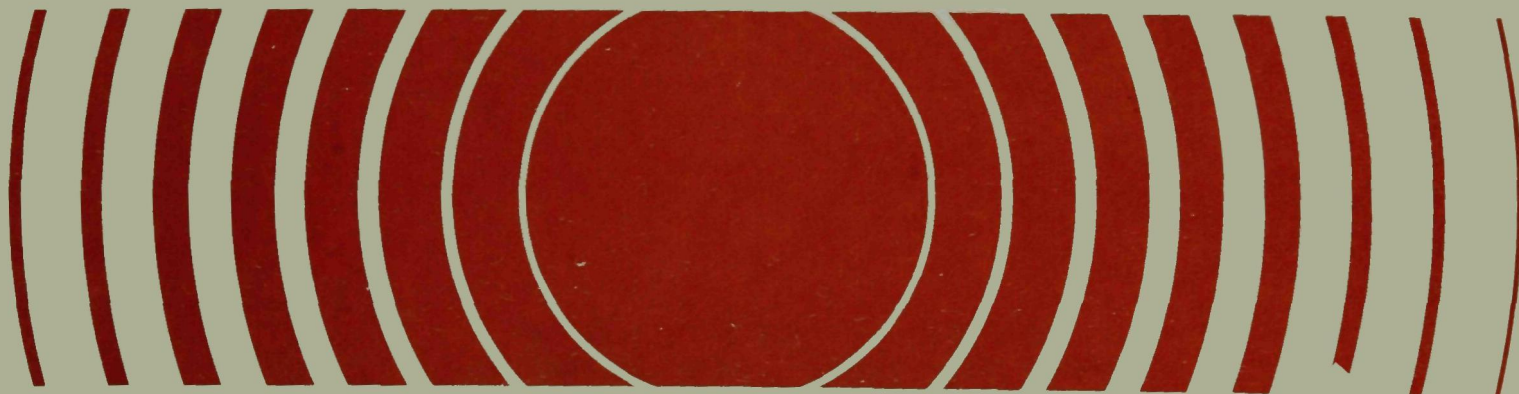

Radiation



Final Rule for Radon - 222 Emissions from Licensed Uranium Mill Tailings

Response to Comments



40 CFR Part 61
National Emission Standards
for Hazardous Air Pollutants

EPA 520/1-86-011

RESPONSE TO COMMENTS

RULE FOR RADON-222 EMISSIONS
FROM LICENSED URANIUM MILL TAILINGS

August 15, 1986

Office of Radiation Programs
U.S. Environmental Protection Agency
Washington, D.C.

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Section 1: INTRODUCTION

In this document EPA responds to comments received on the proposed rulemaking "National Emission Standards for Hazardous Air Pollutants; Standards for Radon-222 Emissions from Licensed Uranium Mill Tailings," published in the Federal Register on February 21, 1986 (51 FR 6382-6387).

Subsequent to the announcement of the proposed rule, a public hearing was held on March 25, 1986 in Denver, Colorado (51 FR 8205). The comment period was held open until April 28, 1986.

In addition to requesting comments on the proposed alternative work practices, the Agency specifically asked for comments pertaining to the following questions:

1. Is it feasible to dewater tailings, as would be required under a continuous disposal alternative?
2. What is the maximum period for design licensing and construction?
3. Is the size limit of 20 acres for phased disposal reasonable?
4. Are current or potential ground water problems severe enough to warrant termination of pumping tailings into unlined impoundments?
5. Are there any unidentified public health or environmental problems associated with evaporation ponds?
6. Are interim controls for tailings piles a practical alternative?
7. Is it reasonable to assume for a reference case, a 40-year lag before compliance with UMTRCA?
8. To what extent should the timing of UMTRCA requirements be factored into the choice of a control option?

Copies of written documents and transcripts of the hearing are available for inspection and copying at EPA's Central Docket Section, West Tower Lobby, Gallery One, Waterside Mall, 401 M Street, S.W., Washington, D.C. 20460. The docket number is A-79-11. (A fee may be charged for copying).

Major concerns and issues arising from written and oral comments on the proposed rulemaking are summarized. Each commenter is identified by a letter and number after the comment. EPA's response to the comment then follows. In the interest of clarity and economy, some comments are paraphrased, and some closely related comments are combined. A list of the commenters and their identification numbers is given in Appendix A.

Section 2: LEGAL AND PROCEDURAL ISSUES

Comment 2.1: There is no need for regulation under the Clean Air Act because existing standards, regulations contained in the Atomic Energy Act and Uranium Mill Tailings Radiation Control Act and license conditions administered by NRC and Agreement States adequately protect the public from risk due to radon-222 (D-2, D-5, D-6, D-12, D-13, D-19, D-22).

Response: The Agency feels that there is a significant risk to individuals living near active uranium mill tailings piles. According to our model calculations, the risk may be as high as 1 in a 100. The concentration limit of 3 pCi/l at the boundary of a mill established by NRC regulations may not provide an ample margin of safety for the local population. The number of committed fatal cancers per year to the local, regional and national populations may be as high as 2 to 9 due to the operating tailings piles depending on how dry the piles become.

