Defining Economic Feasibility under the Safe Drinking Water Act

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Abstract

Benefit-cost analysis lacks a formal definition for “economic feasibility,” but the concept is used in many areas of public policy. A particularly interesting use is in Section 1401(1)(C)(i) of the Safe Drinking Water Act of 1974, a provision that has remained intact through multiple statutory revisions. The U.S. Environmental Protection Agency has never promulgated a regulatory definition. Instead, EPA articulated through guidance an alternative metric of “affordability.” This metric is incompatible with economic principles because it counts costs but ignores benefits, and treats a designated fraction of every household budget as an asset implicitly belonging to the government. “Affordability” also raises serious equity concerns because it imposes disproportionate burdens on low-income communities and low-income households in non-low income communities.

This paper proposes that EPA for the first time adopt a regulatory definition of economic feasibility consistent with economic principles. This would substantially reduce both economic inefficiency and inequity in drinking water standard-setting. In addition, this action would enable EPA to direct the Drinking Water State Revolving Fund to water systems lacking financial capacity to implement economically feasible standards. Finally, the proposal is consistent with statutory changes made to the SDWA by Congress in 1996 that allow EPA to limit its SDA rulemaking to regulations in which benefits justify costs.

Redefining Economic Feasibility for the Safe Drinking Water Act

I. INTRODUCTION

The U.S. Environmental Protection Agency has regulated drinking water since 1974 under a series of statutes through which Congress has sought to accomplish multiple policy objectives. EPA regulation has a mixed record largely because these objectives have been in conflict. Nonetheless, from the outset the law required national primary drinking water standards to be both technologically feasible and economically feasible. EPA has never implemented the latter requirement, however.

In its 1996 revision of the Safe Drinking Water Act, however, Congress included provisions that make it feasible for EPA to regulate based on sound scientific and economic principles while simultaneously protecting low-income communities, and low-income households everywhere, from having to bear costs wildly disproportionate to the health benefits they obtain.

This paper summarizes the history of economic feasibility in drinking water regulation from 1974 to date, and proposes that, for the first time, EPA establish by regulation a definition of economic feasibility that is consistent with both economic principles and commonsense lay understanding. This reform would have the added, but not incidental, benefit of significantly reducing inequities experienced by low-income communities and households. Finally, the proposed reform would allow EPA to direct the limited resources appropriated by Congress to the Drinking Water State Revolving Fund to those water systems lacking the financial capacity to comply with economically feasible standards. These reforms would greatly simplify drinking water regulation in the U.S., significantly reduce conflict. They also would restore to the states the responsibility for providing health and welfare without the micromanagement that has characterized the federal role for over 40 years.

II. ECONOMIC FEASIBILITY UNDER THE SAFE DRINKING WATER ACT

Economic feasibility was established as a key principle for standard-setting in the original Safe Drinking Water Act of 1974 (SDWA 1974). Though the statute was revised in 1977 (SDWA 1977), 1986 (SDWA 1986) and 1996 (SDWA 1996), each revision sought and failed to solve the lack of economies of scale characteristic of small water systems. Nevertheless, none of these amendments altered the overarching requirement that national primary drinking water standards be economically feasible.

A. SDWA 1974

SDWA 1974 (88 Stat. 1660) prescribed a multi-step process for setting primary federal drinking water standards (called "Maximum Contaminant Levels," or MCLs). First, for any contaminant in drinking water "which, in the judgment of the Administrator, may have any adverse effect on the health of persons," Congress directed that MCLs be set at a level that is "economically and technologically feasible" (§ 1401(1)(C)(i)). Congress did not define these terms, but it clearly expected EPA to account for economic feasibility by "taking cost into consideration" in standard-setting (§ 1412(a)(2)).

Second, if no qualifying MCL could be ascertained, Congress directed EPA to choose a treatment technique "which leads to a reduction in the level of such contaminant sufficient to satisfy the requirements of section 1412."

Third, states assuming primary enforcement responsibility were authorized to issue a *variance* to any water system that could not comply because of "characteristics of the raw water sources which are reasonably available" (§ 1415(a)(1)); or an *exemption* if the water system could not comply "due to compelling factors (which may include economic factors)" (§ 1416(a)(1)). Neither variances nor exemptions permanently relieved a water system of the burden of compliance; they indefinitely postponed the day of reckoning.

Early regulatory analyses conducted by EPA in support of SDWA 1974 rulemaking were at best rudimentary efforts that, among other things, did not calculate incremental benefits and costs (see, e.g., Page et al. 1981; U.S. Environmental Protection Agency 1977) and encountered substantial criticism for this deficiency (e.g., Bosworth 1978). Yet, both EPA and its critics were silent about how to define and apply the statutory concept of economic feasibility. Though EPA developed a methodology for conducting and utilizing benefit-cost analysis, it did not clearly specify how to meld it with the statutory requirement for economic feasibility, and in any case, the methodology was rarely used (Schnare 1998).

Despite the key role variances and exemptions played in the statute, EPA actively but informally deterred states from utilizing their authority to issue them (Schnare 2017). Senior EPA staff appear to have believed that the Agency lacked statutory authority to review state-issued variances (Schnare 2017) unless it could craft "intake" regulations governing the quality of water entering water systems, as required by § 1415(a)(1)(E), but which statutory directive they concluded was infeasible to implement. In any case, only if EPA could *not* specify an economically and technologically feasible MCL did the statute give the Agency authority to regulate source water intake quality (§ 1401(1)(D)(i)).

B. SDWA 1986

The primary purpose of SDWA 1986 (100 Stat. 642) was to fix implementation problems EPA had identified with respect to small systems (Schnare 2017). The product was, *inter alia*, authority for EPA to determine economic and technical feasibility based on system size:

> The Administrator's finding of best available technology, treatment techniques or other means for purposes of this subsection may vary depending on the number of persons served by the system or for other physical conditions related to engineering feasibility and costs of compliance… (SDWA 1986, § 1415(a)(1)(A)).

But there is no evidence that EPA took advantage of this statutory revision, and (Schnare 2017) reports that senior staff objected to it because, in their view, it would inappropriately subject households to unequal protection from health risk. As explained in detail In Section V.H below, this view does not reflect the statutory text, which is silent on the subject, and it embraces a quantity-based definition of equal protection that is not obviously appropriate for private goods such as drinking water.

SDWA 1986 left unchanged the statutory requirement that MCLs be economically feasible. Instead of implementing this requirement, EPA continued to try to manage the small-system problem through now-expanded variance and exemption procedures. That these efforts failed is obvious, because ten years later Congress again revised provisions applicable to small systems without confronting the inherent variability in economic and technical feasibility across system sizes.

Instead of resolving this problem, Congress intensified it by requiring EPA to finalize MCLs for contaminants listed in advanced notices of proposed rulemaking, published in 1982 and 1983, at the rate of nine within 12 months, 40 within 24 months, and all within 36 months (SDWA 1986, § 1412(b)(1)(A)-(C)). This directive exacerbated EPA's implementation conundrum. Instead of securing appropriate levels of public health protection, Congress directed EPA to massively expand federal drinking water regulation irrespective of risk. Indeed, Congress apparently was so certain that contaminants in drinking water posed an existential threat to public health that it directed EPA also to interpret all new scientific information the Agency obtained as implying greater public health risk (see § 1412(b)(2)(A), allowing EPA only to set more stringent MCLs based on new information).

At the same time, Congress converted the statute's internal tension between economic feasibility and public health protection into an irreconcilable conflict. It was now EPA's job to accomplish three fundamentally incompatible policy objectives: (a) massively expand the scope and scale of federal drinking water regulation irrespective of public health risk, (b) accommodate (somehow) the inability of small systems to achieve these standards at reasonable cost, and (c) ensure that all MCLs were economically and technologically feasible.

C. SDWA 1996

SDWA 1996 was enacted because SDWA 1986 failed to achieve any of Congress's three incompatible policy objectives. The amendment made significant changes to existing law but left unchanged the requirement that MCLs be economically feasible. Congress sought to remedy its own error (which it blamed on EPA) by significantly expanding the standards and procedures for states to issue variances and exemptions and articulating new provisions for objective risk analysis and standard-setting based on normative benefit-cost analysis. While both of these changes were highly significant, it is the latter change that had the most important effect for the purposes of this analysis: for the first time, Congress gave economic feasibility an implicit definition (benefits needed to justify costs) and limited EPA to standard-setting consistent with it.

This implicit definition adopts conventional benefit-cost principles, albeit in a convoluted manner. First, Congress directed EPA to rely only on objective scientific information (SDWA 1996, § 1412(b)(3)(A)). The Agency had historically based its health risk estimates on cherry-picked scientific information interpreted to maximize apparent risk (U.S. EPA Office of the Science Advisor 2004), and EPA now had a clear statutory directive to end this practice.

Second, Congress directed EPA to identify and analyze multiple regulatory alternatives for every new proposed MCL, not just its preferred regulatory option (SDWA 1996, § 1412(b)(3)(C)(i)). Further, Congress required that regulatory analyses be conducted in incremental terms (SDWA 1996, § 1412(b)(3)(C)(i)(IV)), similar to the benefit-cost analysis guidance devised by EPA staff in the late 1970s but not implemented (Schnare 1998).[1]

Third, Congress directed EPA to determine whether the benefits of a contemplated standard justified the costs (SDWA 1996, § 1412(b)(4)(C) and it established a strong

[1] Incremental cost differs from marginal cost because it includes amortized fixed costs.

preference that EPA promulgate only those MCLs that satisfied this condition (SDWA 1996, § 1412(b)(6)(A)).

These economic criteria are distinct from technological feasibility, which Congress separately defined (SDWA 1996, § 1412(b)(4)(D)). Among other things, Congress explicitly limited technological feasibility to "treatment techniques and other means" found to be effective "under field conditions and not solely under laboratory conditions" and "available (taking cost into consideration)." Whereas previously economic feasibility was subsumed into technological feasibility, and cost was considered only insofar as engineers considered it unreasonable based on their unarticulated subjective judgment, SDWA 1996 formally established economic principles for standard-setting while retaining the rudimentary consideration of economics by engineers. Note also that the implicit definition of economic feasibility given by Congress ("benefits justify costs") is very similar to the definition given by economists ("benefits exceeding costs"), as indicated in Section V.B.

Since SDWA 1996 was enacted, EPA has set standards for lead and copper;[2] radionuclides;[3] and arsenic.[4] The Agency made an economic feasibility determination in the radionuclides rule but not the others, and in the radionuclides case economic feasible was facially contestable. Thus, it cannot be inferred that the Agency's post-SDWA 1996 standard-setting practices properly account for economic feasibility. Rather, economic feasibility appears to have been a determination of convenience in the radionuclides case

[2] (U.S. Environmental Protection Agency 2000c) and (U.S. Environmental Protection Agency 2007), revising (U.S. Environmental Protection Agency 1991).

[3] (U.S. Environmental Protection Agency 2000a).

[4] (U.S. Environmental Protection Agency 2001).

that the Agency elided in the other regulations because no such determination would have been credible.

Table 1 summarizes how EPA used the terms *economic feasibility* and *economically feasible* in final national primary drinking rules promulgated after SDWA 1996. In no case did the Agency define one or both terms or use them in a context that plausibly referenced the statutory requirement in § 1401(1)(C)(i). In the 19 final rules, the term *economically feasible* appears only three times. None of these uses is definitional; the first is a paraphrase of the statutory language in§1401(1)(C)(i); the second is an unsupported assertion that a MRDL ("Maximum Residual Disinfectant Level") adheres to this statutory language; and the third is an unsupported acknowledgement that a specific technology may not be *technically and economically feasible* — a use in which economic feasibility is treated as a redundant with technical feasibility.

The subsections that follow show that in the national primary drinking water standards for lead and copper, radionuclides and arsenic, EPA was silent about economic feasibility in two cases (lead and copper, arsenic). The Agency could be inferred to have implicitly claimed that the third standard (radionuclides) was in fact economically feasible because it asserted that the benefits "justified" the costs. However, in that case there is convincing evidence that EPA's assertion is false.

