National Advisory Council for
Environmental Policy and Technology

January 31, 2011

The Honorable Lisa P. Jackson
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

RE: First NACEPT Advice Letter on EPA Workforce Planning
Scientific and Technical Competencies to Meet Tomorrow's Challenges

Dear Administrator Jackson:

The National Advisory Council for Environmental Policy and Technology (NACEPT) is working on your charge to provide advice for development of the Agency's next Strategic Workforce Plan. The charge comprises the following topics:

1. Scientific and technical competencies needed to be prepared for tomorrow's challenges.
2. Strategies to obtain and retain scientific and technical expertise.
3. Strategies to attract and retain superior executive leadership talent.
4. Leadership capabilities and culture for "One EPA."
5. Ensuring diversity.

A final report covering these topics was originally scheduled to be delivered within 15 months. However, the Office of Administration and Resources Management (OARM) has requested inputs from NACEPT as quickly as possible. To meet this need, NACEPT is responding with this advice letter on the first topic: scientific and technical competencies needed for the Agency to be prepared for tomorrow's challenges. We anticipate providing another advice letter on the remaining topics by May 2011.

The initial part of the charge to NACEPT poses a fundamental question that underlies many of the workforce decisions confronting the Agency: "Given the complexity of EPA's mission, the rapid pace of scientific and technological advances, and shifts in policy, science, engineering and other technical competencies, what are the scientific and technical competencies necessary to support EPA's mission today and ten years from now so that EPA is prepared for tomorrow's challenges?" This Advice Letter summarizes NACEPT's recommendations for addressing this critical question.

SUMMARY OF RECOMMENDATIONS

Recommendation #1: In assessing scientific and technical competencies needed to meet tomorrow's challenges, EPA should consider a broad range of plausible changes in circumstances (scenarios) over the decade ahead and the implications of these scenarios for evolving mission priorities.

The charge recommends that in assessing needed Agency competencies, "NACEPT should evaluate EPA's broader mission and determine the most effective means for aligning the workforce to address change. Specifically, NACEPT should develop realistic future scenarios that capture evolving mission priorities and their drivers, then identify the scientific and technical competencies required to successfully accomplish developing mission areas."

In response, NACEPT presents a set of scenarios that capture the range of changing circumstances that members believe are most plausible during the decade ahead. We urge the Agency to consider this full range of potential developments:

1. Cuts are made to EPA's budget.
2. Some big cross-cutting problems prove especially difficult and do not lend themselves to the Agency's traditional environmental media approaches.
3. The Agency focuses more effort on supporting innovation in clean/green technology.
4. Major climate-related events occur.
5. New environmental justice issues emerge.
6. Nanotechnology poses serious environmental problems.
7. Convergence of nano-, bio- and information technology creates new environmental challenges, but also opens opportunities for environmentally superior technologies.
8. Sustainability becomes a major emphasis across the Agency.
9. Rapidly falling costs of advanced sensor systems create a paradigm change in environmental protection.
10. Growth of digital technology changes the way the Agency gathers information and communicates with communities, partners and stakeholders.

Recommendation #2: Develop new or strengthened competencies in areas needed to successfully accomplish the mission changes that these scenarios would drive. To focus attention on these areas, EPA should consider adding several new occupations to its list of Mission Critical Occupations (MCOs) or elevating the importance of some occupations by other appropriate means.

NACEPT recommends the occupational areas listed below as equally important to the current Agency list of MCOs for dealing with potential developments over the decade ahead. We believe these occupations are also relevant to the strategic goals and cross-cutting strategies set out in EPA's Fiscal Year 2011–2015 Strategic Plan. Most can be matched at least roughly to conventional U.S. Office of Personnel Management (OPM) occupational groups and series, but for clarity are better expressed as follows:

- Business and Finance
- Social, Behavioral and Decision Sciences
- Computer Science and Information Technology (IT)
- Environmental Design
- Statistical Analysis

Other areas of expertise and experience that are not generally recognized as occupations but will be increasingly important are:

- Trans-disciplinary Thinking
- Partnership Development
- Public Outreach
- Global Perspective

Recommendation #3: Within the Agency's existing set of science and technology-related MCOs, new consideration should be given to what subfields and specialties are likely to prove increasingly important over the decade ahead.

