Safe Drinking Water Act (SDWA): Selected Regulatory and Legislative Issues

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Summary

Much progress has been made in assuring the quality of public water supplies since the Safe Drinking Water Act (SDWA) was first enacted in 1974. Public water systems must meet extensive regulations, and water utility management has become a much more complex and professional endeavor. The Environmental Protection Agency (EPA) has regulated some 91 drinking water contaminants, and more regulations are pending. In 2007, the number of community water systems reporting no violations of drinking water standards was 89.5%. Despite nationwide progress in providing safe drinking water, an array of issues and challenges remain.

Recent issues have involved infrastructure funding needs, regulatory compliance issues, and concerns caused by detections of unregulated contaminants in drinking water, such as perchlorate and pharmaceuticals and personal care products (PPCPs). Another issue involves the adequacy of existing regulations (such as trichloroethylene (TCE)) and EPA's pace in reviewing and potentially revising older standards. Congress last reauthorized SDWA in 1996. Although funding authority for most SDWA programs expired in FY2003, Congress continues to appropriate funds annually for these programs. No broad reauthorization bills have been proposed, as EPA, states, and water systems continue efforts to implement current statutory programs and regulatory requirements. A long-standing and overarching SDWA issue concerns the cumulative cost and complexity of drinking water standards and the ability of water systems, especially small systems, to comply with standards. The issue of the affordability of drinking water regulations, such as those for arsenic, radium, and disinfection by-products, has merged with the larger debate over what is the appropriate federal role in assisting communities with financing drinking water projects needed for SDWA compliance, and for water infrastructure improvement generally.

Water infrastructure financing legislation has been offered repeatedly in recent Congresses to authorize higher funding levels for the Drinking Water State Revolving Fund (DWSRF) program, and also to provide grants and other compliance assistance to small communities. In the 111th Congress, this issue found early focus in the economic stimulus debate, and the American Recovery and Reinvestment Act of 2009 (ARRA; P.L. 111-5) included $2 billion for the DWSRF program. The Omnibus Appropriations Act, 2009, provided $829 million for this program, and the Department of the Interior, Environment, and Related Agencies Appropriations Act, 2010 (P.L. 111-88), included an additional $1.387 billion. In July, the Senate Environment and Public Works Committee reported S. 1005, a drinking water and wastewater infrastructure financing bill, and a bill to establish a water infrastructure trust fund, H.R. 3202, was introduced in the House.

A newer SDWA issue concerns proposals and research regarding the underground injection of carbon dioxide (CO_2) for long-term storage as a means of reducing greenhouse gas emissions. EPA has proposed regulations under SDWA to provide a national permitting framework for managing the underground injection of CO_2 for commercial-scale sequestration projects. In August 2009, EPA published a notice of data availability and requested additional comment on the proposed rule. The Energy Independence and Security Act of 2007 (EISA; P.L. 110-140) included carbon sequestration research and development provisions, and specified that geologic sequestration activities shall be subject to SDWA provisions related to protecting underground drinking water sources. Another underground injection issue concerns the increasing use of hydraulic fracturing to produce natural gas from unconventional geologic formations. Bills have been introduced to authorize regulation of this practice under the SDWA underground injection control program.

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Introduction

The Safe Drinking Water Act[1] (SDWA) is the primary federal law for protecting public water supplies from harmful contaminants. First enacted in 1974, and broadly amended in 1986 and 1996, the SDWA is administered through programs that regulate contaminants in public water supplies, provide funding for infrastructure projects, protect underground sources of drinking water, and promote the capacity of water systems to comply with SDWA regulations.

The Environmental Protection Agency (EPA) is the federal agency responsible for administering SDWA; however, the 1974 law established a federal-state structure in which EPA may delegate primary enforcement and implementation authority (primacy) for the drinking water program to states and tribes. The state-administered Public Water Supply Supervision (PWSS) program remains the basic program for regulating public water systems, and EPA has delegated primacy for this program to all states, except Wyoming and the District of Columbia (which SDWA defines as a state). EPA has responsibility for implementing the PWSS program in these two jurisdictions and throughout most Indian lands.[2]

A second key portion of the act requires EPA to regulate the underground injection of fluids to protect underground sources of drinking water. Primary enforcement authority for the underground injection control (UIC) program also may be delegated to the states. Thirty-three states have assumed primacy for the program, EPA has lead implementation and enforcement authority in 10 states, and authority is shared in the remainder of the states.

Since the law was first enacted, much progress has been made in assuring the quality of public water supplies. EPA has regulated 91 drinking water contaminants, and more regulations are pending. Despite this progress, drinking water safety concerns and challenges remain. According to EPA's 2006 National Public Water Systems Compliance Report, the number of public water systems reporting no violations of the health-based standards for 2006 was 93%, and 73% of the U.S. population was served by public water systems that had no reported significant violations.[3] However, EPA estimated that states had submitted to the EPA database only 62% of violations of health-based standards and 29% of violations of monitoring and reporting requirements, thus increasing uncertainty as to the quality of water provided by many systems. EPA and the states have resolved some data quality and reporting problems, and efforts to address this issue continue. EPA and state compliance data indicate that water systems still incur tens of thousands of violations of SDWA requirements each year. Although these violations primarily involve monitoring and reporting requirements, they also include thousands of violations of standards and treatment techniques. Moreover, monitoring and reporting violations create uncertainty as to whether systems actually met the applicable health-based standards.

[1] Title XIV of the Public Health Service Act, as added by P.L. 93-523 and subsequently amended (42 U.S.C. 300f-300j-26).

[2] For purposes of the PWSS program, the term "state" includes 57 states, commonwealths, and territories that have been approved to implement the drinking water program within their jurisdiction. It also includes the Navajo Nation, which received EPA approval to implement its drinking water program in 2000.

[3] U.S. Environmental Protection Agency, *Providing Safe Drinking Water in America: 2006 National Public Water Systems Compliance Report*. Office of Enforcement and Compliance Assurance. Report No. EPA-K-09-002. March 2009. 18 p. plus appendixes.

Also at issue is the rate at which EPA has been reviewing and updating existing contaminant regulations to respond to newer scientific information (e.g., trichloroethylene (TCE)) or to address implementation and compliance problems (e.g., the Lead and Copper Rule).[4] Concern also exists over the potential health effects of drinking water contaminants for which standards have not been set, such as perchlorate and methyl tertiary butyl ether (MTBE). The act requires EPA to continually evaluate contaminants that may be candidates for regulation and to periodically review existing standards; however, EPA's perceived lack of action on specific contaminants of concern has generated criticism in Congress and elsewhere.

Last Major Reauthorization and Amendments

Congress last broadly revised the act with the Safe Drinking Water Act Amendments of 1996 (P.L. 104-182). These changes resulted from a multi-year effort to amend a statute that was widely criticized as having too little flexibility, too many unfunded mandates, and an arduous but unfocused regulatory schedule. Among the key provisions, the 1996 amendments authorized a drinking water state revolving loan fund (DWSRF) program to help public water systems finance projects needed to comply with SDWA regulations. The amendments also established a process for selecting contaminants for regulation based on health risk and occurrence, gave EPA some added flexibility to consider costs and benefits in setting most new standards, and established schedules for regulating certain contaminants (including *Cryptosporidium*, disinfection byproducts, arsenic, and radon).

The 1996 law added several provisions aimed at building the capacity of water systems (especially small systems) to comply with SDWA regulations, and imposed many new requirements on the states. Among other provisions, the amendments required states to develop programs for source water assessment, operator certification and training, and compliance capacity development. The law also required community water systems to provide customers with annual "consumer confidence reports" that contain information on regulated contaminants found in the local drinking water. Appropriations for most SDWA programs were authorized through FY2003, and although most of the act's funding authorities have expired, broad reauthorization bills have not been proposed, as EPA, states, and public water systems remain focused on meeting the requirements of the 1996 amendments.

In 2002, Congress added drinking water security provisions to the SDWA through the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (P.L. 107-188, Title IV). New SDWA section 1433 required community water systems serving more than 3,300 people to conduct vulnerability assessments and prepare emergency response plans. The law also required the EPA to conduct research on preventing and responding to terrorist or other attacks. In November 2009, the House passed H.R. 2868, the Chemical and Water Security Act of 2009, to direct the EPA Administrator to issue regulations establishing risk-based performance standards for covered water and wastewater utilities. The bill would require systems to update vulnerability assessments, develop site security and emergency response plans, and provide employee training.[5]

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[4] SDWA §1412(b)(9) requires that, at least once every six years, the EPA Administrator must review and revise, as appropriate, each national primary drinking water regulation. Any revision must maintain or provide for greater public health protection. (42 U.S.C. 300g-1)

[5] For more information, see CRS Report R40695, *Chemical Facility Security: Reauthorization, Policy Issues, and Options for Congress*, by Dana A. Shea, and CRS Report RL31294, *Safeguarding the Nation's Drinking Water: EPA* (continued...)

