



ORD Air Research Planning with ECOS

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- Are there any clarifying questions about our capabilities and/or the kind of research we do related to air?
- Do the areas on which we are focusing align well with your states' science and technical needs?
- Are there areas you would suggest emphasizing or de-emphasizing? Is there anything missing?
- Do you have any other feedback as we formulate our Strategic Research Action Plans that cover 2019-22?





EPA National Research Programs

Air and Energy (A-E)



Sustainable & Healthy Communities (SHC)



Homeland Security (HS)



Chemical Safety for Sustainability (CSS)



Human Health Risk Assessment (HHRA)



Safe & Sustainable Water Resources (SSWR)





Air and Energy (A-E) National Research Program

*Preparing for the Future: Building a Foundation of Science
to Inform Policy Decisions and to Solve Problems*

- Background
- Addressing States' Priorities
- Planning for the Future: Strategic Research Action Plan (StRAP) Refresh
 - Air and Energy Research within the EPA Strategic Plan
 - Approach to developing priorities
 - Proposed program structure
 - Consideration of current ECOS/ERIS state research needs
- Request for Feedback and Timeline
- Supplemental Information

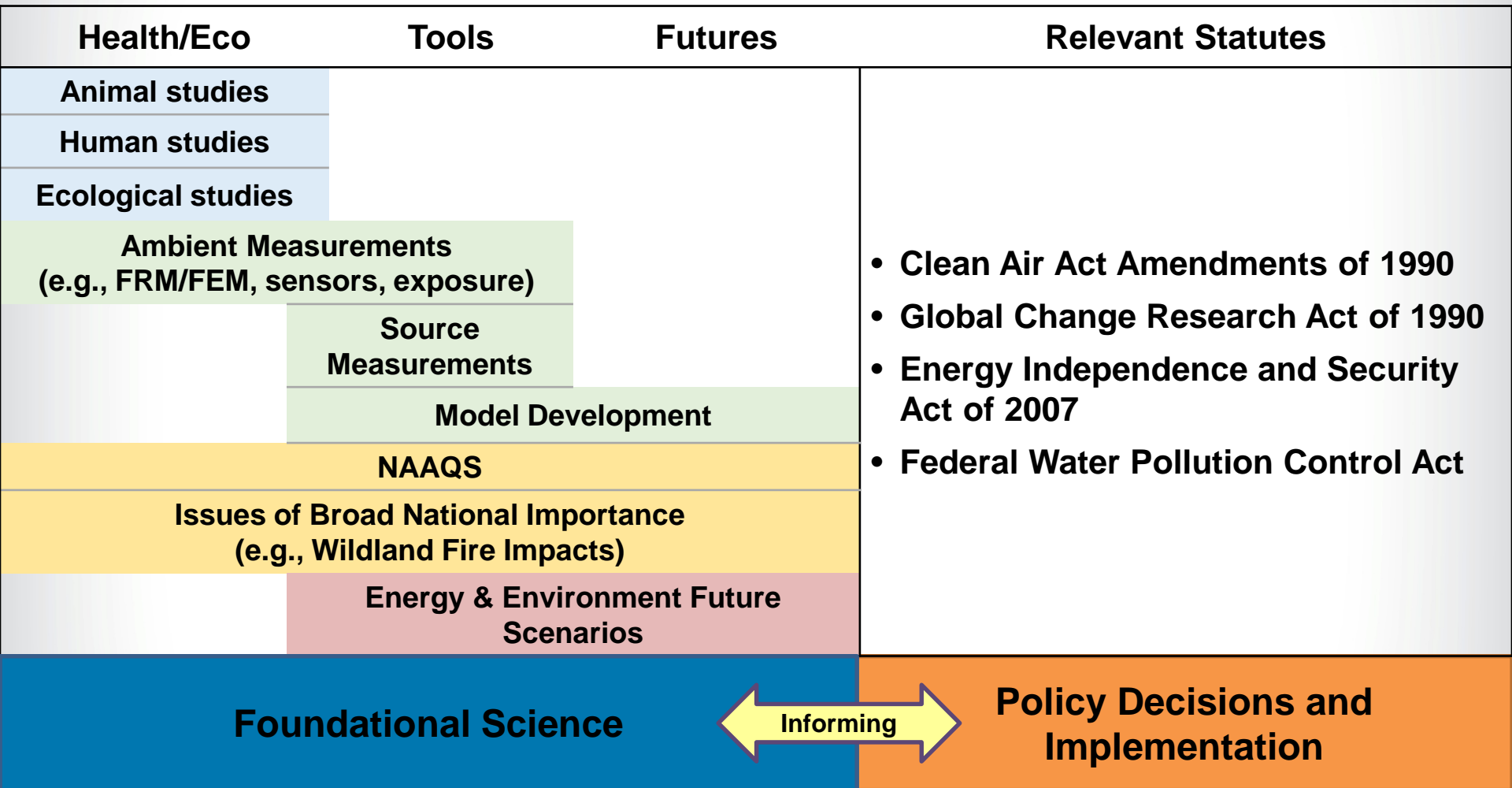


To advance the science and provide information critical to improving air quality and addressing impacts that are influenced by changes to the Nation's energy portfolio and environmental conditions





