

**THE SAFE DRINKING WATER ACT:
A CASE STUDY OF AN
UNFUNDED FEDERAL MANDATE**

The Congress of the United States
Congressional Budget Office

NOTES

Numbers in the text and tables of this study may not add to totals because of rounding.

All data on local expenditures are in the fiscal years used by local governments, which end on June 30. All references to legislation are in calendar years.

Preface

The Congressional Budget Office (CBO) prepared this report at the request of the then Chairman of the Senate Committee on Governmental Affairs. The report uses data provided by the Environmental Protection Agency (EPA), the American Water Works Association, and local communities to examine the cost of treating drinking water according to the standards set under the Safe Drinking Water Act (SDWA). It also discusses available data on the benefits that result from treating drinking water and examines the actual use of legislative provisions that are meant to provide the EPA and the states with flexibility in enforcing the requirements of the SDWA.

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Summary

State and local officials have voiced strong opposition in recent years to the growing number of federal requirements. At the local level, environmental requirements are perceived to be particularly onerous. Critics of those so-called "unfunded mandates" argue that they place a large burden on local governments, the federal government frequently underestimates local costs, the costs of such mandates sometimes outweigh their benefits, and often the mandates lack the flexibility to accommodate important differences in local conditions. The Congressional Budget Office (CBO) examined available data to determine the validity of those criticisms with respect to the Safe Drinking Water Act (SDWA). The SDWA was enacted in 1974 and requires all public water systems to meet drinking water standards and monitoring requirements that the Environmental Protection Agency (EPA) has developed.

CBO chose to use the SDWA as a case study of the unfunded mandates issue because the SDWA has been identified as one of the more burdensome federal mandates. In addition, examining its local cost impact is relatively easy because only a limited amount of federal aid is provided to drinking water systems. Consequently, one does not need to try and separate federally funded costs from locally funded costs for most systems. Even with that simplifying feature, this case study highlights many of the difficulties in measuring the costs and benefits of federal mandates. Data on costs and benefits are limited. In addition, no reliable method exists to estimate the incremental cost of the SDWA--that is, the additional

expenditures that federal standards require water systems to make above and beyond the expenditures that they would have made to ensure safe drinking water without such standards. Despite those difficulties, this study reaches several conclusions.

To Date, the SDWA Has Resulted in Fairly Modest Costs for Most Households

Although the SDWA has been cited as a particularly burdensome mandate, available data do not indicate that it has imposed high costs on most households. Cost estimates from the EPA and available data on actual experiences with costs at the local level both indicate that most households--approximately 80 percent--are expected to incur costs of less than \$20 per year to treat their drinking water to meet the standards specified by the existing rules of the SDWA. Moreover, comparing EPA data with available local estimates does not reveal that the EPA has underestimated local compliance costs.

The limited available data indicate that the Safe Drinking Water Act currently places a small fiscal burden on most municipalities, accounting for less than 0.1 percent of median household income or average residential property values. Although those results are important, this study did not examine the cumulative effect that multiple federal mandates have on municipalities.

Average household costs are modest for most communities, but some could face very high household costs--in excess of \$100 per year--under existing drinking water standards. Households served by small water systems are particularly likely to face high costs. Furthermore, compliance costs could increase significantly over time. In fact, four rules that are currently proposed under the SDWA could more than triple compliance costs.

Benefit-to-Cost Ratios Vary Widely by Categories for Contaminants and System Sizes

For both existing and proposed regulations for carcinogens in drinking water, CBO examined available data on the cost per cancer case avoided--that is, the cost to prevent a single case of cancer. Those data indicate that the cost per cancer case avoided varies greatly among contaminants. For example, the average cost per cancer case avoided (averaged for all system sizes) is estimated at \$500,000 for regulating the pesticide ethylene dibromide and its co-contaminants compared with more than \$4 billion for regulating the pesticides atrazine and alachlor. In addition, the cost per cancer case avoided tends to increase sharply as the size of the system decreases. For example, in the category for the largest-sized systems, the expected cost per cancer case avoided because of the proposed regulation of adjusted gross alpha emitters (which primarily reduces exposure to the radionuclide polonium) is \$600,000 compared with more than \$1 billion for the category for the smallest-sized systems.

