



Science for a Sustainable Future

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

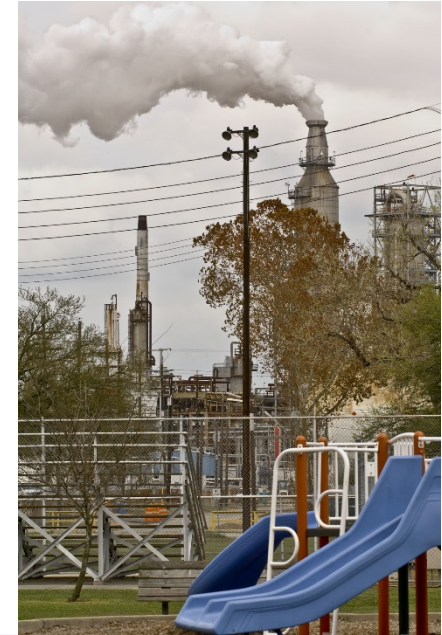
Lek Kadelic
Acting Assistant Administrator
April 9, 2015

- I. Environmental & Science Challenges**
- II. ORD Research Examples**
- III. ORD Role, Planning Process and Budget**
- IV. BOSC Role**



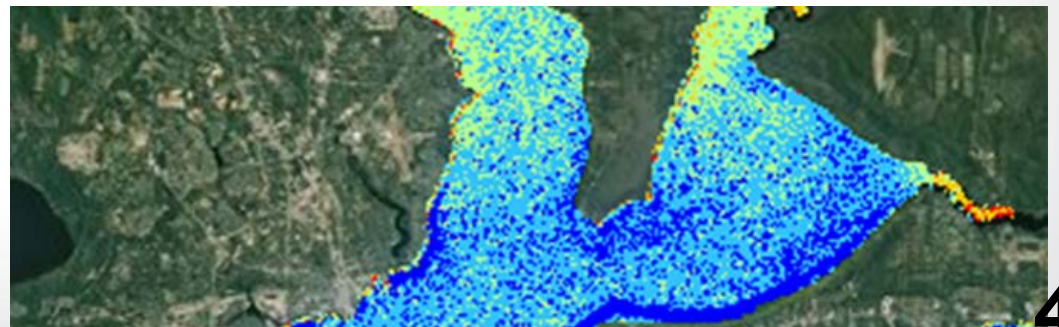
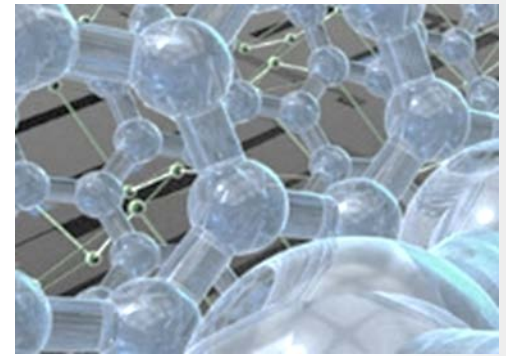
21st Century Environmental Challenges

- **Climate change**
- **Changing energy landscape**
- **Multi-pollutant exposure**
- **Increasing nitrogen and phosphorus impair water quality**
- **Susceptibility & environmental justice**
- **Thousands of new industrial chemicals and pesticides each year**
- **Chemical, biological, radiological-based terrorism**



Scientific Challenges

- **Generate information to advance understanding of complex relationships between human activities and impacts to health and the environment**
- **Revolutionize assessment of potential for risks to humans and the environment**
- **Predict adverse outcomes of societal choices over time and space**
- **Promote innovative and sustainable solutions to 21st environmental challenges**





Research that prepares us for these challenges

- **Innovative** – foster creativity and stimulate transformational change
- **Integrative** – work collaboratively across disciplines
 - Across ORD labs and centers
 - Engage EPA and outside stakeholders
- **Solution-oriented** – emphasis on developing sustainable solutions
- **Responsive** – provide relevant and timely results to inform environmental policy decisions
- **Translational** – end users receive the necessary information to utilize ORD products





Aligning Research with EPA Strategic Goals

Cross-Agency Strategies

- Sustainable Future
- Visible Difference in Communities
- New Era of Partnerships
- High-Performing Organization

EPA Goals 2014-2018

Addressing Climate Change and Improving Air Quality

Protecting America's Waters

Cleaning Up Communities and Advancing Sustainable Development

Ensuring the Safety of Chemicals and Preventing Pollution

Enforcing Laws, Ensuring Compliance

Research Programs

Air, Climate & Energy

Safe and Sustainable Water Resources

Sustainable and Healthy Communities

Chemical Safety for Sustainability

Human Health Risk Assessment

Homeland Security

- **What is a Strategic Research Action Plan (StRAP)?**
 - Describes our research program for internal and external audiences
 - Serves as our guide for resource planning activities
 - First generation covered 2012-2016
 - Currently completing 2nd generation to over FY16-19 (final release October 1, 2015)
 - Developed in consultation with advisors (Science Advisory Board and Board of Scientific Counselors), EPA partner offices, other stakeholders

Air, Climate & Energy



Chemical Safety for Sustainability



Sustainable & Healthy Communities



Human Health Risk Assessment



Safe & Sustainable Water Resources



Homeland Security





Draft Strategic Research Action Plans

Executive Summary

Introduction

Program Purpose

Problem Statement

Program Vision

Program Design

Research Program Objectives

Science Challenges – For each objective, state the science challenges or questions presented by the objective.

Research Topics

Describe the research (organized into 3-5 Topics) that will accomplish the research objectives and answer the science challenges.

Anticipated Research Accomplishments and Projected Impacts

Appendix of Anticipated Outputs



Next Generation Air Monitoring

- **New technology revolutionizing regional, community, fence-line, personal monitoring**
 - Village Green community monitoring
 - Hong Kong deployment
- **EPA's Air Sensor Toolbox on the web**
- **Promoting community science, outreach and education**
- **Working with NOAA, NASA, NSF to relate satellite-based air quality data**
 - Discover AQ



EPA Research Priorities

- **Preparedness for climate change and the development of sustainable adaptation and mitigation options**
- **Human and environmental health impacts of current and future energy alternatives**
- **Social, behavioral and economic factors that influence the effectiveness of air quality and climate policies**
 - Example: impacts of wildfires on public health





Science for Sustainable Water Resources

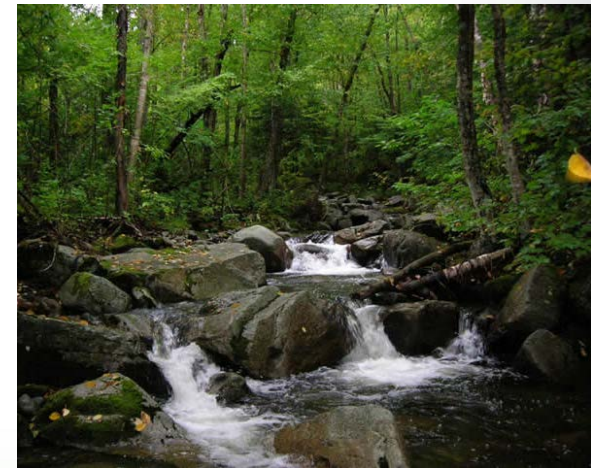
Challenges to sustainable water resources

- climate change and extreme events,
- population growth and urbanization,
- aging infrastructure,
- invasive species and
- land use for energy and agriculture



Research priorities - develop information and tools to:

- Assess & map water resources
- Support new/revised water quality criteria
- Protect water resources while developing energy and mineral resources
- Promote integrated watershed management for sustainability
- Develop a national water quality benefits framework



Objective: Assess ecosystem, economic and social benefits of management actions for sustainable nutrient loading.

