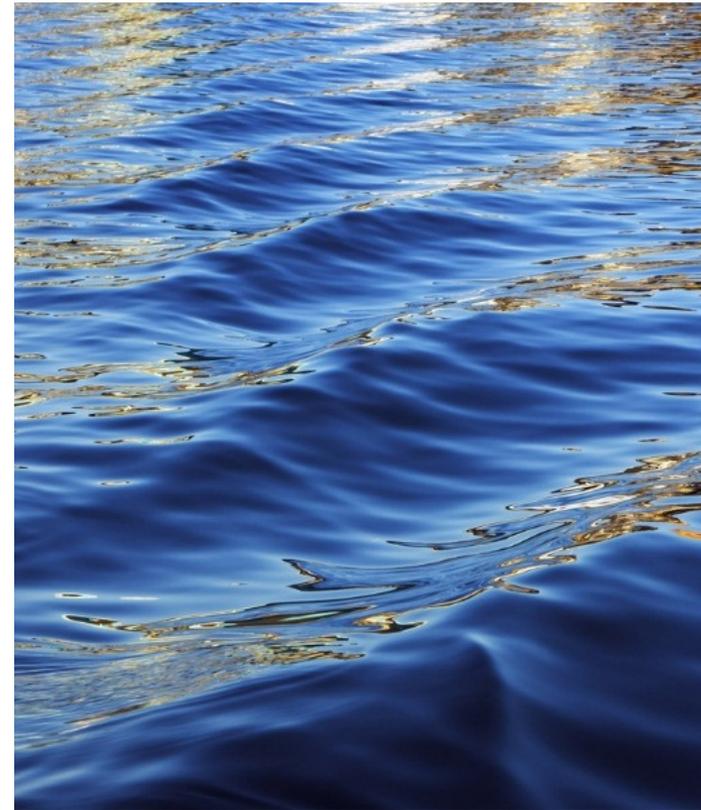


# THE EVOLUTION OF ENVIRONMENTAL MEASUREMENTS AT EPA

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# EVOLUTION – PAST TO PRESENT

The PAST is where you  
learned the lesson  
The FUTURE is where you  
apply the lesson.

Don't GIVE UP  
in the middle!

# OVERVIEW

- History
  - 1970's – 1980's
  - 1990's – 2000's
  - 2010's – Present
- Tools and Programs
  - Methods
  - Monitoring
  - Assessing Measurements
- Summary
- Contact Us

# HISTORY: 1970's – 1980's

- EPA recorded history indicates that measurements initially were taken by employing any available technology or gadget that could be rigged from available supplies, coupled with the creativity of individual field researchers and scientists.
- Ruckelshaus said in 1980, “Our ability to pinpoint the adverse health or environmental effects at a given concentration, or measure those adverse concentrations in the air or water, varies greatly with the individual pollutant and media in which it is found.”

# HISTORY: 1990's

- A common total quality management adage – “What gets measured gets managed” – is equally true in reverse at EPA – “What gets managed gets measured”.
- The 1990 Clean Air Act Amendments required regulated installations to install continuous emissions monitoring equipment.
- As technology improved, the specifications of the methods and measurement techniques defined in the Agency's rules and regulations became limitations.
- Under the impetus of the National Partnership for Reinventing Government reforms, EPA published a 1997 Federal Register Notice promoting performance-based measurement systems (PBMS).

## HISTORY: 2000's

- Monitoring methods have evolved, since PBMS.
- Biomonitoring, which measures the chemicals in human body fluids and tissues, is worth noting.
- With the proliferation of methods, the Forum on Environmental Measurements (FEM) was formed in April 2003 to address issues related to environment measurements.

# FORUM ON ENVIRONMENTAL MEASUREMENTS (FEM)

- **Purpose** – Promote consistency and consensus on measurement methodology, monitoring, technology, and laboratory science issues with multi-program impact.
- **Scope** –
  - Validate and disseminate methods for sample collection and analysis;
  - Ensure monitoring studies are scientifically rigorous and statistically sound; and
  - Employ a quality systems approach to ensure data gathered/used is of known and documented quality.

