Report to Congress: Radon in Drinking Water Regulations

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I. Introduction

EPA proposed the Radon in Drinking Water Rule in the *Federal Register* on November 2, 1999 (64 FR 59246). The proposed rule was designed to promote a multimedia approach that would reduce radon risks in indoor air, where the problem is the greatest, while protecting public health from the highest levels of radon in drinking water. Most radon exposure results from radon gas that enters indoor air from soil under homes and other buildings. Only approximately one to two percent of radon exposure comes from drinking water, which occurs primarily through inhaling radon gas that bubbles out of solution. Under the framework set forth in the 1996 amendments to the Safe Drinking Water Act (SDWA), EPA proposed that water systems comply with a lower maximum contaminant level (MCL) for radon in drinking water, or a higher, alternative maximum contaminant level (AMCL) for dissolved radon in drinking water combined with requirements for multimedia mitigation (MMM) programs to address radon that enters indoor air from soil under homes and buildings. Public water systems in States that adopt qualifying MMM programs would be subject to the AMCL, while those in States that did not adopt such programs would be subject to the MCL. Public water systems could also develop an MMM program with EPA approval in the absence of a State program. EPA proposed an MCL for radon in drinking water of 300 picocuries per liter (pCi/L) and an AMCL of 4,000 pCi/L.

As part of the 2003 appropriations process, Congress directed EPA to report on the pending radon in drinking water regulations by August 19, 2003 as follows: "The Committee directs the Administrator of the Environmental Protection Agency to report to the Congress, not later than 180 days after the date of enactment, on the pending radon in drinking water regulations. In developing such report, the Administrator shall (1) consult with the State drinking water, air, and radiation programs and (2) evaluate options to implement a single drinking water standard for radon" (House Report 107-740, page 105). EPA interprets the phrase "single drinking water standard," as used in this Report, to mean a single MCL for all systems, rather than giving States and public water systems the option of choosing between two different approaches (i.e., an MCL or an alternate MCL with an MMM program) for reducing public health risks from radon.

In developing this report, EPA identified three "single drinking water standard" options for consideration. The 1996 SDWA amendments require EPA to establish an AMCL and guidelines for MMM if EPA sets the MCL lower than 4,000 pCi/L, the drinking water standard equivalent to the natural background level of radon in outdoor air of 0.4 pCi/L [SDWA section 1412(b)(13)(F)].[1] Thus, the current SDWA allows EPA to issue a single drinking water standard

[1] The transfer coefficient from water to indoor air is about 10,000 to 1. This transfer coefficient means that, given typical water use patterns and indoor physical configurations, on average, 10,000 picocuries of radon per liter of tap water will contribute approximately one picocurie per liter to the concentration of radon in indoor air. Therefore, 4 pCi/L of radon in indoor air corresponds to about 40,000 pCi/L in drinking water, which is over 100 times greater than the proposed MCL of 300 pCi/L.

that is above 4,000 pCi/L (i.e. > 4,000 pCi/L), but does not allow EPA to issue a *single* drinking water standard that is lower than 4,000 pCi/L (i.e. <4,000 pCi/L). To respond to Congress' request to evaluate options for a single MCL, this report discusses options for a single drinking water standard less than 4,000 pCi/L, which would require a change in SDWA to implement.

EPA's consultations with State drinking water programs elicited the following general opinions concerning these options: (1) State drinking water representatives favored a single standard without the MMM option; (2) based on current information, they recommended a single standard in the neighborhood of 4,000 pCi/L in water; and (3) they agreed that radon in indoor air is a serious health risk, but believed that this risk should be addressed through indoor air programs, not drinking water programs.

EPA's consultations with State air and radiation programs also elicited the following general opinions: (1) State air and radiation representatives supported a single MCL for drinking water ranging from 4,000 to 40,000 pCi/L; and (2) they expressed concern that a standard for radon in drinking water will mislead the public about the risks of radon in drinking water relative to the greater public health risk of radon in indoor air because the radon drinking water MCL is enforceable whereas the voluntary action level for indoor air is not.

A detailed summary of the consultation results is presented in Section V of this report.

This report discusses: (1) the pre-1996 background for the radon regulations, (2) the 1996 radon provisions of SDWA, (3) EPA's consultations with stakeholders prior to its 1999 proposed radon in drinking water rule, (4) major stakeholder comments on the proposed rule, (5) options for a single radon in drinking water standard, and (6) EPA's consultations with State drinking water, air, and radiation programs regarding these options.

II. Background

EPA estimates that out of about 146,000 lung cancer deaths each year in the U.S., about 21,100 lung cancer deaths were related to radon exposure from radon gas in the soil. Approximately 2,900 of these are radon-related lung cancer deaths occurred in non-smokers and 18,200 in smokers (EPA, 2003).[2] EPA also estimates that one in every 15 homes in the U.S. has indoor radon levels that exceed EPA's recommended action level of 4 pCi/L in indoor air, which is 10 times the average outdoor level of 0.4 pCi/L in air. By comparison, the 1999 EPA rule proposed a drinking water MCL of 300 pCi/L, which corresponds to an indoor air concentration of about 0.03 pCi/L, using the National Academy of Sciences' (NAS) transfer coefficient.[3] This

[2] The National Academy of Sciences estimated that radon in indoor air derived from soil gas causes 15,000 to 22,000 lung cancer deaths annually and that approximately 5,000 to 7,000 of these lung cancer deaths would be prevented if indoor air radon levels above 4 pCi/L were eliminated. (NAS, 1999a). The BEIR VI models estimate the fraction of lung cancers due to radon for a specified average radon level in homes and population size under steady state conditions. This fraction is then applied to the total number of U.S. lung cancer deaths occurring in a particular year.

[3] The transfer coefficient from water to indoor air is about 10,000 to 1. This transfer coefficient means that, given typical water use patterns and indoor physical configurations, on average, 10,000 picocuries of radon per liter of tap water will contribute approximately one picocurie per liter to the concentration of radon in indoor air. Therefore, 4 pCi/L of radon in indoor air corresponds to about 40,000 pCi/L in drinking water, which is over 100 times greater than the proposed MCL of 300 pCi/L.

means that limiting radon concentration in drinking water to the 1999 proposed MCL would correspond to an indoor air radon concentration two orders of magnitude below the EPA recommended action level. In any event, limiting radon concentrations in drinking water is unlikely to greatly affect actual exposure to radon gas, since exposure occurs primarily when radon gas enters the home from the soil.

Under the 1999 proposed rule, States would have the option of enhancing their indoor air radon abatement programs through the adoption of MMM programs, in lieu of adopting the MCL of 300 pCi/L for drinking water, provided they achieved comparable risk reductions. EPA estimates the costs to States and community water systems to achieve comparable risk reductions to a 300 pCi/L in water MCL (about 70 avoided cancer deaths per year) through a combination of an AMCL of 4,000 pCi/L in water and associated MMM programs to be approximately $100 to $110 million per year ($2010), depending on whether a 3% or 7% discount rate is used to annualize costs (this assumes that 80% of states adopted the AMCL and developed qualifying MMM programs). These cost estimates compare favorably with the estimate of about $520 to $620 million per year ($2010) to achieve these same risk reductions through the use of a 300 pCi/L MCL alone. EPA cautions, however, that this estimate is based on a 1992 study of average cost per cancer death avoided for voluntary State indoor air programs up to that time.[4]

A. *EPA Actions on Radon in Drinking Water Prior to the 1996 SDWA Amendments*

Prior to the 1996 Amendments to SDWA, EPA initiated a number of actions to address radon in drinking water. These actions include a 1986 advance notice of proposed rulemaking; a 1991 proposed rule; and a 1994 Report to Congress on the multimedia risks and costs of radon control (EPA, 1994). The following paragraphs discuss these actions in greater detail.