Table 1: No SDWA-1996 Final Rule Defines "Economic Feasibility" or "Economically Feasible"

Date Citation	**Rule**	**"Economic Feasibility"**	**"Economically Feasible"**
08/14/1998 63 FR 43834	Revision of Existing Variance and Exemption Regulations To Comply With Requirements of the Safe Drinking Water Act	Not mentioned	Not mentioned
12/16/1998 63 FR 69478	Interim Enhanced Surface Water Treatment	Not mentioned	Not mentioned

Date Citation	Rule	"Economic Feasibility"	"Economically Feasible"
12/16/1998 63 FR 69390	Disinfectants and Disinfection Byproducts	Not mentioned	"The fundamental objective of the SDWA is to establish protective public health goals (MCLGs) together with enforceable standards (MCLs or treatment techniques) to move the water treatment systems as close to the public health goal as is technologically and economically feasible." (69400) "EPA has reassessed the health effects data on chlorine dioxide, including the new CMA two-generation study and determined that the MRDL should remain at 0.8 mg/L as proposed. EPA believes that this MRDL is set at a technically feasible level for the majority of chlorine dioxide plants. This is the case because EPA considered children and susceptible populations in its MRDLG determination (EPA, 1998h). The MRDL is set as close to this MRDLG as is technically and economically feasible."
04/14/2000 65 FR 20304	Revisions to IESWTR, Stage 1 DBPR	Not mentioned	Not mentioned
05/04/2000 65 FR 25982	Public Notification Rule	Not mentioned	Not mentioned

Date Citation	Rule	"Economic Feasibility"	"Economically Feasible"
12/07/2000 65 FR 76708	Radionuclides	Not mentioned	Not mentioned
01/16/2001 66 FR 3770	Revisions to IESWTR, Stage 1 DBPR	Not mentioned	Not mentioned
01/22/2001 66 FR 6976	Arsenic	Not mentioned	Not mentioned
05/22/2001 66 FR 28342	Arsenic and Clarifications to Compliance and New Source Contaminants Monitoring: Delay of Effective Date	Not mentioned	Not mentioned
06/08/2001 66 FR 31086	Filter Backwash Recycling Rule	Not mentioned	Not mentioned
01/14/2002 67 FR 1812	Long Term 1 Enhanced Surface Water Treatment Rule	Not mentioned	Not mentioned
02/13/2004 69 FR 7156	Approval of Additional Method for the Detection of Coliforms and E. Coli in Drinking Water	Not mentioned	Not mentioned
01/04/2006 71 FR 388	Stage 2 Disinfectants and Disinfection Byproducts Rule	Not mentioned	"EPA assumes that small systems may adopt GAC20 in a replacement mode (with replacement every 240 days) over GAC10 because it may not be <u>economically feasible</u> for some small systems to install and operate an on-site GAC reactivation facility." (413)
01/05/2006 71 FR 654	Long Term 2 Enhanced Surface Water Treatment Rule	Not mentioned	Not mentioned
11/08/2006 71 FR 65574	Ground Water Rule	Not mentioned	Not mentioned

Date Citation	Rule	"Economic Feasibility"	"Economically Feasible"
10/10/2007 72 FR 57782	Lead and Copper: Short- Term Regulatory Revisions and Clarifications	Not mentioned	Not mentioned
10/19/2009 74 FR 53590	Drinking Water Regulations for Aircraft Public Water Systems	Not mentioned	Not mentioned
02/13/2013 78 FR 10270	Revisions to the Total Coliform Rule	Not mentioned	Not mentioned
02/26/2014 79 FR 10665	Minor Corrections to the Revisions to the Total Coliform Rule	Not mentioned	Not mentioned

1. Lead and copper

The 2000 and 2007 lead and copper rules revised an existing a treatment technique promulgated in 1991 in lieu of an MCL. EPA attempted to finesse relevant provisions of the statutory language and was tested in court.[5] The Natural Resources Defense Council (NRDC) alleged that EPA's interpretation of "feasibility" was improper, but the Court sided with EPA, largely for reasons of *Chevron* deference, concluding that the Agency's definition ("capable of being accomplished in a manner consistent with the Act") was reasonable. But this case did not address the definition of *economic* feasibility. EPA made no case that its treatment technique was economically feasible, and neither of the plaintiffs challenged EPA's rule on this ground. Moreover, EPA's regulatory impact analysis for the challenged 2007 final rule included multiple cost estimates (pp. 57799-57807) but no benefit estimates, so it cannot be construed as establishing that the final rule was economically feasible based on an *economic* definition of the term.[6]

2. Radionuclides

In 2000, EPA set the MCL for uranium at 30 μg/L instead of the proposed 20 μg/L because the incremental cost would have been an estimated $39 million per year to prevent at most 0.2 cancer case per year. This implied a cost of at least $195 million per

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[5] American Water Works Ass'n v EPA 1994).

[6] In SDWA 1996, Congress adopted EPA's reasoning by requiring EPA to estimate countervailing increases in risk (§ 1412(b)(3)(C)(i)(VI)) and allowing the Agency not to promulgate an MCL that would increase health risks (§ 1412(b)(5)(A)), as the NRDC's interpretation of "feasibility" ("as close to the maximum contaminant level goal as is feasible") would have required it to do.

cancer case, well above the then-applicable EPA central tendency willingness-to-pay (WTP) estimate of $5.8 million for premature mortality (not cancer).[7] Even the least stringent MCL considered, 80 μg/L, was estimated by EPA to have a cost-effectiveness ratio of at least $32 million per cancer case ($16 million/0.5 case), averaged across variable system sizes.[8] Thus, the Agency's judgment that benefits "justified" the costs was facially contestable, and because longstanding EPA risk assessment practices (U.S. EPA Office of the Science Advisor 2004)[9] routinely resulted in inflated risk and benefit estimates, an unbiased estimate of the

[7] (U.S. Environmental Protection Agency 2000b, p. 90).

[8] EPA declined to select a select a less stringent MCL. "EPA does not believe that uranium levels above 30 μg/L are protective of kidney toxicity with an acceptable margin of safety" (Ibid., p. 76714). Logically, this imputed an extraordinary WTP for reductions associated with precaution, not health risk.

[9] See p. 13: "[S]ince EPA is a health and environmental protective agency, EPA's policy is that risk assessments should not knowingly underestimate or grossly overestimate risks. This policy position prompts risk assessments to take a more 'protective' stance given the underlying uncertainty with the risk estimates generated. Another framing policy position is that EPA will examine and report on the upper end of a range of risks or exposures when we are not very certain about where the particular risk lies." With respect to SDWA standard-setting, EPA acknowledges that it ignores economic feasibility: "Under the Safe Drinking Water Act, OW conducts risk assessments to determine nonenforceable Maximum contaminant level goals (MCLGs). OW then sets enforceable Maximum contaminant levels (MCLs) as close as *technically* feasible to the MCLGs after taking costs into consideration" (emphasis added).

"Protective" risk estimates of hazard and exposure, combined with values drawn from the "upper end of a range of risks or exposures" necessarily overstates the expected value of baseline risk, the amount of risk reduced through regulation, and the benefits of regulation. Cost-effectiveness ratios reported here represent hypothetical upper bounds.

cost-effectiveness ratio would have been much greater. Still, EPA implied that this standard was economically feasible while giving no reasoned basis for that determination (U.S. Environmental Protection Agency 2000a, p. 76714).[10] The final rule was challenged by several parties on numerous grounds, one of which was EPA's failure to comply with the benefit-cost provisions of SDWA 1996. In City of Waukesha v. EPA (2003), the D.C. Circuit accepted EPA's argument that the rule was exempt from these provisions because it was a no-change revision of a pre-1986 standard (SDWA 1996, § 1412(a)(1)). In any case, like the lead and copper rule, the radionuclides rule does not establish a precedent for EPA's interpretation of economic feasibility under SDWA 1996.

3. *Arsenic*

EPA conducted a complex analysis of alternative assumptions for WTP, the latency of benefit realization, and discount rates to calculate benefits and costs for alternative arsenic MCLs ranging from 3 to 20 μg/L (U.S. Environmental Protection Agency 2000d). However, benefits were less than costs for each alternative MCL, making economic feasibility facially impossible.

The preamble to the radionuclides regulation (see footnote 8) predates the Agency's 2004 acknowledgement that it embeds precautionary risk management policies within putatively scientific risk assessments.

[10] The determination of consisted of a single sentence: "EPA believes an MCL of 30 μg/L maximizes the benefits at a cost justified by the benefits." Because the estimate of cancer cases prevented relies on assumptions about toxicity and exposure that render it a theoretical upper bound, EPA's statement would not necessarily apply if benefits were estimated correctly. Nonetheless, EPA's characterization of its judgment is consistent with the principle of economic feasibility as set forth in Section IV.G below.

Like the lead and copper and radionuclides rules, the arsenic rule was exempt from the benefit-cost provisions in SDWA 1996. EPA did not comply with those provisions because drinking water standards for arsenic were exempt pursuant to SDWA 1996 § 1615(a)(1).

III. VARIANCES AND EXEMPTIONS

In 1974, Congress established a relatively simple regime of variances and exemptions to deal with compliance issues characteristic of systems for which compliance was economically or technology infeasible. As noted in Section II.A above, that regime failed in practice. Congress revised the statute's provisions for variances and exemptions in 1986, but made them more complex and no more workable. To fix what was not working a second time, Congress made wholesale changes in 1996 that expanded the regime's complexity beyond the breaking point but never addressed the fundamental issue: for many U.S. public water systems, especially small systems, there simply are no cost-effective ways to achieve MCLs that are presumptively cost-effective for large water systems.

A. SDWA 1974

SDWA 1974 allowed states with primary enforcement authority (and EPA otherwise) to grant variances or exemptions to water systems that could not comply with an MCL or treatment technique. States were authorized to issue variances if the inability to comply was "because of characteristics of the raw water sources which are reasonably available" to the system, "taking costs into account" (SDWA 1974, § 1415(a)(1)(A)), or issue exemptions if a water system's inability to comply was "due to compelling factors (which may include economic factors)" (SDWA 1974, § 1416(a)). Variances and exemptions were temporary and uncertain reprieves: states were required to establish compliance schedules, and EPA was required to review variances and exemptions every three years and revoke them wholesale if "a State has, in a substantial number of instances, abused its discretion" (SDWA 1974, § 1415(a)(1)(G)(i) [variances]; § 1416(d)(2)(A) [exemptions]). According to Schnare (2017), EPA discouraged states from exercising their statutory authority to issue variances and exemptions.[11]

B. SDWA 1986

SDWA 1986 revised the variance/exemption regime in significant ways. First, Congress directed EPA to determine "best available" technologies and treatment techniques for water systems eligible for variances and allowed EPA to differentiate based on "the number of persons served by the system or for other physical conditions related to engineering feasibility and costs of compliance" (SDWA 1986, § 104). Second, Congress created new compliance deadlines for water systems eligible for exemptions and formally established merger with a larger water system as a compliance alternative. Third, Congress permitted indefinite exemptions for water systems with fewer than 500 service connections and limited financial capacity if they were "taking all practicable steps to meet the requirements" (SDWA 1986, § 105(a)(4)(B)(iii) and (C)). This appears to have been the first time Congress acknowledged that very small water systems might never be able to

[11] "[T]he Office of Drinking Water articulated a nationwide policy that did not allow states to issue variances for several years" because Congress denied it the authority to review them before state approval and Agency staff believed that it was impossible for them to promulgate standards for raw water.

comply with MCLs that were presumptively economically and technologically feasible for large systems.

C. SDWA 1996

In its latest SDWA incarnation, Congress once again tried to achieve conflicting policy goals. With respect to variances and exemptions, Congress added substantial new complexity and narrowed eligibility to public water system serving fewer than 10,000 persons (SDWA 1996, § 1412(b)(15)(A)). For the first time, systems could consider point-of-entry or point-of-use treatment units but had to retain ownership, control, and maintenance responsibility, even for systems located inside customers' residences (SDWA 1996, § 105). EPA was directed to prescribe by regulation or guidance "the best treatment technologies, treatment techniques, or other means" ... that are "available and affordable" to small water systems. Congress said these so-called "variance technologies" "shall achieve the maximum reduction or inactivation efficiency that is affordable considering the size of the system and the quality of the source water." Congress did not define "available" or "affordable," the key terms EPA was to apply in making these determinations.

Also for the first time, Congress provided an indirect definition of economic feasibility: the costs of a standard must be justified by the benefits. EPA was directed to conduct extensive risk and economic analysis (SDWA 1996, § 1412(b)(3)(C)) and permitted not to promulgate MCLs in which benefits did not justify costs (SDWA 1996, § 1412(b)(6)(A)). EPA also was allowed not to promulgate standards that indirectly increased risk, such as from other contaminants (SDWA 1996, § 1412(b)(5)(B)(i)). Finally, EPA was now allowed to promulgate standards less stringent than the *technologically* feasible level as long as they "maximize[d] health risk reduction benefits at a cost that is justified by the benefits."

SDWA 1996 directed EPA to publish guidance to the states to assist their development of affordability criteria, and EPA published this guidance in 1998 (U.S. Environmental Protection Agency 1998b). In principle, SDWA 1996 provided a statutory predicate for multiple MCLs: one MCL applicable to large water systems, and one or more system-specific MCLs where the national MCL was not economically feasible for small systems.

Exemptions remain temporary — the greatest delay a water system can obtain is nine years — and EPA appears to have resisted policies that could make variances available in practice. Eligibility requirements are stringent and the paperwork burden is extensive (40 C.F.R. § 142.20-21). The threat of subsequent revocation by EPA is not trivial (40 C.F.R. § 142.24). The variance provisions in SDWA 1996 are triggered only if EPA determines that a national standard was not affordable, and as of 2013 the Agency had not made any such determination (U.S. Conference of Mayors et al. 2013a).[12] Multiple stakeholders agree that EPA's affordability criteria failed to provide the relief Congress intended (U.S. Conference of Mayors et al. 2013b).[13]

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[12] For an earlier authoritative admission by EPA, see U.S. Environmental Protection Agency (2006c, pp. 10673 and 10678).

