REGULATORY STUDIES PROGRAM

Public Interest Comments on
the U.S. Environmental Protection Agency's Proposed
National Primary Drinking Water Regulations: Arsenic Rule[1]

The Regulatory Studies Program (RSP) of the Mercatus Center at George Mason University is dedicated to advancing knowledge of the impact of regulation on society. As part of its mission, RSP produces careful and independent analyses of agency rulemaking proposals from the perspective of the public interest. Thus, these comments on the U.S. Environmental Protection Agency's (EPA's) proposed arsenic in drinking water rule do not represent the views of any particular affected party or special interest group, but are designed to evaluate the effect of the Agency's proposals on overall consumer welfare.

EPA proposed the arsenic rule on June 22, 2000 (40 CFR Parts 141 and 142, in the *Federal Register* at page 38888). The proposed rule is intended to offer public health risk reduction benefits for Americans who are served by public water systems (PWS) that rely on groundwater or surface waters that have elevated levels of arsenic. The focus of the rule is on reducing arsenic concentrations from the existing standard of 50 micrograms per liter (ug/L) to a new proposed Maximum Contaminant Level (MCL) of 5 ug/L. The Agency has evaluated MCL options of 20, 10, and 3 ug/L as well, and has solicited comment on these alternative potential MCLs. For each MCL option, the goal is to reduce the risks of several cancers (e.g., bladder, lung, and skin) and other adverse health effects that have been associated with ingestion of elevated levels of arsenic.

The process by which EPA determines the arsenic MCL is particularly important and precedent-setting. As discussed more fully below, the arsenic rule is the most compelling case to date for using EPA's authority to rely on benefit-cost analysis, granted in the 1996 Amendments to the Safe Drinking Water Act. These comments raise and address a series of key questions regarding the proposed arsenic rule, with a specific focus on how the Agency's benefit-cost analysis (BCA) was developed and interpreted within the context of the statutory authority and the economic goal of maximizing the welfare of society. Section I provides background information and reviews the rule's key provisions and rationale, and indicates that EPA's interpretation and application of BCA is not consistent with either its statutory direction, nor basic economic principles. This is particularly important due to the precedent-setting nature of this particular rule. EPA has fallen short in its responsibilities to serve the public interest and maximize social welfare by ensuring that the nation is receiving the greatest health protection possible from its investments in environmental and safety programs.

Section II elaborates on the legal, economic, and policy implications of the Agency's incorrect application of BCA. It contrasts the Agency's approach with what EPA should have done if it properly adhered to the statute and the principles of social welfare economics. Section III describes the Agency's analysis and findings and section IV offers alternative estimates of the benefits and costs of the proposed options. Examining the proposed MCL options with this analysis suggests how the rule might be improved to provide greater net social benefits. Section V offers conclusions and recommendations. Appendix I provides the RSP checklist, which evaluates the proposed rule and its supporting analysis according to seven elements of good regulatory policy.

I.   The Precedent of Using Benefit-Cost Analysis is Pivotal for this Proposed Rule

A.   The Critical Issue is How Society's Benefits Compare to the Regulatory Costs

In evaluating the Environmental Protection Agency's proposed revision to the arsenic standard for drinking water (U.S. EPA, 2000a), several key issues are widely accepted as facts:

1.   There is compelling evidence that elevated levels of arsenic in drinking water are associated with serious risks to human health, including cancer of the bladder, lung, and skin.

2.   It is technically feasible to reduce arsenic levels in drinking water to very low levels.

3.   There is no party with a vested economic interest in keeping arsenic levels in drinking water high. Drinking water utilities (known as community water systems, CWS) are either investor-owned and economically regulated so as to obtain a reasonable return on any arsenic removal investments they would have to make, or are publicly owned (e.g., municipal) and thus represent the same people who would benefit from reduced arsenic levels (and can recover the costs through increased rates or taxes).[2]

Given these facts, one might find it hard to imagine that setting a revised drinking water standard (Maximum Contaminant Level, or MCL) for arsenic would be a highly contentious issue. Nonetheless, there is a vigorous debate about how stringently to set the revised drinking water standard for arsenic in the U.S. Why is this the case? Quite simply, the debate hinges around how the benefits compare to the costs.

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[2] Also, because arsenic typically is a naturally occurring compound when found in drinking water supplies, there are few business entities with potential third-party liabilities or pollution control costs associated with a more stringent drinking water standard. The impact on clean-up standards applied to Superfund sites may be a matter of concern for many parties, however.

B. EPA Has Discretionary Authority for Using Benefit-Cost Analysis in Setting the MCL

The households that ultimately bear the costs of a more stringent arsenic MCL are also the beneficiaries of the health risk reductions. However, the costs of moving from the current U.S. standard of 50 ug/L to levels approaching what is technically feasible (e.g., 3 or 5 ug/L)[3] are quite high. Also, the benefits that consumers receive from reducing their current arsenic exposures to such levels are uncertain and may be quite modest. Hence the debate about how stringently to set the MCL is, in reality, a question about what level of public health protection the regulation should compel American households to make on their own behalf.

Prior to the 1996 Amendments, the Safe Drinking Water Act compelled EPA to establish MCLs as low as was technically feasible.[4] Recognizing that there are times when what is technically feasible is not necessarily a wise investment in public health protection, Congress in 1996 provided a mechanism by which the benefits and costs could be weighed and a more prudent level of risk reduction achieved. Provisions inserted in the Safe Drinking Water Act Amendments of 1996 (SDWAA) enable EPA to set an MCL at a level less stringent than what is technically feasible. Specifically, an MCL less stringent than what is technically feasible can legally be established in cases where the Administrator determines that the benefits of the technically feasible level do not justify the costs (Section 1412(b)(6)(A)). The proposed arsenic rule is the most compelling case to date for using this authority, and these comments provide a review of the benefit and cost information pertaining to the proposed new MCL for arsenic.

