Department of Energy
Washington, DC

April 16, 1999

Comment Clerk
Docket Number W-98-30
Water Docket (MC4101)
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

Dear Sir or Madam:

Enclosed are comments prepared by the Department of Energy's Office of Environmental Policy and Assistance on the "Health Risk Reduction and Cost Analysis for Radon in Drinking Water" (EPA-815-Z-99-002). Please contact James Bachmaier of my staff at 202-586-0341 or james.bachmaier@eh.doe.gov, if there are any questions on these comments.

Sincerely,

Raymond P. Berube
Acting Director
Office of Environmental Policy and Assistance

Enclosure

DEPARTMENT OF ENERGY COMMENTS ON THE HEALTH RISK REDUCTION AND COST ANALYSIS FOR RADON IN DRINKING WATER (EPA-815-Z-99-002)

The Department of Energy's (DOE) Office of Environmental Policy and Assistance has reviewed the Health Risk Reduction and Cost Analysis for Radon in Drinking Water (HRR&CA). The document provides estimates of health benefits, primarily in terms of reduction of fatal cancers, and costs associated with reduction of radon in drinking water to certain recommended levels. The HRR&CA analysis depends, in part, on a report commissioned by THE Environmental Protection Agency (EPA) and drafted by the National Research Council (NRC) entitled "Risk Assessment of Radon in Drinking Water". The NRC report touches on a significant shortcoming of the HRR&CA when it comments that "…stopping smoking is the most effective way to reduce the risk of lung cancer and reduce the risks associated with radon". The NRC report also concludes that the total estimated population risk from radon in community water systems is 160 fatal cancers (142 from progeny inhalation and 18 from ingestion), compared with 15,400 – 21,800 fatal cancers from inhalation of radon in indoor air. An estimated population risk of 700 lung-cancer deaths each year is attributable to "exposure to natural levels of radon while people are outdoors". The risk from exposure to radon in drinking water seems trivial in comparison with that from radon in indoor air, and small when compared to that from radon in outdoor air. Although the Safe Drinking Water Act only provides EPA with limited flexibility in selecting alternatives for reducing radon exposures (i.e., by providing for the development of an Alternative Maximum Contaminant Level), it would be informative to the public and to the regulated community for EPA to evaluate the costs and benefits of a wider range of alternatives for reducing the health effects of radon exposure. Comparison of the risk reduction from reducing radon in indoor air or reducing smoking would add valuable perspective to the costs and benefits of reducing radon in drinking water.

Many of the DOE concerns expressed in the November 15, 1991 memorandum from Raymond F. Pelletier to the EPA Office of Ground Water and Drinking Water (copy attached) apply to the HRR&CA, and should be addressed in the Regulatory Impact Analysis that is being performed in support of this rulemaking. The HRR&CA does not include an analysis of either risk or cost associated with potential occupational exposures to radiation and radioactive material at water treatment facilities or with disposal of wastes in sanitary sewers or at offsite waste disposal facilities. There is also no consideration of the potential for generating radiological or mixed wastes as a result of radon removal from source waters.

GENERAL COMMENTS

There are a number of aspects of cost and risk related to regulating radon and other radionuclides in drinking water that were not addressed in this analysis, either due to lack of data or a lack of time to complete the analysis. There are other aspects that DOE feels should be considered in all drinking water rulemakings related to costs and risks that EPA has traditionally not considered. DOE has identified some of these issues in the 1991 comments referenced in the preceding section and in the detailed comments that follow. There may be others. DOE expects that EPA will include full analyses of all costs and all reductions in risk (benefits), as well as new risks created, in the Regulatory Impact Analysis that will be prepared in support of the proposed and final rules.

DOE is concerned that the HRR&CA for radon may not be a proper model for analyses of other possible rulemakings, including the anticipated revisions to the National Primary Drinking Water Regulations (NPDWR) for the other radionuclides, since radon is an atypical drinking water contaminant. It is atypical for the following reasons:

1. Radon is naturally-occurring and, therefore, not associated with a specific industrial or commercial source;
2. Radon is primarily a health risk through inhalation, not ingestion, whereas ingestion is the primary pathway for other drinking water contaminants;
3. Radon in drinking water is treated primarily through aeration, not through filtration or chemical treatment processes;
4. The primary health risks associated with radon are more appropriately addressed by regulatory and non-regulatory activities outside of the scope of the Safe Drinking Water Act (i.e., those that are aimed at reducing indoor air levels and at anti-smoking incentives). Congress recognized this matter when it linked AMCLs to multi-media mitigation programs.