Conclusions about the merits of drinking water standards are limited by a great deal of uncertainty underlying estimates of both costs and benefits. However, in some cases the cost per cancer case avoided would need to be decreased by a factor of 10 or more to fall within the range that is generally considered reasonable.

The most costly rule currently proposed is the Disinfectants/Disinfection By-Product (D/DBP) Rule. The degree to which that rule would reduce the risk of cancer is extremely uncertain. The EPA estimates that the average cost per cancer case avoided ranges between \$867,000 and \$8.7 billion in the initial stage of the rule and between \$840,000 and \$19 billion in the extended stage.

The second most costly rule currently proposed is the Enhanced Surface Water Treatment (ESWT) Rule, which is designed to prevent the outbreak of waterborne gastrointestinal diseases. Using an estimate of medical costs and lost wages as a measure of benefit, the benefits are expected to exceed the average cost per case of waterborne disease avoided as a result of complying with the proposed initial phase of the ESWT rule (averaged for all systems). That assessment, however, is based on limited data on the potential risk of waterborne diseases.

The EPA's and States' Use of Legislative Tools to Provide Flexibility to Water Systems Has Been Limited

One benefit of federal drinking water standards is the assurance that all water systems meet minimum health standards. A potential disadvantage of federal requirements, however, is that uniform requirements may cause some localities to take actions that do not make sense for their specific community--such as testing for chemicals that are not used in their area or undertaking treatment measures for which the costs far outweigh the benefits. An important question, therefore, is whether the SDWA provides sufficient flexibility to adjust requirements in those cases.

The SDWA provides the EPA and the states with several tools that are designed to allow them to provide flexibility to water systems. Those measures of flexibility, however, have not been widely used. Furthermore, numerous barriers prevent more wide-

spread use of those measures. Such barriers include constraints on resources, concerns about public perception, and the effect that those measures might have on protecting public health.

The SDWA Case Study Highlights Challenges That CBO Faces in Providing State and Local Cost Estimates

The Unfunded Mandates Reform Act of 1995 requires CBO to estimate the costs that proposed legislation will impose on state and local governments as well as the private sector. The SDWA case study highlights some of the challenges involved in fulfilling that responsibility. Because mandates are often designed to achieve goals that state and local govern-

ments share, a particularly difficult issue is how to estimate the additional, or incremental, costs that a mandate imposes--above and beyond the expenditures that state and local governments would have made in its absence.

Estimating state and local costs at the legislative stage is more difficult than estimating the cost of current and proposed standards under the SDWA for at least three reasons. First, legislation is often broad and lacks the specifics, which are developed through the regulatory process, to project costs. Second, many of the sources of data used in this study are not available at the legislative stage. Third, often only a very limited amount of time is available to collect information on projected state and local costs. As a result of those complicating factors, cost estimates constructed at the legislative stage will be much less precise than examinations conducted after the law or regulation has taken effect.

Introduction

In the past several years, a growing movement has attempted to draw attention to the costs that state and local governments bear in complying with federal requirements. At the local level, environmental laws are regarded as particularly burdensome. For example, in two surveys that were designed to draw attention to the cost that federal mandates impose on local governments, over half of the mandates on which localities provided information were environmental ones.¹ The Congressional Budget Office (CBO) examined the Safe Drinking Water Act (SDWA) as a case study of federal mandates. The SDWA requires all public water systems to comply with drinking water standards and monitoring requirements developed by the Environmental Protection Agency (EPA).

CBO chose to use the SDWA as a case study of federal mandates for two reasons. First, it has often been cited as a particularly onerous mandate.² Second, examining the local cost impact is relatively easy because only limited offsetting federal funds have been provided to localities; hence, separating local from federal cost shares is unnecessary.

The increasing concern about the costs that federal mandates impose on state and local governments has led the Congress to pass legislation--the Unfunded Mandates Reform Act of 1995--that would make it harder to enact additional unfunded mandates. That legislation allows Members of Congress to raise a point of order against intergovernmental mandates that exceed a \$50 million threshold unless funding is provided to pay fully for the mandate. The legislation also requires CBO to estimate the cost of federal mandates to state and local governments.

