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FINAL COMMENTS OF
ROCKY MOUNTAIN ENERGY COMPANY
ON THE
NUCLEAR REGULATORY COMMISSION'S
PROPOSED AND FINAL REGULATIONS
ON
URANIUM MILL TAILINGS LICENSING CRITERIA,
AND THE
DRAFT GENERIC ENVIRONMENTAL IMPACT STATEMENT
ON URANIUM MILLING

(NUREG-0511)

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I. Introduction

Rocky Mountain Energy Company (RME) is the Denver-based subsidiary of Union Pacific Corporation responsible for developing the Corporation's coal, uranium and trona reserves. During recent years, RME has had a growing role in developing uranium reserves through the operations of the Bear Creek Uranium Company in the Southern Powder River Basin of Wyoming.

We believe that the necessary growth of U.S. uranium production depends upon the orderly promulgation of reasonable federal and state regulations. Through the reasoned efforts of state and federal governments designed to ensure the public health and safety, coupled with uranium industry efforts to update and improve all facets of uranium production operations, the U.S. can be assured of adequate energy resources to meet future energy demands.

II. General Views on the NRC Proposed and Final Regulations, and the GEIS on Uranium Milling.

RME clearly recognizes the difficulty involved in creating a reasonable regulatory program on uranium milling. We congratulate the authors of the draft GEIS on preparing a document directed at such a program. They have covered a number of complex and difficult issues and have added to the scientific basis for assessing the environmental impacts of uranium milling. It is RME's position, however, that the NRC proposed and final regulations, as well as the draft GEIS, have a number of deficiencies which should be rectified before they become the basis for promulgating final regulations concerning uranium milling.

RME agrees with the central purpose of the proposed regulations which is to ensure proper management and disposal of mill tailings and mill decommissioning. These comments are made in the interest of establishing reasonable regulations upon which the uranium industry can continue to provide an energy resource to meet future U.S. energy demands.

With respect to Rocky Mountain Energy Company's position on the GEIS and the NRC proposed and final regulations, the following general conclusions are provided for NRC review:

- The NRC proposed and final regulations, in general, lack clarity. For example, Criterion 1 of the proposed regulations references locating tailings or waste disposal areas at "remote sites." While this may be a feasible goal with respect to tailings management, it does not provide the clarity needed by the uranium industry to effectively plan existing or future uranium operations. Exactly what is to be considered "remote" is not addressed in the Criterion, and this may well prove to be a future source of discord unless adequately defined in the final regulations and supported with a firm rationale in the GEIS. To merely remove the word "remote" would represent some improvement, for what is remote today is not necessarily remote in the future. Further clarity and precision of wording is required in the Criterion 3 reference to a "prime option" for tailings disposal as well as the conflicting definitions of "by-product material" in Sections 40.4(a-1), 170.3, and 150.3.

- The proposed and final NRC regulations are untimely given EPA authority to promulgate general environmental standards (Atomic Energy Act, as amended - Section 275.) As previously stated, RME does not disagree with the intent of the proposed NRC regulations, yet these regulations are ill-timed given EPA responsibility to promulgate general environmental standards for inactive and active tailings piles within the next several months. The result could clearly be a complete revision of these proposed rules. Furthermore, the GEIS, in that it should serve as the supporting or rationale document for the NRC regulatory program, should not be finalized until the culmination of the EPA rule-making process. The conclusions to be drawn in the GEIS and the NRC regulatory program must rely on the EPA health and environmental standards. RME recognizes that the National Resources Defense Council petition stimulated the preparation of the GEIS, and that NRC has a responsibility to respond to that petition. However, the Congressional action in the interim by passage of the Uranium Mill Tailings Radiation Control Act (1978), provides an overriding mandate and establishes a logical regulatory schedule that must be honored.

- NRC Proposed Regulations imply assured government ownership of by-product materials and land used for disposal of by-product material. RME concurs with the concept that ultimate government ownership of tailings is desireable in virtually all cases; however, ownership of the land on or under which these tailings are placed is not in all cases desireable or necessary for the protection of the health and well-being of the human population and the general environment. Moreover, RME believes the authority provided the NRC through UMTRCA (Section 202), now Section 83 of the Atomic Energy Act, does not preclude private ownership of such property. The proposed regulations, specifically Criteria 11 & 12, disregard the authority provided in the Atomic Energy Act for continued private ownership of land under conditions and standards determined by the NRC. Consequently, the proposed regulations should be modified to make them consistent with the statute, in all of its provisions.

- Proposed NRC regulations and the GEIS are technologically constraining. In recognition that the thrust of the proposed regulatory program deals with tailings and waste, RME believes the general approach in the regulations should be to promote technological innovation and continuing improvements in disposal methods. Stifling of invention and imagination by overly specific regulations broadly applied, can be counterproductive. This restrictive feature is most evident in Technical Criteria, Appendix A to 10 CFR Part 40, Criteria 1 through 8. Several of these Criteria are based upon assumptions related to a hypothetical model mill and environmental setting. The assumptions selected by the NRC for milling and waste disposal characterization are outdated, not reflective of the state-of-the-art in the uranium milling industry, and do not recognize the wide range of variability, present and future, in the industrial processes utilized and the environments in which the operations may occur.

- The proposed NRC regulations, particularly the Technical Criteria of Appendix A (10CFR40), establish specific methods to accomplish goals. RME believes that specific methods should not be established for tailing management. Instead, the technical criteria should be limited to concise statements of the goals or objectives, perhaps taking the form of standards of performance. To establish by rule techniques or methods is to assume that there is nothing new to be learned. RME recommends that the Technical Criteria be totally revised to establish the societally and environmentally beneficial targets for the design of tailings management systems without limiting the flexibility as to the methods to achieve those targets.

- The "prime option" for tailing disposal as proposed in Criterion 3 of Appendix A (10CFR40) is unnecessary and unwarranted. The regulation of an entire industry, diverse in its processes and the environments in which individual facilities operate, by the designation of a prime option, is technically and environmentally questionable. RME does not feel that any prime option should be designated within the proposed regulations. A prime option designation would establish a bias in favor of the option itself, while concurrently limiting the industry from utilizing equally as effective alternatives to accomplish the desired goals.

  RME believes, moreover, that the careful analysis of alternatives necessary on a site specific NEPA review or in an agreement state review will be biased by the "prime option" designation in the GEIS (NUREG-0511) and proposed regulation, Criterion 3. A balancing of all factors, technical, environmental, social and economic must continue on a case-by-case basis within the framework of acceptable standards and the NEPA process.

- The relationship of Criterion 3 to Criterion 4 would appear to establish inequality of regulation with respect to above versus below-ground tailing disposal. The "prime option" of below-ground tailings disposal (Criterion 3) seems favored by not having to meet the stringent criteria for above ground sites established in Criterion 4. RME suggests that uniform tailings disposal regulations should be promulgated which will in turn provide consistent evaluations of all tailings management systems.

- The 3 meter cover requirement specified in Criterion 6 is not adequately supported in the GEIS. This rule appears to be justified on the basis of a combination of health protection from radiation risk and long term isolation goals. The health risk is not firmly related to the proposed radon exhalation standard cited in the GEIS.

- The NRC has failed to recognize that mill wastes and tailings, in some circumstances, may be found to be non-hazardous. The Environmental Protection Agency has been charged with the responsibility to designate health and environmental standards for uranium mill tailings. The EPA rulemaking process, when finalized, should not be anticipated to categorically define all mill wastes or tailings as hazardous. Rather, the standard setting process, including a risk assessment, should be expected to result in certain levels of radiological and non-radiological parameters being found to be non-hazardous. Given this likelihood, a universal set of standards or regulations, as proposed by the NRC, is inappropriate at this time.

- The NRC regulatory program will apparently be applied to all producers of by-product tailings and wastes. However, the GEIS, upon which the rules were developed, concentrated on "conventional uranium milling", with incomplete assessment of such processes as in situ extraction or other non-conventional processes. Given the conclusions as presented in Chapters 12 and 13 of the GEIS, inappropriate regulations have resulted.

  Several other technologies of actual or potential application in the uranium industry are not thoroughly evaluated in the GEIS and the proposed rules are therefore found to be misdirected. Such examples include heap leaching, reprocessing of tailings, vat leaching, and tailings disposal underground in conventional underground mines or hydraulic borehole mining cavities.