Comment 2.2: Confusion exists over the application of this proposed regulation because the definition of "licensed site" is unclear. Sites which are currently licensed by agreement states that are undergoing remedial action by DOE under Uranium Mill Tailings Radiation Control Act should not be included within the definition of licensed sites (D-9).

Response: This rule has no affect on existing licensed piles that are undergoing remedial action leading to final closure, or to sites being reclaimed by the DOE. However, it does apply to all sites that are not reclaimed and hold a license from the NRC or one of its agreement States.

Comment 2.3: EPA should not consider the cost and technical feasibility of regulation under Section 112 of the Clean Air Act. The congressional mandate directs EPA to adopt standards based exclusively on protection of public health (D-20).

Response: Section 112 of the Act requires EPA to establish emission standards for hazardous air pollutants that protect public health with an "ample margin of safety." EPA has interpreted that language to require standards that protect against significant or unreasonable public health risks. Similarly, Section 112 is construed to require standards that do not necessarily eliminate all public health risks, but minimize those risks without causing unreasonable social or economic impacts.

The merit of the Agency's interpretation is well demonstrated in the context of regulating carcinogens (such as radionuclides). EPA agrees with the current scientific consensus that there is no threshold level below which a carcinogen poses no risk to health. Consequently, to control a carcinogen so that it poses absolutely no health risk would require a standard permitting no emissions; yet such a standard could, and often would, prove beyond the technological or financial capacity of the affected industry to implement.

The benefits of a particular industry or activity may make some health risk reasonable to bear if eliminating the risk would entail significant societal harm. EPA believes that Congress intended that section 112 standards give primary emphasis to protecting public health, but not at all costs; instead, Congress sought standards which minimized risks to public health posed by a pollutant without causing unreasonable economic and societal consequences. Both the legislative history of the Clean Air Act and the Courts support such a common sense approach to setting standards for hazardous pollutants. See Industrial Union Department, AFL-CIO v. American Petroleum Institute, 448 U.S. 607, 642 (1980); Ethyl Corp. v. EPA, 541 F. 2d 1 (D.C. Cir. 1976), cert. den. 426 U.S. 941 (1976); H.R. Rep. No. 95-294, 95th Congress, 1st Sess. 43-51, 127.

Comment 2.4: The Administrative Procedures Act was violated by EPA by failing to provide adequate notice of its proposed rule. The EPA has not set forth the terms or substance of the proposed rule or a description of the subjects or issues involved with sufficient specificity to allow reasonable public comment (D-12).

Response: EPA maintains that the notice of proposed rulemaking provided sufficient detail of the issues involved and the possible regulatory actions to allow for reasonable public comment. This judgment is supported by the extent and detail of the public comment EPA has received on this rule.

Comment 2.5: Radionuclides should not be regulated under Section 112 of the Clean Air Act until a legal challenge to EPA's listing of radionuclides as a hazardous air pollutant is resolved (D-12).

Response: EPA has listed radionuclides as hazardous air pollutants under Section 112. In addition, under the terms of an order of the U.S. District Court of California, EPA must act with respect to uranium mills by August 15, 1986. Given this deadline, foregoing action at this time is not a legally available option.

Comment 2.6: EPA should consider alternative work practices and regulatory programs that more fully address localized or site specific circumstances (D-19).

Response: EPA has considered other alternative work practices but there are difficulties with all of them. For example, water covers would prevent radon emission but this would likely cause ground water contamination problems at most sites. The Agency feels it is proposing a rule that provides sufficient flexibility to protect the public health and safety. EPA is legally unable to propose site-specific criteria.

Comment 2.7: The proposed rule may impose regulations that are duplicative of and yet inconsistent with existing EPA and NRC rules (D-22).

Response: It is true that there are inconsistencies with several of the proposed alternatives as to which Federal agency will implement the new rule. The language of the final rule will correct this. The Agency is committed to work closely with NRC to avoid duplication of effort.

Comment 2.8: Mill operators should comply with the standard within 90 days as required by Section 112 (c) of the CAA unless an extension is granted on a site by site basis (D-20).

Response: Under Section 112(c)(1)(B) EPA may grant a waiver permitting a period of up to two years if necessary for the installation of controls. This waiver need not be site specific. The purpose of this waiver is to provide existing licensed operators the necessary time to meet the work practice standard. EPA believes it is not practical to design, license and build new mill tailings impoundments within two years. Much of this delay is occasioned by the many Atomic Energy Act requirements and NRC licensing procedures, and by the practicalities of constructing a new impoundment. Therefore, EPA will require mill tailings pile owners to comply to a strict schedule and build new impoundments as quickly as practical but within a maximum of 6 years. As a result, EPA believes that Section 112(c)(1)(B) is not applicable to these circumstances.

Comment 2.9: Ground water quality should not be considered in regulating radon-222 under Section 112 of the Clean Air Act (D-1, D-3, D-5, D-6, D-7, D-8, D-19, D-21).

Response: This rule does not regulate ground water. Ground water contamination is controlled by pre-existing

regulations prepared under the Uranium Mill Tailings Radiation Control Act. EPA has considered the effects of ground water on the environment and industry under this rule. However, if water cover is maintained or expanded in order to limit radon-222 emissions to the atmosphere, the potential for impacting ground water increases because of the greater hydraulic head. The Agency is also concerned that extended use of existing unlined piles could increase ground water impact problems.

