

June 20, 2012

To: EPA Science Advisory Board and Board of Scientific Counselors  
Subject: ORD Innovation Moving Forward

To help catalyze change in ORD and EPA, and find a systematic way to bring new ideas into our research, ORD established the Innovation Team in September 2010. Our initial vision for a small “skunkworks” (i.e., a group tasked with bold and ambitious thinking, situated outside the bureaucracy) has already yielded some notable successes (see attached). We have a fledgling network of partners within EPA, and have established relationships with innovation groups in other agencies (e.g., NASA, HHS, DOD).

Innovation is challenging for public-sector organizations because internal decision processes generally are not designed to foster creativity, experimentation is not always valued, and failure is rarely accepted. Often, incremental improvement is emphasized over transformational thinking. Creative ideas can languish because they lack internal advocates.

With that in mind, we are asking you several questions:

1. *How can ORD's initial innovation activities be improved to ensure continued and long-term benefits for EPA?*
2. *Are there useful experiences and lessons from other research organizations about managing innovation?*
3. *What guidance can the SAB and BOSC provide for ORD in developing metrics that would be most effective in assessing the success of our innovation efforts?*

Below are preliminary ideas about how we can continue to foster an ORD culture that enables innovation. We hope to catalyze further discussion and refinement of these concepts as we progress and learn. We believe that innovation in ORD will prosper with:

- Visible leadership and commitment. Consistent support from lab and center directors and the new National Program Directors, demonstrated by aligned resources and incentives, is a critical determinant of innovation success.
- Design-thinking and experimentation. An organization willing to experiment, test, and learn will be able to produce and sustain innovation over the long haul. ORD might benefit from trying rapid prototyping techniques (e.g., design labs), as a way to quickly test and iteratively rethink and redesign potential solutions.
- Smart risk taking. Innovation research projects aimed at ambitious goals can thrive with calculated risk-taking. Not all innovation activities will succeed, but we can still learn from, and benefit from, creative projects that don't achieve the anticipated results.
- Creative empowerment. Because innovation can come from anyone, it is essential that we empower people across ORD and be open to external ideas and processes.
- Teams and partners.– Innovation often benefits from networking, collaboration, and formation of teams with disparate backgrounds. ORD needs to become better at working across disciplines and with users and practitioners both in ORD and EPA, and with a variety of external partners.
- Measurement and accountability. We must strive to understand which ORD investments in innovation are yielding the greatest results, and continuously look for ways to improve ORD's innovation processes and infrastructure.

We look forward to working with you to improve and expand our innovation efforts.

Peter Preuss

**ORD Innovation  
Overview  
June 20, 2012**

To support EPA's mission, the Office of Research and Development (ORD) must invest in **innovation** that offers better solutions to the environmental problems of both today and tomorrow, and contributes to a more sustainable future.

**ORD's Innovation Team was created to catalyze innovation** and, working with the rest of the Agency, encourage and enhance creative problem solving aimed at groundbreaking improvements in the protection of human health and the environment.

The Innovation Team's **strategy** includes:

- *Fostering a dynamic environment that rewards and recognizes creative problem solving*
- *Piloting, evaluating, and institutionalizing new research approaches*
- *Demonstrating the merits of integrated transdisciplinary research*
- *Addressing major environmental challenges by promoting new technologies and approaches beyond those possible with traditional ORD capabilities*

**Current Innovation Initiatives**

**Pathfinder Innovation Projects (PIPs):** The PIPs are an internal competition for Agency scientists that provides one-year seed funding and time for innovative, high-risk, high-reward projects.

- 22 awards have been made through two competitions on issues ranging from nanomaterial design to algal bloom forecasting

**Open Innovation:** The team is leading the Agency in developing and implementing processes for "challenges" and prizes to fill priority gaps in environmental protection programs. By working with EPA's Programs and Regions, we are also piloting a series of challenges to explore the efficacy and cost-effectiveness of open innovation for filling EPA's science and technology needs.

- EPA recently announced the "My Air, My Health" challenge in partnership with US Department of Health and Human Services

**Apps and Sensors for Air Pollution (ASAP):** The team is leading the EPA effort on real-time, low-cost environmental sensors and apps that hold promise for regulators, researchers and communities.

- We convened a workshop for air pollution sensor developers and users, resulting in new collaborations, opportunities for instrument evaluation, and plans for another meeting in 2013

**Culture and Collaboration:** We are developing programs and activities to move EPA and ORD toward a culture of innovation, where interdisciplinary collaboration and risk-taking are supported and rewarded.

- We are planning a peer-driven awards program and workshop to highlight innovative projects from across ORD
- ORD employees will vote for award finalists from among applications scored highly by reviewers

**ORD is Poised for Innovation.** To continue our early success, we must:

- Work with the National Program Directors to support their programs' innovation efforts
- Strive for innovative solutions while recognizing the risk of failure - in successful innovation cultures, failure is not only acceptable, but often used as an opportunity
- Expand and institutionalize innovation activities that have proven effective

**"Innovation transforms the useful seeds of invention into solutions ... that are then widely adopted to protect the environment and human health."**

*- adapted from Braden Kelley, founder of Business Strategy Innovation*

## Pathfinder Innovation Projects (PIPs)

### Update

June 20, 2012

**Background:** Innovative organizations often allocate a small percentage of their budgets and employee time for seed funding and piloting innovative ideas.

