Department of Energy
Washington, DC 20585

November 15, 1991

Comment Clerk - Radionuclides
Drinking Water Standards Division
Office of Ground Water and Drinking.
Water (WH-550D)
Environmental Protection Agency
401 M St., SW
Washington, DC 20460

Dear Sir:

The Department of Energy (DOE) has reviewed the Environmental Protection Agency's (EPA) proposed National Primary Drinking Water Regulation (NPDWR) for Radionuclides published in the Federal Register on July 18, 1991 (56 FR 33050). Department-wide comments on the proposed NPDWR for radionuclides and supporting EPA documentation are enclosed.

The major DOE concerns, discussed in detail in the enclosure, are:

- DOE agrees with and supports EPA's attempt to set guidelines for disposal of water treatment wastes containing radionuclides, but is concerned that the guidelines are weakened by the lack of a strong technical analysis supporting its recommendations.

- EPA has not considered the potential exposure and risk caused by implementing this rule during water treatment plant operations, or through management of water treatment plant residuals, and disposal of these residuals either through sanitary sewers or off-site disposal facilities.

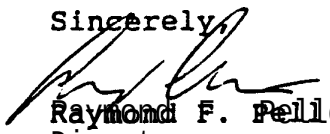
- EPA has underestimated the costs and difficulties associated with implementing this regulation, primarily resulting from the requirements for managing wastes produced at water treatment plants.

- EPA has not considered that water treatment residuals may contain RCRA Subtitle C hazardous constituents, requiring treatment and disposal as RCRA mixed wastes.

- EPA has not considered the effect of MCL's and MCLG's on other regulatory actions taken at the Federal and State level, that involve setting remediation goals or environmental performance levels.

DOE appreciates the opportunity to comment on this proposed rule. If there are any questions concerning these comments, please contact James Bachmaier at (202) 586-0341 or Gary Roles at (202) 586-0289.

Sincerely,



Raymond F. Pelletier
Director,
Office of Environmental Guidance

Enclosure

CONSOLIDATED DOE COMMENTS
SAFE DRINKING WATER ACT
PROPOSED NATIONAL PRIMARY DRINKING WATER REGULATION - RADIONUCLIDES
(40 CFR Parts 141 and 142)

1. EPA has not considered the creation of new sources of risk resulting from implementing this regulation.

Although implemention of the proposed radionuclide drinking water regulation will reduce low levels of risk to large populations, it will create larger sources of risk to a smaller population of water treatment workers and others. Risks from these sources could exceed the estimated risk prevented by regulating radium, uranium, alpha emitters, and beta particles and photon emitters.

"New sources of risk are created by the generation of wastes at the approximately 2000 drinking water treatment plants that become subject to this regulation. Much of the waste generated by the various Best Available Technology (BAT) treatment systems will be radioactive. Some of this waste will be radioactive mixed waste (RMW). Management of wastes at the water treatment plant, including long-term storage, will present additional risk to treatment plant employees. Transportation to a disposal facility and disposal of solid waste, disposal of liquid wastes through the municipal wastewater treatment system, or direct discharge to surface water, presents new sources of risk to workers and to the general public. These sources of risk have not been evaluated by EPA in developing the regulation that reduces risk by removing radionuclides from drinking water. For further discussion, see Appendix B: Consideration of Health Effects Caused by Implementing 40 CFR 141.

If the waste generated is a liquid waste that is discharged to a municipal wastewater treatment system, new risks are presented to the wastewater treatment plant workers, and to anyone exposed to sewage sludge generated by the wastewater treatment plant. Many municipal wastewater treatment plants have established sludge recycling programs, including marketing and distribution to commercial fertilizer manufacturers, farmers, and private citizens. EPA has not considered the risk presented by introducing radionuclides into sewage sludge that is destined for some beneficial use. At the present time, the proposed comprehensive sewage sludge regulations pursuant to the Clean Water Act (CWA) have not been promulgated. It is unlikely that these CWA regulations will address radionuclides in municipal sewage sludge. (See Comment #7 of Appendix A)

Additionally, removal of radium from raw water at an additional 110 treatment plants through use of prescribed BAT presents another source of radon exposure to treatment plant workers, since radon is a decay product of radium. This source of radon exposure, in addition to airborne radon released from packed tower aeration, does not appear to have been considered by EPA.

RECOMMENDATION: EPA should re-evaluate the impact of this regulation by assessing the risk created by occupational exposure to workers at water treatment facilities, and to workers who manage drinking water treatment system residuals, and wastewater treatment plant residuals. Additionally, risk to transportation workers and to the general public from transportation accidents and spills during shipment of wastes to a commercial disposal facility, as well as exposure to wastewater treatment sludge, should be assessed. EPA should not set MCL's so low that implementation will cause a net increase in risk of human health effects. The final rule should reflect the results of these assessments.

2. Potential difficulties of implementins this regulation have not been adequately addressed.

DOE has identified a number of potentially significant issues regarding implementation of this regulation. EPA should address these issues, described below and in Comment #l of Appendix A, through more comprehensive technical guidance and improved coordination with its other regulatory programs.

a.) In "Suggested Guidelines for the Disposal of Drinking Water Treatment Wastes Containing Naturally-Occurring Radionuclides", EPA suggests a number of options for disposal of liquid and solid wastes containing different concentrations of naturally-occurring radionuclides, such as isotopes of radium or uranium. DOE agrees in principle with EPA that a range of disposal methods is appropriate for such wastes, and that small quantities of radioactive material can be safely disposed by methods such as sanitary sewers, landfills, or hazardous waste disposal facilities. However, DOE also believes that since EPA has not provided a strong supporting analysis for the suggested concentration limits, State and local officials may be reluctant to accept and implement these guidelines. (See Appendix C to these comments.) In addition, the guidelines seem to conflict with other EPA positions on disposal of radioactive material by less restrictive means than a low-level radioactive waste disposal facility. As a result, treatment residuals disposal options by the methods suggested by EPA may not be available to operators of water treatment systems. EPA's analysis of treatment options should include the compliance requirements

for managing these waste materials in accordance with other regulations, including RCRA.

b.) Another problem not addressed by EPA is possible public perception about disposal of radioactive water treatment residuals. The stigma of radioactivity may make disposal of radioactive materials by a method such as a municipal landfill politically unacceptable, even if EPA provides a strong technical basis 'for the Guidelines and there are no other regulatory or legal barriers. Because of this stigma, operators of water treatment plants may have no choice but to dispose of water treatment residuals at low-level radioactive waste disposal facilities. Not only will this be difficult and expensive, but available disposal capacity for low-level radioactive waste will soon be very limited. (Also see Appendix A, Comment #8.)

c.) How will a waste generated at a drinking water treatment plant (e.g., spent resins, brines, etc.) as a result of BAT, that contains radionuclides, and also may be a RCRA hazardous waste, be managed? Disposal capacity for RCRA mixed waste is very limited. Costs of managing and disposing of mixed waste are substantially higher than managing and disposing of non-hazardous wastes. The application of the RCRA Land Disposal Restrictions regulation (40 CFR 268.35(d)) to mixed waste will require treatment before disposal, as well as limitations on the length of time the waste can be stored.

d.) If the waste generated is not a RCRA mixed waste, but is a low-level radioactive waste, how will it be managed? Disposal capacity nationwide for low level wastes is limited. The Low Level Radioactive Waste Policy Amendments Act of 1985 (Amendments Act) requires each State to provide disposal capacity for wastes generated in the State, or to form a compact with other States. In many parts of the country, disposal sites have not been developed, and are not likely to be developed for many years. Generators will need to store wastes indefinitely, since they will generally be precluded from shipping wastes to a host State in some other part of the country.

e.) Has EPA assessed the effectiveness of conventional wastewater treatment plant technology for removing radionuclides from the wastewater stream? What is the likely discharge of radionuclides to surface water, based on typical removal rates by wastewater treatment technology? Combined sewer overflows (CSOs) are a major problem in many communities. Where CSO is a problem, has EPA assessed the risk of exposure to radionuclides in surface water, resulting from the by-passing of the wastewater treatment system entirely?

f.) EPA suggests that liquid wastes be discharged directly into surface waters. Although EPA acknowledges the applicability of NPDES/SPDES permits and the requirement to meet all Clean Water Act water quality standards for radionuclides, there has been no analysis to indicate whether these standards can be met and whether permits can be obtained. Water quality standards for radionuclides may be expressed in terms of protecting "public health" (e.g., 40 CFR 131.35), which suggests the use of a standard such as the Maximum Contaminant Level Goal (MCLG), since it is based strictly on human health effects. Since the MCLGs are zero, it is questionable whether a NPDES permit could be obtained. For facilities licensed by the NRC, EPA has not analyzed whether discharges would meet license conditions or State standards in agreement States.