Research areas:

- **Reducing impacts of harmful algal blooms**
 - Collaboration with NASA
 - Open challenge for Cyano predictive modeling and mobile app
- **Improve thresholds & targeting actions**
- **Improve nutrient management practices, metrics of benefits, accountability, and communication**
 - Open Challenge: Nutrient sensor development



Nutrient Sensor Challenge

A Market Stimulation Challenge

Federal agencies, the Alliance for Coastal Technologies, and other partners **CHALLENGE YOU** to join the effort to develop affordable, accurate, and reliable nutrient sensors!

Registration closes March 16, 2015



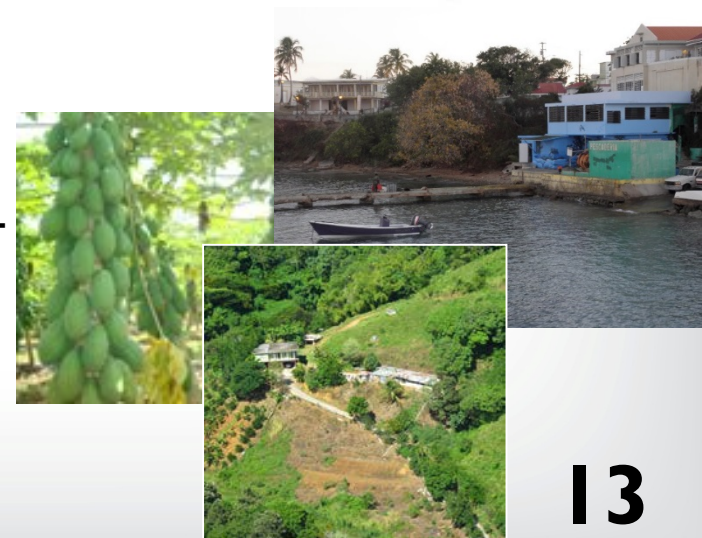
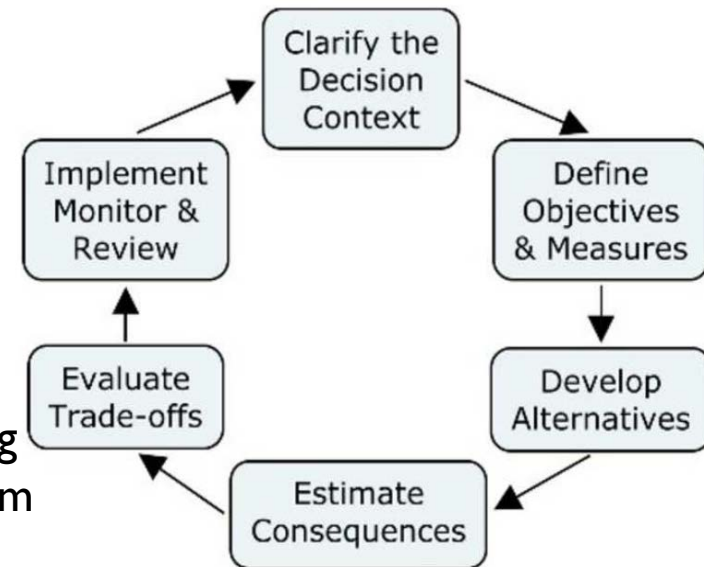
Nutrient Sensor Features

- Measures dissolved nitrate and/or phosphate
- Provides real-time data
- Easy to use
- Less than \$5,000 purchase price
- Unattended deployments for 3 months
- Highly accurate and precise

Develop tools and approaches that can be generalized to the broad range of community types for the broad range of environmental decisions made by community stakeholders

Example: structured decision-making in Guanica Bay, Puerto Rico

- Multiple issues: managing development, protecting water quality, sustaining fisheries, boosting tourism and recreation
- Engaged stakeholders in decision process that led to broad consideration of issues and evaluated alternative policy options.
- Result: Made higher up-front investment in shade-grown coffee, anticipating benefits over time in reduced sediment in run-off, reduced flooding, improved water and reef quality





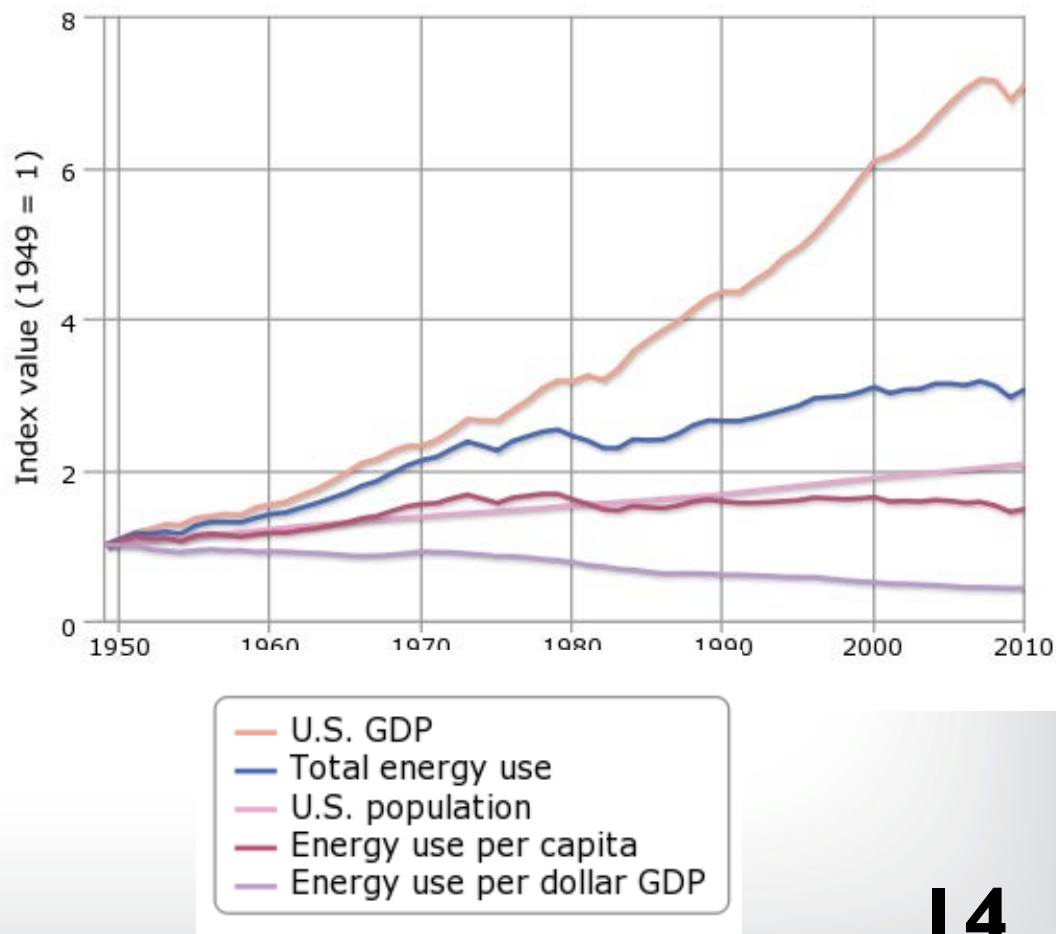
Report on the Environment

- **Presents the best available indicators of national trends in the environment and human health:**