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Once again, the immediate solution to this dilemma, is for NRC to redraft all technical criteria (Appendix A, Part 40) which will become a set of concisely stated goals or performance standards without dictating or biasing toward "NRC preferred" technologies for waste disposal. A thoughtfully prepared set of goals, based upon supporting EPA originated standards for health and environmental protection is sufficient.

III. NUCLEAR REGULATORY COMMISSION'S PROPOSED AND FINAL REGULATIONS ON URANIUM MILL TAILINGS LICENSING CRITERIA--RME COMMENTS

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The following RME comments are directed at the NRC's proposed and final regulations on uranium mill tailings licensing criteria which were published in the Federal Register on August 24, 1979. Rocky Mountain Energy Company urges NRC consideration and adoption of the following comments.

Section 40.4(p)--Definition "Uranium Milling."

As proposed:

> 10 CFR 40.4(p) "Uranium milling" means any activity that results in the production of byproduct material as defined in this Part.

Comments:

> RME finds no reason to require "uranium milling" to be defined. Furthermore, the proposed definition is all encompassing, potentially including all mining, ore transport, ore stockpiling and other operations <u>not</u> within the jurisdiction of the Nuclear Regulatory Commission. It is RME's concern that an expansion of regulatory purview by the NRC could be forthcoming should this presently worded definition be promulgated, or allowed to remain in final rules already promulgated by the NRC.
>
> With respect to uranium ore operations, the NRC authority is limited to "byproduct" tailing or wastes as provided for in the UMTRCA and to materials that upon refinement or processing become source materials. Particularly exempted is "unrefined and unprocessed ore," the definition of which is found in 10 CFR 40.4(k).
>
> RME specifically objects to the definition of uranium milling as proposed and promulgated on p. 50019 and p. 50014 of the August 24, 1979 Federal Register, Vol. 44, No. 166. The definition is superfluous and it potentially sets the stage for NRC usurping authorities not granted by Congress. It is recommended to be deleted.

PROPOSED REGULATIONS

Section 40.32--General Requirements for Issuance of Specific Licenses.

To provide clarity to the proposed regulations and continuity to section 40.32, General Licenses, reference should be made in proposed section 40.32(e) to the granting of an exemption from section 40.32(e) requirements under authority of specific exemptions provided in section 40.14. 10 CFR 40.14(a) sets forth authority for specific exemptions to be granted upon application of any interested person or upon the Commission's own initiative, and that any person subject to section 40.32(e) provisions may be exempted from such requirements by the Commission balancing certain factors and determining that an exemption is justified.

For clarity of the proposed law, therefore, the following language is suggested to be inserted in proposed regulation section 40.32(e) after the first sentence: "Such requirement for a specific license may be exempted from applicability under authority of the Commission pursuant to 10 CFR 40.14(a) and (b)."

PROPOSED REGULATIONS

Appendix A to Part 40

The GEIS on uranium milling stated clearly the purpose of regulatory control over uranium milling operations which is to ensure public health and safety, and protection of the environment (GEIS--Section 12.1). "In some cases," as stated in the GEIS, "the proposed actions can be implemented by regulations" (emphasis supplied). Introductory section to Appendix A, Part 40 of the proposed regulations, however, states that all Technical, Financial, Site and Byproduct Material Ownership, and Long-Term Site Surveillance Criteria would at a minimum be "requirements." This language contradicts the GEIS statement that proposed actions, in some cases, could be implemented by regulations.

The introductory section to the proposed regulations indicates that "This appendix establishes technical, financial, ownership, and long-term site surveillance requirements relating to the siting, operation, decontamination, decommissioning, and reclamation of mills and tailings or waste systems and sites at which such mills and systems are located" (emphasis supplied). Setting such a rigid structure that all Appendix Criterion would be requirements does not permit the flexibility originally written into the GEIS. While Rocky Mountain Energy fully supports efforts to ensure the public health and safety, and protection of the environment, it believes that to make all of the proposed regulations requirements on the uranium industry is unnecessary.

For example, where environmental, economic, and site-specific criteria indicate that an earth cover of less than three meters would be sufficient to meet the goals of other NRC criteria (i.e., to achieve the calculated reduction in surface exhalation of radon), then a company's efforts should not be locked into the three-meter requirement, but should have the flexibility to meet the goal.

The following change in language is suggested to the Introduction Section to Appendix A to Part 40: Beginning with the second sentence, "This appendix establishes technical, financial, ownership, and long-term site surveillance criteria relating to the siting, operation, decontamination, decommissioning, and reclamation of mills and tailings or waste systems and sites at which such mills and systems are located."

TECHNICAL CRITERIA

Criterion 1--Mill tailings to be located at remote sites.

RME essentially agrees with the purpose of this section which is to reduce potential population exposures and the likelihood of human intrusions at the tailings or waste disposal areas. Clarity of language with respect to this Criterion, however, is imperative.

When consideration is given to disposing of tailings or other wastes at "remote sites," it is necessary to clearly delineate countervailing considerations which could negate the requirement of disposal at remote areas. RME believes this clear delineation has not been made. Specifically, costs and environmental impacts of a large disposal site will affect whether disposal at remote and separate sites is desirable. Also, consolidation of disposal sites as required by Criterion One would impinge upon the authority of a company to have its own mill; this concentration by the government should not be forced on industry. Varied industry approaches to technical uranium issues are stimulated by less rather than more government regulation. To require under this criteria that small waste disposal sites should be discouraged, would be to abrogate a technical and operational alternative to disposing of wastes which should not be summarily dismissed; near-term technical improvements may in fact encourage small disposal sites over large waste centers. For example, it may well be demonstrated that the health and environmental impacts of rehandling and transporting small tailing quantities are greater than the impacts of suitably disposing of such wastes on site.

Reference in the proposed regulations to in-situ extraction operations implies an in-situ extraction operation produces little wastes from its process of uranium extraction. While this assumption may prove correct in the near term, individual in-situ extraction operations in the future could well increase in size and produce significant amounts of waste; thereby requiring on-site disposal areas based on technical, environmental and economic considerations. This NRC-proposed regulation will preclude consideration of small waste facilities, particularly at in-situ mining operations, as a means to reduce potential population exposures and the likelihood of human intrusions at tailings or waste disposal areas.

Criterion One, as proposed, states that "Tailings or waste disposal areas shall be located at remote sites so as to reduce potential population exposures and the likelihood of human intrusions to the maximum extent reasonably achievable (emphasis supplied). Again, while this requirement may be proposed to achieve the stated goal of a reduction of potential population exposures, etc., it is a vague requirement that needs clarification. The term "remote sites" should be defined so that the final regulation issued by the NRC can provide a specific guideline upon which the industry can effectively plan future operations.

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TECHNICAL CRITERIA

Criterion 2--Tailing disposal areas to be located to reduce disruption and dispersion by natural forces.

RME is in substantial agreement with the concept embodied in this criterion; however, certain revisions in the language seem appropriate.

The proposed rule would provide that "Tailings or waste disposal areas shall be located at sites where disruption and dispersion by natural forces are eliminated or reduced to the maximum extent reasonably achievable." RME believes that total assurances indicating disruption and dispersion can be eliminated are not feasible or within the predictive capability of human knowledge to describe all future potential disruptive and dispersive natural forces. For these reasons, we recommend that the words "eliminated or" be deleted from this sentence in recognition of the protection provided by the fully adequate language which follows, i.e., "reduced to the maximum extent reasonably achievable." RME interprets the word "reasonably" to include many considerations such as degree of risk, incremental benefits and costs, technical potential, and assessed/expected success.

RME also recommends that in the second sentence of Criterion 2 the word "mill" should be replaced by "tailing."

It is also recommended that the entire sentence dealing with the Executive Order 11988 concerning flood plain management be deleted. Citation of a specific concern or executive order is inappropriate for a criterion which should embody only general concepts or goals. Many other constraints or citations could have been specifically itemized but were not. RME finds this anomolous in the regulation and suggests that such specific citations be placed in appropriate regulatory guides.

TECHNICAL CRITERIA

Criterion 3--Prime Option for Disposal of Mill Tailings.