[13] "If EPA affordability criteria functioned properly, the economic hardship imposed on lower-income households might be alleviated in many communities by relaxing compliance requirements or stretching them out over a longer time frame. Unfortunately, there are several critical limitations to how EPA defines affordability and applies its assessment criteria. This is due in part to EPA's reliance on metrics such as median

Congress expressed its displeasure with this state of affairs in 2002 by directing EPA to review and update its national-level affordability criteria. EPA conducted this review, changed "affordability criteria" to "affordability methodology" and proposed some alternatives (U.S. Environmental Protection Agency 2006c), but a decade latter still has not issued final revised guidance.

IV. AFFORDABILITY

In lieu of a implementing the statutory requirement for economic feasibility in SDWA § 1401(1)(C)(i), EPA developed unpublished internal guidance concerning how much expenditure on drinking water was "affordable" (Schnare 2017). EPA had faced an unforgiving legislative history and received pushback against an economics-based definition of economic feasibility:

> EPA has traditionally analyzed the cost of regulations in terms of affordability for large public water systems; this approach reflects the legislative history of the SDWA. The 1974 House Report provides that "the Committee intends that the Administrator's determination of what methods are generally available (taking cost into account) is to be based on what may reasonably be afforded by large metropolitan or regional public water systems." Because of economies of scale available to large systems, the cost of technology has generally not been a limiting factor in setting regulations.

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household income (MHI), which is highly misleading as an indicator of a community's ability to pay. As a result, regulatory relief is not provided in many communities where substantial and widespread economic hardships are indeed being created" (p. 1).

However, as the number of drinking water regulations increases, the national costs of implementing these regulations have caused concern in some quarters. As a result, there have been a number of recommendations as to how the Agency should factor cost into its regulatory decisions.

It has been suggested that the Agency should not look at the costs of implementing each regulation separately, but should estimate the costs of implementing all applicable drinking water regulations. Many have recommended that EPA should not regulate contaminants at levels where the benefits do not outweigh the costs of regulation. This cost-benefit argument arises more frequently now that EPA is generally addressing contaminants that pose fewer health risks and occur less frequently. In proposing regulations for radionuclides (including radon), EPA proposed to use a cost-effectiveness approach in setting the standards. The Agency received a great many comments from the public on the radionuclides proposal and the cost-effectiveness analysis. In general, industry, water systems and State commenters agreed with the approach and encouraged its further use. However, environmental commenters opposed it. NRDC indicated that the cost-effectiveness approach is an "extremely dangerous attack on the fundamental requirements of the SDWA that was directly rejected by Congress during the 1986 legislative amendment debates." The Agency has not finalized this rule or use the cost effectiveness approach in any existing rules (Anonymous 1987 [sic]).[14]

[14] See also (Schnare 1998). Whatever the past role legislative history may have played in statutory construction in the 1980s, it has surely attenuated since the textualism movement led by Justice Scalia, who believed that reliance on it "was much more likely to produce a false or contrived legislative intent than a genuine one." See (Breyer et al. 1999, p. 335). Scalia's objection is particularly salient given that EPA elevated legislative history about economic feasibility above the statutory text.

A. Pre-SDWA 1996

SDWA 1974 does not mention affordability, nor does it direct EPA to apply the concept either in national standard-setting or for setting policy with respect to variances and exemptions. Rather, EPA derived its affordability principle from a selective reading of legislative history. Schnare (1998) reports that Members had conflicting views; some objected to benefit-cost balancing, which was the only way to ensure that MCLs met the economic feasibility requirement in § 1401(1)(C)(i). Others recognized and worried about the financial burden imposed on small systems by MCLs designed for large systems, and expected EPA to figure out ways to accommodate them.

Given seemingly inconsistent congressional direction, EPA was left with the authority to make law. Schnare (1998) describes "open warfare" within EPA between those advocating setting standards using benefit-cost analysis and those who preferred to take costs "into consideration" some other way (or not at all). When asked by states for advice concerning how to "take costs into consideration" for variances (SDWA 1974, § 1415(a)(2)) or determine when cost was a "compelling factor" justifying an exemptions (SDWA 1974, § 1416(a)(1)), EPA staff told them *they* thought 2% of median household income was "affordable," based in part on the judgment by outside experts in social policy (Schnare 2017). But this Agency advice was never put in writing, either as a regulation or formal guidance. And it appears that EPA has never determined that a proposed standard was *not* affordable (Raucher et al. 2011, p. 5; U.S. Conference of Mayors et al. 2013a, p. 4; U.S. EPA National Drinking Water Advisory Council 2003, p. x), suggesting that the victors of the internal war within EPA were whose who preferred to maximize the Agency's bureaucratic discretion.

B. SDWA 1996

In SDWA 1996, Congress formally embraced the EPA staff's "affordability" concept, including its choice of national-level criteria. Congress left unchanged the economic feasibility criterion in § 1401(1)(C)(i), which applied to standards in general, but directed EPA to ensure that variances and exemptions accounted for affordability without defining the term quantitatively. This led the Agency to finally issue guidance to states on how to apply the affordability concept in implementing their variance and exemption authorities (U.S. Environmental Protection Agency 1998b). This guidance says states have "complete discretion in developing their affordability criteria" and are not required to obtain prior EPA approval (p. Iv). Yet as before, variances and exemptions remain temporary, do not apply to pre-1986 and microbial contaminants, and are subject to ex post micromanagement by EPA.[15] The Agency's ability to micromanage state affordability determinations derives from its statutory authority to specify so-called "variance technologies," which may not be affordable in practice,[16] and determine ex post that a state

[15] Variances can be permanent if a state determines that a water system's contaminant level "ensure[s] adequate protection of human health." See SDWA 1996, § 1415(e)(3)(B). Exemptions can be permanent if compliance is infeasible "due to compelling factors (which may include economic factors)" and the exemption "will not result in an unreasonable risk to health." See SDWA 1996, § 1416(a). The issuance of variances and exemptions remains procedurally burdensome.

[16] (U.S. Environmental Protection Agency 1998b, p. 4): "Variance technologies must achieve the maximum reduction that is affordable, considering system size and source water quality. Again, the variance technology selected must ensure adequate protection of public health."

variance or exemption is “not in compliance with the State's [not EPA’s] affordability criteria.”[17]

In 2015, EPA established the Water Infrastructure and Resiliency Finance Center to identify “adequate revenue streams necessary to finance projects and activities to maintain and upgrade their water infrastructure and meet their Clean Water Act and Safe Drinking Water Act obligations” (U.S. EPA Environmental Financial Advisory Board 2016, p. 2).[18] But the Center’s primary purpose with respect to affordability is to identify and tap other sources of funds to compensate when affordability is lacking. The Center also charged the Environmental Financial Advisory Board (EFAB), a Federal Advisory Committee Act (FACA) chartered entity, to identify ways for the Center to assist local governments with household affordability problems (U.S. EPA Environmental Financial Advisory Board 2016). The EFAB responded with numerous questions but no answers, recommending that

[17] The authority granted to EPA to review and override state determinations based on state affordability criteria is potentially vast and unsettling, and may partially or completely undermine the states’ purportedly “complete discretion” to devise their own affordability criteria.

[18] The Center funds 10 university-affiliated regional “Environmental Finance Centers” to provide assistance; see (U.S. Environmental Protection Agency 2017). Some appear to have programs that may address the affordability of SDWA regulation ((UNC Environmental Finance Center 2018), (Southwest Environmental Finance Center 2018)); most do not ((New England Environmental Finance Center 2018), (University of Maryland Environmental Finance Center 2018), (Great Lakes Environmental Infrastructure Center 2018), (Wichita State University Environmental Finance Center 2018), (Environmental Finance Center at Sacramento State 2018)).

the Center collect data on how affordability decisions are made and how success is measured. Interestingly, EFAB also asked EPA to define "affordability" more clearly[19] In short, four decades after formulating the affordability concept, its meaning remains unclear.

The result is a highly complex regime of overlapping and competing federal and state authorities. Implementation problems and perverse incentives have been amply documented (see, e.g., U.S. Conference of Mayors et al. (2013a). The SDWA model, and especially its 1996 iteration, includes exemptions and variances that make multiple de facto MCLs inevitable: an explicit MCL for public water systems serving more than 10,000 persons, and one or more implicit MCLs for small systems. This result was opposed by some stakeholders despite its statutory foundation,[20] who wanted EPA to reject that which the law permitted. Opponents perceived multiple MCLs as creating an unequal protection problem (U.S. EPA National Drinking Water Advisory Council 2003), but as noted in Section V.H below, uniform national MCLs have unequal protection problems of their own.

C. Internal inconsistencies in the affordability principle

Apart from its inconsistently with the overarching statutory requirement that MCLs be economically feasible and the implementation problems observed in practice, EPA's

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[19] EFAB also recommended that the Center "compile a summary of related work that all the EFCs and interest groups have already completed or are in the process of completing," implying that the Center is not the clearinghouse it says it is.

[20] (U.S. EPA National Environmental Justice Advisory Council 2009, p. 1): "The NEJAC believes that EPA should avoid the use of variances for small drinking water systems… The NEJAC cannot support a two-tiered policy that the use of variances clearly would trigger."

affordability principle invites ambiguity, mischief and inequity. Moreover, even in the absence of these structural deficiencies, the choice of affordability metric is inherently arbitrary (Schnare 2017; U.S. EPA Science Advisory Board 2002).

1. Domains are easily Gerrymandered

The effect of any affordability rule depends on how it applied, and the choice of domain significantly affects application in practice (Irvin 2017; U.S. EPA Science Advisory Board 2002). Specifically, the larger the set of systems included in the domain, the greater will be the number of systems for which the average is a misleading proxy. Indeed, the limits of domain aggregation range from a regime in which all water systems belong to the same set (i.e., a national MCL without variances or exemptions), to a regime in which each water system belongs to its own domain. Because there is no objective basis for determining which system grouping to use along this continuum, domain boundaries can be Gerrymandered to maximize or minimize system-level flexibility. Gerrymandering also can be used to effect constitutionally or statutorily impermissible policy goals, such as racial discrimination.

2. Measures of central tendency are inherently arbitrary and misleading

There is nothing special about MHI as an affordability metric, nor is the particular MHI statistic obtained from the Census Bureau without critics (see, e.g., Eskaf 2013). Indeed, even the choice of which median to use is arbitrary and can be chosen strategically, either to justify higher expenditures or oppose them. Other measures of central tendency besides the median are available, and it is not clear that central tendencies are superior to other percentiles of the relevant distribution.

3. All income-based affordability metrics are inequitable

Affordability must be given a practical definition, but income-based metrics are inherently susceptible to imposing greater burdens on low-income households. Higher income communities obviously can afford more protection from drinking water contaminants, irrespective of the magnitude of benefits. In high-income jurisdictions, income-based affordability thresholds have the practical effect of discouraging efficiency in drinking water supply. High community income allows a water system to be less vigilant about not spending their customers' money on low-valued projects.

Any fixed percentage of an income-based metric such as MHI imposes disproportionate burdens on lower-income households within the domain (Berahzer 2012; U.S. EPA Science Advisory Board 2002). Even if, say, 2.5% of MHI were stipulated to be upper-bound of what is affordable, by definition half of all households within the domain must pay more than 2.5%, which exceeds the stipulated upper-bound.

Furthermore, the larger the domain the wider will be the range about the median. Not only will the number of lower-income households disadvantaged be larger, but the disproportional impact on these households will be greater. There is no equity principle that justifies willfully imposing greater financial burdens on lower-income households for the purchase of the same good or service. As Irvin (2017) notes:

> [U]sing percent MHI on its own can obscure the affordability issues that low-income households face within a service area. If the goal of the affordability analysis is to understand whether a utility or community should focus on mitigating affordability, then using the percent MHI provides little insight compared to other more precise metrics.

Irvin and others (e.g., Raucher et al. 2011; U.S. Conference of Mayors et al. 2013a, b; UNC Environmental Finance Center 2017) suggest different approaches intended to make the affordability metric sensitive to the disproportionately high opportunity costs experienced by low-income households.[21]

Finally, the shape of the income distribution also matters. Communities with the same MHI may differ significantly with respect to income variability, and thus the proportion of households that would bear a much greater burden. If the distribution is wide, the greater will be the fraction of households whose financial burden is disproportionately great.

