



## The Use of Title 42 Authority at the U.S. Environmental Protection Agency: A Letter Report

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# **The Use of Title 42 Authority at the U.S. Environmental Protection Agency: A Letter Report**

Committee to Review EPA's Title 42 Hiring Authority for  
Highly Qualified Scientists and Engineers

Board on Environmental Studies and Toxicology

Division on Earth and Life Studies

National Research Council

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## THE NATIONAL ACADEMIES

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April 14, 2010

The Honorable Dr. Paul Anastas  
Assistant Administrator for Research and Development  
U.S. Environmental Protection Agency  
Washington, DC 20460

Dear Dr. Anastas:

At the request of the U.S. Environmental Protection Agency (EPA), the National Research Council (NRC) convened an expert committee to evaluate the effectiveness of EPA's Title 42 program. Title 42 authority was granted to EPA for 5 years, from 2006 to 2011. As that period draws to a close, it was thought that a review of the current program would be appropriate.

The committee held three meetings. At the first two meetings, public sessions were held during which the committee heard various perspectives from current and former EPA staff and others on the Title 42 program. The committee also requested information from EPA on hiring mechanisms, employment statistics, workforce analyses, and various aspects of EPA's Title 42 program. NRC staff and committee members also collected information from current Title 42 hires and from members of search committees for Title 42 positions. All the information was used in the committee's review of EPA's Title 42 program.

Although the Title 42 program at EPA is still evolving, the committee found that the agency has implemented the program appropriately. Most important, the Title 42 appointees have already had a favorable effect on EPA's scientific research even after such a short time since implementation of the program. A leading example is the development of the National Center for Computational Toxicology. The committee emphasizes the importance of the Title 42 program to recruit and retain world-class scientists and engineers and recommends that Title 42 authority be permanently granted to EPA and expanded to allow EPA to define the total number of Title 42 positions on the basis of its programmatic needs and available funds. Those changes would make EPA's program similar to Title 42 programs in other federal agencies.

This letter report first provides some background information on the origin of EPA's Title 42 program and then more detailed information on the committee's task and its approach to the task, comments on implementation of the Title 42 program, and suggestions for strengthening the program. The report concludes with the committee's overall findings and recommendations. (There are several attachments: a verbatim statement of the committee's task, a committee roster and biographies, a bibliography, acknowledgment of reviewers, and a graph illustrating the budget of the Office of Research and Development over the last 20 years.) This report reflects the consensus of the committee and has been reviewed in accordance with standard NRC procedures.

Sincerely,



Thomas Burke, *Chair*  
Committee to Review EPA's Title 42  
Hiring Authority for Highly Qualified  
Scientists and Engineers



## THE USE OF TITLE 42 AUTHORITY AT THE U.S. ENVIRONMENTAL PROTECTION AGENCY: A LETTER REPORT

### THE ENVIRONMENTAL PROTECTION AGENCY AND TITLE 42 AUTHORITY

Over the years, distinguished panels and committees have emphasized the importance of a strong scientific foundation at the U.S. Environmental Protection Agency (EPA). In 1992, an independent expert panel, in its report *Safeguarding the Future: Credible Science, Credible Decisions* (Loehr et al. 1992), expressed concern about the poor perception of science at EPA and made the following points regarding the role of science at the agency:

Science is especially necessary to characterize today's subtle and complex environmental problems that cut across all environmental media...and transcend national boundaries...In short, science is one of the soundest investments the nation can make for the future. Strong science provides the foundation for credible environmental decisionmaking. With a better understanding of environmental risks to people and ecosystems, EPA can target the hazards that pose the greatest risks, anticipate environmental problems before they reach a critical level, and develop strategies that use the nation's, and the world's, environmental protection dollars wisely (Loehr et al. 1992, pp. 14-15).

In 2000, the National Research Council (NRC) released a report (NRC 2000) that again focused attention on the need for strong, credible science at EPA. The NRC committee commended EPA on the progress made in addressing environmental pollution but noted the increasing complexity of environmental problems and the need to keep abreast of scientific advances in molecular biology, information technology, social sciences, and other fields. That committee stated that strong scientific and technical foundations and recent scientific advances were keys to solving the complex problems facing EPA, and it emphasized the dangers of not keeping pace with scientific developments. The NRC committee strongly agreed with the 1992 expert panel on the importance of science at EPA and made the following statements concerning EPA's research program:

A vigorous research program should be maintained at EPA. Moving the research program out of the agency would most likely weaken, not strengthen, the scientific foundation of EPA's decisions and actions...Overall, the level of damage [that would be caused by moving the research program out of the agency] would increase with passing time as EPA became increasingly unable to pursue, apply, or even understand new research knowledge. An EPA devoid of a research program would not be likely to attract substantial scientific talent, and an EPA without scientific talent would be ineffective and potentially harmful to the nation (NRC 2000, p.14).

Today, EPA is one of the few remaining regulatory agencies of the federal government that have substantial intramural and extramural research programs.<sup>1</sup> The rationale for research programs in federal regulatory agencies is to provide a strong scientific basis for regulatory decisions and to be able to identify emerging issues and their relative importance independently. Numerous expert panels (see, for example, NRC 1997, 2003; Powell 1999; Morgan 2006, 2008; Swackhamer and Morgan 2008; Swackhamer 2009) have echoed the sentiment that a strong research program is essential for sound

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<sup>1</sup>The research program at EPA is primarily in the Office of Research and Development (ORD). The ORD budget for FY 2011 is \$606 million. The funding for ORD has remained relatively flat for the last 20 years and has declined somewhat when adjusted for inflation (see Attachment E).

decision-making at EPA and have supported a balance of in-house and external scientific research funded by the agency. Lisa Jackson, the current EPA administrator, concurred with those expert opinions and stated at her confirmation hearing that “science must be the backbone of what EPA does” (Jackson 2009).

To ensure that EPA has a strong research program, it needs a premiere scientific staff. The 1992 expert panel acknowledged that although EPA had some excellent scientists, it did not have “the critical mass of externally recognized scientists needed to make EPA science generally credible to the wider scientific community” (Loehr et al. 1992, p. 7). That panel recommended that EPA hire scientists and engineers who had national or international reputations and who could serve as mentors to more junior scientists and engineers. It added that EPA should make a long-term commitment of support to the “world-class” scientists and engineers hired by the agency. The 2000 NRC committee agreed with the 1992 expert panel and emphasized that “the ability to attract, retain, and support a capable and dedicated work force of scientists, engineers, technicians, managers, other professionals, and support staff is the most critical requirement for strong scientific and technical performance” (NRC 2000, p. 87).

EPA, however, has had difficulty in recruiting, hiring, and retaining the premiere scientists and engineers that it needs. As a result of the recommendation of the 1992 expert panel, the Office of Research and Development (ORD)—the arm of EPA that provides the scientific research to support its mission and regulatory responsibilities—was able to create scientific or professional (ST) positions that allowed EPA to promote scientists and engineers to senior scientific positions equivalent to the Senior Executive Service (SES) positions without supervisory or managerial responsibilities (see Box 1 for further description of ST and SES positions). Although creation of the ST positions helped, it did not solve EPA’s recruiting and hiring problems. ST positions were created primarily for internal candidates, and the number of positions is restricted, as is the number of SES positions. Other limitations of the existing hiring mechanisms are discussed further below.

**BOX 1** Hiring Mechanisms Available to the Environmental Protection Agency for Senior Candidates

*Senior Executive Service (SES) positions:* SES positions were created by Title 4 of the Civil Service Reform Act of 1978 and are to be used for senior managerial, supervisory, and policy position candidates (see OPM 2010). The number of SES positions available to EPA is strictly controlled by the Executive Resources Staff in EPA’s Office of Administration and Resources Management. ORD is allowed 28 SES positions and currently has none available for recruitment (personal communication, EPA, December 10, 2009). The salary range for SES positions in EPA is \$119,554-179,700.