Regulated Public Water Systems

Federal drinking water regulations apply to some 154,879 privately and publicly owned water systems that provide piped water for human consumption to at least 15 service connections or that regularly serve at least 25 people. (The law does not apply to private residential wells.) Of these systems, 51,988 are *community water systems* (CWSs) that serve most people in the United States—a total residential population of roughly 292 million year-round. All SDWA regulations apply to these systems. Another 18,742 systems are *non-transient, non-community water systems* (NTNCWSs), such as schools or factories, that have their own water supply and serve the same people for more than six months but not year-round. Most drinking water requirements apply to these systems. Additionally, 84,149 systems are *transient non-community water systems* (TNCWSs) (e.g., campgrounds and gas stations) that provide their own water to transitory customers. TNCWSs generally are required to comply only with regulations for contaminants that pose immediate health risks (such as microbial contaminants), with the proviso that systems that use surface water sources must also comply with filtration and disinfection regulations.

Of the nearly 52,000 community water systems, roughly 83% serve 3,300 or fewer people. While large in number, these systems provide water to just 9% of the population served by all community systems. In contrast, 8% of community water systems serve more than 10,000 people, and they provide water to 82% of the population served. Fully 85% (15,954) of non-transient, non-community water systems and 97% (81,324) of transient noncommunity water systems serve 500 or fewer people. These statistics give some insight into the scope of financial, technological, and managerial challenges many public water systems face in meeting a growing number of complex federal drinking water regulations. **Table 1** provides statistics for community water systems.

Table 1. Size Categories of Community Water Systems

System size (population served)	Number of community water systems	Population served (millions)	Percentage of community water systems	Percentage of population served
Very small (25-500)	29,1606	4.86	56%	2%
Small (501-3,300)	13,585	19.87	27%	7%
Medium (3,301-10,000)	4,838	28.13	9%	10%
Large (10,001-100,000)	3,728	106.31	7%	36%
Very large (>100,000)	404	133.13	1%	46%
Total	51,988	282.3	100%	100%

Source: Adapted from US Environmental Protection Agency, *Factoids: Drinking Water and Ground Water Statistics for 2008*, EPA 816-K-08-004, November 2008.

(...continued)

and Congressional Actions, by Mary Tiemann.

Safe Drinking Water Act Issues

Recent drinking water safety issues have included the gap between infrastructure funding needs and spending; the capacity of public water systems, especially small systems, to comply with a growing set of complex standards; and the contamination of water supplies by unregulated contaminants, such as perchlorate and various pharmaceuticals and personal care products. Issues involving the act's groundwater protection provisions include proposals for large-scale storage of carbon dioxide deep underground to mitigate greenhouse gas emissions, as well as the increased reliance on hydraulic fracturing to develop domestic gas resources, and the potential impacts these activities might have on underground sources of drinking water. Congress last reauthorized appropriations for most SDWA programs in the 1996 amendments, through FY2003. As with other EPA-administered statutes having expired funding authority, Congress has continued to appropriate funds annually for SDWA programs.

In the 111th Congress, three SDWA bills, all funding-related, have been enacted. The American Recovery and Reinvestment Act of 2009 (ARRA; P.L. 111-5) provided $2 billion for drinking water infrastructure projects through the Drinking Water State Revolving Fund program, the Omnibus Appropriations Act, 2009 (P.L. 111-8), included $829 million for this water infrastructure funding program, and the Department of the Interior, Environment, and Related Agencies Appropriations Act, 2010 (P.L. 111-88), provided $1.387 billion for the program. The FY2010 funding act and ARRA require states to make available at least 20% of their DWSRF grants for projects to address green infrastructure, water or energy efficiency improvements, or other environmentally innovative activities.[6] Additionally, ARRA included $50 million for site characterization activities in geologic formations related to carbon sequestration, and $20 million for geologic sequestration training and research activities.

In July, the Senate Environment and Public Works Committee reported the Water Infrastructure Financing Act (S. 1005, S.Rept. 111-47), which would authorize a grant program and increase funding authority for the drinking water and clean water state revolving fund programs. Other introduced bills include H.R. 3727 and S. 1035, which would require EPA to establish a research program to help water utilities develop and implement climate change adaptation policies.

Regulating Drinking Water Contaminants

Contaminant Candidate List

Since 1996, the Safe Drinking Water Act has required EPA to publish, every five years, a list of unregulated contaminants that are known or anticipated to occur in public water systems and that may require regulation (§1412(b)(1)). EPA published contaminant candidate lists (CCLs) in 1998 (CCL 1) and in 2003 (CCL 2). In early 2008, EPA published for public comment a draft CCL 3 that contains 93 chemicals or chemical groups and 11 microbiological contaminants (73 *Fed. Reg.* 9627).[7] The list included commercial and agricultural chemicals, biological toxins, disinfection

[6] For information on water infrastructure provisions in ARRA, see CRS Report R40216, *Water Infrastructure Funding in the American Recovery and Reinvestment Act of 2009*, by Claudia Copeland, Nicole T. Carter, and Megan Stubbs.

[7] The Environmental Protection Agency's Contaminant Candidate List 3 and related documents are available at http://www.epa.gov/safewater/ccl/ccl3.html.

byproducts, and pathogens; 16 chemicals, including perchlorate, were carried over from CCL 2. EPA screened some 7,500 chemicals and microbes and selected 104 candidates for the draft CCL 3. As discussed below, the list did not include any pharmaceuticals. EPA has been reviewing the effectiveness of its screening process, as recommended by the National Academy of Sciences (NAS).

Regulatory Determinations

Every five years, EPA is required to determine whether or not to regulate at least five of the contaminants included on the contaminant candidate list. The act requires EPA to evaluate contaminants that present the greatest health concern, and then to regulate those contaminants that occur at concentration levels and frequencies of public health concern, where regulation presents a meaningful opportunity for health risk reduction.

In July 2008, EPA published final regulatory determinations for 11 contaminants from the CCL 2 and issued the draft CCL 3. All of the determinations were decisions not to regulate. In making these determinations, EPA noted that the data indicated that the contaminants either did not appear to occur in public water systems, or appeared infrequently at levels of health concern, and that regulating the contaminants did not present a meaningful opportunity for health risk reduction. For those contaminants with low occurrence frequencies, EPA is updating and broadening the health advisories to reflect new information on the contaminants or to include information on a contaminant's degradation byproducts.

The agency did not make determinations for two chemicals that have been detected in numerous water supplies and have received considerable congressional attention: perchlorate and MTBE. EPA noted a decision was not made for MTBE because the health risk assessment for MTBE is being revised. In early January 2009, EPA stated its intent to request the National Research Council (NAS) to review anew the available scientific data prior to EPA making a final regulatory determination. In August 2009, the Obama Administration announced its decision not to ask the NRC to conduct further review of perchlorate, having concluded that additional NRC review would unnecessarily delay regulatory decision making. Instead, on August 19, 2009, EPA published a *Supplemental Request for Comments* notice in the *Federal Register*, seeking public comment on additional ways to analyze the health effects and occurrence data for perchlorate.[8] Specifically, EPA is re-evaluating potential perchlorate exposure for infants and young children, in addition to pregnant women and fetuses, as sensitive subpopulations. The agency intends to consider public comments before making a final regulatory determination. H.R. 3206, introduced in July 2009, would require EPA to promulgate a drinking water standard for perchlorate.[9]

Unregulated Contaminant Monitoring

In another provision aimed at improving the regulatory process, the 1996 amendments directed EPA to establish criteria for a program to monitor unregulated contaminants. This monitoring program enables EPA to collect data for contaminants that are not regulated but are suspected to

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[8] Environmental Protection Agency, "Drinking Water: Supplemental Request for Comments," 74 *Federal Register* 41883, August 19, 2009.