RECOMMENDATION: EPA should assess the likely implications of the above and other plausible situations, not only from the standpoint of the creation of new sources of risk, but also from the standpoint of implementation. If successful implementation becomes problematic due to these situations, what alternatives does EPA offer that are equally protective of the environment (i.e., do not increase risk), and are not prohibitively expensive?

Technical guidance is needed on the techniques for treating and managing solid and semi-solid wastes and brines generated by BAT systems. The guidance should address waste testing and identification, in addition to waste management options. De minimis concentration levels for each radionuclide, below which the waste no longer must be managed as a low-level, naturally-occurring, radioactive waste, are needed. Appendix C contains a detailed discussion of issues related to waste disposal, based on DOE's review of EPA's "Suggested Guidelines for the Disposal of Drinking Water Treatment Wastes Containing Naturally Occurring Radionuclides".

3. Costs of compliance with this rule may be underestimated.

EPA's analysis of costs indicates that the greatest impact will be on small and moderate sized treatment plants and communities. In light of the significance of the economic impact, EPA should conduct a more in-depth analysis of the costs associated with this regulation. Appendix A contains more detailed comments based on DOE's review of the Regulatory Impact Analysis (RIA) prepared for this proposed rulemaking.

Although the compliance costs associated with this rule are not likely to be significant to the Department of Energy, we are concerned that the levels chosen for Maximum Contaminant Levels (MCLs) may have been based on an underestimation of the ultimate costs of compliance. Further, secondary costs (e.g., costs associated with waste management), and tertiary costs (e.g., costs associated with using these MCLs or MCLGs as cleanup levels under RCRA, CERCLA, or State authorities), which have not been considered by EPA in developing this rule, may exceed the compliance costs. Additionally, if EPA has overestimated the risks associated with radionuclides in drinking water (see following two comments), and has not considered the risks caused. by implementing this rule, then the compliance costs to the entire regulated community may not be justified.

Classifying radionuclides as "known human carcinogens" results in setting the MCLG at zero. Although this level is not enforceable under the Safe Drinking Water Act, it could be used as a clean-up level under other Federal and State environmental restoration programs. It could also be used by local water control authorities to set pretreatment requirements for discharges into sanitary sewers. The added costs of meeting a cleanup level below the regulatory level (i.e., the MCL), and approaching zero, should be considered by EPA in assessing the ultimate costs of this regulation, and a comparison made to the marginal gains in environmental protection achieved by setting the MCLG at zero. (See Comment #lO below.)

RECOMMENDATION: EPA should perform a more in-depth analysis of the costs associated with implementation of this regulation.

4. The MCL for radon-222 may be unrealistically low.

EPA can set the radon-222 MCL higher than the proposed regulatory limit of 300 pCi/liter without exposing drinking water system users to unreasonable risk. EPA concludes that radon in water accounts for only 1% to 5% of radon air levels in homes, and that 10,000 pCi/liter of radon in water is associated with 1.0 pCi/liter in air. This suggests that the risk presented by radon in drinking water is quite small. Another factor that suggests that the 300 pCi/liter limit is too low is the fact that the majority (possibly 85%) of lung cancer cases attributable to radon in indoor air occur in cigarette smokers. This suggests synergistic effects of exposure to radon and cigarette smoke. Controlling radon in homes without controlling inhalation of cigarette smoke, therefore, will not reduce incidence of lung cancer to the extent that EPA expects.

Setting the MCL at 500 pCi/liter would equate to an increase in risk from 1.5 x 10-4 to 2.5 x 10-4. This increase is small and within the acceptable risk range. At 500 pCi/liter, air radon levels in homes would increase by 0.02 pCi/liter over the proposed MCL. This difference is far below the resolution of existing room air monitors. Given the level of uncertainty in the health effects analysis and the general conservative nature of the exposure assumptions, this difference should not be considered significant. At 500 pCi/liter, the number of DOE drinking water systems that would face compliance costs decreases by 17%. The impact on small drinking water systems nationwide should likewise be reduced.

In addition, setting the MCL for radon at 500 pCi/liter should not result in unacceptable workplace exposures. The MCL is based on inhalation of radon released from water in a residential scenario, primarily during showering, cooking, washing dishes and clothes, etc. While workers at DOE (and other) facilities that manage radioactive materials are required to shower before leaving their work place, other activities related to residential exposure would not apply. A higher MCL for radon, such as the 500 pCi/liter level recommended above, should, therefore, also be protective in a workplace scenario, assuming that workers are only exposed through daily showering.

RECOMMENDATION: EPA should set the final MCL for radon at 500 pCi/liter.

5. The MCL for uranium may be unrealistically low.

In deriving an MCL for uranium, EPA uses the Lowest Observed Adverse Effect Level (LOAEL) from a single, short-term study of the occurence of kidney toxicity in rabbits. Results of studies of the toxic effects of ingestion of uranium on humans were not used. Since EPA's policy is to apply a safety factor of 1000 to the results of animal studies or studies which report a LOAEL, the MCL for uranium appears to be unnecessarily stringent. Data on the effects of uranium exposure on humans is available, and should be reviewed by EPA for its applicability to setting an MCL for uranium based on non-cancer effects. A study cited by EPA in the preamble to the proposed regulation (Wrenn, et.al., 1985) reviews the results of studies of the metabolism of uranium in humans, and recommends a regulatory level of 100 pCi/liter in drinking water, and the use of a safety factor of 50 - 150, rather than 1000. The study also recommends performing additional research on uranium exposure before setting a regulatory limit.

RECOMMENDATION: EPA should review the human health effects data on uranium exposure generated since 1985, and consider setting a revised MCL based on human health effects, using a safety factor less than 1000.

6. Risk and exposure assessment.

Exposure models used by EPA are contained in draft criteria documents which have not been publicly examined or peer reviewed. The models and assumptions should be critically reviewed before they are used in setting regulatory standards. The exposure assumptions for radon, uranium, and radium used by EPA in setting regulatory levels appear to be extremely conservative.

EPA has not adequately and convincingly addressed the issues raised by the Science Advisory Board's Radiation Advisory Committee. Questions remain regarding EPA's assessment of the occurrence, health effects, and risk from radionuclide exposure.

EPA should carefully distinguish between "cancer incidence" and "cancer mortality" in discussing risk of exposure to radionuclides. NCRP and ICRP estimates of cancer risk are based on cancer mortality, while EPA determines risk factors based on cancer incidence. This distinction is important in that a given numerical risk level (e.g., 1 x 10-6) based on cancer incidence is more stringent than the same level based on mortality. Assuming that not all cancers are fatal, preventing an excess cancer incident in a population of one million leads to a lower regulatory level than preventing one excess cancer death in a population of one million. It is not clear throughout the preamble discussion whether EPA is basing its radionuclide risk assessment on incidence or mortality. EPA should clarify the basis for risk assessments used to set regulatory levels for carcinogens.

RECOMMENDATION: EPA should review its risk and exposure assessment assumptions, with particular attention to issues raised by the Science Advisory Board, and address these issues in the final regulation.

7. Sampling and analysis.

Currently, there are a limited number of laboratories nationwide that are equipped and certified to perform the drinking water quality analyses required by this rule. With possibly 28,000 systems affected nationwide (the majority of which are small systems), the need for adequate commercial analytical laboratory capacity is apparent. EPA needs a strategy by which it will work with individual States to ensure sufficient certified analytical laboratory capacity.