C. EPA's Use of Its Discretionary BCA Authority is Flawed and Over-Constrained

As discussed below, we have several concerns about the accuracy and credibility of the benefit and cost estimates that EPA derives and uses in assessing the proposed rule. However, perhaps more important than the benefit-cost calculations themselves is the manner in which EPA has proposed applying its discretionary authority in the proposed rule.

The Agency claims the technically feasible level is 3 ug/L, but uses its discretionary authority to propose an MCL of 5 ug/L based on benefit-cost considerations. This is a step forward in that the 3 ug/L option would yield significant negative net social benefits (as discussed below). However, the Agency does not go nearly far enough in using its authority because, according to its data, setting an MCL of 5 ug/L would also yield significant negative net social benefits.   Most important is that in selecting an MCL, EPA sets several constraints and misapplies concepts with the result that the Agency's

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[3] EPA's proposal claims that 3 ug/L is technically feasible, but the feasibility of moving below 5 ug/L has been questioned by the Agency's Science Advisory Board and drinking water utilities.
[4] Specifically, the Act prior to 1996 required that the MCL be set as close to the risk-free health protection goal (MCLG) as feasible. However, for all carcinogens, the risk free goal implied an MCLG of zero, so technical feasibility was the sole determinant for where the standard could be set.

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logic is at odds with both the statute and the basic principles of welfare economics. This proposal thus raises important legal, policy, and economic issues, which are discussed more fully in Section II.

D. Health Risks Associated with Elevated Arsenic Levels May be Overstated by EPA

Arsenic has long been known as a potential toxin to humans, especially with respect to acute risks posed by high exposures (70 to 180 mg).[5] More recently, epidemiological evidence from Taiwan, Chile, and other locations has demonstrated that long-term (chronic) exposure to more moderate levels of arsenic in drinking water—at levels generally in the hundreds of parts per billion range (comparable to hundreds of micrograms per liter)—is associated with elevated risks of cancer of the bladder, skin, lung, and perhaps other target organs. These arsenic levels also may be associated with other (noncancer) ailments as well.

While arsenic is clearly hazardous to humans at some level, the key questions for regulating its level in drinking water are:

- What level of risk is posed to humans at the current U.S. standard of 50 ug/L, and

- How much risk reduction would be achieved if the current standard were reduced to regulatory options such as 20 ug/L, 10 ug/L, 5 ug/L, or lower?

In accordance with the SDWAA, the National Research Council (NRC) assembled an expert panel that provided a comprehensive and scholarly review of the scientific evidence pertaining to these questions. The panel reached a consensus that the risk posed at the current standard of 50 ug/L may be unacceptably high, and that the MCL should be made more stringent (NRC, 1999). However, the panel left unanswered the key questions of (1) what is the level of risks borne at or below the current 50 ug/L standard? and (2) how low should the revised standard be set?

In conducting its benefit-cost analysis of potential MCLs for arsenic, EPA relied heavily (as appropriate) on the NRC report (U.S. EPA, 2000b). However, the Health Risk Reduction and Cost Analysis (HRRCA) that EPA prepared for this rule may have misinterpreted or overlooked important NRC information. For example, the Agency's Science Advisory Board (SAB), Drinking Water Committee (DWC), indicated that EPA's analysis of lung cancer risk is based on a misinterpretation of how such risks compare to those for bladder cancer (SAB/DWC, 2000).[6]

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[5] Vallee et al., 1960, as cited in Casarett and Daull, *Toxicology*, 1986. This is equivalent to 70,000 to 180,000 ug/L in drinking water, given mean tap water consumption of 1L/day.
[6] The SAB Drinking Water Committee report on the arsenic proposal is still in draft form as of this writing. However, the points raised throughout these comments and attributed to the SAB/DWC have been aired by the Committee in several public meetings, and consistently remain in previous iterations of the Committee's draft report.

The SAB's Environmental Economics Advisory Committee (EEAC) also recently issued a report indicating the latency periods associated with cancer effects should be included in the analysis, and that these future health risk reductions need to be discounted to their present values at the same rates as all other benefits and costs (SAB/EEAC, 2000). These and other issues associated with the health risk reduction and associated benefits analysis have an appreciable impact on net benefit estimates and the appropriate arsenic MCL and are discussed below.

E.   The Feasibility and Costs of Meeting Lower Standards are in Question

While the health benefits of a lower arsenic standard remain somewhat uncertain, the scientific evidence of potential risk probably is sufficient enough that there would be little debate about tightening the standard to the technically feasible level if it were reasonably inexpensive and straight-forward to do so. However, the costs of attaining the proposed level of 5 ug/L or even higher levels such as 10 ug/L or 20 ug/L appear to be very high, and there also are numerous concerns about the technical feasibility and potential adverse unintended consequences of doing so (including the potential risks and costs associated with the handling and disposal of hazardous wastes generated as the residuals of water treatment).

As discussed in Section IV, EPA's cost estimates are considerably lower than those developed by a study it cofunded with the American Water Works Association Research Foundation (AWWARF) and other co-sponsors (Frey et al, 2000). In addition, the SAB panel reviewing the rule has raised concerns with key elements of EPA's cost analysis, including the technical feasibility of a potential 3 ug/L or 5 ug/L standard, assumptions about the handling and disposal of wastes generated by treatment to remove arsenic from drinking water, the compliance decision tree, and other facets that contribute to the apparently understated EPA cost estimates (SAB/DWC, 2000).