[9] For further discussion, see CRS Report RS21961, *Perchlorate Contamination of Drinking Water: Regulatory Issues and Legislative Actions*, by Mary Tiemann.

be present in drinking water. Every five years, EPA is required to identify as many as 30 contaminants to be monitored. This list is largely based on the contaminant candidate lists. All systems serving more than 10,000 people and a sample of smaller systems must monitor for the contaminants. The resulting data are added to the National Contaminant Occurrence Database (NCOD). EPA published the first unregulated contaminant monitoring rule (UCMR 1) in 1999 requiring monitoring for 26 chemicals. In January 2007, EPA issued the second rule (UCMR 2), requiring systems to monitor for 25 chemicals over a 12-month period between 2008 through 2010.[10] EPA had included perchlorate on the draft UCMR 2 list, but deleted it from the final list. EPA stated that it had sufficient perchlorate occurrence data, but some advocates of perchlorate regulation were critical of EPA's decision not to require further monitoring.

Standard-Setting

In the 1996 amendments, Congress attempted to focus regulatory attention on contaminants that posed the greatest health risks. The act's revised standard-setting provisions direct EPA to promulgate a National Primary Drinking Water Regulation for a contaminant if the Administrator determines that the following three criteria are met:

- the contaminant may have adverse health effects;
- it is known, or there is a substantial likelihood, that the contaminant will occur in public water systems with a frequency and at levels of public health concern; and
- its regulation presents a meaningful opportunity for health risk reduction for persons served by public water systems. (SDWA §1412(b)(1)(a))

Drinking water regulations generally include numerical standards that establish the highest level of a contaminant that may be present in water supplied by public water systems. Where it is not economically or technically feasible to measure a contaminant at very low concentrations, EPA may establish a treatment technique in lieu of a standard, as it has done for lead and copper.

Developing a drinking water regulation is a complex process, and EPA must address technical, scientific, and economic issues. The agency must (1) estimate the extent of occurrence of a contaminant in sources of drinking water nationwide; (2) evaluate the potential human exposure and risks of adverse health effects to the general population and to sensitive subpopulations; (3) ensure that analytical methods are available for water systems to use in monitoring for a contaminant; (4) evaluate the availability and costs of treatment techniques that can be used to remove a contaminant; and (5) assess the impacts of a regulation on public water systems, the economy, and public health. Regulation development typically is a multi-year process. EPA may expedite procedures and issue interim standards to respond to urgent threats to public health.

After reviewing health effects studies, EPA sets a nonenforceable maximum contaminant level goal (MCLG) at a level at which no known or anticipated adverse health effects occur and that allows an adequate margin of safety. EPA also considers the risk to sensitive subpopulations, such as infants and children. For carcinogens and microbes, EPA generally sets the MCLG at zero. Because MCLGs are based only on health effects and not on analytical detection limits or the availability or cost of treatment technologies, they may be set at levels that are not technically feasible for water systems to meet.

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[10] January 4, 2007 (72 *Fed. Reg.* 367-398).

Once the MCLG is established, EPA then sets an enforceable standard, the maximum contaminant level (MCL). The MCL generally must be set as close to the MCLG as is "feasible" using the best technology or other means available, taking costs into consideration (SDWA §1412(b)). The act does not discuss how EPA should consider cost in determining feasibility; consequently, EPA has relied on legislative history for guidance. Congress last addressed this issue in the Senate report accompanying the 1996 amendments, which stated that "feasible" means the level that can be reached by large, regional drinking water systems applying best available treatment technology. The Senate committee report explained that this approach is used because 80% of the population receives its drinking water from large community water systems, and thus, safe water can be provided to most of the population at very affordable costs.[11]

However, because standards are based on cost considerations for large systems, Congress expected that standards could be less affordable for smaller systems. In 1996, Congress expanded the act's variance and exemption provisions to give small systems some added compliance flexibility. (See the discussion below on "Small Systems Issues.") Congress further revised the act to require EPA, when proposing a standard, to publish a determination as to whether or not the benefits of a proposed standard justify the costs. If EPA determines that the benefits do not justify the costs, EPA, in certain cases, may promulgate a standard that is less stringent than the feasible level and that "maximizes health risk reduction benefits at a cost that is justified by the benefits."[12] EPA used this authority to establish new standards for arsenic and radium.

Recent and Pending Rules

EPA's latest rulemaking activities include a January 2006 rule package that expanded existing requirements to control pathogens (especially *Cryptosporidium*) and disinfectants (e.g., chlorine) and their byproducts (e.g., chloroform). These rules, the Long Term 2 Enhanced Surface Water Treatment Rule (LT2 Rule) and the Stage 2 Disinfectant and Disinfection Byproduct Rule (Stage 2 DBP), complete a series of statutorily mandated rules that impose increasingly strict controls on the presence of pathogens and disinfectants and their byproducts in water systems. EPA promulgated a related Ground Water Rule to establish disinfection requirements for systems relying on ground water.

In the past several years, EPA also issued standards for several radionuclides, including uranium and revised standards for radium and arsenic. These rules are expected to reduce an array of health risks for consumers, but they have potentially significant costs for the communities that must expand treatment facilities to comply with the standards.

In 2007, EPA completed targeted revisions to the Lead and Copper Rule (LCR). The revisions were made to address weaknesses identified during a nationwide review of the rule, following the discovery of high lead levels in Washington, DC, tap water in 2004.[13] The changes involved regulatory requirements for monitoring, treatment, customer notification, and lead service line replacement. Some of the regulatory revisions clarify the intent of the original LCR for provisions that may not have been sufficiently clear, while others revise LCR requirements. These changes

[11] U. S. Senate. *Safe Drinking Water Amendments Act of 1995*, Report of the Committee on Environment and Public Works on S. 1316. S.Rept. 104-169. p. 14. November 7, 1995.

[12] SDWA §1412(b)(6); 42 U.S.C. 300g-1.

[13] The 2007 revised Lead and Copper Rule and more information on lead in drinking water are available at http://www.epa.gov/safewater/lcrmr/index.html.

are intended to strengthen implementation of the LCR in the short term; EPA is currently considering making more comprehensive revisions to the LCR and/or issuing additional guidance for public water systems. In the 111th Congress, S. 1005, the Water Infrastructure Financing Act, reported by the Senate Committee on Environment and Public Works, would establish a national grant program to reduce lead in drinking water.

Among ongoing rulemakings, EPA has been working to finalize a radon rule (proposed in 1999), and has been evaluating numerous contaminants, including perchlorate and MTBE, for possible regulation. As noted, in August 2009, EPA published a notice in the *Federal Register* seeking additional comment on the analysis of data for purposes of making a regulatory determination for perchlorate. Specifically, EPA is re-evaluating potential perchlorate exposure for infants and young children, in addition to pregnant women and fetuses. **Table 2** reviews the status of several recently completed or proposed drinking water regulations and guidelines.

Table 2. Recent and Pending Regulatory Actions

Regulatory Action	Date Published	Purpose
Revisions to Lead and Copper Rule (LCR)	10/10/2007 (72 Fed. Reg. 57781) **Final**	EPA promulgated targeted changes to the LCR to improve implementation in the areas of monitoring, treatment, customer awareness, and lead service line replacement, to better control exposures to lead in drinking water. The revisions do not affect the lead MCLG or action level, or the rule's basic requirements. (A comprehensive revision of the rule is under consideration.)
Unregulated Contaminant Monitoring Rule (UCMR 2)	1/4/2007 (72 *Fed. Reg.* 367) **Final**	SDWA requires EPA to publish every five years a list of unregulated contaminants to be monitored. This second UCMR requires monitoring of 25 chemicals during 2008-2010. These data provide the main occurrence and exposure data for EPA to determine whether to regulate the contaminants. (Perchlorate was included in the first UCMR and in the draft, but not final, UCMR 2.)
Ground Water Rule (GWR)	11/8/2006 (71 *Fed. Reg.* 65574) **Final**	The 1996 amendments directed EPA to require disinfection for all public water systems, including all surface water systems and, as necessary, ground water systems to provide greater protection against microbial pathogens.
Proposed Revision of National Affordability Methodology and Methodology to Identify Variance Technologies	3/2/2006 (71 *Fed. Reg.* 65573)	EPA proposed options for revising its criteria for determining whether a technology needed to comply with a standard is affordable for small systems and for revising its methodology for determining if an affordable variance technology protects public health. As provided for in the 1996 amendments, states may grant variances to small systems for standards that EPA determines are unaffordable. Under the current criteria, no small system variances are available.
Long-Term 2 Enhanced Surface Water Treatment Rule (LT2 Rule)	1/5/2006 (71 *Fed. Reg.* 653) **Final**	Supplements existing rules by increasing *Cryptosporidium* treatment requirements for higher risk systems. Contains provisions to reduce risks from uncovered finished water reservoirs and to ensure that systems maintain microbial protection when they act to decrease the formation of disinfection byproducts (DBPs).
Stage 2 Disinfectants and Disinfection By-Products Rule (DBPR)	1/4/2006 (71 *Fed. Reg.* 387) **Final**	Builds on existing rules to strengthen requirements for higher risk systems to reduce potential health risks from DBPs in drinking water, which form when disinfectants are used to control microbial pathogens. Tightens monitoring requirements for 2 groups of DBPs, trihalomethanes (TTHM) and haloacetic acids (HAA5). (This rule was issued with the LT2 Rule to address concerns about risk tradeoffs between pathogens and disinfection byproducts.)