- Air
- Water
- Land
- Human Exposure and Health
- Ecological Condition
- Sustainability

- **Web-based**
- **Draft undergoing Science Advisory Board Review**
- **Future: expanding sustainability indicators; strengthening analysis tools**

Sustainability indicator: Intensity of US Energy Consumption





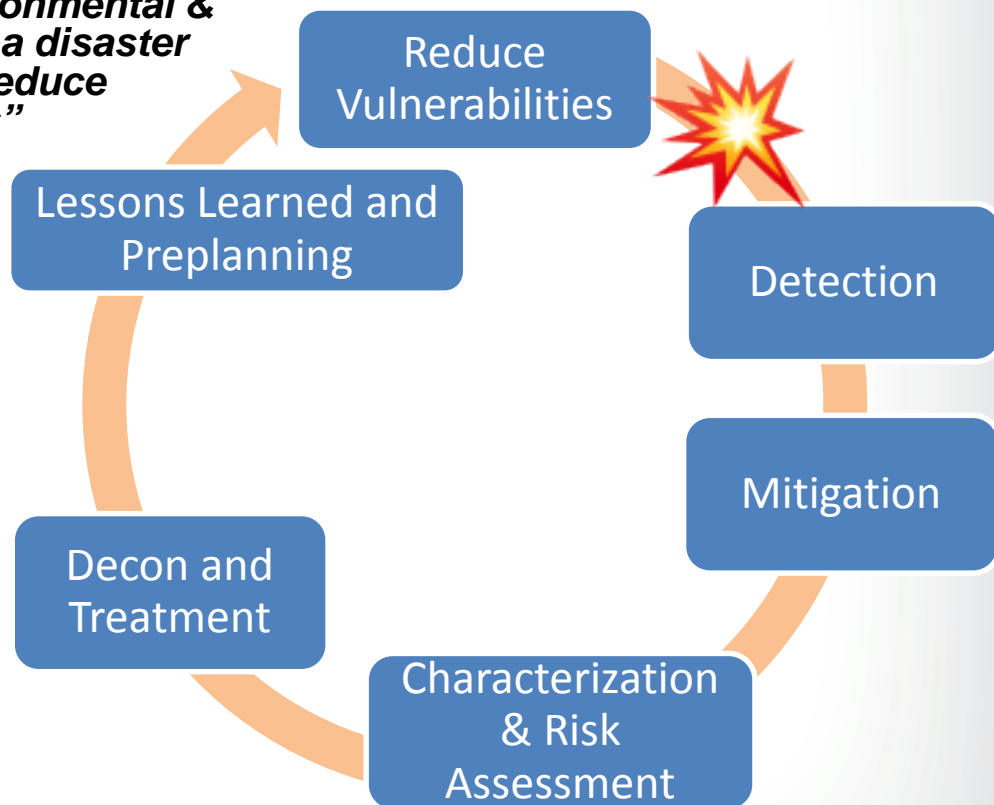
Improve Community Resilience to Disasters

Environmental resilience:

“Minimizing environmental risks associated with disasters, quickly returning critical environmental & ecological services to functionality after a disaster while applying this learning process to reduce vulnerabilities & risks to future incidents”

Relevant research:

- Water infrastructure designs
- Real-time contamination detection
- Analytical methods
- Toxicity and risk info
- Rapid clean up approaches
- Waste management strategies
- Decision support tools
- Crisis and risk communication
- Resilience assessment tools

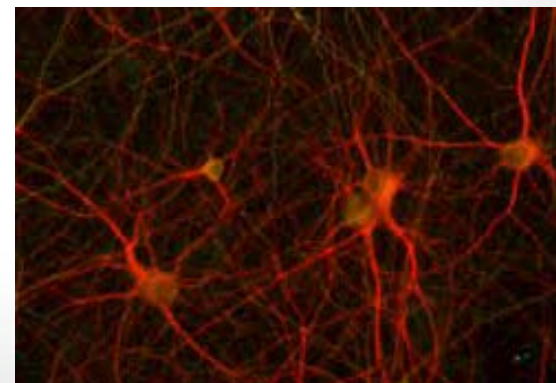
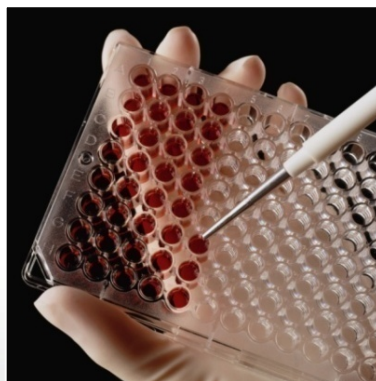


Emergency Response, Preparedness
& Building Resilience



Accelerate the Pace of Chemical Evaluation

- **High-throughput toxicology –increasing biological coverage and efficiency**
 - Early exploratory activity to apply functional genomic and proteomic screening approaches
 - Fully implemented, would rapidly test new chemicals and identify high-affinity targets of selective compounds, identify modes of toxicity of less selective chemicals and find chemicals with low intrinsic bioactivity
 - Use of functional screens, particularly with primary cells, would also ground the outcomes to expected *in vivo* effects
- **Advanced exposure measurement**
 - Supporting development of untargeted screening for chemical occurrence in biological and environmental media
 - Developing methods for effects-based biomonitoring



- **Models of human development for predictive toxicology**
 - Bringing ‘synthetic biology’ to the forefront of children’s environmental health research through integration of multicellular computer simulation with human-on-a-chip microscale systems
 - Newly awarded STAR Centers to develop Organotypic Cell Models (OCMs) for high-priority biological systems including the brain and neurovascular systems
 - OCM experimental platform will complement computational platform for the modeling of prenatal thyroid development and function under development in ORD
- **Strategic Automated Approach for Assessing Protein (Molecular Target) Similarity**
 - Efficiently and quantitatively assess the taxonomic conservation of molecular targets to support informed extrapolation of mechanistic toxicology data across species
 - Supports informed decisions where empirical toxicity data for broad range of species is limited