Basic Program Components and Connections to Statutes





Addressing States' Priorities

(a few highlights)



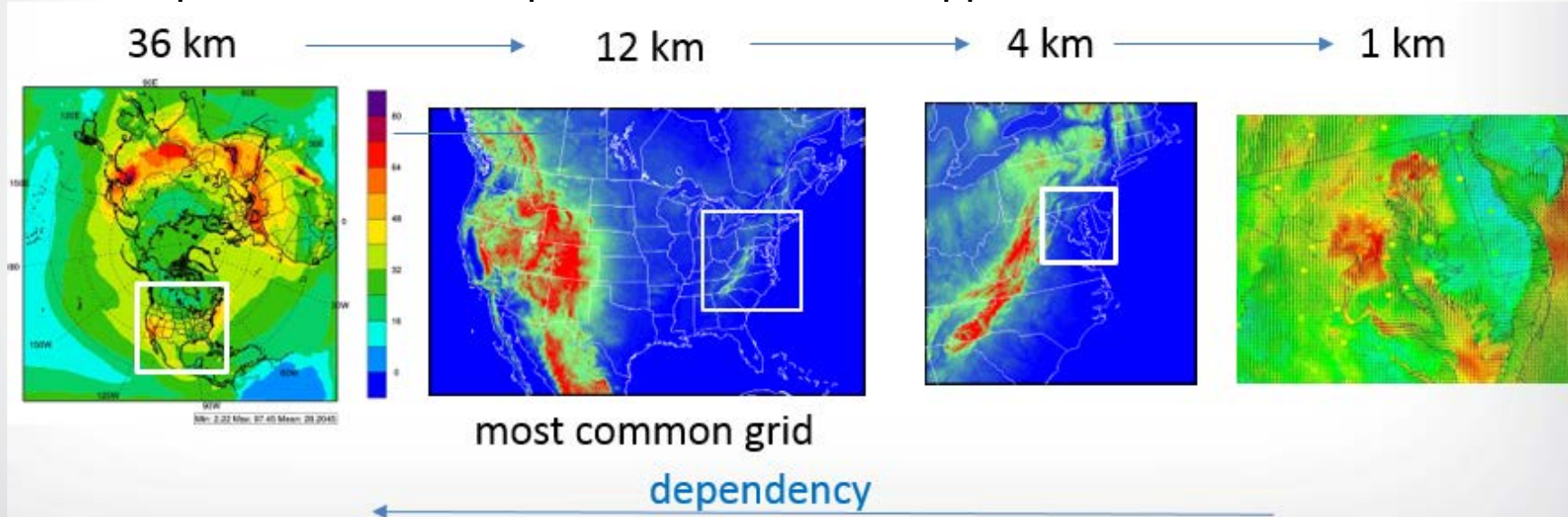
Results of ECOS/ERIS 2016 Survey

- Ozone: 2015 national ambient air quality standards (NAAQS)
 - Role of transport
 - Monitoring
 - Background
- Clean air/air quality
 - Regional haze
 - Monitoring PM_{2.5}
 - Emissions profiles of flaring from landfills
- Climate adaptation/resiliency/mitigation
- Reducing CO₂



Community Multiscale Air Quality (CMAQ) Model

- Initial version 1998 – now on Version 5.2 (released 2017)
- Open-source, cutting edge – model founded on first principles (meteorology and empirical chemistry)
- Fundamental model for EPA's Office of Air Quality Planning and Standards assessments
- Used by 27 states for SIPs and Regional Haze – esp O₃ and PM
- Over 12,000 downloads internationally: govt., private sector and academic
- Multipollutant and multiple scales for broad application





Ambient Air Quality Monitoring

- **Federal Reference and Equivalent Methods (FRM/FEMs)**
 - Evaluate and approve methods used by States to support attainment/non-attainment decisions
- **Independent evaluation of low-cost, air sensor technologies**
 - Lab and field testing of O₃, NO_x, VOCs, and PM sensor technologies
- **Field Campaigns (e.g., DISCOVER-AQ, LMOS, LISTOS)**
 - Method evaluation and science to promote new measurements and techniques using satellite and airplane remote measurements in combination with ground-based measurements
 - Collaborative efforts with federal agencies (NASA, NOAA, NSF), EPA regions, and states
- **Village Green Project** – Solar-powered park bench with small, high quality instruments, streams real-time meteorology, O₃, and PM data to public (currently 8 active)
- **E-Enterprise** – Joint EPA/state team developing a path forward to promote understanding and use of advanced monitoring technology





Research Informing State Implementation Plan (SIP) Development (1 of 2)

2017 Utah Winter Fine Particulate Study (UWFPS)

- Urban air basins along Utah’s Wasatch Mountains; population: >2.4 million
 - Experiences some of the most severe PM air pollution episodes in the Nation
 - PM_{2.5} exceedances associated with adverse health effects along the Wasatch Front
 - PM_{2.5} exceeded 24-hr NAAQS ~18 days/year
- Outcomes of UWFPS
 - Demonstrated central role of formaldehyde and its precursors to oxidant budgets and PM_{2.5} formation in Salt Lake City area
 - Data informs SIP development to reduce PM_{2.5}



