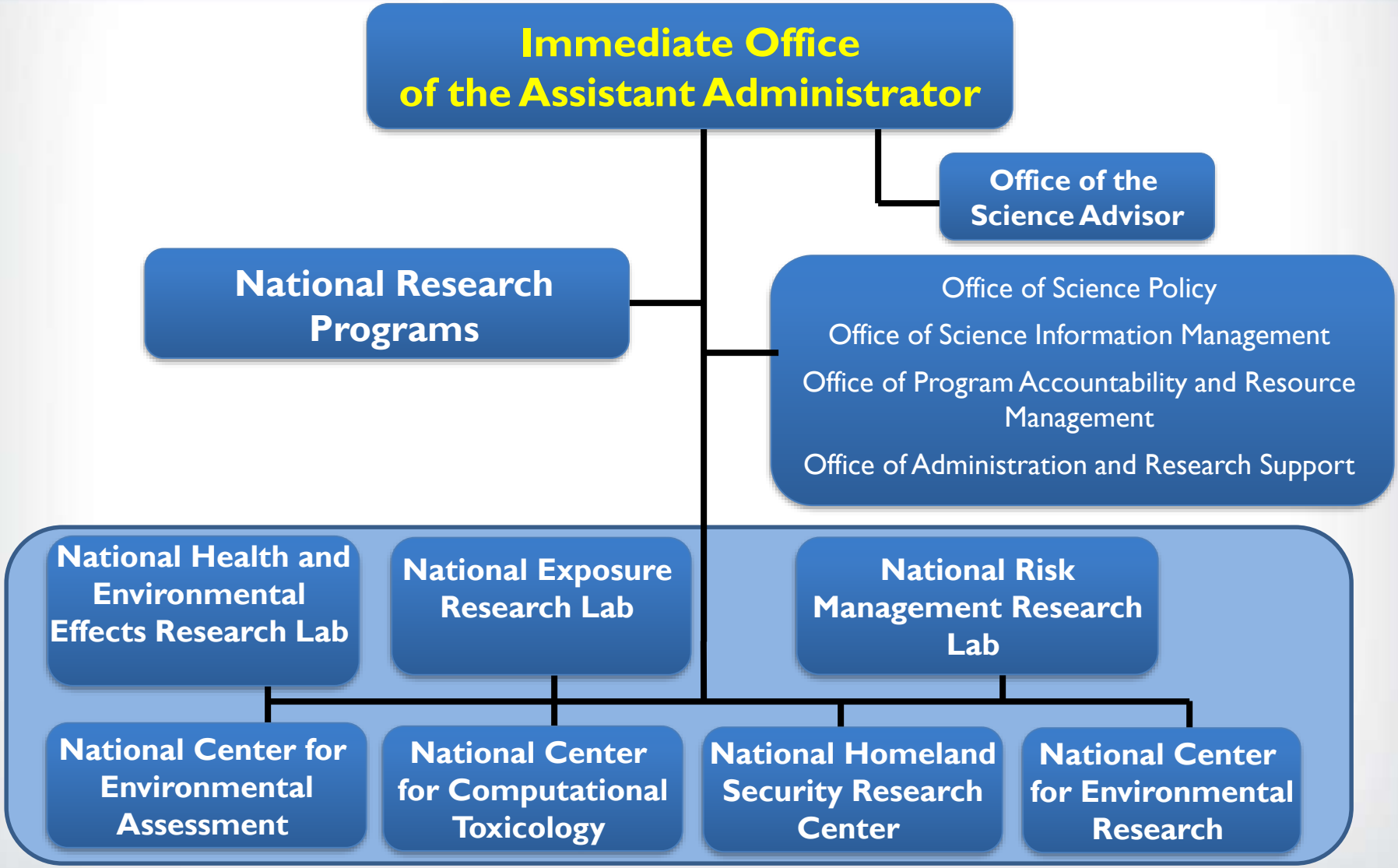
U.S. EPA's Office of Research and Development

Our Mission

Provide the science, technical support, technology and tools to inform EPA's mission to protect public health and the environment