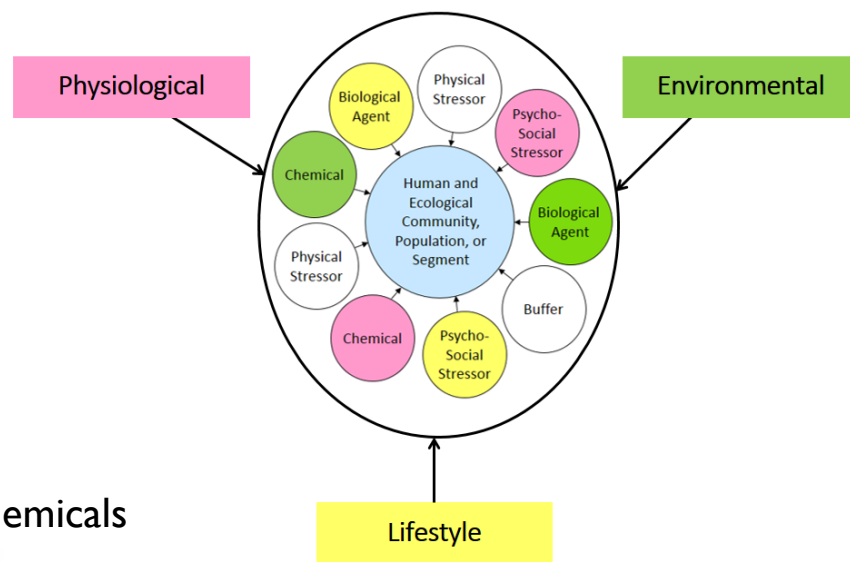


- **Increasing interest**

- NAS (2009) recommendations for problem formulation framework
- Public interest in all causes of illness in their community → “place-based” characterization
- Assist EJ evaluation and support sustainability

- **EPA cumulative risk activities (examples)**

- Case studies
- Developing new indicators
 - Environmental Quality Index
 - Resiliency
- Exposure
 - Epigenetic biomarkers
- Integrating ecological evidence and assessments
- STAR grants addressing:
 - Nonchemical stressors
 - Health impacts of multiple environmental chemicals
 - Community engagement
 - Incorporation of CRA research into the decision-making process





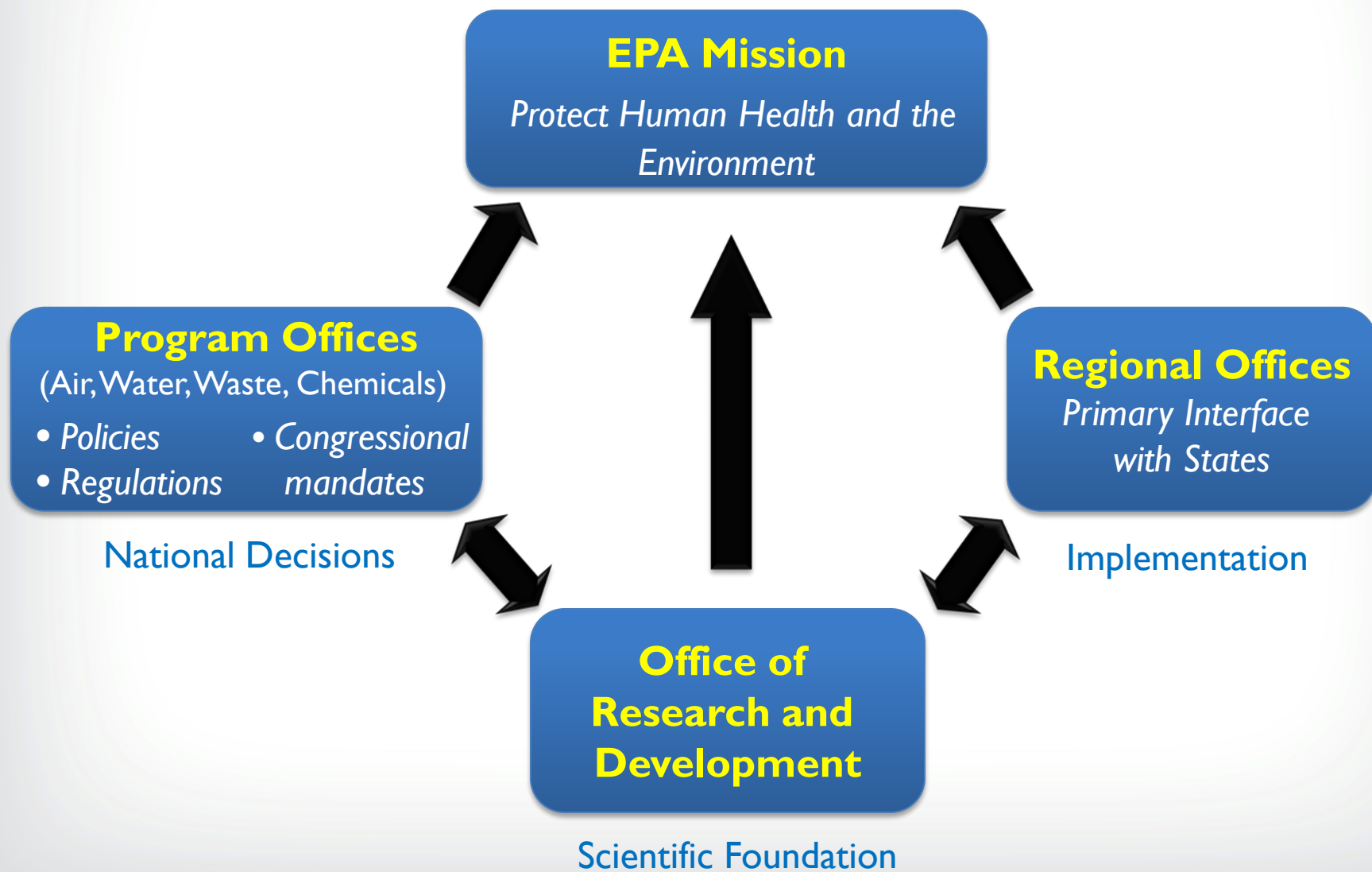
Mission for Research & Development

Provide science and technology to support EPA's mission of protecting human health and the environment.