EPA recognizes the household-level affordability problem and has asked various entities, such as the Environmental Financial Advisory Board (EFAB) and the National Drinking Water Advisory Council (NDWAC) for assistance in solving it. The EFAB found the assignment challenging given the Agency's focus on a subset of large water systems (those serving ≥ 100,000 persons), where the affordability problem is smallest, and its apparent lack of relevant information concerning how affordability decisions actually were made and what funding sources were available (U.S. EPA Environmental Financial Advisory Board 2016, pp. 4-5). NDWAC endorsed EPA's continued use of the MHI but recommended that EPA replace 2.5% with 1% (U.S. EPA National Drinking Water Advisory Council 2003, p. xii) — a 60% reduction.

[21] Raucher et al. (2011, Figure 1 ("Hierarchy of household necessities") provides a useful qualitative description of disproportionate opportunity costs borne by low-income households). U.S. Conference of Mayors et al. (2013b) notes that the cost of complying with federal drinking water regulations displaces other investments in water infrastructure.

D. Unintended consequences of the affordability threshold

When senior EPA staff settled on 2.5% of MHI as the Agency's threshold for affordability for SDWA regulation in the 1970s, this amount was well above what they expected actual costs to be (Schnare 2017). But as EPA promulgated more and more MCLs and other regulatory requirements under the SDWA, at some point these aggregate costs increased up to, or even beyond, the 2.5% threshold.

The affordability threshold has become a practical constraint on how much drinking water suppliers can charge. This, in turn, appears to have contributed to the rising gap between reported infrastructure needs and revenues available to fund them.[22] In short, the affordability threshold set four decades ago is now a de facto regulatory budget. Once the threshold is reached, no new drinking water regulations may be promulgated without either breaking the regulatory budget (i.e., ignoring the affordability threshold) or eliminating one or more existing regulations, and their costs, to create budget headroom.

Regulatory budgets can be useful for controlling costs, but they have well known pathologies. First, they do not account for benefits. If a highly cost-effective opportunity for regulation arises but there is insufficient room under the budget cap, it must be tabled until headroom under the cap is created. Second, the need for headroom intensifies agencies' existing incentives to understate regulatory costs. If a regulatory budget is not enforced honestly, growing cynicism may take over and undermine public confidence that the budget (or, in this case, the affordability threshold) is real. Third, incumbent regulations

[22] [[Any estimates from AWWA on the size of this gap that can be converted into household equivalents?]]

without automatic sunset provisions enjoy privileged status over potential new regulations regardless of comparative merit. Highly cost-effective new regulations must displace, not merely outcompete, incumbent regulations. Displacement can be exceedingly difficult because incumbent regulations enjoy internal agency support, external support from rentseekers, and can only be rescinded subsequent to compliance with the rulemaking provisions of the Administrative Procedure Act 5 U.S.C. § 553).

E. Managing affordability under SDWA

States with SDWA primacy can issue variances and exemptions with respect to federal MCLs, but as noted in Section III above, the eligibility requirements and paperwork burdens are highly complex, subject to considerable uncertainty, and intended to be temporary. Drinking water standards issued pursuant only to state law have additional complexity depending on applicable state law. For example, California's SDWA allows the drinking water regulator to issue variances and exemptions to qualifying small systems regardless of whether the standard is federal or state, but the regulator restricts the definition of small systems to those serving fewer than 200 connections,[23] or about 500 persons. This is much lower than the threshold of 10,000 persons in SDWA 1996 § 1415(e)(1)(A), about 4,000 connections. Thus, California has chosen to provide much less small-system relief. How much less flexible California's law is in practice depends on the number of systems that serve between 200 and 4,000 connections (about 500 to 10,000 persons. In the case of California's 2014 hexavalent chromium MCL, which in 2017 was vacated and remanded for failure to account for economic feasibility, this cannot be

[23] California Health and Safety Code § 116380 (a)(1).

discerned from publicly disclosed data because California uses different group sizes than those set forth in SDWA 1996.[24]

For individual households, EPA encourages states to permit, and water systems to adopt, customer assistance programs (CAPs) (U.S. Environmental Protection Agency 2016; UNC Environmental Finance Center 2017). These programs have limited potential for managing affordability because they are targeted at a small fraction of households.[25] They cannot address situations in which a substantial fraction of households served by a particular system face costs exceeding EPA's affordability threshold.

CAPs funded via rate surcharges are explicitly authorized by law in just one state for public utilities (Washington) and four states for private utilities (California, Kansas, Nevada and Washington). However, they are explicitly prohibited by law in three states each for public utilities (Arkansas, California and Mississippi) and private utilities (Arkansas, Colorado, Maryland and New Jersey). Laws governing CAPs are ambiguous elsewhere. The UNC Center's recommendations consist of seeking legislative changes, "framing" subsidies

[24] See California Department of Public Health (2013), grouping water systems into <200 connections (~500 persons), 200-1,000 connections (~500 to ~2,500 persons), 1,000-10,000 connections (~2,500 to ~25,000 persons) and ≥10,000 connections (≥~25,000 persons).

[25] U.S. Environmental Protection Agency (2016, p. 3) implies that about 1% of households may have financial capacity constraints.

in ways that might neutralize legal and political opposition,[26] and relying on charitable contributions.

CAPs reduce the economic infeasibility of drinking water regulation to those households who receive subsidies. However, CAPs operate by shifting costs elsewhere, not reducing them. Moreover, where CAPs are funded by rate surcharges, they reduce efficiency by artificially raising the cost of water to the vast majority of customers, who are ineligible for subsidy. Reductions in efficiency translate to deadweight losses, which must be accounted for in any benefit-cost or Regulatory Impact Analysis in which low-income households, small system customers, or both, are assumed not to pay. For example, if burdens on systems serving low-income communities or low-income households in larger systems are assumed to escape the cost of water treatment for which they benefit, the resulting deadweight losses are real social costs that cannot be simply ignored because someone else pays.

F. Economic analysis in SDWA standard setting

SDWA 1996 amended the main standard-setting provisions of the law to create to create a much larger role for economics while retaining unchanged the SDWA 1974 requirement that MCLs be economically feasible. Amendments included requirements for higher-quality benefit-cost analysis[27] and a requirement that the Administrator "publish a

[26] See (UNC Environmental Finance Center 2017, p. 9): "[R]ather than framing a CAP as a subsidized rate class, present it as an essential cost of running a utility that provides financial benefits to all customers."

[27] SDWA 1996 § 103.

determination as to whether the benefits of the maximum contaminant level justify, or do not justify, the costs."[28]

This language finally resolves the longstanding conflict between the goal of public health protection and the reality of highly variable compliance cost, which prior congresses chose to ignore in hopes it would go away. MCLs must be economically feasible, and SDWA 1996 implicitly defines economic feasibility as the case where benefits "justify" costs. Moreover, EPA is required to identify variance technologies that "are available and affordable … for public water systems of varying size, considering the quality of the source water to be treated" (§ 1412(b)(15)(A)). But if the benefits of a national MCL must "justify" the costs, there is no principled basis for identifying by regulation variance technologies that account for size and source water quality but for which benefits *do not justify* the costs. Thus, the only plausible way to reconcile the overarching requirement for economic feasibility and the directive to ensure that variance technologies are affordable is to define affordability to apply to circumstances in which benefits justify costs but a water system is financially incapable of complying with even cost-effective MCLs.

G. Recent reform proposals

Dissatisfaction with EPA's affordability metric has led to several reform proposals. All such proposals seek to make changes at the margin in EPA's affordability metric. None addresses the fundamental problem that the affordability metric conflicts with the SDWA requirement that MCLs be economically feasible.

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[28] SDWA 1996 § 104.

1. <u>*Reform proposal by EPA*</u>

In 2006, EPA proposed to modify its affordability guidance in several important ways (U.S. Environmental Protection Agency 2006c). Prior to publishing the proposal, EPA sought advice from the Science Advisory Board and the Regarding substantive changes, EPA had previously sought advice from the Science Advisory Board (SAB) and the National Drinking Water Advisory Council (NDWAC).

(a) Science Advisory Board (SAB)

The SAB raised concerns that previously discussed in Section IV.C above (U.S. EPA Science Advisory Board 2002). The panel recommended that EPA consider lower percentiles than the median of the 2.5% MHI distribution, such as the 10th or 25th percentiles. SAB also recommended that EPA consider lower thresholds than 2.5%, having noted evidence that 2.5% implied substantial opportunity costs.

The SAB also recommended a number of reforms, such as "case-by-case assessment of affordability in individual water supply systems" and local determinations of affordable small system technologies. If incorporated into standard-setting, these reforms would replace EPA's one-size-fits all national MCLs with system or system-size specific MCLs. As the SAB noted, these changes would enhance both efficiency and equity. Efficiency would be served by ensuring that MCLs produced more benefits than costs for more water systems. Equity would be improved by reducing the propensity of drinking water standards to impose greater costs on systems serving poorer communities (which national-affordability criteria imposed inequitable burdens), and on poorer households within any system (who faced disproportionately higher burdens regardless of where the affordability threshold was set). The SAB also recognized that EPA's view of quantity-based equal protection was inequitable if equal protection was interpreted to mean equal prices, a point discussed in greater detail in Section V.H below.

(b) The National Drinking Water Advisory Council (NDWAC)

The NWDAC majority provided very different opinions (U.S. EPA National Drinking Water Advisory Council 2003). With respect to EPA's affordability metric, the NDWAC majority recommended that EPA replace its 2.5% MHI threshold with an "incremental" threshold of 1% MHI[29] and consider cumulative regulatory burden.[30] It also objected to EPA's use of variances to manage affordability because of concern that this would lead to a

[29] U.S. EPA National Drinking Water Advisory Council (2003, 87): "Specifically, the [majority] recommends that the national incremental affordability threshold for each rule be set at a specific percent of MHI [i.e., 1%] that EPA would then apply to individual rules for purposes of determining whether to issue small system variance technologies."

[30] (U.S. EPA National Drinking Water Advisory Council 2003, pp. 99-100).

"two-tier system of water quality standards",[31] an outcome it viewed as unethical.[32] The NDWAC majority recommended that EPA manage affordability using other means.[33]

NDWAC member National Rural Water Association (NRWA) file a scathing minority report. NRWA opined that the majority's threshold for affordability was not affordable for small and rural systems, and that other majority recommendations were "either not authorized by the Safe Drinking Water Act (SDWA) or ... impossible to implement" and

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[31] U.S. EPA National Drinking Water Advisory Council (2003, p. 24).

[32] U.S. EPA National Drinking Water Advisory Council (2003, p. 89): "[NDWAC] Work Group members suggesting that 2.5 percent or a higher value be used were concerned that a 'widening of the door' or increasing the likelihood of variance considerations for small water systems might promote a two-tier system of water quality standards and delay otherwise achievable improvements in water quality." See also p. 85 ("The awarding of variances suggests that there could be two water quality standards for American citizens depending on the system from which they acquire their drinking water. Citizens obtaining water from systems for which the new standards are affordable may have access to higher quality water than those who obtain their water from small systems that cannot afford to implement the technology required to meet the new MCL.") and p. 99 ("[T]he potential acceptance of lower water quality for disadvantaged communities is ethically troublesome."). Section V.H explains why this view depends on a quantity-based interpretation of equal protection that is inequitable if equal protection is defined in terms of equal prices.

[33] (U.S. EPA National Drinking Water Advisory Council 2003, p. 99): "The NDWAC believes that alternatives to the variance process identified by the Work Group (such as cooperative strategies, targeted use of funding to disadvantaged water systems, a Low Income Water Assistance Program, etc.) are more appropriate means to address the affordability problem."

provided little or no relief for small and rural water systems. NRWA also objected to the composition of NDWAC work group.[34]

(c) EPA proposal

EPA's proposed revisions to the affordability guidance attempted to thread the needle between these conflicting views (U.S. Environmental Protection Agency 2006a). EPA identified three key factors to be considered: (i) variability in cost across households; (ii) variability in small systems' ability to pay for treatment; and (iii) the 2.5% MHI is not affordable for many small systems.

EPA reported that average cost per household served by small systems varied by a factor of seven in the 1998 Stage1 disinfection byproducts rule; a factor of 10 in the 2001 arsenic rule; and a factor of 16 in the 2000 radionuclides rule (U.S. Environmental Protection Agency 2006c, p. 10677).[35] The Agency further acknowledged that "per household costs for the median sized system within a statutory size category may not be the best proxy for per household costs within the category generally…" (Id.). But EPA also stated that it still prefers system-level MHI as the relevant affordability indicator; "does not believe that the economic circumstances of the poorest households within a system should drive its national level affordability methodology"; and believes "[c]ommunities have other mechanisms (e.g., financial assistance, rate structures) for addressing inequalities within a

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[34] U.S. EPA National Drinking Water Advisory Council (2003, Appendix 1): "Colleges, private water systems, environmental organizations, state primacy agencies, and large water systems do not represent the types of systems that have to pay the unaffordable rates — so it is easy to come up with a solution that does little good for the low-income rural water customer… EPA should Implement the small system variance provisions in the SDWA as Intended by Congress and avoid bringing outside institutions into the process that are not impacted by this provision."