Comment 2.10: The provision of the rule which requires owners to "begin negotiating a reclamation plan and an agreement to implement the plan with the NRC within one year..." would not be binding on NRC unless it is addressed in the EPA-NRC Memorandum of Understanding. (D-22)

Response: It is anticipated that the EPA-NRC Memorandum of Understanding will have to be updated as a result of this new rule.

Comment 2.11: There is an inconsistency between the EPA-NRC Memorandum of Understanding and the proposed rule as to which agency has implementation authority (D-22).

Response: This inconsistency will be corrected in the final rule. EPA will not usurp NRC implementation authority under this rule.

Comment 2.12: The basis for granting exemption under 61.252(b)(2) should be extended to include facilities in compliance with 40 CFR 192 secondary standard (D-21).

Response: The Agency has determined that existing impoundment designs of 40 acres or less that have a liner meeting the specifications of 40 CFR 246.221 will be provided an exemption from the schedule requirements. This liner requirement assures that the impoundment has the capability to retain water, thereby keeping tailings wet and greatly reducing radon-222 emissions.

Section 3: TECHNICAL ASPECTS

3.1 Use of Interim Earth Cover and Design of New Impoundments

Comment 3.1.1: Interim cover is not practical at operating sites because tailings are discharged from the perimeter of an impoundment. Thus fresh tailings may be discharged onto interim covers. Operation of earth-moving equipment on wet areas is difficult. Fugitive dust from the cover material may be a problem. It is impractical to place interim cover on steep slopes of tailing sands. Interim cover on dams would interfere with monitoring of their stability. In addition, covering drains of these dams could impact their stability (D-1, D-3, D-8, D-12, D-18, D-19, D-21, D-22, D-23).

Response: The option of applying an interim earth cover to dry areas of tailings impoundments was reevaluated in the final Background Information Document (BID) and Economic Analysis (EA) to better assess its practicality, effectiveness, and cost. A detailed discussion of these aspects associated with interim cover has been incorporated into the BID both in Chapter 7 and Appendix C. Because of the significant uncertainties and difficulties associated with application of interim cover to dams constructed of coarse tailings, a revised explanation has been made. The revised evaluation assumes slopes remain uncovered, areas that are currently dry would be covered immediately, that a 5 year drying period is required before wet or ponded areas could be covered and that evaporation ponds would not be covered. The Agency concluded on the basis of this revised evaluation that interim cover is inappropriate as a generally applicable work practice.

Comment 3.1.2: There is no need for EPA to require an immediate earth cover to decrease radon-222 emissions at existing impoundments. The NRC and/or Agreement States, through licensing procedures, will force use of interim covers on a site-by-site basis when appropriate (D-3).

Response: The NRC does require application of an interim cover on impoundments on standby status to limit windblown tailings. While a thin cover (i.e. 1 foot) of coarse material may effectively limit fugitive emissions, its effectiveness in controlling radon-222 emissions is minimal. In contrast, the BID assumes that the cover material is a 1 meter thick homogeneous, silty, clay soil with an 8 percent moisture content. The function of this interim cover is to control radon-222 emissions whereas the basic function of the NRC's interim cover is to limit the quantity of tailings particles that are blown by wind from the impoundment. The EPA is not requiring an interim cover in the final rule.

Comment 3.1.3: Any regulation of the design of future tailings impoundments to achieve a reduction in radon-222 emissions should allow flexibility for site-specific considerations and not dictate one type of design (D-3, D-7, D-12, D-18, D-19, D-23).

Response: The standard will allow more than one type of technology to be used. It also allows for site-specific considerations in the design of future impoundments through petitions to the Administrator, if the proposed designs are sufficient to protect the public health and safety of nearby populations.

Comment 3.1.4: The industry has minimal experience with dewatering sands and no experience with dewatering slimes. Dewatered slimes would not be stable enough to support the cover. Therefore, continuous disposal is not practical from an operational standpoint (D-12, D-19).

Response: Tailings dewatering systems have been used successfully at nonferrous ore beneficiation mills. Although continuous disposal has never been actually practiced on uranium mill tailings in the United States, it has been proposed by industry as the preferred method of tailings disposal at three sites. A proposed mill on the East coast submitted plans for above grade, continuous disposal of dewatered tailings including a 40 foot thick cap. This operation was licensed but never constructed. Additionally, the Anaconda mining company proposed disposal of dewatered tailings in trenches with continuous covering as an alternative at the Bluewater mill. This option was never put into practice because of the downturn in uranium production. Pioneer Uranium also submitted plans for continuous disposal using belt filters. Umetco Minerals has proposed the use of dewatering and continuous disposal at the Uranium mill. The EPA believes that these proposals submitted by industry demonstrate that continuous disposal can be a viable option.

Comment 3.1.5: Earth cover is preferred as an interim cover, rather than water, for existing piles since it would reduce the potential for ground water contamination (D-15).

Response: EPA agrees that earth is the preferred cover material. The concern with potential ground water contamination was stated both in the BID and in the proposed standard. The use of water cover to control radon-222 emissions is most feasible at lined impoundments during relatively short stand-by periods.