Therefore, the HRR&CA for radon may set a poor precedent for similar analyses for future drinking water regulations. To ensure that this analysis does not set an inappropriate precedent for future analyses, DOE suggests that EPA consider the following issues when conducting future HRR&CA's.

1. When evaluating the costs and benefits of the rulemaking, EPA should consider the creation of new risks as a result of establishing regulatory control over a new contaminant. New risks include exposure to workers at a water treatment plant where treatment residuals are managed, as well as exposure to the general public resulting from management and eventual disposal of water treatment plant residuals. In the latter case, EPA's guidance [1] recommends disposal of water treatment plant residuals containing radionuclides below certain levels in the municipal sanitary sewer system. Disposal of any waste containing radionuclides to a municipal sanitary sewer system results in an increase in radiological contaminant levels in the sludges generated by the publicly owned treatment works (POTW). Such sludges are typically managed by POTW workers who are not protected as "radiation workers". The sludges at many POTWs are either applied to agricultural lands or are processed as commercial fertilizers and soil conditioners for unrestricted residential use. Although these "beneficial uses" of POTW sludge are regulated under programs developed pursuant to Section 503 of the Clean Water Act, there are no standards for radiological contaminants. Therefore, there is no mechanism for determining what exposures or risks may result from disposal of water treatment plant residuals. The analysis of the costs and benefits of additional or revised NPDWRs for radiological contaminants must include an analysis of the potential impact of waste management, including the effect on POTW sludges and the possible pathways of exposure to POTW workers and to the general public.

2. When remedial goals or cleanup levels for radiologically contaminated soils and ground water are set, based on RCRA or CERCLA requirements, the Maximum Contaminant Levels (MCL) are typically used as ground water protection standards or reference points. This is justified in the RCRA and CERCLA cleanup programs by making the assumptions that the contaminated ground water is a potential future source of drinking water and that future users of this drinking water source would not necessarily treat the ground water to meet the MCL before ingestion. While DOE's position has been that the MCL is not an appropriate ground water protection standard in the context of a RCRA or CERCLA remediation, nevertheless, the MCL is used for setting cleanup levels at many sites. Additionally, the MCL is used in the development of other standards, such as 40 CFR Part 191, which addresses high level radioactive waste, and draft rules for low-level radioactive waste (40 CFR Part 193) and for cleanup of radiologically contaminated sites (40 CFR Part 196). Therefore, EPA should evaluate the incremental costs associated with ground water remediation at RCRA and CERCLA sites, as well as the implications for DOE cleanup and radioactive waste management, resulting from establishing additional or revised MCLs for radiological contaminants in drinking water.

   Since radon is naturally-occurring, it is not likely to be included as a contaminant of concern at a RCRA or CERCLA site where a cleanup level would be set, except where radium is a primary contaminant. However, other radiological contaminants, either man-made or technologically enhanced, would be subject to remediation, and therefore, a cleanup level would be set. Other analyses similar to the HRR&CA for radon should, therefore, evaluate the costs associated with the use of the new or revised MCL as a ground water protection standard in the context of a RCRA or CERCLA cleanup.

3. When setting new or revised MCLs for any contaminant, EPA should evaluate the potential impact (risk reduction and cost) on owners of private wells. Although private wells are generally not subject to NPDWRs promulgated pursuant to the Safe Drinking Water Act, the levels set for drinking water quality in public water systems may be either adopted voluntarily or required under authority of a state or local health department or other agency responsible for the quality of drinking water from private wells. There are a substantial number of people across the country that derive their drinking water from private wells. EPA should conduct an analysis of the cost and benefits resulting from the adaptation of the various levels considered in this rulemaking to private wells.

[1] "Suggested Guidelines for Disposal of Drinking Water Treatment Wastes Containing Radionuclides", Office of Ground Water and Drinking Water, U.S. EPA. June 1994 Draft

4. EPA has not included the costs or benefits of the various levels being considered for the MCL for radon that would be realized by the owners of non-community, non-transient water systems (NCNTWS), due to lack of time to gather data to complete the analysis. From data presented in the HRR&CA, the number of such systems is significant, and the average radon levels in the source water for these systems may be 60% higher than in community water systems. The MCL for radon would apply to an NCNTWS even though the patterns and levels of exposure through ingestion and inhalation would not be consistent with residential exposure. In addition, it is not clear how an AMCL would apply to a NCNTWS, assuming a state-wide multi-media mitigation (MMM) program were approved by EPA. If the state-wide MMM program were directed strictly at residential and commercial buildings, and schools, and not necessarily at an industrial facility such as a DOE weapons production facility or a national laboratory, the presumed reduction in radon levels in indoor air may not be realized. Therefore, the state may determine that the AMCL is inappropriate for these facilities, and may implement the MCL for industrial facilities that operate NCNTWS. This is an issue for the individual states and has apparently not been addressed by EPA in the HRR&CA, since the costs and benefits related to NCNTWS were not included. Future analyses must include NCNTWS and must consider the possibility that a state-wide MMM program may not apply to a DOE facility, and therefore, the AMCL does not apply.