[35] Table III-1; "[T]here is significant variability in per household costs, even within the statutory system size categories, particularly within the smallest size category."

community" (p. 10677). EPA proposed to retain the MHI but consider lower percentages and use a regulation-specific "incremental" approach even though it could result in total household costs in excess of 2.5%. However, the proposed "incremental" approach could exacerbate the financial burdens faced by small systems and low-income households instead of providing relief.[36]

EPA's acknowledged that its longstanding approach to variances "has not allowed small system variances to be included among the options that States and systems consider as they struggle to address small system affordability issues," so the Agency was "considering revisions that would make a national level determination of unaffordability significantly more likely" and "give primacy states which choose to include small system variance provisions in their drinking water programs the option to evaluate small system variance applicants on a case-by-case basis and to authorize adoption of affordable

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[36] (U.S. Environmental Protection Agency 2006c, p. 10678): "As recommended by both the SAB and NDWAC, EPA is considering revisions that would drop the expenditure baseline and move to an incremental approach. This means that the total cost of water (including current costs) could be significantly higher than whatever affordability threshold EPA selects, because the threshold is compared only to the incremental cost of complying with the regulation. In addition, as water systems are subject to future regulations, they could potentially be required to undergo expenditures up to the affordability threshold multiple times."

EPA's interpretation of the "incremental" alternative recommended by the NDWAC majority is plausible; NWRA's minority report asserts that it offers little or no relief to small rural water systems. However, the SAB report does not support changes that would *increase* inefficient and inequitable burdens on systems serving low-income communities or low-income households generally. See, e.g., U.S. EPA Science Advisory Board (2002, p. 5 [EPA's use of variances to protect small systems from costs exceeding the affordability threshold is sound]; p. 7 [both efficiency and equity are served by modifying requirements for small systems]; and p. 13 [alternative "incremental" approach requires a lower affordability threshold to offer sufficient protection to small systems]).

alternatives to compliance technologies that provide some measure of regulatory relief while still protecting public health (U.S. Environmental Protection Agency 2006a, pp. 10678-10681). These options included (i) considering only incremental costs of compliance with new regulations rather than cumulative costs, but using a lower percentile of the cost distribution in each system-size category (e.g., 10th percentile) instead of the median; (ii) determining county-specific affordable small-system technologies for systems in "economically at-risk counties," giving states the authority to evaluate and decide on variance applications; and (iii) complying with the SDWA 1996 provisions for affordable small-system technologies by "interpreting 'affordable' to mean something different for compliance and for variance technologies" (U.S. Environmental Protection Agency 2006a, p. 10681).[37]

As previously noted, option (i) could result in total costs well in excess of the 2.5% MHI threshold that EPA acknowledges is not affordable for many small systems. Option (ii) could double the cost of drinking water for households served by small systems irrespective of whether total cost is greater than 2.5% of household income. Combined with an "incremental" approach to affordability, total costs would rise over time and the affordability threshold would not be adjusted. EPA justified option (iii) based on the fact Congress did not define "affordable" and "expressly left the definition of 'affordable' to EPA (in consultation with States)" (U.S. Environmental Protection Agency 2006a, p. 10681).

EPA received more than 12,000 public comments (U.S. Environmental Protection Agency 2006b), and more than ten years have elapsed. EPA still has announced no plan to finalize any revisions, and no regulatory or deregulatory actions related to drinking water are included in EPA's Fall 2017 regulatory plan (U.S. Environmental Portection Agency 2017).

[37] EPA acknowledged that its refusal to determine affordable small-system technologies has been "inconsistent with Congressional intent" and states that this approach would be "a reasonable way to implement these provisions in a manner consistent with Congressional intent" (U.S. Environmental Protection Agency 2006a, p. 10681).

2. *Proposals from States*

California has established by statute the policy that safe drinking water is a positive right to be guaranteed by the government (AB 685, 2012). However, the law is strictly hortatory. It does not elevate this "right" above other statutes, including the California Safe Drinking Water Act (California Health and Safety Code Secs. 116270-1167552015a). Further, while the statute directs state agencies to "*consider* this state policy when revising, adopting, or establishing policies, regulations, and grant criteria when those policies, regulations, and criteria are pertinent" (§ 1(b), emphasis added), it "does not expand any obligation of the state to provide water or to require the expenditure of additional resources to develop water infrastructure" (§ 1(c)) and "shall not apply to water supplies for new development" (§ 1(d)). Finally, nothing in the policy converts drinking water into an actual public or private good.

Separately, the California legislature has directed the State Water Resources Control Board to develop a Low-Income Water Rate Assistance Program (AB 401, 2015b), which may involve a state-run financial aid scheme for low-income households (Walton 2017b). Four alternatives have been analyzed so far, with annual transfers from taxpayers ranging from $277 million to $580 million, not including administrative costs (Luskin Center for innovation 2017). Because it would rely on subsidies, the program would not reduce the aggregate cost of drinking water regulation in California. Burdens would be reduced on eligible low-income households but increased elsewhere. Moreover, neither AB 401 nor AB 685 amends the state's Safe Drinking Water Act (2015a), which like its federal counterpart requires state drinking water standards to be economically feasible (California Health and Safety Code § 116365(a)). Unlike the federal SDWA, this provision is not dormant in

California: the state's 2014 primary drinking water standard for hexavalent chromium was overturned and vacated for failure to demonstrate economic feasibility (CMTA et al. v. State Water Resources Control Board, 2017).

3. *Proposals from stakeholders*

On behalf of a coalition of stakeholders, Stratus Consulting prepared a comprehensive review of EPA's affordability guidance, identified problems in its implementation, and proposed a number of reforms (U.S. Conference of Mayors et al. 2013a, b). It was noted that, whereas EPA looks at affordability at the community level with respect to wastewater treatment, for drinking water EPA considers affordability only at a national level:

> EPA does not consider the affordability of drinking water requirements in any manner that pertains to individual utilities (even small ones), or to the category of medium and large utilities.
>
> EPA has stated that it would consider a National Primary Drinking Water Regulation to be unaffordable to small communities (those with populations under 10,000) if the standard would result in a household drinking water bill in excess of 2.5% of the national MHI in such communities. In this context, MHI is evaluated based on all small community water systems collectively (i.e., MHI is not considered for any individual utility, but for all small utilities lumped together). To date, EPA has never determined that a drinking water regulation is unaffordable for small systems. If EPA were to make such a finding, it would be required to identify technologies for small systems that might not result in meeting a particular drinking water standard but are found to protect public health. Then, on a case-by-case basis, states may approve the use of such affordable small system technologies (called a variance) or approve an extended deadline for compliance (called an

exemption). States cannot approve both a variance and an exemption for the same standard in the same community. Variances are subject to review and approval by EPA. States have allowed very few variances and exemptions because they can be difficult and expensive to issue (U.S. Conference of Mayors et al. 2013b, p. 2).

When compared with other household expenditures, EPA's upper-bound for affordability in its so-called "Residential Indicator" (RI) — 2.5% of MHI for drinking water and 2.0% of MHI for wastewater — is an astounding sum. Average household income was $83,143 in 2016 (U.S. Bureau of the Census 2018), so EPA's threshold implies that it is reasonable for a household to spend on average $2,079 on drinking water and $1,662 on wastewater treatment. The amount for drinking water is greater than the average amount spent on gasoline and oil ($1,885) and apparel and services ($1,803), and half of the amount spent on food at home ($4,049). The total for drinking water and wastewater treatment combined ($3,741) exceeds the amount spent on health insurance ($3,354), food away from home ($3,154), and entertainment ($2,913) (Bureau of Labor Statistics 2016). Meanwhile, water rates are going up in part because of conservation; by consuming less water, households have to pay more per unit (Walton 2017a).

USCM et al suggest that EPA consider alternative measures of affordability besides the median, such as lower quintiles; smaller dimensions of the domain, such as Census tracts or Public Use Microdata Areas (PUMA); alternative measures of poverty, such as the

Census Bureau's Supplemental Poverty Measure; and a variety of other indicators of economic need.[38]

USCM et al also raise concerns about deficiencies in EPA's secondary screening tool, the Financial Capability Indicator (FCI), which EPA uses as a measure of a community's ability to finance federal drinking water and wastewater mandates. The FCI accounts for property taxes as a fraction of property value, but ignores other taxes. It captures differences in unemployment from the national average, but ignores whether the national average is high. It accounts for a community's formal debt burden, but ignores unfunded liabilities such as pensions and health care commitments as well as any applicable debt ceiling. Finally, the FCI does not account for the opportunity cost of compliance — the public services that communities must forego in order to comply with federally mandated drinking water and wastewater regulations.

Other stakeholders are critical of the methodology in the USCM reports, most notably because the reports do not account for differences in water bills between single family and multi-family housing, where a disproportionate fraction of low-icnome households reside (Osann 2016). Many, and perhaps most, low-income residents in multifamily housing may receive no water bill at all because the cost of water is embedded in their rent. This is said to fundamentally change the affordability calculus, when in fact it makes more difficult the calculation of incidence on low-income households. The burden of drinking water costs on the poor does not go away when it is hidden in rents.

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[38] They do not question the *magnitude* of EPA's affordability threshold or contest it in principle. Nonetheless, virtually any alternative affordability policy could be achieved through the other changes suggested.

4. Incorporate health-health analysis in SDWA benefit-cost analyses

A team of experienced drinking water economists examined the apparently conflicting goals of SDWA in search of solutions that, with the enactment of SDWA 1996, for the first time, statutorily permitted the use of benefit-cost analysis (Raucher et al. 2011). This study used lessons from health-health analysis (HHA) to identify and estimate the countervailing risks created by EPA's conventional approach to standard-setting, and thereby highlight previously undisclosed and unanalyzed equity effects. The authors' persuasively show that the traditional insight that economic efficiency and equity are in conflict (Okun 1975) does not necessarily apply to drinking water regulation.

Four ways to manage small-system affordability problems are identified and briefly discussed: (a) multiple MCLs by system size, (b) federal subsidies directed to small systems or their low-income customers, (c) forcing consolidation of small systems into large systems, and (d) taking no action. Because each of the first three has significant opposition, the fourth has survived by default, resulting in a regime that is simultaneously inefficient and inequitable.

Given this default, Raucher et al. (2011) propose accounting for, within the benefit-cost analyses performed in support of SDWA regulation, the higher opportunity costs experienced by low-income households, including countervailing health risks. For arsenic, they estimate that countervailing health risks are about half as great as the EPA-estimated health risks from arsenic.[39]

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[39] Health risks estimated by EPA to be avoided through the arsenic MCL (fatal and nonfatal cancer) are different than the authors' estimated countervailing health risks (diabetes, high blood pressure, heart attack, and stroke). While the authors imply that WTP

While Raucher et al. (2011) are correct that proper application of benefit-cost analysis requires accounting for welfare losses from the countervailing health risks created by drinking water (and other regulation), a water system need not be small and the affected households need not be poor for HHA to matter. Countervailing health risk may occur in any drinking water regulation regardless of system size or the income of the affected households. Water system size should not be conflated with low income, though they may co-occur. Costs per connection in small systems are high because they lack economies of scale, not because their customers are poor. Conversely, low-income customers served by large systems may experience rate increases that are economically infeasible even if these rate increases are economically feasible for their higher-income neighbors. As shown in Section IV.C, defining affordability as a fixed percentage of median community income necessarily imposes disproportionate burden on those households whose income is below the median. That is, while inequity may be a "bug" in the affordability calculus, it's also very much a feature.

5. <u>Conduct separate benefit-cost analyses for different system sizes</u>

In addition to incorporating HHA in SDWA benefit-cost analyses, Raucher et al. (2011, p. 19) also advocate modifying these benefit-cost analyses to "explicitly examine the

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to avoid these health effects is roughly the same on both sides, that assumption is not well supported given the disproportionate fraction of EPA-estimated arsenic-related health effects that consist of premature mortality. The key points, which Raucher et al. (2011) explain in detail, are that the health effects avoided by regulation and the countervailing health effects caused by regulation both must be objectively estimated and monetized.

impacts of MCLs on small [water systems] (rather than aggregating results across all water system size categories." Conventional, aggregated analyses are misleading; disaggregated analyses highlight differences in net benefits by system size and income group.

Of course, conducting additional analysis without a plan for utilizing the results obtained could be a sterile reform whose analytic costs do not justify its decision-making benefits. Therein lies the path forward: if SDWA § 1401(1)(C)(i) is taken seriously, then it follows that a proposed MCL is incompatible with the where net benefits are negative.

V. DEFINING "ECONOMIC FEASIBILITY" USING ECONOMICS

The missing element in each of these recent reform proposals is any acknowledgement of the principal underlying problem: drinking water standards often do not satisfy the statutory requirement for economic feasibility. This problem began when EPA began implementing SDWA 1974 and it has persisted for more than four decades. It cannot be solved without establishing, by regulation, an economics-based definition of economic feasibility and requiring that all future SDWA standards adhere to the definition. Variances and exemptions should be limited to situations in which no standard is economically feasible, and the Drinking Water State Revolving Fund should be directed to systems that lack sufficient financial capacity to comply with economically feasible standards.