Section 1412 of SDWA, as amended in 1986, required EPA to publish maximum contaminant level goals (MCLGs) and to promulgate national primary drinking water regulations for contaminants that may cause an adverse effect on human health and that are known or anticipated to occur in public water supplies. On September 30, 1986, EPA published an advance notice of proposed rulemaking (51 FR 34836) concerning radon-222 and other radionuclides. The notice discussed EPA's understanding of the occurrence, health effects, and risks from these radionuclides, as well as the available analytical methods and treatment technologies, and sought additional data and public comment on EPA's planned regulation.

On July 18, 1991, EPA proposed a national primary drinking water regulation (56 FR 33050) for radon and the other radionuclides addressed in the 1986 advance notice of proposed rulemaking. The 1991 notice, which supplemented and updated the information presented in the 1986 notice, proposed an MCLG of zero, an MCL of 300 pCi/L in water, best available technologies (BAT) for removal of radionuclides in water, and monitoring, reporting, and public notification requirements for radon in public water supplies. The proposed rule was

[4] See *Technical Support Document for the 1992 Citizen's Guide to Radon* (EPA 400-R-92-011), May 1992. EPA is not able to determine the extent to which the study results would be applicable to future MMM programs, which would be incremental to the existing voluntary programs. It is clear, however, that direct mitigation of radon in indoor air is substantially more cost effective than reducing indoor air levels through regulation of drinking water.

accompanied by an assessment of regulatory costs and economic impacts, as well as an assessment of the risk reduction associated with implementation of the MCL.

In the 1991 proposed rule, EPA estimated an incremental lifetime cancer risk at the proposed MCL of about two cancers for every 10,000 persons exposed to radon in drinking water (2×10^{-4} lifetime risk), approximately 80 avoided fatal cancer cases annually, approximately 27,000 affected public water systems, and a total annual cost of approximately $180 million (1991$). EPA received substantial comments on the proposal and supporting analyses from States, water utilities, and other stakeholder groups. Major comments on the proposed rule included concern over the costs of rule implementation, especially for small public water systems, and the larger risk to public health from radon in indoor air.

In 1992, Congress directed EPA to report on the multimedia risks from residential exposure to radon, the costs to control this exposure, and the risks from treating to remove radon. In addition, Congress extended the deadline for promulgating a final radon rule. Congress subsequently prohibited EPA from spending FY 1994 funds to issue a radon rule, effectively delaying the rule's promulgation one more year.

EPA's 1994 Report to Congress (EPA, 1994) estimated the risks, fatal cancer cases, cancer cases avoided by the 1991 proposed rule, and costs for mitigating radon in water and indoor air. The Report found that there are three exposure pathways for waterborne radon: (1) ingesting radon dissolved in water; (2) inhaling radon gas released from water during household use; and (3) inhaling radon progeny derived from radon released from water. This Report also estimated a total of 192 cancer fatalities per year from unregulated waterborne radon and annual treatment costs of approximately $272 million (1994$) to attain a drinking water MCL of 300 pCi/L avoiding 84 cancer fatalities annually. Additionally, the Report estimated a total of 13,600 cancer fatalities per year from radon in indoor air with approximately $1.5 billion in annual costs (to test all residences and mitigate those with levels above 4 pCi/L of radon in air) for a fully implemented voluntary indoor air mitigation program. The Report also assessed the risks of off-gas exposure from treating drinking water to remove radon and found, in an analysis of 20 water systems, that the estimated number of fatalities per year from treatment plant off-gas emissions to outdoor air was *de minimis*.

At the direction of Congress, EPA's Science Advisory Board (SAB) reviewed the supporting analyses for the Report to Congress. The final part of the Report included SAB's comments on the analyses and an EPA discussion of the issues raised by SAB. In general, SAB found that EPA had conducted a reasonable analysis of occurrence data, technologies, and costs as a function of system size. The Committee suggested only minor changes to EPA's central tendency risk estimates, but suggested expansion of the uncertainty bounds surrounding the central risk estimates.

B. *1996 Amendments to SDWA - Requirements for Radon in Drinking Water*

The 1996 Amendments to SDWA established new requirements for the national drinking water program. Among other mandates, Congress amended section 1412 of SDWA to direct

EPA to: (1) withdraw the 1991 proposed regulation for radon; (2) arrange for a NAS Risk Assessment of radon in drinking water; (3) set an MCLG and MCL for radon-222; (4) set an AMCL if the MCL was below the background concentration in outdoor air[5], and (5) if an AMCL was established, develop MMM program guidelines and evaluate MMM programs every five years [SDWA 1412(b)(13)]. Pursuant to these requirements, EPA proposed the Radon in Drinking Water Rule on November 2, 1999 (64 FR 59246). In this action, EPA proposed an MCLG of zero and an MCL of 300 pCi/L in water. Also, EPA proposed an AMCL of 4,000 pCi/L in water combined with requirements for MMM programs to address radon in indoor air.

EPA proposed to set the MCL at 300 pCi/L for drinking water after considering several factors. First, the Agency considered the general statutory requirement that the MCL be set as close to the MCLG of zero as feasible, and its responsibility to protect public health. In addition, the radon-specific provisions of SDWA amendments provide that, in promulgating a radon standard, the Agency take into account the costs and benefits of programs to control indoor air radon [SDWA 1412(b)(13)(E)]. The proposed MCL takes into account and relies on the unique conditions of this SDWA provision. SDWA amendments reflect the reality that the preponderance of radon risk is attributable to indoor air and the most cost-effective means of reducing radon risk is to reduce radon in indoor air directly, rather than through drinking water treatment. In the 1999 proposed rule, EPA requested comment on a preliminary determination that a level of 100 pCi/L in water was "feasible" within the meaning of the statute, but proposed an MCL of 300 pCi/L in consideration of the costs and benefits of control programs for radon from other sources, in accordance with Section 1412(b)(13)(E) of the statute.

In proposing an alternate MCL (AMCL) of 4,000 pCi/L, EPA relied on the technical and scientific guidance contained in the 1999 NAS report on the risks of radon in drinking water (NAS, 1999b). Specifically, NAS estimates that the average natural background concentration of radon in outdoor air is 0.4 pCi/L, and that the "transfer coefficient" from water to indoor air is about 10,000 to 1. This transfer coefficient means that, given typical water use patterns and indoor physical configurations, on average, 10,000 picocuries of radon per liter of tap water will contribute about one picocurie per liter to the concentration of radon in indoor air. This means that the drinking water level that corresponds to 0.4 pCi/L in air is 4,000 pCi/L in water. SDWA requires that there be both an MCL and an AMCL when the MCL is below the 0.4 pCi/L background concentration in outdoor air (i.e., 4,000 pCi/L in water).

EPA also proposed guidelines for MMM programs to reduce the risks of radon in indoor air. The proposed radon rule requires that water systems meet the MCL of 300 pCi/L unless the State or water system itself develops and implements an EPA-approved MMM program to address indoor air radon, in which case the water system must meet the AMCL of 4,000 pCi/L. EPA must evaluate any such MMM program based on its guidelines and information developed by NAS and approve the program if it is expected to achieve health risk reduction benefits equal to or greater than those that would result from compliance with the MCL. The proposed MMM

[5] Specifically, SDWA 1412(b)(13)(F) requires an AMCL if the MCL is "more stringent than necessary to reduce the contribution to radon in indoor air from drinking water to a concentration that is equivalent to the national average concentration of radon in outdoor air". The "transfer coefficient" estimated by NAS determines the contribution to radon in indoor air from a given concentration of radon in drinking water.

program guidelines include four components to ensure that the statutory requirements are satisfied: (1) a process for involving the public; (2) quantitative goals both for mitigations of existing homes with elevated indoor air radon levels and for new homes built radon-resistant; (3) implementation plans to achieve quantitative goals; and (4) plans for measuring and reporting results including health risk reduction benefits and an explanation of why the plan is expected to achieve health risk reduction benefits equal to or greater than those achievable by compliance with the MCL. EPA developed the four MMM program criteria based on the extensive stakeholder consultation discussed in Section III of this Report.