EPA should also address the requirements for analytical laboratory certification and training of laboratory technicians, in terms of special or unique requirements related to potentially radioactive samples. Also, EPA should establish procedures to ensure that a laboratory is not in a conflict of interest situation.

EPA should develop guidance for States for establishing analytical acceptance limits (equivalent to EPA's Practical Quantitation Limits (PQLs) developed for its regulatory standards) for State regulatory standards that are more stringent than EPA's. The error limits that apply to measurements above EPA's PQLs are in the range of ± 30 - 50%. Below EPA's PQLs, one would expect the error limits to be even greater.

Table 16 (56 FR 33095) should be modified to indicate that both glass and plastic are acceptable containers for tritium, rather than glass only.

RECOMMENDATION: EPA should address the above concerns in the final regulation.

8. Gross Beta Screening Level for Tritium Is Too Low.

Figure 3 (56 FR 33109 and 33110) and Appendix B of the proposed rule (56 FR 33120) indicate that when screening water samples for Gross Beta compliance, an activity level of 60,000 pCi/liter for tritium is the level above which BAT is required. DOE calculates that this level should be more than 80,000 pCi/liter. For EPA's Appendix B concentration to be valid, the annual dose limit for drinking water would have to be 3 mrem ede/year, rather than 4 mrem ede/year as stated in the preamble. EPA's action level for tritium is either too low, or based on unexplained or inappropriate assumptions.

RECOMMENDATION: For implementing the Gross Beta and Photon Emitters MCL, EPA should use values and methodologies consistent with those contained in Internal Dose Conversion Factors, DOE/EH-0071, U.S. Department of Energy, July, 1988, and Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion, Federal Guidance Report No. 11, EPA-520/l-88-020, September, 1988. These documents are consistent with the recommendations of the International Commission on Radiological Protection (ICRP), and are generally accepted by Federal agencies for determining annual dose to the public through the drinking water exposure pathway. If other exposure pathways contribute sufficiently to lower the concentration limit for tritium (i.e., from 80,000 to 60,000 pCi/liter), or for other radionuclides, EPA should clarify these calculations.

Additionally, the final table developed for Appendix B should be included in the regulation (at proposed 40 CFR 141.25(d)(3)), not in the preamble.

9. Vulnerabilitv Assessment

An assessment that leads to the conclusion that a drinking water system is vulnerable results in additional (i.e., gross beta screening) and more frequent monitoring. EPA suggests that any drinking water system within a 15 mile radius of a facility that manages radioactive materials should be considered vulnerable (56 FR 33104). Rather than base this assessment strictly on linear distance, EPA should identify other, more pertinent factors (e.g., direction of ground water or surface water flow, topography, prevailing wind direction, total radiological contribution that a facility could make to a potential drinking water system, etc.) and provide better guidance to States on how this assessment should be performed. If a linear distance such as 15 miles is to be used as a factor in determining vulnerability, clarification is needed on how the distance is measured (i.e., from the facility, or the property boundary, or the radiologically active area, etc.). For additional discussion, see Comment #13 of Appendix A.

Clarification is also needed on the relationship of the vulnerability assessment discussed in this proposed rule to the vulnerability assessment performed pursuant to the Phase II National Primary Drinking Water Regulations (NPDWR) for 33 synthetic organics and inorganics promulgated on January 30, 1991. Under that rule, operators of individual drinking water systems are responsible for assessing their vulnerability to these 33 specific contaminants. The proposed radionuclide regulation, however, indicates that the States are responsible for assessing vulnerability. Does EPA anticipate separate assessments, performed in a coordinated manner, by each drinking water system and each State agency? How will EPA ensure that the results of each assessment will be comparable? How does a finding of vulnerability by the State relate to the drinking water system's self-evaluation?

Additionally, the test for "vulnerability" included in 40 CFR 141.25(d) refers only to proximity, whereas the test for vulnerability included in 40 CFR 142.16(f) refers to monitoring results and use of water influenced by a nuclear power facility, in addition to proximity. Since this latter section determines whether a State program receives primacy for this regulation, and, as previously discussed, the State is responsible for determining the vulnerability of a drinking water system, these two sections should be consistent.

RECOMMENDATION: EPA should provide clarification on the basis for assessing vulnerability, and on the relationship of assessments performed by different entities, and should also provide guidance and training on how the assessments are to be performed.

10. MCLGs for Radionuclides Should Be Attainable Goals

An MCLG should not be set at zero for radionuclides that are naturally-occurring and primordially ubiquitous in the crust of the earth and in its waters. Ample legislative history exists to justify setting MCLGs at zero for man-made carcinogens, a class of contaminants for which threshholds are presumed to be non-existent. No distinction appears to have been made in that legislative history or in the Safe Drinking Water Act between naturally-occurring and anthropogenic contaminants. The radionuclides that are the subject of this rule may be both, and cannot be distinguished in a water sample or at a drinking water treatment plant. Therefore, setting a goal of zero for substances that occur naturally is not realistic.

Although the MCLG is not an enforceable standard under the Safe Drinking Water Act, it will become a regulatory level under other authorities. For example, the City Council of Albuquerque, New Mexico, in considering a City ordinance to allow Sandia National Laboratory to discharge low level radioactive wastewaters to its municipal wastewater treatment plant, discussed the use of the proposed MCLG of zero as a pretreatment requirement. Additionally, the State of Washington's Department of Ecology may use the MCLG as a ground-water cleanup standard under authority of the State's Model Toxics Control Act (MCTA). MCTA gives the State the authority to set its cleanup levels at any Federal or State health-based level, and EPA's policy is to set the MCLG at zero, based strictly on consideration of human health effects. It does not seem reasonable to set such a goal, the attainment of which is technically infeasible, when it could become a pretreatment requirement or a cleanup level under another authority.

RECOMMENDATION: EPA should modify its policy of setting MCLGs at zero for all known carcinogens, by recognizing that it is inappropriate for certain naturally-occurring substances. Use of the ALARA (As Low As Reasonably Achievable) concept seems to be more appropriate.

11. Monitoring

DOE recommends that monitoring for radionuclides begin as soon as the regulations are effective, rather than January 1, 1996. Data collected will be useful as baseline monitoring data for determining the frequency of routine monitoring as of January 1, 1996, or whenever the next three year monitoring cycle begins. It can also be used in vulnerability assessments, especially by drinking water systems in the vicinity of facilities that manage radioactive materials.

The final regulations (40 CFR 141.25(d)(l)) should define the length of the compliance period for monitoring for beta and photon emitters. Also, the regulations should require that monitoring begin within a specified time period (e.g., 90 days) after the drinking water system is determined to be "vulnerable" by the State agency, or by January, 1996, whichever is sooner. As written, the system would be required to begin monitoring in January, 1996, regardless of whether the State has provided notice of vulnerability.

For systems that initially exceed the MCLs, the proposed regulations (40 CFR 141.25(b)(8) and 141.25(c)(7)) do not specify the monitoring frequency once the system's quarterly samples show compliance with the applicable MCLs.

The proposed regulations (40 CFR 141.25(c)(4)) limit the waiver term to "one nine year compliance cycle". Does the nine year waiver follow the three year annual sampling period, resulting in a twelve year monitoring cycle, or does the nine year waiver include the three year annual sampling period, resulting in a six year waiver? EPA should clarify this point in the preamble to the final regulations.

The phrases "rolling average" and "running annual average'* (40 CFR 141.25(d)(S) and 141.25(h)(l)) should be defined in the final regulations.

RECOMMENDATION: EPA should clarify the above points in guidance or in the preamble to the final rule, as appropriate.

12. Variances and Exemptions

under SDWA, variances and exemptions may be granted by the State agency if a public water system cannot comply with the MCL and if the variance or exemption will not pose an "unreasonable risk to health" (URTH). The preamble discussion at FR 33112 suggests that States set the URTH value at the proposed MCL, except for gross alpha and uranium. This would effectively nullify the variance and exemption mechanism provided by the statute.