ORD Organizational Chart



Research Authorization

- EPA's research provides science that is authorized by nearly 50 environmental laws including:
  - **Toxic Substances Control Act:** "conduct such research, development, and monitoring as is necessary to carry out the purposes of this Act. The Administrator may enter into contracts and may make grants for research, development, and monitoring under this subsection."
  - **Safe Drinking Water Act**: "conduct research, studies, and demonstrations relating to the causes, diagnosis, treatment, control, and prevention of physical and mental diseases and other impairments of man resulting directly or indirectly from contaminants in water, or to the provision of a dependably safe supply of drinking water."
  - **Comprehensive Environmental Response, Compensation, and Liability Act:** "shall assure the initiation of a program of research designed to determine the health effects (and techniques for development of methods to determine such health effects) of such substance…and in combination with other substances with which it is commonly found."
  - **Clean Air Act:** "shall establish a national research and development program for the prevention and control of air pollution."

ORD Research

ORD provides the scientific foundation for EPA to execute its mandate to protect human health and the environment.

1. Longer Term Research: ORD conducts innovative and anticipatory research applied to a range of EPA program and regional needs in air, water, land, and homeland security to solve longer term major environmental challenges and provide the basis of future environmental protection.
2. Research on Specific Environmental Challenges: ORD experts provide research support to EPA program and regional offices, as well as states, tribes, and communities, to help them respond to contemporary environmental challenges.
3. Technical and Emergency Support: Because of our expertise, local, state, and national officials come to us for technical support to respond to environmental crises and needs, large and small.

1. Longer Term Research

Chemical & Exposure Science

EPA's Computational Toxicology research applies cutting-edge technologies to efficiently and economically evaluate the safety of thousands of chemicals currently in use.

Advances in chemical research include:

- **Rapid testing for chemical exposures** combined with EPA's toxicity data to prioritize chemicals based on their potential to cause health risks
- **Alternatives to animal-testing** that are faster and less expensive, aligning with new TSCA standards
- **Publicly available data and tools** for use by states, companies, and the scientific community
- **Tox21 partnership** with NIEHS, NIH and FDA
- **Endorsed by recent NAS Report**, "Incorporating 21st Century Science in Risk-Based Evaluations"
- **Global interest** in applying new methodologies to accelerate the pace of chemical risk assessment

Homeland Security Research

- **ORD's Homeland Security Research Program** focuses on protecting water systems security, and remediating wide-area contamination incidents.
- For more than a decade, ORD has been assessing the best methods to identify and decontaminate threats from chemical, radiological, and biological agents.
- **Advances in decontamination research include:**
  - Identification and testing of several anthrax decontamination technologies during the Bio-Response Operational Testing and Evaluation project, in partnership with the Department of Homeland Security.
  - Evaluation of decontamination techniques in real-world situations to measure the costs and effectiveness of each method, and the expense of managing waste from cleanup.
  - Determination of the best ways to bring a transportation system, like a subway, back to service following an event as part of the Underground Restoration Project where we worked with the Department of Homeland Security, and the Department of Defense.

Other Longer Term Research

- **Sensor Technology Research and Challenges**
  - Creating challenges, prizes, and other incentive-based strategies to find innovative, cost-effective solutions to environmental challenges, such as monitoring pollution
- **National Aquatic Resource Surveys**
  - Supporting assessments of the Nation's waterways and wetlands to compare their condition over time and to support States in managing their aquatic resources
- **Oil Spills Research**
  - Mitigating the effects of past and future oils spills by developing laboratory protocols for the National Contingency Plan Product Schedule, providing guidance on bioremediation following spills and demonstrating important factors for dispersion of oil into the water column
- **Enabling Local Decisions**
  - Developing tools and approaches to effectively translate science and communicate public health information to people affected by environmental challenges and hazards, such as wildfires
  - Developing tools to help communities understand how a decision, such as building new roads, will impact their local communities and environments
  - Conducting research to understand how ecosystems services, such as clean air and water, fertile soil, and flood control, interrelate with human health and well-being