As EPA's mission priorities evolve over the next ten years, we anticipate significant changes in the composition and relevance of the subfields and specialties within the current list of MCOs. For example, within the field of economics, the areas of behavioral economics and ecological economics deserve more attention. Within biology, competency in systems biology will be increasingly important. Physical science and engineering subfields like nanomaterials management and geoengineering could prove mission critical. NACEPT recommends that EPA consider such changes when recruiting so that position descriptions are broad enough to maximize outreach to potential talent pools, yet focused enough to convey specific job needs.

The question of competencies needed to be prepared for tomorrow's challenges is arguably the most important question facing EPA as it develops its new Strategic Workforce Plan. We hope the recommendations in this first Advice Letter will prove useful in addressing that question. The next Advice Letter will address strategies to attract and retain needed expertise and leadership talent, leadership capabilities and organizational culture needed for "One EPA," and strategies for ensuring diversity.

FULL RESPONSE TO THE INITIAL QUESTION POSED IN THE CHARGE

"Given the complexity of EPA's mission, the rapid pace of scientific and technological advances, and shifts in policy, science, engineering and other technical competencies, what are the scientific and technical competencies necessary to support EPA's mission today and ten years from now so that EPA is prepared for tomorrow's challenges?"

Future Scenarios of Changing Circumstances and Mission Priorities

The charge recommends that NACEPT approach this question by developing "realistic future scenarios that capture evolving mission priorities and their drivers." In response, NACEPT presents ten scenarios of potential changes in circumstances and mission priorities over the decade ahead. These scenarios were developed through discussions within NACEPT's Workforce Workgroup, interviews with environmentally-oriented futurists, a review of EPA's current Strategic Plan and the recent NACEPT report *Outlook for EPA*, a workshop with twenty members of EPA's informal Futures Community of Practice organized by the Office of the Chief Financial Officer (OCFO), and consultations with the executive directors of the Water Research Foundation and the Water Environment Research Foundation.

The scenarios are not mutually exclusive. In reality, many of the changes they explore are likely to occur to some degree over the decade ahead. Other scenarios and changes in mission priorities are possible, but these ten emerged as the most highly plausible and were used by NACEPT as the bases for assessing competencies the Agency may need in the decade ahead.

1. Resource Constricted – Efforts to reduce the federal budget deficit include significant cuts in the budgets of most departments and agencies, including the EPA. The Agency is challenged to protect its core mission, clarify its priorities, work smarter, and develop more partnerships to leverage its resources.

2. Big Cross Cutting Problems – Some environmental problems prove especially tough and persistent. The largest of these problems are multidimensional issues like water resource sustainability, climate change, ecosystem decline, sustainable agriculture, and ocean health that do not lend themselves to the Agency's traditional environmental media approaches. The Agency is challenged to develop more integrative approaches.

3. Encouraging Technological Innovation – The Agency focuses more effort on supporting innovation in clean/green technology. It is challenged to increase awareness of emerging technological opportunities and to develop the business-related knowledge needed to work in new ways with entrepreneurs, venture capitalists and other sources of financing.

4. Climate Becomes a Top Priority – Major climate-related events occur, e.g., faster than expected melting of Arctic sea ice, large scale methane releases from melting tundra, a major ice sheet breakup in Greenland or Western Antarctica. Working with other agencies and governments to head off global climate disruption becomes a prime EPA priority.

5. New Environmental Justice Issues – Climate change, for example, creates a new set of environmental justice issues. Heat waves, extreme weather events, and other climate impacts are projected to have the greatest impacts on parts of the country that have the largest vulnerable populations. Disasters like hurricane Katrina and the Deepwater Horizon oil spill in the Gulf highlight the disproportionate impacts that natural and human-caused disasters have on especially vulnerable populations. Further disasters are likely over the decade ahead.

6. Focus on Nanotechnology – EPA's Office of the Inspector General has started an investigation into the ways different programs in the Agency are looking at nanomaterials regulation. This investigation or new developments over the decade ahead might initiate a movement to create new regulations and to make nanotechnology a much stronger focus of Agency attention.

7. Getting in Front of Change – The long anticipated convergence of nano-, bio- and information technology creates a new array of environmental challenges, but also opens opportunities for creating a new generation of environmentally superior technologies. A new "molecular economy" emerges based on the ability to manipulate matter atom-by-atom and gene-by-gene. A dollar spent helping to insure that environmental impacts are minimized, as this major industrial transformation unfolds, is worth thousands of dollars cleaning up after it. The Agency is challenged to stay on the forefront of the molecular economy and foster "design for the environment" practices.