III. Consultation Activities Prior to the 1999 Radon Proposal and Stakeholder Comments on the Proposed Rule

A. *Outreach Activities*

In developing the proposed radon in drinking water rule, EPA consulted with a broad range of stakeholders and technical experts. Participants in a series of stakeholder meetings held in 1997 and 1998 included representatives of public water systems, State drinking water and indoor air programs, Tribal water utilities and governments, environmental and public health groups, and other Federal agencies. EPA convened an expert panel in Denver, Colorado in November 1997 to review treatment technology costing approaches. This panel made a number of recommendations for modification to EPA cost estimating protocols that were incorporated into the radon cost estimates in the proposed rule and this Report.

EPA conducted one-day public meetings in Washington, D.C., on June 26, 1997, in San Francisco, California on September 2, 1997, and in Boston, Massachusetts on October 30, 1997, to discuss plans for developing a proposed national primary drinking water regulation for radon. EPA presented information related to developing the proposed rule and solicited stakeholder comments at each meeting. Participants in these stakeholder meetings included representatives from the National Rural Water Association, the National Association of Water Companies, the Association of Metropolitan Water Agencies, State departments of environmental protection, State health departments, water utilities, Tribes, private industry, professional organizations, environmental and public health groups, and other members of the public. In order to inform and involve Tribal governments in the rulemaking process, EPA staff also made presentations on the proposed rule at Tribal meetings in October 1998 and February 1999.

EPA held a series of conference calls in 1998 and 1999 with State drinking water and indoor air program personnel to discuss issues related to developing guidelines for MMM programs. EPA also held a public meeting in Washington, D.C., on March 16, 1999, to discuss the preliminary cost-benefit estimates for the radon in drinking water rule and the multimedia mitigation framework. In order to address environmental justice issues, EPA convened a public meeting in Washington, D.C., in March 1998 to discuss ways to involve minority, low-income, and sensitive sub-populations in the stakeholder process and to obtain input on the proposed radon rule. In addition, EPA made presentations at meetings of the American Water Works Association, the Association of State Drinking Water Administrators, the Association of State and Territorial Health Officials, the National Association of Counties, the National Governors'

Association, the National Association of Towns and Townships, the National League of Cities, and the Conference of Radiation Control Program Directors.

In 1998, the Agency conducted outreach directly to representatives of small entities that could be affected by the radon rule in accordance with the Small Business Regulatory Enforcement Fairness Act. This outreach provided a forum for small entity input on key issues related to the radon rule including compliance challenges for small water systems and the development and implementation of MMM program guidelines.

EPA also participated in the American Water Works Association Radon Technical Workgroup, convened in 1998. This workgroup provided input to EPA's technical analyses and discussed conceptual issues related to developing guidelines for MMM programs. Members of the Radon Technical Workgroup included representatives from State drinking water and indoor air programs, public water systems, drinking water testing laboratories, environmental groups, and the U.S. Geological Survey.

B. *Summary of Comments on the 1999 Proposed Rule*

EPA received numerous comments on the proposed rule during the public comment period. Commenters on the proposed rule submitted 775 comments which were communicated in over 2,000 pages of text. The commenters included water utilities, State and local governments, water utility associations, environmental groups, and private citizens. Significant comments on the proposed rule addressed topics such as the proposed MCL and rule structure, State resource drain for MMM program implementation, risk communication challenges, and risk reduction equity between the MCL and the AMCL/MMM option.

In the 1999 *Federal Register* notice, EPA proposed an MCL of 300 pCi/L and presented information on options for MCLs ranging from 100 pCi/L to 4,000 pCi/L in water. EPA requested comment on setting the MCL closer to or at the AMCL of 4,000 pCi/L and asked commenters to provide their rationale for how such alternative levels could be supported under SDWA and in the record for the rulemaking, given the statutory considerations EPA used in selecting the proposed MCL (as provided in Section 1412(b)(13)(E)). A number of commenters recommended that EPA give serious consideration to setting the MCL at the AMCL of 4,000 pCi/L (which would eliminate the need for an AMCL) in order to control radon levels in drinking water at a level comparable to background levels in outdoor air. Other commenters recommended MCLs of 500, 1,000, or 2,000 pCi/L based on the smaller exposure to radon in drinking water compared to exposure to radon in indoor air, and the costs of treating radon in drinking water compared to the costs of mitigating radon in indoor air. Some commenters also recommended a lower MCL (e.g., 100 pCi/L). Commenters variously mentioned the Agency's traditional target risk range (1 in 10,000 or 10^{-4}); the higher exposure risk from indoor air; the substantially lower risks from radon exposure to never-smokers (0.8 in 10,000 at 300 pCi/L water) versus current and former smokers (3.1 in 10,000 at 300 pCi/L water); economic costs and benefits; and small system implementation challenges as justifications for an MCL other than the proposed level of 300 pCi/L.

EPA also received a number of comments on the challenges that State drinking water programs and community water system operators might face in implementing an MMM program for radon in indoor air. They noted that an indoor air program could be difficult to design and implement and would require coordination between State air and water program personnel, and could divert funds from drinking water protection to support the implementation of indoor radon programs. Commenters were also concerned over the perceived inequity and potential tort liability of requiring systems to meet different MCLs depending on whether or not they had an MMM program, given that the distribution of costs and benefits from the MMM program would not necessarily mirror the distribution of costs and benefits to drinking water customers.

IV. Options for a Single Radon in Drinking Water Standard

In the development of this Report to Congress, EPA explored various options for a single radon in drinking water standard. The existing statutory requirements, as outlined in section 1412(b)(13) of the 1996 amendments to the Safe Drinking Water Act, direct EPA to propose an MCL and, if that MCL is less than the national average concentration of radon in outdoor air, also propose an AMCL equivalent to this concentration combined with a program to mitigate radon in indoor air. Pursuant to these requirements, EPA proposed: (1) an MCL of 300 pCi/L in water and (2) an AMCL of 4,000 pCi/L in water, which represents the average natural background levels of radon in outdoor air, combined with requirements for an MMM program to address radon in indoor air.

Three options for a single drinking water standard are discussed below: A) an MCL equal to 4,000 pCi/L, B) an MCL equal to 1,000 pCi/L, and C) an MCL equal to 300 pCi/L. Consistent with Congressional directive to evaluate options for a single standard, none of these options includes a provision for an AMCL combined with requirements for MMM programs. Only Option A, an MCL of 4,000 pCi/L, could be adopted under the current statute because this MCL is not less than atmospheric background and thus would not trigger the statutory requirements for an AMCL. Options B and C would require a change to the current provisions of SDWA. Estimated risks, annual national costs and benefits (discounted at 3% and 7%), and numbers of systems affected for these (and other) possible MCLs are presented in Table 1. All costs and benefits are given in 2010 constant dollars.

A. *Analysis of MCL Options*

Table 1 outlines the benefits, costs, risks, cases avoided, and numbers of systems and people affected for each regulatory option analyzed in the development of the 1999 proposed radon in drinking water rule, including the three options discussed in this Report. These figures have been updated since the proposed rule and reflect the inclusion of mixed water systems which accounts for an upward revision (from the proposal estimates) in the estimated cases and costs avoided at the various MCLs shown in Table 1.[6]

[6] For example, in the proposed rule, EPA estimated 62 fatal cancer cases avoided at the proposed MCL of 300 pCi/L. With the inclusion of mixed water systems, the revised estimate at 300 pCi/L is 70 fatal cancer cases avoided.

