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Report to the Chairman,
Committee on Commerce,
House of Representatives

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DRINKING WATER RESEARCH

Better Planning Needed to Link Needs and Resources

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Resources, Community, and
Economic Development Division

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September 24, 1999

The Honorable Thomas J. Bliley, Jr.
Chairman, Committee on Commerce
House of Representatives

Dear Mr. Chairman:

As the Environmental Protection Agency's (EPA) safe drinking water program matures, public water systems are faced with regulations that are far more complex than in the past and whose costs could be significant for both the systems and their customers. In the Safe Drinking Water Act Amendments of 1996,[1] the Congress made significant changes to the way that EPA is required to set drinking water quality standards for public water systems. Among other things, the regulations must be based on the best available peer-reviewed science and must consider health risks, risk reduction, and implementation costs. The statute also authorized increased funding for the scientific research needed to support the regulations.

Concerned about whether EPA's drinking water research will be sufficient to support the agency's forthcoming regulations, you asked us to

- compare EPA's budget requests for drinking water research during fiscal years 1997 through 2000 with (1) the amounts authorized for such purposes by the Safe Drinking Water Act Amendments of 1996 and (2) the amounts estimated by EPA to be needed to support the regulations and regulatory determinations required under the amendments;
- obtain the views of stakeholders—those involved with supplying and ensuring the safety of drinking water—regarding the likelihood that EPA will be able to complete the research necessary to support new regulations and regulatory decisions over the next 10 years and the potential consequences if the research is not completed;[2] and
- assess EPA's drinking water research plans, including the tasks, projected funding, and anticipated accomplishments, to support the development of new regulations and regulatory decisions over the next 10 years.

[1]P.L. 104-182, 110 Stat. 1613 (1996).

[2]To obtain stakeholders' views, we interviewed officials with the American Water Works Association, American Water Works Association Research Foundation, Association of Metropolitan Water Agencies, Association of State Drinking Water Administrators, National Association of Water Companies, National Drinking Water Advisory Council, and Natural Resources Defense Council. We also contacted officials associated with the National Research Council and the Science Advisory Board.

Results in Brief

For fiscal years 1997 through 2000, EPA annually requested millions of dollars less than the Congress authorized for drinking water research and regulatory development in the 1996 amendments, although the gap has narrowed recently. For example, EPA requested $77.4 million for fiscal year 1998, or nearly 24 percent less than the $101.6 million that was authorized for that year, but this gap was reduced to about 14 percent for fiscal year 2000, since EPA requested $87 million of the $101.6 million authorized.[3] According to EPA officials, the agency's annual budget requests reflect the level of resources that agency officials believe is needed to fulfill EPA's mission and program responsibilities, within the planning ceilings and policy directives provided by the Office of Management and Budget. However, because EPA does not generally prepare estimates of the total resources that will be needed to carry out multiyear research programs, there is no overall estimate of resource needs for drinking water with which to compare EPA's annual budget requests.

The stakeholders we interviewed all expressed concerns about the adequacy of the research for the upcoming regulations on (1) arsenic and (2) microbial pathogens, disinfectants (used to treat drinking water), and disinfection by-products, particularly in the areas of health effects and the analytical methods used to detect contaminants. While EPA officials acknowledge that some high-priority research projects will not be completed in time for these regulations, they believe that the available research will be sufficient to support the regulations with sound science. According to the stakeholders we interviewed, the potential consequences of not having adequate research to support upcoming regulations could be significant. If EPA issues regulations that are more stringent than can be justified by the available science, then water utilities could bear unnecessarily high treatment costs. On the other hand, if EPA decides to set a less stringent standard because some scientific data are not available, consumers could be exposed to harmful contaminants longer than necessary.

EPA has prepared detailed research plans that identify the specific tasks that it needs to complete in order to support upcoming regulations on arsenic and microbial pathogens, disinfectants, and disinfection by-products. However, EPA has not completed research plans for other significant portions of its regulatory workload, including determinations on contaminants that are candidates for regulation and the review and revision of existing drinking water standards. Moreover, while the plans it

[3]We used fiscal year 1998 data for this example because EPA's fiscal year 1997 budget request was prepared prior to the enactment of the 1996 amendments and therefore was unusually low. See table 1 for more information.

has prepared specify research tasks, projected accomplishments, and expected completion dates, EPA has not identified the resources that are required to implement the plans and does not have an effective system for tracking the progress of ongoing research in relation to the plans. As a result, it is difficult to ascertain whether the research has been adequately funded or will be available in time to support the development of new regulations and regulatory determinations. We are recommending actions to improve the transparency of the budget development process and the effectiveness of the system used to track the progress and funding of research projects.

Background

EPA's responsibility for conducting drinking water research and developing the applicable regulations is split between the agency's Office of Research and Development and Office of Water. The Office of Research and Development's five laboratories and centers are responsible for conducting research on health effects, exposure, treatment technologies, and analytical methods.[4] In addition, the Office's National Center for Environmental Assessment develops risk assessments for some contaminants.[5] Within the Office of Water, the Office of Science and Technology also does some risk assessments, and the Office of Ground Water and Drinking Water collects data on the occurrence of contaminants in drinking water; prepares the economic assessments, including cost-benefit analyses, and makes the risk management decisions necessary to support the regulatory decisions; and writes the regulations.

Among other things, the 1996 amendments to the Safe Drinking Water Act required EPA to finish developing most of the regulations that were in process at the time of the act's reauthorization, including requirements for filtration treatment at surface water systems, disinfection treatment at groundwater systems, and standards for certain "priority contaminants."[6] The amendments also replaced the requirement to regulate 25 additional contaminants every 3 years with a new selection process that explicitly

[4]The Office of Research and Development's five laboratories and centers are the National Health and Environmental Effects Research Laboratory, the National Exposure Research Laboratory, the National Center for Environmental Assessment, the National Risk Management Research Laboratory, and the National Center for Environmental Research and Quality Assurance.

[5]A risk assessment typically involves an evaluation of the likelihood that a contaminant will cause an adverse health effect, the extent to which the population is exposed to the contaminant through drinking water and other sources, and the relationship between the level of exposure and the adverse health effect.