The analysis of the SDWA conducted in this study does not represent the types of cost estimates that CBO will make under the Unfunded Mandates Reform Act. Rather, this study is a much more complete analysis that examines both costs and benefits using data that are typically not available at the legislative stage. (See Chapter 6 for a more complete discussion of the requirements of the Unfunded Mandates Reform Act of 1995 and the challenges that CBO faces in providing state and local cost estimates.)

1. See the U.S. Conference of Mayors, *Impact of Unfunded Federal Mandates on U.S. Cities* (Washington, D.C.: U.S. Conference of Mayors, October 1993); and National Association of Counties, *The Burden of Unfunded Mandates: A Survey of the Impact of Unfunded Mandates on American Counties* (Washington, D.C.: National Association of Counties, October 1993).

2. For example, see "Costly Federal Mandates Spur Protest," *Washington Post*, October 27, 1993, p. A3.

Study Objectives

Critics of unfunded mandates argue that the number of mandates that the federal government has imposed on state and local governments has increased while the amount of federal aid has declined and that those

mandates displace local priorities. Furthermore, they argue that the federal government has often underestimated the cost of complying with those mandates; the costs of the mandates sometimes outweigh the benefits; the mandates have placed a large burden on local governments; and the federal mandates are inflexible, requiring localities to do things that do not make sense for their particular communities.

Conversely, proponents of federal mandates argue that they prevent states and localities from imposing costs on citizens or businesses outside their boundaries and that they ensure that citizens are guaranteed a minimum level of safety (such as clean drinking water) or rights (such as access to public facilities for handicapped people) regardless of where they live or travel. In addition, uniform national standards may be more efficient than multiple state or local standards in some cases, such as for companies that have plants in different locations. Finally, uniform standards may prevent local governments from setting lower safety or environmental standards in order to attract businesses to their area.

In this study, CBO examines whether some of the criticisms that have been made of federal mandates are valid for the SDWA. Specifically, it examines whether the SDWA:

- o Has imposed large costs on households,
- o Has costs that exceed benefits,
- o Has imposed a large fiscal burden on municipalities, and
- o Lacks flexibility to allow regulators to adjust the act's requirements based on the specific circumstances of individual communities.

In addition, CBO examines whether the available data on the SDWA show that the federal government has underestimated the actual costs of compliance. Finally, CBO uses the SDWA to draw conclusions about the challenges that it faces in providing state and local cost estimates.

Measuring the Incremental Cost of Unfunded Federal Mandates

Many federal mandates are designed to achieve a goal that state and local governments share. Consequently, many state and local governments would take actions toward achieving that goal without a federal mandate. The true cost of the mandate, therefore, is the incremental cost that the mandate imposes on state and local governments. For example, most communities strive to provide their residents with safe drinking water. They would undertake some testing and treatment of their drinking water even without federal requirements. Calculating the incremental cost of the SDWA requires subtracting the cost of treatment and testing that communities would have undertaken without the mandate from the total treatment and testing costs that they incur once the mandate is in place. Unfortunately, no accurate method is available to determine what communities would have done if no federal requirements had been in force.

Because the actions that communities would have taken without a mandate are unknown, cost estimates of mandates typically reflect total, not incremental, costs. Those cost estimates, therefore, generally overstate the cost of the mandate. For example, when the EPA estimates the cost of the SDWA, it typically does not attempt to exclude the costs of testing and treatment that communities would have undertaken without federal drinking water standards.

Data on the Costs and Benefits of the Safe Drinking Water Act

Three primary sources provide information about the cost of the SDWA:

- o Census data indicate actual expenditures for drinking water by local governments in the United States. Although those data reflect actual costs at the national level, they do not provide a breakdown of what share of the costs are the result of drinking water treatment, as opposed to delivery.
- o Engineering models are used to construct cost estimates based on assumptions about treatment design characteristics and cost components. An advantage of those estimates is that they may be designed to represent costs at the national level. However, they have two major limitations. The costs generated by those models depend on numerous assumptions and may not accurately reflect actual costs. In addition, those estimates do not account for the actions that communities would have undertaken in the absence of drinking water standards--that is, they reflect total, not incremental, costs.
- o Data on actual costs at the local level are available in the form of case studies and surveys. The most comprehensive source of data on actual local costs (and the one used in this study) is a municipal expenditure survey that was conducted by Price Waterhouse for the United States Conference of Mayors and the National Association of Counties. That survey, however, was not designed to be representative at the national level, has numerous quality control limitations, and also reflects total--not incremental--costs.