Mixed water systems were added to the radon economic analysis on the recommendation of the Government Accountability Office (GAO). GAO performed an exhaustive review of the radon in drinking water cost analysis in 2002.[7]

TABLE 1. Total National Benefits and Costs for Various MCL Options

Radon Level (pCi/L)	Lifetime Cancer Risks to General Population from Radon[1]	Lifetime Cancer Risks to Smokers from Radon[2]	Lifetime Cancer Risks to Never-Smokers from Radon	Annual Fatal Lung and Stomach Cancer Cases Avoided	Annualized National Benefits (discounted at 3%/7%, millions of 2010$)[3]	Annualized National Costs (discounted at 3%/7%, millions of 2010$)[3]	Numbers of CWS Above Radon Level[4] (# systems < 10K)[5]	Population Exposed Above Radon Level (thousands)[4]
4,000	26×10^{-4}	41×10^{-4}	10×10^{-4}	3	17/8	50/60	1,312 (1,311)	77
2,000	13×10^{-4}	21×10^{-4}	5.2×10^{-4}	9	43/20	80/100	2,852 (2,842)	381
1,000	6.6×10^{-4}	10×10^{-4}	2.6×10^{-4}	21	105/49	160/190	5,892 (5,846)	1,695
500	3.3×10^{-4}	5.2×10^{-4}	1.3×10^{-4}	44	224/105	320/380	11,408 (11,222)	6,893
300	2.0×10^{-4}	3.1×10^{-4}	0.8×10^{-4}	70	367/171	520/620	17,349 (16,942)	16,641
100	0.7×10^{-4}	1.0×10^{-4}	0.3×10^{-4}	140	711/332	1,040/1,260	31,307 (30,258)	56,054

Source: Except where noted, March 2002 Draft Economic Analysis for Radon in Drinking Water (EPA, 2002).

Notes:
1. Risks include inhalation and ingestion risks attributable to drinking water and represent mean (average) risks. For a more complete discussion of the derivation of the risk estimates supporting the proposed rule, please see Section XII of the November 2, 1999 Proposed Rule (64 FR 59246).
2. Smokers defined as persons who have smoked at least 100 cigarettes during their lifetime (CDC 1995).
3. Benefit and cost estimates are shown in 2010 dollars. These estimates reflect benefits and costs for treating to an MCL only. Benefits and costs associated with MMM programs are not reflected in this report because of the report's focus on MCL-only options.
4. Methods, Occurrence, and Monitoring Document for Radon in Drinking Water (EPA, 1999).
5. Under SDWA, systems serving 10,000 or less people are considered small.

[7] See GAO's report *Drinking Water: Revisions to EPA's Cost Analysis for the Radon Rule Would Improve Its Credibility and Usefulness* (GAO-02-333), February 2002.

B. *MCL of 4,000 pCi/L (no statutory change required)*

Based on exposure data from 1997, an MCL of 4,000 pCi/L would impact approximately 1,300 water systems (i.e., this many systems are estimated to have source water exceeding the standard), most of which are small, serving a total population of about 77 thousand. As previously noted, this option would obviate the statutory requirement for an AMCL and MMM program. EPA estimates that lifetime exposure to drinking water at 4,000 pCi/L would correspond to an incremental lifetime cancer risk of 26 in 10,000 to the general population, which exceeds the risk range of 1 in 10,000 to 1 in 1 million (10^{-4} to 10^{-6}) traditionally used by EPA in developing national drinking water standards. This risk estimate is a weighted average of risks from radon exposure through drinking water to both smokers and never-smokers. Risks from radon to smokers (41 in 10,000) are about four times greater than the risks from radon to never-smokers (10 in 10,000), due to an apparent synergistic effect between smoking and radon exposure on lung cancer risk.

Treating drinking water to this level would avoid approximately 3 fatal lung and stomach cancer cases per year. The monetized costs and benefits depend upon the discount rate. At a discount rate of 3 percent, estimated annual costs are $50 million, and estimated annual benefits are $17 million based on a value of statistical life (VSL) approach.[8] At a discount rate of 7 percent, estimated annual costs are $60 million while estimated annual benefits are $8 million based on the same VSL approach.

C. MCL of 1,000 pCi/L (statutory change required to promulgate as single standard – i.e., with no AMCL)

An MCL of 1,000 pCi/L would impact approximately 5,900 systems, about 99% of which are small, serving a total population of about 1.7 million, based on the 1997 exposure data. Exposure at this level would correspond to an incremental lifetime cancer risk of 7 in 10,000 and would avoid approximately 21 fatal lung and stomach cancer cases annually. At a 3 percent discount rate, estimated annual costs are $160 million and annual monetized benefits, using the VSL approach, are about $105 million. At a discount rate of 7 percent, estimated annual costs are $190 million and estimated annual benefits are $49 million based on the VSL approach.

D. *MCL of 300 pCi/L (statutory change required to promulgate as single standard)*

Based on exposure data from 1997, the proposed MCL of 300 pCi/L would impact approximately 17,000 systems, about 98% of which are small, serving a total population of about 16.6 million. Exposure at this level would correspond to an incremental lifetime cancer risk of 2 in 10,000 and would avoid approximately 70 fatal lung and stomach cancer cases annually. At a 3 percent discount rate, estimated annual costs are $520 million and annual monetized benefits, using the VSL approach, are about $367 million per year. At a discount rate of 7 percent,

[8] Estimating the VSL involves inferring individuals' implicit tradeoffs between small changes in mortality risk and monetary compensation. An adjusted central tendency estimate of $9.25 million ($8.8 million in 2007$, adjusted to 2010$) is used in the monetary benefits calculations in this report. This figure, adopted from EPA's *Revised Total Coliform Rule*, was determined from the VSL estimates in 26 studies reviewed in EPA's *Guidelines for Preparing Economic Analyses* (EPA, 2000).

estimated annual costs are $620 million and estimated annual benefits are $171 million based on the VSL approach.

V. September 2003 State Consultations

EPA conducted two consultation meetings in September 2003 to address Congress' directive in the 2003 appropriations language to "consult with State drinking water, air, and radiation programs." On September 16, 2003, EPA held a conference call with the Association of State Drinking Water Administrators (ASDWA) to solicit their views on a range of options for a single radon in drinking water standard. EPA also met with the Council of Radiation Control Programs Directors (CRCPD) on September 24, 2003, to solicit their views on the same range of options. These two consultations included 22 State drinking water representatives and 10 State radon program representatives, respectively. Both groups were given the same background material on the proposed radon rule and were asked the same discussion questions. The discussion questions and a summary of the perspectives of the participating State officials are presented below. While the participants presented a range of views and concerns, there was general agreement on a number of key points, as summarized below. A list of the participants for each consultation and the materials provided to them is appended to this Report.

A. *Discussion Questions*

i. What is your view of each single drinking water standard (4,000 pCi/L, 1,000 pCi/L, and 300 pCi/L) with respect to the following?
- Public health protection impacts
- Burden
- Implementation
- Anticipated stakeholder reaction

ii. What challenges do you see in successfully adopting any of these options?

iii. If a single drinking water standard would eliminate the statutory incentive to undertake a multimedia mitigation (MMM) program, what are your views with respect to the following?
- Public health protection impacts
- Burden
- Implementation
- Anticipated stakeholder reaction

iv. What other thoughts do you have regarding a single drinking water standard?

B. *Summary of State Perspectives from September 2003 Consultations*

The preceding questions were asked at each consultation meeting. A summary of perspectives from each group is presented below.

State Drinking Water Program Consultation with the Association of State Drinking Water Administrators (ASDWA) – September 16, 2003, Conference Call

- 22 State drinking water representatives participated on this conference call which was chaired by ASDWA.

- State drinking water representatives supported a single standard (MCL) for radon greater than 300 pCi/L in water, rather than two different standards for States with and without MMM programs.

- Drinking water representatives favored a single standard without the MMM option. They believed allowing a choice within a State would pose a significant risk communication challenge and could expose systems meeting the less stringent AMCL to tort liability. For example, they indicated that it will be challenging to explain to consumers that a drinking water AMCL of 4,000 pCi/L coupled with an effective indoor air mitigation (MMM) program is both equitable and as protective as a more stringent drinking water MCL, (e.g., 300 pCi/L with no MMM program requirement) given that not all drinking water consumers would benefit from the indoor air program.

- They were also concerned about the lack of resources and expertise within state drinking water programs to develop effective MMM programs and about the challenges of cross-agency coordination with air and radiation programs.

- Drinking water representatives did not support the proposed 300 pCi/L standard. Rather, they favored a drinking water MCL in the neighborhood of 4,000 pCi/L because it corresponds to background levels of radon in outdoor air.