[6]Priority contaminants include arsenic; microbial pathogens, such as cryptosporidium; disinfection by-products; and radon.

allows EPA to identify contaminants that warrant regulation on the basis of their adverse health effects, their frequency of occurrence in public water systems, and the projected risk reduction to be achieved by regulating them. EPA was required to publish, by February 1998, a list of high-priority contaminants not currently regulated. (This list is known as the Contaminant Candidate List.) Beginning in August 2001 (and in 5-year cycles thereafter), EPA must determine whether to regulate at least five of the contaminants on the list. A determination to regulate them must be based on the best available public health information and data concerning the occurrence of the contaminant. In addition to regulating new contaminants, EPA must review and revise, as appropriate, existing drinking water standards at least once every 6 years.

The 1996 amendments also modified EPA's standard-setting authority so that health risks, risk reduction, and costs must be considered when drinking water quality standards are established. When proposing a regulation, EPA is required to publish an analysis of, among other things, the effects of the contaminant on the general population and on subpopulations that are identified as likely to be at greater risk of adverse health effects due to exposure to the contaminant in drinking water than the general population.[7] In addition, EPA is required to publish a determination of whether the benefits do or do not justify the costs. To the degree that its actions are based on science, EPA must use the best available peer-reviewed science and supporting studies conducted in accordance with sound and objective scientific practices.

EPA's Annual Budget Requests for Drinking Water Research and Regulatory Development Are Less Than the Legislatively Authorized Amounts

For fiscal years 1997 through 2000, EPA annually requested millions of dollars less than the amounts that the Congress authorized for drinking water research and regulatory development in the 1996 amendments to the Safe Drinking Water Act. The annual requests focus on a specific budget year, reflecting known budgetary constraints. EPA does not generally prepare estimates of the total resources that will be needed to carry out a multiyear research program for any given research area.

Authorized Amounts Exceed EPA's Requests

Table 1 shows the differences between the amounts authorized and requested by fiscal year for drinking water research by the Office of

[7]These "sensitive subpopulations" may include infants, children, pregnant women, the elderly, individuals with a history of serious illness, or other groups.

Research and Development and for regulatory development activities by the Office of Water. Beginning with fiscal year 1998, EPA requested a much lower percentage of its authorized funding for drinking water research than it did for regulatory development. However, in both fiscal years 1998 and 1999, the Office of Research and Development ultimately received substantially more funding for drinking water research than EPA requested for it; the total funds received during those years were $40.3 million and $47.7 million, respectively.

The gap between the authorized funding levels and budget requests has narrowed recently. For example, EPA requested 35 percent less than what was authorized for drinking water research in fiscal year 1999, but this gap was reduced to 24 percent for fiscal 2000. Over the same period, EPA requested about 13 percent less than what was authorized for regulatory development in fiscal year 1999 and about 3 percent less for fiscal 2000.

Table 1: Comparison of Authorized Funding Levels to Budget Requests for Drinking Water Research and Other Activities Related to Regulation Development for Fiscal Years 1997 Through 2000

Dollars in thousands

Fiscal year	Amounts authorized under the Safe Drinking Water Act Amendments of 1996	Amounts of budget request	Difference between amounts authorized and requested	Percent difference[a]
1997[b]				
Office of Water[c]	$45,000.0	$19,343.5	$25,656.5	57.0
ORD	54,593.0	26,600.0	27,993.0	51.3
Total	**$99,593.0**	**$45,943.5**	**$53,649.5**	**53.9**
1998				
Office of Water[c]	$47,000.0	$41,467.5	$5,532.5	11.8
ORD[d]	54,593.0	35,900.0	18,693.0	34.2
Total	**$101,593.0**	**$77,367.5**	**$24,225.5**	**23.8**
1999				
Office of Water[c]	$47,000.0	$40,859.9	$6,140.1	13.1
ORD[d]	54,593.0	35,500.0	19,093.0	35.0
Total	**$101,593.0**	**$76,359.9**	**$25,233.1**	**24.8**
2000				
Office of Water[c]	$47,000.0	$45,484.9	$1,515.1	3.2
ORD[d]	54,593.0	41,500.0	13,093.0	24.0
Total	**$101,593.0**	**$86,984.9**	**$14,608.1**	**14.4**

(Table notes on next page)

Legend

ORD = Office of Research and Development

[a]The amounts shown in the Total line for each fiscal year represent the percent difference between the total amounts requested for the Office of Research and Development and the Office of Water in a given year and the total amounts authorized in that year.

[b]In fiscal year 1997, there were large differences between the amounts authorized and requested because EPA's budget request for that year was prepared prior to the enactment of the 1996 amendments. Subsequently, EPA received a supplemental appropriation under the Omnibus Consolidated Appropriations Act of 1997. Under this appropriation, the Office of Water obtained an additional $6.8 million for regulatory development, and the Office of Research and Development obtained an additional $10 million for health effects research. If these funds are added to the amounts requested for the Office of Water and the Office of Research and Development in the fiscal year 1997 budget, then the difference between the amounts authorized and requested decreases to 41.9 percent and 33 percent, respectively.

[c]The amounts shown for the Office of Water include funds for the Standards and Risk Management Division within the Office of Ground Water and Drinking Water and the Office of Science and Technology. In addition, the Office of Water's totals for fiscal years 1998, 1999, and 2000 include $2 million for unregulated contaminant monitoring under the set-aside provision of section 1452(o) of the Safe Drinking Water Act. Although the 1996 amendments provided $10 million for such monitoring, EPA has never requested these funds.

[d]Since 1997, EPA has included $10 million for health effects research in the base budget for drinking water research and has obtained these funds through the annual appropriations process. EPA relies on the appropriations process for this funding rather than reserving funds from the authorized set-aside of $10 million for health effects studies in the Drinking Water State Revolving Loan Fund under section 1452(n) of the Safe Drinking Water Act.

Source: GAO's analysis of EPA's data.

According to officials within both the Office of Water and the Office of Research and Development, EPA does not prepare its annual budget requests on the basis of the specific funding authorizations in environmental statutes. Instead, the budget requests reflect (1) the level of resources that agency officials believe is needed to fulfill EPA's mission and program responsibilities and (2) the planning ceilings and policy directives provided by the Office of Management and Budget.