EPA has prepared draft guidance for States to use in determining the URTH value for purposes of providing variances and exemptions. This guidance is currently being revised by EPA. As suggested by the preamble, this guidance will presumably be used by EPA in reviewing, revising, or revoking State-issued variances and exemptions. It should, therefore, be published in the Federal Register as a proposed regulation, allowing notice and comment as required by the Administrative Procedures Act.

13. Enriched versus Naturally-Occurring Uranium

Throughout the preamble and in the public notice provisions of the proposed regulations (FR 33125, 40 CFR 141.32(e)(80)), EPA refers to naturally-occurring uranium, whereas the discussion of MCLs and other sections of the preamble do not distinguish between naturally-occurring and enriched or depleted uranium. Does EPA consider enriched uranium or depleted uranium to be included in the MCL and MCLG for alpha emitters, or those for uranium? Clarification of this point in the preamble to the final rule is needed.

14. Use of Bottled Water as a Mitigation Measure for Radon

The preamble discussion on FR 33112 indicates that use of bottled water would not be acceptable as a mitigation measure for systems that exceed the radon MCL. An explanation for this statement and rationale for this policy is needed.

APPENDIX A

Comments on EPA's "Regulatory Impact Analysis of Proposed National Primary Drinking Water Regulations for Radionuclides"

1. p. l-l, Section 1.2, first sentence.

EPA bases its cost estimates on the assumption that treatment residuals are all disposed as sanitary wastes. This assumption is unrealistic and minimizes disposal costs. For a variety of reasons, DOE believes that many operators of water treatment facilities will be unable to exercise this option, and must opt for more expensive options.

First, EPA's "Suggested Guidelines for the Disposal of Drinking Water Treatment Wastes Containing Naturally-Occurring Radionuclides" recommends a graduated selection of disposal options depending on concentrations of radioactivity in the waste (EPA90). For solid wastes, these options range from disposal into sanitary sewers, to disposal into municipal landfills, to disposal into hazardous waste facilities, to disposal into low-level radioactive waste (LLW) disposal facilities licensed pursuant to the Atomic Energy Act (AEA). In general, as the "confinement ability'* of the disposal method increases, the cost of waste disposal increases.

Second, there is a general and growing lack of waste disposal capacity in the country, and this situation will. lead to higher waste transportation and disposal costs. As noted in the October 9, 1991 Federal Register Notice (FRN) for the recently promulgated EPA regulations for municipal solid waste-landfills (MSWLF), "While 1970 estimates of the U.S. landfill population neared 18,000, EPA estimates that in 1986, only approximately 6,000 MSWLFs were operating -- and that the total number of landfills continues to decrease" (EPA91). Elsewhere in this FRN, EPA cites a 1986 survey in which "45 percent of the municipal solid waste landfill owners/operators reported that their landfills would reach capacity by 1991" (EPA91). EPA then states, "Today's disposal capacity crisis is further compounded by the difficulty in siting new solid waste management facilities" (EPA91). This situation will be aggravated by the stringent requirements contained in the new EPA regulations that will result in closure of many of the remaining MSWLFs.

Third, this general lack of disposal capacity is aggravated by existing prohibitions against acceptance of radioactive materials at many municipal landfills and hazardous waste disposal facilities. Because of the probability that these

prohibitions will become more extensive in the future, there may be only limited capacity for disposal of treatment residuals. Many operators of water treatment facilities may have to transport wastes for long distances to locate a landfill or hazardous waste facility that will accept wastes containing technologically enhanced quantities of radionuclides. Longer transport distances result in higher costs.

If only a few disposal facilities accept waste containing enhanced concentrations of radionuclides, additional problems are likely to occur. One very strong possibility is that States or communities with disposal capacity may become concerned that they are becoming the national "dumping ground" for water treatment wastes. This would likely lead to State or local prohibitions against accepting "outside" wastes, further limiting national disposal capacity.

As a result, many operators of water treatment facilities may have no alternative but disposal of solid wastes into commercial LLW disposal facilities. This alternative will not only be quite expensive, but may prove to be essentially impossible to implement because of the imminent paucity of commercial LLW disposal capacity. Only three major facilities currently operate nationwide. Two of these facilities are expected to close by the end of 1992, at which time the remaining disposal facility, located in Washington State, may only accept wastes originating from the Northwest Interstate Compact, a group of seven northwestern states formed pursuant to the Low-Level Radioactive Waste Policy Amendments Act of 1985 (Amendments Act). Another disposal facility, located in Utah, only accepts limited quantities of dry, naturally-occurring radioactive materials. This disposal facility is also located in the Northwest Interstate Compact, and the license for this disposal facility stipulates that wastes outside the Compact cannot be accepted without a 2/3 vote of agreement by the Compact members (Utah91).

Ultimately, all States are required to develop LLW disposal capacity pursuant to the provisions of the Amendments Act. However, very slow progress is being made in development of this disposal capacity, which means that generators in most States will be forced to store LLW for many years. Assuming that disposal capacity is eventually developed, costs could range from hundreds to over a thousand dollars per cubic foot of waste.

Therefore, DOE believes that EPA has underestimated the difficulty by which water treatment system wastes may be disposed. It is likely that operators of treatment plants

will be faced with costly construction and long-term operation of waste storage facilities.

2. p. l-2, first sentence below Exhibit l-l.

EPA assumes that co-occurrence of radionuclides will have only a very small impact on total national costs. This assumption may or may not be true. However, co-occurrence of radionuclides with hazardous constituents may also occur, and if it does, then such co-occurrence may have a significant impact on national costs. Before disposal, such wastes may require a significant amount of treatment pursuant to RCRA requirements. This could significantly increase costs.

3. pp. l-3 & l-4, Section 1.5, Impacts on Small Water Systems.

See comment 16.

4. p. 2-11, Aeration.

The RIA uses the term "cross media transfer" to summarize concerns about use of aeration for removal of radon gas from water. In other words, the possibility exists that radon treatment may lead to releases of possible concern with regard to Federal and State requirements for airborne releases. In its cost analysis, EPA must consider possible restrictions in the use of aeration. If operators of water treatment facilities are restricted from using aeration, they will be compelled to use a more expensive option such as granular activated carbon (GAC). These additional costs should be estimated by EPA for the rulemaking. The assumption that all treatment systems use packed tower aeration systems underestimates the costs and possibly the risks that will be caused by the regulation.

5. p. 2-11, Granular Activated Carbon.

In the last line of the second paragraph, EPA acknowledges that the accumulation of daughter progeny within the GAC contactor may result in an elevated gamma radiation hazard. It should also be recognized that the accumulation of radioactive daughter products (and other radionuclides) within the GAC contactor will result in generation of a radioactive waste stream that will require disposal. (See comment 6.)

6. p. 2-13, Section 2.4.2, first paragraph.

The second sentence states that "because neither aeration nor GAC treatment produce process wastes, it is assumed that no costs or impacts will be incurred due to waste disposal

for radon." This assumption is clearly unrealistic. As noted in EPA90, capture of radon will lead to an accumulation of daughter radionuclides, including Pb-210, a radionuclide having a half-life of about 20 years. The life of this radionuclide is sufficiently long that temporary storage (for a few years) will have little effect on its concentration within the GAC. In addition, the EPA90 notes that GAC will accumulate uranium and radium. Thus, use of GAC will result in generation of a solid waste stream contaminated with radionuclides. Costs for treatment, packaging, transport, and disposal of this waste stream should be considered.

7. p. 2-13, Section 2.4.2, third paragraph.

The third paragraph suggests options for disposal of brine wastes including direct discharge to receiving waters, direct discharge to sanitary sewers, mechanical evaporation, chemical precipitation, and evaporation ponds. However, the last three options will result in generation of a solid waste stream that will require disposal by some means. In addition, there is a strong possibility that disposal of brine by some or all of EPA's suggested methods might be precluded depending on State or local restrictions or the co-occurrence of hazardous constituents other than radionuclides. EPA should consider the possibility that brines may have to be solidified and disposed as radioactive or hazardous waste.