- Some States were concerned about the resources that would be needed to implement a 300 pCi/L standard and felt that a standard in the neighborhood of 4,000 pCi/L would be more manageable. States, particularly in the northeast, had conducted inventories of systems likely to exceed the proposed drinking water standard of 300 pCi/L. For example, Vermont indicated that 80% of small groundwater systems exceed 300 pCi/L; 3% exceed 4,000 pCi/L . New York indicated that 60% of upstate wells exceed 300 pCi/L and less than 1% exceed 4,000 pCi/L. Rhode Island had found only 2 wells out of a survey of 144 that did not exceed 300 pCi/L, while 50% of their bedrock wells were expected to exceed 4,000 pCi/L. Pennsylvania noted that 1,900 systems exceed 300 pCi/L, and 50 systems exceed 4,000 pCi/L. Idaho estimated that 70-80% of its groundwater systems would exceed 300 pCi/L.

- State drinking water representatives stated that because indoor air presents the greatest exposure risk to individuals, creating a drinking water MCL for radon of 300 pCi/L would actually decrease the benefit to public health because reducing radon levels in water would entail large monetary costs but would only minimally decrease radon levels in air. Resources would be better spent decreasing radon levels in the air directly.

- Drinking water representatives agreed that indoor air exposure is a serious health risk; however, they believed health risks from indoor air exposure should be addressed

through indoor air programs, not drinking water programs, and adequate funding for indoor air programs should be provided.

General concerns raised at the meeting by State drinking water representatives include:

- One State representative noted that under the anti-backsliding provisions of SDWA section 1412(b)(9), it would not be possible to relax an MCL of 300 pCi/L if it proved difficult to implement.

- One State questioned the appropriateness of including the synergistic risk to smokers in the general population risk estimates for radon in drinking water, noting that there are more effective ways to reduce cancer risk from smoking (e.g., public education).

- One State questioned whether EPA's traditional risk range (10^{-4} to 10^{-6}) should be applied to both inhalation and ingestion risk or only ingestion risk.[9]

- State representatives expressed concern about the cumulative impacts of multiple standards (arsenic, groundwater rule, radionuclides, disinfection byproducts, and radon) on small groundwater systems.

State Air and Radiation Programs Consultation with the Council of Radiation Control Program Directors (CRCPD) - September 24, 2003, Meeting in Washington, D.C.

- Ten State radon program representatives participated in this meeting which was arranged by CRCPD.

- State radon program representatives were concerned that a standard for radon in drinking water will mislead the public about the risks of radon in drinking water relative to the risks from radon in indoor air. If there is an enforceable standard for drinking water and only a voluntary action level for indoor air, they believe this will draw public attention and resources away from the greater public health risks of radon in indoor air. They cited anecdotal information suggesting that some private well owners were investing resources to reduce radon in drinking water without addressing radon risk from indoor air exposure, which could be reduced at lower cost. They also noted that because of the transfer coefficient between water and air, a drinking water concentration of 300 pCi/L appears to pose a greater risk than the current recommended action level for radon in indoor air of 4 pCi/L. This makes it difficult to explain to the public that the risks from radon in air are greater than risks from radon in drinking water and substantial staff time is spent responding to individual inquiries resulting from this confusion.

- States suggested that any regulatory framework should be flexible enough to allow resources to be targeted to the highest risk exposure (i.e., indoor air first). They believed

[9] State representatives suggested that since the remaining drinking water risk is due to inhalation of volatized radon gas (and radioactive progeny), EPA could set a standard that stayed within the traditional risk range based on ingestion risk, and leave the inhalation risk to be addressed as part of the larger issue of indoor air exposure, of which it constitutes only a small part.

that it was not an effective use of resources at this time to address any but the highest water exposures, given the relative magnitudes of water and air exposure.

- Some States further indicated that State voluntary programs are doing all they can to address indoor air risk with available resources, and believed that SDWA AMCL/MMM option would only be useful if it provided resources to enhance current programs.

- Some radon program representatives shared the concerns of drinking water program representatives over the perceived inequity and potential tort liability of reducing air exposure in some homes to offset higher drinking water exposure in different homes. They noted that the parts of a state with high indoor air levels may not be the same as those with high drinking water levels.

- When asked what level they would support for a drinking water MCL, radon program representatives gave specific recommendations for the MCL ranging from 4,000 pCi/L to 40,000 pCi/L in water. The lower end of this range corresponds to the background level in outdoor air, while the upper end corresponds to the current action level for indoor air programs of 4 pCi/L (equivalent to 40,000 pCi/L of radon in water). State representatives suggested that the appropriate regulatory level for water should be developed using a holistic approach with indoor air based on the combined risk from indoor air and drinking water.

- Some radon program representatives expressed concern for the possible health risks from radon gas emitted from water treatment (aeration) units, or from improperly handled residuals (e.g., from an ion exchange unit). One representative mentioned that vendors have developed an individual air stripping unit for private wells. He suggested that the risks from such units might be higher than the risk of leaving the radon in the water, particularly if the well (and unit) were located in an enclosed area. (Note: EPA has analyzed the risks from off-gas emissions from aeration units at public water systems and found them to be *de minimis*, see Section II.A).

- State radon program representatives believe that it would be more effective to provide additional funding for indoor air abatement under the IRAA, rather than trying to address indoor air through MMM programs (without additional funding) under SDWA.

VI. References

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List of Attendees

Association of State Drinking Water Administrators (ASDWA) Conference Call
September 16, 2003

Representatives from the following States:

Alaska	Massachusetts
Arizona	Minnesota
California	Missouri
Delaware	New York
Georgia	North Carolina
Idaho	North Dakota
Indiana	Ohio
Kansas	Pennsylvania
Louisiana	Rhode Island
Maine	Vermont
Maryland	Virginia

Representatives from the following organizations:
-ASDWA
-EPA-IED/ORIA (EPA's Indoor Environments Division and Office of Radiation and Indoor Air)
-EPA-OGWDW/OST (EPA's Office of Ground Water and Drinking Water and Office of Science and Technology)
-EPA-OPEI (EPA's Office of Policy, Economics, and Innovation)
-OMB (Office of Management and Budget)

Council of Radiation Control Program Directors (CRCPD) Meeting
September 24, 2003

Representatives from the following States:

Florida	Nevada
Idaho	New York
Kansas	Ohio
Maine	Pennsylvania
Massachusetts	Utah

Representatives from the following organizations:
CRCPD
EPA-IED/ORIA
EPA-OGWDW/OST
EPA-OPEI
EPA-Region 4
OMB
ASDWA

APPENDIX A: Association of State Drinking Water Administrators (ASDWA) Conference Call Meeting Notes – September 16, 2003

Radon in Drinking Water Meeting Minutes
September 16, 2003 (1:00 – 2:30 PM)

MEETING ATTENDEES:

ASDWA[10] (via phone):	Matt Corson, Jim Taft
EPA[11]:	Becky Allen, Nancy Chiu, Ann Codrington, Ann Johnson, Ephraim King, Richard Reding
EPA (via phone):	Tom Kelly, Dave Rowson, Anita Schmidt
OMB[12] (via phone):	Jim Laity
States (via phone):	Alaska, Arizona, California, Delaware, Georgia, Idaho, Indiana, Kansas, Louisiana, Maine, Maryland, Massachusetts, Minnesota, Missouri, New York, North Carolina, North Dakota, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia.

Members from CRCPD[13] also participated in the call via phone.

MEETING OBJECTIVE:

To review EPA's presentation to ASDWA and receive states' comments on four summary questions.

MEETING SUMMARY:

The meeting opened with Ephraim King giving a brief introduction, noting that a similar conversation will be held with air representatives later in the month. Next, Becky Allen reviewed the slides and restated the following summary questions:

- What is your view of each single drinking water standard (4000 pCi/L, 1000 pCi/L, and 300 pCi/L) with respect to the following?
  - Public health protection impacts
  - Burden
  - Implementation

[10] Association of State Drinking Water Administrators
[11] Environmental Protection Agency
[12] Office of Management and Budget
[13] Conference of Radiation Control Program Directors

- Anticipated stakeholder reaction

- What challenges do you see in successfully adopting and implementing any of these options?