Pharmaceuticals in Drinking Water

As monitoring technologies have become available and testing has increased, traces of more pharmaceuticals and personal care products (PPCPs) have been detected in surface waters and drinking water supplies. Pharmaceuticals include prescription drugs, veterinary drugs, and over-the-counter medicines. Personal care products cover a broad spectrum and include cosmetics, hair products, sun-screens, fragrances, anti-bacterial soaps, and vitamins. These chemicals are released to the environment in various ways, including elimination of human and animal waste, disposal of unused medicines down the toilet, veterinary drug usage, hospital waste disposal, and industrial discharges.

Although significant research is being conducted, much is unknown about the occurrence and movement of PPCPs in the environment, their occurrence in drinking water supplies, or about the potential health risks from exposure to PPCPs at extremely low levels through drinking water. Nonetheless, the detection of pharmaceuticals and related products in public water supplies generates concern, because many of these products are specifically designed to have a biological effect in humans, animals, and/or plants. Pharmaceuticals often contain chemical compounds that can affect the endocrine system by altering, mimicking, or impeding the function of hormones. Such endocrine disrupting chemicals (EDCs) have the potential to affect growth, development, reproduction, and metabolism. Over the past decade, scientists and regulators have become increasingly concerned about the effects that exposures to low levels of PPCPs may be having on aquatic organisms, and also potentially on human health.[14]

The U.S. Geological Survey (USGS) and EPA have identified a wide array of research needs and gaps that, if addressed, would help delineate the scope of environmental and human health issues that might result from the presence of PPCPs in the environment. The USGS has conducted research on the occurrence of hormones, pharmaceuticals, and other wastes in residential, industrial, and agricultural wastewater, and has found that a broad range of these chemicals occur commonly downstream from large urban areas and concentrated animal production areas.[15]

EPA has been conducting and supporting numerous PPCP research projects in several areas, including the relative importance of different sources of PPCPs in the environment (e.g., veterinary vs. human medicine), how PPCPs move through the environment, human exposure pathways, ecological exposure pathways, monitoring and detection tools, assessment of potential human health effects, and assessment of potential ecological effects. Research is also being conducted to evaluate the ability of drinking water treatment technologies to remove various PPCPs.

Ecological research has received particular attention because exposure risks for aquatic life have been considered to be much greater than those for humans.[16] Nonetheless, a key research issue concerns the possible health risks from exposure to very low doses of the myriad chemicals found

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[14] For more information on EDCs and potential health risks, see CRS Report R40177, *Environmental Exposure to Endocrine Disruptors: What Are the Human Health Risks?*, by Linda-Jo Schierow and Eugene H. Buck.

[15] See for example, U.S. Geological Survey, *Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in U.S. Streams*, USGS FS-027-02, June 2002.

[16] Aquatic organisms face higher risks of exposure than humans for several reasons. For example, these organisms have continuous exposure, and generally are exposed to higher concentrations of PPCPs in untreated water, compared to treated drinking water.

in PPCPs. Because PPCPs occur in the environment at low concentrations, their effects may be subtle. Among other research gaps, EPA has identified a need to develop tests that can detect more subtle health effects.

The agency is also conducting a study to determine the amount of PPCPs that are discharged to wastewater treatment plants from various sources. As part of this study, EPA is evaluating how hospitals and other institutions dispose of unused medications.[17] Other research projects address the development of analytical methods to determine the source and fate of PPCPs in the environment.

As noted above, EPA proposed its third list of unregulated contaminants being considered for regulation in February 2008. This Contaminant Candidate List 3 (CCL 3) contains 104 contaminants, none of which are pharmaceuticals. Following recent reports of the detection of pharmaceuticals and commonly used over-the-counter drugs in the drinking water supplies of 24 large community water systems, EPA has asked its Science Advisory Board (SAB) and stakeholders to evaluate and comment on the contaminant candidate screening and selection process to determine whether the process requires revision.[18]

Because of ecological concerns, as well as human health concerns, regulating contaminants in drinking water represents only part of the response to this multi-faceted problem. Recognizing that people and animals will continue to take and use pharmaceutical products, water suppliers and other stakeholders consider changes at wastewater treatment plants to be a key part of the solution.

The Association of Metropolitan Water Agencies (AMWA), which represents the largest publicly owned water systems, has made several recommendations to address this emerging drinking water issue. Among these recommendations, the AMWA strongly encouraged EPA to make research on treatment technologies a high priority, and urged water utilities to inform consumers of efforts to monitor and remove pharmaceuticals from water sources. AMWA also called for EPA and the Food and Drug Administration (FDA) to determine whether the presence of trace amounts of pharmaceuticals results in short-term or long-term effects on health and the environment, recommended that the federal government take the lead in developing a national program for disposing of unused prescriptions, and called for animal feeding operations to reduce their contributions of antibiotics and steroids into water supplies.[19]

In this Congress, several bills address this issue, including two that have passed the House: H.R. 1145 (H.Rept. 111-76) would call for research on prevention and removal of contaminants of emerging concern, including PPCPs, in water resources; and H.R. 1262 (H.Rept. 111-26) would direct EPA to conduct a study on the presence of PPCPs in the nation's waters. Additionally, the House Appropriations Committee report for EPA's FY2010 appropriations (H.R. 2996, H.Rept. 111-180) encourages EPA to develop a plan to synthesize available research on contaminants of emerging concern and to apply a systematic approach to addressing the problem of such contaminants in water supplies. The House report further directs EPA to publish a list of at least 100 chemicals for screening in the Endocrine Disruptor Screening Program that includes drinking

[17] For further information on PPCPs and related EPA activities, see http://epa.gov/ppcp.

[18] Information of the CCL3 is available at, http://www.epa.gov/OGWDW/ccl/ccl3.html.

[19] Association of Metropolitan Water Agencies, *AMWA Discusses Pharmaceuticals in Water Supplies*, March 11, 2008, http://www.amwa.net.

water contaminants such as PPCPs. H.R. 276 was introduced in January 2009 to require the EPA Administrator to convene a task force to develop recommendations for the proper disposal of unused pharmaceuticals to protect water sources.

Drinking Water Infrastructure Needs and Funding

A persistent SDWA issue concerns the ability of water systems to construct or upgrade infrastructure to comply with drinking water regulations and, more broadly, to ensure the provision of a safe and reliable water supply. In the 1996 amendments, Congress responded to growing complaints about the act's unfunded mandates and authorized a drinking water state revolving loan fund (DWSRF) program to help water systems finance infrastructure projects needed to meet drinking water standards and address the most serious health risks.

The program authorizes EPA to award annual capitalization grants to states. States then use their grants (plus a 20% state match) to provide loans and other assistance to public water systems. Communities repay loans into the fund, thus replenishing the fund and making resources available for projects in other communities. Eligible projects include installation and replacement of treatment facilities, distribution systems, and some storage facilities. Projects to replace aging infrastructure are eligible if they are needed to maintain compliance or to further public health protection goals.[20]

The SDWA authorized appropriations for the DWSRF program totaling $9.6 billion, including $1 billion for each of FY1995 through FY2003. Congress provided $829.0 million for each of FY2008 and FY2009. In the American Recovery and Reinvestment Act (ARRA; P.L. 111-5), Congress provided an additional $2 billion for the DWSRF program. For FY2010, the President requested $1.5 billion for the program. Congress approved $1.387 billion in the Department of the Interior, Environment, and Related Agencies Appropriations Act, 2010 (P.L. 111-88). Since FY1997, Congress has appropriated more than $14.5 billion for this program. (**Table 3** lists funding levels for the DWSRF program since its inception.)