*Senior level (SL) positions:* SL positions were created by the Federal Employees Pay Comparability Act of 1990 and are to be used for senior candidates who will serve as independent advisers or technical experts in a nonsupervisory and nonmanagerial manner (for example, senior scientists who serve as scientific advisers and are not directly involved in laboratory research). The number of SL positions available to EPA is strictly controlled by the Executive Resources Staff in EPA’s Office of Administration and Resources Management. ORD is allowed six SL positions and currently has none available for recruitment (personal communication, EPA, December 10, 2009). The salary range for SL positions in EPA is \$119,554-165,300.

*Scientific or professional (ST) positions:* ST positions were created by the Federal Employees Pay Comparability Act of 1990 and are to be used for senior scientists actively conducting research. The positions are nonsupervisory and nonmanagerial. All ST positions are in ORD. ORD currently has 19 ST positions; 16 have been filled, and three are available for recruitment (personal communication, EPA, December 10, 2009). The salary range for ST positions in EPA is \$119,554-165,300.

NOTE: SES, SL, and ST positions are outside the competitive hiring process established by Title 5, in which the highest grade is 15 and the maximum base salary is \$129,517.

The 2000 NRC committee also noted problems in recruiting and hiring at EPA and cited periodic hiring freezes at EPA and its inability to compete with the recruitment and retention packages offered by industry and academic institutions as issues that have compounded the problem. That committee recognized the importance of the ST positions but stated that “even greater measures are warranted and practicable to attract and retain outstanding research leaders” (NRC 2000). As one option, the committee suggested that EPA seek Title 42 authority (see Box 2) and create a program similar to that of the National Institutes of Health (NIH). As a result of that recommendation, EPA sought and was granted Title 42 authority to hire up to five appointees each year in FY 2006-2011 [H.R. Rep. No. 109-188, 109th Cong., 1st Sess., 33 (2005)]. The language of the hiring authority was amended by the FY 2009 Appropriations Act and allowed EPA, after consultation with the Office of Personnel Management, to hire up to 30 people at any one time [H.R. Rep. No. 111-180, 111th Cong, 1st Sess., 192 (2009)].

### **BOX 2** Title 42 Authority and Its Use in Other Agencies

Title 42 §209(f)-(h) of the U.S. Code is an administrative provision that gives federal agencies the authority to appoint highly qualified consultants, scientists, and engineers at a pay scale outside civil service laws described under Title 5. The flexibility of the Title 42 hiring program allows federal agencies to compete with industry and academe to fill critical senior-level positions. The National Institutes of Health (NIH), the Centers for Disease Control and Prevention (CDC), and the National Science Foundation (NSF) are among the federal agencies that have used Title 42 or equivalent authority.

NIH has used the Title 42 authority to hire experts when documented recruitment and retention efforts under other systems have failed (Zerhouni 2005). NIH distinguishes between the use of Title 42 §209(f) and (g); subsection (f) refers to employing “consultants,” and subsection (g) refers to granting “fellowships.” Title 42 §209(f) has been used to hire senior investigators, some health-scientist administrators, scientific review administrators, program administrators, program and project officers, division directors, and senior officials in the Office of the Director (NIH 2005). In 2004, of the roughly 18,000 NIH employees, 1,396 were employed under Title 42 §209(f) (Weiss 2004). Title 42 §209(g) has been used to hire research fellows, senior research fellows, staff scientists, staff clinicians, investigators on tenure track, senior scientists, and senior clinicians (NIH 2005). Appointments made under Title 42 may be indefinite or temporary for any period up to 5 years; unlimited extensions are allowed. Appointees must have at least a bachelor’s degree in a discipline related to the position and professional experience appropriate to the level of the position (Sontag 2004). Appointments can be made for entry-level professionals or senior-level positions (NAPA 2008). Base salary cannot exceed \$250,000 per year unless approved by the Secretary for Administration and Management, and total compensation cannot exceed \$275,000 (Sontag 2004).

Like NIH, CDC has used primarily provision (f) of §209, in contrast with EPA, which has used only provision (g). At CDC, requirements for a Title 42 position include a doctoral degree and outstanding contributions to public health and science. As of June 2007, 90 of the 585 senior-level employees held Title 42 positions. Most were heads of program units in the coordinating center or at the office, national center, or division level. As of 2007, the pay range was \$113,427-260,000, and total compensation was restricted to \$375,000 per year (NAPA 2008).

NSF has used 42 USC §1873, also known as the NSF Act. This authority is similar to §209 in that it allows the agency to hire employees outside Title 5 on a temporary or permanent basis, but it is specific to NSF. Those hired under the NSF Act must have at least a bachelor’s degree. Higher-level positions require a doctoral degree and successful research, research administration, or managerial experience related to the position. The pay scale for 2009 ranged from AD-1 at \$33,269-79,280 to AD-5 at \$144,997-162,900 (NSF 2008).



## STATEMENT OF TASK AND THE COMMITTEE'S APPROACH

The authority to use Title 42 was granted to EPA for 5 years. As the end of the period approaches, EPA has determined that an evaluation of its program is warranted. Accordingly, EPA asked the NRC to conduct an independent evaluation of the effectiveness of its program and to comment on its recruitment and retention of highly qualified environmental research scientists and engineers and the overall quality and value of EPA's Title 42 appointees.<sup>2</sup> The committee was also asked to recommend methods and approaches that EPA might use to strengthen its scientific leadership and to enhance its Title 42 program. (Attachment A contains the verbatim statement of task.)

The NRC convened a committee with expertise in environmental policy and regulation, performance evaluation and management, and administration of the Title 42 program to undertake the task (Attachment B contains biographies of the committee members). The committee held three meetings; two meetings included public sessions in which the committee heard from the acting and former ORD assistant administrators, various EPA center and division directors, a union representative of the American Federation of Government Employees, a senior scientist from the National Institute of Environmental Health Sciences familiar with the NIH Title 42 program, and the chair of EPA's Board of Scientific Counselors (BOSC). The committee requested specific information from EPA on hiring mechanisms that it has at its disposal, employment statistics since creation of its Title 42 program, workforce analyses, materials used to justify Title 42 authority for EPA, information on implementation of its Title 42 program, descriptions of Title 42 positions created, and information on progress in filling positions. NRC staff and committee members also collected information via e-mail and telephone interviews from current Title 42 hires and from members of search committees for the Title 42 positions. On the basis of the in-depth discussions with EPA staff and others at the public sessions, the information received from EPA and others, and its own expertise and experience, the committee reviewed the EPA Title 42 program. The committee notes that although the issue of retention is raised in the committee's task, it was not addressed in depth because the program is in its early stages and the agency currently does not have long-term Title 42 authority. Furthermore, the committee emphasizes that it was tasked with reviewing the Title 42 program at EPA, a program focused on hiring exceptional, world-class experts, and not with reviewing the public-sector labor market for scientists and engineers, overall hiring practices at EPA, or the impact of the Title 42 program on the federal recruitment of scientists and engineers. Such a review would involve many factors and is clearly beyond the committee's charge.

## THE ENVIRONMENTAL PROTECTION AGENCY'S USE OF TITLE 42 AUTHORITY

### Implementation of Title 42 Authority: Setting Up the Program

EPA's objective is to use "Title 42 authority to recruit and retain the talent needed to...ensure a critical mass of world-class science and engineering experts to strengthen EPA's research and development programs in support of the agency's mission" while maintaining "the necessary flexibility to shape regulatory decisions on emerging environmental issues" (EPA Exec. Order No. 3110.22 [Sept. 19, 2006], p. 1). Once authority was granted to EPA, its staff had to determine the best way to implement its Title 42 program to meet its objective. NIH already had a successful program, and EPA sought to model its program after the one at NIH. Table 1 compares the current EPA program with the one at NIH as of 2004. Many structural aspects of the program are similar. The primary differences are related to the

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<sup>2</sup>EPA policy uses the term *world-class* to describe the type of scientists and engineers that it seeks to hire under Title 42 authority. The committee uses *highly qualified* and *world-class* interchangeably to refer to scientists and engineers who are among the world's best in their specialty; that is, they meet all traditional benchmarks of excellence and leadership in research, including strong publication records, experience in leading research, and national and international recognition.