2. Research on Specific Environmental Challenges

Tire Crumb Research

- **Tire crumb** or crumb rubber is recycled rubber produced from automotive and truck scrap tires which contain various chemicals. Tire crumb is often used as a filler in artificial turf to increase shock absorption.
- **Concerns about possible adverse health effects (e.g., cancer) from exposure to tire crumb have been raised by the public** about the safety of recycled tire crumb used in playing fields and playgrounds in the United States.
- **Reports in the literature have not shown an elevated health risk from playing on fields** with tire crumb, but the existing studies do not comprehensively evaluate the concerns about health risks from exposure to tire crumb.
- **A Federal Research Action Plan on Recycled Tire Crumb Used on Playing Fields and Playgrounds** has been launched jointly by EPA, ATSDR and CPSC in order to study key environmental human health questions.
- **Key research plan components:**
  - Outreach and communication to key stakeholders
  - Data gaps analysis
  - Identify and characterize chemical compounds found in tire crumb used in artificial turf fields and playgrounds
  - Characterize exposures - how people are exposed to these chemical compounds based on their activities on the fields

Perfluoralkylated Substances (PFAS)

- More than 1,000 different PFAS in the TSCA inventory and some are used in everyday products, including stain resistant materials, non-stick cookware, and firefighting foam.
- PFAS contamination in soil and water: Hoosick Falls, NY; Joint Base Elmendorf Richardson in Anchorage, AK; and Wurtsmith Air Force Base in Michigan.
- Studies indicate that PFAS are associated with low infant birth weights, effects on the immune system, liver effects, increased cholesterol levels, cancer, and thyroid hormone disruption.
- **ORD researchers are:**
  - studying the potential hazards of PFAS in the environment using cutting-edge technologies pioneered by our computational toxicology research
  - developing a standardized method for remediation of PFAS in groundwater, ambient water, soil, and sediment
  - developing robust analytical methods for ground, surface, and wastewater and for solids including soils, sediments, and biosolids
- Co-leading a Cross-Agency workgroup to characterize the available toxicity information.
- Cross-Agency Coordination Team for PFAS led out of Office of Science Advisor (OSA)

Wildland Fire Related Research

- **Toxicology studies** are ongoing to differentiate how wildland fire smoke impacts human health compared with a typical urban environment
- **Health communication** information "Wildfire Smoke: A Guide for Public Health Officials" is available at the AIRNOW wildland fire site
- **Smoke Sense App** development - intended to understand effective health risk communication strategies for people impacted by wildfire smoke
- **Wildland Fire Sensors Challenge** - intended to stimulate development of low-cost, light-weight, accurate, and easily deployable sensor technology for first responders and public health agencies during wildland fires
  - Learn more at https://www.challenge.gov/challenge/wildland-fire-sensors-challenge/
- **Improved emissions and air quality modeling of wild and prescribed fire**; recent field work in Flint Hills, KS for Region 7 RARE; early stages of planning field work and model development focused on prescribed burning in the southeast U.S.
- Working toward a **comprehensive survey/inventory of EPA research** related to wildland fire (wildland fire research prospectus)

Other Contemporary Activities

- **Chemical Evaluation**
  - **TSCA Implementation**
    - Providing research expertise to evaluate specific chemicals and framing broader assessment activities within timelines mandated by the new law
  - **Integrated Risk Information System**
    - Enabling 21st century chemical evaluations
  - **Integrated Science Assessments**
    - Creating evaluations and syntheses of the most policy-relevant science for reviewing the National Ambient Air Quality Standards
  - **Environmental Contaminants**
    - Lead Exposure, Methyl Bromide
- **Harmful Algal Blooms**
  - Monitoring algal blooms and building an early warning indicator system for toxic and nuisance blooms
- **Climate Change**
  - Interpretation, assessments, and development of tools to respond to the changing environment
- **Small Water Systems Research**
  - Information, tools, training workshops and webinars, and technical assistance to state, local, and utilities personnel so that they can reduce costs and deliver safe, clean drinking water.

3. Technical and Emergency Support

Toledo Drinking Water Crisis

- In August 2014, Ohio EPA and the City of Toledo requested ORD's technical assistance to analyze drinking water for the presence of cyanobacterial toxins resulting in a harmful algal bloom.
- ORD helped identify the best approach for controlling cyanobacterial toxins in the treatment plant and the distribution system.
- Scientists provided rapid, crucial scientific assistance to inform the "Do Not Drink" order that the City of Toledo issued for approximately 500,000 people.
- We then provided critical information to the Mayor of Toledo and the Governor of Ohio to help them make the decision to lift the "Do Not Drink" order.