Comment 3.1.6: Contrary to EPA's evaluation, the single-cell approach is more advantageous than either phased or continuous disposal impoundment design. It has less total surface area and provides better long-term containment (D-12).

Response: The single cell tailings impoundment design does have less total surface area than the other alternatives as shown in the BID. However, during operations and particularly during stand-by periods, the single cell impoundment has more exposed surface area from which radon-222 would be emitted. Additionally, when operations cease, the single cell impoundment would require dewatering and covering of the total impoundment area at one time. The phased and continuous impoundments have only a fraction of their total surface area exposed during operations and at closure. Thus, there is less potential for radon-222 emissions to escape if final closure is delayed for any reason. Similarly, if an extended stand-by period occurs during the life of the mill, less surface area of tailings is exposed with the phased and continuous alternatives. Each alternative is believed to provide the same degree of long term containment.

3.2 Dewatering Tailings and Phased Disposal

Comment 3.2.1: Technology to dewater tailings is believed to exist, but increased energy and manpower to accomplish this are probably too costly to be economically feasible (D-1, D-3, D-18).

Response: EPA believes this option can be economically feasible based on proposals for continuous disposal from the industries and on the evaluation presented in the BID.

Comment 3.2.2: A 20 acre cell for phased disposal is acceptable but the economic impact to operators due to this option must be assessed (D-1).

Response: The 20 acre cell size for the phased tailings disposal alternative was determined to be an acceptable size as described in the BID. The cost comparison of this option to the others is presented in the BID. Additionally, the final BID includes an evaluation of a three cell phased disposal option, each cell having about 40 acres. In the final rule we are requiring that tailings piles be no greater than 40 acres.

3.3 Other Types of Cover

Comment 3.3.1: Lead sheeting is being investigated as a possible cover for tailings impoundments (D-4).

Response: EPA will follow the progress of this investigation. Since the technology is not proved at this time, the Agency has not considered this as an alternate cover in their analysis.

Comment 3.3.2: A work practice standard related to maximizing the wet area of a tailings impoundment to reduce radon-222 would be acceptable at some sites (D-8, D-21).

Response: Such a practice was incorporated into the EPA's consideration of interim cover. Sites with lined impoundments and operational practices that keep tailings flooded during normal operations effectively control radon-222 emissions during operations. These practices are site specific and could not be used at most existing impoundments.

3.4 Groundwater Considerations

Comment 3.4.1: Maintaining a water cover on a lined impoundment has the following disadvantages: it would not allow reclamation in the shortest time, there may not be enough water to keep the impoundment flooded, a full impoundment has increased risk of failure, and the hydraulic head increases potential for leaks (D-18,D-22).

Response: The EPA agrees with the comment. For the reasons cited in this comment and in the response to comment 3.1.5, the preferred cover material in most cases is earth. However, a lined impoundment does retain more water as a result of normal operations. This extra water cover then reduces the radon-222 emissions.

Comment 3.4.2: Present and potential ground water contamination at uranium mills is not severe enough to justify shutdown of all unlined tailings impoundments (D-19).

Response: EPA is not considering the closure of tailings impoundments based on groundwater contamination under this rule. Ground water quality is already protected at licensed uranium tailings sites by existing EPA regulations. The radon emissions from existing tailings piles is of primary concern.

Comment 3.4.3: The NRC stated that recent literature indicates that a water cover may not be as effective in reducing radon emissions as previously thought (D-22).

Response: Recent technical assessments of radon emission rates from tailings indicate that radon emissions from tailings covered with less than one meter of water, or merely saturated with water, are about 2% of emissions from dry tailings. Tailings covered with more than one meter of water are estimated to have a zero emissions rate. The Agency believes this calculated difference between 0% and 2% is negligible. The Agency used an emission rate of zero for all tailings covered with water or saturated with water in estimating radon emissions.

3.5 Timing of Standard

Comment 3.5.1: One commenter stated that the assumption of a 40-year period between the end of an impoundment's useful life and compliance with Uranium Mill Tailings Radiation Control Act (UMTRCA) requirements is reasonable (D-1). Several other commenters, however, stated that EPA's assumption of 40 years is excessive (D-6, D-8, D-12, D-15, D-18, D-19).

Response: A 40-year time period between the end of an impoundment's useful life and compliance with UMTRCA is believed by the EPA to represent a "worst-case" scenario. Reclamation may be accomplished under NRC's or the Agreement State's direction in a shorter time period. However, the Agency has evaluated the cumulative impacts (i.e. health effects) over this extended time to serve as a point of reference. The Agency has evaluated in the final Economic Analysis a 20 year period. This time period is being used in our calculations of costs and benefits for the final rule.

Comment 3.5.2: Permits for new tailings management processes can be obtained in 1 year (D-1, D-21). Implementing and permitting new technologies may take substantially longer (D-21). The entire process of acquisition, design, licensing and construction is more like 6.5 years (D-8, D-18, D-19). It also could take more than 10 years (D-12).

Response: Based on the comments received from the NRC, Agreement States, and individual companies, EPA realizes that three years for constructing and operating a new tailings pile is too short a time. The Agency now considers 6 years as the time needed to design, permit, and construct a new tailings impoundment.

Comment 3.5.3: Setting a time limit on use of existing tailings impoundments would preclude utilizing full capacity and have adverse economic impacts on operators (D-3, D-6, D-12).