Officials from the Office of Research and Development told us that the amount of funding to be requested annually for research on drinking water and other areas is determined through an extensive planning process within the Office. Research coordination teams comprising representatives of the Office of Research and Development's laboratories and centers and the applicable program offices determine the Office's research priorities for the upcoming budget year. Each of the Office's five coordination teams is responsible for a broad area of research: air, water, pesticides and toxic chemicals, hazardous wastes, and multimedia issues. The teams consider several factors in establishing research priorities, including the Office's

overall research strategy, the status of ongoing research, program offices' priorities, and statutory and budgetary constraints. In the case of drinking water, for example, the starting points for identifying priorities include EPA's strategic plan, existing research plans, input from other federal agencies engaged in related research, and advice from external scientific advisory groups such as the Science Advisory Board. Next, an executive council within the Office of Research and Development and EPA's Research Coordinating Council, comprising Deputy Assistant Administrators from across the agency, review the teams' recommendations and modify them as appropriate to ensure that the Office's annual budget request focuses on the highest research priorities across the agency. The Assistant Administrator for Research and Development works to resolve any differences and forwards the budget for EPA-wide review.

Annual Requests Are Not Linked to Multiyear Resource Estimates

Using this process, EPA estimates only the resources needed for drinking water (and other) research for a specific budget year, rather than the total resources needed to carry out a multiyear research program for any given research area. In effect, the agency determines—on an annual basis—what research can be accomplished within the targets provided by the Office of Management and Budget. Therefore, there is no overall estimate of the resource needs for drinking water research with which to compare the annual budget requests for drinking water research.

Beginning with the fiscal year 2001 budget request, officials from the Office of Research and Development plan to identify what additional research could be accomplished at a funding level of 120 percent of their base budget. However, the focus will still be on research funded for a specific budget year. Officials from the Office of Research and Development told us that the Office of Management and Budget discourages executive branch agencies from projecting resource needs beyond the current budget-planning cycle. Out-year projections are included in the President's budget submission to the Congress, but these estimates are provided at a general account level—not at specific program levels. In addition, the officials said that EPA and other executive branch agencies must work within current balanced budget constraints. According to the Staff Director of the Science Advisory Board, which annually reviews EPA's research budget, the Office of Research and Development is reluctant to develop a realistic estimate of the funding needed to support drinking water research because such an estimate could lead to funding reallocations within the agency.

In fiscal year 1998, EPA did attempt to do an unconstrained needs assessment that would identify the activities and resources necessary to meet the new statutory mandates of the 1996 amendments, including requirements for drinking water research, and to achieve public health objectives. EPA's Office of Water launched the Drinking Water Strategic Needs Assessment project in the fall of 1997 and, with input from the Office of Research and Development and experts in the drinking water stakeholder community, comprehensively identified the applicable statutory requirements, outputs, and deadlines for the next 7 to 10 years. On the basis of this information, the project team calculated an initial, midrange estimate of the staffing and financial resources necessary to meet those requirements. As we reported earlier this year, EPA concluded that the shortfall in research and data collection funding was in the range of $10 million to $20 million annually for fiscal years 1999 through 2005.[8] The agency identified an additional but smaller resource gap over the same period for program activities related to other aspects of the 1996 amendments. The results of the assessment were presented to the National Drinking Water Advisory Council and other stakeholders in April 1998.

EPA officials subsequently explained that the intent of the needs assessment was not to calculate exact budget requirements. Instead, the purpose was to develop a "ballpark" estimate that would provide trends and an overall picture of resource requirements for the full and timely implementation of the Safe Drinking Water Act amendments. In March 1999, EPA officials testified that the level of funding received in fiscal year 1999 and requested for fiscal 2000 is sufficient to provide the resources needed to (1) meet all near-term requirements of the act's amendments in a timely manner and (2) base regulatory decisions on sound science.[9] Officials from the Office of Water and Office of Research and Development are currently conducting a comprehensive evaluation of resource needs for the drinking water research program for fiscal year 2001 and beyond.

Several of the stakeholders we interviewed expressed concern about the adequacy of EPA's budget requests for drinking water research and the proportion of the Office of Research and Development's research budget

[8]Safe Drinking Water Act: Progress and Future Challenges in Implementing the 1996 Amendments (GAO/RCED-99-31, Jan. 14, 1999).

[9]Implementation of the 1996 Safe Drinking Water Act Amendments: Hearing Before the Subcommittee on Fisheries, Wildlife and Drinking Water of the Senate Committee on Environment and Public Works, 106th Cong. 13-14 (1999) (Internet, GPO Access).

that is devoted to drinking water. Although safe drinking water was identified as one of six priority research areas in the Office's strategic plan, from fiscal years 1997 through 1999, drinking water research has accounted for 4.9 to 6.9 percent of the total research budget request.[10] Officials from the American Water Works Association, the Association's Research Foundation, the National Drinking Water Advisory Council, and the Natural Resources Defense Council told us that considering its potential impact on public health, drinking water research receives a disproportionately small share of the Office of Research and Development's total research budget. They believe that funding for drinking water research should receive a higher priority within EPA, and they cited specific areas, such as certain health effects studies, in which they believe that funding constraints caused the research to be started too late to be available when needed.

Officials from the Office of Research and Development pointed out that drinking water research as a percentage of the total research budget has more than doubled, from 3.3 percent in fiscal year 1995 to 7.8 percent in EPA's fiscal 2000 budget request. They said that research by EPA scientists and engineers in the areas of health effects, exposure, risk assessment, and risk management is making significant contributions to the understanding of drinking water risks and to the development of reliable, cost-effective treatment techniques. While the officials acknowledge that it is beyond the capacity of EPA to address all drinking water research needs, they said that they have worked to establish partnerships with federal and nonfederal research entities, such as the National Institute of Environmental Health Sciences, the Centers for Disease Control and Prevention, and the American Water Works Association Research Foundation, to leverage additional resources.