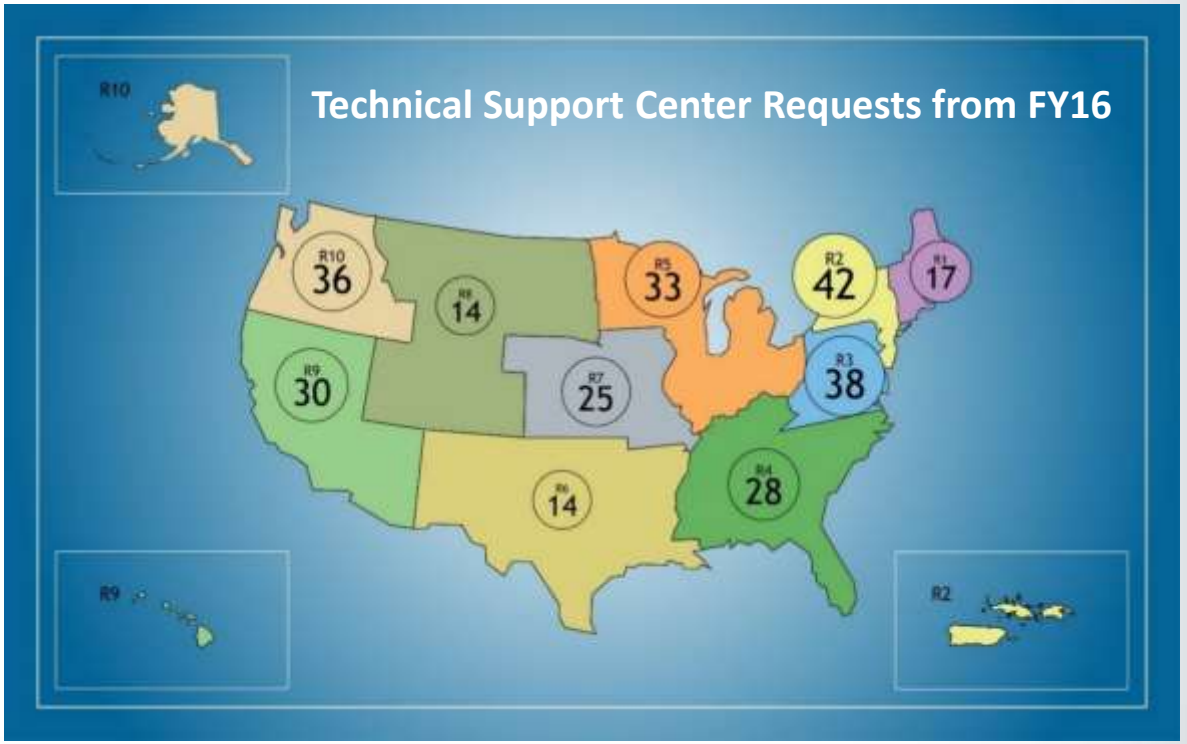
"When we were faced with an emergency in Toledo due to cyanobacterial toxins detected in their treated drinking water, ORD staff was a great partner and exceeded our expectations in understanding science and helping optimize treatment and restore safe drinking water to our residents." – Ohio EPA Director Craig Butler

Other Emergency Response

- **ReAChback for Emergency Response**
  - Quick-response scientific support capability to ensure coordinated, timely response to large-scale disasters
- **Corpus Christi, Texas Drinking Water Contamination**
  - Identified decontamination approaches to purge the drinking water systems of the contaminant
- **Flint, Michigan Drinking Water Crisis**
  - Developed sampling protocols and exposure risk assessment models for lead in drinking water, and distribution system monitoring for disinfectant and disinfection byproducts
- **Ebola Response**
  - Prepared for Ebola patients in U.S. by identifying decontamination methods for Personal Protective Equipment for health care workers, technical support for waste management, and the fate of the virus in wastewater
- **Gold King Mine**
  - Provided toxicity information and developed modeling for long-term monitoring
- **Elevating Critical Public Health Issues Policy**
  - Developed a process to allow staff to expedite the elevation of important issues