SPECIFIC COMMENTS AND RECOMMENDATIONS

Page 9566, Executive Summary

There is no Table 7.3 (referenced in last paragraph before **2. Introduction**).

RECOMMENDATION: This table should be added to simplify the cumbersome risk/benefit comparisons made in the Executive Summary between mitigation of radon in drinking water and the MMM program implementation scenarios.

Page 9573, Section 3.5

The total estimated population risk from radon in community water systems is 160 fatal cancers (142 from progeny inhalation and 18 from ingestion), compared with 15,400-21,800 fatal cancers from inhalation of radon in indoor air. The public summary of *Risk Assessment of Radon in Drinking Water* (National Academy of Sciences), page PS-4, (from which the EPA estimates are drawn) estimates a population risk of 700 lung-cancer deaths each year attributable to "exposure to natural levels of radon while people are outdoors." The risk from exposure to radon in drinking water seems trivial in comparison with that from radon in indoor air, and is even significantly less than that from radon in outdoor air.

RECOMMENDATION: A more broadly based comparison of alternatives should be performed to determine the optimum regulatory approach. In particular, the alternatives should compare the risk reduction and costs associated with reducing radon in drinking water with those for reducing radon in indoor air.

Page 9573, Section 3.6

EPA acknowledges, "The frequency with which radon treatment would also reduce risks from other contaminants, and the extent of risk reduction that would be achieved, has not been evaluated quantitatively in the HRRCA."

RECOMMENDATION: This evaluation should be performed, since it is also not clear whether there might be a risk increment from co-contaminants. Removal of organic (both volatile and non-volatile) and some inorganic contaminants by granular activated carbon (GAC), and the reduced solubility of toxic metals such as arsenic resulting from aeration, suggest that new or increased quantities of hazardous or toxic waste streams may

result from treatment primarily intended for radon reduction. The likelihood that radon and hazardous or toxic materials may co-exist in the spent GAC also suggests that mixed wastes may be generated.

Page 9574, Section 3.8

EPA cites the relative risk of radon-induced cancers as 85% among ever-smokers, and only 15% among never-smokers, according to Table 3-9. This estimate is based on the public summary of *Risk Assessment of Radon in Drinking Water* (National Academy of Sciences), page PS-3, which notes that "…stopping smoking is the most effective way to reduce the risk of lung cancer and reduce the risks associated with radon." A more detailed model of risk of radon-induced cancer as a function of some measure of the level of smoking (or years since smoking ceased) would be helpful. It would seem on the surface, however, that an effective program to reduce smoking might provide a more favorable return on investment by achieving the goal of reducing radon-induced fatal cancers as part of a larger reduction of fatal cancers in a large segment of the U.S. population.

RECOMMENDATION: A more broadly based comparison of alternatives should be performed to determine the optimum regulatory approach. In particular, the alternatives should compare the risk reduction and costs associated with reducing radon in drinking water with those for reducing smoking in the U.S. population.

Page 9576, Section 4.2.2

EPA cites "Guidelines for Preparing Economic Analyses – Review Draft" (Office of Policy, November) as basis for the $5.8M central tendency value of a statistical life (VSL). The title page of this document states, "Do not cite or quote."

RECOMMENDATION: The VSL estimate should be taken from the peer-reviewed scientific literature or from agency documents that have been accepted after public review and comment. Details of the assumptions, methodology, and analysis for quantifying the VSL should be readily available for public scrutiny.

Page 9576, Section 4.2.3 and Table 4-2

EPA derives medical care cost estimates from "Cost of Lung Cancer (Draft)" (Office of Ground Water and Drinking Water, October), which is a draft final report. The costs for lost leisure and productive time for lung cancer survivors cited in Table 4-2 seem to be reversed. The first–year costs appear to have been calculated using hours lost (776 productive hours and 1,493 leisure hours) from Table II.5-14 of the draft final report, combined with the per-hour valuation of leisure ($9.64) and productive time ($12.47) from "Potential Benefits of the Ground Water Rule – Draft Final Report" (Office of Ground Water and Drinking Water, February). This calculation yields a lost-leisure cost of 1,493 h ×$9.64/h = $14,393 (the lost-productive-time cost cited in Table 4-2) and a lost-productive-time cost of 776 h × $12.47/h = $9,677 (close to the lost-leisure cost of $9,886 cited in Table 4-2). No lost time is assumed beyond the first year for lung cancer survivors, which is consistent with assumptions in the draft final report.