# FEM – AREAS OF FOCUS

- **Methods** – opportunities to improve the Agency's methods through policies and guidelines for method validation and peer review; flexibility in how environmental measurements are taken; method detection, quantitation, and calibration review; method formatting; and method collections.
- **Monitoring** – collaborations through programs like the National Environmental Monitoring Conference, which is the largest annual conference focused on environmental measurements in North America with a program designed to bring together a balance of technical and policy topics that are of interest to all.
- **Assessing Measurements** – policies and programs (e.g., standards, accreditation) designed for field sampling organizations or laboratories to demonstrate their compliance to a quality system.

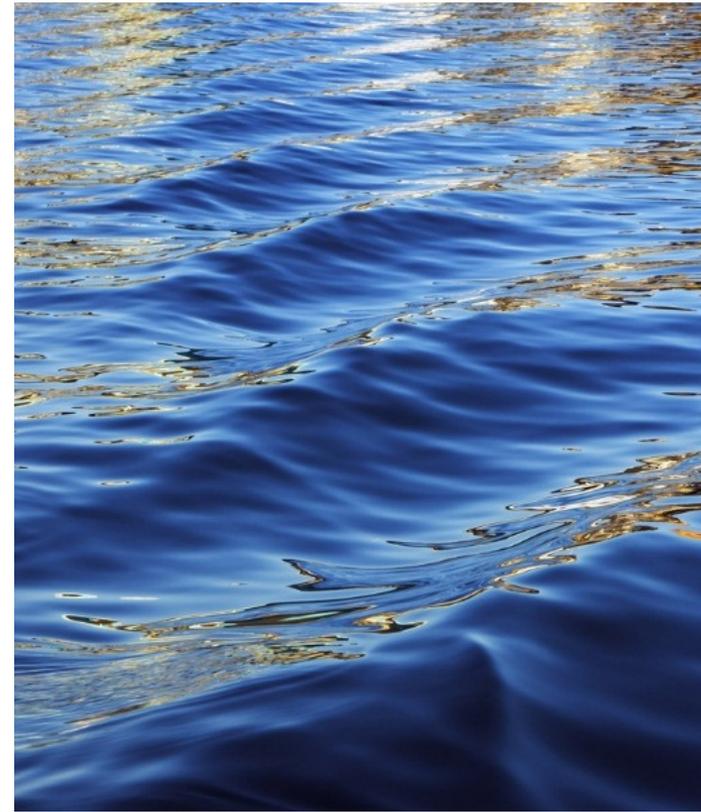
# OFFICE OF THE SCIENCE ADVISOR (OSA)

- **OSA Purpose** – To support the Science Advisor's key responsibilities:
  - Advise EPA Administrator on science and technology (S&T) issues;
  - Hold a corporate view and coordinate cross-agency S&T policy issues;
  - Resolve conflicts on science and science policy;
  - Provide a vision on S&T and advance emerging issues; and
  - Serve as face and spokesperson for agency science overall.
- **OSA Initiatives** – Science and Technology, Measurement, Monitoring, Modeling, Risk, Human Health, Information Management

# HISTORY: 2010's – PRESENT

- Due to the lack of consistency in measurement terminology across the Agency, an *Environmental Measurement Glossary of Terms* was established in 2010.
- Since PBMS lacked the versatility needed by EPA programs, it was transformed and expanded to *Flexible Approaches to Environmental Measurement*.
- EPA – with industry, academic, and other partners – is developing, evaluating, and applying new, innovative technologies in addition to utilizing management and modeling data.

WHAT ARE SOME  
TOOLS AND  
PROGRAMS THAT  
HAVE BEEN  
ESTABLISHED?



# METHODS VALIDATION – GUIDANCE/POLICY

- Chemical Methods – October 14, 2005/February 3, 2016
- Radiochemical Methods – September 29, 2006
- Sampling Methods – December 17, 2007/February 3, 2016
- Microbiological Methods Validation – October 7, 2009
- Emergency Response (Policy Only) – July 21, 2010
- Environmental Sampling Techniques for the Detection and Recovery of Microorganisms – December 12, 2012 (12/12/12)

# FLEXIBLE APPROACHES TO MEASUREMENT

(Reaffirmed – November 20, 2015)

- Increased emphasis on flexibility in choosing sampling and analytical approaches to meet regulatory requirements for measurements;
- Development of processes for validation that confirm that measurements meet quality requirements;
- Increased collaboration with stakeholders to develop validation processes for new measurement technology; and
- Rapid assessment of new or modified technologies, methods and procedures.