Technical Support Centers

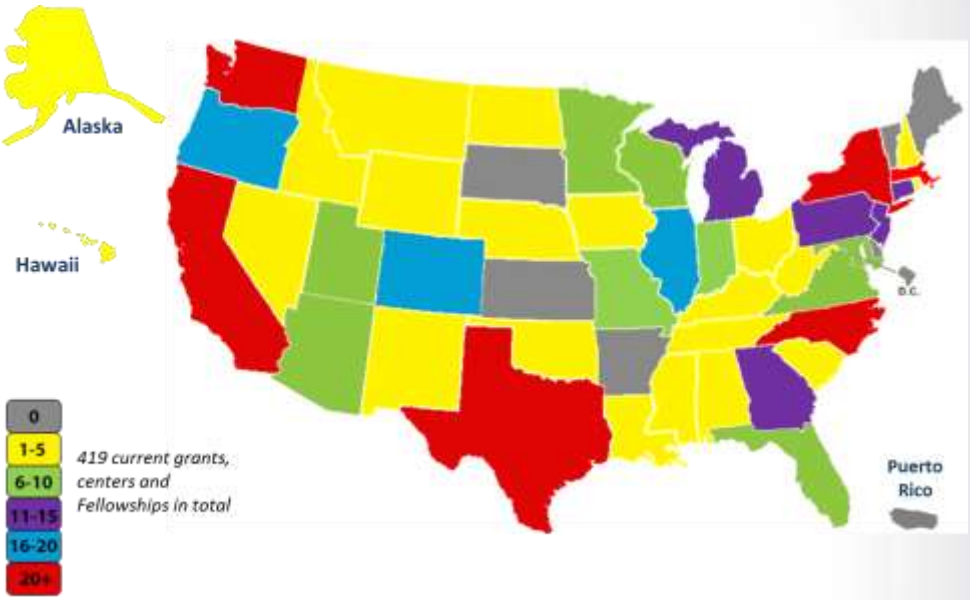
- ORD has Technical Support Centers that respond to requests from EPA's program offices and regions at Superfund, Resource Conservation & Recovery Act (RCRA), and Brownfields sites.
- 15 million pounds of explosive propellant were found at the Camp Minden site in Doyline, LA, after a portion of the stock detonated in 2012. ORD helped Region 6 and DoD by recommending a low-emission controlled burn system for rapid material disposal. Since its activation in 2016, the system has destroyed over 4 million pounds of propellant.



Extramural Research

Science to Achieve Results (STAR)

- EPA's STAR program funds research grants through a competitive selection process.
- STAR engages some of the nation's best scientists and engineers in research that complements EPA's own research.
- The map shows extramural research grants, centers, and Fellowships active in FY15.



Small Business Innovation Research (SBIR) Program

- Mandated by the Small Business Innovation Development Act of 1982, EPA's SBIR program provides critical early-stage capital for innovative small companies in the green tech arena.
- Since 1982, SBIR has supported 616 individual small businesses with 1,782 (1329 Phase Is, 453 Phase IIs) awards and around $186,000,000 in 46 states (as of 2016).
- A great SBIR success is the company Ecovative, which developed an innovative technique using mushrooms to create water-resistant, flame-retardant, compostable, heat-trapping insulation that is as strong as concrete by weight.

ORD's Regional Science Program

OSP's Regional Science Program links ORD with EPA's regional offices and promotes the integration of ORD science into regional and state decisions.

- Builds networks and partnerships between ORD and regional office staff
- Coordinates programs involving regionally-focused research that often includes a state or local partner and addresses high priority science needs
- Provides technical support to regions, states and communities
- Key components include:
  - Regional Applied Research Effort – responds to high priority, near-term applied research needs of EPA's regions, state and local governments, and tribes
  - Regional Research Partnership Program – A short-term training program that provides opportunities for regional scientists to work with ORD researchers
  - Regional-ORD Community of Science Networking Program – A networking program for regional scientists and engineers who have limited familiarity with ORD

State Engagement

State agencies work on the front lines of protecting public health and the environment and rely on EPA's science-based tools, approaches and methods, technical support and training.

- **State Research Needs**
  - Through ECOS/ERIS surveys, ORD better understands the science needs of state environmental agencies
- **Memorandum of Agreement with ECOS and the Association of State and Territorial Health Officials (ASTHO)**
  - Two ORD pilots on Wildfire Smoke Guide and EPA's Community-Focused Exposure and Risk Screening Tool (C-FERST)
- **Webinars on research products and tools**
  - *EPA Tools & Resources* monthly series addresses state identified priority areas and provides a mechanism for state input on ORD research
- **Outreach and collaboration**
  - Lab visits to share ORD scientific capabilities and discuss research topics of interest to states

"I want to thank EPA ORD for their assistance in gathering and interpreting air quality data from around the Denka Performance Elastomer facility in LaPlace, LA. The information ORD provided helped the Louisiana Department of Environmental Quality (DEQ) design and implement actions to reduce chloroprene emissions from the plant. The multi-step Denka remedy is in the first stages of its implementation and has already produced significant reductions in chloroprene emissions. When agencies work together, everyone benefits."