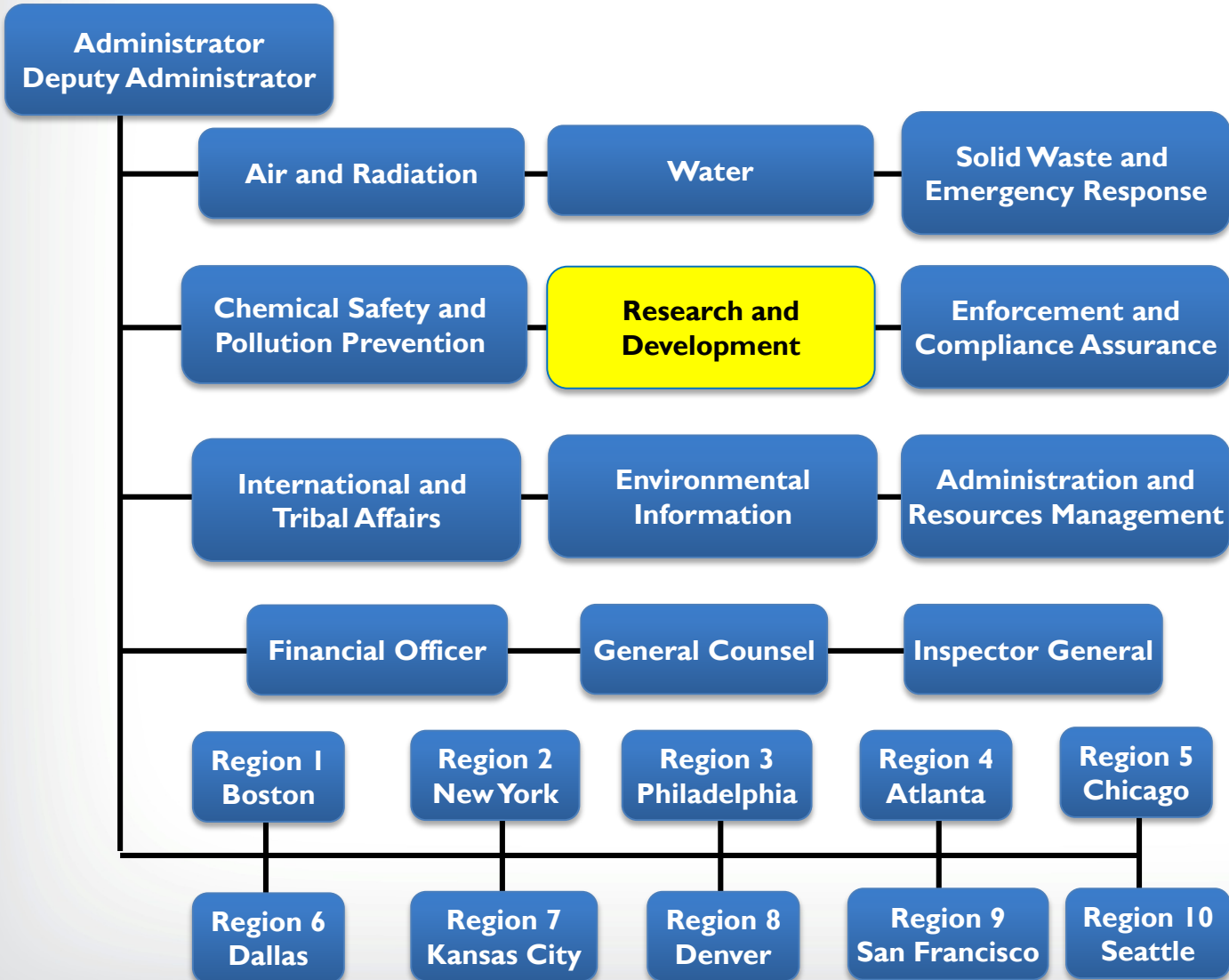


Science to Support EPA's Mission





U.S. EPA Organizational Chart





ORD Organizational Chart

Immediate Office of the Assistant Administrator

Office of the
Science Advisor

National Program Directors

- Air, Climate & Energy
- Chemical Safety for Sustainability
- Safe and Sustainable Water Resources
- Sustainable and Healthy Communities
- Human Health Risk Assessment
- Homeland Security

Headquarters Offices

Administrative offices
Office of Science Policy– RSL/STL

National Research Laboratories and Centers

Health and
Environmental
Effects Lab

Exposure
Research
Lab

Risk
Management
Lab

Environmental
Assessment
Center

Computational
Toxicology
Center

Homeland
Security
Center

Environmental
Research
Center

Research Planning to Research Results

Advisors and Stakeholders

EPA Programs and Regions

EPA Strategic Plan

Congressional Mandates

States, Tribes, Local governments
Other stakeholders

External Science Advisors

Needs & Priorities

Strategic Research Action Plans

Research Priorities & Schedule

Feedback & Evaluation

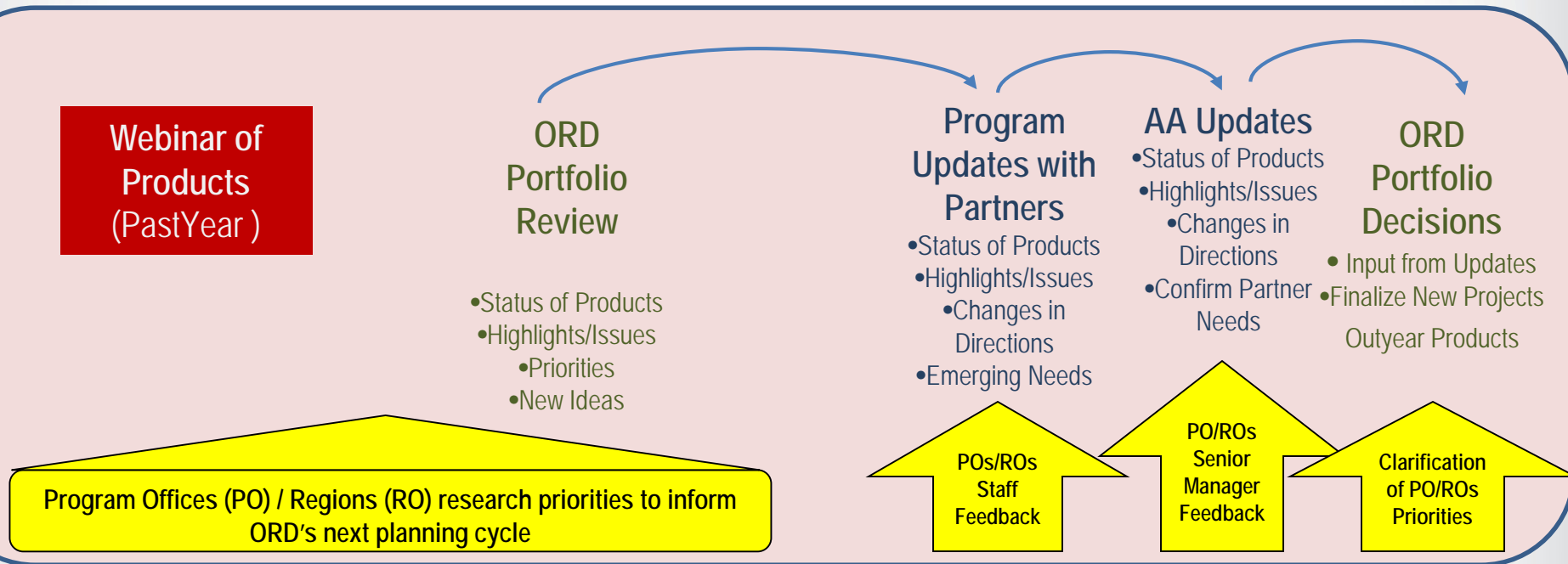
Deliver Products

Conduct Research and Develop Products

Feedback



Extensive Interaction with EPA Partners



Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep

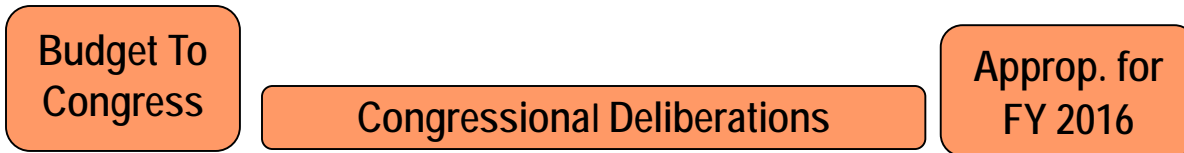
← Regular Meetings/Updates, Targeted Discussions →
The developing role of Project Advocates



Planning and Budgeting

Feb 2015	April 2015	June 2015	August 2015	Oct 2015	Dec 2015
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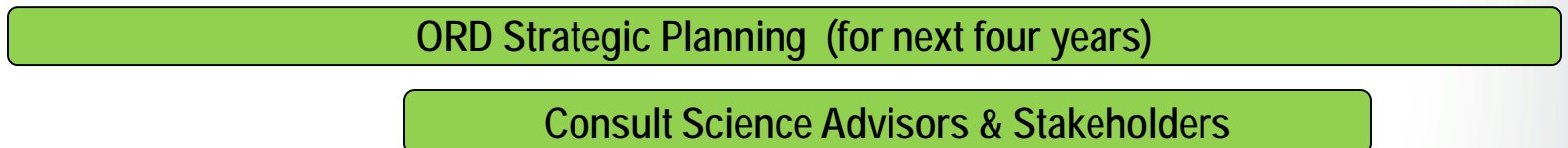
**FY 2016
Budget
Activities**