Data on benefits are even more limited than those on costs. Estimates of benefits do not accompany local estimates of actual costs for particular communities in the municipal expenditure survey. The EPA is the primary source of information on benefits. In some cases, the EPA provides information on the number of health effects (such as cases of cancer or gastroenteritis) that may be avoided as a result of the regulation. In other cases, it is only able to estimate the number of people who will avoid exposure to a contaminant.

Although the data on both costs and benefits are limited, careful examination and comparison of the available data reveal important insights into the magnitude of the burden that the SDWA places on local

communities and the potential sources of local discontent.

Background on Drinking Water Regulations and Trends in Cost

Local governments treated their drinking water to ensure acceptable taste and odor and to prevent the outbreak of acute waterborne disease long before the Environmental Protection Agency was established and the SDWA was enacted. The initial federal action concerning drinking water was the establishment of the Public Health Service (PHS) Hygienic Laboratory in 1901.³ That laboratory investigated infectious diseases. In 1914, the PHS established criteria to test drinking water that interstate carriers used. Over time, those standards began to be applied to water that was distributed by municipalities, and such standards were revised in 1925, 1946, and 1962. By 1971, a large number of states had officially adopted or were using the PHS drinking water standards. However, the federal enforcement authority was limited to prohibiting interstate carriers from using water from a system that failed to comply with standards.

Several events led to the passage of the SDWA in 1974, which considerably expanded the federal role in protecting drinking water. First, although waterborne diseases had been virtually eliminated since the 1930s, they began to reemerge during the 1960s. One explanation for that reemergence was that states switched often limited resources away from drinking water safety programs to deal with water pollution following the inception of the federal water pollution program in 1948. In response to the reemergence of waterborne disease, the Bureau of Water Hygiene of

3. The discussion on drinking water treatment before the passage of the SDWA and the factors that led to its passage is drawn from Thomas J. Douglas, "Safe Drinking Water Act of 1974--History and Critique," *Environmental Affairs*, vol. 5 (Summer 1976); statement of Robert W. Fri, Deputy Administrator, Environmental Protection Agency, before the Subcommittee on Public Health and Environment of the House Committee on Interstate and Foreign Commerce, March 8, 1973; and Congressional Quarterly, *Almanac: 93rd Congress, 2nd Session--1974*, vol. 30 (1974), pp. 423-426.

Box 1.
Existing and Proposed Rules Under
the Safe Drinking Water Act as of September 1994

Following the 1986 amendments to the Safe Drinking Water Act, the Environmental Protection Agency (EPA) issued seven major rules (referred to as "existing rules" in this study). In addition, EPA has proposed four more rules.

Existing Rules

The EPA has issued rules for both individual contaminants, such as fluorides, and groups of contaminants, such as inorganic compounds. Each of the final rules is listed below. The Phase II rule is broken down into synthetic organic compounds and inorganic compounds. The date in parentheses indicates when the rule was published in the *Federal Register*. Rules generally become effective 18 months after they are published.

Fluoride (April 2, 1986). Fluorides occur naturally and are added during the treatment process in many water systems. Amounts greater than two parts per million can have harmful effects, ranging from discoloration and pitting of teeth to bone and skeletal damage. Systems must test for fluoride. If it is found to be above allowable levels, they must change their operations or take other actions to lower the level.

Phase I Volatile Organic Compounds (July 8, 1987). Volatile synthetic organic chemicals (VOCs) are man-made compounds used for a variety of industrial and manufacturing purposes in the form of products such as solvents, degreasers, and dry cleaning chemicals. VOCs have adverse effects on the liver, kidneys, and nervous system, and they may cause cancer in humans. Water systems must sample for VOCs. When the compounds are found, the source of the VOCs must be removed or treatment must be undertaken.