Issues regarding the details of the costs and engineering feasibility analysis are addressed in other documents (e.g., Frey et al., 2000), and are not covered at length in these comments. However, the cost estimates provided by EPA and Frey et al are both used in the benefit-cost comparisons offered below to indicate the implications of considering alternative potential MCLs. As such, it is important that readers understand that there are considerable divergences in the cost estimates, and that many legitimate concerns exist about the accuracy and completeness of EPA's cost figures.

II.   Legal, Policy, and Economic Issues Associated with EPA's Application of the BCA

A. Issues of Precedent

EPA claims in the proposal that it has for the first time invoked the specific cost-benefit provisions of the SDWA to support the choice of an MCL of 5 parts per billion (ug/L) for arsenic. As such, it is vitally important to consider how EPA interprets its mandate and responsibilities in this regard.

One issue is whether the arsenic rule is indeed setting precedent. The Agency has previously used the SDWAA's BCA provisions, in both the radon MCL proposal (Federal Register, November 2, 1999) and again in the Notice of Data Availability (NODA) issued for the proposed radionuclides MCLs (Federal Register, April 21, 2000). In both of these cases, benefit-cost information was used (albeit not quite as explicitly as in the case of the arsenic proposal) as the basis for not extending the enforceable standards to non-transient non-community water systems (NT-NCWS). The rationale employed by the Agency in both cases was that the benefits of extending the MCLs to NT-NCWS did not justify the costs (and data provided in both rulemaking packages indicated that the "unjustified" costs per fatal cancer avoided were on the order of $100 million to $165 million, as compared to a central estimate of the "Value of a Statistical Life (VSL) of about $6 million).

In the case of both radon and other radionuclides (e.g., radium and uranium) the BCA information was used to exclude applicability of the MCL to the NT-NCWS class of public water systems (PWS) rather than to consider how stringently to set the MCL. Nonetheless, these actions created a precedent in that they departed from how EPA had applied MCLs in the past (i.e., it has previously applied all MCLs to NT-NCWS as well as CWS). EPA also indicated in the radon rule that an MCL lower than proposed might have been technically feasible (e.g., 100 pCi/L in contrast to 300 pCi/L), but did not draw explicit attention to this matter.

In the arsenic proposal, the Agency has explicitly drawn attention to the use of its discretionary authority to use BCA in setting the MCL, and has requested comment. In doing so, the Agency raises several important issues that are addressed below.

B.   Statutory Provisions Call for the Use of Incremental Benefit-Cost Analysis

Section 1412(b)(3) of the Safe Drinking Water Act Amendments states:

> …When proposing any national primary drinking water regulation that includes a maximum contaminant level, the Administrator shall, with respect to a maximum contaminant level that is being considered ... and each alternative maximum contaminant level that is being considered ..., publish, seek public comment on, and use for the purposes of paragraphs (4), (5), and (6) an analysis of ... (t)he incremental costs and benefits associated with each alternative maximum contaminant level considered.

It is thus clear that the BCA's role in MCL-setting is to be based on incremental costs and benefits (rather than total or average benefits and costs). This is consistent with economic principles (as described below). However, EPA has not adhered to this requirement.

1. EPA Incorrectly Focuses on Total, Rather than Incremental, Costs and Benefits.

As in most activities, increasingly stringent arsenic MCLs would generate diminishing returns. As lower and lower treatment targets are considered, costs increase at an increasing rate while the benefits are expected to increase at a decreasing rate (although at most, if the dose-response function is truly linear, it is conceivable that benefits would increase at a constant rate). This relationship implies that there is a balance point where the marginal benefit obtained equals the marginal cost, and it is at this point that net benefits (i.e., social welfare) are maximized. Equating marginal benefits with marginal costs is the appropriate use of benefit-cost analysis to justify a decision—not only is it consistent with economic theory, it is what the statute explicitly requires.

EPA does not use this method to justify the proposed arsenic MCL. Instead, EPA discusses an aggregate comparison of total costs and benefits in an attempt to justify the proposed MCL. In this procedure, the more favorable relationship between benefits and costs from the first increments of additional stringency (i.e., moving from 50 ug/L to 20 ug/L) are averaged in with the less favorable data relating to the last increments (i.e. moving from 10 ug/L to 5 ug/L). EPA bases its decision on comparison of these aggregates. EPA does not employ a reasonable analysis of the incremental costs and benefits associated with each alternative maximum contaminant level considered. EPA has not therefore performed a proper cost-benefit analysis and has not complied with the SDWAA.

Instead of relying on these average values, EPA should examine the tradeoffs between the incremental costs and the incremental benefits from moving from one regulatory option to the next most stringent alternative. The real intent of the statute is clear from the fact that EPA is compelled to compute incremental costs and benefits. EPA presents such incremental values, but provides no discussion of them and does not incorporate them into its justification, relying instead on aggregate cost-benefit comparisons and analysis of uncertainties on the benefits side. The aggregate comparison performed by EPA embodies a decision rule that is structured such that it will always over-shoot the economically optimal level of stringency that would be prescribed by marginal analysis. In other words, given increasing marginal costs per unit of arsenic removal in drinking water treatment, an MCL based on average net benefits will always imply a more stringent MCL, and lower total welfare improvement, than a decision based on comparing incremental benefits to incremental costs

2. EPA Fails to Recognize that Equating Benefits with Costs Does Not Maximize Social Welfare

As a further indication of how EPA fails to comprehend and properly interpret the cost-benefit findings, the Agency states that the objective is to try to *equalize costs and benefits* (with due consideration of nonmonetized costs and benefits). The Agency states: "Congress did not direct EPA to ensure strict equality of monetizable benefits and costs" (p 38951). This statement from the Preamble clearly indicates that EPA does not

understand how benefit-cost analysis should be interpreted in directing the nation's investments in public health protection.