**FY 2017
Budget
Activities**



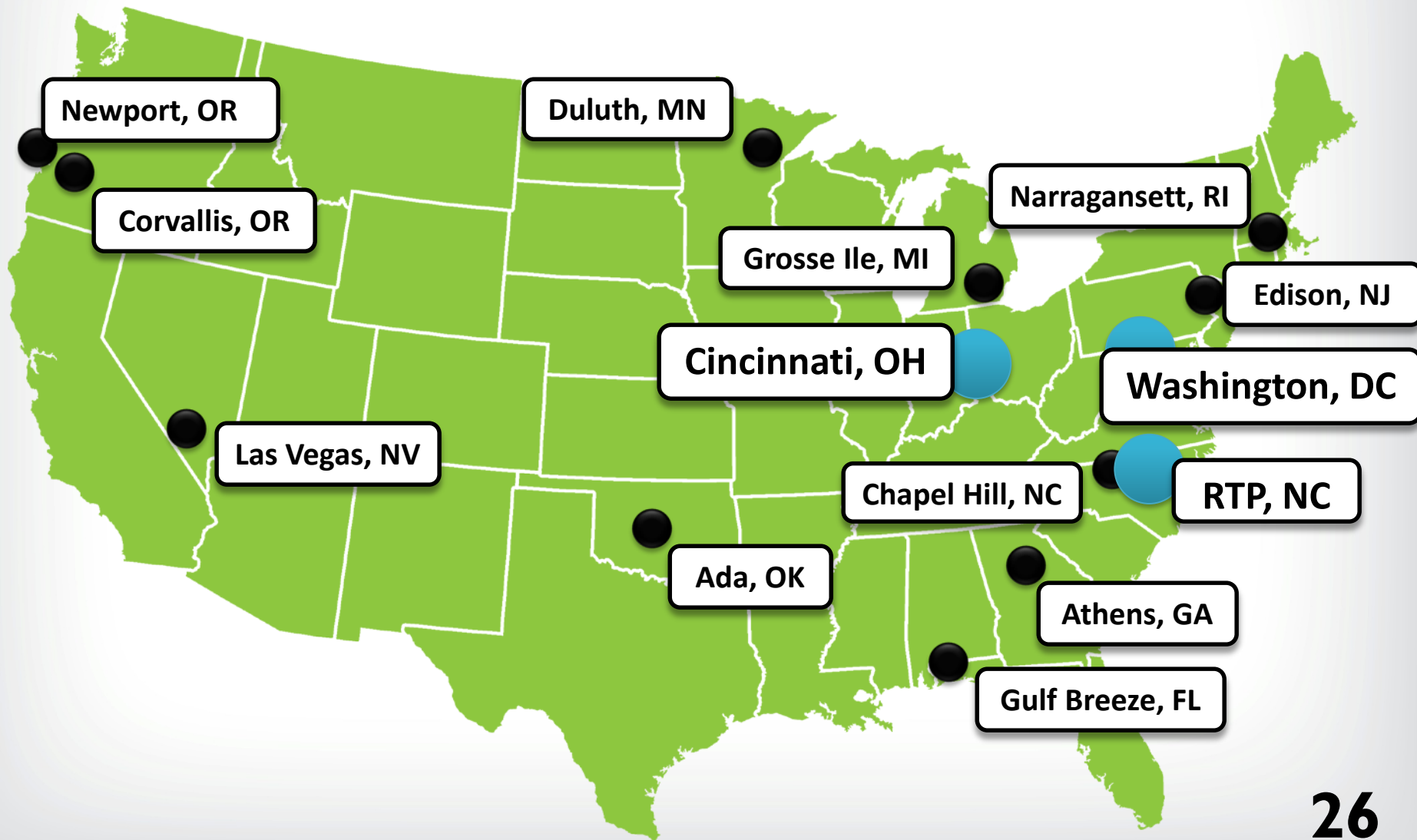
**Strategic
Planning
Activity**



Note: Estimated timeframes



ORD Research Facilities





EPA Research Grants to Universities

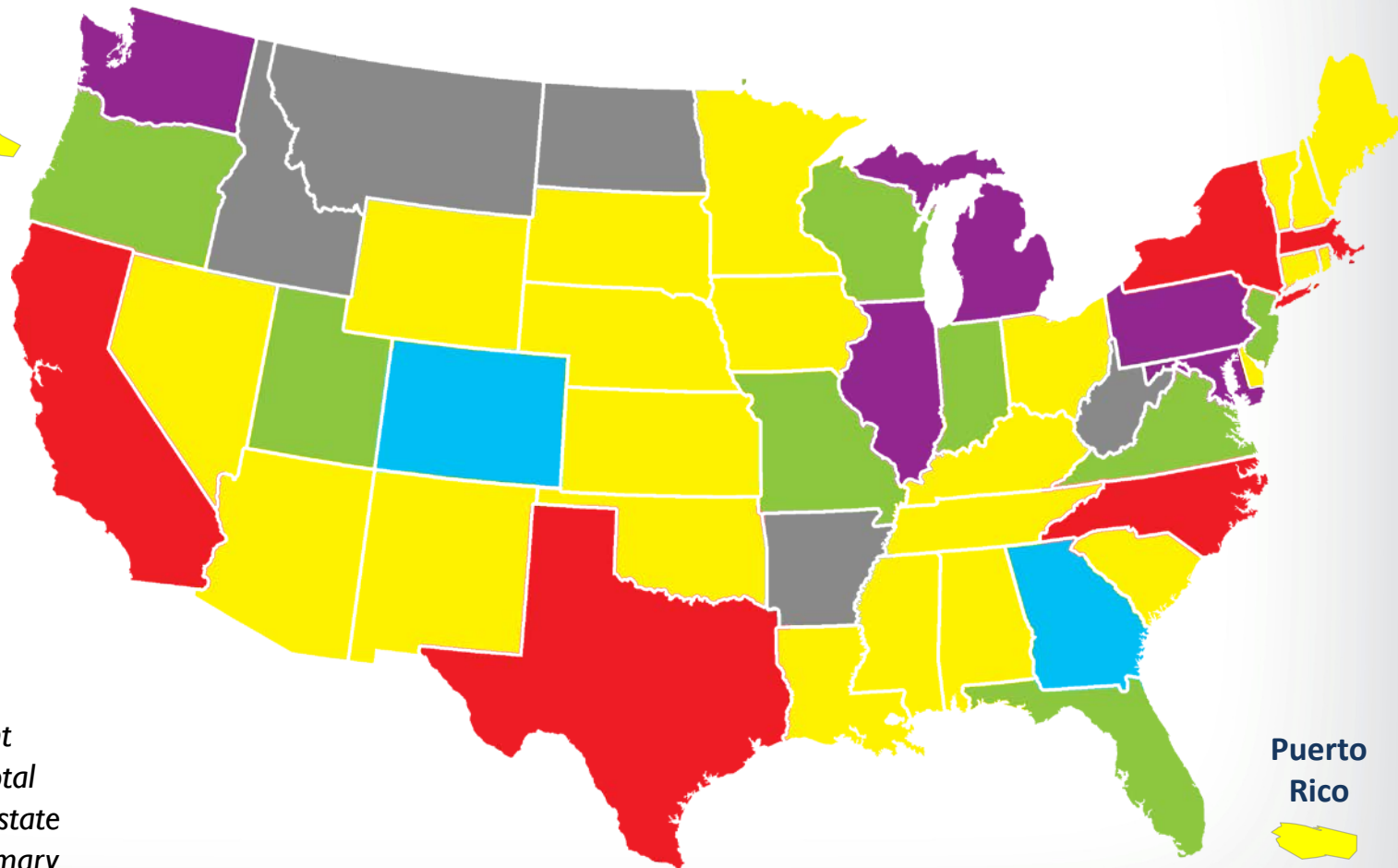
 *STAR Research Grants by State*



Alaska



Hawaii



- 1-5
- 6-10
- 11-15
- 16-20
- 20+

266 current grants in total (counts by state include primary and secondary Institutions)

\$52 million extramural research grants + \$9 million fellowships (FY 2014 Enacted Budget)

Puerto Rico





Cross-cutting Research



- Climate change



- Nitrogen and co-pollutants



- Children's environmental health



- Environmental justice