# UPDATING THE TOXIC ORGANIC METHODS

- History

- *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*, 1988, Winberry et al.
- Performance based methods last updated (with no process even in place for updating) in 1999
- Guideline methods: Air toxics are not regulated

- Goals

- To update the TO methods
  - Develop and implement a formal process for updating existing TO methods
  - Develop and implement a process for approving new TO methods
- To develop and implement a communication strategy for updating and revising the TO methods



**Overall goal: To advance the science for air toxics!!!!**

# APPROACH TO UPDATES

- Design:
  - TO method updates are not mandated, so we have leeway in our approach
  - We define the schedule based on stakeholder and client needs
  - We define the number of updates being addressed at any given time
  - Not all methods will necessarily need to be updated
- Schedule:
  - **TO-15: Canister samples, GC-MS, 2016–2017**  
(Note: TO-15 is serving as a pilot process)
  - **TO-11A: Formaldehyde, HPLC**
  - TO-17: Active sampling with sorbent tubes, GC-MS
  - TO-4A: Pesticides and PCBs, high-volume PUF, GC-MD
  - TO-13A: PAHs, GC-MS
  - TO-16: Long-path open-path FTIR

# HOW TO SUBMIT COMMENTS

Visit EPA's website

<https://www.epa.gov/measurements/method-development#toxic>

for the submission package:

- A PDF version of the TO-15 method with line numbering – reference this copy for all comments
- A list of currently planned revisions for review
- A comment form with instructions
  - Download the comment form
  - Fill in requested information including the reference section, pages, and lines for each comment
  - Save and email to designated addresses as an attachment

# WEBSITES

## ENVIRONMENTAL MEASUREMENT

(<https://www.epa.gov/measurements>)

- Methods
- Monitoring
- Assessments
- Environmental Laboratory Advisory Board

## ENVIRONMENTAL MODELING

(<https://www.epa.gov/modeling>)

- Training
- Guidance Documents
- Registry of EPA Models, Applications and Databases
- Integrated Environmental Modeling

# CITIZEN SCIENCE

- WHO – Community members and individuals can now measure some of their exposures
- WHAT – People largely do not know about exposure and are exposed to a variety of pollutants everyday that can cause adverse health effects
- WHEN – Anytime, it only takes one person to tell others about low-cost sensors currently available
- WHERE – Anytime, anywhere
- WHY – Individuals can now know more about the personal environmental exposure in protecting their own health



Touch More...

Your Current Air Quality is:

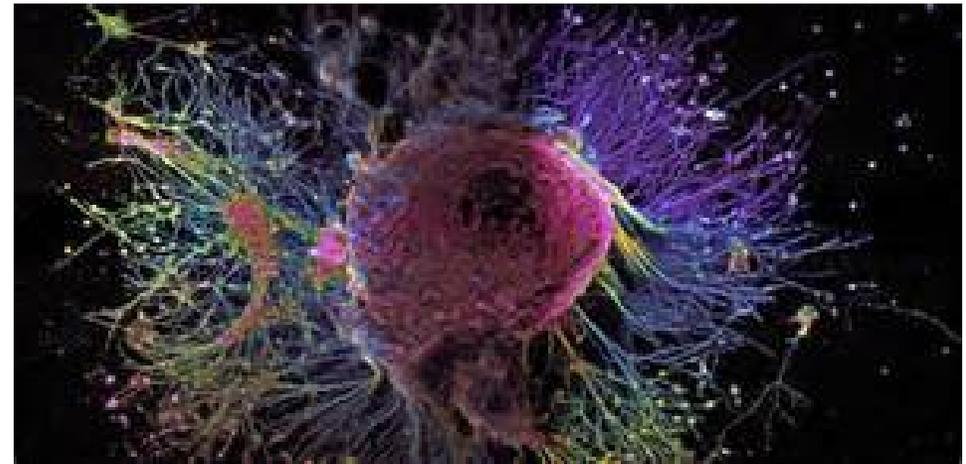
**UNHEALTHY**

Carbon Monoxide	Air Quality Index (AQI) Values	Levels of Health Concern	Colors
When ppm is:	When the AQI is in this range:	...air quality conditions are:	...as symbolized by this color:
0 - 4.4	0 to 50	Good	Green
4.5 - 9.4	51 to 100	Moderate	Yellow
9.5 - 12.4	101 to 150	Unhealthy for Sensitive Groups	Orange
12.5 - 15.4	151 to 200	Unhealthy	Red
15.5 - 30.4	201 to 300	Very Unhealthy	Purple
>30.4	301 to 500	Hazardous	Maroon