8. p. 2-13, fourth paragraph.

EPA states that current operators of water treatment systems generally do not handle process residuals as LLW, and assumes that this situation will remain unchanged under the proposed revisions. This assumption appears to be questionable. EPA apparently proposes to greatly expand the number of water treatment systems that will generate process residuals containing radionuclides.. In addition, the proposed rulemaking should result in increased public awareness about the existence and management of treatment residuals containing radionuclides. Both of these factors may lead to increased State and public concerns about disposal of treatment system wastes, and increased numbers of State and local requirements that would essentially make disposal as LLW a requirement.

9. Chapter 4, general.

The method by which EPA estimates costs for waste treatment and disposal is described in only general terms. For example, EPA states that it uses the "What-If" model to determine costs, but provides no references for it. The

details of this model should be made available for public review and comment.

10. p. 4-1, last line on page.

If the radium requirements were only loosely enforced at 5 pCi/L, and stringently enforced at 20 pCi/L, the net effect may be positive incremental impacts.

11. p. 4-5, Decision Trees, second paragraph.

See comment 6 regarding generation of "process wastes" from use of GAC.

12. p. 4-6, third complete paragraph.

As noted in Appendix C, use of sanitary waste disposal is not a reasonable assumption for all (and perhaps even most) wastes generated from treatment of water. The use of different disposal methods will tend to increase costs, particularly if the treatment residuals must be managed as LLW. Disposal capacity may not exist for some wastes.

13. p. 4-11, Beta emitters.

EPA needs to be more specific about vulnerability determinations for water systems near facilities "using or producing radioactive materials." If taken literally, this could include a very large number of facilities, which would mean that a very large number of water systems could be considered vulnerable. Therefore, the specifics and details of how vulnerability is determined could have a significant effect on costs.

To illustrate, consider that roughly 24,000 entities currently hold specific licenses issued by NRC or its Agreement States for possession and use of radioactive materials under the Atomic Energy Act. In addition, NRC has issued several general licenses which allow members of the general public to possess and use radioactive materials in small concentrations. Thus, literally millions of persons can be said to be "users of radioactive materials." For example, smoke detectors containing Am-241 have been installed in hundreds of thousands, if not millions, of buildings. Other examples of the general distribution of radioactive devices (as of 1987) include:

Device	Number of Devices
Tritium exit signs	100,000
PO-210 static eliminators	50,000
Liquid scintillation and back-scatter sources of Cs-137, H-3, C-14, Sr-90, or Pa-147; 40-100 µCi.	30,000
Level test gauges up to one Ci of radioactive material	20,000
	200,000

(Source: NRC87)

14. Chapter 5, Assessment of Benefits, general.

In this chapter, EPA summarizes the benefits of the rulemaking, which EPA calculates in terms of the numbers of health effects avoided through the imposition of alternative MCLs. The Department has serious concerns that these estimates are based on a very limited consideration of risk, and that they do not represent a comprehensive assessment of benefits and risks. A more detailed discussion of the Department's concerns is presented in Appendix B to these comments.

15. Chapter 6, Summary of Benefits and Costs, general.

EPA's analysis of benefits and costs do not appear to be reasonable. DOE's concerns with EPA's analysis of benefits are summarized in Comment #14 above, and in Appendix B. DOE's concerns with EPA's analysis of costs are contained in several previous comments.

Additionally, it appears that EPA has not considered the costs associated with radiation protection and training for water treatment plant workers. If these workers are to be provided an equivalent level of protection to that provided to workers in the nuclear industry, as required by the Nuclear Regulatory Commission and by DOE Orders and regulations, EPA should address the need for radiation health physics training for drinking water system workers. The costs of such training and related worker protection should be included in the costs associated with implementing this regulation.

16. pp. 7-l to 7-4, Regulatory Flexibility Analysis, general.

The analysis of impacts on small systems is faulty because it does not consider all the water treatment systems that will be affected by the rulemaking and because of the large costs that are likely to result from handling and disposal of water treatment residuals. Many operators of water treatment systems may not be able to use packed tower aeration for radon removal, but must instead rely on systems using GAC, a method that may be expensive to implement and will generate a solid waste requiring disposal. In addition, removal of radium, uranium and other alpha-emitting radionuclides from water will generate large quantities of solid and liquid wastes. Disposal of these wastes will likely prove to be difficult and expensive.

References

EPA90 U.S. Environmental Protection Agency, "Suggested Guidelines for the Disposal of Drinking Water Treatment Wastes Containing Naturally Occurring Radionuclides," Office of Drinking Water, July 1990.

EPA91 U.S. Environmental Protection Agency, "40 CFR Parts 257 and 258, Solid Waste Disposal Facility Criteria, Final Rule," Federal Register, (56 FR 50978), October 9, 1991.

NRC87 U.S. Nuclear Regulatory Commission, "Results of the General License Study and Corrective Measures Taken or Planned by the Staff," SECY-87-167, July 9, 1987.

Utah91 Utah Department of Health, Bureau of Radiation Control, Radioactive Material License for Envirocare of Utah, Inc., License Number UT2300249.

APPENDIX B

Consideration of Health Effects

Caused by Implementing 40 CFR 141

In the proposed National Primary Drinking Water Regulation for radionuclides, EPA summarizes the benefits of the rulemaking, which EPA calculates in terms of the numbers of health effects avoided through the imposition of alternative maximum contaminant levels (MCL). EPA's analysis is flawed due to its limited scope. It does not consider, and subtract from health effects avoided, those health effects that would be caused by the regulatory alternatives. The actual benefit of the rule would be the net number of calculated health effects, considering both those avoided and those caused.

Risks can be estimated for construction and operation of water treatment facilities, and for storing, treating, shipping, and disposing treatment residuals. Except for release of radon gas from packed tower aerators, none of these risks were considered by EPA in the proposed rulemaking.

Construction. Because the EPA regulation will require that operators of water treatment systems construct additional facilities for removal of radionuclides from water, and likely construct facilities for storage of treatment residuals, EPA will create risks from construction and industrial accidents. EPA could estimate these risks for each alternative by determining the total man-hours required to construct the additional facilities, and by multiplying these man-hours by a risk factor. One DOE study has used a risk of SE-7 fatalities per man-hour to estimate construction risks (DOE91).

Operation - Risks to Workers. Workers will receive radiation doses from operation of water treatment systems and managing water treatment residuals. External doses can result from exposure to direct radiation from process equipment such as granular activated carbon (GAC) contactors or ion-exchange vessels, from immersion in air containing high concentrations of radon, from plateout of radon daughters onto surfaces, from managing water treatment residuals, or from maintaining and replacing process equipment. Internal doses can result from inhalation of radon and its daughter products, and from possible inhalation of particulates from dried solid wastes.

An estimate of the risks from these pathways could be made by multiplying the average annual dose received by plant workers by the number of workers. If one assumes for the sake of illustration that at each water treatment system an average of two workers are exposed to radiation, and that these workers each

receive the maximum dose recommended in EPA's guidelines for disposal of treatment residuals (EPA9O), one obtains an average dose of about 50 man-mrem per year per treatment system. If a risk of 4E-4 fatalities per rem is assumed, the following estimate of total risk to workers is obtained:

Radionuclide Removed	Number of Systems	Annual Health Effects
Rn-222	26,000	5.2E-1
Ra-226	70	1.4E-3
Ra-228	40	8.OE-4
Uranium	1,500	3.OE-2
Adjusted gross alpha	130	2.6E-3
Beta-gamma emitters	0	0
	27,700	5.5E-1

Given the available information on personnel requirements at water treatment systems and on current exposure levels, EPA should be able to estimate worker exposures and risks more precisely. In so doing, however, EPA should keep in mind that the more waste must be treated to meet RCRA regulations or waste disposal facility acceptance criteria, the more worker exposures will be experienced. Additional worker exposures will result if water treatment wastes must be stored for appreciable times.