8. Sustainability Emphasis – On the occasion of its 40th anniversary, EPA has asked the National Academy of Sciences to convene a committee of experts to provide the Agency with an "operational framework for sustainability that applies across all of the Agency's programs, policies, and actions." This and other developments could lead to a much stronger emphasis on sustainability.

9. Sensor Rollout – Rapidly falling costs of distributed sensor networks and other advanced sensor systems allow EPA to monitor across wide areas, detect a broad range of pollutants, and see monitoring data in real time. Widely deployed sensors create a paradigm change in environmental protection. They make it possible to understand the dynamic nature of environmental systems, respond quickly to worsening conditions, get a better fix on results of remedial actions, and begin to automate some responses. They enable community groups and vulnerable populations to document local environmental hazards.

10. Convergence of Communication Technologies – Advances in digital technology allow text, audio and video messaging on wireless networks creating trends such as virtualization, cloud computing, web, wireless, and mobile systems to provide efficiencies in how problems are addressed and day to day business is preformed. These systems offer almost unlimited capacity for handling large databases and real time decisions and actions.

Implications of Alternative Scenarios for Needed Agency Competencies

Each of these scenarios has implications for the competencies required to adapt to changing mission priorities. The table below presents NACEPT's summary of needed competencies for addressing potential changes in mission priorities over the decade ahead.

Scenarios of Changing Mission Priorities	Implications for Needed Agency Competencies
Resource Constricted	• Work smarter – Develop capability to coordinate more effectively internally • Improve capability to create partnerships in order to leverage resources
Big Cross-Cutting Problems	• Strengthen capabilities for systems thinking • Develop more integrative, trans-disciplinary, multi-media approaches • Develop broader competencies in the social, behavioral and decision sciences • Improve in-house statistical capacity to deal with multi-media issues, cumulative impacts and probabilistic risk assessment involving multiple uncertainties • Improve capabilities for working collaboratively with other federal agencies, other levels of government, the private sector, universities, and NGOs in emergency and proactive situations, e.g. Homeland security and extreme weather events • Improve capabilities for public outreach and communication
Encouraging Technological Innovation	• Increase capacity to speak the language of business and work cooperatively with entrepreneurs, corporations, venture capitalists, other sources of finance • Increase ability to monitor and stay on the forefront of technological developments in green/clean technology • Develop broader capabilities in computer science and IT, not just for internal program support but for understanding IT aspects of emerging clean technology, advanced environmental sensor systems allowing real-time understanding and action, data visualization, simulations, and many other purposes
Climate Becomes a Top Priority	• Develop specific capabilities related to climate change such as knowledge of atmospheric chemistry, meteorology, hydrogeology, glaciology, conservation ecology, oceanography • All the capabilities listed in "Big Cross-Cutting Problems" above
New Environmental Justice Issues	• Expand public outreach and communication capabilities • Improve foresight capability • Maintain and improve capabilities for emergency preparedness and response and homeland security
Focus on Nanotechnology	• Develop greater competencies in materials science and nanomaterials management • Green nanotechnology – encourage uses of nanotechnology to create environmentally superior technologies • Technology to detect and remediate hazardous impacts • Risk analysis as a basis for standards • Refine or develop regulations as needed
Getting in Front of Change	• Develop greater capacity to monitor technological change across the economy • Expand ability to foster "design for the environment" approaches in the private sector in order to minimize environmental impacts of new technologies • Improve foresight capability and its application in strategic planning • All the capabilities listed in "Encouraging Technological Innovation" above

Scenarios of Changing Mission Priorities	Implications for Needed Agency Competencies
Sustainability Emphasis	• Add physical and environmental design capabilities including fields like environmentally-oriented architecture, urban planning and landscape architecture • Add ecosystem restoration and design capabilities including fields like ecological design, conservation ecology, and environmental design • All the capabilities listed under "Big Cross-Cutting Problems" above
Sensor Rollout	• Expand capability to partner with IT firms • Develop broader capabilities in computer science and IT to make use of advancing sensor technology and the full range of IT needed to transmit, organize, display and assess sensor data • Improve in-house statistical capacity for analysis of sensor data • Improve public outreach capability to work with community groups and vulnerable populations
Convergence of Communication Technologies	• Need to better understand and use new systems • Increase in cyber security concerns • Better management of large databases • Consolidate data centers to reduce space, staff, power, HVAC, cables, etc.