Study dates: Jan 16 – Feb 15, 2017



“EPA ORD has been a valuable partner in our efforts to advance needed energy development while improving air quality in the Uinta Basin.” – Utah DEQ Executive Director Alan Matheson





Research Informing SIP Development (2 of 2)

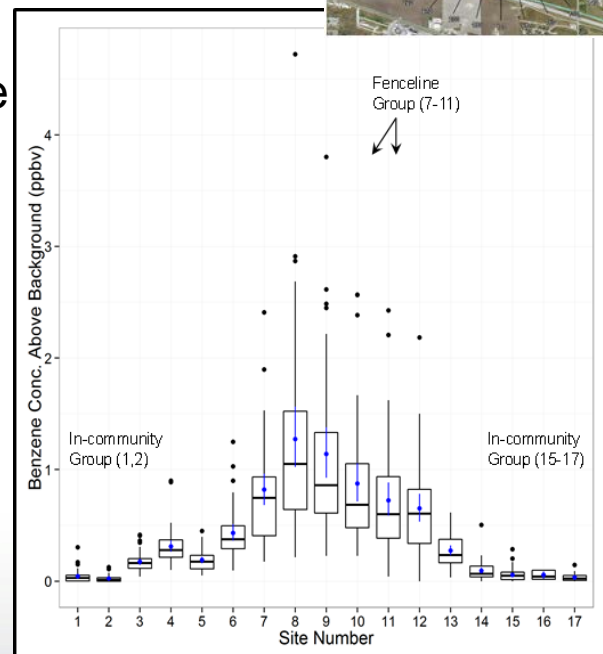


2017 Lake Michigan Ozone Study (LMOS) and 2018 Long Island Sound Tropospheric Ozone Study (LISTOS)

- Ozone nonattainment issues at land-water interfaces are challenging for current modeling capabilities
- Two field campaigns, in two different regions, are focused on improving characterization of complex ozone nonattainment regions
 - NASA satellite measurements provide spatial context to EPA surface measurements
 - Scientific Aviation and Univ. of MD measurements (insitu aircraft) provide vertical characterization
 - EPA ground-based measurements provide connection to surface
- Study goals include:
 - Improve understanding of specific features of ground-level ozone photochemical formation in near-shore environments and downwind transport
 - Provide assistance to states on new PAMS requirement for Enhanced Monitoring Plans
 - Help define needs to enhance current chemical modelling capabilities
 - Investigate impacts of long-range transport of wildland fire plumes



- Advanced monitoring for detecting fugitive volatile organic compound (VOC) emissions at large facilities
- Spod: Solar powered “drop in place” fence-line sensor system for leak detection providing real-time data
 - Seminal work by ORD/AE [Method 325A,B] incorporated into 2015 New Source Performance Standard for petroleum refineries
 - GMAP: mapping perimeter with mobile sensors
 - Data from these fence-line monitors provides data to industry for corrective action or other emission controls
 - Provide information for nearby communities about toxic air pollutants



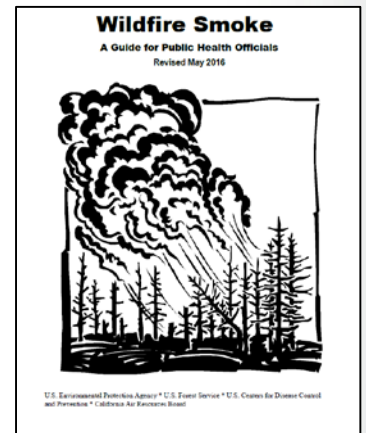
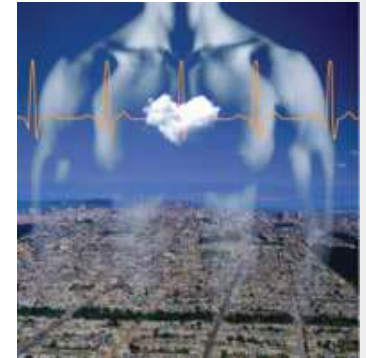


Cardiovascular Risks of Air Pollution: Advancing Public Health

- Significant research investments since ~2002
- Established biological mechanistic pathways for effects (intramural and STAR grants)
- [Multi-Ethnic Study of Atherosclerosis – Air](#) demonstrated progressive clinical disease over 10 years (Lancet, 2016)
- Wildfire smoke associated with more ER visits for heart, stroke ailments among seniors (Jour Am Heart Assoc, April 2018)

IMPACTS

- *Critical science supporting PM NAAQS*
- *CDC advising heart patients to avoid PM exposure*
- *EPA outreach to clinicians and public health agencies*