Operation - Risk to Public. Risks will be caused by release of radioactive materials into either airborne or waterborne pathways. EPA considered one airborne pathway for one radionuclide, that of release of radon gas from packed tower aerators, and calculated an annual national risk of 0.4 health effects per year assuming a radon MCL of 300 pCi/L. However, other airborne pathways not considered include dispersion of contaminated particulates from handling and treating treatment residuals (e.g., dried sludges). Waterborne pathways include discharge of liquids into surface or subsurface water bodies, and discharge of liquids into the sanitary sewer.

It is not clear why EPA failed to consider the possible impacts of disposal into sanitary sewers. First, EPA assumes, in its analysis of the costs of implementing the proposed drinking water standard, that all treatment residuals are released into the sanitary sewer. Second, disposal of radioactive material into the sanitary sewer can result in exposure to the public and workers by a large number of secondary pathways. Initial estimates of the extent of these secondary pathways can be derived from the following table which lists the disposition of sewage sludge generated by publicly owned treatment works (EPA89):

Use or Disposal Practice	Percent of Sewage Sludge
Land application	15.9
Distribution and marketing	9.1
Municipal landfills	41.0
Surface disposal	2.5
Monofills	1.3
Incineration	21.4
Ocean Disposal	5.5
Other	3.5
	100

Approximately 16% of the sewage sludge volume is recycled and reused for agricultural purposes; in "silviculture to increase forest productivity and to revegetate and stabilize harvested forest land and forest land devastated by fires, land slides, or other natural disasters;" and to "stabilize and revegetate areas destroyed by mining, dredging, and construction activities** (EPA89). Sewage sludge that is distributed and marketed is generally composted and "used as a substitute for topsoil and peat on lawns, golf courses, parks, and in ornamental and vegetable gardens" (EPA89). EPA states that "distribution and marketing [of sewage sludge] is a highly beneficial practice and one the Agency encourages" (EPA89).

Yet EPA has not considered the potential national impacts of exposure via these pathways in the drinking water rulemaking, in the proposed rule for disposal of sewage sludge (EPA89), or in the recently promulgated rule on municipal solid waste landfills (MSWLF) (EPA91). This oversight should be corrected.

Transportation. Risks from transporting waste to disposal facilities would include both radiological and non-radiological risks. Estimates of radiological risks might be made using one of the many computer codes that have been developed to determine possible radiological doses from transport of radioactive materials. (An early one is described in NRC77.) Essentially, a source term is assumed, typical radiation dose levels at the surfaces of transport vehicles are determined, and then public (and driver) exposures (and risks) are estimated, considering typical populations, truck speeds, numbers of vehicles, etc. Non-radiological risks could also be estimated, using a similar approach.

Illustrative calculations of non-radiological risks can be performed for water treatment residuals containing uranium. EPA proposed that best available technology for uranium could include lime softening, coagulation/filtration, ion-exchange, and reverse osmosis. All these technologies will produce both liquid and solid 'wastes. The former two treatment technologies generate solid wastes as sludges, and many disposal options will require

that the liquid portion of the sludge waste be removed before disposal. Additional treatment, such as solidification, may be required, which will increase waste volumes. The latter two treatment technologies produce a liquid waste stream as a brine. Although in some cases direct discharge of the brine may be possible, in many cases other disposal techniques will be required. Use of an evaporation pond will generate solid waste, as will chemical precipitation. Depending on the radionuclide and chemical content of the brine, it may have to be solidified, as might sludge from brine treatment. In addition, ion-exchange resins will eventually need replacement, whether or not their life may be extended by regeneration. Solid wastes will be generated from any treatment system during system maintenance and equipment replacement.

As an illustration, assume that an ion-exchange system is used to treat water for uranium, and that the brine is discharged to an evaporation pond. Table 5-6 of EPA86 estimates generation of 0.5 to 0.7 cubic yards (CY) of solid wastes from this process per million gallons (MG) of water treated. (Alternatively, assuming that the brine is treated by chemical precipitation followed by freeze-thaw drying, Table 5-7 of EPA86 projects a range of 0.7 to 1.4 CY/MG.) Table 7-3 of EPA86 provides an estimate of the average flow rate of water in different sized categories of treatment systems, while Appendix A of the Regulatory Impact Assessment (RIA) estimates the numbers of systems that would be affected assuming an MCL of 20 µg/L. Using these numbers, one can estimate a total amount of treated water as illustrated below:

Size Cat.	Pop. Range	Ave. Plant Flow (MGD)	Number of Systems	Total Flow (MGD)
1	25-100	.013	751	9.763
2	101-500	.045	474	21.330
3	501-1000	133	122	16.226
4	1001-3000	.4	133	45.200
5	3001-10k	1.3	24	31.200
6	l0k-25k	3.25	1	3.250
7	25k-50k	6.75	0	0
8	50k-75k	11.5	0	0
9	75k-100k	20.0	0	0
10	l00k-500k	55.5	0	0
11	500k-1M	205.	0	0
12	>lM	650.	0	0
			1,489	126.969

Assuming an average of 0.7 CY of sludge per million gallons of treated water per day (MGD), a total volume of sludge of 32,400 CY per year can be estimated. Additional wastes would be generated from replacement of ion-exchange media and from equipment maintenance and replacement.

Impacts from transport of this material to a disposal facility will depend on many factors, including the presence of organic and inorganic material, the radionuclide content, and State and local requirements on solid, hazardous, and radioactive waste disposal. EPA86 does not provide an estimate for average distance for transport to a sanitary landfill, although apparently the assumption is made that transport distances will be quite short. It does assume an average distance of 100 miles for transport to a hazardous waste disposal facility and 1500 miles for transport to a LLW disposal facility. These assumptions may be low, given the availability of these disposal facilities.

Transport to a sanitary landfill is likely to require relatively long haul distances. National sanitary landfill capacity is rapidly diminishing and new EPA regulations will further restrict this'.capacity (EPA91). The estimate of 100 miles for hazardous waste disposal is almost certainly a gross underestimate, considering the national limitation in hazardous waste disposal capacity and the restrictions that most hazardous landfills have about accepting radioactive material. For disposal into hazardous waste disposal facilities, a more realistic transport distance would appear to be closer to the 1500-mile distance assumed for transport to a LLW disposal facility.

Regarding transport to a LLW disposal facility, it must be realized that by the end of 1992, the only available LLW disposal capacity will be located in the western portion of the country, while most waste (because of population) will be generated in the eastern part of the country. Licenses for the two available LLW disposal facilities, located in Utah and Washington State, will very likely contain restrictions that generally prohibit acceptance of wastes other than those originating from a few Western States.

In any case, if it can be assumed that the sludge can be transported in 5500-gallon tank trucks as assumed in EPA86 for estimation of transport and disposal costs, then 27 cubic yards of sludge can be transported per shipment. This translates to 1200 shipments per year. NRC77 estimated a risk of 5.3E-8 fatalities per vehicle mile. Using this risk factor implies a risk of 0.006 per year assuming an average l00-mile loaded run, or a risk of 0.095 per year assuming a 1500-mile loaded run.

However, use of tank trucks to deliver wastes *to* disposal facilities will be precluded in many cases because of waste acceptance criteria at disposal facilities. Restrictions on free liquids *are* imposed in the following regulations: 10 CFR Part 61.56(a) for wastes delivered to LLW disposal facilities; 40 CFR Part 264.314(b) and 40 CFR Part 265.314(b) for wastes delivered to hazardous waste disposal facilities; and 40 CFR Part 257.28 for wastes delivered to MSWLFs (see EPA9l). This means that

sludges and other wet wastes must be dewatered, which might imply initially that waste volumes would be reduced, as well as transport requirements. This would, however, create a secondary, liquid waste stream requiring treatment and disposal. In addition, facility waste acceptance requirements would reduce the volumes of waste that could be delivered per shipment.