This section sets forth a coordinated plan to reform SDWA standard-setting to ensure that standards are economically feasible for all water systems. To protect against the inequities imposed by the current regulatory regime, EPA would direct resources held by the Drinking Water State Revolving Fund to those systems that lack the financial capacity to comply with economically feasible standards.

A. Economic feasibility in benefit-cost analysis and private markets

Economic feasibility is not defined in benefit-cost analysis — not in the original works in the field (see, e.g., (Mishan 1976), or popular textbooks used in graduate education (see, e.g., Greenberg and Boardman 2017), or practical guides (see, e.g., Brown and Campbell 2015). Moreover, federal guidance on regulatory impact analysis also is silent. Office of Management and Budget (2003) directs agencies to identify a range of regulatory alternatives for analysis, specifying only that they "should reasonably explore which approaches are feasible and plausible ways of meeting the regulatory objective." In context, OMB is describing *technological* feasibility; it is premature to presume economic feasibility before economic analysis has been performed. Similarly, U.S. EPA's RIA guidance uses the conventional definition of economic *efficiency* but does not define economic *feasibility* (U.S. Environmental Protection Agency 2014). Thus, we must define economic feasibility indirectly through the application of microeconomic theory.

A prerequisite for any voluntary exchange is that both buyer and seller are made better off. For this to occur, the expected present value benefits to both the seller and buyer resulting from the transaction must exceed their expected present value costs.[40] In

[40] By definition, *expected* values are not *certain* values. The actual outcome generally cannot be known in advance and, in many cases, benefits and costs will not be fully realized until well into the future. This may impede some transactions, most notably those in which expected benefits and costs are similar, and market participants cannot know for sure in advance whether benefits will in fact exceed costs.

conventional welfare economics, where governments act in place of private decision-makers, it is stipulated that expected net benefits are positive if aggregate present value benefits exceed aggregate present value costs, without regard to the identities of the persons involved (Hicks 1939; Kaldor 1939). All effects are counted exactly once and all persons are treated the same. If gains to those made better off exceed losses to those made worse off, then in principle, winners could compensate losers and a net social benefit would result. This is the minimum economics-based condition for economic feasibility, for if it did not hold, winners could not compensate losers, even in theory, if aggregate losses exceeded aggregate gains. Potential voluntary choices that do not make both buyer and seller better off are infeasible, and any regulatory action that incurs net expected social costs is economically infeasible.

In lay terms, therefore, economic feasibility is the condition in which expected net present value benefits are positive. All voluntary transactions adhere to this rule, and drinking water as a product is no different in principle to any other in the marketplace. That drinking water is supplied by monopolies often under the control of the government changes important characteristics of the supply side of the market, it has no effect whatsoever on the demand side. Consumers are willing to pay for incremental improvements in the safety of drinking water as long as the expected benefits of these improvements exceed the expected costs.

B. Economic feasibility as defined in regulatory contexts other than drinking water

The scholarly literature is replete with papers invoking economic feasibility in the context of drinking water, but in most cases these papers are cast in engineering terms:

economic feasibility is an implicit component of technological feasibility.[41] Nonetheless, a consistent, albeit implicit, definition of economic feasibility is presented: expected present value benefits exceed expected present value costs (see, e.g., Molinos-Senante et al. (2014), Dumit Gómez and Teixeira (2017). This is consistent with treatises on water policy that pre-date SDWA 1974 (see, e.g., Hershleifer et al. (1960) but not those published later, which either ignore economic feasibility or subsume it beneath one of the other policy goals established by SDWA 1974 (see, e.g., Johnson (1978).

Federal statutes direct agencies to use this definition to ensure economic feasibility for water supply and other infrastructure projects. Federal law also directs agencies to conduct economic feasibility analyses in many settings, with the typical objective being to ascertain whether the benefits of a project exceed the costs. States also define economic feasibility in similar terms and require agencies to perform economic feasibility analyses.[42]

In rare cases, economic feasibility has developed a regulatory meaning contrary to the principles of economics. The best example is federal regulation under the Occupational

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[41] An external measure of this subordination is the refusal of prominent legal scholars to even include SDWA among federal statutes directing agencies to use feasibility as the basis for regulatory decision-making. See (Masur and Posner 2010, Table A1).

[42] Washington State defines a project as economically feasible "when, over a reasonable period of time, the application's cumulative benefits outweigh or are equivalent to the application's cumulative costs" (Washington State Office of Financial Management n.d.). California has a similar definition for water projects (California Department of Water Resources 2008 ("total benefits that result from the project exceed those which would accrue without the project by an amount in excess of the project cost")). [[Add more states]]

Safety and Health Act of 1970 (OSH Act).[43] The OSH Act directs OSHA to set standards ensuring that "no employee will suffer material impairment of health or functional capacity" as the result of exposure to a hazard during his working lifetime (§ 6(b)(5)). But the text of the OSH Act is silent about economic feasibility. Rather, the term arose as a result of the "Cotton Dust" case (*American Textile Manufacturers Institute, Inc. v. Donovan,* 452 U.S. 490), in which the Supreme Court decided that OSHA was required to conduct an *economic feasibility* analysis but not a *benefit-cost* analysis, somehow imagining that the former could be done without the latter. OSHA standards have been characterized in practice as "technology-based whose stringency is limited only to their affordability" to firms which must comply, where the threshold for *un*affordability vaguely defined as "the point where added safety becomes prohibitively expensive (Viscusi et al. 1997, p. 803).

C. Economic feasibility in nonregulatory governmental contexts

Where the term economic feasibility is found elsewhere in government, it means that the present value of benefits expected to be obtained exceed the expected value costs. Longstanding federal guidance in water supply specifies that the "Federal objective … is to contribute to national economic development consistent with protecting the Nation's environment," where "[c]ontributions to national economic development … are increases in the *net value* of the national output of goods and services, expressed in monetary units" (U.S. Water Resources Council 1983, p. 1 [emphasis added]). Similarly, the Army Corps of Engineers Institute for Water Resources (2009) says "[a] project should be implemented only if it is better for society than doing nothing. The project must be convincingly shown

[43] Pub. L. 91–596, Dec. 29, 1970, 84 Stat. 1590, 29 U.S.C. Chapter 15.

to be preferred over no action." This understanding of economic feasibility is endorsed by key nongovernmental organizations (e.g., National Research Council 2004).

D. Proxies for economic feasibility in the SDWA

As noted previously, SDWA 1996 established an implicit new requirement for economic feasibility:

> At the time the Administrator proposes a national primary drinking water regulation under this paragraph, the Administrator shall publish a determination as to whether the benefits of the maximum contaminant level justify, or do not justify, the costs… (SDWA § 1996, § 1412(b)(4)(C).

Moreover, Congress explicitly authorized EPA *not* to promulgate standards if

> the benefits of a maximum contaminant level … would not justify the costs of complying with the level… (SDWA 1996, § 1412(b)(6)(A).[44]

Operationally, the starting point for any determination of economic feasibility under this requirement is an objectively conducted benefit-cost analysis.[45] Where benefits clearly

[44] SDWA 1996 § 1412(b)(6)(B) states an exception to this authority if (a) benefits experienced by persons served by large water systems would justify costs, *and* (b) water systems serving persons where this condition does not hold would receive a variance or exemption. It also includes an exception to the exception, if the contaminant in question "is found almost exclusively in small systems eligible … for a small system variance." Considered together, these provisions forbid EPA from misusing its discretion so as not to issue standards that are economically feasible.

[45] Objectivity is required by government-wide and EPA-specific information quality guidelines. See (Office of Management and Budget 2002) and (U.S. Environmental Protection Agency 2002). As noted by Raucher et al. (2011) and in footnote 9 and the

exceed costs, it automatically follows that benefits are "justified." However, where costs exceed benefits, or may do so under uncertain conditions, the meaning of the statutory text becomes murky. The greater the excess of costs over benefits, the more difficult it would be to "justify" them. For example, EPA might appeal to unquantified benefits to "make up the difference. This cannot be sustained, however, if there are unquantified costs that may have similar or greater potential magnitude. And there is no easy way to compare unquantified benefits and costs and determine that the former exceed the latter.

E. Application to SDWA

Drinking water is more like a private than a public good. Like private goods, those who bear costs and those who obtain benefits are generally the same persons and households (Raucher et al. 2011). Drinking water is supplied locally and funded by user fees on those who receive and consume it. Health benefits from regulation accrue almost exclusively to the same persons and households who pay, through these user fees, the costs of providing it. Few benefit without paying for it, and virtually no one pays without benefitting from it. This feature allows the application of traditional economic principles for individual decision-making, not just the principles of benefit-cost analysis that apply to regulatory decision-making on behalf of the population, including the Kaldor-Hicks principle.

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accompanying text, EPA relies on highly precautionary assumptions and models that overstate risk, and therefore overstate benefits. Cost estimates, however, are not subject to those biases, and in many cases costs are understated by, for example, failure to account for opportunity costs.

When Congress enacted SDWA 1974, it expected EPA to establish standards that were protective of public health, technologically and economically feasible, uniform across the United States, and "[took] costs into account." These goals were impossible to simultaneously achieve then and remain so today. Uniform national standards cannot be economically feasible across water systems of diverse sizes and types. Setting standards that are economically feasible for large systems requires imposing economically *in*feasible standards on small systems. Variances and exemptions could have provided a circuit-breaker for small systems, but that would have allowed the vast majority of water systems to escape federal standards, which EPA was unwilling to permit. Meanwhile, EPA risk assessment practices were (and remain) highly biased in favor of overstating likely health risks. That, in turn, systematically undermined economic feasibility by overstating health benefits even in the rare case where the opportunity cost of regulation was accurately estimated.

The attempt to shore up this unworkable regime in 1986 failed, but by 1996 there was a congressional majority in favor of cutting the SDWA's Gordian Knot. For the first time, EPA was directed to objectively analyze risks, benefits and costs, and it was permitted to set only those standards for which benefits exceeded costs.

Since it was enacted in 1974, SDWA has defined a "primary drinking water standard" as a regulation applying to public water systems that "is economically and technologically feasible to ascertain" for a contaminant that may have any adverse health effect" (SDWA § 1401(1)(A)-(C)). Economic feasibility thus requires that, for every such standard, the benefits of the regulation, chiefly or exclusively in the form of health risk reduction, must exceed the costs of obtaining them. Moreover, this requirement supersedes the statutory requirements for standard-setting in SDWA § 1412; any standard that EPA derives from § 1412 must first comply with § 1401.

EPA can cut the SDWA's Gordian Knot by requiring, for the first time, that all MCLs be economically feasible, as SDWA has required since 1974 but which requirement the Agency has ignored, and interpreting the cumbersome provisions for variances and exemptions in SDWA 1996 as indistinguishable from enacting multiple MCLs that account for differences in system size and compliance cost. There are four steps to implement this reform.

First, EPA would clearly define economic feasibility in § 1401(1)(C)(i) by regulation as the condition in which expected present value net benefits are positive — in other words, define economic feasibility in accordance with common sense. Second, EPA would recognize that system size, source water quality and other factors work to create vast differences in expected value net benefits. The Agency would objectively take these factors into account to determine technologically feasible MCLs for each system category. Third, for each system category containing at least one technologically feasible MCL, EPA would objectively determine which are economically feasible. Fourth, EPA would apply SDWA's variance and exemption provisions to systems for which there is an economically feasible MCL but financial constraints limit or prevent compliance.

F. Economic feasibility at the individual water system level

Because of the diversity water systems, it is unlikely that a single treatment strategy will be technologically feasible everywhere. Indeed, for some water systems, source water will be incompatible with most or all treatment technologies — the very reason why Congress enacted variance provisions in SDWA 1974, and expanded upon them in 1986 and 1996. It is also highly unlikely that a treatment technology will be economically feasible for all water systems regardless of size. The challenge is to devise analytic and decision-making rules that account for variability in technology and cost.

Figure 1 illustrates the incremental benefits and costs of treatment for a given water system and a drinking water contaminant that follows EPA's default linear no-threshold risk model for carcinogens. The horizontal axis represents alternative MCLs, ranging from the most to least stringent. The vertical axis represents the cost per connection (household) of applying treatment technology. The green line represents the incremental benefit obtained from treatment; it is constant because every unit of exposure is assumed to pose the same level of risk, and for small risks every unit of risk reduction is assumed to have equal value. The downward-sloping red curve shows the rising incremental cost of treatment as stringency intensifies. Incremental cost approaches infinity as the permitted concentration after treatment approaches zero.