**TABLE 1 Comparison of Title 42 Programs at the National Institutes of Health and the Environmental Protection Agency**

Title 42 Application	NIH (2004)	EPA (Current)
Appointments	<p>Has a tenure-track research program whereby scientists can become permanent only after a long evaluation period and extensive internal and external reviews.</p> <p>Offers renewable-term appointments to outstanding scientists who have reached their ceiling in the General Service or Senior Executive Service pay scales.</p> <p>Offers automatically renewable appointments to outstanding tenured scientists to run NIH's institutes and large extramural-grants programs; appointees can remain in their positions indefinitely or can be dismissed for poor performance.</p>	<p>Does not offer a tenure program.</p> <p>Appointments<sup>a</sup> (1) are temporary, (2) will not exceed 5 years in duration, (3) may be terminated before the end of the appointment term, and (4) may be renewed in 5-year increments.</p> <p>Does not offer automatically renewable appointments.</p>
Position allocation	<p>Apparently does not have a limit regarding the number of Title 42 appointments.</p>	<p>Under EPA's current Title 42 authority language, the agency has the authority for FY 2006-2011 to employ up to 30 persons at any one time.</p>
Recruitment tools	<p>Predominantly uses a search-committee structure with intramural and extramural representation.</p>	<p>Uses a suite of recruitment tools and strategies, including a search committee, depending on the need for hiring.</p>
Hiring of foreign nationals	<p>Hires foreign nationals who have appropriate employment visas.</p>	<p>Hires foreign nationals who have appropriate employment visas.</p>
Recruitment negotiation issues	<p>Depending on available resources, can negotiate on issues of laboratory space, start-up funding, equipment, technical support, and technical staff.</p>	<p>Depending on available resources, can negotiate on issues of laboratory space, start-up funding, equipment, technical support, and technical staff.</p>
Compensation	<p>Caps at \$250,000 (base salary capped at \$200,000; recruitment or retention bonuses capped at a total of 2.5% of base salary and paid as a lump sum but not as an adjustment of or addition to base salary)</p>	<p>Salary is capped at \$250,000, and total compensation at \$275,000.</p>
Benefits—annual leave	<p>Does not offer increases in annual-leave biweekly rates at the time of appointment.</p>	<p>May offer (at the time of appointment and at management discretion) an increase in the annual-leave biweekly rate from 4 hours to 6 or 8 hours.</p>
Removal	<p>Appointments may be terminated before their expiration dates for cause or other administrative reasons.</p>	<p>Appointments may be terminated before their expiration dates for cause or other administrative reasons.</p>
Ethics and financial disclosure	<p>(NIH was reviewing its policies on ethics and financial disclosure at the time of EPA's implementation of its program.)</p>	<p>All appointees must adhere to the same applicable laws, regulations, and policies regarding ethics and financial disclosure as Title 5 appointees.</p>
Labor relations	<p>Title 42 hires are not in bargaining units. (This has not been an issue, primarily because of union inactivity at NIH.)</p>	<p>Because of the nature of the positions, Title 42 hires are not in bargaining units.</p>

<sup>a</sup>Persons who convert from Title 5 permanent competitive status to Title 42 status are subject to the same appointment restrictions as persons hired from outside the government. They may retain reinstatement eligibility but have no guarantee of a Title 5 position if their Title 42 appointment is terminated (EPA 2009a).  
 Source: Adapted from EPA 2009, unpublished material.

Congressional time limit of 5 years for the EPA program. For example, EPA does not offer a tenure program; the appointments are temporary and subject to 5-year renewal. Furthermore, EPA has experimented with various recruitment tools and has not yet formalized an approach whereas NIH has formalized a search-committee process. One other substantial difference is that NIH is not limited in the number of Title 42 appointments, whereas EPA is limited to 30.

To implement the program formally in ORD, EPA developed an Operational Manual that addresses all aspects of the program, including responsibilities of various EPA staff, duration of appointments, allocation of positions, preparation of position descriptions, eligibility, recruitment and selection requirements, compensation and benefits, performance management, and ethics and financial disclosures (EPA 2009a). Some guidance in the manual is quite detailed. For example, templates are provided in appendixes for drafting a position description, evaluating a candidate's qualifications, and determining compensation. Other guidance, such as that on recruitment and selection, is less prescriptive. The committee discusses that guidance further in the section "Filling Title 42 Positions."

The committee notes that EPA requires that Title 42 appointees have doctoral-level degrees—such as PhD, MD, DVM, and ScD—in their fields. That requirement may exclude many highly qualified scientists and engineers who do not have such degrees. EPA should be flexible, taking such situations into account and making exceptions as appropriate. Overall, however, the committee found that EPA has established its Title 42 program appropriately.

### **Determination of Scientific Focus**

The 2,000 scientists, engineers, and other professionals of ORD support the agency's efforts to protect human health and the environment. To set priorities for its research, ORD considers its budget, emerging issues, and evolving technical approaches and tools for investigation and analysis and creates a strategic plan for its research efforts that draws its focus from the agency's overall strategic plan (EPA 2009b,c). Further refinement and priority-setting is done through a biannual review of needs of other EPA offices, such as the Office of Water and the Office of Air and Radiation. The products of the reviews are multi-year plans that are viewed as working documents that will be continually updated (EPA 2009d). For important issues, specific research strategies are generated (for example, the Mercury Research Strategy and the Research Plan for Endocrine Disruptors; EPA 2008). Each document is reviewed by outside reviewers, often members of the agency's Science Advisory Board (SAB) or the BOSC. The research plans and strategies all touch on the expertise needed to meet the research objectives of ORD.

Workforce needs of ORD have been the subject of many internal and external reviews. External reviews include those by the NRC (see, for example, NRC 2000), BOSC (see, for example, EPABOSC 2000), and SAB (see, for example, EPASAB 2009). In 2002, the ORD Executive Council, which is made up of its laboratory and center directors, began to identify critical research positions that needed to be filled. It did so by comparing future research needs identified in its various research strategies and plans with existing ORD workforce capabilities. Presentations of that analysis were made to the BOSC and the SAB. Critical gaps were identified and approaches to filling them were developed. The approaches included targeted hiring of postdoctoral fellows, using hiring authorities in the existing EPA personnel system (that is, using the ST positions), and forming partnerships with other research organizations, primarily academic institutions. ORD's Executive Council determined that a number of the identified gaps called for people with substantial scientific accomplishments if the agency were to build the needed research capabilities rapidly. Bioinformatics and toxicogenomics were identified as needing such hires. EPA decided to use the newly granted Title 42 authority to fill the positions. In 2006, the Executive Council determined that a number of ORD's scientific leadership positions that had been chronically vacant because of the lack of SES positions should be filled by using the Title 42 authority. That practice is also followed at NIH, as explained to the committee during its public session with an NIH representative.

The committee emphasizes that determining which field of science or engineering research in ORD would benefit most by a Title 42 hire is paramount. Placing Title 42 hires in fields that are not of highest priority will not generate the results most needed by the agency. Therefore, careful and deliberate consideration must be given not only to choosing what research to emphasize but also to whether existing agency expertise is available to conduct it. If the expertise is not available, the question is whether using Title 42 hires is the most appropriate and expedient way to correct the deficiency. As noted above, ORD has used internal and external reviews to determine its research focus and in many cases has consulted the BOSC and the SAB to determine whether Title 42 authority is the appropriate mechanism for filling a particular need. The present committee commends those efforts and strongly recommends that such practices continue, especially the reviews by external advisers.