- Google employees spend 20% of their work time developing their own ideas
- DOD, DOE, and DHS have offices that fund high-risk, high-reward research (DARPA, ARPA-E, and HS-ARPA respectively)
- NIST runs an internal competition for innovative research projects for inclusion into their standard research plans

**PIP Process:** ORD launched the Pathfinder Innovation Projects (PIPs) in fall 2010. PIPs are an internal competition for Agency scientists that provides one-year seed funding for innovative, high-risk, high-reward projects. Reviewed by external experts in innovation and sustainability, applications are evaluated on the following criteria:

- Relevance to the Agency's mission and ORD's research priorities
- Potential to dramatically change the way that EPA solves environmental problems
- Potential for a significant advance toward sustainability and altering EPA's strategies

**PIP1:** EPA scientists are energized by the opportunity to engage in transformative research:

- 117 proposals from almost 300 scientists, about 25% of ORD scientists (fall 2010)
- 12 awards in January, 2011, with projects starting in summer 2011, including:
  - An innovative biological treatment method for drinking water contaminants
  - Nanomaterials designed to facilitate decomposition at end of product life
- Considerable success in the first nine months of PIP1 projects, including:
  - Christian Daughton (NERL) published twice on using data from waste treatment plants to monitor community population and health.
  - Blake Schaeffer (NHEERL) is collaborating with the Office of Naval Research and NASA to use the International Space Station to monitor coastal waters

**PIP2:** Following the success of the 2010 program, ORD announced PIP2 in fall 2011.

- Over 200 ORD scientists - in collaborations across labs, centers, and research programs - submitted applications for the competition
- 10 awards announced on May 1, 2012
- Results could be very useful to the regions, especially those dealing with water (monitoring for viruses, forecasting algal blooms) or air quality (high throughput screening of VOCs)
  - These projects are addressing critical gaps in EPA science
- Another study will examine new approaches for desalinating water that, if successful, could have global impacts

**The Bottom Line:** Pathfinder Innovation Projects provide:

- Implementation of a research strategy proven effective in industry and other agencies
- Opportunities to create a culture of innovation among EPA scientists
- Potential for game-changing scientific results and products
- Direct value for EPA programs and regions

**Open Innovation  
Update  
June 20, 2012**

**Background:** EPA is using open innovation to bring the best ideas and top talent to help with the Agency's most pressing environmental problems. In doing so, we join 40 agencies that have awarded more than 150 prizes on the Challenge.gov platform, and meet President Obama's call for agencies to increase their use of such tools to solve tough problems.

**Implementing Challenges at EPA:** The America COMPETES Reauthorization Act of 2010 granted all Federal agencies the authority to conduct prize competitions to spur innovation, solve tough problems, and advance their core missions. In order to implement America COMPETES in EPA, the Deputy Administrator asked ORD to lead the Agency in developing a framework of policies and procedures for using challenges and prizes. The framework draws on EPA's experience, as well as the experiences of other agencies, to ensure that EPA personnel have clear expectations and appropriate guidance for using challenges and prizes.

**Benefits of Challenges**

- Pay only for success, and establish ambitious goals without having to predict which approach is most likely to succeed
- Reach beyond the "usual suspects" to increase the number of minds tackling a problem
- Bring out-of-discipline perspectives into the mix
- Increase cost-effectiveness to maximize the return on taxpayer dollars

**EPA Challenges.** Over the past year, ORD has worked with and supported the Programs and Regions to launch a series of challenges designed to meet specific needs and problems. For example:

Stand Alone Field Measurement of Atmospheric Benzene & Butadiene – Methods or technologies that will enable sensitive, reproducible, and rapid field-based monitoring of atmospheric benzene and 1,3 butadiene at low concentrations.

Recovering Bacillus Spores from Swabs – Protocols to efficiently recover bacterial spores (*Bacillus subtilis/Bacillus atrophaeus*) from pre-wetted surface sampling tools with handles.

Tracking Molecular Components of Electronics – Developing a 'molecular bill of materials' for electronic products and components.

"My Air, My Health" – Location-specific systems to monitor air pollutants and related physiological metrics in near real time (an EPA/HHS challenge).