At MCL = T*, incremental cost and benefit are equal. Thus, for alternative MCLs more stringent than T*, incremental cost exceeds incremental benefit, rendering it economically infeasible. However, every alternative MCL greater than or equal to T* is economically feasible, and thus within the domain set by SDWA § 1401(1)(C)(i). If technology is "lumpy," such that only the fixed values MCL_a through MCL_f are technologically feasible, then MCL_c is the most stringent MCL that is economically feasible.

Figure 1: Economically Feasible Contaminant Levels (MCLs) for a Contaminant Having No Risk Threshold

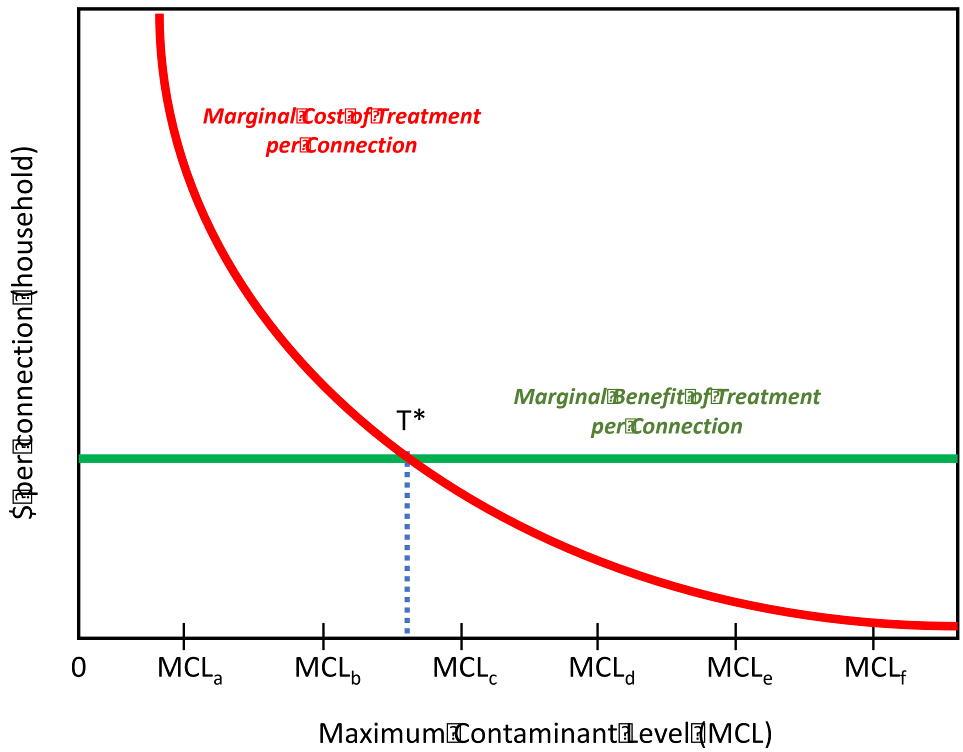
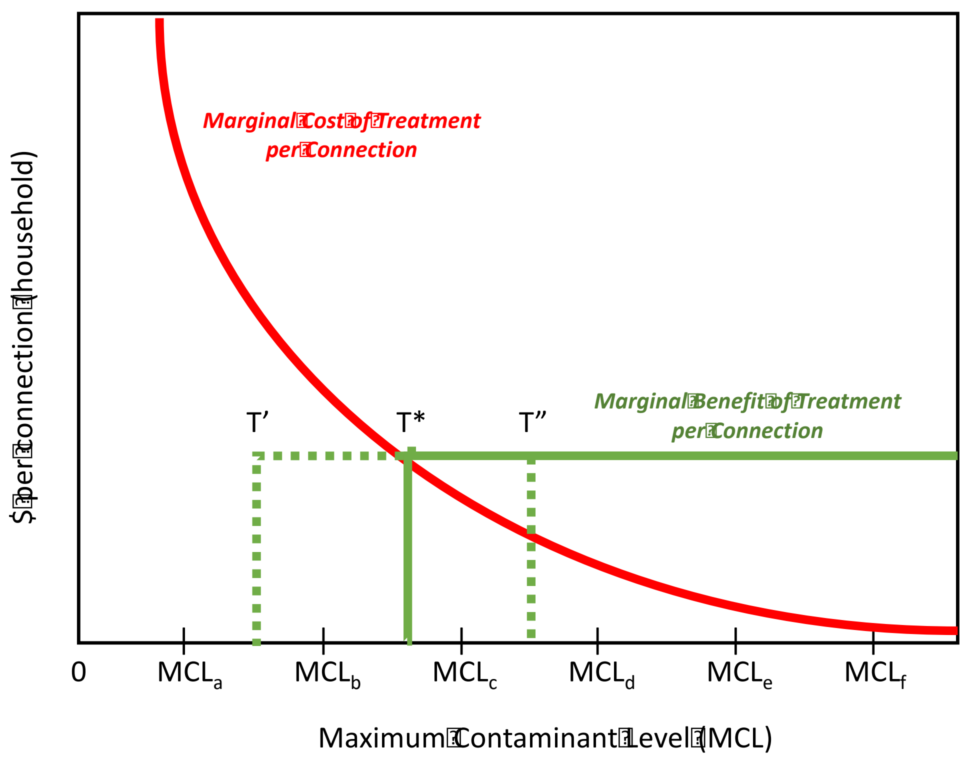


Figure 2 illustrates the incremental benefits and costs of treatment for a given water system and a drinking water contaminant that has an exposure threshold, all other graphical devices and simplifications left unchanged. Risk exists only above the threshold, so incremental benefit must be zero for all possible MCLs below it. The most stringent MCL that is economically feasible depends on where the threshold is located. If the threshold is T* or greater, then every potential MCL that is economically feasible in Figure 1 also is economically feasible in Figure 2 because it has incremental benefits greater than incremental costs. However, if the threshold for health effects is less than T*, then T* is the most stringent economically feasible MCL. Any alternative MCL less stringent than T* also is economically feasible.

Figure 2: Economically Feasible Contaminant Levels (MCLs) for a Contaminant Having a Risk Threshold



To implement this model of economic feasibility requires two steps. First, water engineers must ascertain the technological feasibility of each potential treatment train or technique, assuring that each one deemed feasible is effective "under field conditions and not solely under laboratory conditions" (SDWA 1996, § 1412(b)(4)(D)).[46] Second, for every water system in which one or more technologically feasible treatment alternatives is identified, economists must estimate expected benefits and costs to determine whether it is also economically feasible. Section 1401(1)(C)(i) is satisfied if for each system there is at least one treatment alternative that is simultaneously technologically and economically feasible.

The practical tasks which must be performed are shown in Figure 3 below. Alternative MCLs are arrayed from MCL_a (the most stringent) to MCL_e (the least stringent). Water system classes (WSCs) are arrayed from WSC^1 (highest cost) to WSC^6 (lowest cost). In the top half of the figure, a plus symbol (+) indicates that one or more treatment technologies is available and effective "under field conditions and not solely under laboratory conditions" for the specified WSC/MCL combination (§ 1412(b)(15)(A)). A minus symbol (–) indicates that no technology is feasible, and the analysis for these WSC/MCL combinations is complete and the determination of economic feasibility is moot. Technologically infeasible treatment options cannot ever be economically feasible.

However, for every WSC/MCL combination in which one or more treatment technologies is feasible, an economic feasibility determination must be performed for each feasible technology. Risks, benefits and costs must be objectively estimated, and the economist must determine whether the expected present value of net benefits is positive.

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[46] Congress has deemed granular activated carbon to be technologically feasible "for the control of synthetic organic chemicals." See SDWA 1996, § 1412(b)(4)(D).

In the bottom half of the figure, a plus symbol (+) indicates that one or more treatment technologies is economically feasible and minus symbol (–) indicates that it is not.[47] EPA would promulgate standards only for WSC/MCL combinations in which one or more options is both technologically and economically feasible, and consistent with § 1412(b)(4)(B), for each WSC EPA would select the economically feasible MCL "which is as close to the maximum contaminant level goal."

[47] For illustrative purposes, for each WSC there is at least one technologically feasible treatment option that is not economically feasible.

Figure 3 Hypothetical Sequential Determinations of Technological and Economic Feasibility

Technological Feasibility Determination

MCL_a = most stringent
MCL_e = least stringent

+ = feasible
– = infeasible

MCL	WSC^1	WSC^2	WSC^3	WSC^4	WSC^5	WSC^6
MCL_a	–	–	–	–		+
MCL_b	–	–	–		+	+
MCL_c	–	–	–	+	+	+
MCL_d	–	–	+	+	+	+
MCL_e	–	+	+	+	+	+

Economic Feasibility Determination

MCL_a = most stringent
MCL_e = least stringent

+ = feasible
– = infeasible

MCL	WSC^1	WSC^2	WSC^3	WSC^4	WSC^5	WSC^6
MCL_a	–	–	–	–	–	–
MCL_b	–	–	–	–	–	+
MCL_c	–	–	–	–	+	+
MCL_d	–	–	–	+	+	+
MCL_e	–	–	+	+	+	+

G. Economic feasibility for larger domains

The analysis in Section V.F above applies to a single water system. However, EPA's longstanding practice has been to aggregate individual systems into groups of systems. A similar two-step analysis can be conducted for groups of systems, but the outcome may be ambiguous. A treatment alternative that is determined to be economically feasible for the group as a whole may not be economically feasible for individual systems within the group. The more diverse the group, the greater will be the number of systems for which an economically feasible group-wide treatment alternative is economically infeasible at the system level.

A one-size-fits-all national MCL maximizes the number of systems for which an economically feasible group-wide standard imposes economically infeasible demands. That, in turn, maximizes the need for variances and exemptions. There is no objective way to determine how much economic infeasibility should be permissible under a statutory regime that establishes economic feasibility as a minimum statutory requirement.[48] There are only three ways to manage this conundrum. One option is to promulgate MCLs that are economically feasible for some systems but not others. This creates the need for variances and exemptions *from economically infeasible* MCLs, and it is analogous to how EPA has attempted to implement SDWA since 1974. A second option is to ensure that economic feasibility is satisfied for each member of each group. The analytic burden of conducting

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[48] To the extent that SDWA is ambiguous on this point, it has been the policy of the Executive branch since 1993 to eschew one-size-fits-all regulatory standard-setting. See (Clinton 1993, Sec. 1(b)(11)) ("Each agency shall tailor its regulations to impose the least burden on society, including individuals, businesses of differing sizes…").

individual assessments may seem overwhelming, but such assessments must be conducted anyway; the only question is whether they are conducted before or after promulgating standards. A third option also exists, and that consists of grouping like systems together. While a standard may be economically infeasible for some systems within a group of like systems, the degree of economic infeasibility they experience will be small.

H. Defining equal protection

A key reason why EPA has been unwilling to set different MCLs for different systems is concern about unequal health protection. Some stakeholders share this view (U.S. EPA National Drinking Water Advisory Council 2003, p. x ["the potential acceptance of lower water quality for disadvantaged communities is ethically troublesome"]). This concern is understandable, but it reflects a quantity-based understanding of equal protection when a price-based definition may be more appropriate.

To see why this is so, consider a standard for small systems that is one-tenth as stringent than the standard for large systems because small-system costs are ten times greater. This would mean that residual risk among those served by the small system is ten times greater than residual risk among those served by the large system. This violates the traditional EPA view that equal protection requires equal post-regulation outcomes. That is, leaving aside biological variability in the population, consumers must be assured of facing the same post-regulation health risk regardless of whether they are served by a large or a small system.

But this quantity-based equal protection principle inevitably imposes unequal protection in prices. Households served by the small system must pay ten times as much per unit of risk reduction as households served by the large system. This obvious inequity is maximized under a quantity-based equal protection principle. To achieve price-based equal protection, the cost per unit of risk reduction must be the same for large and small systems.

EPA's traditional view of equal protection is strictly quantity-based, and gives no weight whatsoever to price-based equal protection. But the SDWA is silent concerning which form of equal protection (if any) EPA ought to seek. SDWA 1996 requires EPA to limit its standard-setting to cases in which regulation "presents a meaningful opportunity for health risk reduction" (§ 1412(b)(1)(A)(iii)). Moreover, EPA is required to ensure that variances and exemptions "will not result in an unreasonable risk to health" (§§ 1415(a)(1)(A), 1416(a)(3)). But neither of these texts prescribes a quantity- or price based equal protection principle, or any such principle at all.[49]

A quantity-based equal protection principle is reasonable and appropriate for the defense of certain constitutional rights (e.g., free speech, protection from unreasonable search and seizure, trial by jury) and the provision of public goods supplied by government and funded by general taxation (e.g., national security).[50] However, drinking water is a private good even where provided by a public entity. Consumption is rivalrous and producers can deny access to those who refuse to pay. Thus, drinking water is more like

[49] As noted in Section V.E, Congress directed EPA to achieve three mutually exclusive goals when it enacted SDWA 1974. However, it did not direct EPA to also achieve quantity-based equal protection; that objective originated at EPA.