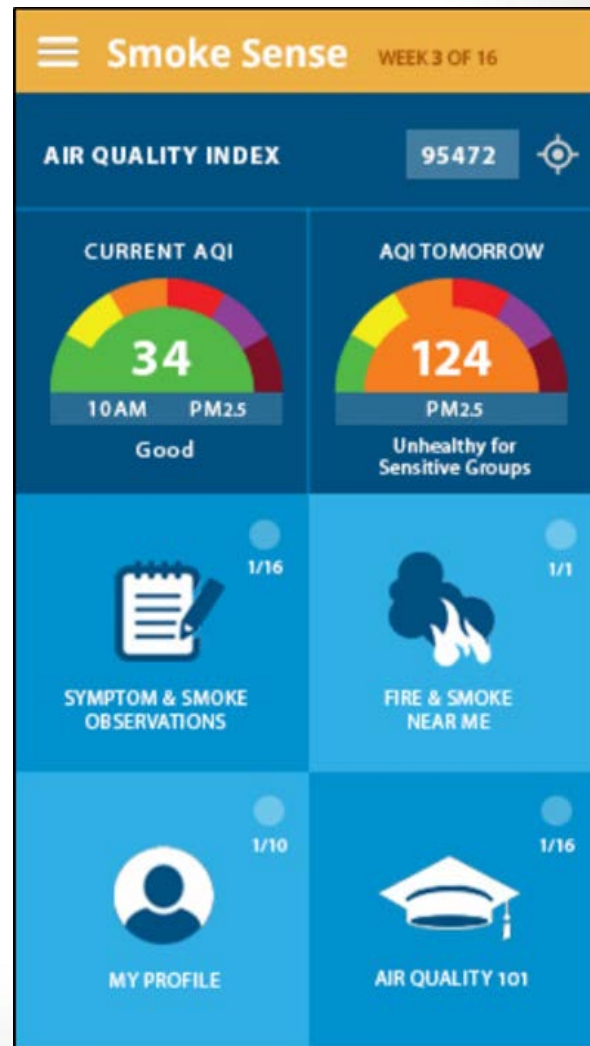


Smoke Sense Project

Improving Public Health Outcomes

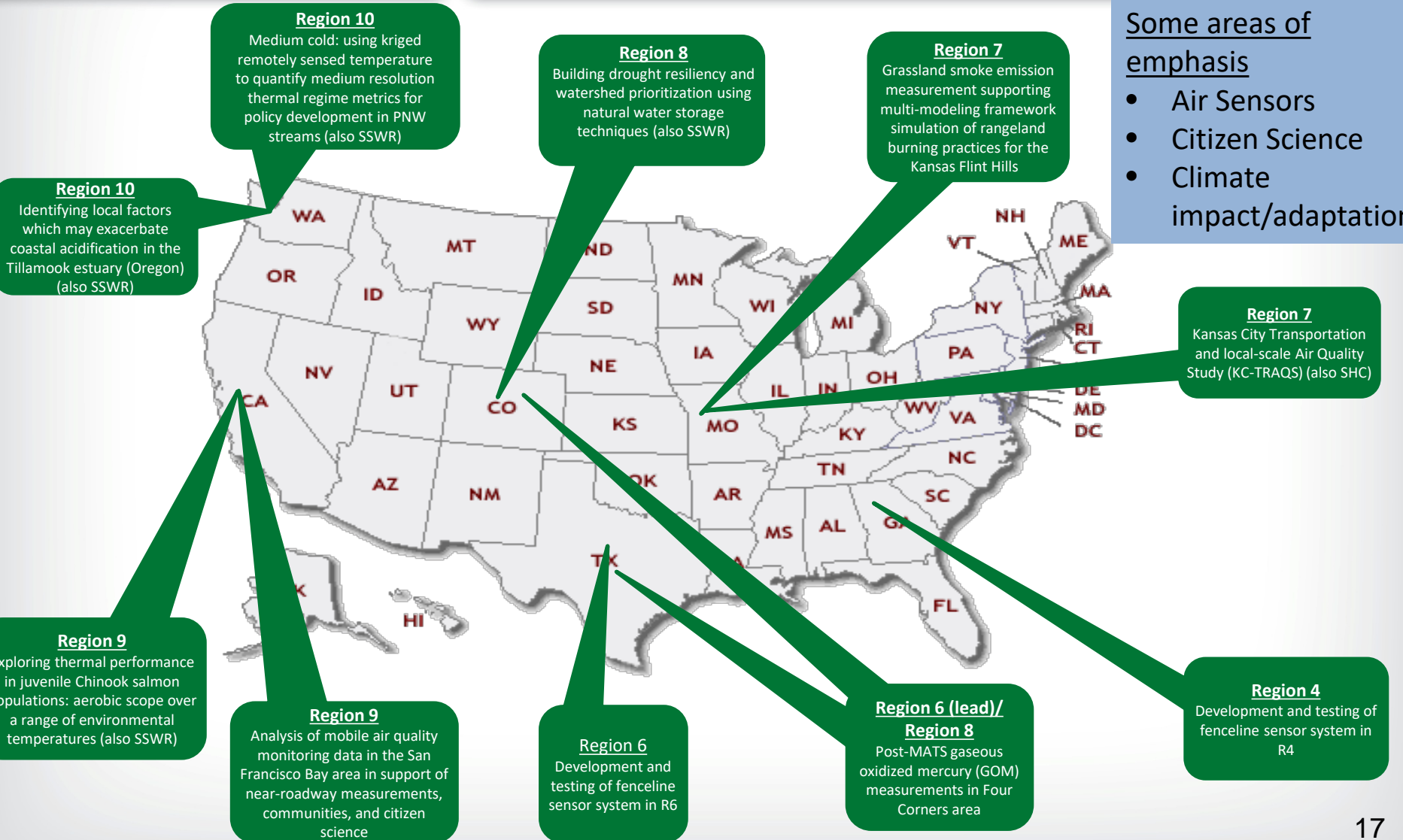
- Aims of Smoke Sense:
 - Measure the effect of wildfire smoke exposure on health and productivity
 - Develop health risk communication strategies to improve public health outcomes
- As part of this, researchers have developed a Smoke Sense mobile phone application (Android and iOS) to:
 - Collect user input on how smoke events impact their health and daily activities, and
 - Provide information about the smoke exposure and recommended health risk messages
- In 2017, ~ 5,000 people started using the app; primarily from CA and WA