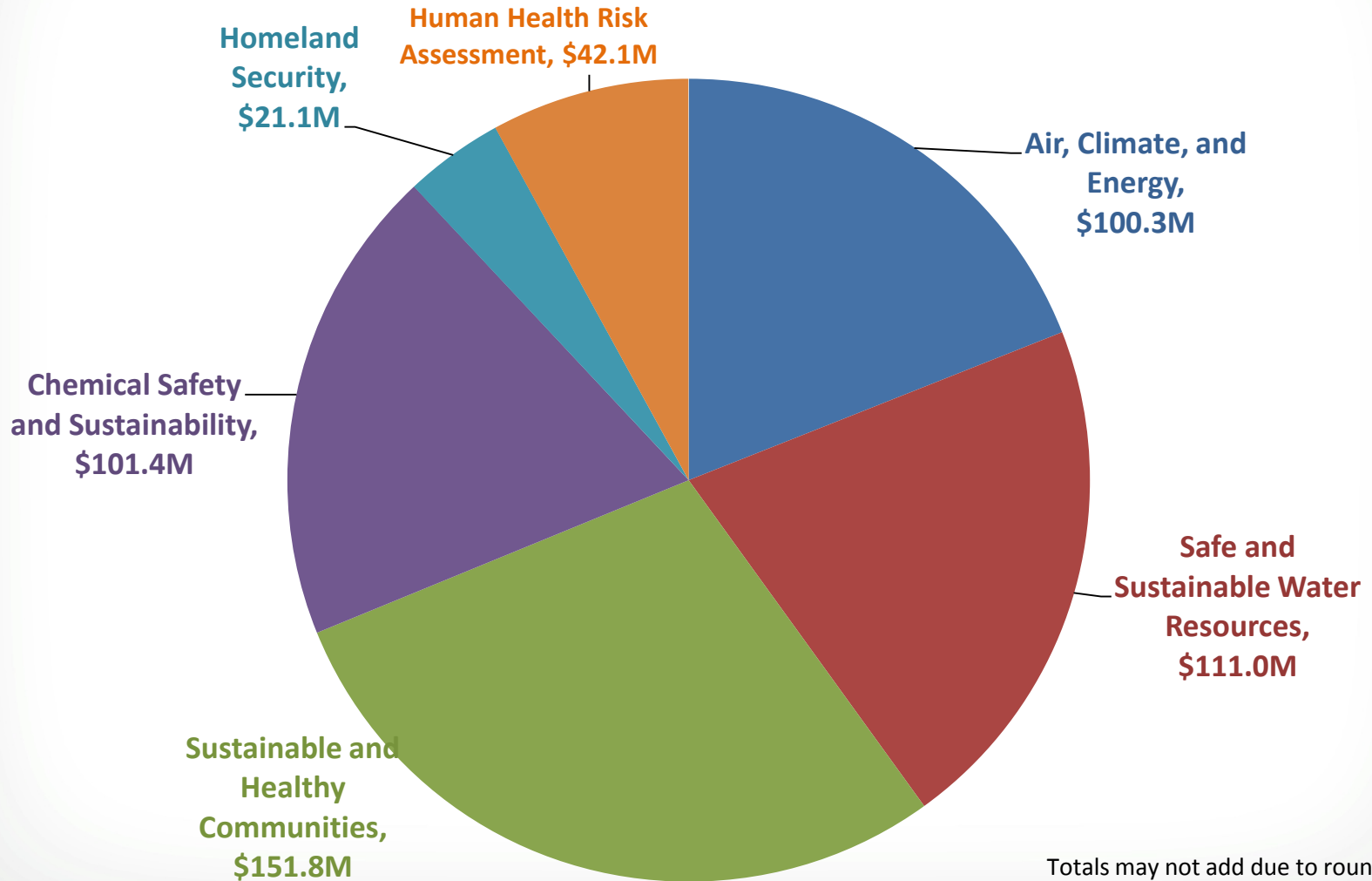


Roadmaps for Cross-cutting Issues

- **Purposes**
 - Describe coordination/collaboration with EPA and federal partners, and others
 - Show how research is integrated across the six programs; identifies gaps
 - Catalyze integration across the 6 programs
 - Focused on a small number of cross-cutting issues
- **Research Roadmaps at different stages of development**
 - Nitrogen and Co-Pollutants
 - Global Climate Change
 - Children's Environmental Health
 - Environmental Justice
- **Key Distinction from StRAPs**
 - Not creating additional research programs beyond the six
 - Does not serve as basis for resource planning
 - Informed by and informs the StRAPs