[50] A public good is one that is non-rival in consumption (i.e., each person's consumption does not reduce the supply available for others to consume) and is non-excludible (i.e., the producer of the good cannot exclude anyone from consuming it). See (Pearce 1981, pp. 352-353).

other *private* goods and services, such as electricity, natural gas and sewage treatment, that are supplied by regulated monopolies because of high fixed costs,[51] as well as risk-reducing goods and services routinely bought and sold in private markets. Indeed, where risk reduction is an attribute of a private good or service provided by a natural monopoly, consumers typically pay the same price per unit of risk reduction but obtain different quantities of risk reduction depending on other factors, such as their baseline propensity for risk. The result is variability in post-regulation risk outcomes, not post-regulation differences in the price of risk reduction. Indeed, in some jurisdictions, public utilities are required to change all customers the same rate (UNC Environmental Finance Center 2017). This practice also is consistent with price-based equal protection.[52]

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[51] Sewage treatment often is supplied by the same public utilities that supply drinking water. However, because sewage treatment is subject to regulatory standards promulgated by EPA, comparisons between the drinking water and sewage treatment "markets" is confounded by common layers of regulation. Moreover, all public utilities experience regulatory control over price and quantity, which creates additional margins for confounding effects.

[52] Laws requiring equal prices are mentioned by, e.g., (Berahzer 2012) and (U.S. EPA Environmental Financial Advisory Board 2016, p. 5): "If state laws or regulations require all customers to pay the same rate, perhaps some consideration can be given to considering a system in which some low income customers can have a discounted rate. In the case of private utilities, there may be rules or regulations that require "reasonable rates" to be charged. However, the rules associated with 'reasonable' may prevent the actions designed to promote affordability. States may wish to examine the ways in which to deal with regulating private utility rates and determine the best ways to ensure affordability."

A few examples outside the world of public utilities may help illustrate this phenomenon.

For decades, automobile manufacturers invented and marketed as options safety features including seat belts, air bags, and antilock brakes. They charged the same price to all customers. But customers varied greatly in the amount of risk reduction they obtained, largely due to differences in baseline risk. The same pattern applies to newly invented automotive safety features, such as lane-departure, forward-collision, and blind-spot warning technologies. The unit price of these technologies is fixed, at least in broad categories, but the quantity of risk reduction varies across consumers.[53]

There is a vibrant consumer market for inherently risky power tools despite every effort by manufacturers and government regulators to reduce risk. Operating risk varies greatly because consumers differ in experience, technical skill, intensity of use, and the propensity to read and follow directions. Still, all consumers pay the same unit price for each risk-reduction technology built into these products. What varies across consumers is the quantity of risk reduction they obtain.

Since the establishment of the National Organic Program by the U.S. Department of Agriculture, food producers have had a governmentally-sanctioned way to appeal to

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[53] Automotive safety innovations have greatest value to those with the highest baseline propensity for risk. Consumers who understand that they are riskier than average are more likely to purchase these innovations. Of course, they also are more likely to adapt their behavior in ways that undermine some or all of the risk-reduction benefits obtained. See, e.g., (Peltzman 1975). Whether or not they engage in adaptive responses that reduce benefits, they still pay the same price.

consumers who believe that foods certified as organic are safer than conventional foods. Whatever these benefits might be, consumers who purchase organic foods pay the same unit price regardless of how much they benefit.

It is difficult to imagine examples in which markets for private goods deliver the same post-purchase unit risk but, like drinking water under EPA's conventional equal protection principle, cost widely different amounts depending on consumer attributes, some of which are beyond their control. The typical consumer experience is one of variable post-purchase risk resulting from variability in the magnitude of risk reduced, not differences in the price of risk reduction. This is true in the theoretical case in which consumer preferences are identical and the real-world case where they are different.

Implementing economic feasibility within the existing domain of federal drinking water regulation

As noted in Section IV.D above, EPA's affordability threshold acts as a regulatory budget on federal drinking water regulation. Once the 2.5% threshold has been met, there is no room for any additional federal drinking water regulation unless one or more existing federal standards is repealed and their costs eliminated.

The problem is existing regulations are explicitly or implicitly grandfathered into the federal regulatory system even if they were not economically feasible when promulgated. Compliance costs have been borne, and repealing them without eliminating their compliance costs opens up no additional room under the affordability budget.

Executive Order 13,771 provides an administrative mechanism to rescind or substantially modify existing drinking water regulations to create room for economically feasible new regulations (Trump 2017). And this would be necessary even if EPA were to formally abandon its affordability guidance because EO 13,771 requires EPA to eliminate or substantially modify two existing regulations for every new regulation promulgated (§ 2). Because agencies also are required to comply with regulatory cost caps set by the Office of Management and Budget (OMB) (§§ 2(b)–(d), 3), it may not be sufficient to simply abandon past policies and practices in favor of strict adherence to economic feasibility for new drinking water standards. EPA likely would have to identify existing drinking water rules that could be rescinded or modified in ways that created substantial cost savings. This might conflict with the SDWA's so-called anti-backsliding provisions (SDWA 1996, § 1415(b)(9)).[54] At a minimum, it appears that a less stringent MCL may be permissible only if a revised risk assessment showed that a less stringent standard was equally or more protective than the existing standard.[55]

I. Managing limited financial capacity

The variance and exemption provisions in SDWA are intended to deal with primarily small water systems that are economically and/or technologically unable to comply.

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[54] "The Administrator shall, not less often than every 6 years, review and revise, as appropriate, each national primary drinking water regulation promulgated under this subchapter. Any revision of a national primary drinking water regulation shall be promulgated in accordance with this section, *except that each revision shall maintain, or provide for greater, protection* of the health of persons" (emphasis added).

[55] SDWA 1996, § 1416(b)(9) says "each revision shall maintain, or provide for greater, protection of the health of persons." The level of protection is scientifically ambiguous insofar as it depends on the underlying risk assessment. Thus, it may be possible to increase an MCL by, say, a factor of two if a revised risk assessment shows that risk was originally overestimated by the same amount.

Variance provisions (in § 1415) apply to water systems whose source water quality makes compliance technologically infeasible. Exemption provisions (in § 1416) apply to water systems that, in the state's judgment, cannot comply "due to compelling factors (which may include economic factors)." In both cases, the fundamental underlying constraint, which may appear to be technological, is actually economic.

EPA's administrative solution to this dilemma was to issue guidance assisting states in determining whether compliance is "affordable" (U.S. Environmental Protection Agency 1998a, b, 2006a). As described in Section IV, the Agency deemed 2.5% of median household income as "affordable" and adopted extensive tests of water systems' financial capacity to measure it. A regime in which MCLs are required to be both technologically and economically feasible ensures that benefits exceed costs for every water system. Under such a regime, disputes about "affordability" largely disappear; they are relevant only for water systems lacking the financial capacity to implement economically feasible treatment technologies.

For some water systems, especially very small ones, limited financial capacity would remain a difficult problem. It is one thing to show that a community would obtain net benefits from water treatment to reduce risk from a drinking water contaminant, but communities with limited financial capacity, including serious constraints on borrowing, may be unable to act in accordance with their residents' best interests. If economic feasibility were required at the system level for standard-setting, only systems with limited financial capacity would need special treatment. EPA could limit access to the Drinking Water State Revolving Fund established by SDWA 1996 § 1452 to these water systems, thereby "promot[ing] the efficient use of fund resources" (§ 1452(a)(1)(1)(A)).

Adopting a price-based equal protection principle appears also to be consistent with analysis and recommendations provided by independent economists advising EPA. When asked by EPA to review key economic aspects of its affordability concept, the Environmental Economics Advisory Board noted that requiring small systems to meet the same standards as large systems may be inequitable because households served by small systems would have to pay higher prices for the same good (U.S. EPA Science Advisory Board 2002, pp. 6-7). If households served by small systems also had lower incomes, "the equity argument for modifying the [regulatory] requirement is strengthened" because it "would involve a greater relative income sacrifice."

VI. THE PATH FORWARD

Each iteration of the SDWA has directed EPA to set MCLs "as close to the maximum contaminant level goal as is feasible."[56] As noted previously, this text is not internally dispositive as a matter of statutory construction. Rather, it merely redirects attention to the economic and technological components of "feasibility" in § 1401(1)(C)(i). Because of wide variation in compliance cost across water systems, economic feasibility cannot be achieved without multiple, system or system-size specific MCLs. Any reasonable reading of the variance provisions in SDWA 1996 implies this; permitting small systems to comply through lesser technologies necessarily means the acceptance of less stringent de facto MCLs. Finally, the requirement in SDWs 1996 that these lesser technologies ensure adequate protection of public health necessarily involves comparing costs and benefits.

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[56] See SDWA 1974 and SDWA 1977, § 1412(b)(3); SDWA 1986, § 1412(b)(4); SDWA 1996, § 1412(b)(4)(B).

Public health is adequately protected when the benefits of treatment justify the costs. Requiring treatment in which benefits are not justified by the costs exceeds the statute's risk management objective, and SDWA 1996 explicitly authorizes EPA not to promulgate excessively stringent standards.

As a matter of regulatory practice, however, EPA has not implemented SDWA 1996 provisions for affordable small-system variance technologies, and it has ignored the *mandatory* requirement for economic feasibility in § 1401 and invoked only the *discretionary* statutory directive to "tak[e] costs into consideration" found elsewhere.[57] This latter text permits EPA to exercise unfettered and unaccountable discretion. The Agency could do nothing, apply a strict net benefit maximization principle to all standard-setting, or do anything in between.

It is unsurprising that the Agency has preferred the statute's discretionary suggestion to its mandatory directive, and there are multiple reasons why. First, EPA styles itself a public health agency, which means it strongly prefers to exercise precaution with respect to public health risk (U.S. EPA Office of the Science Advisor 2004), even if that necessarily requires the Agency to be risk-loving with respect to economic and financial risk. Second, it is the interest of every bureaucracy to maximize its capacity to exercise discretion, and exercising discretion in a manner supported by key legislators ensures their support and avoids conflict (Bardach 1978; Downs 1967). More importantly for the present case, promulgating system- or system-size specific MCLs within a single standard could

[57] SDWA 1974 and SDWA 1977, § 1412(a)(2); SDWA 1986, § 14512(b)(10); SDWA 1996, § 1412(b)(4)(D).

undermine the Agency's claim of purportedly scientific authority to determine what exposures are "safe," even though "safety" has no scientific definition and the statute has evolved since 1974 from being safety- to risk-based.[58]

Executive Order 13,771 directs agencies to eliminate two existing regulations for every new regulation they promulgate, adhere to strict budgets with respect to the costs of new regulations, and actively search for deregulatory opportunities (Trump 2017). EPA protestations to the contrary, its drinking water affordability guidance is in fact highly (if indirectly) regulatory and thus provides myriad opportunities for deregulatory actions that reduce cost, enhance efficiency and equity, and restore federalism by reviving state authorities previously suppressed by Agency micromanagement.

The challenge before EPA is to determine, and then exercise, the maximum discretion it has under SDWA 1996 to give economic feasibility a proper role in standard-setting.[59] By law, all drinking water standards must be economically feasible. Thus, it is appropriate for EPA to promulgate a regulatory definition that implements this statutory requirement. Because the requirement appears in § 1401, it should be accorded the same

[58] Prior to SDWA 1996, the statute did not include any reference to risk in its definitions or standard-setting provisions. In SDWA 1974 and 1977, EPA was directed to set MCLs "at a level at which, in the Administrator's judgment based on such report, no known or anticipated adverse effects on the health of persons occur and which allows an adequate margin of safety" (§ 1412(b)(1)(B)). In SDWA 1986 and 1996, this safety directive was changed to apply to unenforceable goals rather than enforceable standards (§ 1412(b)(4)).

[59] EPA also should identify reforms that are needed to improve efficiency and equity but are forbidden by SDWA 1996.

relative weight as technological feasibility, its companion term in the same sentence of the same section, which also applies to all national primary drinking water standards. The definition proposed in Section V.E above is consistent with both economic principles and a commonsense lay understanding of the term.

The next task is reconciling economic feasibility with EPA's small system affordability criteria, which are facially inconsistent with economic feasibility because they count costs but ignores benefits. The affordability criteria also discriminate against small systems; whereas large systems are protected from economic infeasibility by the economic feasibility requirement, small systems are subject to economically infeasible mandates because the affordability criterion ignores benefits and does not apply to large systems. The reform proposed here solves this conundrum by extending to *all* water systems the statutory requirement for economic feasibility that EPA now applies only to large water systems.

Some water systems will have limited financial capacity to implement economically feasible drinking water technologies. That is, for some systems health protection benefits may exceed costs, but the system or its customers may not be able to pay because they lack the ability to finance such investments. Therefore, the final task before EPA is to remedy these financial capacity constraints In Section V.I above, it is proposed that EPA focus all Drinking Water State Revolving Fund monies to lowering the cost of capital for these systems, enabling them to afford health protections their wealthier neighbors can comfortably take for granted.

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