Learn more at: <https://www.epa.gov/air-research/smoke-sense-study-citizen-science-project-using-mobile-app>





A-E Regional Applied Research Efforts (RARE) Research – FY17





Region 7 RARE Project: Flint Hills Prescribed Fires

- Annual grass/rangeland prescribed burning in Flint Hills region of central KS
- Minimize invasive woody species and stimulate new grass growth for cattle grazing
- This practice can lead to elevated O_3 and PM regionally
 - Kansas developed an exceptional event demonstration for O_3 impacts in Kansas City & Wichita from Flint Hills burning in 2011
- Field work at Konza Prairie Biological Station conducted to evaluate and improve emission estimates (March 2017)
 - Also working to better understand plume rise and dispersion to improve air quality model representation of these fires



“Kansas Department of Health and Environment is excited and optimistic about the potential uses of this multi-model framework...that can be used to supplement our existing Flint Hills Smoke Management Plan modeling tool.” – KDHE Division of Environment John Mitchell (former director)

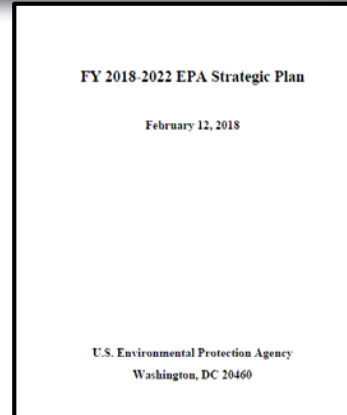


Planning for the Future



Approach to StRAP “Refresh”

- Align with [FY2018-2022 EPA Strategic Plan](#) (Feb 2018)
- Continue with current focus areas
 - Maintain emphasis on high priority research areas
 - Increase emphasis on specific research areas that are of emerging importance to EPA program and regional offices and states/tribes/locals
- Enhance translation of science
- Revise organization of program structure to more efficiently and effectively address critical research questions
 - Reflect input from partners in EPA program and regional offices and states
- Leverage A-E portfolio to complement other agencies’ research efforts
 - Expand collaborations with these agencies, as appropriate





Final EPA Strategic Plan

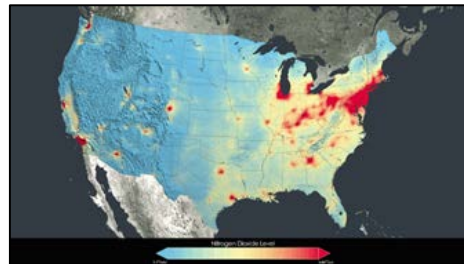
(FY2018-2022, issued February 12, 2018)

- Goal 1 – Core Mission: Deliver real results to provide Americans with clean air, land, and water, and ensure chemical safety
 - **Objective 1.1 – Improve Air Quality**
 - *Work with states and tribes to accurately measure air quality and ensure that more Americans are living and working in areas that meet high air quality standards*
- Goal 2 – Cooperative Federalism: Rebalance the power between Washington and the states to create tangible environmental results for the American people
 - **Objective 2.1 – Enhance Shared Accountability**
 - *Improve environmental protection through shared governance and enhanced collaboration with state, tribal, local, and federal partners using the full range of compliance assurance tools*
 - **Objective 2.2 – Increase Transparency and Public Participation**
 - *Listen to and collaborate with impacted stakeholders and provide effective platforms for public participation and meaningful engagement*
- Goal 3 – Rule of Law and Process: Administer the law as Congress intended, to refocus the Agency on its statutory obligations under the law
 - **Objective 3.3 – Prioritize Robust Science**
 - *Refocus the EPA's robust research and scientific analysis to inform policy making*