Surface Water Treatment Rule (June 29, 1989).

The rule for treating surface water requires treatment to control bacteria and other microbes that are difficult to detect and pose immediate health risks. This rule covers all surface water systems and groundwater systems that are under the direct influence of surface water. The rule requires affected systems to disinfect and install a subset of systems to filter their water.

Total Coliform Monitoring (June 29, 1989).

Total coliform monitoring requirements affect all community water systems. Systems are required to conduct monthly tests for coliform bacteria, which indicate whether potentially harmful bacteria may be in the water. Over the years, bacteria from sewage and animal wastes have presented the most frequent and immediate health risks to community water supplies.

Phase II Synthetic Organic Compounds (January 30, 1990, for 14 Contaminants; July 1, 1991, for One Contaminant).

This rule covers Phase II synthetic organic compounds (SOCs) and nonvolatile man-made compounds, primarily pesticides and polychlorinated biphenyls. Adverse health effects from exposure to SOCs include damage to the nervous system and kidneys and risk of cancer. Vulnerable water systems must test for SOCs. If the contaminants are found, the source of the SOCs must be removed or the water supply must be treated to remove them.

Phase II Inorganic Compounds (January 30, 1990, for 19 Contaminants; July 1, 1991, for Four Contaminants).

Phase II inorganic compounds (IOCs) may be naturally occurring in geological structures or they may be caused by mining, industrial, or agricultural activities. In large amounts, these chemicals can damage the liver, kidney, nervous system, circulatory system, blood, gastrointestinal system, bones, or skin.

the PHS undertook a study of 969 public water systems in 1969. That study played an important role in generating Congressional interest in legislation on drinking water and the ultimate passage of the SDWA. It indicated deficiencies in the quality of drinking water, the capacities of purifying and distri-

bution systems, and the surveillance of water systems by state and local officials. Furthermore, the study noted that many of the Public Health Service's drinking water standards had been based on insufficient data and that they did not cover many contaminants found in drinking water.

All community water systems must monitor for regulated IOCs. If IOCs are found, their level must be adequately reduced or treatment must be undertaken.

Lead and Copper (June 7, 1991). Lead and copper contamination generally occurs after water has left the public water system. Therefore, testing for it should be done at household faucets. Water systems must target homes with a high risk of lead and copper contamination and conduct tests in those locations. If contamination is found, water systems must reduce the corrosiveness of the water or replace materials containing lead under the control of the water system. Water systems are not required to replace customers' pipes containing lead.

Phase V SOCs and IOCs (July 25, 1992). See the description above of Phase II SOCs and IOCs.

Proposed Rules

The EPA has proposed four rules that are not yet final. The Radionuclides Rule and the Sulfate Rule cover compounds that the EPA was specifically required to regulate under the 1986 amendments. The Disinfectants/Disinfection By-Product Rule is one of the first group of 25 substances for which EPA is required to set standards.

Radionuclides Rule. The Radionuclides Rule sets standards for radon-222, radium-226, radium-228, uranium, and adjusted gross alpha emitters. Those radionuclides are classified as Group A human carcinogens; in addition, uranium is toxic to kidneys. People can be exposed to radionuclides by drinking tap water that contains them or by inhaling radionuclides released into indoor air from tap water. The proposed rule on radionuclides primarily affects groundwater systems.

Disinfectants and Disinfection By-Products. Disinfectants (such as chlorine) are used by over 90 percent of surface water systems and less than one-half of

groundwater systems to prevent diseases caused by microbiological contaminants. Although disinfection provides important benefits, the disinfectants themselves can react with organic materials in water supplies to form disinfection by-products. Such by-products may ultimately increase the risk of cancer. Stage I of the proposed rule would require systems to use existing treatment processes to remove precursors (for example, total organic carbon) of disinfection by-products. Stage II would require systems serving more than 10,000 people to undertake testing and treatment for disinfection by-products. An extended Stage II would expand those requirements to all systems.