# INNOVATION

- **Innovation** is a new idea, or more-effective device or process.<sup>[1]</sup> Innovation can be viewed as the application of better solutions that meet new requirements, unarticulated needs, or existing market needs.<sup>[2]</sup> This is accomplished through more-effective [products](#), [processes](#), [services](#), [technologies](#), or business models that are readily available to [markets](#), [governments](#) and [society](#). The term "innovation" can be defined as something original and more effective and, as a consequence, new, that "breaks into" the market or society.<sup>[3]</sup>





**RELIABILITY**

**ACCURACY**

**TIMELINESS**

**RELEVANCE**

**PRECISION**

**CREDIBILITY**

**COMPLETENESS**

# WHAT IS QUALITY?

- According to Webster's...

Quality is ... 1. peculiar and essential character, an inherent feature , a capacity, role; 2. a degree of excellence, superiority in kind; .....

- According to Wikipedia...

Quality in business, engineering and manufacturing ... is also defined as fitness for purpose.... Support personnel may measure quality in the degree that a product is reliable, maintainable, or sustainable.

- According to US EPA...

Quality is the totality of features and characteristics of a product or service that bear on its ability to meet the stated or implied needs and expectations of the user.

# WHAT IS DATA?

- According to Webster's...

Data is **factual information** (as measurements or statistics) used as a basis for reasoning, discussion, or calculation.

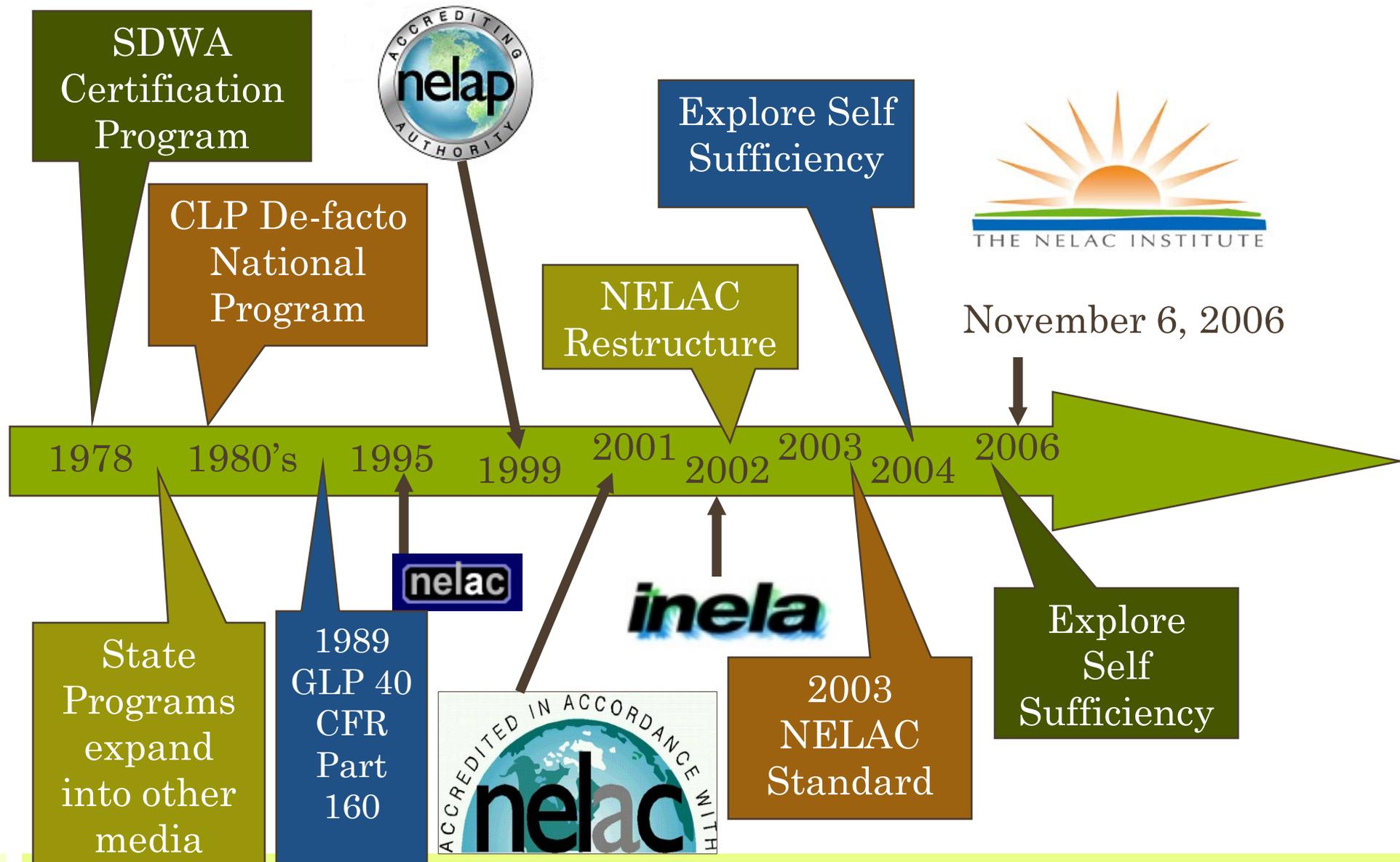
- According to Wikipedia...