– Louisiana DEQ Secretary Dr. Chuck Carr Brown

State Research Priorities

Water Quality

- Nutrients
- Stormwater
- Water reuse
- Wastewater infrastructure
- Small system drinking water and wastewater treatment

Emerging Contaminants/Toxics

- Manage new chemicals of emerging concern and existing chemicals (e.g. PFAS)

Waste/Remediation

- Soil
- Groundwater
- Surface water
- Sediment

Air

- New ozone standard
- Interstate and cross-border transport

2016 ERIS States' Research Needs Survey Summary:
https://www.ecos.org/wp-content/uploads/2017/04/ERIS-Survey-Summary-One-Pager.pdf

ORD Support for States

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AK – PFAS
ID – Modeling for agriculture, energy, water and air systems interactions
OR – Water nitrate contamination; Tools to help communities identify environmental issues; Ocean acidification research; Reducing methyl mercury levels; Advanced monitoring technologies
WA – Managing nutrients in riparian ecosystems; Habitat suitability models

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CA – Evaluating chemicals; Population and land use projections; Synthetic turf field safety; Decontaminating subway railcars; Decision support tools to advance communities' priority projects; Risk assessment training; Advanced monitoring technologies
NV – Groundwater characterization and remediation

8

CO – Simulating conditions in drinking water utilities; Advanced monitoring technologies
MT – IRIS assessment for Libby Amphibole Asbestos; Asbestos exposure following forest fires
UT – Fine particle air pollution; Emissions measurement methods

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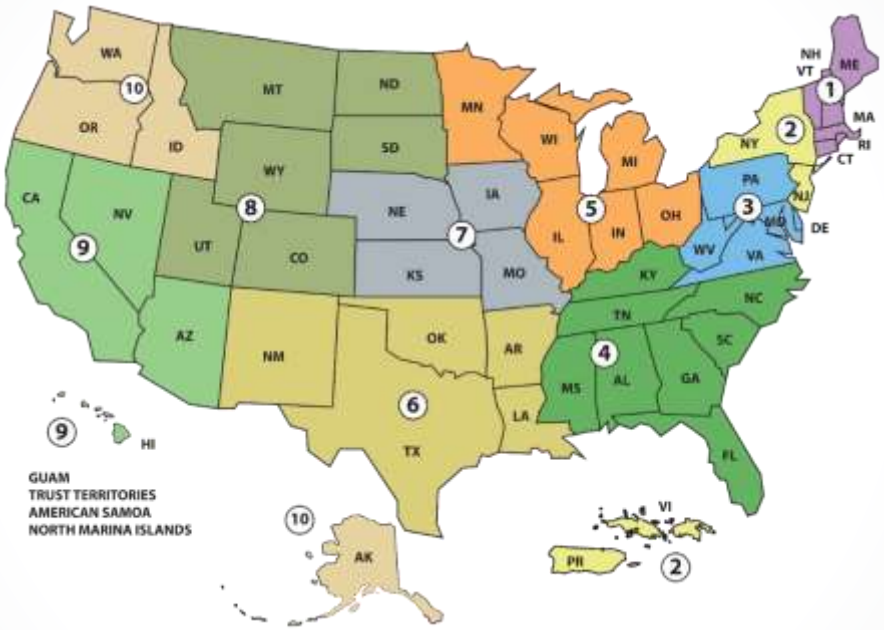
IA – High ammonia levels in drinking water
KS – Prairie rangeland burning; Community air quality monitoring
MO – Models and tools to reduce sewer overflows



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LA – Cancer risk assessments
OK and **TX** – Community air quality monitoring
OK – Chemical composition analysis; Evaluating water interactions at Superfund site
TX – Chemical contamination risks