Through June 2008, the EPA had awarded $8.97 billion in capitalization grants, which, when combined with the 20% state match, bond proceeds, loan principal repayments, and other funds, amounted to $16.2 billion in DWSRF funds available for loans and other assistance. Through June 2008, 6,177 projects had received assistance, 4,082 of which had been completed. Total assistance provided by the program reached $14.6 billion.[21]

The DWSRF program is well-regarded, but many state and local officials and interest groups have argued that greater investment in water infrastructure is needed. EPA's latest needs survey estimates that public water systems need to invest $334.8 billion on infrastructure improvements over 20 years (2007 through 2026) to achieve regulatory compliance and ensure the provision of safe water. Although all of the infrastructure projects in the needs assessment promote the health objectives of the act, EPA reports that just 16% ($52.0 billion) is attributable to SDWA

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[20] See also CRS Report RS22037, *Drinking Water State Revolving Fund (DWSRF): Program Overview and Issues*, by Mary Tiemann. For information on other assistance programs, see CRS Report RL30478, *Federally Supported Water Supply and Wastewater Treatment Programs*.

[21] Program statistics are available at http://www.epa.gov/safewater/dwsrf/dwnims.html. For further discussion of the DWSRF program, see EPA Report to Congress, *Drinking Water State Revolving Fund: Investing in a Sustainable Future*, EPA 816-R-08-002, March 2008, http://www.epa.gov/safewater/dwsrf.html.

regulations, while $282.8 billion (84%) represents nonregulatory costs. Most needs typically involve installing, upgrading, or replacing transmission and distribution infrastructure to allow a system to continue to deliver safe drinking water. Although aging, deteriorated infrastructure often poses a threat to drinking water safety, these needs occur independently of federal mandates.[22]

Table 3. Drinking Water State Revolving Fund Program Funding, FY1997-FY2010

(in millions of dollars, nominal dollars)

Fiscal Year	Authorizations	Appropriations
1997	$1,000.0	$1,275.0
1998	$1,000.0	$725.0
1999	$1,000.0	$775.0
2000	$1,000.0	$816.9
2001	$1,000.0	$823.2
2002	$1,000.0	$850.0
2003	$1,000.0	$844.5
2004	—	$845.0
2005	—	$843.2
2006	—	$837.5
2007	—	$837.5
2008	—	$829.0
2009	—	$829.0
		2,000.0[a]
2010	—	$1,387.0
Total		$14,517.8

Sources: Prepared by CRS using information from the following sources: FY1997-FY2000 and FY2002 enacted amounts are from the enacted appropriations bills for those fiscal years. FY2001enacted amount is the prior year enacted amount specified in EPA's FY2002 congressional budget justification. FY2003-FY2004 enacted amounts are from EPA's Office of Water. FY2005-FY2006 enacted amounts are prior year enacted amounts specified in House Appropriations Committee reports on subsequent year appropriations bills. FY2007 and FY2008 enacted amounts, and FY2009 President's request, are as reported to CRS by the House Appropriations Committee. All enacted amounts reflect rescissions.

a. ARRA.

EPA also has prepared a broader municipal wastewater and drinking water infrastructure funding gap analysis, which identified potential funding gaps between projected needs and spending from 2000 through 2019.[23] This analysis estimated the potential 20-year funding gap for drinking water and wastewater infrastructure capital and operations and maintenance (O&M), based on two scenarios: a "no revenue growth" scenario and a "revenue growth" scenario that assumed

[22] Environmental Protection Agency, 2007 *Drinking Water Infrastructure Needs Survey and Assessment: Fourth Report to Congress,* EPA 816-R-09-001, March 2009, http://www.epa.gov/safewater/needs.html.

[23] U.S. Environmental Protection Agency, *The Clean Water and Drinking Water Infrastructure Gap Analysis Report,* Report No. EPA 816-R-02-020, September 2002, 50 p.

infrastructure spending would increase 3% per year. Under the "no revenue growth" scenario, EPA projected a funding gap for drinking water capital investment of $102 billion ($5 billion per year) and an O&M funding gap of $161 billion ($8 billion per year). Using revenue growth assumptions, EPA estimated a 20-year capital funding gap of $45 billion ($2 billion per year), and no gap for O&M.

Other assessments also have found a funding gap. In 2000, the Water Infrastructure Network (WIN) (a coalition of state and local officials, water providers, environmental groups and others) reported that over the next 20 years, water and wastewater systems need to invest $23 billion annually more than current investments to meet SDWA and Clean Water Act health and environmental priorities and to replace aging infrastructure. WIN and other groups have proposed multibillion dollar investment programs for water infrastructure. Others, however, have called for more financial self-reliance within the water sector.

In the 111th Congress, this issue found early focus in the economic stimulus debate. As noted, ARRA included $2 billion, while the FY2009 and FY2010 appropriations acts provided $829 million and $1.387 billion, respectively, for a total of more than $4.2 billion for drinking water infrastructure. Beyond stimulus and appropriations actions, drinking water and other water infrastructure issues continue to receive attention in this Congress. In July, the Senate Environment and Public Works Committee reported a broad drinking water and wastewater infrastructure financing bill, S. 1005 (S.Rept. 111-47), the Water Infrastructure Financing Act, which is similar to the committee bill from the 110th Congress. It would authorize more funding for drinking water and wastewater SRF programs (authorizing $15 billion over five years for the DWSRF), and create a grant program at EPA for small or economically disadvantaged communities for critical drinking water and water quality projects. S. 1005 includes a Davis-Bacon prevailing wage provision, requiring that prevailing wage requirements would apply to all projects financed in whole or part through an SRF. This would be a new requirement for the states under the DWSRF program, and the provision has been problematic for similar legislation in recent Congresses. However, Congress did apply prevailing wage requirements[24] to projects that are funded through ARRA or P.L. 111-88. In the House, the Water Protection and Reinvestment Act (H.R. 3202) has been introduced to establish a dedicated water infrastructure trust fund. The trust fund would be supported by taxes on various products, including PPCPs, water-based beverages, and a tax on some corporate profits. H.R. 537, the Sustainable Water Infrastructure Investment Act of 2009, would amend the Internal Revenue Code of 1986 to provide that the volume cap for private activity bonds would not apply to bonds for water supply or wastewater facilities. The purposes of this bill include providing alternative financing for water infrastructure investments and promoting the federal partnership with state and local governments.[25]

The 110th Congress considered various bills to address water infrastructure funding needs and related issues. Late in the second session, the House passed an emergency supplemental appropriations bill, H.R. 7110 (the Job Creation and Unemployment Relief Act of 2008). This bill proposed to provide $1 billion for the DWSRF program, and another $6.5 billion for the Clean Water SRF program. Additionally, the Senate Environment and Public Works Committee reported several bills that would have authorized funding for drinking water infrastructure: S. 3617 (S.Rept. 110-509), the Water Infrastructure Financing Act; S. 1933 (S.Rept. 110-475), which

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[24] SDWA section 1450(e); 42 U.S.C. 300j-9(e).

[25] For a discussion of legislative issues related to the Clean Water Act and wastewater infrastructure, see CRS Report R40098, *Water Quality Issues in the 111th Congress: Oversight and Implementation*, by Claudia Copeland.

would have created a grant program for small drinking water systems; and S. 199 (S.Rept. 110-476), which proposed to increase the authorization of appropriations for water and wastewater grants for Alaska's rural and Native villages. None of the bills was enacted.

In the face of uncertainty over increased federal assistance for water infrastructure, EPA, states, communities, and utilities have been examining alternative management and financing strategies to address SDWA compliance costs and broader infrastructure maintenance and repair costs. Such strategies include establishing public-private partnerships (privatization options range from contracting for services to selling system assets), improving asset management, and adopting full-cost pricing for water services. Still, these strategies may be of limited use to many small and/or economically disadvantaged communities, and stakeholders are likely to continue to urge Congress to increase funding for water infrastructure.[26]

Small Systems Issues

An issue that has received considerable attention concerns the financial, technical, and managerial capacity of small systems to comply with SDWA regulations. Roughly 84% (44,000) of the nation's 52,800 community water systems are small, serving 3,300 persons or fewer, and 57% (30,000) of the community water systems serve 500 persons or fewer. Many small systems face challenges in complying with SDWA rules and, more fundamentally, in ensuring the quality of water supplies. Major problems include deteriorated infrastructure, lack of access to capital, limited customer and rate base, inadequate rates, diseconomies of scale, and limited managerial and technical capabilities. Because of these same characteristics, the DWSRF program has not been as successful for small systems, compared to larger systems. Although these systems serve just 9% of the population served by community water systems, the sheer number of small systems has created challenges for policymakers and regulators.