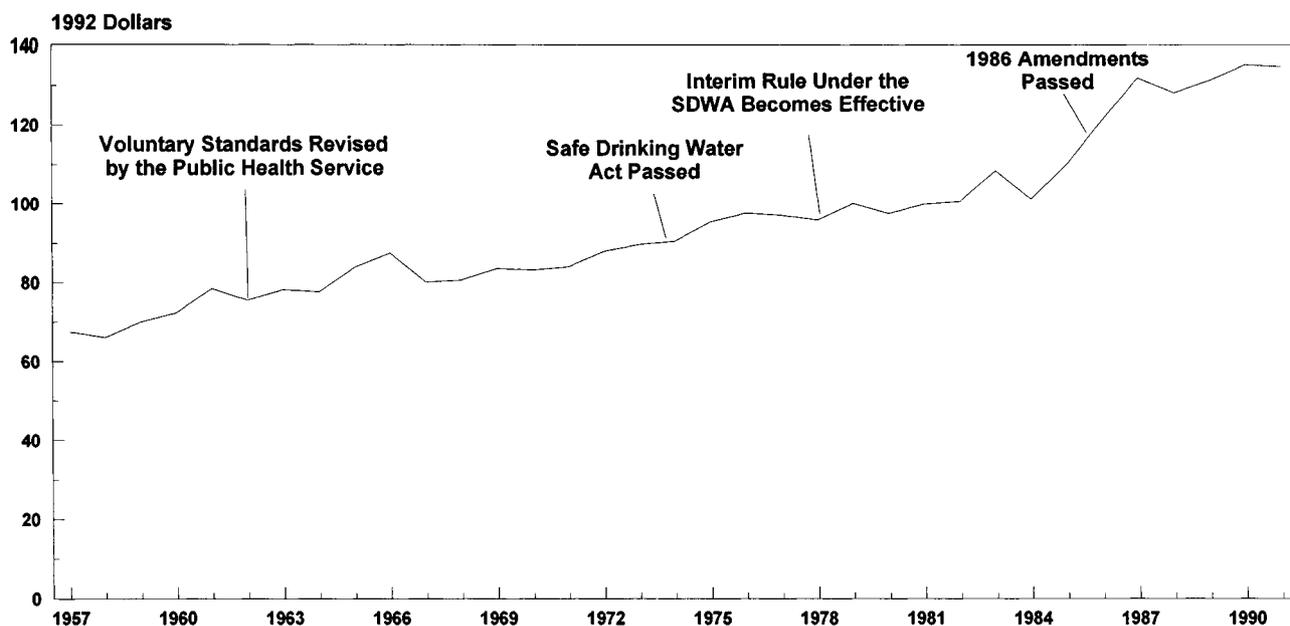
Enhanced Surface Water Treatment Rule. The rule on enhanced surface water treatment (ESWT) would expand the controls established under the Surface Water Treatment Rule. Additional controls are proposed because of new evidence that exposure to microbial contaminants in surface waters may be significantly greater than previously believed. In addition, requirements under the proposed rule for disinfectants and disinfection by-products may result in greater risk from microbial contaminants. Under the proposed rule, an "interim" ESWT rule would require additional controls for systems serving more than 10,000 people. A "long-term" ESWT rule would extend those requirements to all systems.

Sulfate Rule. The primary adverse health effect of ingested sulfate is diarrhea in unacclimated individuals, who include infants and new residents and visitors to high-sulfate areas. The Environmental Protection Agency is proposing four options for regulating sulfate. The preferred option, Option 1, is an alternative to central treatment. Under that option, a system may comply by providing the exposed population with alternative water supplies, establishing and maintaining a public education program, and carrying out a public notice program. Under that option, systems may still opt for central treatment, and almost all large systems are expected to do so.

In addition to the reemergence of waterborne diseases, the passage of the SDWA stemmed from a concern about introducing many new chemical pollutants into water supplies following World War II and the belief that treatment technology for drinking water was not advancing rapidly enough to address

those types of pollutants. Two reports--one by the Environmental Defense Fund and the other by the EPA--linked certain pollutants found in drinking water with cancer. Those reports provided the final impetus needed to pass the SDWA.