The committee notes, regarding shifting research emphasis over time, that the Title 42 program was built to be responsive to emerging science priorities. As in some segments of the private sector with rapid developments, the program provides EPA with the flexibility to hire top scientists with critical expertise under limited-term contract agreements. That aspect is yet another important difference between Title 42 and civil service hiring. It enables the agency to “maintain the necessary flexibility to shape regulatory decisions on emerging environmental issues” (EPA Exec. Order No. 3110.22 [Sept. 19, 2006], p. 1).

### **Types of Science Positions and the Role of Title 42**

As discussed above, EPA can use several mechanisms to hire senior scientists (see Box 1), but the mechanisms have some important drawbacks. SES positions are restricted primarily to administrative management, senior-level (SL) positions are advisory and do not involve laboratory research, and ST positions involve primarily laboratory research and are not allowed to include much scientific oversight or management. Although the law allows some flexibility in job responsibilities for GS 15 appointees (the highest grade under Title 5), they are typically required to allocate their time between management responsibilities and scientific research. All the hiring mechanisms suffer from compensation limits that are often not competitive in the market and from rigidity in job criteria that fail to keep pace with the dynamics of science. Furthermore, the recruitment process for all hiring mechanisms is inflexible, bureaucratic, and too slow. For example, obtaining approval for EPA to recruit for an SES position can take months, a year, or even longer (personal communication, EPA, December 10, 2009).

Title 42 authority creates unique positions that the other options do not. A Title 42 appointee can conduct laboratory research *and* manage a scientific research program. In fact, job descriptions for Title 42 appointees often indicate that the appointee will be expected to develop, direct, and lead an interdisciplinary research program and coordinate, collaborate in, and communicate research both inside and outside the agency (see, for example, EPA 2007, 2009e). The committee emphasizes that the type of management conducted by Title 42 appointees is what is required to manage a successful scientific research program, and it distinguishes that type of management from administrative management, which focuses primarily on maintaining a properly functioning infrastructure and involves such duties as contract management, building maintenance, travel allocations, and personnel review.

As discussed above, Title 42 authority allows EPA to offer salaries that are competitive with industry and academe and that can attract world-class scientists and engineers. It also creates a hiring program that has some flexibility and is less bureaucratic than the other programs. For example, SES candidates are often required to complete 18-24 months of management training to qualify for a position. That requirement would take world-class scientists away from their research, may be unacceptable to them, and certainly would detract from their scientific endeavors. A program that does not have such rigid requirements would be more suitable for attracting premiere talent. Thus, the committee emphasizes the uniqueness of the Title 42 program and its value in recruiting and retaining world-class scientists and engineers who can strengthen EPA’s research and develop programs to support its mission to protect human health and the environment.

## Filling Title 42 Positions

The ORD assistant administrator (AA) or a designee allocates Title 42 positions and is responsible for recruiting and reviewing Title 42 candidates, establishing the ranges of compensation, selecting the candidates, and ultimately approving the appointments and their renewals (EPA 2009a). Since implementation of the program, most of those responsibilities have been delegated to the laboratory or center directors, but the ultimate approval of selections and compensation packages has been retained at the AA level.

As noted above, general guidance and requirements for filling Title 42 positions are provided in EPA's Title 42 Operations Manual (EPA 2009a). The manual indicates that appointees can be direct hires (that is, selected without an advertised competition), conversions of existing Title 5 positions with or without advertised competition, or selections from outside the agency through an open competitive process. The manual gives no further guidance or specifications for recruitment.

## Creating the Candidate Pool

Methods to fill Title 42 positions have varied at ORD and reflect the nature of the positions to be filled, the different approaches used by different ORD programs, and the lack of guidance provided in the manual. Table 2 shows, for the Title 42 positions currently established in ORD, the extent of advertisement, whether committees were used in the hiring process, the composition of the committees, and the numbers of applicants from inside and outside EPA. Eleven positions have been filled thus far, and 10 are in the process of being filled. On the basis of the small number of filled positions, the committee can make only a few tentative observations here about EPA's practices in filling Title 42 positions.

Most of the positions were advertised, some widely. EPA used a search committee to help with the recruitment of some potential candidates. Search committees composed of EPA employees and experts outside EPA were used for the five science-expert positions and the branch-chief position. Those positions were to bring expertise to EPA that it lacked, such as expertise in systems biology and bioinformatics. They were filled by nonfederal employees—three from industry and three from academe. A search committee was also used to fill a division-director position (position 11 in Table 2).

For its review, the present committee sought information from the 16 non-EPA people who had served on committees to oversee recruitment for the filled positions; nine responded. Search-committee members reported that they were used in various ways. Some were asked to review ads, propose candidates, and sometimes contact them; others were asked to review job descriptions, suggest places to post or advertise positions, or help to shape the requirements for positions. All but one of the nine considered the process competitive, and those aware of the resulting candidate pools indicated that they were good. Those aware of the eventual selections considered the appointees to be world-class except that one stated that the appointee was more junior although “very strong” and with the potential to be world-class.

Search committees were used or are being used for only four of the 13 competitive Title 42 positions for center director, associate laboratory director, and division director. Although the positions are generally well advertised and reasonable numbers of applicants are responding, the table conveys no insight into the quality of the applicants other than that one position that attracted 36 applicants and used no search committee had to be readvertised for lack of a good candidate pool. The present committee emphasizes that search committees can help to identify candidates that may be looking but may not notice an advertisement, and they can get the word out to various networks and organizations and to well-qualified people who might be able to identify potential candidates, including those who may not be actively looking to change jobs. However, two of the six non-EPA people hired heard about their positions through an on-line *Science* advertisement and a third through a *Science* magazine advertisement.

**TABLE 2** Recruitment Methods for Current ORD Title 42 Positions

Position (Status)	Where Advertised	Search-Committee Members	Evaluation-Committee Members	Applicants
1 Science expert (filled—external)	Web sites: Science, Nature, Nature Genetics, Nature Biotechnology, Chemical and Engineering News, International Society for Computational Biology, Dnajobs, Bioplanet, Careerbuilder, Craigslist, KDruggets, USA Jobs Journals: <i>Science, Nature, Bioinformatics, Nucleic Acids Research, Environmental Health Perspectives</i> Flyer: Society of Toxicology annual meeting	4 external 2 EPA	5 EPA	24 external
2 Science expert (filled—external) <sup>a</sup>	Web sites: Science, Nature, Nature Genetics, Nature Biotechnology, Chemical and Engineering News, International Society for Computational Biology, Dnajobs, Bioplanet, Careerbuilder, Craigslist, KDruggets, USA Jobs Journals: <i>Science, Nature, Bioinformatics, Nucleic Acids Research, Environmental Health Perspectives</i> Flyer: Society of Toxicology annual meeting	4 external 3 EPA	4 EPA	23 external
3 Science expert (filled—external) <sup>a</sup>	Web sites: Science, Nature, Nature Genetics, Nature Biotechnology, Chemical and Engineering News, International Society for Computational Biology, Dnajobs, Bioplanet, Careerbuilder, Craigslist, KDruggets, USA Jobs Journals: <i>Science, Nature, Bioinformatics, Nucleic Acids Research, Environmental Health Perspectives</i> Flyer: Society of Toxicology annual meeting	4 external 3 EPA	4 EPA	23 external
4 Science expert (filled—external)	Web sites: Science, Microbe, USA Jobs Journals: <i>Science, Nature, Bioinformatics, Nucleic Acids Research, Environmental Health Perspectives</i> Flyer: Society of Toxicology annual meeting	3 external 7 EPA	7 EPA	24 external
5 Science expert (filled—external)	Web sites: Science, Nature, Nature Biotechnology, ISCB, Dnajobs, Bioplanet, Careerbuilder, Craigslist, KDruggets, USA Jobs Journals: <i>Science, Nature, Bioinformatics, Environmental Health Perspectives</i>	4 external 3 EPA	8 EPA	15 external
6 Branch chief (filled—external)	Web sites: American Thoracic Society, Society of Toxicology, Science, New England Journal of Medicine, American Heart Association, American College of Cardiology, Physician Recruiting, USA Jobs	4 external 4 EPA	4 EPA	4 external
7 Center director (filled—EPA)	Position not competed	None	None	0 (conversion)
8 Center director (filled—EPA)	Web sites: Society for Risk Analysis, Environmental Health Perspectives, Society of Toxicology, USA Jobs	None	1 external 3 EPA	3 external 3 EPA
9 Associate laboratory director (filled—EPA)	Web sites: Science, International Society of Exposure Analysis Journal, American Chemical Society, USA Jobs	None	1 NIEHS 2 EPA	8 external 2 EPA
10 Division director (filled—EPA)	Position not competed	None	None	0 (conversion)