- If a single drinking water standard would eliminate the statutory incentive to undertake a Multi-Media Mitigation (MMM) program, what are your views with respect to the following?
  - Public health protection impacts
  - Burden
  - Implementation
  - Anticipated stakeholder reaction

- What other thoughts do you have regarding a single drinking water standard?

During the review, the following question was raised:

Rhode Island:

- Currently, as stated in the statute, indoor air quality should be no more than background levels (0.4 pCi/L); thus a 1,000 square foot house would be required to reduce radon levels to 0.4 pCi/L. Can the statute language be changed so that background levels are reflective of a shower instead of a 1,000 square foot home? If so, using the rule of thumb that 10,000 pCi/L of radon in air is equivalent to 1 pCi/L of radon in water, the quantity of radon in a shower would be 4,000 pCi/L.

Response: This issue was tabled for later discussion because the meeting was not held to discuss regulatory content.

Next, New York presented the general comments from the States:

1. The majority of states want a single drinking water MCL.
2. The MCL standard should be above 300 pCi/L_{water}, and most states would prefer an MCL level of 4000 pCi/L_{water} (or background level).
3. All states agree that indoor air exposure is a serious health risk; however, health risk from indoor air exposure should be addressed through indoor air programs, not drinking water programs, and adequate funding for indoor air programs should be provided.
4. With regards to equity, 2 different MCL levels within states would increase difficulties regarding public health perceptions.
5. Because outdoor and indoor air presents the greatest exposure risk to individuals, creating an MCL for radon of 300 pCi/L_{water} would actually decrease the benefit to public health because people would still be exposed via inhalation at a large monetary cost. This is because reducing radon levels in water minimally decreases radon in air. Therefore, money needed to fund public protection would be better spent towards decreasing radon levels in the air.

The fifth point was discussed further, and it was noted that indoor air and water radon levels have no correlation. Additionally, it did not appear that the cost:benefit relationship was taken into consideration when proposing the MCL. Respondents asked if EPA could revisit the risk assessment taking the above issues into account. EPA responded that Congress would have to amend the statute. EPA's recommendation of 300 pCi/L_{water} was derived based on the 10^{-4} to 10^{-6} individual cancer risk, as historically done. It was then asked if the 10^{-4} to 10^{-6} risk was mostly contributed from breathing. EPA responded yes, noting that 10% of the overall risk was attributed to water consumption.

The conversation then was open to the states to address the summary questions. Individual state discussion points are presented below.

California:

- Stated that if an MMM program is included in the rule, CA would opt out because they do not have the ability to run an MMM program.

Virginia:

- Stated that an MMM program with a level 4,000 pCi/L_{water} would cost the state less, while setting the MCL at 300 pCi/L_{water} would cost a lot with little benefit.
- Added that an MCL of 300 pCi/L_{water} makes sense as an overall exposure value from the literature; however, it is not supportable given that there is no correlation between air radon levels versus water radon levels.

Alaska:

- Stated there is not enough science to support an MCL of 300 pCi/L_{water}, but an MCL of 4,000 pCi/L_{water} can be scientifically upheld.
- Emphasized that air, not water, was the problem.
- Noted it would be difficult to gain the support of the stakeholders, and an MCL of 300 pCi/L_{water} would burden the state program.

Vermont:

- Asked the attendees what if there was no MMM program associated with the proposed rule. The MMM program appears to be the driving force between the states' decisions.
- In a 1986 study, 123 out of 366 small water systems tested would have levels over 1,000 pCi/L_{water}. Eighty percent would have levels over 300 pCi/L_{water}. Ten systems (3%) would have levels greater than 4,000 pCi/L_{water}.

New York:

- Stated 60% of upstate wells (> 1000) would violate an MCL of 300 pCi/L_{water}, and 12 would violate an MCL of 1000 pCi/L_{water}.

Rhode Island:

- Stated that out of 144 wells sampled, 2 had radon levels less than 300 pCi/L_{water}. Gravel and high volume wells have low radon levels and MMM programs would be feasible, whereas bedrock wells (~50%) have levels greater than 4,000 pCi/L_{water}.

California:

- Questioned if there was any way to perform a risk analysis for radon excluding smokers due to the way smokers are defined (an individual who has smoked 100 or more cigarettes in a lifetime).
- Stated 300 wells (~60%) were above 300 pCi/L_{water}. Noted that small systems (e.g., ones in the foothills) are already burdened with arsenic and uranium regulations and implementing an MCL of 300 pCi/L_{water} would be daunting.

EPA asked if there were any views on 1,000 pCi/L_{water} versus 4,000 pCi/L_{water}.

Pennsylvania:

- Noted 50 systems had radon levels greater than 4,000 pCi/L_{water} and 1,900 had levels greater than 300 pCi/L_{water}.
- Did not believe that an MCL of 300 pCi/L_{water} offered more protection than an MCL of 4,000 pCi/L_{water}.
- Emphasized the need to separate water and air programs, noting that Pennsylvania had a very effective indoor radon reduction program.

New York:

- Emphasized the economic costs of reducing radon levels to 300 pCi/L_{water} versus 4,000 pCi/L_{water} and added that there is no real change to public health by decreasing the MCL.
- Also argued that it was an equity issue and that problems would be created if some water systems within a state had lower standards than others. Environmentalists in New York want equal protection in all systems.

The conversation was then redirected to the third summary question on eliminating the statutory incentive to undertake an MMM program and the following points were made:

Georgia:

- Stated that they favored a single MCL value and that an MMM program would be extremely difficult to implement due to record keeping and the burden of measuring MMM program results.

New York:

- Stated the decision to participate in an MMM program depends on the individual state's program structure (i.e., are air and water in the same program or division?). Usually, air and water are separate divisions; however, in New York they are connected, and therefore, New York would opt for an MMM program.

California:

- Noted the issue is centered on resources for California because State Indoor Radon Grant (SIRG) only funds 1 person.

Louisiana:

- Stated that a radon program is not in effect for the entire state due to low radon levels; therefore, starting an MMM program would be a huge burden and the state would opt not to do it.

Rhode Island:

- Stated air and water programs are part of the same division; however, an MMM problem may cause problems with the licensing process and funding allocation.

Alaska:

- Stated there is no indoor air program for radon in Alaska, and an MMM program would not be implemented.

Massachusetts:

- The state's air and water programs are separate, and they would prefer to divert radon water funding to the air program.
- Noted an MCL of 300 pCi/L_{water} would be problematic for the state and expressed support for a higher MCL.

Idaho:

- Stated that 70-80% of its water systems would be impacted, and that an MMM program would be inherently problematic because of: (1) coordination between the air and water divisions and (2) funding.
- Added that a low quantitative MCL goal does not translate into a decrease in public health burden, but instead may increase compliance problems.

EPA then asked if there were any additional comments from the Office of Management and Budget (OMB) or the Office of Radiation and Indoor Air (ORIA). Dave Rowson (ORIA) said that the states had articulated their points well. OMB concurred and had no additional comments.

Arizona:

- Stated there was common theme in the states' comments, which was the need to separate air and water issues. For the MMM program to be worthwhile, it should be placed under the air statutes and receive separate funding.

Louisiana:

- Stressed new rules may cause problems with compliance and would prefer new rules with fewer complications.

Rhode Island:

- Concurred with Louisiana, indicated that no state would set levels more stringent than EPA.
- Also added that they needed a consistent national message on the risks from indoor air, instead of mixed state messages.

Massachusetts:

- Emphasized the need to lower air risk.

Alaska:

- Stated that public comments made 3 years ago when the proposal was made were similar to those today. Asked if EPA was going to respond to any of those comments in the context of the Final Rule.

EPA stated that today's meeting was to answer the summary questions, and it was not the Agency's intent to revisit any previous comments.

Virginia:

- Stated that radon is a complex problem that may be viewed like TMDLs; it may be a good idea to look at the cumulative risks. It also appears that the radon proposal is mired down in details and that 90% of cancers attributed to radon are related to air exposure. Because of this, it appears that by implementing the MCL, one is trying to save an individual from stomach cancer (radon exposure via water) only to have them develop lung cancer (radon exposure via air). Therefore, air problems should be handled before water exposures because air presents a greater risk. Congress should promulgate a separate air requirement and then revisit radon in drinking water.