General Comment

There is an obvious disparity in the intensity of regulation or criteria for acceptability between below grade tailing disposal (Criterion 3) and above ground tailing disposal (Criterion 4). RME believes this disparity to be an inappropriate and inconsistent application of regulations, the intent obviously being to require a greater depth of review and justification for above grade sites. The demonstration of acceptability for above ground sites should not be judged arbitrarily, requiring a greater degree of justification than a below grade site. A reasonable and thorough evaluation of alternatives and the ability of each to attain design goals or criteria should be the test of relative merit of various alternative actions.

RME finds Criterion 3, specifically designation of tailings disposal below grade as a prime option, as technically objectionable and unnecessarily restrictive upon the industry, resulting in a stifling of technological innovation and creativity. RME firmly believes that "below grade" disposal is not and should not be considered the prime option. No single option should be declared in a criterion, rule, regulatory guide, or the Generic Environmental Impact Statement as the prime option. RME believes that to designate a prime option for tailing disposal prematurely judges against other options, which, if given careful and reasoned review, might be found more desirable from a balancing of technical, environmental, social and economic factors. Further, to designate a prime option by rule will result in a subversion of the basic principles of the National Environmental Policy Act, which requires an analysis of alternatives and balancing of factors to preserve the environment. (See generally, Pub. L. No. 91-180, 83 Stat. 852, 42 USCA Sec. 4331 et. seq.)

While the NRC may argue that statutory NEPA procedures have been met with respect to the GEIS on Uranium Milling (NUREG-0511), it is apparent that GEIS analyses and conclusions are broad with respect to an industry that is diverse in processes utilized, waste characteristics, and environmental, geographic and demographic settings. It is well understood, moreover, that NEPA requires a detailed statement that is sufficient to enable those who did not have a part in compilation of an EIS to understand and meaningfully consider facts involved (see Environmental Defense Fund, Inc. v. Corps of Engineers, 492 F.2d 1123 at 1136).

In virtually all licenses, a site-specific environmental analysis will be performed under NEPA. For all new applications, a site-specific environmental impact statement is expected. The NRC should, therefore, not feel obliged under the GEIS to predispose of issues that will be covered more properly in the statement. Such a site-specific review should take place without bias either by the applicant or due to regulatory narrowness.

RME has no objection to including in all tailing disposal alternative analyses the option of below grade disposal; however, we do object to "below grade" disposal being designated as the prime option. It is recommended that NRC redraft Criterion 3 to provide design suggestions or criteria if the applicant chooses to dispose of tailing below original grade. All references to "prime option" are strongly recommended to be deleted.

TECHNICAL CRITERIA

Criterion 4--Above-ground disposal design criteria.

This criterion apparently assumes that all above-ground tailing or waste systems will consist of impoundments. RME submits that this is an example of the continuing NRC view that only past disposal technology will be utilized, with no future innovative changes. Rules should accommodate change, even encourage change, and these rules do not.

Criterion 4 would establish a mixture of siting considerations, design criteria/standards and performance standards. A distinction between these, i.e., siting, design and performance, is necessary for clarity. Siting considerations such as subparagraphs (a), (b) and (e) are already covered in Criterion 2 and need not be repeated; subparagraphs (c) and (f) pertain to design standards (see below); and, performance criteria are contained in subparagraph (d).

Subparagraph (a): RME has no major comment on this criterion and agrees that it is a valid siting consideration. Subparagraph (a), however, should be stated as a siting consideration, not a design or construction criteria. A balancing of siting factors may result in not "minimizing" the catchment area, since other siting factors may be deemed more important in the course of a comprehensive multifaceted review.

Subparagraph (b): This section implies that wind protected topographic features must exist to qualify a site for tailings disposal. RME believes that wind erosion potential should be considered in siting and design, yet should not be a mandatory criterion. Manmade, as well as natural topographic features to control wind erosion should be fully considered and allowed on a site-specific basis. It is also conceivable that for some processing technologies and related tailing systems, wind erosion would not be a factor of major importance.

Subparagraph (c)--Embankment slopes. This subparagraph is confusing and, therefore, requires rewording to establish clarity with respect to this regulation. As proposed, the apparent intent of subparagraph (c) is to suggest specific final embankment slopes and overall slopes and contours.

RME suggests the following be inserted in lieu of proposed subparagraph (c):

> "Final contours of the reclaimed tailing or waste site should be designed and executed to assure the long-term stability and integrity of isolation of the tailing or waste mass. Slopes shall be designed

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based upon the mechanical and structural properties of materials utilized, as related to erosion resistance and other forms of slope failure, utilizing recognized engineering principles."

Specific slope criteria are not warranted without knowledge of the material properties or the potential hazard. Also, to include comparative reference to the below-grade option is inappropriate for reasons pointed out previously in RME's comment on Criterion 3.

Subparagraph (d): RME recommends that approvable techniques of final stabilization of cover should not be limited to vegetation or riprap. Other materials, particularly durable physical covers, may prove to be suitable and should be allowed, if demonstrated, to be equal to or superior to the vegetation or riprap. Riprap is generally considered to consist of large broken rock. In certain environmental settings, revegetation may not be achievable or necessary and riprap may not be available. In such cases, the operator should have the flexibility to be innovative and provide alternative solutions.

The present rule does not allow such flexibility and should, therefore, be changed.

Subparagraph (e): The language and terminology of the criteria are so imprecise as to provide no guidance. In particular, terms that lack definition are "potentially active fault," and "maximum credible earthquake."

Subparagraph (f): RME agrees that it would be desirable to create a design with features promoting deposition of sediment and potentially enhancing the tailing cover over time. It should be noted, however, that prediction of sediment agradation is at least as difficult as prediction of erosion over the long term. The two processes are obviously complimentary within any regional watershed. Furthermore, to design for agradation of sediments could have confounding or adverse effects on other design features such as are suggested in Criterion 2, by premature or repeated filling of channels that are designed for diversion of surface storm waters.

It is recommended that subpparagraph (b) be reworded to recognize the practical difficulties in accomplishing agradation. This subcriteria should also be stated as a goal rather than a requirement.

TECHNICAL CRITERIA

Criterion 5--Groundwater protection.

Specific methods to achieve seepage control and groundwater protection are stated in the first sentence of this criterion. RME maintains that statement of the design goal should be the only statement necessary in this criterion. Specific methods or applied technologies should not be mandated by regulation, but left for the applicant/operator to propose based upon site specific and process specific factors.

Since limited groundwater effects are likely with almost all tailing systems, the stated goal of groundwater protection should be conditional to a particular zone, such as the proposed ultimate restricted area boundary.

Should NRC elect not to amend the text of this criterion to the statement of a goal, RME recommends that mandatory language and terminology be deleted regarding methods to be utilized or examined.

RME specifically objects to the statement requiring minimizing penetration of seepage from ore pads since this portion of a uranium operation is not within the regulatory jurisdiction of the NRC (Atomic Energy Act of 1954, as amended, Sec. 2, Sec. 11.2, and Ch. 7 (Sec. 61 et seq.)). No uranium milling or ore processing to create source material takes place until ore enters the mill and is processed in the first step of ore grinding. Furthermore, the uranium ore on the pad could in no way be considered byproduct material, since it has not been processed. RME recommends deletion of the third sentence of Criterion 5.

TECHNICAL CRITERIA

Criterion 6--Tailing cover.

The GEIS (NUREG-0511) fails to adequately justify the designation of a minimum 3-meter earth cover over tailings or wastes. The 3-meter cover depth has not been shown to be required for radon flux reduction to the suggested 2pCi/m^2-sec above background, nor for achieving background direct gamma exposure levels. To the contrary, NRC and DOE conducted tests utilizing actual tailings, as well as tests by private industry, and calculational models indicate that significantly less cover is necessary to achieve the proposed limits of radon flux. The excess cover specified by NRC in this proposed regulation is apparently intended to provide for design goals previously stated and adequately covered in Criterion 2, and supplemented in Criterions 3 and 4, all related to long-term isolation and maintenance of integrity of the disposal site and the tailings or wastes.

The NRC has failed to heed the mandate of the U.S. Congress, as specified in the Uranium Mill Tailings Radiation Control Act of 1978, Section 206(a), which establishes the authority and responsibility of the U.S. Environmental Protection Agency with regard to promulgating health and environmental standards for uranium mill tailings (Section 275 of the Atomic Energy Act, as amended). Specifically, Section 275b.(1) provides that EPA shall "promulgate standards of general application for the protection of the public health, safety and the environment from radiological and non-radiological hazards...of byproduct material..."