To meet disposal facility waste acceptance criteria, dewatered wastes would probably have to be delivered to disposal facilities in containers, to minimize dispersion of contaminated material. Use of containers to deliver solid wastes reduces transport and disposal efficiency, since a certain amount of the volume within a container will normally be unused, or taken up by absorbents. This is to preclude generation of free liquids during waste transport. (Waste transport vibrations will cause phase separation between solids and entrained liquids). Also, stacking efficiencies and transporter weight and volume restrictions limit the amount of waste that can be shipped in one load. One study that considered LLW transport assumed a maximum delivery volume, per vehicle, of about 525 ft^3 (19 CY), corresponding to transport of 70 55-gallon drums per shipment (D&M81). (Fifty-five gallon drums are the most common waste containers used to transport and dispose LLW.) All other factors being equal, this implies that shipment of 32,400 CY of sludge would require 1700 shipments rather than 1200, with correspondingly higher risks.

A very likely management alternative could be waste solidification to meet RCRA or facility-specific waste acceptance requirements. Such solidification will increase waste volumes. Other work has assumed a volume increase factor of 1.4 for solidification within cement (D&M81). In addition, waste solidification will increase the mass of the waste, which means that the delivery efficiency could be limited or reduced by vehicle weight limits imposed by Department of Transportation regulations.

Waste Disposal - Operations. Risks from waste disposal operations include risks to the public as well as risks to disposal facility workers.

Risks to the public would likely result from possible airborne dispersion of sludges or other solid wastes delivered to disposal facilities, although some activity might be distributed into surface or subsurface water bodies.

Radiological risks to workers would arise from exposure to direct radiation or inhalation pathways, while non-radiologial risks would result from industrial accidents. To estimate radiological exposures to workers at sanitary landfills or hazardous waste disposal facilities, EPA could consider use of computer codes such as PRESTO-EPA-BRC or IMPACTS-BRC which have been developed by EPA and NRC, respectively, to model disposal of very low-

activity (below regulatory concern, or BRC) LLW in landfills **or** by other methods (RAE87, NRC86, DOE89). For disposal into a LLW disposal facility, a somewhat similar approach might be taken, although one must also consider that exposures will result even if no detectable radiation is emitted by the waste itself. This is because handling and disposal of treatment residuals will require that workers spend time in an environment having elevated levels of radiation. (They must work in proximity to other LLW.) Analyses of several years of operational data from commercial disposal facilities implies an average exposure rate of 6.3E-4 man-rem per cubic meter of waste (DOE87, IDB89, NRC83, NRC90, USE90). Using this value, disposal of 32,400 cubic yards of sludge waste at a LLW disposal facility would imply an annual risk of 0.006 fatal cancers.

Waste Disposal - Long Term. Assuming that treatment residuals are disposed into a sanitary landfill, hazardous waste disposal facility, or LLW disposal facility, long-term risks to the public would result from release to the environment. These releases would probably be largely dominated by releases into ground-water pathways. Again, estimates of possible human doses and risks from sanitary landfill or hazardous waste disposal could be made using PRESTO-EPA-BRC or IMPACTS-BRC or other models and codes. A number of models are available for LLW disposal facilities. If such releases are theoretically precluded by disposal facility design, then doses to workers and the public could result from possible corrective action activities. Assuming that waste is released into the sanitary sewer, a variety of exposure pathways could result as discussed above, depending upon how sanitary sewer sludges are handled, disposed, or recycled.

Conclusion. In support of the proposed rulemaking, EPA has estimated the numbers of health effects that would be avoided by implementing the chosen MCLs and other requirements. The avoided risks are as follows as a function of radionuclide:

Rn-222	Ra-226	Ra-228	Uranium	Adj. Gross Alpha	Beta	Total
80	3	0.2	0.2	0.2 - 1.4	0	84

However, this analysis is unrealistic because it does not consider; and subtract from health effects avoided, the number of health effects that would be caused by the regulatory alternatives. The actual benefit of the rule would be the net number of calculated health effects considering both those avoided and those caused. The above discussion outlines the factors that could be considered when determining these risks.

This is especially important when one considers, as indicated above, that the estimated risks avoided by the regulation are quite small. This is the case, for example, for Ra-228, uranium, adjusted gross alpha emitters, and beta-gamma emitters. Risks

avoided from removal of Ra-226 are slightly higher. This suggests that for these radionuclides, EPA could very easily create a situation in which more health effects are caused by implementing the regulation than are avoided.

References

D&M81 Oztunali, O.I., G.C. Re, P.M. Moskowitz, E.D. Picazo, and C.J. Pitt, "Data Base for Radioactive Waste Management, Impacts Analyses Methodology Report," NUREG/CR-1759, Volume 3, Dames and Moore, November 1981.

DOE87 U.S. Department of Energy, "Conceptual Design Report: Alternative Concepts for Low-Level Radioactive Waste Disposal," DOE/LLW-60T, Rogers and Associates for National Low-Level Waste Management Program, June 1987.

DOE89 U.S. Department of Energy, "A Manual for Implementing Residual Radioactive Material Guidelines", DOE/CH/8301, June, 1989.

DOE91 U.S. Department of Energy, "U.S. Office of Management and Budget Pilot Study, U.S. Department of Energy Development of Cost and Risk, Estimate Process," draft, September 16, 1991.

EPA86 U.S. Environmental Protection Agency, "Technologies and Costs for the Treatment and Disposal of Waste Byproducts from Water Treatments for the Removal of Inorganic and Radioactive Contaminants," revised draft, September 23, 1986.

EPA89 U.S. Environmental Protection Agency, "40 CFR Parts 257 and 503, Standards for the Disposal of' Sewage Sludge, Proposed Rule," Federal Resister, 54 FR 5746, February 6, 1989.

EPA90 U.S. Environmental Protection Agency, "Suggested Guidelines for the Disposal of Drinking Water Treatment Wastes Containing Naturally Occurring Radionuclides," Office of Drinking Water, July 1990.

EPA91 U.S. Environmental Protection Agency, "40 CFR Parts 257 and 258, Solid Waste Disposal Facility Criteria, Final Rule," Federal Resister, in press.

IDB89 U.S. Department of Energy, "Integrated Data Base for 1989: Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics," DOE/RW-0006, Rev. 5, Oak Ridge National Laboratory, November 1989.

NRC77 U.S. Nuclear Regulatory Commission, "Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes," NUREG-0170, Office of Standards Development, December 1977.

NRC83 Hadlock, D.E., et al., "Current Practices for Maintaining Occupational Exposures ALARA at Low-Level Waste Disposal Sites," NUREG/CR-3125, Pacific Northwest Laboratory for U.S. Nuclear Regulatory Commission, December 1983.

NRC86 U.S. Nuclear Regulatory Commission, "De Minimis Waste Impacts Analysis Methodology: IMPACTS-BRC User's Guide and Methodology for Radioactive Waste Below Regulatory Concern," NUREG/CR-3585, Volume 2, September 1986.

NRC87 U.S. Nuclear Regulatory Commission, "Results of the General License Study and Corrective Measures Taken or Planned by the Staff," SECY-87-167, July 9, 1987.

NRC90 Roles, G.W., "Characteristics of Low-Level Radioactive Waste Disposed During 1987 Through 1989," NUREG-1418, U.S. Nuclear Regulatory Commission, December 1990.

RAE87 Rogers and Associates, "PRESTO-EPA-BRC: A Low-Level Radioactive Waste Environmental Transport and Risk Assessment Code, Documentation and User's Manual,** Prepared for EPA/ORP, 1987.

USE90 Steve Marshall, Operations Officer, U.S. Ecology, personal communication to G.W. Roles, U.S. Department of Energy, December 28, 1990.