[10]Over the same period, drinking water research represented 7.9 to 8.5 percent of the Office of Research and Development's operating plan budget.

Stakeholders Believe Some Research Will Not Be Available in Time to Support Upcoming Regulations

Beyond the questions surrounding the funding of drinking water research, the stakeholders we interviewed all expressed concerns about the adequacy of the research that will be available to support the regulations on arsenic and microbial pathogens, disinfectants, and disinfection by-products.[11] In the case of arsenic, for example, several stakeholders told us that some of the epidemiological studies, which will provide information on health effects,[12] will not be completed in time, in part, because the research was started too late for the results to be available when needed. While some stakeholders, such as the National Drinking Water Advisory Council and the Association of Metropolitan Water Agencies, agree that there will be gaps in health effects research, they believe that sufficient information exists to take some interim action on arsenic. They expect EPA to lower the existing standard by the statutory deadline of January 2001, and, when the longer-term research is completed, to consider revising the standard again.

Regarding the regulations on microbial pathogens, disinfectants, and disinfection by-products, many stakeholders commented that some of the health effects research—including epidemiological studies and research on sensitive subpopulations, such as children and pregnant women—will not be completed in time for the rule. Both the Chairman of the National Drinking Water Advisory Council and the Executive Director of the National Association of Water Companies, among others, also expressed concern about whether researchers will be able to identify reliable analytical methods for detecting microbial contaminants, such as cryptosporidium, that will be included in the upcoming regulations. Not having reliable analytical methods makes it difficult to determine whether and to what extent drinking water is contaminated and, thus, produces uncertainty with respect to any assessment of consumers' exposure to microbial contaminants.

EPA officials acknowledge that some high-priority research projects will not be completed in time for the upcoming regulations on arsenic and microbial pathogens, disinfectants, and disinfection by-products. For example, in the case of arsenic, EPA has testified that a significant investment in health effects research must continue for several years to

[11]Conventional water treatment practices require the addition of disinfectant chemicals to the water, that, while effective in controlling many harmful microorganisms, combine with organic and inorganic compounds in the water and form potentially harmful disinfection by-products.

[12]In general, environmental epidemiological studies are used to determine whether an association exists between an adverse health effect and a population's exposure to a contaminant. Further studies are often needed to confirm the epidemiological association and determine the relationship between the level of exposure and the adverse health effect.

address priority research needs. In the case of research on disinfection by-products, officials from the Office of Research and Development told us that the importance of studying certain noncancer health effects has only recently been recognized, as EPA's understanding of the science has evolved. Even so, EPA officials believe that the available research will be sufficient to support the regulations with sound science. They told us that they will issue regulations using the best available science and, when additional research results become available, will modify the regulations, if appropriate, as part of the review and revision of existing standards that are required every 6 years. In the case of the research on microbial pathogens, disinfectants, and disinfection by-products, some results may be available after the regulations are proposed. If this occurs, EPA would likely make the information available to stakeholders through a notice of data availability.

Some stakeholders questioned EPA's approach. For example, the Executive Director of the American Water Works Association Research Foundation sees EPA's regulatory approach as a compromise that became necessary because some research was started too late to be available. In addition, using a two-stage approach to regulate contaminants could increase costs to utilities in some instances. According to the Executive Director of the National Association of Water Companies, it is often not cost-effective to make incremental changes in treatment technologies. For example, in the case of arsenic, water systems that meet the current standard of 50 parts per billion (ppb) would be required to install additional treatment to achieve a more stringent standard (i.e., a level that is less than 50 ppb but more than 5 ppb). If the standard is revised a second time to a level below 5 ppb, then another treatment component would be required. Although the second treatment unit would be an additive rather than a replacement unit, it is generally less expensive for water systems to purchase and install all of the required equipment at one time.

The consensus among stakeholders is that the availability of research for contaminants on the Contaminant Candidate List may be the most serious concern because relatively little research has been initiated so far and EPA does not expect to have a research plan until May 2000. According to a variety of stakeholders and officials within the Office of Water, EPA should be conducting research on these contaminants now so that the regulatory determinations and rulemakings associated with these contaminants will be supported by sound science. However, this research is just now beginning for the most part. In a March 1999 hearing before the House Committee on Science, the Assistant Administrator for the Office of

Research and Development testified that in its fiscal year 2000 budget, EPA redirected approximately $6 million from the funding that had been dedicated to research on microbial pathogens, disinfectants, and disinfection by-products to fill key data gaps and develop analytical methods for chemicals and microbial pathogens on the Contaminant Candidate List. Although the Office of Research and Development has already initiated research in the areas of health effects, exposure, and treatment for selected high-priority contaminants on the list, the fiscal year 2000 funding represents the first major transition of resources within the drinking water research budget to address these research needs.

Some of the stakeholders we interviewed believe that EPA may have sufficient information for the first set of regulatory determinations, which is due in August 2001. When EPA initially developed the Contaminant Candidate List, the agency categorized some contaminants as "regulatory determination priorities" because sufficient information was already available—or could be obtained quickly with a relatively small investment of resources—to conduct exposure and risk analyses.[13] From this group, EPA officials expect to select five or more contaminants for the first set of regulatory determinations. However, stakeholders point out that although this group may represent the contaminants for which the most information is available, they are not necessarily among those on the list that pose the most significant health risks. Without more research, however, this is impossible to know.

Most of the stakeholders we interviewed raised concerns about whether EPA will have sufficient information for the next round of regulatory determinations on the Contaminant Candidate List, which must be made by August 2006. A number of stakeholders, including officials from the Association of Metropolitan Water Agencies, the Natural Resources Defense Council, and the National Drinking Water Advisory Council, were particularly concerned that little or no health effects research has been initiated for the contaminants on the list. Some stakeholders also noted that epidemiological studies, in particular, can take 4 or more years to plan and conduct. Consequently, they believe that it is important to begin the work now so the results will be available when they are needed.

[13]Other contaminants were categorized as "research" and/or "occurrence" priorities because of significant data gaps in the areas of health effects, treatment, analytical methods, and/or occurrence. Of the 20 contaminants initially identified as regulatory determination priorities, 7 or 8 have since been redesignated as research priorities because EPA officials subsequently learned that additional information is needed in one or more areas.