In the earliest SDWA debates, Congress recognized that setting standards based on technologies affordable for large cities could pose problems for small systems. During the reauthorization debate leading up to the 1996 amendments, policymakers gave considerable attention to the question of how to help small systems improve their capacity to comply with SDWA mandates. The 1996 amendments added provisions aimed at achieving this goal, including a requirement that states establish strategies to help systems develop and maintain the technical, financial, and managerial capacity to meet SDWA regulations. Congress also revised provisions on standard-setting (§1412(b)), variances (§1415(e)), and exemptions (§1416) to increase consideration of small system concerns.

Exemptions

The act's exemption provisions are intended to provide compliance flexibility in certain cases. States or EPA may grant *temporary* exemptions from a standard if, due to certain compelling factors (including cost), a system cannot comply on time. For example, all systems are required to comply with the new arsenic standard five years after its promulgation date. An exemption would allow three more years for qualified systems. Small systems (serving 3,300 persons or fewer) may be eligible for up to three additional two-year extensions, for a total exemption duration of nine

[26] For further discussion of infrastructure issues, see CRS Report RL31116, *Water Infrastructure Needs and Investment: Review and Analysis of Key Issues*, by Claudia Copeland and Mary Tiemann.

years (and for a total of up to 14 years to achieve compliance). In the preamble to the arsenic rule published in January 2001, EPA noted that exemptions will be an important tool to help states address the number of systems needing financial assistance to comply with this rule and other SDWA rules (66 *Federal Register* 6988).

However, to grant an exemption, the law requires a state to hold a public hearing and make a finding that the extension will not result in an “unreasonable risk to health.” Because of the administrative burden to the states and uncertainty as to what constitutes an “unreasonable risk to health,” the act’s exemption authority has seldom been used. Approximately 13 states had indicated that they would likely use the exemption process for the arsenic rule, but it appears that many states have not exercised this option.

Small System Variances and Affordability

In contrast to exemptions, variances offer a more permanent form of compliance flexibility for small systems. Since 1996, SDWA has required EPA, when issuing a regulation, to identify technologies that meet the standard and that are affordable for systems that serve populations of 10,000 or fewer. If EPA does not identify affordable “compliance” technologies, then the agency must identify small system “variance” technologies. A variance technology need not meet the standard, but must protect public health. States may grant variances to systems serving 3,300 persons or fewer if a system cannot afford to comply with a rule (through treatment, an alternative source of water, or other restructuring) and if the system installs a variance technology. With EPA approval, states also may grant variances to systems serving between 3,300 and 10,000 people. (Regulations addressing microbial contaminants are not eligible for variances under the statute.)

In 1998, EPA published affordability criteria to establish guidelines for determining whether a regulation is deemed affordable for small systems, and whether small system variances would be available. Under the criteria, EPA evaluates the affordability of a regulation by determining whether the compliance cost would raise the total water cost above 2.5% of annual median household income (MHI) in the three categories of small systems. Using this approach, EPA has determined that affordable compliance technologies are available for every drinking water regulation. Consequently, the agency has not identified any small system variance technologies, and thus, no small system variances are available.

Several recent regulations (such as the revised arsenic and radium standards and the Stage 2 Disinfectants and Disinfection Byproducts Rule) have heightened concern, particularly among rural communities, that EPA has not used the tools Congress provided to help small systems comply with SDWA regulations.

Affordability Criteria Review

Prompted by debate over the revised arsenic standard and its potential cost to small communities, the conference report for EPA’s FY2002 appropriations (H.Rept. 107-272) directed EPA to review its affordability criteria and how small system variance programs should be implemented for the arsenic rule. EPA began the review and sought the advice of the EPA’s National Drinking Water Advisory Council (NDWAC) and Science Advisory Board (SAB).

After considering recommendations from its affordability work group, the NDWAC reported to EPA in 2003. The council acknowledged the statutory basis for small system variances and recommended changes, but cautioned that "significant practical, logistical, and ethical issues mitigate against the use of variances."[27] The National Rural Water Association, a member of the NDWAC work group, dissented and issued a separate report urging EPA to adopt a safe and affordable variance approach that would make variances available to small communities, as authorized by Congress. The Science Advisory Board concluded that EPA's basic approach was justified on the basis of equity, efficiency and administrative practicality, but recommended ways to improve the criteria. The SAB suggested that EPA consider lowering its affordability threshold, noting that "the national affordability threshold has never been exceeded, but some small water systems appear to have genuinely struggled with costs, suggesting that the 2.5% rule is too high."[28] The SAB also encouraged EPA to develop clear guidelines about when variances should be granted, and recommended that EPA consider measures other than median income to better capture impacts on disadvantaged households.

In March 2006, EPA proposed three options for revising its affordability criteria for determining whether a compliance technology is unaffordable for small systems (71 *Federal Register* 10671). EPA currently assumes that treatment technology costs are affordable to the average household if they do not cause median annual water bills to exceed about $1,000 (this threshold is calculated by taking 2.5% of median household income among small systems). Based on this approach, EPA has determined that affordable technologies are available for all standards. The three proposed options are well below that level: 0.25%, 0.50%, and 0.75%. EPA also requested comment on whether or not the agency should evaluate affordability strictly on a national level, or use a two-step process that would include evaluations of affordability first at the national level and then at the county level. A county level analysis would be performed only when a standard was found to be affordable at the national level. The revised criteria are further intended to address the issue of how to ensure that a variance technology would be protective of public health—an issue that has historically hampered the use of variances.

EPA has been evaluating comments on its proposed revisions, and had noted its intention to apply the revised criteria only to future rules. States could use the criteria to grant small-system variances, on a case-by-case basis, when systems cannot afford to comply with a standard. If these variances become available, it is not clear how often they might be used. A key issue is that variances allow systems to provide lower-quality water in lower-income communities, and this could raise issues for states, communities, and consumers.

In its 2010 budget, the agency has committed to work with state and local governments to provide "equitable consideration of small system customers."[29] To accomplish this, EPA is reviewing various drinking water policies, including the use of small system variances, the existing variance determination methodology, the small water system capacity development strategy, and the DWSRF program.

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[27] U.S. Environmental Protection Agency, *Small Drinking Water Systems Variances: Revision of Existing National-Level Affordability Methodology and Methodology to Identify Variance Technologies that Are Protective of Public Health*, (71 *Fed. Reg*. 10671), March 2, 2006, p. 10657.

[28] U.S. Environmental Protection Agency, Science Advisory Board, *Affordability Criteria for Small Drinking Water Systems: An EPA Science Advisory Board Report*, 2002, p. 4. The SAB report is available at http://www.epa.gov/safewater/pws/affordability.html.

[29] U.S. Environmental Protection Agency, *2010 Annual Performance Plan and Congressional Justification*, State and tribal Assistance Grants, p. 686.

Small System Legislation

For several Congresses, various bills have been introduced to help small water systems comply with the arsenic standard and other drinking water regulations. In July, the Senate Environment and Public Works Committee reported S. 1005 (S.Rept. 111-47), the Water Infrastructure Financing Act, which would create a grant program at EPA for small or economically disadvantaged communities for critical drinking water and water quality projects. H.R. 2206 would amend SDWA to authorize: (1) increased appropriations to EPA for technical assistance to help small water systems to comply with national primary drinking water regulations; and (2) the Administrator to provide technical assistance to organizations providing on-site technical assistance, circuit-rider technical assistance programs, training, and assistance with regulatory compliance and water security enhancements.

Underground Injection Control Program

Most public water systems rely on groundwater as a source of drinking water, and the 1974 Safe Drinking Water Act authorized EPA to regulate the underground injection of fluids (including solids, liquids, and gases) to protect underground sources of drinking water.[30] SDWA §1421 directed EPA to promulgate regulations for state underground injection control (UIC) programs, and mandated that the regulations contain minimum requirements for programs to prevent underground injection that endangers drinking water sources.[31] Section 1422 authorized EPA to delegate primary enforcement authority (primacy) for UIC programs to the states, provided that state programs prohibit any underground injection that is not authorized by a state permit.[32] Thirty-three states have assumed primacy for the program, EPA has lead implementation and enforcement authority in 10 states, and authority is shared in the remainder of the states.[33]

The UIC program regulations specify siting, construction, operation, closure, financial responsibility, and other requirements for owners and operators of injection wells. EPA has established five classes of injection wells based on similarity in the fluids injected and activities, as well as common construction, injection depth, design, and operating techniques.