The Atomic Energy Act Section 275b.(2) (as amended) makes clear that the standard setting function of EPA must be consistent with the Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act. Furthermore, it is clear in UMTRCA and the amended Atomic Energy Act, Section 275.d, that the NRC is <u>not</u> responsible for standard setting. The NRC responsibility is in the area of "implementation and enforcement of the standards" promulgated by EPA.

These proposed rules by the NRC, particularly those associated with standards for radiation from byproduct tailings, such as Criterion 6 of Appendix A are clearly in opposition to the orderly regulatory development process established by Congress. This premature NRC regulatory proposal should, therefore, be deleted at this time. A revised criterion would be in order <u>only</u> after EPA has carried out its responsibility under UMTRCA.

Another built-in inconsistency of the proposed 2pCi/m^2-sec standard for radon flux is found in the pending standard setting of EPA regarding radium-226 under EPA's implementation of the Resource Conservation and Recovery Act. It is highly questionable whether the EPA proposed definition of hazardous wastes, which suggest a 5pCi/gm Ra-226 limit, is achievable or realistic in uranium mining districts. Furthermore, it is possible that the NRC proposed Rn-222 flux limit of 2pCi/m^2-sec could not be achieved in reclaimed mining areas by utilizing materials that would be considered nonhazardous by EPA. The result would be that radon flux could potentially be higher in reclaimed mining areas than is allowed over reclaimed tailing, an obvious disparity in regulation and lack of a realistic view of natural radioactivity in our environment.

The final two sentences of Criterion 6 appear unnecessary. The use of synthetic materials for caps should not be totally dismissed by regulation, for to do so is an unjustified restriction of technological development. Cover material restrictions based upon radium content likewise do not need to be established since an overriding limit on incremental radon flux would be sufficient. "Elevated levels of radium" is not defined and will not be defined until EPA standards are set. RME believes that these referenced sentences should, therefore, be stricken.

In summary, it is RME's recommendation that Criterion 6 be sharply modified. The present action necessary by NRC to be in conformance with Congressional mandate is to delete <u>Criterion 6</u> until EPA establishes the health and environmental standards that will form the basis for radiation control for tailings. Once such a basis is established, providing it is firmly founded on scientific principal and fact, NRC may proceed to implement, through regulation and licensing, an appropriate criterion. Such a criterion should not establish a minimum cover depth or specify technologies that are considered acceptable or unacceptable. It should merely state the performance objective for radiation protection.

TECHNICAL CRITERIA

Criterion 7--Preoperational/Operational Monitoring.

RME basically agrees with the statement of this criterion with only limited exceptions.

"Major site construction" should not include site disturbances necessary for the collection of geologic, engineering, environmental or other information necessary for the orderly development, environmental design, and feasibility assessment of a project.

The last words of the first sentence, "prior to development," should be deleted as they are redundant.

In the second sentence, the NRC proposes that operational monitoring programs should "demonstrate compliance." Surely the intent of monitoring is not to demonstrate compliance but rather it is to "measure or evaluate compliance."

TECHNICAL CRITERIA

Criterion 8--Reduction of airborne effluent emissions.

The principal of "as low as reasonably achievable" (ALARA) is stated in the opening sentence of this proposed criterion. RME accepts and supports this goal. A significant amount of the supporting statements to this criterion, however, are unnecessary. Moreover, a great deal of the language assumes strictly conventional operations, that is, continuation of historical practices.

For example, many present and planned operations are considering shipping yellowcake as a slurry or moist filtercake, thereby eliminating the yellowcake dryer emission. Certain institutional limitations currently constrain this. The present wording also largely assumes conventional pond type tailing disposal, an unreasonable assumption for the future. RME believes that new technology, not anticipated by the NRC, will come forward and that the motivation for new technology will be minimizing environmental emissions and to improving overall plant performance and product recovery efficiency.

Once again, in the last sentence of Criterion 8, NRC has proposed controls on the ore pad, an area of operations for which NRC has no jurisdiction under the Atomic Energy Act or the Uranium Mill Tailings Radiation Control Act. The words "and ore pads" should, therefore, be deleted.

In summary, RME finds the basic principal of ALARA to be a worthy criterion with regard to mill operation and tailing/waste disposal. Criterion language, however, should be condensed to reflect this principal and all references to specific practices deleted.

FINANCIAL

Criterion 9--Financial arrangements for decommissioning.

The Uranium Mill Tailings Radiation Control Act of 1978 authorizes the NRC to promulgate regulations requiring mill operators to undertake surety arrangements to ensure proper decommissioning and post-decommissioning activities (UMTRCA of 1978, Public Law No. 95-604, 92 Stat. 3021). Proposed regulation to 10 CFR 40, Appendix A--Financial Criteria, Criterion 9, is intended to establish such financial surety regulations. The NRC analysis provided in the draft GEIS sets forth financial aspects of uranium mill decommissioning and tailings management (see section 14--draft GEIS), yet the proposed regulation to 10 CFR Part 40 falls short of clearly addressing and establishing surety requirements.

Underlying the proposed regulation, which will require a short-term financial surety ensuring that a mill operator undertakes decommissioning activities, is the <u>current policy</u> of the NRC and Agreement states, of requiring financial surety arrangements for proper decommissioning activities. As previously stated, the UMTRCA requires promulgation of financial surety regulations. The statutory authorization to establish regulations will take financial surety arrangements out of flexible state/federal government <u>policy</u>, and into the regulatory/law area. This transformation, from general policy to enforceable legal status subject to penalty for violation, requires clarity of the new law's language and clearness of scope.

The thrust of this comment is not to disagree with the central purpose of the financial surety requirement, viz., requiring proper application of decommissioning and long-term surveillance responsibilities on the mill operators in order to ensure public health and safety from milling operations, but moreover to suggest proper means through which the regulatory framework can be established to accomplish desired ends. In short, the proposed regulations relating to Financial Criteria require clarification.

With respect to the amount of funds to be ensured by a surety arrangement, proposed Criterion 9 sets forth the standard that "the amount of funds to be ensured by such surety arrangements shall be based on cost estimates in an approved plan for (1) decontamination and decommissioning of <u>mill buildings and the milling site</u> to levels which would allow <u>unrestricted use</u> of these areas upon decommissioning, and (2) the reclamation of tailings and/or waste disposal areas in accordance with technical criteria delineated in Section I of this Appendix" (emphasis supplied). While RME agrees with the concept of allowing unrestricted use of mill buildings and milling sites, such a standard is in direct conflict with the NRC staff conclusion set forth in section 14.3 of the generic EIS stating that "the mill structures and sites should be decommissioned to allow unrestricted use of portions of the site away from the tailings disposal area." It is suggested that the proposed standard in the Financial Criteria section is much higher than the staff conclusion set forth in section 14.3 of the draft GEIS; the latter sets an unrestrictive use standard for portions of the site away from the tailings disposal area, while the former sets a specific standard and perhaps an unnecessary one of unrestrictive use of the mill buildings and milling site. Again, while RME favors the express purpose behind such regulations which is to ensure public health and safety, financial requirements of establishing a complete unrestrictive use of mill buildings and milling sites may not be economically or practically rational. RME suggests that the standard of unrestricted use be amended on a site-specific basis, if necessary, to a limited use. In many cases, assuming the proposed NRC rule of locating tailings or waste disposal areas at "remote sites" (which as proposed remains a vague standard itself) is met, such an unrestricted use standard may well be environmentally, economically, and pragmatically unnecessary.

As indicated in the draft GEIS section 14.1.1, decommissioning of the mill site and tailings disposal is addressed well before the mill operation begins, provisions for short-term financial surety arrangements are agreed upon between the NRC and the operator before a license is granted, and many of the tailings disposal, reclamation and decontamination procedures will be conducted by the mill operator during milling operations.

FINANCIAL

Criterion 10--$250,000 charge to cover costs of long-term surveillance.