According to the stakeholders we interviewed, the potential consequences of not having adequate science to support the regulations could be significant. They believe that if EPA issues regulations that are more stringent than what is justified by the available research, then water utilities could bear unnecessarily high treatment costs. In the case of arsenic, for example, under both EPA's and industry's projections, annual compliance costs could increase dramatically depending on how much the existing standard of 50 ppb is lowered, as shown in table 2.

Table 2: Changes in Estimated Annual Compliance Costs at Different Arsenic Levels

Dollars in millions

Arsenic level	EPA's estimate[a]	AWWA's estimate[b]
20 ppb	$74	$330
10 ppb	270	708
5 ppb	620	1,521
2 ppb	2,100	4,178

Legend

AWWA = American Water Works Association

[a]EPA's estimate is from a January 1995 informational briefing that the agency provided for Senate staff; it was also published in an article entitled "Uncertainties Drive Arsenic Rule Delay" in the April 1995 issue of the Journal of the American Water Works Association (p.12).

[b]The American Water Works Association's estimate was published in an article entitled "Cost to Utilities of a Lower MCL for Arsenic" in the March 1998 issue of the Journal of the American Water Works Association (p. 96).

According to an official in EPA's Office of Ground Water and Drinking Water, the costs increase as the standard gets lower because additional systems are affected at each level. In addition, he said that once the standard falls below 5 ppb, water systems would have to add another treatment component to achieve compliance.

On the other hand, not having adequate research could have an impact on public health. If EPA decides to set a less stringent standard or defers the regulation of a contaminant because some scientific data are not available, this could mean that consumers would be exposed to harmful contaminants for an additional 6 or more years.[14] The Natural Resources Defense Council and other organizations have expressed concern about the relatively limited research on the impact of drinking water contaminants on sensitive subpopulations, such as pregnant women,

[14]Under section 102(a) of the 1996 amendments, the EPA Administrator has authority to take action more quickly (i.e., promulgate an interim national primary drinking water regulation) whenever contaminants are determined to pose urgent threats to public health.

children, the elderly, and people with compromised immune systems. An official with the Office of Ground Water and Drinking Water acknowledged that the study of human reproductive and developmental effects, in particular, is an area in which more research is needed. He told us that some earlier studies indicated a possible association between these effects and exposure to drinking water treated with disinfectants but that additional long-term studies are needed to determine if there is any basis for concern. The National Program Manager for Drinking Water Research cited several studies now being conducted or supported by EPA to evaluate whether exposure to disinfection by-products is associated with adverse reproductive outcomes.

EPA Has Not Completed Some Research Plans and Does Not Identify or Track the Resources Needed to Implement Existing Plans

Although EPA has prepared detailed research plans in two significant areas—arsenic and microbial pathogens, disinfectants, and disinfection by-products—it has not yet completed plans for other major aspects of its regulatory workload. Where research plans do exist, they lack key information on resource requirements. In addition, although the Office of Research and Development uses a variety of methods to communicate the results of ongoing research projects, the Office does not have an effective system for tracking the progress and funding of the projects in relation to the research plans.

Some Plans Are Still Under Development

EPA has not yet completed research plans for its anticipated work on the Contaminant Candidate List and the review and revision of existing standards, and has not developed a comprehensive research plan that integrates both near-term and long-term research needs. EPA started work on a research strategy for the Contaminant Candidate List after the first list was published in 1998.[15] Although EPA will be required to make a regulatory determination on at least five contaminants from the first list by August 2001, the agency does not expect to complete its strategy until May 2000. Similarly, although EPA must complete the review and revision of about 80 existing standards by August 2002, EPA only recently began the initial work associated with identifying the research needs for this effort. EPA officials explained that at this point, they do not expect the review of existing standards to require a significant research effort. According to the National Program Manager for Drinking Water Research, EPA is not currently considering the development of a separate research plan for the

[15]According to the Office of Research and Development, a strategy is less specific than a plan in that the former provides the framework for making and explaining decisions about a program's purpose and direction and serves as a link between the Office's overall strategic plan and individual research plans.

review and revision of existing standards. Instead, this work will be incorporated into EPA's comprehensive research plan, which is targeted for completion by December 2000.[16]

A number of stakeholders were concerned that EPA does not yet have a comprehensive research plan. They believe that developing such a plan would require EPA to lay out an integrated approach for supporting ongoing regulatory efforts and identifying and conducting research on emerging concerns, such as the presence of pharmaceuticals in some sources of drinking water. In addition, a long-term plan would allow the agency to be more anticipatory and less reactive. The stakeholders cited several reasons why it is important for EPA to make developing a long-term research plan a priority as shown below:

- Officials from both the American Water Works Association and the Association of Metropolitan Water Agencies said that it is essential for EPA to break the cycle in which the research lags behind the regulatory needs. They said that EPA must avoid falling back into the position that it was in after the 1986 amendments when the agency was required to set standards at a rapid pace— namely, facing regulatory deadlines without having adequate science to support its decisions.
- The Chairman of the National Drinking Water Advisory Council said that EPA needs to identify emerging concerns, articulate a plan of attack, and develop scientific information before a crisis occurs. He noted that when the 1993 waterborne disease outbreak from cryptosporidium occurred in Milwaukee, Wisconsin, over 100 people died and several hundred thousand people became ill as a result. He said that utilities were in a panic about their potential vulnerability to similar incidents. However, very little was known about cryptosporidium or whether it could be detected and treated effectively because little or no research had been done.
- The Executive Director of the American Water Works Research Foundation commented that knowing what research is planned by EPA helps shape the Foundation's own research planning. The Foundation can avoid duplicating research that EPA already plans to fund itself and, instead, sponsor research that complements EPA's efforts.

[16]EPA is required to develop a long-term research plan under section 202(a) of the 1996 amendments. The statute does not impose a deadline on the plan's completion.