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MI – Lead contamination technical support; Simulating conditions in drinking water utilities
MN – Sulfate standard development support; Modeling bioaccumulation of PCBs and mercury in fish
OH – Harmful algal blooms limiting drinking water; Managing algal toxins; Small drinking water systems; Simulating conditions in drinking water utilities
WI – Predicting water quality at beaches

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CT – Community air quality monitoring;
CT, MA, ME , NH, RI and **VT** – Stream monitoring network; Planning for energy and air emissions
CT and **NH** – Advanced monitoring technologies
ME – Tribal risk assessment (sediment and water quality)
VT – Impervious cover data for watersheds

2

NJ and **NY** – Stream monitoring network; Planning for energy and air emissions
NJ – PFAS
NY – Management of bio-hazardous wastes; Planning for biological incident; Simulating conditions in drinking water utilities

3

DE, MD, PA, VA and **WV** – Stream monitoring network
MD – Managing stormwater treatment systems; Advanced monitoring technologies; Reducing harmful air pollutants; Management of bio-hazardous wastes
MD, PA and VA – Stormwater management planning support
PA – CADDIS causal assessment; Community air quality monitoring

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AL, GA, KY, NC, SC, TN – Stream monitoring network
FL, GA, KY, NC, SC, TN – Characterizing urban background levels for contaminated site cleanup levels
FL, KY – Simulating conditions in drinking water utilities
GA – Green infrastructure in Atlanta's Proctor Creek
KY – Advanced monitoring technologies
MS – Fecal bacterial and viral indicators
NC – Community air quality monitoring; STEM education; Wright Chemical Superfund Site
SC – Food waste reduction

https://www.epa.gov/research/us-epa-office-research-and-development-and-environmental-council-states-partners-meeting

Upcoming Meetings

- **ECOS Fall Meeting**
  - September 11-13, 2017, in Jackson Hole, WY
  - Have proposed an ERIS-led plenary session to discuss our joint work on state research needs, highlighting how EPA research, tools and technical assistance have helped states
  - ERIS Board meeting to make connections with states and research partners, set future directions, and follow-through on action items from the summer meeting in Oklahoma

- ***EPA Tools and Resources* Monthly Webinar Series**
  - Upcoming webinar: *ECOTOX Database* – July 19, 2017 3:00-4:00 PM ET
  - Archived past webinar recordings and presentations available at: https://www.epa.gov/research/epa-tools-and-resources-webinar-series

- **Invitation to EPA Laboratory Facilities**

Additional Slides

Recent ORD Support for Region 6 States

Partner: Louisiana Department of Environmental Quality (DEQ); LaPlace, LA
Challenge: Potential cancer risks from emissions of chloroprene (completed)
Resource: IRIS assessment and air quality monitoring

- ORD scientists assisted Region 6 and the state of Louisiana with their evaluation of potential cancer risks from emissions of chloroprene from the Denka Performance Elastomer facility in LaPlace.
- Ambient air monitoring near the facility showed high levels of chloroprene in the area. EPA researchers characterized potential health risks associated with chloroprene.
- EPA directly supported Louisiana in achieving action to reduce public health risks from the chloroprene emissions.

I want to thank EPA ORD for their assistance in gathering and interpreting air quality data from around the Denka Performance Elastomer facility in LaPlace, LA. The information ORD provided helped the Louisiana DEQ design and implement actions to reduce chloroprene emissions from the plant. The multi-step Denka remedy is in the first stages of its implementation and has already produced significant reductions in chloroprene emissions. When agencies work together, everyone benefits."

– Louisiana DEQ Secretary
Dr. Chuck Carr Brown

Recent ORD Support for Region 6 States

Partners: Oklahoma Department of Environmental Quality (DEQ) and participating pilot locations including the cities of Chicago, IL; Durham, NC; Hartford, CT; Houston, TX; Kansas City, KS; Oklahoma City, OK; Philadelphia, PA and Washington, DC
Challenge: Air quality monitoring for community awareness (ongoing)
Resource: Village Green Project

- Original prototype was field-tested outside a public library in Durham, NC; currently there are 8 stations across the U.S., including stations in the Myriad Botanical Gardens in Oklahoma City and the John P. McGovern Museum of Health & Medical Science in Houston.
- Village Green Project (VGP), developed by ORD, is a compact, solar-powered system that takes air and weather measurements with instruments built into a park bench.
- VGP showcases next-generation air measurement technology by providing quality-assured data to the public on a near real-time basis, updating to a public data website every minute.