Response: The EPA is aware that setting a time at which the use of existing impoundments would cease would have economic impacts. The Economic Analysis includes this cost of lost capacity in the evaluation of the different time frames considered. However, it is difficult to evaluate these costs since the future of the industry is uncertain.

3.6 Evaporation Ponds

Comment 3.6.1: Properly designed (i.e., lined) and constructed evaporation ponds provide adequate protection for public health and the environment (D-1, D-12, D-18, D-19).

Response: Since phased and continuous tailings disposal methods require evaporation ponds, any health or environmental problem associated with the ponds is important. The Agency agrees that adequate health and environmental protection is provided with a properly designed pond.

3.7 Source Term Estimates

Comment 3.7.1: EPA assumed that radium-226 is evenly distributed; however, coarser sands are much lower in radium-226 content and yield lower radon-222 emissions (D-6).

Response: The Agency is aware that radium-226 is not uniformly distributed in the tailings. The fines contain much higher radium-226 and the sands contain less radium-226. Data on the variations of flux and radium over the surface of individual piles is not known at this time. Reported radium-226 concentrations represent average values reported by milling companies and are based on their measurements and/or estimates. This is considered to be the best available data.

Comment 3.7.2: The area of tailings and/or radium-226 contents used in BID are not correct (D-6, D-8).

Response: Tailings areas were based on aerial photographs taken in the late summer of 1985. Radium-226 concentrations were based on the milling company's measurements or previous EPA estimates and are considered to be the best available data. Corrections to this data does not affect the overall results by more than 10%.

Comment 3.7.3: More accurate site-specific emanation factors₂ should be used as opposed to using the relationship of 1 pCi/m²s per pCi Ra-226/g tailings (D-12, D-13, D-14).

Response: Site-specific emanation factors were not used because most of the information needed to estimate these factors, such as moisture content, porosity, density, and emanating power, are not known for each site. The Agency thus used a conservative factor of 1 pCi/m²s per pCi Ra-226/g of tailings for all dry areas and a factor of zero for wet areas.

Comment 3.7.4: Water may not be as effective in reducing radon-222 as previously thought (D-21).

Response: As stated in the response to Comment 3.7.3, the Agency believes that the use of a conservative emanation factor adequately approximates the overall rate. We acknowledge that water may not be 100 percent effective as a radon-222 control.

3.8 Mill Descriptions

Comment 3.8.1: Site-specific corrections in mill and tailings impoundment descriptions should be made (D-11, D-19).

Response: Corrections in mill and impoundment descriptions will be made in the final BID where appropriate based on comments from the industry.

3.9 Alternative Standards

Comment 3.9.1: A site-specific alternative standard based on radium-226 content and a risk of 1 in a million should be set for each mill to determine the allowable exposed surface area (D-20).

Response: Setting a site-specific standard for each mill requires detailed knowledge about its size, radium-226 content of the tailings, and information on local meteorology and topography. The radium-226 content of the tailings also varies widely, especially between the sands and fines fractions. The Agency has not accepted the proposition that the standard must reduce risk to a level of 1 in a million. EPA believes that it must protect the public with an ample margin of safety which is met by the final rule.

Comment 3.9.2: An emission standard should also be implemented to monitor emissions (D-15, D-22).

Response: The Agency did consider an emission standard. It was felt that boundaries could be changed to comply with an emission standard which is not an acceptable practice under the Clean Air Act. Also, methods to determine emissions from tailings piles also have not been sufficiently developed to provide accurate and consistent measurements of radon emissions.

Section 4: RISK ASSESSMENT

4.1 Risk Modeling and Estimates

Comment 4.1.1: Risks from radon-222 are very approximate and overestimated. Lower relative risk coefficients should be used. EPA should stress the low side of the risk which is zero (D-2, D-5, D-6, D-8, D-12, D-19, D-21).

Response: Scientific evidence does not support the idea of a threshold at low doses below which the risk coefficient for cancer induction by radon daughters approaches zero. On the contrary, laboratory studies of in vitro cell transformation and of cancer induction in animals indicate that the risk per unit dose of alpha radiation is maximal at low doses and dose rates. Epidemiological studies of miners exposed to radon also show a decreasing risk coefficient at higher doses and dose rates.

For any carcinogen, however potent, there will always be a dose level below which it becomes practically impossible to directly demonstrate harm in a human population. In particular, it may never be possible to observe harmful effects of radiation at dose levels comparable to natural background or below. Risk estimates in this dose region are derived through empirical extrapolations and theoretical calculations based on the entire body of relevant scientific evidence.

It remains the view of EPA that a risk coefficient of 1%-4%/WLM, is reasonable in light of current evidence from epidemiological studies of miners. This view has been endorsed by an independent group of experts, the Radiation Advisory Committee of the Agency's Science Advisory Board.

The substantially lower risk estimates which have been suggested are in general either based (1) solely on analysis of the U.S. miner data set, failing to take into account the evidence for decreasing risk per unit dose at high doses and the probable upward bias in dose estimates or (2) on model assumptions which do not seem prudent in light of current evidence (e.g., an absolute risk coefficient which decreases over time).