The stated purpose of the $250,000 charge designed to cover the costs of long-term surveillance is to require the "waste generator" to pay all costs for waste disposal, including any long-term costs incurred (see draft GEIS, section 14.3.1). RME does not dispute that the mill operator should be responsible for surveillance costs and for that reason RME is not in disagreement with the purpose behind the charge. It is unclear from the draft GEIS, however, exactly why the $2,500 upper limit was selected as an estimated annual cost per site for long-term surveillance. While the draft GEIS indicates in section 14.3.3 that the range for such costs was $1,250 to $2,500, the only justification given for selecting the upper limit was to "use a conservative estimate." Further justification for the change is, therefore, requested.

The draft GEIS indicates that virtually the only cost item for long-term monitoring is expected to be the "time and effort of government inspectors who will visit the sites." The Atomic Energy Act, as amended by Section 202(a) of the UMTRCA, requires that mill tailings disposal sites be transferred to the United States or the state in which such land is located, at the option of such state, except where the Commission determines that government ownership is not "necessary or desirable to protect the public health, safety or welfare or to minimize or eliminate danger to life or property." The Atomic Energy Act, therefore, sets forth three parameters for long-term site surveillance cost analysis: (1) the federal government will have control/title to the mill tailings disposal sites; (2) a state in which a mill tailings disposal site is located may at its option take title to the land; and, (3) the federal or state government may not have to take title to land in which a mill tailings disposal site is located if the NRC determines that government ownership is not necessary or desirable to protect the public health, etc. (See Atomic Energy Act, Section 83.)

In the first instance, i.e., with federal government ownership of the land, the federal government may possibly incur a $2,500 expense per site for long-term surveillance; yet this would be a conservative overestimate as indicated in the GEIS. In the second case, with the respective state taking ownership of the stated property, costs for long-term surveillance would be reduced significantly under the estimated $2,500 amount because site visitation expenses relating to travel, inspections and follow-up analyses could be reduced by the proximity of state operation/agencies to the subject areas. Therefore, initial cost estimates proposed in Criterion 10 (i.e., $250,000 for long-term

surveillance) should be adjusted downward for the likely possibility that states will assume this long-term regulatory function.
With respect to the last parameter, little or no costs are expected to be incurred if in fact the need for state or federal government control of a waste disposal site is unnecessary because the mill operator has done an adequate job with respect to decommissioning, decontamination and reclamation and, therefore, retains title to the land.

SITE AND BYPRODUCT MATERIAL OWNERSHIP

Criterion 11--Criteria relating to ownership become effective 11/8/81.

RME fully supports all efforts to minimize any negative impact of uranium milling operations on the environment and the public. In this regard, RME finds no justification for the proposed rule, Criterion 11, which would require a transfer of land which is used for the disposal of byproduct material to the federal or state governments subsequent to November 8, 1981. This proposed requirement is contrary to the express language in the Atomic Energy Act section 83.

The Atomic Energy Act, as amended, provides that the NRC shall require by rule, regulation or order that prior to the termination of any license...title to land, including any interests therein (other than land owned by the United States, or by a state) which is used for the disposal of..."tailings" shall be transferred to (a) the United States, or (b) the state in which such land is located, at the option of such state, unless the Commission determines prior to such termination, that transfer of title to such land and such byproduct material is not necessary or desirable to protect the public health, safety, or welfare or to minimize or eliminate danger to life or property (emphasis supplied). Contrary to NRC staff conclusions, RME does not agree that "there should be government ownership of tailings disposal sites" (emphasis supplied). The Atomic Energy Act specifically sets forth a standard which must be met prior to the transfer of property; proposed regulation Criterion No. 11, however, sets forth a broad rule for government ownership which is not adequately justified.

The proposed regulation, Criterion 11 paragraph D, would provide, upon determination by the NRC, a limited use permit to be given by the new government owner of the land for use of the surface or subsurface estates. While the person (landowner) transferring such land to the government would be given the right of first refusal under such a situation, this would do little to recompense the landowner for actually transferring his property when there may be no reason to do so.

Specific circumstances in which there may be no need to transfer title of tailings or wastes to a governmental unit could include cases when the materials in question are determined to be nonhazardous in accordance with EPA standards for protection of health and the environment, or cases where the manner of disposal provides such a high degree of isolation and assured integrity that disruption is highly unlikely. Examples of such cases could include cleaned or treated tailings wherein the radionuclides have been removed or immobilized, and/or cases where tailings have been deposited in deep disposal pits or mines. Other cases could result from future technological research and development.

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LONG-TERM SITE SURVEILLANCE

Criterion 12--Final disposition of mill tailings should not require ongoing active maintenance.

RME concurs with the intent of the proposed regulation which is to encourage proper decommissioning, decontamination and reclamation operations in order to reduce the need for active long-term maintenance. An apparent inconsistency arises, however, between NRC proposed Criterion 12 and Criterion 10.

Criterion 10 provides a charge of $250,000 to cover the costs of long-term surveillance shall be paid by each mill operator to the general treasury of the United States or to an appropriate state agency. The draft GEIS indicates in section 14.3.3 that the $250,000 amount was selected based on "conservative estimates" of government expenses relating to travel, inspections and follow-up analyses for site surveillance. Criterion 12, however, provides that, as a minimum, annual site inspections shall be conducted by <u>site owners</u>. As previously indicated in RME comment to Criterion 11, the site owner may well be either the federal or state governments, <u>or a private party</u> (see Atomic Energy Act, Section 83). Given the possibility, therefore, of private ownership of the sites, the $250,000 site surveillance charge paid to the federal government may well be a windfall for site surveillance activities that may never be conducted by a governmental body. RME suggests that this inconsistency be clarified by deleting the words "site owners" in the second sentence of Criterion 12 and inserting the words "tailings owners."

(A) Section 70.23(a)(7) Requirements for the Approval of Applications.

(B) Section 30.33(a)(5) General Requirements for Issuance of Specific Licenses.

The proposed amendments to 10 CFR 30 and 70 pertain to commencement of construction of plants and facilities in which byproduct and special nuclear materials are used and possessed. Supplementary information provided in 44 FR 50018 indicates that the NRC staff believed that "commencement of construction of plants/facilities utilizing special nuclear and byproduct material may also result in irreversible and irretrievable commitments of resources and, therefore, that it would be desirable and necessary that a final environmental impact statement be completed and documented before authorizing commencement of construction." Nowhere in the draft GEIS section 15.4 (Irreversible and Irretrievable Commitments of Resources) is justification provided for such a finding by the NRC.

Proposed NRC regulations would extend the desire to error on the side of caution beyond a reasonable limit. For example, the draft GEIS indicates that an "irreversible commitment" generally concerns changes set in motion by a proposed action which at some later time could not be altered to restore the present order of environmental resources. Clearly, the mere commencement of construction of a facility which eventually will be licensed to handle special nuclear and byproduct materials would not irreversibly set actions in motion preventing restoration of a useful environmental resource. The proposed regulation, therefore, would unnecessarily prevent commencement of construction of a specific facility based on mere estimations that construction alone pushes the resources to a point of irreversibility. Frequently, the only commitment of resources that is irretrievable is the risk capital invested by the applicant. Such business risks should not be disallowed categorically by regulation.

The draft GEIS acknowledges that "most of the materials used in construction could be recovered" and that relatively small quantities of asbestos, chromium, manganese and zinc are actually committed in the construction phase (GEIS, section 15.4.3.1) (emphasis supplied). Thus, to delay actual commencement of construction of a facility which will be licensed to handle special nuclear and byproduct materials, as defined in 10 CFR Sections 30 and 70, until completion of a final environmental impact statement, would be unnecessarily dilatory if based solely on the criteria that such commencement would lead to an irreversible and irretrievable commitment of resources.

Section 150.31 Requirements for Agreement State Regulation of Byproduct Material.

New proposed section 150.31 is taken directly from section 274(o) of the Atomic Energy Act, as amended by section 204(e) of the UMTRCA. While the proposed regulatory language of this new section (10 CFR 150.31) is expressly taken from the UMTRCA as enacted, one point deserves clarification.