The appropriate objective is to maximize net benefits (which is accomplished when marginal benefits are equated with marginal costs). By merely aiming to have total benefits and total costs be roughly equal, all EPA is accomplishing is to aim for a "break even" proposition that would leave society (if EPA's estimates are correct) neither much worse off nor much better off for having set the MCL. To set regulations and public policies on the basis of such a "zero net benefits" basis would lead to large-scale misallocation of the nation's resources. Instead, the Agency should examine the incremental net benefits of moving to each regulatory option (i.e., the incremental benefits minus the incremental costs), and select the MCL at which the incremental net benefits are greatest.

C. EPA Inappropriately Uses an Ill-Defined "Acceptable Risk" Policy as its Basis for Regulatory Option Selection, Over-Riding the Benefit-Cost Implications

Considerable mention is made in the proposal of the EPA "policy" that MCLs must be established such that individual lifetime cancer risks do not exceed a threshold of 10^{-4}, or that lifetime exposure to the chemical would not induce a greater than one in ten-thousand chance of cancer. This notion that a maximum "allowable risk" (of 10^{-4}) is the ultimate binding constraint on EPA rulemaking—regardless of what the costs of the rule are, or how the benefits compare to those costs—is problematic from the standpoint of welfare maximization, as well as the law.

There is neither statutory mandate nor authority to have a self-defined and self-imposed Agency policy on an "acceptable risk" floor apply to the MCL-setting process. The Safe Drinking Water Act Amendments do not impose or envision such a constraint.

By using the 10^{-4} rule of thumb as a "bright line" above which no MCL can be set, EPA is unduly compromising public welfare. For example, consider an instance where the incremental cost of a potential MCL was not justified by its incremental benefits, but where the estimated cancer risk at a less stringent alternative exceeded the 10^{-4} level. The proposal language appears clearly to state that the Administrator would be obliged to set the MCL at the unjustified level (to maintain a 10^{-4} risk ceiling) rather than follow the letter and intent of the statute and set a less stringent MCL that was indeed justified on a reasonable benefit-cost basis.

EPA should explicitly clarify whether this indeed is its intent and its interpretation of the statute. If this is the case, then the "acceptable risk" floor of 10^{-4} is more of a rule-making itself than a policy, and EPA should publish an "acceptable risk" proposal that allows for public comment on such a critical issue. The change in the statutory standard to a benefit-cost comparison sheds doubt on the legality of the acceptable risk approach that EPA appears to adhere to here.

III. The EPA Analysis Underlying the Proposal Suggests a Less Stringent Arsenic MCL Would Offer Higher Net Benefits.

EPA's preamble (Federal Register, June 22, 2000) and Regulatory Impact Analysis (RIA, U.S. EPA, June 2000) describe the rationale for the proposed rule, the options the Agency considered, and the benefit-cost analysis of the alternative options. This section reviews EPA's analysis and results. It presents the conclusions EPA has drawn from its analysis, and offers alternative interpretations that may be better supported by the data EPA provides.

The Agency's own estimates of costs and benefits are summarized in Exhibit 1. The table includes the EPA-estimated costs of each MCL option, in which the Agency uses a 3 percent discount rate to develop annualized costs, and also a 7 percent rate as mandated by OMB (Circular A-76)(US EPA 2000, RIA, Exhibit 6-10).

Exhibit 1: EPA-Estimated Benefits and Costs

(millions 1999 dollars)

MCL Option	Cancer Cases Avoided				Total Monetized Benefits		Estimated Costs of Compliance		Net Benefits	
	Fatal Cases (1)		Nonfatal Cases							
	Low	High	Low	High	Low	High	at 3%	at 7%	Low	High
50										
20	2.0	6.0	3.0	9.0	$ 12.7	$ 42.1	$ 63.2	$ 73.7	$ (61.0)	$ (21.1)
10	4.6	11.0	6.7	15.5	$ 29.3	$ 76.5	$ 164.9	$ 192.4	$ (163.1)	$ (88.4)
5	8.4	18.8	11.8	26.6	$ 53.3	$ 130.8	$ 378.9	$ 442.2	$ (388.9)	$ (248.1)
3	11.4	21.8	16.3	31.1	$ 72.4	$ 151.9	$ 644.6	$ 753.2	$ (680.8)	$ (492.7)

(1) Fatal cancers avoided are EPA's estimates for bladder fatalities, plus an equal number of lung cancer fatalites

 (I.e., fatal lung cancer and bladder cancer cases avoided are in a 1:1 ratio)

The monetized benefits include EPA's estimated reduction in the number of fatal and nonfatal bladder cancer cases, and its "what if" estimates of potential lung cancer fatalities avoided (based on assuming that regulation-derived avoided cases of fatal lung cancers are as numerous as the fatal bladder cancer cases estimated).[7] EPA values fatal cancer cases at $6.1 million, reflecting a central estimate from the range of literature-derived "Values of a Statistical Life' (VSL), without any latency or discounting considerations. Nonfatal cancers are valued between $178,400 (based on cost of illness data reflecting medical expenses, discounted at a 3 percent discount rate) and $607,200 (based on a benefits transfer of a willingness to pay study of chronic bronchitis). Nonquantified health benefits are also duly noted by EPA, including possible risks of skin and kidney cancer, cardiovascular and pulmonary effects, and potential reproductive and developmental effects.