ORD's FY 2016 Budget by Research Program Projects



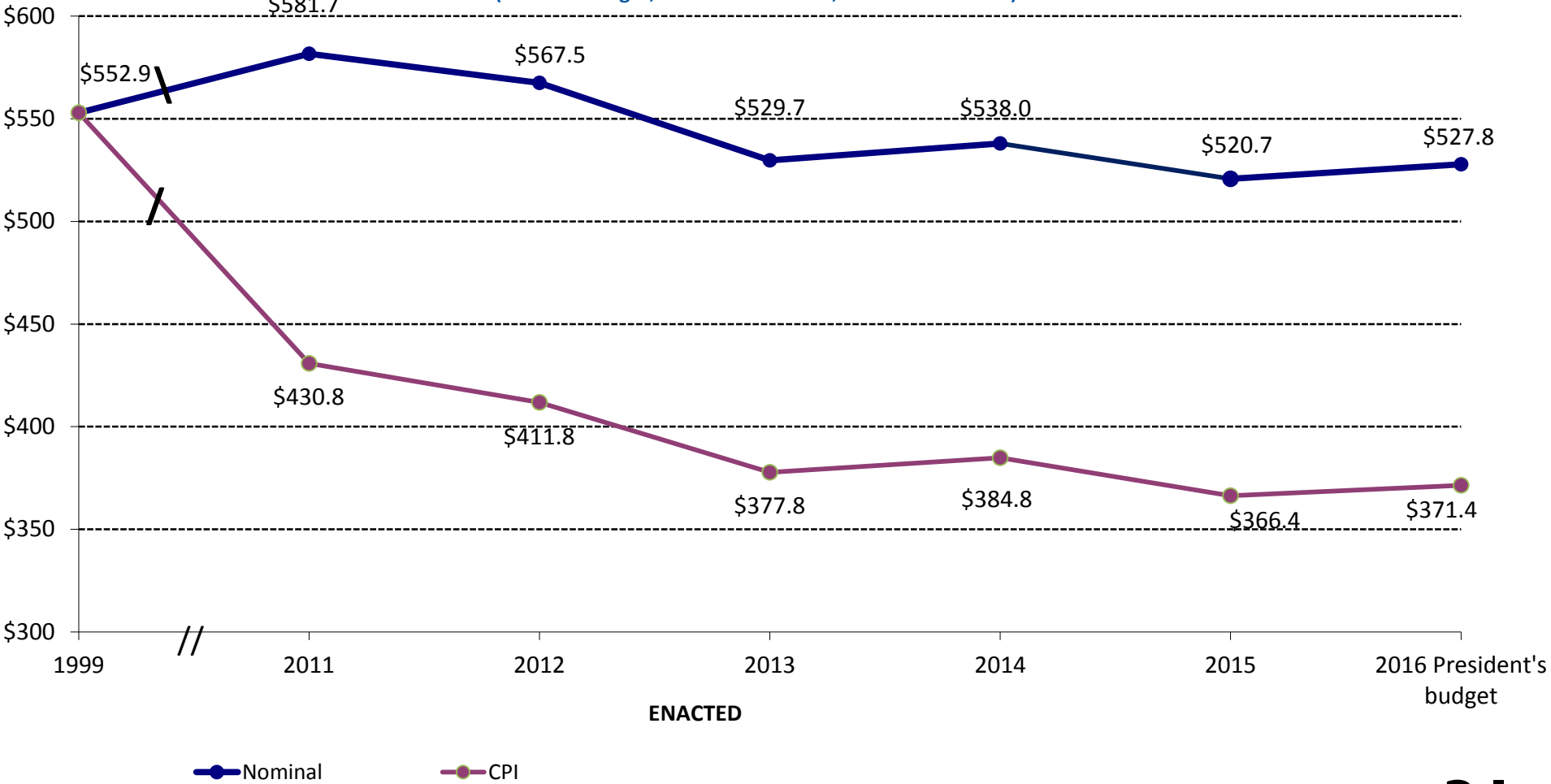
Totals may not add due to rounding



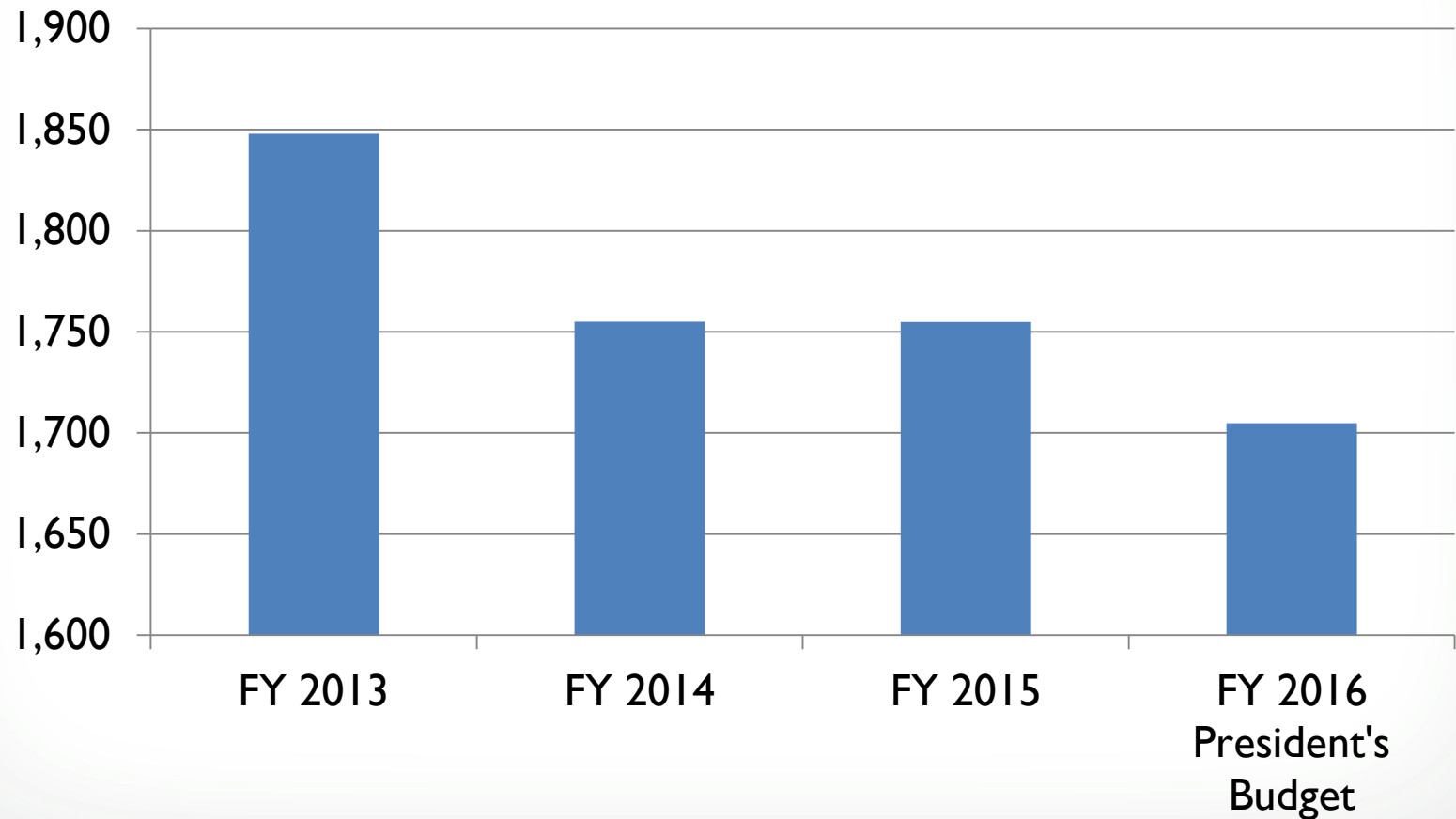
ORD Resource Trends

ORD Total Budget with Inflation Indices

(enacted budget, includes earmarks, dollars in millions)



Total FTE



BOSC provides advice to AA/ORD

- Guidance to help with many challenges
- Advice on program operations
- New standing subcommittees
 - Air, Climate and Energy
 - Safe and Sustainable Water Resources
 - Chemical Safety for Sustainability & Human Health Risk Assessment
 - Sustainable and Healthy Communities
 - Homeland Security

**BOSC
FACA**

- **Tom Burke now on board as the ORD Deputy Assistant Administrator and the Administrator's Science Advisor**
- **Important themes**
 - **Credibility and transparency**
 - **Greater interaction with the science community**
 - **Science needs in a changing world**



Tom Burke