It should also be noted that in extrapolating its risk estimates from miners to the general public, EPA employs an "exposure equivalent", which corrects for the lower average breathing rate in the latter. This correction effectively implies about a 40% reduction in the risk estimate for average

members of the general public. Some recent dosimetric calculations, however, suggest that radon daughter deposition in the lung may vary only slightly with breathing rate. As a result, there can be little support for the contention that the range of risk coefficients used by EPA represent a substantial overestimate in light of current evidence.

Comment 4.1.1a: The linear nonthreshold hypothesis and relative risk model have not been affirmed (D-19).

Response: The statement referred in the Draft BID was meant to convey the point that recent evidence has lent support to these assumptions. The word "affirm" was too strong, and the statement has been modified accordingly.

Comment 4.1.2: Radon-222 exposure from mill tailings on a regional and national level is overshadowed by background radon-222 sources. Therefore, making regional and national risk estimates is meaningless because it is indistinguishable from other sources (D-2, D-5, D-6, D-7, D-8, D-21).

Response: It is acknowledged that radon exposures from mill tailings, at locations distant from mill tailings sites, are small compared to exposures from other sources. It does not, however, follow that it is meaningless to calculate exposure and risk due to emissions from such sites. These calculations are based on procedures generally regarded as sufficiently accurate to support a rulemaking. The significance of the risk is based on the absolute value of the risk and the practicality of control measures.

Comment 4.1.3: The calculated individual lifetime exposure risks are not realistic because: (1) people do not live at the point of maximum exposure for a lifetime; (2) tailings are covered in less than a lifetime; and (3) risk estimates are questionable because they are based on assumptions for radon-222 emissions, lifetime exposures, occupancy figures, nearby populations, and WLM-to-risk factors that are all high (D-2, D-5, D-6, D-12, D-19, D-21).

Response: The Agency has noted that "Estimates of risks to nearby individuals must be interpreted cautiously, as few people generally spend their whole lives at such locations." (draft BID, p. 6-1). The assumptions used to estimate occupancy and risk factors are documented in Chapter 2, those for radon-222 emissions in Chapter 5, and those for population exposed in Chapter 6 of the draft BID. EPA believes these assumptions are a reasonable basis for a rulemaking.

Shorter periods of exposure, as might be associated with an active pile, do not necessarily change conclusions about the associated risk in a direct proportionality, although shortening the time of exposure does diminish the risk. Risk is related to age at first exposure and duration of exposure. Exposures of 5 years or more generally constitute an appreciable proportion of the risk of lifetime exposure (see table below).

Percent of Lifetime Risk for Lifetime
Exposures Accumulated in Shorter
Time Periods

<u>Age at first Exposure</u>	<u>Duration of Exposure</u>				
	5 yrs	10 yrs	20 yrs	30 yr	Lifetime
Birth	11%	25%	47%	61%	100%
25 years	8%	16%	29%	41%	50%
40 years	8%	14%	23%	28%	29%

If tailings are uncovered for at least 20 years, the difference between the risk associated with the pile for that time period or for 70 years or more (lifetime) is less than a factor of two.

Comment 4.1.5: EPA should base any radon-222 standard on actual measured exposure near tailings impoundments (D-5, D-6).

Response: Due to time constraints we have not been able to gather sufficient data on actual exposure measurements to individuals near tailings piles. Exposures based on models have been used for developing the standard. A population study was conducted by EPA in 1983 to determine actual populations near active uranium mills.

Comment 4.1.6: Effective radon-222 decay product equilibrium factors are incorrect because they are based on a simple model that ignores atmospheric removal processes such as plate-out (D-12, D-19, D-21).

Response: The outdoor equilibrium fraction used by EPA is limited to 0.85 in order to take into consideration atmospheric removal processes. The outdoor equilibrium value used to calculate the effective equilibrium fraction is for the released radon-222 which has been transported to the location under consideration. This value can be substantially greater than a measured equilibrium fraction since that value is influenced by the equilibrium fractions for all sources of radon-222.

Comment 4.1.7: EPA has not, but should, include the risk from radon-222 exposure due to windblown tailings around the mill sites (D-18).

Response: The radon-222 exposure from windblown tailings was not considered as a source because it is believed to be small compared to exposures due to radon-222 from the pile. Also, an extensive field study would be necessary to obtain data necessary to make this correction.

Comment 4.1.8: Exposure and dose should be evaluated on a site-specific basis over the estimated life of each tailings impoundment. The model used disregards concentration differences resulting from average wind rose data at each site (D-21).

Response: Meteorological data (wind rose and stability arrays) were not available for each tailings impoundment. Meteorological data from representative nearby reporting areas was used for each site. Obtaining site special meteorological data for each individual site would have imposed unacceptable time delays and financial burdens on performing a timely risk assessment.

4.2 Significance of Risk

Comment 4.2.1: Significance of the radon effects from mill tailings on total population is negligible. There are no proven adverse health effects (D-2, D-3, D-6, D-8, D-12, D-13, D-19).

Response: Adverse health effects due to radon-222 emissions from mill tailings piles cannot be directly measured because of the very high incidence of lung cancer attributable to other causes. However, it would be imprudent to regulate exposure to carcinogens on that basis. It is the position of EPA that, based on current scientific evidence, excess lung cancers can result from radon-222 emitted by tailings piles and that the numbers of cancers calculated in the BID are a reasonable estimate.