Recommended Revisions in EPA's Mission Critical Occupations

EPA's personnel decisions are currently shaped by a list of nineteen occupations that are considered "Mission Critical." The occupations listed as science and technology-related on EPA's current MCO list include:

- Toxicologists
- Geneticists
- Ecologists
- Biologists
- Economists
- Chemists
- Physical Scientists
- Health Scientists
- Environmental Engineers and Mechanical Engineers
- Attorneys

Given the potential range of plausible changes in the Agency's mission priorities and needed competencies, NACEPT recommends that the occupations and competencies listed below be considered for addition to EPA's list of MCOs or given a higher priority by some other appropriate means. While these occupations and competencies were identified by considering potential developments over the decade ahead, we believe they are equally relevant to the strategic goals and cross-cutting strategies set out in EPA's current Strategic Plan (Plan).

Business and Finance – The Agency's current list of MCOs only touches on internal financial resource management. If the Agency is going to put more emphasis on supporting innovation in

clean technology or minimizing environmental impacts of emerging technologies, it needs people with MBAs or equivalent experience on the front lines—people who can speak the language of business and are familiar with finance and venture capital.

Current Relevance: The Plan identifies several opportunities for EPA to collaborate with other federal agencies in coordinating incentives to the private sector for building healthy, sustainable, green neighborhoods. To attract and retain private sector funding and participation for these programs, EPA needs staff experienced in business and finance; it needs to promote its vision for science, research and technological innovation in a way that resonates with venture capital, private equity, and small business interests.

Social, Behavioral and Decision Sciences – The only social science on the current MCO list is economics. But improving the Agency's capability in areas such as promoting sustainable individual and collective behavior or determining an equitable distribution of risks, costs and benefits requires a broader range of knowledge from the social, behavioral and decision sciences. A more sophisticated application of knowledge from the social sciences is also needed to improve public communication.

Current Relevance: The Plan alludes to the role these disciplines can play in the areas of cleaning up communities, expanding the conversation on environmentalism, helping to inform and motivate environmentally sustainable behavior, fostering work for environmental justice and improving decision making by understanding the motivations and outlooks of different communities.

Computer Science and Information Technology – The current MCO list only mentions IT in the context of internal program and management support—keeping the computers running. But, given potential changes in mission priorities, IT should be viewed more broadly as an area of competence encompassing everything from advanced environmental sensor systems to data fusion, visualization technology and other graphic advances to make information more accessible to the public, environmental simulations, real-time control technologies and IT aspects of emerging clean technology.

Current Relevance: A close reading of the Plan demonstrates that IT is crucial for achieving the Agency's key program objectives including (i) providing robust scientific data to support the Agency's policy and decision making, (ii) providing the public with access to environmental data and information to educate and empower individuals and communities in decision making; and (iii) using the best science and environmental monitoring data to evaluate the potential for adverse health effects in vulnerable populations.

Environmental Design – This encompasses a variety of professionals dealing with the built environment including environmentally oriented (green) architects, landscape architects, planners, interior designers and facility managers. It also includes industrial ecologists trained in designing industrial complexes where the "wastes" of various processes become the "food" for

other processes, and ecological designers who design ecosystems for specific functions such a filtering wastes. Competencies in these areas are especially required for developing a stronger emphasis on sustainable construction and the development of sustainable communities.

Current Relevance: The Plan describes environmental sustainability as a guidepost for science, research, and technological innovation at EPA and emphasizes EPA's commitment to stimulating the development of sustainable communities and solutions.

Statistical Analysis – Advanced statistical analysis will be needed to deal successfully with big cross cutting problems, develop rigorous approaches to sustainability, and support the widespread deployment of advanced sensor technology.

Current Relevance: A recent Risk Assessment Forum colloquium highlighted the issue that EPA's regions and program offices seldom have the statistical capacity in-house to deal with complex data sets, risk-based analysis of multimedia issues, cumulative impacts, and probabilistic risks assessments involving multiple uncertainties.

The fields listed above are widely recognized occupations. The areas that follow involve equally important competencies, but they are not usually regarded as occupations. They can be viewed as areas of expertise and experience that can go with every other science and technology related MCO as well as with the cross-cutting MCO of "Leadership." People knowledgeable in these areas as well as in their own primary occupation will be critical for meeting tomorrow's challenges.