Resources Needed to Implement Existing Plans Are Not Identified or Tracked

The research plans that EPA has prepared for arsenic and microbial pathogens, disinfectants, and disinfection by-products identify the specific research tasks that will be performed and provide information on the anticipated accomplishments. However, the plans do not include estimates of the resources needed to fund the planned research. As a result, it is not possible to make the link between the estimated cost of the research laid out in the plans and the funds requested for drinking water research in EPA's budget—or to determine whether the research is adequately funded.

Not only do existing research plans lack key information on resource requirements, but EPA also does not have an effective system for tracking the progress and funding of ongoing research in relation to the plans. The Office of Research and Development does make significant efforts to communicate the status and results of its work to the Office of Water (e.g., through regular staff-level contacts, special briefings, and status reports). In addition, the Office of Research and Development periodically communicates the results of individual projects to interested groups outside the agency through stakeholder meetings and other means. Research status tables prepared by the Office of Research and Development at our request indicate that the project duration and completion dates for arsenic and microbial pathogens, disinfectants, and disinfection by-products were consistent with what was contemplated in the applicable research plans. However, the Office does not routinely report this information and could not provide accurate and timely information on project funding. Moreover, officials from both the Office of Water and outside stakeholder groups indicated that they would like to receive regular reports that contain more detailed information on the status of projects in the research plans, including the estimated and actual start and completion dates and the funding for individual projects.

Because the Office of Water needed better information to monitor the status of the work laid out in the research plan and to track project-level resource expenditures, the Office developed its own tracking system for the research on microbial pathogens, disinfectants, and disinfection by-products. Since 1997, the Office of Water has paid a contractor over $148,000 to develop and maintain the tracking system and input data on the status of individual projects. EPA officials believe that the system has been useful for summarizing the types of studies being conducted by the Office of Research and Development and outside entities; it served as the basis for a series of charts, produced for meetings with stakeholders, that indicated the timelines for individual projects. However, we found that as

of mid-July 1999, the system did not contain information on the funding allocated to individual projects for either fiscal years 1998 or 1999.

Concerns about the Office of Research and Development's systems for tracking research are not new. The Office's Federal Managers Financial Integrity Act report for fiscal year 1994 identified

> "difficulties in understanding the nature and relationships of projects and resources to the overall research plan due to limited stand-alone systems which do not communicate or integrate with one another. Resources are difficult to correlate with each project at the project and task level. Events associated with the development of each project are not trackable over time (life-cycle planning). At risk is a lack of current on-line responsiveness to requests for information."

In response to the report, the Office of Research and Development developed a new management information system that was designed to track information at all necessary levels and produce accurate and timely reports. According to officials from the Office of Research and Development, this system is adequate to meet the internal needs of the Office's laboratories and centers. However, it appears that the system is not adequate to meet the needs of key stakeholders in the Office's research within and outside EPA. For example, the system does not compile status reports on projects identified in the research plans or track resources at a project level over the life of individual projects. To obtain such information, it is necessary for the Office to make a special data request to its laboratories and centers.

Better planning and a more explicit link between research needs and resources would improve the transparency of the budget development process. The Science Advisory Board, which annually reviews the Office of Research and Development's budget requests, has noted improvements in the Office's efforts to link research priorities with specific environmental goals and improvements in the coordination between the Office and the needs of EPA's program offices. However, in commenting on the Office's fiscal year 2000 budget, the Board's Research Strategies Advisory Committee indicated that the lack of transparency in the process used to set research priorities made it difficult for the Committee to evaluate the adequacy of the proposed budget. The Committee recommended that EPA make available information on the high-ranking programs that it entertained during the budget-making process but could not fund because of overall budget constraints and competition with other programs. In addition, the Committee found that the criteria that EPA used

to emphasize or de-emphasize programs in the proposed budget were unclear and recommended that EPA develop explicit criteria that can be used for setting research priorities during the budget development process. The Committee concluded that such an exercise would not only improve communication and understanding of the budget process for those outside the agency, but would also assist EPA in making its internal decision process more efficient.

In September 1998, the Committee issued a report to EPA that identified, among other things, ways that the Office of Research and Development could improve its presentation of budget materials.[17] For example, the Committee recommended that the Office provide more detail on how the budget is allocated to individual objectives and research programs and how the current fiscal year's budget fits into the contemplated budgets over the 5-year planning horizon of the Strategic Plan and even over the longer term (10 to 15 years). The Committee also recommended that the Office provide timelines for multiyear programs, showing both past budget trends and future projections. Officials from the Office of Research and Development told us that they recently began a pilot project to link the strategic long-term research priorities for drinking water with annual planning and budgeting.

Conclusions

EPA has invested considerable time and funds in an effort to undertake research needed to support complex new regulations that will profoundly affect water systems and their customers. While the agency has made significant efforts to communicate the progress and accomplishments of its drinking water research, the Congress, water supply industry, and other key stakeholders have indicated a need for greater assurance that the research is adequately funded and will be completed in time to ensure that the applicable regulations will be supported by sound science. This widely expressed desire for greater assurance is understandable, given both the millions of dollars being spent on the research program and the prospect that billions of dollars could be spent by the water supply industry to comply with new and expensive regulations. We believe that more detailed and better-communicated information on planned and ongoing research is warranted on the grounds of both accountability and efficiency.

Developing a realistic estimate of the resources required to support needed research will not guarantee that EPA's budget request will be

[17]Commentary on the Process for Science Advisory Board Review of the Office of Research and Development's Presidential Budget Request (Sept. 17, 1998).

sufficient to meet all needs. We recognize that overall funding constraints and competing demands within the Office of Research and Development and EPA as a whole may prohibit the agency from fully funding all its needs. However, identifying the nature, timing, and estimated cost of needed research for the multiyear research plans—and linking these needs to the annual budget request—will make the funding process far more transparent. Providing information on which projects will be funded in a given fiscal year (and which projects will not) will give stakeholders within and outside EPA a clear basis for assessing the impact of the agency's budget decisions. In addition, EPA's reliance on outside research entities to fill the gaps that are beyond the agency's capacity to meet makes it all the more important for EPA to identify high-priority projects that may be deferred or abandoned because of funding constraints. Similarly, having a more effective system for tracking ongoing research will both enhance the budget development process and allow stakeholders to make informed judgments about whether the research is adequately funded and will be available when needed. We recognize that research, by its very nature, is an evolving process and that some of the projects contemplated in the agency's research plans will likely be modified or halted and some new projects will be added over time. While tracking research may be a more challenging proposition under these circumstances, it is no less important.