New section 150.31(a) would require that after November 8, 1981, in the licensing and regulation of byproduct material, or any activity which results in the production of such byproduct material, an agreement state shall require compliance with requirements established by the Commission pertaining to ownership of such byproduct material and disposal sites for such material. These requirements (i.e., as delineated in the Atomic Energy Act of 1954 section 83, as amended by the UMTRCA) set forth provisions requiring the transfer of ownership of the byproduct material to the government (federal or state) for any license issued or renewed after November 8, 1981. It is clear from the statutory language that Congress intended the ownership of such byproduct material to be based on the necessity of protecting the public health, safety or welfare or to minimize or eliminate danger to life or property (see Atomic Energy Act of 1954, section 83(b) as amended). In this regard, the Atomic Energy Act would provide for private ownership of such lands if the Commission determines it is not necessary for government control of such property (see Atomic Energy Act, Section 83, as amended).

New section 150.31 fails to clearly set forth the requirements pertaining to long-term ownership of disposal areas. The private sector should not be precluded from ownership of such territories provided the proper standards are upheld. To absolutely require through proposed section 150.31 federal or state government ownership of land used for the disposal of byproduct material would be contrary to the express language of the UMTRCA, section 202. Proposed section 150.31, as well as other NRC proposed sections pertaining to site ownership, should be reworded to come into conformity with the clear language of the authorizing statute (UMTRCA).

Definitions to Part 170.3

RME suggests that for continuity of regulation, the NRC incorporate one consistent definition of "byproduct material" throughout the regulations.

Final regulation to 10 CFR 40.4(a-1) indicates "byproduct material" to mean:

> §40.4 Definitions.
>
> (a-1) "Byproduct Material" means the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by such solution extraction operations do not constitute "byproduct material" within this definition.

Proposed regulation to 10 CFR 170.3 indicates "byproduct material" to mean:

> §170.3 Definitions.
>
> As used in this part:
> (a) "Byproduct material" means (1) any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material; or (2) the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by such solution extraction operations do not constitute "byproduct material" within this definition.

No reasonable justification has been expressed in the GEIS nor the proposed/final regulations issued by the NRC for the difference in the "byproduct material" definition. Again, for continuity of regulation by the NRC, RME suggests that these definitions be revised, and all occurrences of this definition should contain, at a minimum, the exact language specified in the Uranium Mill Tailings Radiation Control Act (1978), Section 201.

Sections 170.31 and 170.32--License and Inspection Fees.

RME believes the proposed schedule of fees for tailings and wastes byproduct material unreasonable. NRC has previously reviewed and regulated without specific jurisdiction tailing and waste systems in association with source material license applications, amendments and renewals. RME finds no justification for a high license fee applicable to costs of the NRC licensing process which were previously covered under the existing fee structure. The intensity of review of the tailing and waste systems should not expand extensively beyond that experienced by recently licensed operators.

Similarly, the inspection fees proposed under 10 CFR 170.324.D are duplicative since NRC inspectors for source material licenses have routinely inspected tailing and waste systems in the past.

Section 209 of the Uranium Mill Tailings Radiation Control Act (1978) requires the NRC to consolidate licenses and procedures. The fee structure proposed in 10 CFR 170.31 fails to meet this statutory requirement.

RME recommends that the proposed fee structure be significantly altered to recognize the actual processing of licenses and inspection practices. RME further notes that virtually the only circumstance warranting a new fee structure is a possible custom waste disposal operation, not directly associated with a licensed source material producer. The structure of the proposed fees is also objectionable because it would make a renewal as expensive as a new license; RME believes this to be inappropriate. The proposed fee schedule indicates that the NRC intends to execute environmental and safety analyses for renewals with the same degree of intensity as for new operations, with the likelihood of second and third generation environmental impact statements. Such a process is uncalled for and not an appropriate application of the NEPA process, since subsequent and repeated rigorous environmental reviews should not take place without just cause. A renewal of a license for an existing operation is not just cause for reexamination of the operation unless substantive operational changes potentially affecting the quality of the environment are proposed by the licensee simultaneously with the license renewal request.

NRC assumption that all tailing and wastes are hazardous.

In the Generic Environmental Impact Statement--Uranium Milling (NUREG--0511) and the resulting regulatory proposals and final rules (44 FR 50012), NRC fails to recognize that some tailings and wastes are not hazardous and therefore do not require strong protective design measures for their disposal. These nonhazardous materials do not require the application of a set of stringent regulations as set forth in the proposed NRC regulations.

Should overly constraining regulations be applied to nonhazardous materials, the effect may be counterproductive with regard to improved protection of the general public and the environment, and certainly could lead to unnecessary expenditures of public and private monies and other valuable resources. Such rules will stifle many potentially viable and environmentally advantageous technologies that otherwise could be developed.

It is commonly recognized that tailings from uranium mills consist of a gradation of particle sizes. The smaller particles typically contain the major percentage of the potentially harmful radionuclides. Furthermore, the mass of the small particle fraction is a minor percentage of the overall mass of tailings. This set of circumstances is particularly true with uranium ores from sandstone environments. These facts lead to a potential for reducing the volume of hazardous wastes, that must be protected and isolated, by treating or fractionating the tailings. It would not be unusual to find that only 10 to 25 percent of the total tails would contain 90 percent or more of the mass of radionuclides. The large volume remaining would consist of the host mineral with only minor concentrations of radionuclides. The larger volume, should suitably low concentrations of radionuclides be achieved, could fall into a nonhazardous category.

The advantages of such a possible disposal plan are reduction in volume of the hazardous waste and the resulting reduction in area and volume required to dispose of such wastes, a smaller area requiring long-term isolation and restrictions on land use and potentially reduced disposal costs.

The proposed regulations, however, establish a clear disincentive for developing or proposing such programs. The industry would find no advantage to improving disposal practices by such innovative methods if the NRC did not recognize a distinction in the degree of risk of various byproduct materials. Future state-of-the-art disposal processes may well be foreclosed by narrowly drafted regulations which impede the industry from developing new disposal techniques.

RME believes that although Congress has established the definition of "byproduct materials" to include tailings and wastes from source material processing operations, Congress did not require that a single set of standards apply to all such materials. Moreover, the UMTRCA, Section 206, requires EPA to set health and environmental standards for mill tailings (Section 275 of the Atomic Energy Act). It is clear that Congress intended standards to be developed based upon assessed risk, and that certain levels of radionuclide content would be declared by such standards as below levels recognized as hazardous. NRC, in turn, would then be obliged to recognize the distinction established by EPA with respect to the degree of risk or hazard associated with various types of wastes or specific radionuclides.

As required under the UMTRCA, NRC should tailor its implementing regulatory program to prospective EPA standards, once the EPA standards are promulgated. The present NRC regulatory program is premature and out of the logical regulatory development schedule established by Congress.

EPA has the responsibility for health and environmental standards relating to uranium mill tailings (see Atomic Energy Act (1954) Section 275). EPA's definition of hazardous radioactivity levels for Ra-226, in mining wastes under the Resource Conservation and Recovery Act should be consistent with a hazardous waste concentration cutoff for Ra-226 in uranium mill tailings. Such logic must also prevail for other radionuclides and nonradiological parameters regarding uranium mill tailings. Nonradiological hazards should be firmly grounded and defined based upon scientific evidence of hazard and risk, similar to the basis of standards in RCRA.

RME should not be interpreted as supporting the previously proposed EPA limit of 5pCi Ra-226/gram however. RME believes, as stated in testimony to EPA during the RCRA comment period, that the 5pCi/gm level is too low, given normal background Ra-226 levels and the low associated health risks.

Furthermore, it is RME's belief that standards of protection (or Criteria) ultimately developed by NRC to apply to existing noncommingled or planned tailing systems should not be more stringent than standards of protection applied to the remedial action programs for abandoned tailings or for commingled tailings. The levels of risk should dictate the nature of the response regardless of the origin or current status of the tailings. This, of course, requires that the Secretary of Energy's determination as to what constitutes <u>radioactive</u> "residual radioactive material," Section 101(7) UMTRCA, should be consistent with EPA definitions of, and NRC subsequent regulations regarding "byproduct" wastes and tailings. To do otherwise is to build a dichotomy of responsibility for similar materials between the public sector and private enterprise.