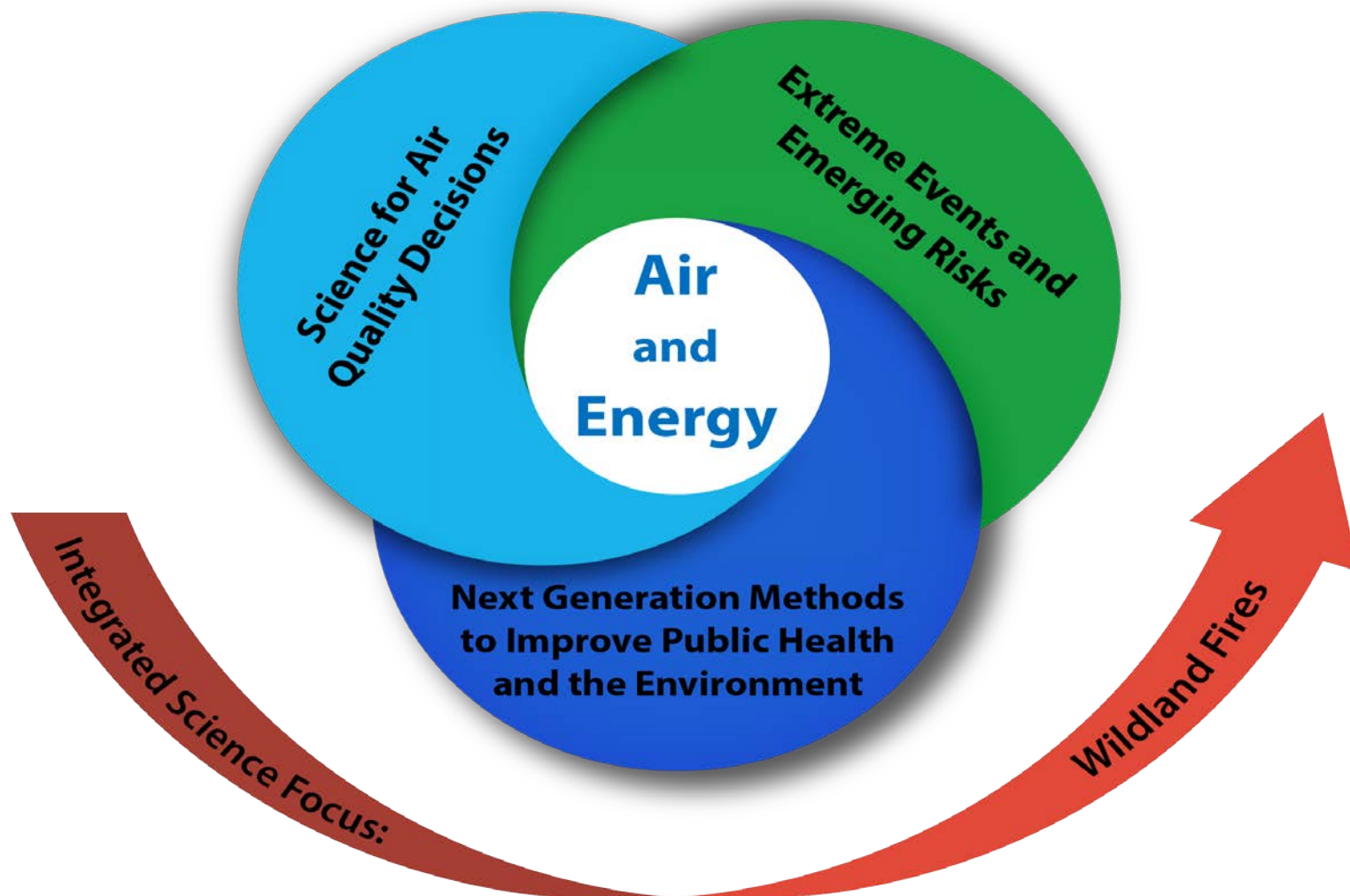
Proposed Program Objectives

- Assess human and ecosystems exposures and effects associated with air pollutants at individual, community, regional, national, and global scales
- Develop and evaluate approaches to prevent and reduce air pollution now and in the future
- Advance human exposure and environmental modeling and monitoring under changing environmental conditions
- Deliver state-of-the-art tools to inform decision making for current and future environmental issues at the national, state, tribe, and local level



Proposed Program Structure

Research topics/areas are interconnected and rely on multiple scientific disciplines working collaboratively



Conduct Science to Inform Decision-Making

- Develop, evaluate, and apply improved measurement methods
- Develop and evaluate methods and models to support air quality management programs
- Provide tools for state/tribal/local stakeholders' use to identify and evaluate effective emissions reduction strategies
- Improve understanding of local and regional characteristics influencing impacts on public health in healthy and at-risk populations



Extreme Events and Emerging Risks

Understand Air Quality and Impacts in a Changing Environment

- Develop or modify existing methods to enhance our knowledge of emerging air pollutant sources and ambient exposures
- Assess:
 - Human health and ecosystem responses to emerging air pollutants and sources and changing environmental conditions
 - Impacts of extreme events on air quality and infrastructure for which EPA has programmatic responsibility (e.g., Superfund sites; water treatment facilities)
- Develop and apply appropriate methods to evaluate potential consequences of the evolving energy system, including transportation technologies
- Improve approaches developing scenarios and decision methods to prepare and build resilience for uncertain futures