Recommendations

To improve the link between research needs and resources and to better ensure that limited research funds within EPA and other organizations are most efficiently targeted, we recommend that the Administrator, EPA, take steps to ensure that the budget development and planning processes for drinking water research are more transparent. Specifically, EPA should (1) identify the specific research that must be accomplished, (2) establish time frames that indicate when the results must be available, (3) estimate the resources that will be required to support the needed research, and (4) use these data to develop budget requests and inform stakeholders of what research will be funded. In addition, we recommend that the Administrator take steps to improve (1) the tracking of ongoing research in relation to existing research plans and (2) the communication of the agency's progress so that the Office of Research and Development's key customers, including the Office of Water and outside stakeholders, can obtain timely and accurate reports on the status, timing, and funding of individual research projects.

Agency Comments

We provided EPA with copies of a draft of this report for review and comment. In general, EPA concluded that the report provides an accurate characterization of its views. The agency commented that it

> "agrees with the importance of the central issues examined in [the] report, including the critical need for an adequate investment in drinking water research to provide a sound scientific basis for drinking water regulations, the importance of linking multi-year research planning to the yearly budget cycle, and the value of using effective tracking systems for monitoring and communicating the status of research activities and resource requirements."

EPA also made some general observations to clarify its position on key issues raised by the report. Regarding the planning and budgeting process, EPA expressed concern that the report does not recognize the significant reallocation of resources to address drinking water needs and implies that EPA does not consider drinking water research as a priority. The agency noted that as part of its annual planning and budgeting process, the Office of Research and Development works with the program and regional offices to allocate funds across various research programs and ensure that the areas of greatest need, such as drinking water research, are given the highest priority. EPA maintained that when other factors, such as balanced budget constraints, are considered, its yearly budget requests are consistent with the needs identified in the Office of Research and Development's research plans and pointed out that its funding for drinking water research has doubled from fiscal year 1995 to fiscal 2000. While we acknowledge that the funding for drinking water research has increased significantly, we continue to believe that an overall estimate of resource needs is essential to assessing the adequacy of the funding and the extent to which EPA will have to rely on external research organizations to supply needed scientific data.

Regarding the tracking of research, EPA commented that the Office of Research and Development uses "a comprehensive system to ensure fiscal controls and to track resources to the project and task level," although, in the agency's view, our report implies otherwise. EPA stated that the Office's management information system was designed to produce accurate and timely reports for use by its laboratories and centers according to (1) fiscal year, (2) goal (e.g., air, water, waste), (3) program results code, (4) organization, (5) research area, and (6) task. However, EPA acknowledged that the Office of Water needs information in a different format and stated that the Office of Research and Development and the Office of Water are currently examining ways to provide information that

is more closely aligned with the program office's rulemaking efforts. We believe that this is an important step in addressing our concerns. EPA faces a difficult task in managing a large body of research to ensure that its regulations are supported by sound science and the data are available in time to meet regulatory deadlines. We recognize that the Office of Research and Development has an information system that meets its internal needs. However, the Office does not have a system that tracks the progress and funding of specific research projects in relation to the research plans. We believe that tracking this information makes sense, in light of EPA's regulatory responsibilities and the time and effort that the Office of Research and Development invests in preparing detailed research plans. A tracking system that meets the needs of key stakeholders in the Office of Research and Development's research—within and outside the agency—should provide detailed information on the status of projects in the research plans, including the estimated and actual start and completion dates and the funding for individual projects.

EPA also commented that our report implies that the agency is not sharing relevant information with stakeholders and stated that it places a high priority on sharing information regarding the status of and plans for research on drinking water contaminants. EPA stated that its efforts to share information in numerous stakeholder meetings and to work closely with other federal agencies offer excellent opportunities to coordinate the utilization of resources and ensure that the research conducted or supported by these organizations is complementary to EPA's research and not duplicative. The agency said that it is prepared to further strengthen these interactions, as necessary, to ensure that all groups are fully informed of research needs, activities, and resource requirements. We agree that EPA has made significant efforts to communicate the results of its drinking water research and believe that implementing our recommendations to improve the link between research needs and resources and to develop a more effective tracking system for ongoing research would enhance this communication.

In addition, EPA commented that the report's title does not accurately reflect the report's contents. We believe that the title is consistent with our findings in that the need for better planning is a key issue throughout the report. Thus, we retained the report's original title.

Finally, in commenting on one of our recommendations, as part of its technical comments, EPA stated that it is not able to disclose what activities were not proposed for funding once the final decisions are made

on the agency's budget request because this information involves internal budget deliberations. We modified the recommendation accordingly. However, we believe that the modified recommendation can still achieve its intended purpose. By linking the agency's budget requests to detailed research plans that identify specific projects, timelines, and required resources—and then providing information on what research "made the cut" and will be funded—EPA will give stakeholders the information they need to determine where the gaps are and, thus, where their own resources would be most efficiently targeted.

The full text of EPA's comments appears in appendix I. EPA also provided technical comments to clarify and amplify the information presented in this report. We incorporated those comments throughout the report as appropriate, but did not reproduce them in the appendix.

Scope and Methodology

To obtain information on the authorized and requested funding for drinking water research, we reviewed the Safe Drinking Water Act Amendments of 1996 to identify specific funding authorizations and EPA's budget requests for fiscal years 1997 through 2000. We also interviewed officials within the Office of Research and Development's Office of Resource Management and Administration and the Office of Ground Water and Drinking Water's Budget and Accountability section to obtain a breakdown of their budget requests by statutory authorization. We were unable to obtain information on the amounts estimated to be needed for drinking water research because, as a general practice, EPA does not identify resource needs outside the targets provided by the Office of Management and Budget. We did obtain information on applicable EPA policies and documentation of a preliminary needs assessment that was prepared by the Office of Water. We also interviewed key stakeholders to obtain their views on the adequacy of the funding for drinking water research. The stakeholders included the American Water Works Association, American Water Works Association Research Foundation, Association of Metropolitan Water Agencies, Association of State Drinking Water Administrators, National Association of Water Companies, National Drinking Water Advisory Council, and Natural Resources Defense Council.