Figure 1.
Annual Local Expenditures for Water Supply Measured on a Per Capita Basis, 1957-1991



SOURCE: Congressional Budget Office calculations based on data from the Environmental Protection Agency and the Bureau of the Census.

NOTES: Local expenditures were divided by estimates of the population served by publicly owned community water systems.

SDWA = Safe Drinking Water Act.

In 1974, the Congress passed the SDWA and directed the EPA to define national interim regulations for primary drinking water while final regulations were being developed. The interim regulations codified existing health standards; they were promulgated in December 1976 and became effective in mid-1978. Another rule--the total trihalomethane regulation--was issued in 1979 and became effective 18 months later. Trihalomethanes are cancer-causing by-products that may form when drinking water is treated with chlorine. The interim regulations and the total trihalomethane rule were the only national regulations covering drinking water in effect before the 1986 amendments to the Safe Drinking Water Act were passed.

The 1986 amendments directed the EPA to develop regulations for 83 specific contaminants as well as regulations mandating filtration (for those water systems supplied by surface water sources) and

disinfection (for all water from public water supplies).⁴ In addition, the law required the EPA to regulate 25 additional contaminants every three years. Since 1986, the EPA has issued seven major regulations that establish standards for either a specific contaminant or groups of contaminants. Under those rules, the EPA sets standards--called maximum contaminant levels--for each contaminant. All of the seven rules are now in effect. Moreover, four regulations are currently in the proposal stage. Two of the proposed rules would be phased in, either having less rigorous requirements or only covering large systems in the initial phase. (See Box 1 on pages 4 and 5 for a listing of the existing and proposed rules.)⁵

4. Environmental Protection Agency, *Estimates of the Total Benefits and Total Costs Associated with Implementation of the 1986 Amendments to the Safe Drinking Water Act* (March 1990).

5. Rules that are now in their final form are referred to as "existing rules" in this report. The EPA refers to those rules as "final rules."

To date, no federal aid has been provided to drinking water systems for the explicit purpose of helping them to comply with the SDWA requirements. Since 1940, however, the Department of Agriculture's Rural Development Administration has provided loans to drinking water systems in rural areas or in cities or towns having populations of 10,000 or less. A grant program was added in 1966. Although most of those funds have been used to build infrastructure for water delivery, the program does not preclude recipients from using the funds to build drinking water treatment facilities.

Average per capita local water expenditures by publicly owned water systems (net of federal funds and adjusted for inflation) have increased significantly, rising from \$67 in 1957 to \$132 in 1991 (see Figure 1).⁶ Using the average household size in those

years would bring those costs to \$223 per household in 1957 and \$343 in 1991.

Increased treatment of drinking water is a factor that could explain at least part of the increase over the 1957-1991 period. However, numerous other factors could contribute to the increase as well. In addition to the need to treat their drinking water, water systems face rising costs for replacing and upgrading their aging infrastructure for water delivery and may be forced to use higher-cost water supplies as populations grow and low-cost supplies are depleted. In addition, increases in household income affect the demand for water.⁷

6. Note that in some years, real (inflation-adjusted) per capita expenditures decreased because nominal per capita expenditures increased less than the inflation rate.

To figure per capita costs, CBO divided local expenditures for water supply in each year by an estimate of the population served by locally owned public water systems. That estimate was based on Bureau of the Census data on the percentage of households served by public and private community water systems and on information about the percentage of community water systems that are publicly, rather than privately, owned (see the appendix for details on how per capita costs were constructed). CBO obtained the latter information from the EPA's Federal Reporting Data System.

7. Models of residential demand for water have generally found income to have a small but statistically significant effect. The magnitude of that effect varies with the model, the region of the country, and the price rate structure. However, most estimates indicate that a 10 percent increase in income would result in an increase in water consumption of between 1 percent and 2 percent. For example, see Michael Niegwiadomy and David Molina, "Comparing Residential Water Demand Estimates Under Decreasing and Increasing Block Rates Using Household Data," *Land Economics*, vol. 65, no. 3 (August 1989); and Michael Niegwiadomy and David Molina, "A Note on Price Perception in Water Demand Models," *Land Economics*, vol. 67, no. 3 (August 1991).