Next Generation Methods to Improve Public Health and the Environment

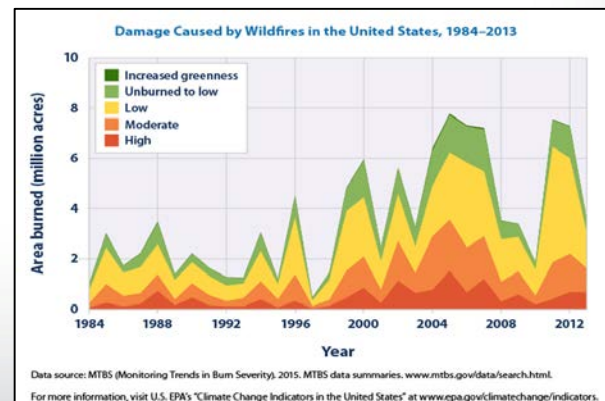
Look Towards the Future

- Evaluate and apply satellite and sensor data to enhance characterization of air quality and exposures
- Develop, evaluate, and apply next generation methods for emissions characterization using measurements and models
- Develop next generation air quality modeling platform, building on existing atmospheric models
- Develop novel approaches and systems to better assess health and ecosystem impacts and risks associated with environmental stressors
- Increase understanding of air pollutant exposures and related health/ecological effects to inform public health and air quality decision-making at national, state, tribal, and local levels

Integrated Science Focus: Wildland Fires

An issue of increasing national concern

- Wildland fires increasing in frequency, size, and intensity in the US
- 2014 National Emissions Inventory estimates >30% of primary PM_{2.5} is associated with emissions from wildland fires
- Cutting across the 3 research Topics A-E proposes to use wildland fires as an integrated science focus to explore:
 - What ecosystems and human populations are vulnerable to wildland fires?
 - What approaches can be used to mitigate risks to human health and ecosystems?
 - How and to whom do we communicate approaches to reduce risks?



Connecting Specific Tools/Research Needed by States with A-E Proposed Research Topics

Activity	Science for Air Quality Decisions	Extreme Events and Emerging Risks	Next Generation Methods
Technical information to better understand causes and contributors of elevated background ozone	X		
Tools to enable states to account for background ozone in determining compliance with ozone standard	X		
Risk-based models to inform decisions that result in improved environmental protection and natural resource management while addressing climate adaptation goals		X	
Improved on-road and non-road mobile emission inventories	X		
Institutional controls to handle vapor intrusion issues			
Multi-state near real-time environmental data to support permitting review and analysis for border regions of states			
Better data on emissions from prairie grassland fires and improved modeling tools for determination of smoke travel from the fires			X
Improved modeling tools for determining lead migration from both point and non-point sources			
Better research/data on connection between pollution and public health outcomes	X		X
Better public messaging of risk			X
Better and more realistic measurements of environmental benefits			

See Supplemental Information for ECOS/ERIS' list of specific tools/research needed by states



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Human Health Risk Assessment (HHRA) Research Areas

(1) Science Assessments & Translation

Science Assessment Development

Science Assessment Translation

(2) Advancing the Practice of Risk Assessment

Emerging and Innovative Assessment Opportunities

Essential Assessment Infrastructure and Support Tools

Vision: To advance the science and practice of risk assessment

Key Outputs: A portfolio of fit for purpose assessment products that meet the needs and priorities of customers, including the states, tribes, and EPA regions and program offices