Georgia:

- Stated that State Revolving Fund (SRF) funds are maxed out, and the state cannot contribute to an MMM program.

Virginia:

- Concurred with Georgia.

EPA thanked the states for their contribution and ended the meeting.

APPENDIX B: Council of Radiation Control Program Directors (CRCPD)
Meeting Notes – September 24, 2003

Radon in Drinking Water Meeting Minutes
September 24, 2003 (10:00 – 12:00 Noon)
Washington, DC

MEETING ATTENDES:

CRCPD[14]:	Ron Fraass
EPA-IED/ORIA[15]:	Tom Kelly, Dave Rowson, Anita Schmidt, Susie Shimek
EPA-OGWDW/OST[16]:	Becky Allen, Nancy Chiu, Ann Codrington, Ephraim King
EPA-OPEI[17]:	Ann Johnson
EPA-Region 4:	Todd Rinck
ASDWA[18] (via phone):	Matt Corson, Jim Taft
OMB[19]:	Jim Laity
State Representatives:	Florida Idaho Kansas Massachusetts Maine New York Nevada Ohio Pennsylvania Utah

MEETING OBJECTIVE:

The purpose of this meeting was to give states an opportunity to express their opinion on options for a single drinking water MCL for radon. EPA consulted with CRCPD as part of the 2003 Appropriations process in which Congress asked the Agency to consult with state drinking water,

[14] Council of Radiation Control Program Directors.
[15] Environmental Protection Agency's Indoor Environments Division and Office of Radiation and Indoor Air.
[16] Environmental Protection Agency's Office of Ground Water and Drinking Water and Office of Science and Technology.
[17] Environmental Protection Agency's Office of Policy, Economics, and Innovation.
[18] Association of State Drinking Water Administrators.
[19] Office of Management and Budget

air, and radiation programs and to evaluate options for a single standard for radon in drinking water.

MEETING SUMMARY:

Tom Kelly of EPA-IED, called the meeting to order and introduced Ron Fraass of CRCPD.

Ron Fraass welcomed everyone to the meeting.

The meeting then opened with Tom Kelly giving a brief introduction, explaining the objectives of the meeting.

- The main reason for the meeting was to find out views of the state representatives about proposing a single MCL standard, as opposed to an MCL along with an AMCL with MMM, as EPA is required to do under the current statute.
- He added that the main question for professionals in the field would be to assess the implications of having a single MCL standard.

Next, Becky Allen of EPA-OGWDW, presented an overview of the issues around this proposed regulation and the cost and benefit numbers for the various MCL levels put forth by EPA. She also restated the following summary questions, and stated that EPA is interested in finding out states' reaction to them:

- What is your view of each single drinking water standard (4000 pCi/L, 1000 pCi/L, and 300 pCi/L) with respect to the following?
    - Public health protection impacts
    - Burden
    - Implementation
    - Anticipated stakeholder reaction

- What challenges do you see in successfully adopting and implementing any of these options?

- If a single drinking water standard would eliminate the statutory incentive to undertake a Multi-Media Mitigation (MMM) program, what are your views with respect to the following?
    - Public health protection impacts
    - Burden
    - Implementation
    - Anticipated stakeholder reaction

- What other thoughts do you have regarding a single drinking water standard?

The meeting was then opened for state representatives to express their opinions on options for a single MCL. In particular, representatives were asked to respond to the 4 questions put forth in Becky Allen's presentation.

The following are summaries of the views expressed by various state representatives:

Pennsylvania:

- Stated that they would prefer to have a single MCL because that would be less confusing to the public and easier to implement, compared to an AMCL with the MMM option. Also, given the three options for a single MCL laid out by EPA, Pennsylvania would prefer 4,000 pCi/L.
- He added one impact of this standard would be its implications for real estate and the effect of any standard on the allowable levels of radon for all drinking water in the state. He projected that at 4,000 pCi/L, there would be approximately 50 public water systems (PWS) out of compliance and this would be a bigger problem if the MCL were made any more stringent.

Massachusetts:

- Stated that one of the unintended consequences of this proposed rule would be that it might encourage people to make poor choices because of the economics of treating water at home as they move away from public water systems. Also, given that EPA is proposing a regulation for radon in water, and no regulation for radon in indoor air, might give the impression to the general public that radon in water is more dangerous than radon in air. This may lead to residents making poor choices in terms of mitigation and lead to further unintended negative consequences.
- The state recommends having a single MCL also, but at a higher level, in the region of 10,000 – 15,000 pCi/L.
- He added since the legal framework in the Safe Drinking Water Act (SDWA) does not allow EPA to set an MCL above 4,000 pCi/L, it might be worthwhile to consider setting an MCL as part of the Indoor Radon Abatement Act (IRAA). Since the ultimate goal of this rule is to control radon in indoor air, the state felt that setting an MCL for water as part of IRAA would circumvent the need to do this under SDWA and therefore would give EPA the flexibility to choose a reasonable MCL similar to the radon in indoor air action guide.

EPA's response:

- Responding to this suggestion, Dave Rowson of EPA-IED, commented that they have a statutory obligation under SDWA to set an MCL at or below 4,000 pCi/L. However, IRAA might provide more latitude for EPA but their impression is that they do not have the authority to set an MCL under IRAA.
- Ephraim King of OGWDW, suggested that setting the standard under IRAA may be a potential option for Congress to consider.
- He added that the proposed 1999 rule requires EPA to set a standard for radon in water and that it is not a discretionary proposition for EPA.

Jim Laity, of OMB:

- Added that EPA has an obligation to set a standard, but might have the discretion to choose the appropriate standard.

Florida:

- Stated that setting any MCL would be interpreted as a positive action for public health.

Kansas:

- Stated that they also support a single MCL of 4,000 pCi/L.
- They felt that a form of MMM is already being performed in those states, including Kansas, that currently have an on-going State Indoor Radon Grant (SIRG) program. Hence, they do not see any loss from having a single MCL for drinking water without adding the MMM element for indoor air.

New York:

- Concurred with Kansas about the existence of an MMM program in New York.

EPA's response:

- Dave Rowson responded that if EPA were to set a single MCL, then there would be no requirement for an MMM program. However, notwithstanding the experience in Kansas and New York, all states do not have an existing MMM program and the issue is what will be the impact on these states of setting a single MCL and no option for an MMM program.

Pennsylvania:

- Questioned whether there would be additional funding sources for an MMM program. They felt that there would be a need for increased funding if they have to implement an MMM program.

New York:

- Concurred that they would also need additional funding if they are asked to implement an MMM program.

Massachusetts:

- Added that without the MMM program, they envision re-targeting some of their resources to areas of the state that have higher radon concentrations in indoor air. If they have to implement an MMM program, however, their resources would be spent on compliance issues, without the corresponding improvements in public health.

Maine:

- Stated that they have been getting risk reduction from radon for a long time and have a standard of 20,000 pCi/L for all PWS. He felt that the proposed national standard might interfere with their existing standard in Maine. If a single MCL is implemented and the federal standard is more stringent than the state standard, then the problem for the state would be that it might lose a significant part of their PWS customers.
- He also added that implementing the proposed MCL for water and no corresponding statutory requirement for indoor air, might give an incorrect perception to citizens that radon in air is not a significant problem. He added there should be a direct correlation between the two mediums and any standard for water should be followed with a standard for air.

Pennsylvania:

- Added that because of the lack of a standard for indoor air, the US Department of Housing and Urban Development (HUD) is not planning on taking action for controlling radon in homes.

Nevada:

- Stated that at first, they were happy to see the AMCL as an available option rather than just have the MCL as the only option, as they felt that it might be a stringent option for everyone to implement. They viewed the AMCL as an enhancement to their current radon in air program. But the problem with having an MMM program with the AMCL is that most western states do not have a regulatory mechanism to implement the MMM program and Nevada doesn't see a regulatory mechanism being developed in the near future to do that. Hence, they now prefer to have a single MCL as the only option as long as the MCL is more in line with the radon in indoor air action level and takes into account the availability of current radon mitigation technologies.