The 1974 SDWA specified that the UIC regulations could not interfere with the underground injection of brine from oil and gas production or recovery of oil unless underground sources of drinking water would be affected.[34] In the Energy Policy Act of 2005, the 109th Congress

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[30] Underground injection control provisions are contained in SDWA §1421 - §1426; 42 U.S.C. 300h - 300h-5.

[31] § 1421(d)(2) states that

> underground injection endangers drinking water sources if such injection may result in the presence in underground water which supplies or can reasonably be expected to supply any public water system of any contaminant, and if the presence of such contaminant may result in such system's not complying with any national primary drinking water regulation or may otherwise adversely affect the health of persons.

[32] P.L. 93-523, SDWA §1421 (42 U.S.C. 300h).

[33] To receive primacy, a state, territory, or Indian tribe must demonstrate to EPA that its UIC program is at least as stringent as the federal standards; the state, territory, or tribal UIC requirements may be more stringent than the federal requirements. For Class II (oil and gas) wells, states must demonstrate that their programs are effective in preventing pollution of underground sources of drinking water (USDWs).

[34] SDWA §1421(d) specifies that "underground injection" does not include the underground injection of natural gas for storage purposes. In legislative history, Congress explained that the natural gas exclusion applies only to "natural gas as it is commonly defined" and "not to other injections of matter in a gaseous state." U.S. House of Representatives, (continued...)

amended SDWA to specify further that the definition of "underground injection" excludes the injection of fluids or propping agents (other than diesel fuels) used in hydraulic fracturing operations related to oil, gas, or geothermal production activities.[35]

Underground injection recently has been receiving congressional attention for its role as a potential means for sequestering carbon dioxide (CO_2) emissions in geologic formations to control greenhouse gas emissions. It also has emerged on the agenda because of the rapidly growing use of hydraulic fracturing in domestic natural gas production.

Carbon Sequestration and Storage

Geologic sequestration (GS) is the process of injecting CO_2 captured from a large stationary source (such as a coal-fired power plant) through a well deep into the earth for long-term storage. Research indicates that numerous geologic formations exist in the United States and worldwide that have the capacity to store large volumes of CO_2. Because coal is responsible for nearly half of the electricity generated worldwide and its use is increasing, carbon capture and storage (CCS) is attracting a growing number of proponents who believe that, with proper site selection and management, geologic sequestration could play an important role in controlling CO_2 emissions.

Although considerable interest has emerged for the rapid, commercial-scale development of carbon sequestration projects, questions exist regarding the long-term safety and effectiveness of sequestration of large volumes of CO_2. Issues include how sequestration activities might affect underground sources of drinking water, what local health and environmental risks could arise from slow leakage or sudden releases of stored gas, and who would have long-term responsibility for water contamination or other damages that might result from sequestration activities.

A key public health and environment issue concerns the potential for stored CO_2 to contaminate underground water supplies or otherwise adversely affect human health and the environment. According to a 2005 report by the United Nations Intergovernmental Panel on Climate Change (IPCC), human and environmental risks potentially could result from leaking injection wells, abandoned wells, or leakage across faults in rock formations and ineffective confining layers. The IPCC report noted that,

> Avoiding or mitigating these impacts will require careful site selection, effective regulatory oversight, an appropriate monitoring program that provides early warning that the storage site is not functioning as anticipated and implementation of remediation methods to stop or control CO_2 releases. Methods to accomplish these are being developed and tested.[36]

Noting that knowledge gaps exist and that more demonstration projects are needed, the IPCC report concluded that, although "more work is needed to improve technologies and decrease uncertainty, there appear to be no insurmountable technical barriers to an increased uptake of geological storage as an effective mitigation option."[37] However, uncertainties and research gaps

(...continued)

H.Rept. 96-1348, 1980, USCCAN, p. 6080.

[35] P.L. 109-58, H.R. 6, Section 322, amended SDWA section 1421(d).

[36] United Nations Intergovernmental Panel on Climate Change, 2005, IPCC Special Report on Carbon Dioxide Capture and Storage, p. 197.

[37] Ibid, p. 198.

involving the safety and effectiveness of long-term carbon sequestration, the potential health and environmental impacts, regulatory requirements, and long-term liability all pose hurdles to the rapid deployment of this technology.[38]

In July 2008, EPA proposed regulations to create a nationally consistent framework for managing the underground injection of CO_2 for geologic sequestration purposes, thus taking a step toward providing certainty to industry and the public about requirements that would apply to this activity.[39] The rule proposes to create a new class of injection wells (Class VI) for geologic sequestration, and establish national requirements that would apply to these injection wells. The proposed rule builds on the existing UIC program, including requirements for well owners and operators to ensure that wells are appropriately located, constructed, tested, monitored, and ultimately closed with proper funding. EPA's stated regulatory goal is to ensure that permitting regulations are in place to ensure that GS can occur in a safe and effective manner in order to enable commercial-scale CCS projects to move forward.

A key issue is that EPA's authority under SDWA is limited to protecting underground sources of drinking water, thus leaving major issues unaddressed, such as long-term liability and regulation of potential emissions to the atmosphere. In August 2009, EPA issued a Notice of Data Availability, providing new data and requesting additional public comment on issues that have evolved in response to comments on the proposed rule. The new data includes, among other items, research from the Department of Energy (DOE) concerning GS projects and modeling to predict the potential impacts of sequestration activities on groundwater.[40] The agency expects to promulgate a final GS rule under SDWA in 2011. In addition to this regulatory effort, EPA is coordinating with DOE on carbon sequestration research, development, and demonstration activities.[41]

Congress has acted on several bills that would facilitate and/or regulate the use of underground injection wells for the purpose of carbon sequestration. The American Recovery and Reinvestment Act of 2009 (P.L. 111-5) included $50 million for site characterization activities in geologic formations related to carbon sequestration, and $20 million for geologic sequestration training and research activities. The Energy Independence and Security Act of 2007 (EISA; P.L. 110-140) expanded the DOE carbon sequestration research and development program. EISA Section 702 required DOE to conduct at least seven large-volume sequestration tests, in addition to conducting research that promotes the development of sequestration technologies. Section 706

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[38] Commercial-scale deployment of CCS faces a range of technical, legal, economic, regulatory, and public policy issues. Capturing carbon and preparing it for transport and storage are generally considered the most economically and technologically challenging aspects of CCS, and no commercial technology to capture these emissions is currently available for large-scale coal-fired power plants. Moreover, carbon capture technologies would markedly increase the cost of electricity generation. Consequently, few companies may be inclined or able to install such technology unless they are required to do so, either by regulation or by a carbon price. For further discussion see CRS Report RL34621, *Capturing CO2 from Coal-Fired Power Plants: Challenges for a Comprehensive Strategy*, by Larry Parker and Peter Folger.

[39] U.S. Environmental Protection Agency, *Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (*CO_2*) Geologic Sequestration (GS) Wells*, Proposed Rule, 73 *Fed. Reg.* 43491-43541, July 25, 2008.

[40] Environmental Protection Agency, "Federal Requirements under the Underground Injection Control (UIC) Program for Carbon Dioxide (C02) Geologic Sequestration (GS) Wells; Notice of Data Availability and Request for Comment," 74 *Federal Register* 44802-44813, August 31, 2009.