Data is a set of values of **qualitative or quantitative variables**....

- According to US EPA...

Environmental data is **any measurements or information that describe** environmental processes, location, or conditions; ecological or health effects and consequences; or the performance of environmental technology. For EPA, environmental data include information collected directly from measurements, produced from models, and compiled from other sources such as data bases or the literature.

# ACCREDITATION/COMPETENCY



# INTERNAL COMPETENCY

- February 23, 2004 – Policy directive developed by the Forum on Environmental Measurement (FEM), *Assuring the Competency of Environmental Protection Agency Laboratories*.
  - Demonstration of adherence to quality system through periodic independent assessments.
  - Participation in inter-laboratory comparisons.
  - In addition, where appropriate accreditation programs are available for one or more components of a given laboratory's operations, the laboratory will seek accreditation for those components.

# INTERNAL COMPETENCY (cont.)

- March 1, 2013 – Acting Administrator, Bob Perciasepe releases a memo requiring all Agency programs with field activities to implement a sustainable management system that incorporates the 10 Field Operation Group (FOG) Guidelines.
  - Personnel and Training
  - Document Control
  - Records Management
  - Sampling and Environmental Data Management
  - Field Documentation
  - Field Equipment
  - Field Inspections and Investigations
  - Reports
  - Internal Audits
  - Corrective Actions

# EXTERNAL COMPETENCY

- March 28, 2011 – In the Agency's continued effort to ensure the quality and validity of environmental measurement data, an EPA policy titled, ***Policy to Assure Competency of Laboratories, Field Sampling, and Other Organizations Generating Environmental Measurement Data under Agency-Funded Acquisitions***, was issued.
- March 13, 2013 – A second policy titled, ***Policy to Assure the Competency of Organizations Generating Environmental Measurement Data under Agency-Funded Assistance Agreements***, was issued with implementation criteria after it was initial approval by the Science Technology Policy Council (STPC) on December 12, 2012.

# Environmental Laboratory Advisory Board (ELAB)

- **Purpose and Scope –**

- Enhancing EPA's measurement programs in areas such as:
  - Validating and disseminating methods for sample collection and for biological, chemical, radiological, and toxicological analysis;
  - Developing scientifically rigorous, statistically sound, and representative measurements;
  - Employing the performance paradigm in environmental monitoring and regulatory programs;
  - Improving communications and outreach between the EPA and its stakeholder communities; and
  - Employing a quality systems approach that ensures that the data gathered and used by the Agency are of known and documented quality.
- Facilitating the operation and expansion of a national environmental accreditation program.

# COLLABORATION – FROM WIKIPEDIA

- Collaboration is ...
  - working with each other to do a task.
  - a recursive process where two or more people or organizations work together to realize shared goals.
  - more than the intersection of common goals seen in co-operative ventures, but a deep, collective, determination to reach an identical objective.
  - an endeavor that is creative in nature – by sharing knowledge, learning, and building consensus.