(Continued)

TABLE 2 Continued

Position (Status)	Where Advertised	Search-Committee Members	Evaluation-Committee Members	Applicants
11 Division director (filled—EPA)	Web site: USA Jobs	3 external	3 external 4 EPA	11 external 5 EPA
12 Division director (in process)	Web sites: Science Careers, ACS Careers, Environmental Science and Technology, Eos, Jobs in Geography, USA Jobs (two rounds of advertising; candidate not selected in first round)	None	4 EPA	2 rounds: 1) 33 external 3 EPA 2) 13 external 2 EPA
13 Division director (in process)	Web sites: Science Careers, American Society for Microbiology, USA Jobs	None	4 EPA	20 external 2 EPA
14 Division director (in process)	Web sites: Science Careers, ACS Careers, Environmental Science and Technology, Eos, Jobs in Geography, USA Jobs	None	4 EPA	34 external 1 EPA
15 Division director (in process)	Web sites: Chronicles of Higher Education, Frontiers in Ecology, Science Careers, American Society of Limnology and Oceanography, USA Jobs	None	Members to be selected	In process
16 Division director (in process)	Web sites: Nature, American Society of Civil Engineers, Science, Association for Women in Science, Society for Advancement of Chicanos and Native Americans in Science, USA Jobs Journals: <i>Society of Women Engineers, Nature, Chronicle of Higher Education, Environmental Science and Technology, Science, Association for Women in Science</i>	None	4 external 7 EPA	11 external 1 EPA
17 Division director (in process)	Web sites: Nature, American Society of Civil Engineers, Science, Association for Women in Science, Society for Advancement of Chicanos and Native Americans in Science, USA Jobs Journals: <i>Society of Women Engineers, Nature, Chronicle of Higher Education, Environmental Science and Technology, Science, Association for Women in Science</i>	None	9 EPA	23 external 1 EPA
18 Division director (in process)	Web sites: Nature, American Society of Civil Engineers, Science, Association for Women in Science, Society for Advancement of Chicanos and Native Americans in Science, USA Jobs Journals: <i>Society of Women Engineers, Nature, Chronicle of Higher Education, Environmental Science and Technology, Science, Association for Women in Science</i>	None	5 external 14 EPA	16 external 1 EPA
19 Division director (in process)	Web sites: Society of Toxicology Job Bank, Science, LinkedIn, Journal of Neuroscience, Environmental Health Perspectives, USA Jobs	4 external 7 EPA	8 EPA (2 from different EPA laboratory)	20 external 4 EPA
20 Division director (in process)	Web sites: Society of Toxicology Job Bank, Science, LinkedIn, Journal of Neuroscience, Environmental Health Perspectives, USA Jobs	3 external 4 EPA	8 EPA (2 from different EPA laboratory)	14 external 3 EPA
21 Division director (in process)	Web sites: Society of Toxicology Job Bank, Science, LinkedIn, Journal of Neuroscience, Environmental Health Perspectives, USA Jobs	4 external 5 EPA	7 EPA (2 from different EPA laboratory)	11 external 1 EPA

\*Positions 2 and 3 used same recruitment and applicant pool.

The committee had little information on practices related to diversity in ORD's Title 42 program. Three leadership positions were advertised on Web sites aimed at groups that are underrepresented in the sciences, and standard equal-opportunity-employment language was included in all job announcements. The committee strongly emphasizes the importance of expanding the practice of advertising to science professionals in underrepresented groups and structuring search committees in a way that will foster a broad and diverse recruitment. As is the case in creating a diverse faculty at a university, recruitment is the first step, although retention efforts are also needed, and Malcom and colleagues (2004) provide practical advice in that regard.

Two positions that have been filled did not involve an advertised competition—one because a group was moved from a different agency (the National Oceanic and Atmospheric Administration) and use of Title 42 was the most efficient means of converting the program-leader position to an EPA position and the other because it involved retention of a highly regarded and renowned scientist. The committee notes that the approach to filling those two positions appears entirely appropriate.

### **Evaluating and Selecting from the Candidate Pool**

The Title 42 Operations Manual (EPA 2009a) states that human-resources staff check the eligibility of candidates before evaluations by appropriate reviewers in the relevant scientific program. According to the manual, the immediate supervisor of a would-be Title 42 appointee makes the selection. The ultimate decision requires the concurrence of the ORD AA or a designee. The committee saw examples of how the process worked for several applicants and a general approach for the remainder.

For all 19 competitive positions, ORD used an evaluation committee to appraise the eligible candidates (see Table 2). Most evaluation-committee members were EPA employees. In some cases in which there was a search committee, the evaluation committee was formed by adding members to the search committee.

The evaluation committees used a formal scoring process to appraise all eligible candidates; the evaluation and rating criteria were reviewed in advance by human-resources staff. The scoring approach followed the basic Candidate Evaluation Framework provided in the Title 42 Operations Manual (EPA 2009a). For example, all eligible candidates for a position of center, laboratory, or division director were rated on scientific expertise, leadership, communication, and collaboration and networking. Clearly articulated criteria were used to rate candidates as “superior,” “above average,” “acceptable,” and “no evidence” for each characteristic. For some positions, preliminary telephone interviews were conducted with the top-ranked candidates. Three or four top candidates for a given position were then invited to ORD for interviews and to give seminars. The program director then selected from among the top candidates. For some positions, it was unclear who beyond the program director was involved in the final selection. Some believe that search-committee members should not be part of the group that makes the final selection (NIH 2009), and in the case of appointments thus far they apparently were not. However, the committee notes that EPA could consider this guidance when formalizing its selection process.

After selection of a candidate, a compensation recommendation was developed in light of the detailed guidance in the Title 42 Operations Manual (EPA 2009a). Total annual compensation cannot be lower than the highest GS 15 salary or higher than \$275,000. Compensation is based on a variety of factors but is heavily weighted by the candidate's current compensation. A recommendation of final selection and compensation is sent for approval to the ORD AA. The committee notes that EPA has been conservative in its salary awards inasmuch as the salaries of the current Title 42 appointees range from \$149,000 to \$209,904—well below the maximum of \$250,000 allowed under EPA's Title 42 program.

The committee interviewed all those hired thus far for Title 42 positions and asked several questions about the recruitment process. All had favorable comments on the process, having found it straightforward and efficient. Several appointees indicated that the salary was an important consideration and that although it was below what industry was offering for a similar position, it was reasonable. Such factors as the scientific focus of the work, the agency's mission, and job location also led appointees to



take positions with EPA. They expressed no concerns other than to note that the program exhibited some inexperience in hiring foreign nationals and could be more streamlined in that regard.

### **Best Practices for Recruitment, Evaluation, and Selection**

The committee notes that several basic concepts should be used by ORD to maximize the probability that people hired under Title 42 program are among the best in their disciplines. Most important, the search process should cast as broad a net as possible to identify qualified applicants. To accomplish that, active outreach is essential. A position should be widely advertised in appropriate journals and by scientific and engineering societies, and people who are known to be highly competent in a given discipline should be notified. A search committee should be formed to guide the recruitment; the goal is that all serious and qualified potential candidates are aware of the position. Extra efforts may be needed to find qualified women and minority-group candidates (MIT 2002; Stanford 2005; University of Michigan 2009). The search committee should be made up of experts in the fields in question and should include non-EPA expert members. The search committee should review and evaluate candidates' credentials, narrow the list to a manageable number, and recommend the best candidates to a selection committee. The present committee notes that a distinct evaluation committee might be used to narrow a pool of candidates; if such a committee is used, it should also include non-EPA experts.