Ohio:

- Stated that they have a serious problem with radon in indoor air, with about 50 percent of the homes in the state above 4 pCi/L, with the average level at approximately 7.1 pCi/L and some as high as 3,000 pCi/L. However, radon in water does not seem to be such a serious problem in Ohio with no identified public water systems at or above 4,000 pCi/L.
- They recommend a single standard, and 4,000 pCi/L could be a usable standard for the state. But they would prefer a standard somewhere in the region of 10,000 pCi/L because it is closer to the actual risk levels comparable to elevated indoor air levels. He also added that he has some reservations with the risk numbers estimated by EPA for this proposed rule and would be happy to discuss them some other time.
- With respect to the issue about stakeholder reaction, Ohio was concerned that it would be hard to explain to stakeholders that the higher level allowed under the AMCL option (with an MMM program) would have less risk than the MCL option.
- He added that Ohio is a state that licenses radon mitigators and they currently perform approximately 4,000 mitigations per year.
- He also added that the state felt there is no significant correlation between radon in indoor air and drinking water and that Ohio's radon mitigation program is targeted to areas with higher radon in indoor air. But if they had to implement a radon in water standard, their research shows that those would be other areas of the state and not those currently targeted for high radon in indoor air.

Massachusetts:

- Commented that they feel there is some direct correlation between radon in indoor air and radon in well water. He agreed with Ohio, however, that under the proposed rule with the AMCL and the MMM option, resources would be spent on MMM programs in areas where radon levels are not the highest and thus would shift their focus away from areas that need the most targeted attention.
-

Maine:

- Concurred with Massachusetts that an MMM program would mean that the targeting of radon mitigation would be flawed with certain parts of the state having to live with high radon levels.

New York:

- Commented that they would also have trouble with an MMM program as the state currently does not certify radon mitigators.
- They would also prefer a single MCL of 4,000 pCi/L or above. At 4,000 pCi/L, they estimate that there would be approximately 20 systems that would need mitigation.
- They also felt that there is no direct correlation with radon in indoor air and radon in water.

Utah:

- Stated that they are concerned with the financial burdens of implementing the proposed rules. They feel that EPA should implement a single MCL and the level should be as high as possible. The rest of money appropriated for this purpose should be given to the states to implement a radon in indoor air program. This, they felt, would give the highest overall risk reduction.

Nevada:

- Expressed some concerns with EPA's estimated cost of the program of $378 million for 72 lives saved, at an MCL of 300 pCi/L. He felt that the cost figure might be too high for saving 72 lives and that that amount of money could save a great deal more lives if applied to radon in air.

Ephraim King of EPA-OGWDW, asked two clarifying questions:

- He first wanted to find out whether the notion that the existence of a drinking water MCL might take away resources from setting an indoor air standard is common to most states.
- Second, whether the 4,000 pCi/L level that states seem to vote for was only due to the fact that EPA put that as the highest option on the table. Given a free hand to choose any MCL, what would the states recommend?

States' response:

- Responding to the second question, **Nevada, Pennsylvania, Kansas,** and **Ohio** reiterated that they would prefer a single MCL and ideally higher than 4,000 pCi/L, somewhere in the region of 20,000 pCi/L or more.
- With respect to the first question, **Pennsylvania** and **Nevada** commented that they feel having to implement an MMM program for indoor air would divert attention and resources from cleaning radon in water.

Tom Kelly asked another clarifying question:

- He asked the states to consider whether EPA should follow a different procedure to set the MCL.
- He suggested one option could be to re-evaluate the radon in indoor air action level (which was based on technical feasibility) from the current level at 4 pCi/L, and reduce it

to a lower number to reflect current technical feasibility. EPA could then use the new air action level to set an appropriate MCL for water that is based on risk reductions. This would mean that the radon in water standard would probably be more than the 4,000 pCi/L which is the current highest level suggested by EPA. Also, it would directly tie the water standard to the indoor air action level.

- He asked the states whether this would be a better solution from the public health perspective because the focus would not be on reducing radon risk in water only, which is not the biggest contributor of the total risk of exposure to radon. It would also address the risk factors associated with radon in indoor air and therefore be more in line with the risk reduction goals of EPA.

Massachusetts:

- Responded that the radon risk is different from other risks. He drew the analogy that risk from radon is similar to risk from gravity and some exposure to that risk is unavoidable. Instead of promulgating rules for radon in drinking water, EPA should use the indoor air action level as the guiding principle, since it is more realistic and achievable from the states' viewpoint.

Florida:

- Stated that the radon in water risk is a significant contributor to the total risk for humans, and the question is how much of that risk are we willing to accept. The MCL should be set based on that premise.

Jim Laity of OMB:

- Asked since most states seem to think that the radon in indoor air action level is a more useful and realistic goal and ultimately the risk from radon exposure comes from radon in air, would it make sense to think about expressing the radon in water in "air equivalent units"? That is, in its communication with the general public, should EPA use risk equivalent units for expressing radon in water in terms of radon in indoor air, and would that alleviate some of the problems and confusion in the public that the states are seeing?

States' response:

- **Florida, Pennsylvania**, and **New York** responded that currently they have to explain some of these equivalency issues between radon in indoor air and radon in water to the public, and any more complication to that would add to the general confusion about the various units for measuring radon.

Idaho:

- Stated that their problem with MMM in Idaho is that it is extremely difficult for Idaho to collect data from MMM mitigators. Similar to problems in New York, Idaho does not certify MMM mitigators and therefore would face an uphill task to collect data on MMM if the AMCL is implemented.
- Inquired about the utility of discussing an MCL higher than 4,000 pCi/L when EPA does not have the authority to set anything above that limit.

Kansas:

- Agreed with Idaho's statement that collecting MMM data would be difficult because Kansas does not currently certify MMM mitigators either.

EPA's response:

- Dave Rowson of EPA-IED, clarified that EPA's interpretation of the current statute is that they cannot set an MCL above 4,000 pCi/L, but EPA would like to find out from the states and other stakeholders their preference for an MCL. That is the reason EPA suggested a number like 20,000 pCi/L for illustrative purposes so that the states can weigh in and help EPA report back to Congress about their preferences.

New York:

- Reminded that one should keep in mind that the risk from radon in water and in indoor air is additive and residents would have to mitigate if the radon in indoor air is more than the action level, and also mitigate if radon in water is more than the MCL.

Nevada:

- Responding to Idaho's question about the usefulness of discussing radon in water levels more than 4,000 pCi/L, stated that 4,000 pCi/L is tied to national goals for radon in ambient levels. But given that many states feel that it might not be possible to reach those national ambient level goals, there might be a need to discuss what the appropriate level should be.
- Stated that a single MCL sufficiently high enough to be justifiable (4,000 pCi/L or greater), given the majority of risk is in indoor air, would alleviate inherent problems with the current proposal. Those problems include justification and explanation to the consumer for two standards, lack of funding for MMM, and the lack of a mechanism and additional funding for results data collection under MMM.
- In addition, it should be noted by EPA that although not covered by the rule, a low MCL is going to result in significant unnecessary costs to the homeowner with a private well as lenders apply federal and state drinking water standards on those homeowners. Ultimately the cost of any regulation comes from the consumer and sometimes from those not intended to be regulated.

Utah:

- Stated that, in line with the recommendations of Massachusetts, they would also recommend that EPA take the proposed rule out of SDWA and put it back into the Toxic Substances Control Act (TSCA) and set up as an appropriate action level. Along with this, EPA should have a requirement that the public water systems have to report the actual radon levels in their water through Consumer Confidence Reports.
- This would allow the consumers to participate in the decision-making process as they can then decide if they want their public water systems to lower the radon levels in the water if it is higher than the action level. This would mean that consumers make the decision of whether they want their PWS to meet the action levels without government intervention.
- Finally, he commented that public water systems are more likely to listen to their consumers than to government representatives.

EPA thanked the states for sharing their views and ended the meeting.

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