Comment 4.2.2: Under Section 112 of the Clean Air Act, EPA must prove a significant risk of harm to public health before a standard is implemented. EPA has failed to prove that radon-222 emissions pose risk sufficient to justify regulation under CAA (D-6, D-12, D-19).

Response: EPA maintains that the record supports its contention that radon-222 emissions pose a sufficient public health risk. Our model indicates that persons living near an active uranium mill tailings pile may have a risk of 1 in 100 of developing lung cancer over their lifetime. It is estimated that the number of fatal cancers to the local, regional and national populations may be as high as 2 to 9 deaths due to the operating piles.

4.3 Risk Levels

Comment 4.3.1: Nearby individuals are to be protected from excess risk as well as large populations. The standard must be, but is not, sufficient to reduce each individual's risk attributable to emission from the mill and tailings to a de minimis level of 1 in a million (D-20).

Response: The Agency feels that reducing the risk to 1 in a million for radon-222 is too low a level to be practical and that the Clean Air Act does not require EPA to protect all individuals at a 1 in a million risk level. The Agency's position in this matter is discussed in the response to Comment 2.3.

Comment 4.3.2: Risks should not be compared with general population cancer risks but instead with lung cancer risk for a prudent person who has avoided exposure to high risk contaminants (e.g., cigarette smoke) in the course of his or her daily life (D-20).

Response: There is some evidence that non-smokers are at lower risk from radon exposure than smokers. This has been implicitly assumed by EPA in adopting a relative risk model in which exposures to radon daughters act multiplicatively with other carcinogens in inducing lung cancer. Thus, as the baseline rate of lung cancer in the U.S. has risen, primarily due to the effects of cigarette smoking, EPA has revised its estimates of the number of radon daughter induced lung cancers upward proportionally.

Based on the EPA model, individuals at low risk for lung cancer (e.g., non-smokers) would have the same relative increase in their risk from a given exposure to radon as would individuals at high risk for the disease (e.g., heavy cigarette smokers). Therefore, the proposed standard is, from the standpoint of absolute risk, more protective of individuals in the former group.

Comment 4.3.3: The NRC stated it continues to believe the existing release limits and interim stabilization practices to be adequate to protect public health and safety under their legislative mandates (D-22).

Response: The existing release limits are the concentration limits listed in the Commission's rule 10 CFR 20. The concentration limit for radon-222 is 3 pCi/l in this rule for any uncontrolled area. A person exposed to this concentration for their entire lifetime would incur a risk of about one in one hundred. The Agency judges that the regulatory standards established by this regulation are necessary to meet the requirements of Section 112 of the Clean Air Act. EPA believes

that the phased management scheme of this standard provides significant additional health benefits in keeping with the "ample margin of safety" provision of Section 112. This is shown in the following table on cost-effectiveness estimates:

Alternative Work Practice Standards for Controlling Radon-222 Emissions from Existing Piles
(Assumes Low Yellowcake Demand Scenario and 20 year Baseline)

Alternative	Benefits ^(b) (Lung Cancers Averted)	Costs ^(c) (\$ M)	Cost Effectiveness Estimates ^(a)			
			Average ^(e)		Incremental ^(d)	
			Costs ^(g) Discounted	C and B ^(f) Discounted	Costs ^(e) Discounted	C and B ^(f) Discounted
1. Status Quo	0 (0%) (g)	0 (0)				
2. New Tech. in 15 years	31 (25%)	64 (0)	2	7	2	7
3. New Tech. in 10 years	50 (40%)	166 (33)	3	10	5	13
4. New Tech. in 5 years	65 (52%)	279 (78)	3	11	8	13
1. Status Quo	0 (0%) (g)	0 (0)				
2. Interim ^(h) Cover	36 (29%)	131	4	8	4	8

- (a) Expressed as \$M per fatal lung cancers averted; benefits expressed as midrange of estimates; benefits at high confidence level would be twice shown and C/B would be half.
- (b) 124 Lung cancers in absence of controls; benefits expressed in fatal lung cancers avoided in 100 years.
- (c) Present value costs for early disposal and replacement capacity, in millions of 1985 dollars, discounted at 5%, () are replacement capacity costs only.
- (d) Incremental to above alternative.
- (e) Costs discounted at 5%, benefits not discounted.
- (f) Costs and benefits discounted at 5%.
- (g) Percent of the 124 cancers in absence of controls.
- (h) Incremented to Status Quo (option # 1).

Section 5: ECONOMIC ANALYSIS

Comment 5.1: Proposed rules will have significant adverse effects on industry's ability to contain costs and threaten the industry's future. The costs of complying with the proposed regulation is unreasonable. Therefore the regulation should be rejected (D-3, D-5, D-6, D-7, D-12, D-19, D-21).

Response: Control measures to meet the provisions of the final rule do have significant impact on the conventional uranium mining and milling industry. As stated in the Economic Analysis for this rulemaking, EPA projects that this impact, although significant, will not threaten the viability of this industry. The EPA also feels that the costs are reasonable in relation to the benefits derived and consistent with previous Agency actions.

Comment 5.2: EPA should calculate cost benefit ratio to justify a standard (D-3, D-5).