Based on EPA's own results shown in Exhibit 1, the net benefit of the proposed 5 ug/L MCL is significantly negative, with the standard imposing between roughly $250 million and nearly $400 million in net costs every year. EPA suggests these costs may be justified because (1) the Agency's self-imposed "acceptable risk" ceiling of 10-4 is met at 5 ug/L (according to EPA's exaggerated risk estimates); and (2) the dollar benefit estimates do not reflect the potential for some nonmonetized or unquantified risk reductions. However, it is difficult to fathom that such unquantified benefits could amount to the nearly half a billion dollars per year required to yield a modest positive net benefit for the proposed rule.

Of course, as noted above, the more appropriate comparison would be to examine incremental benefits, incremental costs, and incremental net benefits. This is done in Exhibits 2 and 3. As shown in Exhibit 3, the incremental net benefits are negative and large for all the potential regulatory options. Hence, based on EPA's own estimates of benefits and costs, one has to wonder whether it makes sense to tighten the existing standard at all. Clearly, there seems to be no basis for selecting 5 ug/L as the preferred option. If the BCA is being used by EPA as its basis for moving away from a technically feasible standard of 3 ug/L[8] because the costs are not justified by the benefits, then how can EPA find that the costs are any more justified by the benefits at 5 ug/L than they are at 10 ug/L? or 20 ug/L?

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[7] EPA presents a scenario attributing benefits to bladder cancer fatalities avoided, along with "what if" scenarios that assume the standard will avoid lung cancer fatalities in the range of 2 to 5 times higher than fatal bladder cancer cases. The SAB/DWC has since noted this was a misinterpretation of the NRC report, and has stated that the risks are roughly equivalent. The benefits figures in Exhibit 1 reflect a one-to-one ratio of bladder and lung cancer fatalities avoided.

[8] Note that the SAB, AWWA, and other parties have questioned whether achieving a standard of 3 ug/L or even 5 ug/L is technically feasible.

Exhibit 2: EPA-Based Incremental Benefits of Arsenic MCLs

(millions of 1999 dollars)

MCL Option	Nonfatal Bladder Cancers Avoided		Nonfatal Bladder Benefits		Fatal Bladder & Lung Cancers		Fatal Cancer Benefits (c)		Combined Benefits	
	Low	High	Low(a)	High(b)	Low	High	Low (d)	High(d)	Low	High
50 → 20	3	9	$ 0.5	$ 5.5	2.0	6.0	$ 12.2	$ 36.6	$ 12.7	$ 42.1
20 → 10	3.7	6.5	$ 0.7	$ 3.9	2.6	5.0	$ 15.9	$ 30.5	$ 16.5	$ 34.4
10 → 5	5.1	11.1	$ 0.9	$ 6.7	3.8	7.8	$ 23.2	$ 47.6	$ 24.1	$ 54.3
5 → 3	4.5	4.5	$ 0.8	$ 2.7	3.0	3.0	$ 18.3	$ 18.3	$ 19.1	$ 21.0

(a) at $178,400 per case based on medical expenses (PV of cost of illness, at 3%), from RIA p 5-21

(b) at 607,200 per case, based on WTP for avoiding chronic bronchitis (Viscusi et al, 1991), from RIA p 5-21

(c) EPA bladder estimate, and lung cancers at 1:1 with bladder

(d) based on unadjusted VSL of 6.1 million

Exhibit 3: EPA-based Incremental Net Benefits of Arsenic Standards

(millions of 1999 dollars)

MCL Option	Incremental Cost		Incremental Benefits		Incremental Net benefits	
	EPA (3%)	EPA (7%)	Low	High	Low	High
50 → 20	$ 63.2	$ 73.7	$ 12.7	$ 42.1	$ (61.0)	$ (21.1)
20 → 10	$ 101.7	$ 118.7	$ 16.5	$ 34.4	$ (102.2)	$ (67.3)
10 → 5	$ 214.0	$ 249.8	$ 24.1	$ 54.3	$ (225.7)	$ (159.7)
5 → 3	$ 265.7	$ 311.0	$ 19.1	$ 21.0	$ (291.9)	$ (244.7)

Hence, even EPA's own estimates of benefits and costs provide no basis for supporting the proposed standard of 5 ug/L. The results also lead one to wonder whether even 20 ug/L MCL would be a worthy investment in public health.

IV. EPA's Estimated Benefits May be Overstated, and its Costs Understated

The discussion above relied on EPA's own assessment of benefits and costs. However, there are several reasons to believe that the benefits may be overstated, and the costs understated by EPA. These issues have been examined by this author elsewhere (Stratus Consulting, 2000c) and are summarized below, with associated implications for where the MCL should be set.

A. EPA's proposal is unlikely to generate the level of health benefits EPA predicts.

As discussed in detail elsewhere (Stratus Consulting, 2000c), EPA's benefit estimates reflect several flawed assumptions and methodologies. The most important of these for the resulting benefit estimates include:

- EPA's risk assessment and benefits analysis (U.S. EPA, 2000b) rely solely on a study of populations in Taiwan that were exposed to relatively high levels of arsenic in their drinking water (e.g., 500 ug/L). These study populations differ in important ways from the U.S. population, and by ignoring these differences, EPA has likely overstated by a significant amount the risk of arsenic ingestion in the U.S. In fact, an epidemiological study of Latter Day Saints in Utah (Lewis et al, 2000) found no statistical evidence linking the amount of arsenic ingested in drinking water with elevated risks of bladder or lung cancer.

- EPA has adopted a linear dose-response function in order to extrapolate cancer risks from the relatively high exposure levels observed in the Taiwanese study data to the much lower concentrations that are being considered as potential MCLs. The NRC expert panel believes, based on the evidence on the mode of action for arsenic-associated cancers, that the dose-response function is more likely to be sublinear – meaning that the linear extrapolation used by EPA overstates the expected risk at low doses (NRC, 1999).