RME recommends, based upon the foregoing analysis, that the Nuclear Regulatory Commission withdraw the proposed rulemaking of August 24, 1979 involving specific "byproduct tailing and waste" licensing and the related requirements for specific licenses, particularly those contained in Sections 40.31, 40.32, and Appendix A to Part 40 of Title 10. A redrafting of these regulations is in order only following EPA promulgation of health and environmental standards. The redraft should then recognize either exemptions from the need for specific licenses for those byproduct materials declared nonhazardous by EPA standards or should provide for protection of wastes only insofar as the standards of protection are related to real and established risks or hazards.

Licensing procedures.

The early promulgation of a general license for "byproduct material (tailings and waste)" by NRC is applauded. The proposed licensing procedures for "byproduct" tailings and wastes, however, are not considered to be efficiently designed, nor are they in conformance with the authority provided under Section 209 of UMTRCA (1978) which requires that NRC "shall consolidate, to the maximum extent practicable, licenses and licensing procedures" under amendments made by UMTRCA.

Specifically, greater clarity is requested in section 40.31 to avoid a dual mechanism for licensing (1) "byproduct" tailings and wastes and (2) source materials. Prior to enactment of UMTRCA, the NRC has regulated and licensed "byproduct" mill tailings in the past through the mechanism of the source material license. RME believes that such a mechanism can easily continue, without establishing any complicating factors such as the license fee, license application, environmental assessment and potentially a separate environmental impact statement. The Congress clearly intended to avoid this type of bureaucratic duplication through passage of Section 209.

RME believes that it should be NRC's responsibility to specifically notify all holders of general licenses for byproduct materials of any deficiencies in their tailing and waste management systems, pointing out particular matters that are not deemed to comply with final regulations, once the regulations are promulgated. Until such notification, general license holders should not be required to initiate any "specific license" procedures. Either the "general byproduct materials" license or their effective source materials license should be utilized as the mechanism for continued legal operation.

If full compliance is not already effective, it is recommended that amendments to the source material license be the mechanism for compliance, rather than creating an entirely new "specific license" procedure. This proposal should extend to all new license applicants for source materials as well as existing licenses. Only in the case of a custom "byproduct" tailing or waste disposal operation, one that is <u>not</u> associated with a source material producer, should the mechanism of a "specific byproduct materials" license be established or used.

RME believes that the above-described licensing procedure should be implemented by the NRC to encompass newly enacted NRC authority over tailings and wastes in both agreement and non-agreement state circumstances. The net effect will be an improved licensing process, with less potential for duplication of efforts in the NRC, the industry and the public. The process will also conform to Congressional direction stated in the Uranium Mill Tailings Radiatior Control Act, Section 209.

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IV. DRAFT GENERIC ENVIRONMENTAL IMPACT STATEMENT ON URANIUM MILLING (NUREG-0511)-- RME COMMENTS

CHAPTER FOUR

Environment of the Model Region

Comment

The model mill is located in a hypothetical model region described in the GEIS. The model region, similar to the model mill, is an inadequate base upon which to develop a regulatory program for the uranium industry. The model region which can only approximately represent a New Mexico setting, ignores the future. Many diverse environments may someday have a uranium mining and milling industry, perhaps not as large as the mill clusters described in Chapter 5 (GEIS) but nevertheless requiring a soundly developed regulatory program.

If one studies published geologic data regarding known occurrences of uranium, it soon becomes obvious that the historical western setting for this industry is not the only potential setting. Other areas, such as the Pacific Northwest, Alaska, New England, the Great Lakes and areas of the Southeast U.S. all contain potential for uranium development.

The supporting supplement to the GEIS entitled "Descriptions of United States Uranium Resource Areas: A Supplement to the Generic Environmental Impact Statement on Uranium Milling Operations" (NUREG/CR-0597), similar to its reflection in the GEIS (NUREG-0511), is short-sighted in that these nonhistorical uranium areas are not adequately described. The regulatory program that results from the GEIS must not be narrowly defined and based upon an unduly restricted view of the environmental setting for milling operations. The result could easily be that the NRC and agreement states would attempt to apply conclusions from the GEIS that are totally inappropriate.

Recommendation

NRC should redraft the GEIS to reflect the potential of placing a uranium milling operation virtually anywhere. This would require that the recommended regulatory program be stated in terms of goals, objectives and standards of performance, as well as a carefully considered set of mill and waste siting criteria. Statements of preferred technologies and methods would, of necessity, have to be eliminated. This is as it should be, except by way of demonstrating that technologies do exist for achieving the goals.

CHAPTER FIVE

Model Mill

Comment

The concept of a model mill, as utilized in the GEIS, is not useful and instead of clarifying a complex situation, has resulted in oversimplification and erroneous projections and conclusions. The model mill is not a model at all, but a narrowly defined and outdated representation of an industry that is diverse and complex. The model mill is unrealistic, particularly when it is replicated time after time in developing cumulative projections of environmental, social or health impacts.

The effluent and environmental controls of the model are outdated and do not reflect controls applied on any operation licensed in the last several years, particularly those that have been reviewed through preoperational site specific NEPA analysis.

Perhaps the most damaging result of utilizing a single definition for the model that is to represent the industry, is that regulatory proposals result that are not founded upon fact, but illusion. The regulations, therefore, become too technology oriented rather than goal oriented, and actually result in constraining future innovation in environmental and processing improvements, rather than promoting such improvements.

A generally improved approach that would have been more reflective of the uranium milling industry would have been to describe the present industry through information gathered from the industry. A more reasonable analysis would: (1) Describe the numerous variations in technology; (2) Categorize the industry by means of ranges in operating characteristics; (3) Survey the plans for the future to describe the emerging technologies relating to mill grades, ore through-puts and potential new processes for effluent and waste control.

Had this broad description of the industry been made, it would have been clear that a model mill could not be defined.

The impacts of the model mill and mill clusters are assessed based upon 0.16% ore grade with 0.15% through the year 2000. This is not realistic. To utilize a uniform grade does not recognize the occassional very good ores $\geq$ 0.75%, nor does it allow for the 0.02-0.03% ores that may be processed in very large operations utilizing unconventional technologies such as heap leach, vat leach or others.

The resulting impact assessment is consequently incorrectly stated based upon a leveling of true variation in the industry.

The model mill is described at a 2,000 tpd operation. Currently planned new operations are ranging from 500 tpd up to 10,000 tpd, with conceivable operations of greater size if regional tolling mills are built. These facts and potentialities should not be ignored for they dramatically influence the projected impacts and resulting recommended programs for industry regulation. For example, the existence of a few very large mills could quickly invalidate model mill cluster projections.

The long range production forecasts for uranium production are overstated in the GEIS (Chapter 3). The estimated electricity generating capacity from nuclear power is apparently taken from the high range provided by DOE (Section 3.1), and does not reflect the downward trends noted in 1978 and expected to be forthcoming in 1979.

Recommendation

As with the preceding comments on the fictitious model region, the model mill is a concept of only very limited application. For most purposes in a GEIS for uranium milling, it has not proven to be useful, and has resulted in inaccurate projections of impacts.

In the redrafting of the GEIS, RME believes and recommends that the model mill must either be deleted or altered to reflect the diversity of the industry, both present and future.

CHAPTER SIX

Environmental Impacts

Regional Population Exposures

Section 6.2.8.2.5, Regional Population Exposures, provides that "annual population dose commitments...are based on a one-year period of exposure to concentrations in environmental media calculated to exist during the 15th year of continuous operation of the model mill. This is the year when environmental concentrations resulting from releases during mill operation will be at their highest values. Annual population dose commitments resulting from exposure to these concentrations therefore represent the highest levels of such doses resulting from any single one-year exposure period. However, population dose commitments resulting from both previous and future exposure years are smaller and would remain uncalculated."

"Total regional radiological impacts from operation of the model mill for 15 years are estimated by multiplying the annual environmental dose commitments by 15." (p. 6-40)

Comment

The methods used for these calculations provide another striking example of the multiplicity of "conservative" (unrealistically high) assumptions used throughout the GEIS.

These statements demonstrate the fact that the 15-year population dose commitments from mill operations were calculated as though the exposure rates throughout the life of the mill were always equal to the highest annual exposure rates, i.e. during the final year of mill operation. However, several exposure pathways initially contribute almost no exposure but gradually increase during the operating life of the mill. For example, external exposure rates from windblown dust deposited on the ground would increase almost linearly with time.