RECOMMENDATION: EPA should review cost estimates cited in Table 4-2 for accuracy and consistency. The cost estimates should be taken from peer-reviewed scientific literature or from agency documents that have been accepted after public review and comment. Details of the assumptions, methodology, and analysis for quantifying the cost estimates should be readily available for public scrutiny.

Page 9576, Section 4.2.3 and Table 4-3

EPA derives medical care cost estimates from "Cost of Stomach Cancer (Draft)" (Office of Ground Water and Drinking Water, October). The value of productive time ($12.47/h) and value of leisure ($9.64/h) are from "Potential Benefits of the Ground Water Rule – Draft Final Report" (Office of Ground Water and Drinking Water, February). Medical care costs for survivors of stomach cancer cited in Table 4-3 do not appear to be consistent with those from Table II.2-9, *Medical Costs Through the 10th Year Post-diagnosis*, in "Cost of Stomach Cancer".

RECOMMENDATION: EPA should review medical care cost estimates cited in Table 4-3 for accuracy The cost estimates should be taken from peer-reviewed scientific literature or from agency documents that have been accepted after public review and comment. Details of the assumptions, methodology, and analysis for quantifying the cost estimates should be readily available for public scrutiny.

Page 9578, Section 5.1.1

EPA has considered the risk downwind of radon and progeny dispersal from a water treatment facility using aeration for radon removal, but there is no assessment of risk to workers at the facility, or of the cost associated with workplace or employee monitoring for internal exposure to radon.

RECOMMENDATION: EPA should provide estimates of risk from occupational exposure to radon and costs of associated radiation protection programs at water treatment facilities and include these estimates in the analysis of costs and benefits.

Page 9579, Section 5.1.2

EPA provides no analysis of external exposures and the associated risks to water treatment facility workers or maintenance crews who may work in the vicinity of, or intimately with, spent granular activated carbon (GAC) installed for the purpose of removing radon from water. The cost of radiation protection programs which may be required as a result of gamma emissions from radon daughters (particularly ^{214}Pb and ^{214}Bi, daughters of ^{222}Rn with significant branching ratios for emission of photons with energies between 0.2 - 2.0 MeV) absorbed in the GAC also has not been addressed.

RECOMMENDATION: EPA should provide estimates of risk from occupational exposure to radon and costs of associated radiation protection programs at water treatment facilities and include these estimates in the analysis of costs and benefits.

Page 9579, Section 5.1.2

The cost of using GAC for removal of radon from water does not consider the potential for generation of radiological or mixed waste and the associated disposal or treatment costs.

RECOMMENDATION: The potential for generating radiological or mixed-waste streams and the associated costs should be estimated by EPA and included in the analysis of costs and benefits for removal of radon from water.

Page 9588, Table 6-7

The annual incremental cost ($46M) of achieving the 2,000-pCi/L level is not within the specified range ($11M-$34M).

RECOMMENDATION: The tabular entry in Table 6-7 showing annual incremental cost of achieving the 2,000-pCi/L level should be changed to a central tendency value within the indicated range of values.

Page 9596, Section 7.4

Many of the values cited in the text of Section 7 are slightly different than those obtained by evaluating the data in Tables 6.12, 7.1, and 7.2. Most of the differences appear to be due to rounding error, but this is not explicitly acknowledged or stated.

RECOMMENDATION: EPA should review these values for consistency and should provide a more detailed explanation of their derivation.

Pages 9596-9597, Tables 7.1 and 7.2

There is no straightforward presentation of cost per cancer avoided for MMM implementation, although some selected values are provided in the text. The water mitigation and MMM components of cost per fatal cancer case avoided are presented separately in Tables 7.1 and 7.2; composite values for reducing risk to the different equivalent radon levels are not given.

RECOMMENDATION: Tables 7.1 and 7.2 should be revised, or a new table added, to present costs per fatal cancer case avoided for each target radon level. Data used in the derivation of composite costs per fatal cancer avoided should be explicitly provided.

Throughout the Document

The generally accepted symbol for liter is ‘L' (see “Units outside the SI that are accepted for use with the SI,” on the World Wide Web at URL <http://physics.nist.gov/cuu/Units/outside.html>), rather than ‘l' used throughout the HRRCA. Similarly, the symbol for hour is ‘h', rather than ‘hr'.

RECOMMENDATION: Change the abbreviation for liter to ‘L' and for hour to ‘h' throughout.