# Collaboration

Cooperation



Alliance



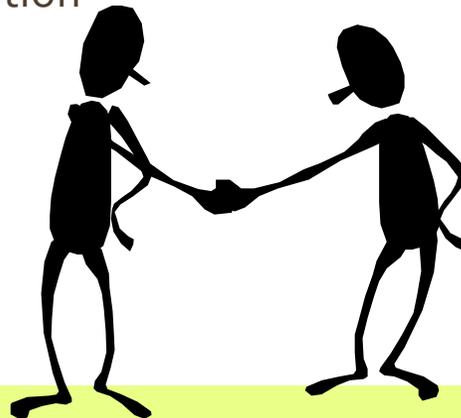
Association



Working Together



Participation



Joint Effort



# COLLABORATIVE ENGAGEMENT



## EPA CAN HELP DEVELOP YOUR NEW TECHNOLOGY

EPA has many programs and resources to assist a company or individual in developing environmental technology.

### The Environmental Technology Opportunities Portal

[www.epa.gov/etop](http://www.epa.gov/etop)

*This web page is your gateway to learning about programs that help fund development of new environmental technologies and offer information on existing environmental technologies.*

### EPA's Environmental Technology Verification (ETV) Program

[www.epa.gov/etv](http://www.epa.gov/etv)

*This web page describes the ETV program, which develops testing protocols and verifies the performance of innovative technologies that have the potential to improve protection of human health and the environment.*

### Small Business Innovation Research Program

[www.epa.gov/ncersbir](http://www.epa.gov/ncersbir)

*This Web page provides information on EPA's Small Business Innovation research program that translates innovative ideas into commercial products to solve environmental problems.*

### Small Business Gateway

[www.epa.gov/smallbusiness](http://www.epa.gov/smallbusiness)

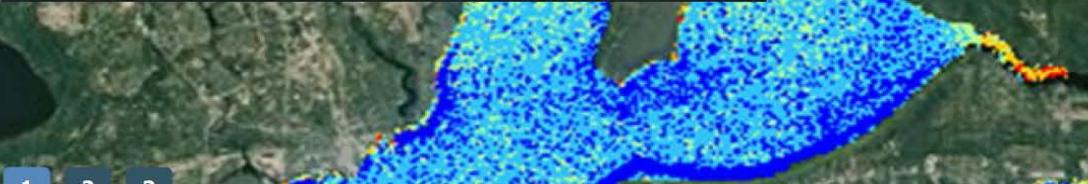
*This web page offers resources for small businesses including compliance assistance and technical help.*



- Small Business Opportunities
  - <http://www.epa.gov/osbp/>
- Grants and Fellowship Information
  - <http://www.epa.gov/epahome/grants.htm>
- Partnership Programs
  - <http://www.epa.gov/partners/index.htm>
- Cooperative Research and Development Agreements

Wouldn't it be amazing if we could transform environmental protection?

- [Pathfinder Innovation Projects \(PIPs\) answer that question](#)



1 2 3

What's new?

- [Campus RainWorks announces university winners](#)
- [Check out the citizen science toolbox for air sensors](#)
- [Village Green expands to cities across the U.S.](#)

## COLLABORATIVE ENGAGEMENT (CONT.)

EPA continually seeks better ways to solve environmental problems. From research and technology to regulation, community programs, and external partnerships – our work demands creative ideas to achieve results.

Below, learn more and find ways you can contribute.

### Innovation at EPA



[Find out more about innovative research](#)

[See examples of technology innovation](#)

[Check out innovation in sustainable practices](#)

[Stay updated with recent news](#)

### Get Involved



[Bring innovation to your school, community or business](#)

[Submit your solution through prize competitions](#)

[Apply for an innovation award](#)

[Collaborate with EPA](#)

[Use an environmental protection tool](#)

[Learn about innovation across the federal government](#)

# THINK ABOUT IT ...

- Collaboration with partners within and outside of the Agency provides leveraging opportunities for greater success in cleaning-up our world's environment.
- The issues we face are more complex and subtle than in the past; so, the need for the best science is greater than ever now.
- Much has been accomplished, but there are always new challenges and, unfortunately, emergency response situations to be faced.

# THANK YOU!!!



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