"The Village Green station is a helpful tool in educating the public, and particularly children, about the importance of air quality in our everyday lives," "We are thankful to be one of several cities across the country to have such an innovative tool."
– Oklahoma DEQ Executive Director Scott Thompson
referring to the VGP in Myriad Botanical Gardens in Oklahoma City

Recent ORD Support for Region 6 States

Partner: Oklahoma Department of Environmental Quality (DEQ)
Challenge: Fish kills and unknown contamination
Resource: Chemical Composition Analysis

- Unknown contaminants were present during four fish kills in the Red River watershed.
- EPA scientists identified the contaminants to be stray gases from an unknown source.
- EPA assisted with overseeing further chemical analysis that determined the gases were from a natural, biogenic source.

"The ORD laboratory in Las Vegas was a valuable asset during Oklahoma DEQ's investigation into the Red River fish kills. This facility's expertise and analytical technologies assisted with researching potential causative agents related to these fish kills. In addition, I strongly support the mission of ORD to conduct valuable research that leads to improvements in the continued protection of public health and the environment."
– Oklahoma DEQ Executive Director Scott Thompson

Recent ORD Support for Region 6 States

Partners: Oklahoma Department of Environmental Quality (DEQ)
Challenge: Evaluation of groundwater and surface water interactions at the Oklahoma Refining Co. Superfund site (ongoing)
Resource: Technical evaluation of remediation plans for the site

- Shallow groundwater beneath the site flows away from the Cyril, OK community and discharges into Gladys Creek. Approx. 1,600 people on public or private drinking water wells live within 3 miles of the site.
- Previous site investigations into contaminant concentrations in groundwater, surface water, soil and sediments showed where contaminants were found and exceeded standards, but mass flux estimates of contaminants were necessary to determine the adverse impacts on Gladys Creek.
- Efforts included identifying groundwater discharge routes, quantifying groundwater and surface water discharge, estimating the contaminant mass flux in the surface water and groundwater, and evaluating the overall hydrology of the Gladys Creek watershed.
- ORD helped review the plan to evaluate the impacts of the groundwater-surface water interactions on contaminant migration at the site. This information will assist Oklahoma DEQ in developing a remedial design for the remainder of the site.

"EPA ORD provided concrete recommendations on data acquisition that have been incorporated into the ongoing investigation at the refinery. This access to experts really augments our ability to focus our resources to obtain the right information to support decision making."
– Oklahoma DEQ Executive Director Scott Thompson

Recent ORD Support for Region 6 States

Partner: Texas Commission on Environmental Quality (TCEQ), Texas Department of State Health Services (DSHS) and City of Corpus Christi
Challenge: Chemical contamination in Corpus Christi's water supply (completed)
Resources: Determine health risks and action level

- In December 2016, EPA ORD scientists and Region 6 responded to a request to assist Texas after an asphalt emulsifying agent, Indulin AA-86, contaminated Corpus Christi's water supply. Toxicity information along with treatment options to remove this chemical from water was lacking.

- ORD researchers provided assistance early in the response for decontamination approaches that might be suitable to remove the contaminant from the system. EPA helped dissect the chemical's toxicity and possible risks associated with ingestion of contaminated water and the water soluble salt from the product.

- TCEQ and the Texas DSHS, along with ORD researchers, worked together to establish a health-based action level for the contaminant and supported an immediate need to protect public health.

"The water situation in Corpus Christi last December was a good example of cooperation between Texas and EPA and the success we have when all work towards solving an environmental issue."
– TCEQ Chairman
Bryan W. Shaw, PhD, PE

Upcoming Meetings

- **ERIS Board-EPA ORD Joint Meeting**
  - Annual face to face meeting
  - July 11 (ORD's Groundwater, Watershed and Ecosystem Restoration Division (GWERD) in Ada, OK) and July 12 (Oklahoma DEQ in Oklahoma City)
  - Have invited senior officials from Region 4 and 6, as well as the Office of Water
  - Agenda is being developed but will include update on ORD budget, follow-up on ERIS survey on state research needs, pilots with ECOS and ASTHO on public and environmental health, GWERD tour and research vignettes, OK DEQ overview and environmental issues facing the state, as well as perfluorinated chemicals and regional perspectives

- **ECOS Fall Meeting**
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