Rather than having the selection of an appointee made solely by the would-be supervisor, the committee recommends that EPA form a selection committee made up of EPA staff and non-EPA experts. That committee would receive the search committee's or evaluation committee's recommendations and would evaluate candidates on the basis of their qualifications, their fit with ORD's mission, and above all whether they are truly among the world's best in their field. The selection committee, which would include the supervisor, would select the best candidate and forward its recommendation to ORD management, ultimately the ORD AA or designee, for approval. If the selection committee does not include the supervisor of the appointee, the concurrence of that supervisor would take place at this stage. If the candidate rejects an offer or if no candidate is deemed qualified, ORD management can decide to renew the search process or terminate it.

The recruitment process should be as open as possible so that people in and outside EPA can evaluate the effort. Some of the Title 42 positions were filled by using essentially the practice outlined here. The committee recommends that written guidelines be developed now to formalize the process; this would ensure broad and diverse searches, integrity in the process, and equal opportunity.

Title 42 appointments are limited to 5-year terms. However, the ORD AA may renew an appointment on written request from the Title 42 appointee's immediate supervisor. The terms of the first Title 42 hires will be expiring in 2011. The review process has not yet been formalized although EPA has developed guidance for appraisal of Title 42 appointees' performance. It is imperative that ORD finalize the process for reviewing Title 42 appointments. The review should have at least two components: one regarding the performance of the appointee and the second regarding whether the particular position and type of work are still essential and have high priority for EPA.

### **Types of Candidates That Have Been Selected**

The implementation of Title 42 at EPA is still in its formative stages and 10 searches are under way. However, an examination of the initial 11 appointees provided the committee with a useful profile of the types of candidates who have been selected, that is, their backgrounds, credentials, and experience. To evaluate the appointees, the committee reviewed their credentials, heard presentations from EPA leaders, and conducted interviews with search-committee members.

The goal of Title 42 is to recruit and retain world-class scientists and engineers who can strengthen EPA's research and improve the application of science to address its regulatory responsibilities, and the committee notes that use of Title 42 authority should continue to be restricted to recruiting and retaining such persons. The program is also aimed at addressing emerging research needs and filling critical gaps in EPA research capacity. The committee found that the appointments have addressed important research needs and improved EPA's capacity to investigate emerging environmental and health research issues. Key expertise of Title 42 appointees includes

- Bioinformatics.
- Genomics and systems biology.
- Computational modeling.
- Waterborne pathogens.
- Microbial risk assessment.
- Atmospheric sciences.
- Air pollution and respiratory health.
- Global climate change.
- Exposure science and human health.
- Exposure biomarkers.
- Sustainable land use.
- Remediation research.

That mix of expertise clearly addresses EPA's current and emerging priorities and reflects major emerging topics in environmental health research. Adding scientists from outside EPA has brought important new perspectives to the agency, and the internal appointments enabled the agency to retain leading scientists and increased recognition of subjects of current research. Perhaps the most important effect of the appointments has been the strengthening of state-of-the-art science in fields that are primary to the agency's mission to protect health and the environment.

As indicated above, comments from search-committee members indicated a consensus that the process has been successful in identifying highly qualified candidates. There is some discomfort with the meaning of *world class*, but the pool of top candidates and the appointees meet all the traditional benchmarks of excellence and leadership in research, including strong publication records, experience in leading research, and national and international recognition.

The use of Title 42 appointments to develop the National Center for Computational Toxicology (NCCT) is an excellent example of how such appointments can be used to build new capacity and advance the state of a science. Through Title 42 authority, EPA was able to recruit three outstanding scientists from private industry and academe and to retain a science leader widely recognized as outstanding to develop a "critical mass" of exceptional talent. The center is collaborating with others throughout EPA, the National Institute of Environmental Health Sciences, and the National Human Genome Research Institute. The center has become a leader in the development of new approaches to toxicology and risk assessment. The ToxCast project is an example of this effort. The project is developing rapid methods for screening and priority-setting among chemicals of concern. A review of NCCT by ORD's BOSC praised it for its "excellent progress," and the chair of the review informed the present committee that "the Title 42 hires have indeed been essential for the success of the center."

In summary, the committee, having reviewed the existing hires, concludes that the Title 42 authority has enabled EPA to attract strong candidates for science-leadership positions, strengthen existing research, develop an important and impressive research program, and apparently achieve a high degree of job satisfaction for EPA's science leaders. Although the average time since appointment of the initial hires is just over 2 years, their effects on the quality of science at EPA are already evident, and the potential for future progress is excellent.

## COMMITTEE'S FINDINGS AND RECOMMENDATIONS

On the basis of its evaluation and review, the committee offers the following findings and recommendations:

- The committee agrees with previous expert panels and committees that a science and engineering workforce that is capable of performing and conducting research at the highest level is essential for EPA to protect public health and the environment.
  - On the basis of the committee's review of ST, SL, and SES positions, the committee concludes that no other hiring mechanisms or authorities available to EPA serve the function of Title 42 to recruit and retain world-class scientists and engineers.
  - The selection of particular research fields that would benefit most from Title 42 appointments is of paramount importance. The committee recommends that ORD focus its Title 42 appointees in fields deemed most critical by its research priority-setting process.
  - The committee notes that the number of Title 42 appointments is not limited at NIH and CDC, other federal agencies that fill scientific positions using Title 42 authority. The numbers of Title 42 appointments in those agencies are substantially larger than at EPA.
  - All world-class scientists and engineers do not necessarily have doctoral-level degrees, and EPA should be flexible in its requirement that all Title 42 appointees have such degrees.
  - EPA has approached the use of Title 42 authority prudently. For example, a position was not filled when highly qualified candidates could not be identified, and EPA has not awarded the maximum compensation allowed under Title 42 to appointees. The committee concurs with EPA's approach.
  - In developing its Title 42 program, EPA has used various techniques to recruit candidates. To identify the most qualified candidate, the committee recommends that EPA adhere to the following procedure: (1) establish a search committee to oversee recruitment, promote diversity in the process, evaluate applicants' credentials, and recommend the most qualified applicants to a selection committee; (2) advertise widely on appropriate Web sites, in appropriate journals, through scientific and engineering societies, and by contacting highly competent people in the relevant disciplines; and (3) form a selection committee to determine the best candidate and forward the recommendation to ORD management, ultimately the ORD AA or designee, for approval. Both search and selection committees should include members who are outside EPA. The entire search and selection process should be as open as feasible to ensure that the best practices are followed, that a broad and diverse search has reached the most qualified potential candidates, and that fairness prevails.
  - The Title 42 program at EPA is small and still evolving, but it has worked well. Outstanding candidates have been identified and hired, and top scientists have been retained. Furthermore, the BOSC and EPA indicate that the Title 42 program has helped the agency to achieve its mission. For example, the NCCT has, in its few years of existence, conducted important research and made substantial progress in developing new tools based on advances in molecular biology and genomics.
    - The committee recommends that permanent Title 42 authority be granted to EPA.
    - The committee recommends that EPA use the BOSC or the SAB to review the Title 42 program every 5 years to ensure that it is being used for the intended purposes of creating a critical mass of world-class scientists and engineers, that Title 42 hires are in the fields identified as having the highest priority by the agency, and that it is implemented in a manner that ensures selection of the best candidates.
    - The committee recommends that EPA be granted expanded authority to define the number of Title 42 positions on the basis of its programmatic needs and available budget.