**Apps and Sensors for Air Pollution  
Update  
June 20, 2012**

**Background:** Rapid developments in technology have led to the production of small, low-cost air pollution sensors. These new technologies, and their use by academics, facilities, communities, and individuals, have large implications for EPA and the future of air quality monitoring. New technologies have the potential to serve many purposes, including:

- In-plant sensor networks and “fenceline” monitoring – facilities could use sensor networks to detect and control fugitive emissions
- Monitoring near emissions sources – helping communities understand near-source exposures
- Wearable sensors – engaging citizens in personal monitoring, and learning about exposures during exercise and the exposure of sensitive family members
- Mobile sensor platforms – developing spatially-resolved data on air quality in local areas
- Supplementing current air quality monitoring networks with a high density sensor network

ORD is working with EPA partners in the Office of Air and Radiation, Office of Enforcement and Compliance, and EPA’s regional offices to stimulate interest, share information, and develop a strategic roadmap for EPA activities to advance the development and use of sensor technologies. The ORD effort is co-led by the Air, Climate, and Energy research program and the ORD Innovation team, with support from the Sustainable and Healthy Communities research program.

**Bringing Together Apps and Sensors Innovators.** In March 2012, ORD and Office of Air and Radiation brought together engineers, roboticists, DIYers, exposure scientists, designers, community groups, and social scientists to share their experiences developing and using low-cost, portable, air pollution sensors. Participants identified challenges and opportunities for advancing sensor development, community engagement, and data management. Demand for a forum for continuing these discussions resulted in the launch of an independent site: [www.citizenair.net](http://www.citizenair.net).

**Air Sensor Evaluation and Collaboration.** ORD is hosting an “open lab” session in July 2012, inviting sensor developers to visit the lab, share ideas, and learn about protocols for device evaluation. They will then be able to submit their devices for testing in EPA’s facility under a range of pollutant concentrations and environmental conditions.

**State of the Science.** ORD is conducting two reviews of sensor technologies to capture the range of existing devices already on the market, and emerging technologies currently under development.

**Benzene Monitor.** ORD is offering two opportunities for the development of new, low-cost technologies to monitor benzene in air – through an open innovation challenge and as a specific topic of interest in the Small Business Innovation Research program.

**Upcoming Activities.** A webinar on existing and emerging sensor technologies; an EPA Regional workshop on the next generation of air monitoring; continued outreach and coordination with other federal agencies (e.g, DHS, NIST, NSF, NIEHS, DOD, etc); an EPA group to address data interpretation, privacy, etc., and demonstration projects to advance sensor development and evaluation.

**The Bottom Line:** The potential benefits of low-cost, powerful, air quality sensors could enable us to:

- Track the most common and hazardous pollutants in every area
- Customize detailed, real-time information to meet local needs
- Reduce air pollution monitoring costs
- Create learning tools and graphics that make data easy to understand
- Connecting health care to the whole environment
- Engage and empower communities and partners, including those who have been historically under-represented, to support and advance environmental protection and human health

## Culture and Collaboration June 20, 2012

**Background.** For any organization that seeks to become more innovative, the work environment and everyday employee expectations are vital to sustainable change. Initiatives to change organizational cultures can take a variety of forms:

- The HHSInnovates program, at the Department of Health and Human Services, gathers peer nominations for innovative activities, providing the best submissions with recognition, monetary awards, and the opportunity to scale their ideas
- Ferrari's Creativity Club offers employees opportunities to learn about, and practice, many different forms of art, spurring them to become more creative at work
- Intuit identifies employees who are "doing innovation right" and recruits them into a coaching program to spread best practices in innovation and design across the company

**Goals.** The innovation team is now developing a suite of projects that seeks to provide:

- A clear framework for innovation at EPA - what it is, why it's needed, and how it can be integrated with previously existing needs and activities
- Rewards and recognition for innovative activity, including the willingness to take risks and work across disciplinary boundaries
- Resources and training for implementing innovative projects, along with concrete examples of success stories

### Examples of Initiatives

**PeerOvation.** We are planning a peer-driven awards program and workshop to highlight innovative projects from across ORD. ORD employees will vote for award finalists from among applications scored highly by reviewers. Each finalist will give a talk describing his/her work and how others in the Agency can use lessons developed from it. Three winners will be chosen from among these finalists, and will receive further prizes and recognition. Workshop participants will also:

- Engage in breakout sessions discussing barriers to innovation, and discuss concrete next steps to overcome those barriers, in specific areas of agency interest
- Participate in networking and design activities with agency members across sites and disciplines

**Federal Environmental Research Network (FERN).** FERN will be designed to increase access to resources, and awareness of work in progress, across agencies and disciplines involved in environmental research. It should allow quick expert consults so that projects can move forward, facilitate long-term collaborations, and help us use limited resources more efficiently by:

- Fast distribution of queries across agencies and offices
- Posting queries in venues already used by employees (e.g., e-mail, intranet)
- Matchmaking between potential collaborators

There is demand for such a service across the federal government, and interest has been expressed by multiple agencies including DOD, DOE, USDA, and CDC.

**The Bottom Line:** Successful organizational change draws on behavioral sciences, educational theory, and design to help people transition to new ways of thinking and doing. The programs we're developing are intended to provide a *framework* for connecting innovation to Agency priorities, create *tools* to support that innovation, and offer *rewards and recognition* for those who pioneer these new tools in the service of environmental protection.