Response: EPA's policy is not to establish a dollar value on life, or on the morbidity effects of cancer. Therefore, in the case of radiation risks, costs and benefits are not expressable in commensurate units, so a cost benefit ratio is not calculated.

Comment 5.3: EPA's uranium production projections are fundamentally flawed. The number of future mills and projected volume of tailings are vastly overestimated. As a result, EPA has not established an appropriate model for evaluating any of its regulatory proposals (D-12).

Response: It is agreed that it is difficult to predict the future of the conventional uranium mining and milling industry. In addition to all unknowns associated with the projected future of the nuclear power industry is the inability to foresee how Congress will react to the present problems of this industry.

As stated in the Economic Analysis, EPA has assumed that imports will continue to be a significant factor in the market for uranium fuel, but that they will not take over the entire market. Thus the domestic fuel production remains viable. This implicitly assumes that Congress does act to restrict imports sufficiently to maintain a viable, conventional,

domestic mining and milling industry. In the model used for the Economic Analysis, EPA assumes that the domestic conventional mining and milling industry attains viability within a short time (1 to 3 years) and maintains this viability well into the future. We do not, however, assume that the industry ever becomes large, or flourishes in a manner similar to its structure in 1979-1980. The growth rates assumed are low, somewhat below the Department of Energy's low growth projection through the year 2000. EPA than assumes only modest growth beyond the year 2000.

Comment 5.4: EPA's standard threatens the economic value of the uranium ore in the ground because it threatens the viability of the conventional uranium mining and milling industry (D-6).

Response: It is true that the economic value of much of the uranium ore in the ground is dependent upon the viability of the conventional uranium mining and milling industry, and if this industry does not maintain viability, the value of this ore will disappear. This is true in the presence or absence of EPA's standard. As stated previously, EPA has projected that the conventional mining and milling industry will attain viability and be sufficiently strong to absorb the costs of the regulations proposed under this rulemaking.

Comment 5.5: If EPA requires interim cover on existing piles, the volume of this cover threatens the economic value of the remaining capacity of these piles (D-6).

Response: The Nuclear Regulatory Commission has estimated that a one meter interim cover on all piles will use up approximately fifty percent of the total remaining capacity of all existing mill tailing plies (EPA BID). However, the total remaining capacity on these piles is much larger than needed to sustain the industry at the growth rates projected by EPA in its economic analysis. Therefore, lost capacity on existing piles does not threaten the overall viability of the milling industry. However, the viability of some individual mills with little remaining capacity on their piles are threatened. EPA is not requiring interim cover in its final rulemaking.

Comment 5.6: The cost of EPA's standard is not justified on the basis of the cancers prevented (D-2).

Response: Uncontrolled emissions from uranium mill tailings piles impose significant risk of cancer to those persons residing in close proximity to the piles and to the U.S. population. The benefit to be derived from this standard is the reduction in this risk. The costs and benefits of reducing the risk to the U.S. population for alternative control levels were compared in establishing this standard. The costs per health effect averted for this standard are in accord with EPA practice and with other standards promulgated under the Clean Air Act. An additional benefit that cannot be quantified, therefore cannot be considered in a benefit-cost evaluation, is that controls significantly reduce the risk to maximally exposed individuals (those residing near the piles), thereby reducing the disparity in the range of risks imposed on the population.

The Agency does expect that extensions would be granted for mills having piles smaller than 200 acres and having no people living within 5 kilometers of the pile. Such mills are remote enough to present small risks to maximally exposed individuals and are small enough to present very small risks to regional and national populations.

APPENDIX A

LIST OF COMMENTERS

A.1 Introduction

The following is a list of the commenters whose comments were responded to in this document. The identification number used in this document is the same number used by the EPA Docket Section (except that the Docket number A-79-11, Category: VIII is deleted from each number). Where there are missing sequential numbers, it means that the document material was not a letter of comment but some other reference material.

A.2 Commenter Listing

<u>Comment No</u>	<u>Category</u>	<u>Date Docketed</u>
D-1	Wyoming Department of Environmental Quality	3/13/86
D-2	State of Utah Department of Health	4/01/86
D-3	Pathfinder Mines Corp.	4/04/86
D-4	St. Joe Minerals Corp.	4/02/86
D-5	The Colorado Mining Association	4/22/86
D-6	Umetco Minerals Corp.	4/22/86
D-7	State of Wyoming Office of the Governor	4/24/86
D-8	Chevron Resources Company	4/24/86
D-9	Hecla Mining Company	4/24/86
D-11	Atlas Minerals	4/28/86
D-12	Kerr-McGee Corp. and Quivira Mining Company	4/28/86

<u>Comment No</u>	<u>Category</u>	<u>Date Docketed</u>
D-13	Rocky Mountain Energy	4/28/86
D-14	Hamel and Park for AMC	4/30/86
D-15	The Navajo Nation	4/30/86
D-18	New Mexico Environmental Improvement Division	4/30/86
D-19	American Mining Congress (AMC)	4/30/86
D-20	Environmental Defense Fund	5/02/86
D-21	Texas Dept. of Health	5/16/86
D-22	U.S. Nuclear Regulatory Commission (NRC)	5/28/86
D-23	U. S. Department of the Interior	7/10/86