Attachments:

- A – Statement of Task
- B – Committee Membership and Biographies
- C – References
- D – Acknowledgment of Reviewers
- E – Total ORD Budget with and without Adjustment for Inflation

## **Attachment A**

### **STATEMENT OF TASK**

The National Research Council will convene an expert committee to evaluate the effectiveness of the U.S. Environmental Protection Agency's Title 42 program. On the basis of available information, theory, and experience, the committee will evaluate the effectiveness of the program in meeting its original objectives, as implemented by EPA and relative to its application in other federal scientific agencies. The committee will comment on EPA's recruitment and retention of highly qualified environmental research scientists and engineers, and it will evaluate in general terms the overall quality and impact of EPA's Title 42 appointees. Finally, the committee will recommend methods and approaches that EPA might employ to strengthen its scientific leadership and to enhance the Title 42 Program.

## Attachment B

### COMMITTEE TO REVIEW EPA'S TITLE 42 HIRING AUTHORITY FOR HIGHLY QUALIFIED SCIENTISTS AND ENGINEERS

**THOMAS BURKE** (*Chair*), Johns Hopkins Bloomberg School of Public Health, Baltimore, MD  
**BURT BARNOW**, Johns Hopkins University, Baltimore, MD  
**RITA COLWELL**, University of Maryland, College Park  
**IRWIN FELLER**, American Association for the Advancement of Science, Washington, DC  
**J. PAUL GILMAN**, Covanta Energy Corporation, Fairfield, NJ  
**ROBERT HUGGETT** (retired), Seaford, VA  
**SHARON, LEVIN**, University of Missouri, Saint Louis  
**KENNETH OLDEN**, Hunter College of the City University of New York, New York  
**LAUREN ZEISE**, California Environmental Protection Agency, Oakland

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**ELLEN MANTUS**, Project Director  
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**JOHN BROWN**, Program Associate

### BIOGRAPHIES

**THOMAS A. BURKE** (*Chair*) is associate dean for public-health practice and professor of health policy and management at the Johns Hopkins University Bloomberg School of Public Health. He holds joint appointments in the Department of Environmental Health Sciences and the School of Medicine's Department of Oncology. Dr. Burke is also director of the Johns Hopkins Risk Sciences and Public Policy Institute. His research interests include environmental epidemiology and surveillance, evaluation of population exposures to environmental pollutants, assessment and communication of environmental risks, and application of epidemiology and health risk assessment to public policy. Before joining Johns Hopkins University, Dr. Burke was deputy commissioner of health for New Jersey and director of science and research for the New Jersey Department of Environmental Protection. In New Jersey, he directed initiatives that influenced the development of national programs, such as Superfund, the Safe Drinking Water Act, and the Toxics Release Inventory. Dr. Burke is a member of the U.S. Environmental Protection Agency (EPA) Science Advisory Board. He was the inaugural chair of the advisory board to the director of the Centers for Disease Control and Prevention National Center for Environmental Health and served two terms on the National Research Council (NRC) Board on Environmental Studies and Toxicology. He has served on several NRC committees; he was chair of the Committee on Improving Risk Analysis Approaches Used by the U.S. EPA, the Committee on Human Biomonitoring for Environmental Toxicants, and the Committee on Toxicants and Pathogens in Biosolids Applied to Land. In 2003, he was designated a lifetime national associate of the National Academies. He received his PhD in epidemiology from the University of Pennsylvania.

**BURT S. BARNOW** is associate director for research and principal research scientist at the Institute for Policy Studies of Johns Hopkins University. He also teaches program evaluation in the institute's graduate public-policy program and labor economics in the Department of Economics. Dr. Barnow's work focuses on the operation of labor markets and the evaluation of social programs, including a study

for the U.S. Department of Labor to evaluate the effects of selected projects in the High Growth Job Training Initiative using nonexperimental methods, an assessment of occupational skill shortages for the Alfred P. Sloan Foundation, an evaluation of the priority of services for veterans mandate for Department of Labor programs for the U.S. Department of Labor, a project to develop cost performance standards for the U.S. Department of Labor, an evaluation of the determinants of the welfare caseload in Colorado for the state of Colorado, an evaluation of a Department of Labor demonstration project to help youth in foster care to make the transition into the labor market, and a project to develop and evaluate demonstrations that test innovative employment projects for welfare recipients for the U.S. Department of Health and Human Services. Dr. Barnow was vice president of a consulting firm in the Washington, DC, area. He also served 9 years in the Department of Labor, most recently as director of the Office of Research and Evaluation for the Employment and Training Administration. Dr. Barnow has served on the Board on Higher Education and Workforce and on several National Research Council committees, including the Committee on Workforce Needs in Information Technology, the Committee on a Review of the United States Institute of Peace Senior Fellows Program, the Committee on Approaches to Evaluating the NIST Postdoctoral Research Program, the Committee on the NASA Workforce, and the Committee for Review of the Title VI and Fulbright-Hays International Education Programs. Dr. Barnow received a PhD in economics from the University of Wisconsin-Madison.

**RITA R. COLWELL** is senior adviser at Canon U.S. Life Sciences, Inc. and distinguished university professor at the University of Maryland at College Park and at the Johns Hopkins University Bloomberg School of Public Health. Her interests are focused on global infectious diseases, water, and health, and she is developing an international network to address emerging infectious diseases and water issues, including safe drinking water for the developed world and the developing world. Dr. Colwell served as the 11th director of the National Science Foundation. She has also held many advisory positions in the U.S. government, nonprofit science-policy organizations, and private foundations and in the international scientific research community. She is a nationally recognized scientist and educator and is author or co-author of 17 books and more than 750 scientific publications. Dr. Colwell served as chair of the Board of Governors of the American Academy of Microbiology and as president of the American Association for the Advancement of Science, the Washington Academy of Sciences, the American Society for Microbiology, the Sigma Xi National Science Honorary Society, and the International Union of Microbiological Societies. Dr. Colwell is a member of the National Academy of Sciences, the Royal Swedish Academy of Sciences, the American Academy of Arts and Sciences, and the American Philosophical Society. She has been awarded 54 honorary degrees from institutions of higher education; she is an honorary member of the microbiologic societies of the United Kingdom, France, Israel, Bangladesh, and the United States; and she has held several honorary professorships. She was awarded the National Medal of Science by the president of the United States and the Order of the Rising Sun by the emperor of Japan. A geologic site in Antarctica, Colwell Massif, has been named in recognition of her work in the polar regions. Dr. Colwell earned a PhD in oceanography from the University of Washington.

**IRWIN FELLER** is senior visiting scientist at the American Association for the Advancement of Science. He is also emeritus professor of economics and former director of and professor of economics in the Institute for Policy Research and Evaluation at Pennsylvania State University. His research interests include science and technology policy, the economics of higher education, and program evaluation. He has published widely on such topics as the influence of the Government Performance and Results Act on research, technology diffusion from university research, research performance measurement, the role of universities in basic research, and state and federal technology policy. He has been a consultant to the president's Office of Science and Technology Policy; the National Aeronautics and Space Administration; the Carnegie Commission on Science, Technology, and Government; the Ford Foundation; the National Science Foundation; the National Institute of Standards and Technology; the COSMOS Corporation, SRI International; the U.S. General Accounting Office; the U.S. Department of Education; and the U.S. Department of Energy. Dr. Feller is a member of the American Economic Association, the American

Association for the Advancement of Science, and the Association for Public Policy Analysis and Management. He is a member of the National Research Council Committee on the Review of the USDOT Strategic Plan for R&D and has served on numerous other committees, including the Committee to Review the Worker and Public Health Activities Program Administered by DOE and DHHS and the Committee for Assessment of Centers of Excellence Programs at NIH. Dr. Feller received a PhD in economics from the University of Minnesota.