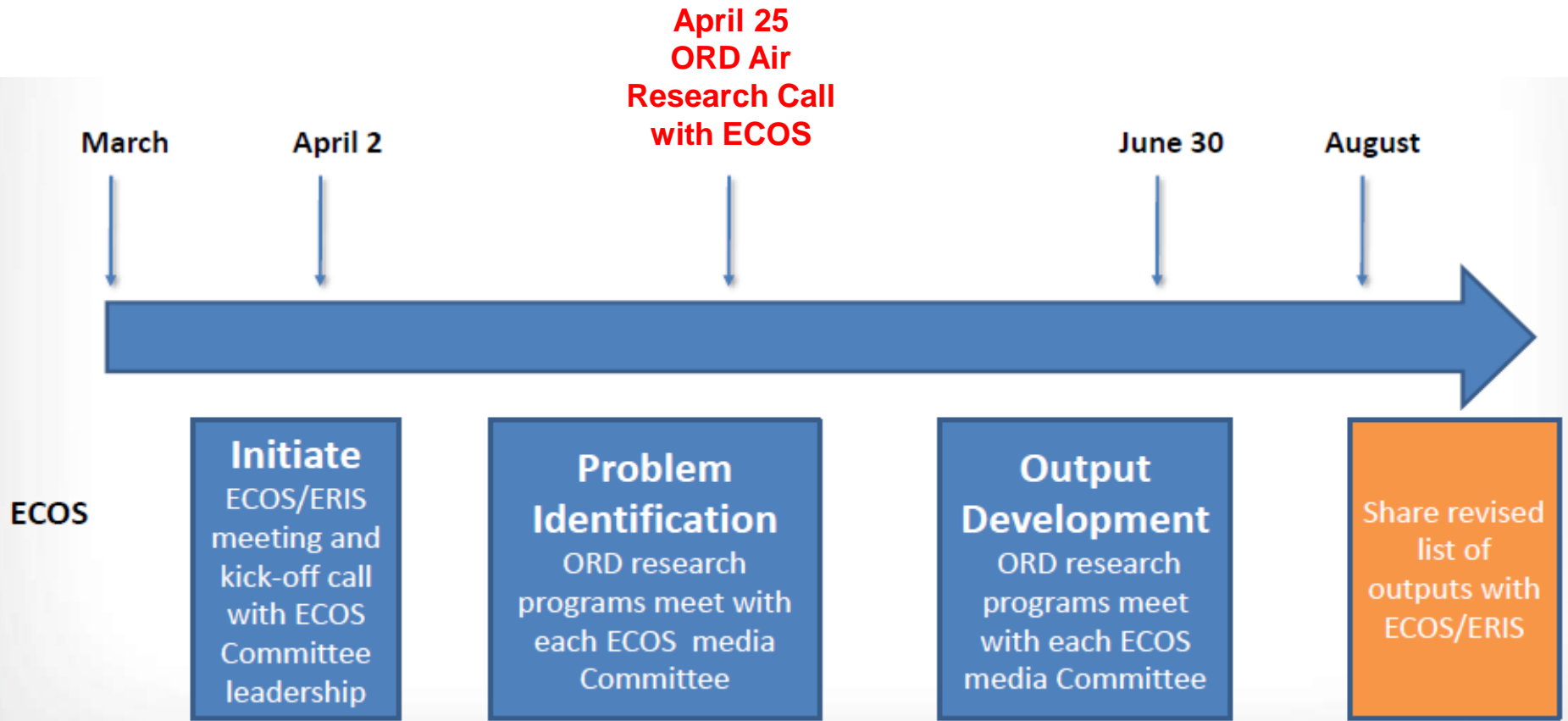
- Focus on priority pollutants (PFAS, lead), criteria pollutants (to support NAAQS), drinking water contaminants, clean up of contaminated and hazardous waste sites
- Integration of new approach methods and emerging data into assessments of data poor chemicals



A Portfolio Approach

- Moving away from a 'one-size-fits-all' approach to risk assessment towards a spectrum of assessment products to meet specific decision contexts
- Facilitating the incorporation of new data and science into risk assessment and decision-making
- Enabling assessments to be better tailored to meet needs of decision makers
- Increasing the number of chemicals that can be evaluated for their effects on human health by utilizing constrained resources in the most efficient manner
- Anchoring in systematic review
- Integrating key components of existing portfolio -- Integrated Risk Information Systems (IRIS), Integrated Science Assessments (ISAs), and Provisional Peer-Reviewed Toxicity Values (PPRTVs) – to inform future assessments

ECOS/ERIS Engagement in StRAP Development



- Clarification of specific scientific and technical needs of states
 - Are there any clarifying questions about our capabilities and/or the kind of research we do related to air?
 - Do the areas on which we are focusing align well with your states' science and technical needs?
 - Are there areas you would suggest emphasizing or de-emphasizing? Is there anything missing?
- Are there additional research/science priority needs that are not listed?
- Are any of the items listed no longer needed?
- Do you have any other feedback as we formulate our Strategic Research Action Plans that cover 2019-22?





Contacts

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Supplemental Information



ECOS: Specific Tools/Research Needed

(1 of 2)

- Improved technical information to better understand causes and contributors of elevated background ozone, and regulatory and policy tools that enable states to account for background ozone in determining compliance with ozone standard
- Developing and applying risk-based models to inform decisions that result in improved environmental protection and natural resource management while addressing climate adaptation goals
- Improving on-road and non-road mobile emission inventories
- Development of appropriate institutional controls to handle future vapor intrusion issues as more formerly contaminated properties are redeveloped
- Provide multi-state near real-time environmental data to support permitting review and analysis for border regions of states

Source: ECOS/ERIS 2016 survey responses



ECOS: Specific Tools/Research Needed

(2 of 2)

- Better data on the quantity and makeup of emissions from our annual prairie grassland fires as well as improved modeling tools for determination of smoke travel from the fires
- Improved modeling tools for determining lead migration from both point and non-point sources
- Better research/data on the connection between pollution and public health outcomes, specifically for nitrate, air pollutants, and soil contamination
- Need for much better public messaging of risk, especially with release of new standards or health advisories
- Better and more realistic measurements of environmental benefits against which to gauge the costs of new environmental standards and requirements

Source: ECOS/ERIS 2016 survey responses



Highlights of Available Resources

- Websites for [Air Research](#), [Air Quality and Climate Change Research](#) and [Risk Assessment](#)
- [Integrated Science Assessments](#)
- [Integrated Risk Information System](#)
- [Air Sensor Toolbox](#) for Citizen Scientists, Researchers, and Developers
- [Healthy Heart](#) Toolkit and Research
- [Wildland Fire Research](#) to Protect Health and the Environment
- [Sign-up](#) for EPA's Science Matters biweekly newsletter