[41] More information on EPA's carbon sequestration activities is available at http://www.epa.gov/safewater/uic/wells_sequestration.html.

specified that the injection and sequestration of CO_2 under EISA will be subject to the requirements of the Safe Drinking Water Act, including the UIC provisions.[42]

Two broad bills, addressing multiple energy and climate change issues, include similar geologic sequestration regulatory and reporting provisions: H.R. 2454, the American Clean Energy and Security Act of 2009 (passed by the House in June), and S. 1733, the Clean Energy Jobs and American Power Act (ordered reported by the Senate Environment and Public Works Committee in November). Both bills would amend SDWA by adding a provision directing the EPA Administrator to promulgate, within one year of enactment, regulations for the development, operation, and closure of CO_2 geologic sequestration wells, taking into consideration the ongoing SDWA rulemaking regarding these wells. The bills also would amend the Clean Air Act and establish a coordinated certification and permitting process for geologic sequestration sites. Within two years of enactment, the Administrator would be required to promulgate regulations to protect human health and the environment by minimizing the risk of atmospheric release of CO_2 injected for geologic sequestration, including enhanced hydrocarbon recovery combined with geologic sequestration. Both bills also would require EPA to submit a report to Congress, within one year of enactment, detailing a national strategy for addressing the key legal and regulatory barriers to deployment of commercial scale carbon capture and sequestration. The bills would require two other reports from studies examining: (1) how the environmental statutes that EPA administers would apply to CO_2 injection and geologic sequestration activities, due within 12 months of enactment; and (2) the legal framework for geologic sequestration sites, including existing federal and state environmental statutes and state common law, due within 18 months of enactment.[43]

Hydraulic Fracturing

A second UIC issue concerns the rapidly growing use of hydraulic fracturing to develop onshore natural gas resources. Hydraulic fracturing involves the high-pressure underground injection of large amounts of water and other fluids into gas-bearing rock formations to form fractures that are propped open with sand and/or other materials and chemicals that are also injected. Once the formation is fractured, the natural gas can flow to the well where it is pumped out of the ground. Hydraulic fracturing is a technique that has enabled the production of natural gas from unconventional formations, which represent an increasingly important source of domestically produced gas.

A single well may be fractured several times, using more than 6 million gallons of water in some locations. Treating and/or disposing of the contaminated flowback water from fracturing operations can pose groundwater and surface water quality management challenges for state regulators and gas developers. Landowners are expressing concern over the potential for contamination of their wells. Some contamination incidents have been reported, but most have been attributed to poor well construction or surface activities, rather than fracturing. However, identifying the cause of contamination can be difficult for various reasons, including the

[42] For a detailed discussion of geologic sequestration and related legislation, see CRS Report RL33801, *Carbon Capture and Sequestration (CCS)*, and CRS Report RL34218, *Underground Carbon Dioxide Sequestration: Frequently Asked Questions*, both by Peter Folger.

[43] For further information, see CRS Report R40867, *Carbon Capture and Sequestration in H.R. 2454 and S. 1733*, by Peter Folger, Mary Tiemann, and Stan Mark Kaplan.

complexity of hydrogeologic evaluations, as well as the confidential business information status given to fracturing fluids in many states.

The SDWA requires controls on the underground injection of fluids to protect underground sources of drinking water. Notwithstanding that general mandate, the law specifically states that EPA regulations for state UIC programs "may not prescribe requirements which interfere with or impede ... any underground injection for the secondary or tertiary recovery of oil or natural gas, unless such requirements are essential to assure that underground sources of drinking water will not be endangered by such injection."[44] Consequently, EPA has not regulated gas production wells, and had not considered hydraulic fracturing to fall within the regulatory definition of underground injection. Then, in 1997, the U.S. Court of Appeals for the 11th Circuit ruled that the hydraulic fracturing of coal beds for methane production constituted underground injection and must be regulated. This decision applied only in the 11th Circuit, and Alabama was the only state required to revise its UIC program.[45]

In response to the 1997 court decision and citizen complaints about water contamination attributed to hydraulic fracturing, EPA began to study the impacts of hydraulic fracturing practices used in coal-bed methane (CBM) production on drinking water sources, and to determine whether further regulation was needed. In 2004, EPA issued a final (phase I) report, based primarily on interviews and a review of the available literature, and concluded that the injection of hydraulic fracturing fluids into CBM wells posed little threat to underground sources of drinking water and required no further study; however, EPA noted that very little documented research had been done on the environmental impacts of injecting fracturing fluids. [46] EPA also noted that estimating the concentration of diesel fuel components and other fracturing fluids beyond the point of injection was beyond the scope of its study.[47] Some Members of Congress and some EPA professional staff criticized the report, asserting that its findings were not scientifically founded.

The 109th Congress also responded to the court's decision, and amended SDWA, Section 1421(d), to specify that the definition of "underground injection" excludes the injection of fluids or propping agents (other than diesel fuels) used in hydraulic fracturing operations related to oil, gas, or geothermal production activities.[48] This language removed EPA's (unexercised) authority under SDWA to regulate the underground injection of fluids for hydraulic fracturing purposes.

Since these developments, the use of hydraulic fracturing has increased. So has concern over the potential impact on water resources, particularly in the water-scarce West, and very few studies have been done to evaluate these concerns. Moreover, hydraulic fracturing is becoming important

[44] SDWA Section 1421(b)(2)(B).

[45] Legal Environmental Assistance Found., Inc. v. U.S. Environmental Protection Agency, 118 F. 3d 1467 (11th Cir. 1997). In 2000, a second suit was filed against EPA for approving Alabama's revised UIC program when it contained several alleged deficiencies. (Legal Environmental Assistance Foundation, Inc. v. U.S. EPA, 276 F.3d 1253 (11th Cir. 2001)). The U.S. Court of Appeals for the 11th Circuit directed EPA to require Alabama to regulate hydraulic fracturing under SDWA. The court determined that EPA could regulate hydraulic fracturing under SDWA's more flexible state oil and gas provisions in Section 1425, rather than the more stringent underground injection control requirements of Section 1422.

[46] Environmental Protection Agency, *Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs*, Washington, DC, June 2004, pp. 4-1.

[47] Ibid. p. 4-12.

[48] The Energy Policy Act of 2005 (P.L. 109-58, Section 322).

in the development of gas from shale formations in the densely-populated eastern states, creating new concerns about possible gas development threats to underground sources of drinking water, as well as to surface water quality and supply. These formations include the Marcellus shale, which underlies large parts of New York, Pennsylvania, and West Virginia. The U.S. Geological Survey recently noted that, while the extraction technology for this gas resource has advanced in recent years, "the knowledge of how this extraction might affect water resources has not kept pace."[49] The gas industry believes that state regulations are adequate, and notes that nearly a million fracturing jobs have been conducted with few problems. The industry cautions that additional federal regulation is unnecessary and would likely slow domestic gas development, increase energy prices, and reduce energy independence. However, landowners have reported various incidents of well water contamination, and various environmental and citizen groups are calling for federal regulation or further study of this activity. The Ground Water Protection Council (GWPC), representing state groundwater protection agencies and underground injection control program administrators, argues for keeping regulatory authority with the states, and notes that states generally have effective programs in place to protect water resources during oil and gas development. However, the GWPC also notes that such environmental regulations are uneven among the states. Currently, the National Academy of Sciences (NAS) is conducting a study titled "Management and Effects of Coalbed Methane Development and Produced Water in the Western United States."[50] The study is expected to be completed in early 2010.

In the 111th Congress, several pending bills address the treatment of hydraulic fracturing under SDWA. H.R. 2300, the American Energy Innovation Act, would express the sense of Congress that SDWA was never intended to regulate natural gas and oil well construction and stimulation, and that the 2005 SDWA amendment clarifying that SDWA was not intended to regulate the use of hydraulic fracturing should be maintained. Companion bills H.R. 2766/S. 1215, entitled the Fracturing Responsibility and Awareness of Chemicals Act, would amend the SDWA definition of "underground injection" to include the underground injection of fluids or propping agents used for hydraulic fracturing operations related to oil and gas production activities. The two bills also would require public disclosure of the chemical constituents (but not the proprietary chemical formulas) used in the fracturing process. Disclosure of a propriety formula to the state, EPA Administrator, or treating physician or nurse would be required in the case of a medical emergency. The House Appropriations Committee report accompanying the Department of the Interior, Environment, and Related Agencies Appropriation Bill, FY2010 (H.R. 2996, H.Rept. 111-180), urges EPA to review the risks that hydraulic fracturing poses to drinking water supplies, using the best available science, as well as independent sources of information.

[49] Daniel J. Soeder and William M. Kappel, *Water Resources and Natural Gas Production from the Marcellus Shale,* U.S. Geological Survey, U.S. Department of the Interior, Fact Sheet 2009-3032, May 2009, http://pubs.usgs.gov/fs/2009/3032/pdf/FS2009-3032.pdf.

[50] The 109th Congress called for the NAS study in the Energy Policy Act of 2005 (P.L. 109-58, Section 1811).

Congressional Hearings and Reports, and Documents

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Additional Reading

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U.S. Environmental Protection Agency. *Drinking Water State Revolving Fund Program: Increasing Impact, 2006 Annual Report.* Office of Water. Report No. EPA 816-R-07-002, June 2007. 44 p. http://www.epa.gov/safewater/dwsrf/index.html

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