Trans-disciplinary Thinking – Dealing with big cross-cutting problems requires thinking that transcends individual media, knowledge domains and government agencies. People capable of this kind of thinking may often be cross-trained in more than one field and will have the ability to collaborate effectively and work across disciplines.

Current Relevance: The Plan acknowledges that for EPA to effectively address today's most challenging problems, the Agency must complement its traditional, single-discipline approaches with a "systems" approach of integrated, trans-disciplinary research. This includes the use of quantitative methods such as mathematical modeling and statistical analysis to provide defensible bases for environmental policy and management decisions.

Partnership Development – The role of spanning organizational boundaries to develop partnerships with other public, private and nonprofit organizations will become more central as the Agency focuses more on leveraging limited resources, encouraging technological innovation, dealing with climate change, helping industry "design for the environment," utilizing advanced sensor technology, and other actions likely over the next decade.

Current Relevance: EPA already accomplishes much of its work through partnerships with various stakeholders. As one of the agency's cross-cutting fundamental strategies, the Plan

reiterates the commitment to strengthening partnerships with states, tribes and the global community.

Public Outreach – The current MCO list only mentions public outreach in the context of internal program and management support. This role will become a major focus of effort as the Agency engages more fully with climate change and other big cross-cutting problems, attends more to environmental justice issues, and works to promote more sustainable individual and collective behavior. To be more effective, outreach efforts need to be customized to different population subgroups and be informed by knowledge from the social and behavioral sciences.

Current Relevance: This competency is especially important for supporting EPA's cross-cutting strategy of working for environmental justice and children's health. The Plan indicates the agency will employ outreach and community-based programs for protecting children and low-income, minority and tribal populations that are disproportionately impacted by environmental and human-health hazards. In addition, the agency seeks to expand its engagement with communities historically under-represented in environmental policy and decision-making processes and to collaborate more effectively with other communities and institutions.

Global Perspective - Pollution is increasingly carried from other nations into the U.S. by winds and water and cannot be eliminated without international cooperation. The most challenging cross cutting environmental issues that loom ahead such as climate change, water resource sustainability, ecosystem decline, and ocean health are all global issues requiring global solutions. The environmental protection strategies and environmentally superior technologies to deal with environmental problems are increasingly being pioneered in many countries around the world, not just in the United States.

Current Relevance: The Plan acknowledges this reality and calls for expanding partnership efforts in bilateral relationships and multilateral forums and nurturing new kinds of international partnerships to support global environmental stewardship.

These occupations and competencies do not in all cases align with the federal government's standard list of occupations, but we list the Occupation Series that appear to be closest to those we recommend.

Recommended Additional MCOs	**Closest Occupational Groups and Series (U.S. Office of Personnel Management, May 2009)**
Business and Finance	Business and Industry
Social, Behavioral and Decision Sciences	Social Science, Psychology and Welfare
Computer Science and Information Technology	IT is currently a Program and Management Support MCO
Environmental Design	Engineering and Architecture Natural Resources Management and Biological Sciences
Statistical Analysis	Mathematical Sciences
Other Important Areas of Expertise and Experience	All fit within the cross-cutting MCO of "Leadership"
Trans-disciplinary Thinking	
Partnership Development	
Public Outreach	Public Affairs/ Information Specialist
Global Perspective	

Changing Emphasis Within Existing MCOs

The potential changes in mission priorities explored here also suggest that more emphasis should be given to specific subfields within the existing set of Mission Critical Occupations. The table below contains several recommendations of subfields that NACEPT members believe merit greater emphasis within the Agency.

Current List of MCOs (Excluding those related to internal Program and Management Support and internal Financial Resource Management)	**Subfields to Consider for Greater Emphasis**
Toxicologists	Computational Toxicology
Ecologists	Conservation Ecology Ecological Design Agroecology
Biologists	Systems Biology Oceanography (ocean health, ocean acidification) Agricultural Science
Economists	Behavioral Economics Ecological Economics
Chemists	Green Chemistry Atmospheric Chemistry
Physical Scientists	Materials Science Nanomaterials Management Hydrogeology Geoengineering
Health Scientists	Geneticists Population-based Medicine
Environmental Engineers/Mechanical Engineers	Environmental Design Industrial Ecology
Attorneys	Cross-trained with fields in science and engineering Conflict resolution

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Sincerely,

/Signed/

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SOURCES AND ACKNOWLEDGEMENTS

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Interviews and Consultations

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