- Bladder cancer is far more prevalent in males than in females, yet EPA assumes data on bladder cancer incidence in U.S. females will correspond to the rates in Taiwanese males. This is likely to overstate cancer fatalities by 25 percent.

- The NCI notes that smoking is the leading cause of bladder cancer in the U.S., and that smokers are 2 to 3 times more likely to get bladder cancer than nonsmokers (NCI, 1998), yet EPA's risk analysis does not reflect the link between tobacco smoking and bladder cancer. The SAB noted that many of its members could not "support an epidemiological study that did not control for such a well established and

major risk factor for lung and bladder cancer as smoking." Correcting for this suggests that one-third of the risk EPA attributes to arsenic may actually be due to smoking.

- Contrary to SAB's guidance (SAB/EEAC, June 2000), EPA's benefit figures do not reflect the long latency between exposure to arsenic and the incidence of cancers, thereby assuming a zero discount rate over those periods. Making appropriate adjustments based on SAB recommendations, EPA's value per statistical life saved declines from $6.1 million to $2.7 million.

- EPA's value of $6.1 million per statistical life does not vary with the age at which fatalities occur. Since that figure is based on studies that reflect the value of life at roughly 40 years of age, it is likely to overstate the value of the increased life expectancies expected from this rule, because these cancers occur when individuals are in their late 60s and 70s. The age adjustment further reduces the estimated value per statistical life saved by about half, to $1.3 per fatal bladder cancer and $1.9 million per fatal lung cancer.

B. EPA's cost analysis is likely to understate costs significantly

Independent estimates suggest that the actual costs of implementing this proposal are likely to be much higher than EPA predicts. In a study sponsored and governed by a group that included EPA (as well as AWWARF and ACWA), Frey et al. (2000) conducted an independent assessment of the costs of compliance with the various MCL options under consideration, and derived cost estimates for the options of 10, 5, and 3 ug/L that greatly exceeded EPA's estimates. For example, the annualized compliance cost estimated by EPA for the proposed MCL of 5 ug/L is $378 million, which is roughly one-quarter the Frey et al. estimate of $1.5 billion.

The Frey et al analysis adopted several key features of EPA's cost analysis (e.g., the same unit cost curves for the applicable arsenic removal technologies). Given these connections to the EPA analysis, it is surprising to note how divergent the EPA estimates are from the Frey et al. numbers. Some of the important points in which the analyses seem to diverge are:

- As increasingly stringent MCLs are considered, community water systems (CWS) must adopt more expensive treatment options to attain the higher arsenic removals necessary to comply. Yet, EPA's analysis fails to reflect the reality that, for example, a system with arsenic levels of 25 ug/L can comply with a 20 ug/L MCL at much lower cost than if it had to attain a 5 ug/L or 3 ug/L standard. EPA appears to have applied a constant cost-per-covered-utility to all of the MCL options. This is unrealistic and understates the incremental costs (perhaps significantly) of moving to more stringent MCL options.

- Removing arsenic from drinking water will generate wastes that will in many cases be considered hazardous under applicable regulations (e.g., RCRA), and water utilities will face considerable costs (and liabilities) for on-site storage, eventual

transport to an approved facility and, ultimately, suitable disposal. EPA has not considered these.

- EPA has applied a social rate of time preference (3 percent) to annualize the capital costs of this rule. This is incorrect and inconsistent with OMB guidance on discounting. As these costs reflect the out-of-pocket expense of households who ultimately bear both the costs and the benefits of the proposed rule, the more appropriate measure is the opportunity cost of capital (cost of borrowing), which is much more likely to be in the 7 percent and higher range.

C. Corrections to the EPA BCA Yield Sizable Changes in the Results, and Provide Even Stronger Evidence that the Proposed MCL of 5 ug/L is Overly Stringent

Exhibit 4 shows the adjusted estimates for incremental benefits, based on several of the points noted above. The results diverge from the EPA estimates in several ways:

- The estimated number of premature fatalities reflects two adjustments: (1) a correction for the error EPA made in extending the male bladder rates (from Taiwan) to females (in the US), and (2) the extrapolation of bladder risks to lung cancer fatalities using a 1:1 ratio rather than a 2:1 or 5:1 ratio.

- The monetary values assigned to premature fatalities avoided reflects adjustments to the EPA's estimates for latency periods, discounting, and income growth. A $2.7 million per premature fatality avoided is applied as an upper bound, and as a sensitivity analysis, the age-adjusted version of the above is applied as a lower bound ($1.3 million per bladder cancer fatality avoided).

All other aspects of the analysis are identical to EPA's published results, and the adjustments made reflect logical corrections as consistent with SAB review comments.[9]

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[9] One exception is the gender-based adjustment, as the male to female extrapolation has not yet been raised to SAB's attention.

Exhibit 4: Adjusted Incremental Benefits of Arsenic MCLs (gender-corrected bladder cases)

(millions of 1999 dollars)

MCL Option	Nonfatal Bladder Cancers Avoided		Nonfatal Bladder Benefits		Fatal Bladder & Lung Cancers		Fatal Cancer Benefits (c)		Total Incremental Benefits	
	Low	High	Low(a)	High(b)	Low	High	Low (d)	High(e)	Low	High
50 → 20	2.3	6.8	$ 0.4	$ 4.1	1.5	4.5	$ 2.0	$ 12.2	$ 2.4	$ 16.2
20 → 10	2.8	4.9	$ 0.5	$ 3.0	2.0	3.8	$ 2.5	$ 10.1	$ 3.0	$ 13.1
10 → 5	3.8	8.3	$ 0.7	$ 5.1	2.9	5.9	$ 3.7	$ 15.8	$ 4.4	$ 20.8
5 → 3	3.4	3.4	$ 0.6	$ 2.0	2.3	2.3	$ 2.9	$ 6.1	$ 3.5	$ 8.1