The stakeholders also provided their views on the likelihood that EPA will be able to complete the research necessary to support upcoming regulations and the potential consequences if the research is not completed in time. In addition, we interviewed several EPA officials, including the Office of Research and Development's National Program

Manager for Drinking Water Research and the Director of the Standards and Risk Management Division within the Office of Ground Water and Drinking Water, regarding the status of the ongoing and planned research needed to support near-term and longer-term regulatory efforts.

To obtain detailed information on EPA's drinking water research planning, we reviewed existing research plans for arsenic and microbial pathogens, disinfectants, and disinfection by-products and interviewed officials from EPA and stakeholder organizations about the status of plans that have not yet been completed. We also contacted officials from scientific advisory organizations, including the Science Advisory Board and the National Research Council, and reviewed their reports relating to EPA's research planning and budgeting. Finally, we obtained and analyzed various reports intended to track ongoing research, reviewed documentation relating to the Office of Research and Development's information system, and interviewed officials responsible for the information system and research tracking reports. Our work was conducted from February through September 1999 in accordance with generally accepted government auditing standards.

As arranged with your office, unless you announce its contents earlier, we plan no further distribution of this report until 30 days after the date of this letter. At that time, we will make copies available to interested congressional committees; the Honorable Carol M. Browner, Administrator, Environmental Protection Agency; and the Honorable Jacob J. Lew, Director, Office of Management and Budget. We will make copies available to others on request.

If you have any questions regarding this report, please contact me at (202) 512-6111. Key contributors to this assignment were Ellen Crocker, Teresa Dee, and Les Mahagan.

Sincerely yours,

Peter F. Guerrero
Director, Environmental
Protection Issues

Contents

Letter 1

Appendix I Comments From the Environmental Protection Agency 28

Tables

Table 1: Comparison of Authorized Funding Levels to Budget Requests for Drinking Water Research and Other Activities Related to Regulation Development for Fiscal Years 1997 Through 2000 5

Table 2: Changes in Estimated Annual Compliance Costs at Different Arsenic Levels 13

Abbreviations

EPA	Environmental Protection Agency
GAO	General Accounting Office

Comments From the Environmental Protection Agency

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

September 9, 1999

OFFICE OF
RESEARCH AND DEVELOPMENT

Mr. David G. Wood
Associate Director, Environmental Protection Issues
Resources, Community and Economic Development Division
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Wood:

Thank you for the opportunity to comment on the GAO draft report entitled *Drinking Water Research: Better Planning Needed to Link Needs and Resources* (GAO/RCED-99-273), received on August 25, 1999.

We found that the draft report provided an accurate characterization of the U.S. Environmental Protection Agency's (EPA) views on the key draft report issues. The EPA agrees with the importance of the central issues examined in this report, including the critical need for an adequate investment in drinking water research to provide a sound scientific basis for drinking water regulations, the importance of linking multi-year research planning to the yearly budget cycle, and the value of using effective tracking systems for monitoring and communicating the status of research activities and resource requirements.

We offer below four general observations that should provide additional clarification of EPA's position on key issues raised by the draft report. In addition, we have enclosed detailed comments on specific portions of the text.

1) Planning & Budgeting Process

The report implies that EPA: (1) does not consider drinking water efforts as a priority; and (2) does not recognize the significant reallocation of resources to address drinking water needs. As part of the Agency's annual planning and budgeting process, ORD works with EPA's program and regional offices to allocate funds across various research programs. This process ensures that media-specific recommendations are fully considered and that the areas of greatest need, such as

2

drinking water, are given the highest priority. Yearly budget requests are consistent with the needs identified in ORD's research plans, balancing EPA's need for research across all environmental activities and keeping in mind balanced budget constraints. EPA funding for drinking water research has doubled from a level of $20.8 million in FY 1995 to $41.5 million in FY 2000. This has enabled the Agency to improve the science and provide new data and technologies in support of all priority Safe Drinking Water Act (SDWA) rule makings and risk management decisions required to date.

2) Tracking

The draft report implies that ORD does not have a comprehensive system to track resources and projects. As currently written, the document may suggest to the reader that in general ORD lacks an efficient and effective tracking system. On the contrary, ORD uses a comprehensive system to ensure fiscal controls and to track resources to the project and task level. The management information system developed by ORD was designed to produce accurate and timely reports for use by the ORD laboratories and centers according to: 1) fiscal year; 2) goal (e.g., air, water, waste); 3) program results code; 4) organization; 5) research area; and 6) task. The system was not designed to track resources by individual regulation. Recognizing the EPA Office of Water's (OW) needs to have the data formatted in a different manner, ORD and OW are currently examining ways to provide tracking information that is more closely aligned with rule-making efforts.

3) Information Sharing

The draft report implies that EPA is not sharing relevant information with stakeholders. EPA places a high priority on sharing information with stakeholders regarding the status and plans for research on drinking water contaminants. Representatives from EPA participate regularly in numerous stakeholder meetings and other public events to share information on research that is being conducted or planned, in support of the Agency's rule-makings. In addition, EPA staff work closely with other federal agencies and serve on numerous research coordination committees and advisory groups with stakeholder groups, including the American Water Works Association Research Foundation. These efforts offer excellent opportunities for more coordinated utilization of resources and ensure that research conducted or supported by these organizations is complimentary, not duplicative. EPA is prepared to further strengthen these interactions, as necessary, to ensure that all groups are fully informed concerning research needs, activities, and resource requirements.

3

4) Report Title

We do not believe the draft report title is an accurate reflection of the content of the report. We, therefore, suggest a more accurate title to consider could be, "Drinking Water Research: Linking Needs and Resources." This revision would be more consistent with the findings of the draft report.

We appreciate the opportunity to respond to this draft report. Should you have questions or would like additional information, please contact me on 202-564-6620.

Sincerely,

Norine E. Noonan, Ph.D.
Assistant Administrator

Enclosure

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