**J. PAUL GILMAN** is senior vice president and chief sustainability officer for Convanta Energy. Previously, he served as director of the Oak Ridge Center for Advanced Studies and as assistant administrator for research and development in the U.S. Environmental Protection Agency. He also worked in the Office of Management and Budget, where he had oversight responsibilities for the Department of Energy (DOE) and all other science agencies, and in DOE, where he advised the secretary of energy on scientific and technical matters. From 1993 to 1998, Dr. Gilman was the executive director of the Commission on Life Sciences and the Board on Agriculture and Natural Resources of the National Research Council (NRC). He is a member of the NRC Board on Environmental Studies and Toxicology and has served on several committees, including the Committee on Evaluating the Efficiency of Research and Development Programs at the Environmental Protection Agency. Dr. Gilman earned PhDs in ecology and evolutionary biology from Johns Hopkins University.

**ROBERT J. HUGGETT** is a consultant and professor emeritus of marine science at the College of William and Mary. From 1997 to 2004, he served as professor of zoology and vice president for research and graduate studies of Michigan State University. Dr. Huggett's aquatic-biogeochemistry research involved the fate and effects of hazardous substances in aquatic systems. From 1994 to 1997, he was the assistant administrator for research and development at the U.S. Environmental Protection Agency, where his responsibilities included planning and directing the agency's research program. He has served on the National Research Council Board on Environmental Studies and Toxicology and Committee on Evaluating the Efficiency of Research and Development Programs at the Environmental Protection Agency and others. Dr. Huggett earned his PhD in marine science at the College of William and Mary.

**SHARON G. LEVIN** is professor emeritus and research professor of economics at the University of Missouri–St. Louis. Her research has focused for the most part on the quality and composition of the scientific workforce. A major theme has been the effect of immigration on the careers of U.S. scientists and engineers. Her research has been the subject of articles in *The Economist*, *Science*, *The Scientist*, and various newspapers and magazines in the United States and abroad. Dr. Levin has served as a consultant to the Howard Hughes Medical Institute on issues concerning scientific productivity over the life cycle and the Office of Technology Assessment of the U.S. Congress. She is a member of the Network on the Scientific Workforce, jointly sponsored by the Sloan Foundation and the National Bureau of Economic Research Inc. In 1993, she received the Chancellor's Award for Excellence in Research and Creativity by the University of Missouri–St. Louis. Dr. Levin earned a PhD in economics from the University of Michigan.

**KENNETH OLDEN** is the founder and acting dean of the School of Public Health of the City University of New York and a tenured faculty member of Hunter College. He is a cell biologist and biochemist by training and has been active in cancer research for almost 4 decades. In 1991, Dr. Olden was named the third director of the National Institute of Environmental Health Sciences and the second director of the National Toxicology Program. Previously, he was director of the Howard University Cancer Center and professor and chairman of the Department of Oncology of Howard University Medical School (1985-1991). He also held several roles at the National Institutes of Health: senior staff fellow, expert, and research biologist in the Division of Cancer Biology and Diagnosis of the National Cancer Institute. Dr. Olden is a member of the Institute of Medicine and served as an ex officio member of the Roundtable on Environmental Health Sciences, Research, and Medicine and as a member of the Office of Scientific and

Engineering Personnel Advisory Committee. He earned a PhD in cell biology and biochemistry from Temple University.

**LAUREN ZEISE** is chief of the Reproductive and Cancer Hazard Assessment Branch of the California Environmental Protection Agency. Her research focuses on modeling human interindividual variability and risk. Dr. Zeise has served on advisory boards of the U.S. Environmental Protection Agency (EPA), the World Health Organization, the Office of Technology Assessment, and the National Institute of Environmental Health Sciences. She is a member, fellow, past councilor, and past editor of the Society of Risk Analysis and received the society's Outstanding Risk Practitioner Award in 2008. She is a lifetime national associate of the National Academies. She has served on the National Research Council (NRC) Board on Environmental Studies and Toxicology and the Institute of Medicine Board on Health Promotion and Disease Prevention, and she has served as a member of several NRC committees, including the Committee on Risk Characterization, the Committee on Comparative Toxicology of Naturally Occurring Carcinogens, and the Committee to Review EPA's Research Grants Program. Dr. Zeise received her PhD from Harvard University.



## Attachment C

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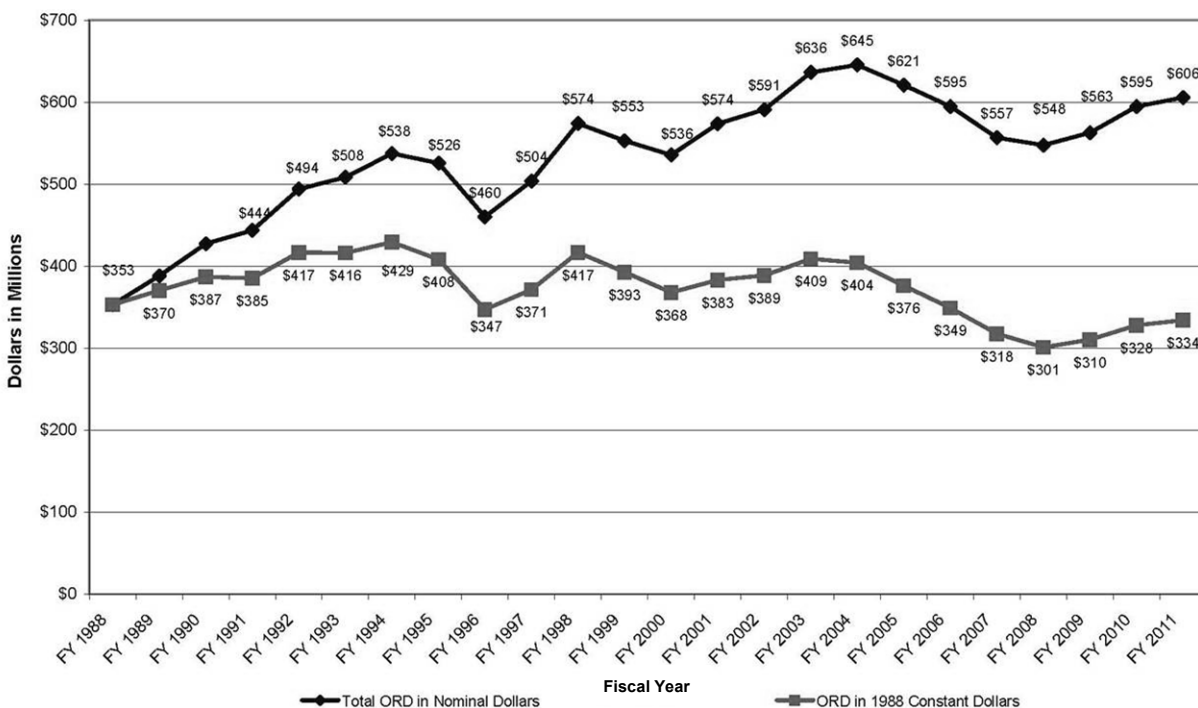
## Attachment D

### ACKNOWLEDGMENT OF REVIEWERS

This report has been reviewed in draft form by persons chosen for their diverse perspectives and technical expertise in accordance with procedures approved by the Report Review Committee of the National Research Council. The purposes of the independent review are to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards of objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We thank the following for their review of this report: J. Carl Barrett, Novartis Institutes of BioMedical Sciences, Inc.; Costel D. Denson, Costech Technologies, L.L.C.; William H. Farland, Colorado State University; Richard B. Freeman, Harvard University; Lynn R. Goldman, Johns Hopkins University; Daniel L. Goroff, Alfred P. Sloan Foundation; and Alan I. Leshner, American Association for the Advancement of Science.

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations, nor did they see the final draft of the report before its release. The review of the report was overseen by the review coordinator, Edwin H. Clark, Earth Policy Institute, and the review monitor, Gilbert S. Omenn, University of Michigan Medical School. Appointed by the National Research Council, they were responsible for making certain that an independent examination of the report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of the report rests entirely with the committee and the institution.

## Attachment E



**FIGURE E-1** Total ORD budget with and without adjustment for inflation. Consumer price index was used to create the graph. All years represent Enacted Budgets except FY 2011, which represents the President’s Request. Source: Department of Labor, Bureau of Labor and Statistics Consumer Price Index.