(a) at $178,400 per case based on medical expenses (PV of cost of illness, at 3%), from RIA p 5-21

(b) at $607,200 per case, based on WTP for avoiding chronic bronchitus (Viscusi et al, 1991), from RIA p 5-21

(c) Gender-based correction of EPA bladder estimate, and lung cancers at 1:1 with bladder

(d) PV income growth and age-adjusted VSL of $1.3 million

(e) PV income growth-adjusted VSL of $2.7 million

These adjustments are still fairly conservative, because there remain several reasons to believe that the estimated risks are still overstated. For example, tobacco smoking impacts, the sublinear dose-response function, and the issues associated with extrapolating from a poor Taiwanese study population to the US population are all ignored in these adjustments to the estimated benefits.

Exhibit 5 then shows a comparison of the revised incremental benefits to incremental costs. Incremental net benefits are negative and large regardless of whether one uses the EPA's lowest cost estimates or the independent cost figures from Frey et al. The sum of these estimates suggest that reducing the standard from 50 ug/L to 5 ug/L would impose incremental costs on drinking water systems and their consumers of over $1.4 billion per year.

- Using EPA's cost data, it is hard to justify going even to 20 ug/L, but it clearly appears unreasonable to consider any MCL less stringent than 20 ug/L.

- Using the Frey et al cost estimates, the incremental net benefits reveal a much sharper "knee of the curve" at MCLs more stringent than 20 ug/L. This is largely driven by the increase in costs associated with reducing the MCL below 20 ug/L. Hence, even if the Agency were inclined to tighten the MCL from its current level of 50 ug/L, the consideration of 10 ug/L or lower is clearly unsupported.

Exhibit 5: Adjusted Incremental Net Benefits of Arsenic Standards

(millions of 1999 dollars)

| MCL Option | Incremental Cost | | Incremental Benefits | | Incremental Net Benefits | | | |
| | EPA (3%) | Frey et al | Low | High | EPA Costs | | Frey et al Costs | |
					Low	High	Low	High
50 → 20	$ 61.9	$ 55.0	$ 2.4	$ 16.2	$ (59.5)	$ (45.7)	$ (52.6)	$ (38.8)
20 → 10	$ 101.8	$ 550.0	$ 3.0	$ 13.1	$ (98.8)	$ (88.7)	$ (547.0)	$ (536.9)
10 → 5	$ 213.9	$ 855.0	$ 4.4	$ 20.8	$ (209.5)	$ (193.1)	$ (850.6)	$ (834.2)
5 → 3	$ 266.0	$ 1,370.0	$ 3.5	$ 8.1	$ (262.5)	$ (257.9)	$ (1,366.5)	$ (1,361.9)

D. The Rule Saves Relatively Few Years of Life, and Those are Achieved at Very High Costs

In lieu of examining net benefits, one may instead wish to consider costs per premature fatality avoided or cost per life-year saved. Exhibit 6 provides estimates of incremental costs per life-year saved for various discount rates. At a 7 percent discount rate, the incremental cost for a year of life saved is $13.8 million for moving the standard from 50 ug/L to 20 ug/L.[10] The incremental cost per life-year saved jumps to nearly $100 million at more stringent MCL options.

Exhibit 6. Incremental cost per LYS[a]

(millions 1999 dollars)

MCL option	Discount rate (w/20 year latency)		
	3%	7%	10%
50 → 20	$3.6	$13.8	$92.4
20 → 10	$21.8	$84.3	$567.1
10 → 5	$23.8	$91.9	$617.9

a. Midpoints of range of $/LYS.

As a point of reference, the EPA's unadjusted value per statistical life is only $6.1 million and refers to contexts in which over 35 life-years are lost per fatality (e.g., occupational settings). The incremental costs per life-year saved for the proposed arsenic MCL are well outside of the acceptable range, implying that the proposed rule represents a very inefficient allocation of the nation's public health resources.

E. Unvalued and Omitted Costs (and Benefits) May be Important

Even though the numerical results shown above provide very compelling evidence that the costs of the proposed rule are not justified by the benefits, it is also important to recognize that many costs are probably omitted from the quantitative analysis. For example, some of the waste disposal costs are omitted, especially with regard to hazardous wastes generation. There also are likely to be adverse impacts on the

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[10] These estimates were derived using a 20-year latency period, reflect the midpoint between the EPA and Frey et al cost estimates, reflect the midpoint in premature fatalities avoided, and include the gender- and lung cancer-related risk adjustments described above)

availability of water resources.[11] Any such impact on water resource availability, or water storage capabilities, will increase pressures to withdraw more water from surface and ground water systems that are already strained in many parts of the country. The net result may well be unsustainable withdrawal rates for western aquifers, and increased ecological risks in surface waters due to diminished instream flows.

EPA has also not examined the indirect impact that lowering the arsenic MCL may have on the cost of cleaning up Superfund sites. Because Superfund cleanup standards are pegged to MCLs, the cost to U.S. taxpayers and consumers of meeting cleanup standards would certainly be expected to increase.

V. Conclusions and Recommendations

Regulation of arsenic in drinking water presents the most compelling case to date for EPA to use its authority to rely on benefit-cost analysis, granted in the 1996 Amendments to the Safe Drinking Water Act. Unfortunately, EPA does not embrace its new mandate enthusiastically. It continues to constrain its decisions in setting drinking water standards with internally-imposed levels of "acceptable risk," and has proposed to set such standards at levels that its own analysis reveals will impose net costs on users of drinking water systems.