APPENDIX C

Comments on EPA's "Suggested Guidelines for the Disposal of Drinking Water Treatment Wastes Containing Naturally Occurring Radionuclides"

In the guidelines document, EPA suggests a number of options for disposal of liquid and solid wastes containing technologically enhanced concentrations of naturally-occurring radionuclides such as isotopes of radium or uranium. For liquid wastes, disposal options include direct discharge to storm sewers or to surface waters, discharge to sanitary sewers, discharge into the air (evaporation), or deep well injection. For solid wastes, and depending on suggested radionuclide concentration limits, disposal options include municipal landfills, hazardous waste disposal facilities, mill tailing piles, or low-level radioactive waste (LLW) disposal facilities. For example, EPA suggests disposal into landfills for solid wastes containing uranium in concentrations not exceeding 30 picocuries per gram (pCi/g), "stabilized landfill" disposal for uranium concentrations ranging from 50 to 500 pCi/g, disposal into hazardous waste facilities for uranium concentrations ranging from 500 to 2000 pCi/g, and disposal into LLW facilities for uranium concentrations exceeding 2000 pCi/g. EPA also recommends radiation exposure guidance for workers in water treatment facilities, suggesting that exposures be limited to 25 millirem per year per worker.

DOE has reviewed the Guidelines, and has the following comments:

1. EPA must provide a detailed justification for the suggested concentration limits. The guidelines provide neither a basis for the limits, nor a reference to any other document that does so. This lack of justification raises numerous questions about the efficacy of the guidance, and the consistency of the guidance (and doses and risks that may arise from disposal of treatment residuals) with respect to other EPA regulatory positions. For example, what dose or risk criteria were used to develop the concentration limits? Why were these criteria considered justified? Based on these criteria, what are the details of any pathway analyses used to set concentration limits so that the dose or risk criteria would not be exceeded? What levels of health effects might be caused by implementation of the disposal guidelines, and how do these health effects compare with those avoided by removal of radionuclides from drinking water?

   Regarding this last question, EPA must address the fact that although EPA might reduce risks to individuals consuming water from public drinking water systems, EPA will definitely <u>increase</u> radiological and nonradiological risks

to workers and the public from operation of water treatment systems and from treatment, packaging, transport, and disposal of treatment system residuals. EPA should not impose requirements and MCLs that are likely to cause a net increase in health effects.

2. In justifying the disposal guidelines, EPA should address the consistency of the guidelines with other EPA regulatory initiatives and policies. For example, EPA has spent a great deal of time and effort to address possible risks from implementing alternative drinking water MCL's, but essentially no time and effort to address risks from constructing and operating water treatment systems and from managing radioactive wastes created by these water treatment systems.

Also, as part of EPA's development of standards for disposal of LLW (40 CFR Part 193), EPA has drafted a standard (April 1989 draft) that specifically addresses disposal of LLW containing source, byproduct, or special nuclear material (as defined by the Atomic Energy Act) by less restrictive methods than disposal into a licensed LLW disposal facility ((BRC) disposal). The draft standard would require that Federal or State agencies that authorize or conduct BRC waste disposal ensure that members of the public would be limited to a dose from all pathways of 4 mrem/yr from handling and disposal of all BRC waste. The agencies would be required to consider the following factors "(i) the collective dose to the general population; (ii) the ability to characterize with reasonable certainty the waste stream's physical, chemical, production, and radiological characteristics; (iii) the potential for waste stream reuse or recycling by individuals or industry; (iv) the ability to assure that the provisions of Paragraph (b) are met [the dose limits], both in a predictive and a compliance mode, including any necessary recordkeeping and/or reporting by the generator of the waste (EPA89)." This draft standard is in strong contrast with the disposal guidelines which are presented without any dose criteria or justification.

Many commenters, including EPA, expressed great concern for NRC's Below Regulatory Concern (BRC) policy, announced in the Federal Register on July 3, 1990 (55 FR 27522), which included a limit of 10 mrem/yr for practices involving few people , and 1 mrem/yr for practices involving large numbers of people. As part of this rulemaking, EPA has issued a guidelines document that, on the surface, appears to have little supporting justification and involves doses of similar magnitude to those in the NRC policy. EPA must provide justification for its proposed guidance, if the guidance is to withstand critical technical and legal review.

3. The guidelines document indicates that the guidance for disposal of uranium is based on uranium's. radiological toxicity. This approach contradicts, and is less restrictive than, EPA's approach for establishing the proposed drinking water MCL of 20 µg/L. On pages 56 FR 33077 and 33078 of the proposed rule (July 18, 1991; 56 FR 33050-33127), EPA states that it "is proposing to limit the MCL because of kidney toxicity, because of the low carcinogenic potency of uranium." If EPA considers chemical kidney toxicity as the "limiting adverse health effect" for uranium in drinking water, then EPA should be consistent when developing guidance for disposal of wastes generated from treating the drinking water.

4. The guidelines document references NRC's requirements for disposal in sanitary sewers pursuant to 10 CFR Part 20. It would appear that the sanitary sewer provisions in Part 20 are principally intended for use by a relatively small number of hospitals, universities, and other licensees that would mostly discharge very short-lived radionuclides. Now EPA proposes to greatly expand this practice to include regular discharge of long-lived radionuclides by up to 1600 water treatment facilities. Since NRC has recently promulgated sweeping revisions to Part 20, including revisions to the Part 20 requirements for disposal into sanitary sewers (see 56 FR 23360-23474; May 21, 1991) which are presently being reassessed, DOE suggests that EPA review the revised 10 CFR Part 20, and possibly contact NRC to assure that the requirements of Part 20 are understood by EPA.

5. The guidelines have limited practical benefit because they do not address common situations which operators of water treatment plants will have to address. For example, EPA suggests that some wastes may be suitable for disposal into municipal solid waste landfills, and other wastes may be suitable for disposal into hazardous waste disposal facilities. Whether or not these suggestions may be justified technically, public opinion and local requirements may serve to limit them. State and local entities have frequently proven to be extremely sensitive to the concept of BRC waste disposal. We understand that at least 10 states have enacted or are considering legislation to prohibit disposal of radioactive material into landfills and hazardous waste disposal facilities. (Legislation has been introduced into Congress -- and hearings held in the case of H.R. 645 -- that would specifically authorize States to impose more restrictive disposal standards for any waste NRC determines to be BRC waste.) We understand that very few, if any, permitted hazardous waste landfills currently accept radioactive material for disposal.

Operators of water treatment plants will probably find it difficult to dispose of wastes according to the guidelines document. Operators of many water treatment plants may find themselves with no option other than to dispose of treatment residuals at LLW disposal facilities.

This will lead to additional problems. This option will not only be quite expensive, but may prove to be essentially impossible to implement because of the imminent paucity of commercial LLW disposal capacity. Only three major facilities currently operate. Two of these facilities will close by the end of 1992, at which time the remaining disposal facility, located in Washington State, may only accept wastes originating from the Northwest Interstate Compact, a group of seven northwestern states formed pursuant to the Low-Level Radioactive Waste Policy Amendments Act of 1985 (Amendments Act). Another disposal facility, located in Utah, only accepts limited quantities of dry, naturally-occurring radioactive materials. This disposal facility is also located in the Northwest Interstate Compact, and the license for this disposal facility stipulates that wastes outside the Compact cannot be accepted without a 2/3 vote of agreement by the Compact members (Utah91).

Ultimately, all States are supposed to develop LLW disposal capacity pursuant to the provisions of the Amendments Act. However, very slow progress is being made in development of this disposal capacity, which means that generators in most States will be forced to store LLW for many years. Assuming that disposal capacity is eventually developed, costs could range from hundreds to over a thousand dollars per cubic foot of waste.

References

EPA89 U.S. Environmental Protection Agency, "40 CFR Part 193 and 764, Environmental Standards for the Management, Storage and Land Disposal of Low-Level Radioactive Waste and Naturally Occurring and Accelerator-Produced Radioactive Waste," draft, April 6, 1989.

EPA90 U.S. Environmental Protection Agency, "Statement of Richard Guimond, Director, Office of Radiation Programs, U.S. Environmental Protection Agency, Before the Subcommittee *on* Energy and the Environment of the Committee on Interior and Insular Affairs, U.S. House of Representatives," July 26, 1990.

WG91 Gunter, W., EPA, presentation and public comments at Seventh Annual Radioactive Exchange LLRW Management Decisionmakers Forum, Amelia Island Plantation, Jacksonville, FL, June 3-6, 1991.