EPA has used its benefit-cost analysis in a narrow way—to reject the "technically feasible" level of 3 micrograms per liter (ug/L) in favor of a slightly less stringent level of 5 ug/L (down from the current level of 50 ug/L). However, its analysis reveals that the selected level is likely to impose more costs than benefits on water systems and (ultimately) their consumers. In fact, EPA's own cost and benefit estimates suggest that all the levels it examined in developing the proposal (ranging from 3 ug/L to 20 ug/L) impose costs greater than benefits.

The above analysis reveals that the Agency's use of its new authority is inappropriate and flawed for the following reasons:

- The Agency's discussion of its use of the authority indicates an intent to stay within the limits of its internal perception that "acceptable risk" levels cannot exceed 10^{-4}. The use of such an internal Agency policy guideline to constrain or over-ride its statutory mandate with respect to how benefit-cost results are used in MCL-setting is not supported by the SDWAA.

- EPA's cost-benefit analysis fails to present or use in a meaningful way the basic principles of economics (maximizing the well being of the nation's citizens). The

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[11] For example, aquifer storage and retrieval (ASR) is a technique that enables utilities to reuse treated wastewater, thereby decreasing demands on raw supplies. However, evidence suggests the process releases small amounts of arsenic into the water from soils surrounding the injection wells. The levels released may be sufficient to cause compliance problems with a 5 ug/L MCL when the water is extracted for potable reuse. The impact will be to raise the costs of ASR considerably, making it uneconomic in some settings and thereby forcing utilities to increase demands on raw supplies.

Agency should examine incremental benefits and incremental costs, and strive to set regulations at the point where incremental net benefits are greatest.

- EPA's analysis has been criticized for overstating benefits and understating costs, but even its own results yield negative incremental net benefits for the rule as proposed. The EPA analysis indicates that from among the options provided in the proposal, 20 ug/L is the most logical choice from society's perspective. But EPA's own flawed cost and benefit data suggest that even 20 ug/L is too stringent, and some level between the current standard and 20 should be considered.

- EPA fails to develop credible, unbiased estimates of benefits or costs, thereby coloring the overall analysis to suggest higher net benefits than can truly be anticipated. More defensible estimates of the incremental net benefits reveal negative net benefits of over $1.4 billion per year from reducing the standard from 50 ug/L to 5 ug/L.

- While unquantified benefits and costs need to be considered in the use of the new authority, the inclusion of these nonmonetized items needs to be done in a legitimate and insightful manner. EPA has failed to do so. EPA simply suggests that because there are unquantified benefits, the results of the benefit-cost analysis can be over-ridden or largely ignored.

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RSP CHECKLIST

PROPOSED ARSENIC RULE

Element	Agency Approach	RSP Comments
1. Has the agency identified a significant market failure?	In addition to statutory mandate, EPA cites the natural monopoly power of water systems, and notes the information burden associated with having consumers self regulate drinking water risks. **Grade: B**	The natural monopoly argument is less valid today, given that consumers having opportunities to drink bottled water or purchase home treatment units. The information barrier has some validity, as it would be costly for consumers to assemble the facts about the challenging issues of arsenic-related risk assessment and drinking water.
2. Has the agency identified an appropriate federal role?	The implied federal role is to establish procedures and standards that state primacy agents and water systems will have to implement. **Grade: C**	MCLs are performance standards, so water systems have some flexibility regarding the manner in which they achieve compliance with the rule. But in reality their options are heavily constrained because they are subject to less regulatory risk if they adopt "best available technologies." Allowing more site-specific flexibility to state and local agents could improve the cost-effectiveness of the rule.
3. Has the agency examined alternative approaches?	EPA describes and provides benefit-cost information for 3 options in addition to the proposed MCL. **Grade: C**	Given the negative net benefits for all the MCL options proposed, a broader and more meaningful set of alternatives should have been developed and analyzed.

Element	Agency Approach	RSP Comments
4. Does the agency attempt to maximize net benefits?	The Agency selected an option with negative net incremental benefits, according to its own analysis of benefits and costs. **Grade: F**	Both EPA's own analysis, and our assessment of benefits and costs reveal that no serious or systematic effort was used to try to maximize net social benefits. Indeed, EPA has stated that its goal is equate benefits to costs, which implies *zero* net benefits. This reveals a lack of comprehension about how a benefit-cost analysis is to be interpreted, or what it means to try to maximize net benefits.
5. Does the proposal have a strong scientific or technical basis?	The NRC report provides a strong basis for interpreting the literature regarding scientific risk assessment issues. Occurrence and exposure issues are addressed based on a range of available studies. Benefits valuation applies standard economic practices. Costs estimates appear incomplete and inaccurate. **Grade: F**	Various committees of the SAB have found key aspects of the Agency analysis problematic. The SAB was critical of EPA's interpretation of the NRC risk report and Utah epidemiological study. The feasibility and costs of treatment also have been called into question by SAB and other informed parties. The Preamble, RIA, and other materials available from the docket lack transparency and are often inconsistent with each other. Many important considerations were ignored (e.g., hazardous waste generation and disposal).
6. Are distributional effects clearly understood?	There is little indication of how this rule would affect people of different economic strata, or small-scale systems. **Grade: F**	Potentially significant impacts on small enterprises and small communities are inadequately assessed. EPA's use of national averages serves to obscure what may be a major ramification of this rulemaking.
7. Are individual choices and property impacts understood?	The approach is highly prescriptive. **Grade: D**	With increased opportunities for individuals to make informed choices over drinking water (e.g., bottled supplies, in-home treatment), there is decreasing justification for nationally-imposed approaches. This is especially true for the smallest systems where any benefits received by consumers are likely to be greatly outweighed by the costs.