"The short-lived daughters of Rn-222 are responsible for essentially all of the external doses, and all of the inhalation dose to the bronchial epithelium. Short-lived Rn-222 daughters continue to yield significant external doses from ground surface concentrations even beyond mill shutdown because they grow in from deposited Ra-226 (the radon produced from deposited Ra-226 is assumed to remain trapped in ground surface particulates)." (See p. 6-38.)

It should be apparent that ground deposition of Ra-226 from windblown tailings and ore dust will increase during the life of the mill. Furthermore, the radon emission rate from the tailings pile will increase with total quantity of tailings and exposed area of the tailings pile. The degree to which the tailings have dried out, also assumed in the GEIS to increase with time, also affects the radon emission rate. Consequently, the deposition of radon decay products, as well as that of Ra-226, changes throughout the operating life of the mill.

Another factor in the overestimation of population dose is the assumption that all radon produced from deposited Ra-226 is assumed to remain trapped in ground surface particulates. Elsewhere (p. G-11) an emanating power of 0.20 is assumed. If the physical and chemical characteristics of the windblown particulates are the same as those of the parent tailings, only 80% of the radon should be assumed to be retained in ground surface particulates.

Calculational procedures for predicting concentrations of radionuclides in environmental media are given in Appendix G-18. A deposition velocity of 0.003 m/sec is listed for radon progeny (Table G-3.1, p. G-19). However, it is not clear that deposition of radon daughters was actually computed, as indicated by the following:

"For radon gas releases, ingrowth and decay of daughter radionuclides during atmospheric transport is accounted for explicitly using the standard Bateman formulation. Decay of radon itself during transit is also accounted for. However, deposition losses of ingrown particulate radon daughters are not treated." (p. 6-25)

Such contradictions between statements in the text of the GEIS and the supporting appendices preclude any direct verification of the population dose commitments presented.

Recommendation

It is imperative that the analysis of population dose commitments in the GEIS be consistent and explicit in the assumptions made. To avoid the gross over-conservatism found in the dose estimates, it is recommended that a time-weighted average of environmental concentrations for calculation of population doses and environmental dose commitment factors be used.

CHAPTER ELEVEN

Monetary Costs of Alternatives

General

The approach to costing tailings disposal alternatives used in the GEIS generally: (1) understates costs, and (2) does not adequately consider existing and potential site specific cost variances. The generic approach may have illustrative value but should not be used to reach conclusions on relative merits of disposal alternatives. Instead, once performance standards are agreed upon, each site should be examined individually to determine all possible site specific disposal options and to cost these options and evaluate economic impacts on a project-by-project basis. Such a site specific approach implies clearer benefit/cost guidelines than established by the NRC to date.

In risk analysis, the NRC should: (1) attempt dollar quantification of health risks, and (2) compare risk levels and benefit/cost effectiveness of regulation in the nuclear fuel cycle to that of existing energy generation alternatives. Such a cross-fuels comparison would probably reveal that risk from nuclear is among the lowest of any energy option and that the expenditures on control per unit of risk is much higher for nuclear, which means that the incremental cost effectiveness of regulation in the nuclear industry is lower than in fossil fuels industries. Consumer resources expended on risk reduction should be directed to the most cost effective area, which probably is not nuclear.

Specific

Grade and Production Scale

New surface mines and mills have recently been opened and are being planned at average grades of 0.08% U_3O_8 and below. Reserves at these grades may be no more than 4-6 million pounds. These values compare to 0.15% and about 30 million pounds for the model mill. Production rates may actually average only 0.5 million pounds per year instead of about 2.0 million pounds assumed for the model mill.

Mines in these lower grade, production, and reserve ranges will, of course, be economically more marginal than a "model mill" type operation. Consequently, economic impacts of more stringent tailings disposal requirements will be more adverse than for larger scale operations. The NRC states (p. 12-16) that subgrade disposal will be reasonably economic on a project specific basis. RME does not believe this will prove true for smaller operations. Clearly, economic hardships must be examined on a project-by-project basis; gross generic conclusions concerning the economic efficacy of subgrade disposal are inappropriate.

Opportunity Costs

Any increment in production cost and any increase in time requirements for licensing will delay startup of new uranium mines, particularly for economically marginal deposits. The sum of such delaying impacts could become sufficiently onerous to ultimately postpone installation of some amount of new nuclear electricity generation capacity. This implies that fossil fuels would be substituted for nuclear, probably at a significantly higher cost to the consumers. This cost can be considered the opportunity cost of delaying uranium development because of imposition of more stringent disposal and reclamation demands. Opportunity cost of the NRC requirements, therefore, could potentially be very large. The NRC should address this issue and attempt to quantify its dimensions.

Inflation and Discounting

Inflation and the time value of money were ignored in the GEIS analysis. However, these represent vital economic considerations for any investor in mining. The NRC should routinely include these issues when analyzing site specific disposal alternatives.

Benefit/Cost Analysis Approach

The NRC makes no attempt to economically quantify the health benefits associated with the tailings disposal alternatives. While it may be distasteful to quantify health risk in dollar terms, it is impossible to make a meaningful Benefit/Cost comparison of the disposal options without stating the benefits in the same units as the costs. Also, without this effort, it is impossible for mining investors to understand the economic limits the NRC may impose during site specific selection of a disposal alternative. Without a clear understanding of likely costs of compliance, it will be difficult for miners to evaluate the overall economics of prospective new projects.

Aside from attempting direct dollar measurement of health effects, another approach to evaluating risk is to examine actual risks currently accepted by society. Presumably, if a proposed activity would generate risk substantially less than levels already accepted by society for alternative activities, it is in some manner "acceptable." This reasoning would not necessarily hold, however, if the proposed activity represents an increment to existing risk. Most people agree there is no readily usable means of determining "acceptable" increments of risk. In the long term, the amount of incremental risk deemed acceptable will most likely be determined by general economic necessity.

Nuclear, however, does represent alternative risk to fossil fuel usage. A difficulty in evaluating risk alternatives is establishment of measurement units useful for cross-activity comparisons. One approach is found in "Accidents and Unscheduled Events Associated with Non-Nuclear Energy Resources and Technology" by the EPA (February 1977). This report shows that electricity generation by fossil fuels incurs quite high fatality and injury rates per megawatt of electricity. For a 1,000 megawatt power plant the estimate is:

	Coal		Crude Oil			Natural Gas
	Deep	Surface	Onshore	Offshore	Import	
Fatalities	4.00	2.64	0.35	0.35	0.06	0.20
Injuries	112.30	41.20	32.30	32.30	5.70	18.30

This data, however, relates to industrial accident rates. The major issue with nuclear involves public risk through radiation, which would be comparable to public risk through pollution from fossil fuels usage.

An article which addresses total risk, public as well as industrial, is "Risk with Energy from Conventional and Non-Conventional Sources" by Herbert Inhaber (Science, February 23, 1979). The article concludes that total risk among existing energy sources is lowest for natural gas followed closely by nuclear. Risk from coal and oil usage is on the order of 300 times as great as nuclear, largely because of public risks from pollution. Occupational risk from less conventional resources, including solar, is high; total risk from non-conventional sources is estimated to be on the order of 100 times that of nuclear. The estimate basis used was total man-days lost through death, accident, or related illness.

Conclusion

RME recommends that the NRC conduct a cross-energy risk comparison analysis, the purpose of which is to reveal the relative risk of any component of the nuclear fuel cycle compared to other energy generation options. Such an analysis would point out that the expenditures on control per unit of risk are much greater in nuclear than in other energy alternatives, while the relative risk from nuclear is far less.

APPENDIX K

Detailed Costs of Mitigating Alternatives

General

The selection of unit cost assumptions in the GEIS underscores the inadequacy of the generic approach. In general, the selected cost values are in the low range of actual industry experience, particularly in regard to earth-moving, haulage, compacting, etc. "Average" industry costs of implementing the alternatives may well be 50% or more (1978 dollars). There are indications that some prospective new mining sites would incur costs as much as twice as great as assumed in the GEIS. Clearly, no conclusions on disposal alternatives should be made on the basis of implied GEIS economics, but rather each site should be independently evaluated.

Also, the GEIS does not adequately consider land costs associated with tailings disposal. These costs may well be significant as RME's operating experience indicates. Exhibit I, attached, details comments on specific sections of Appendix K.

EXHIBIT I

GEIS

COSTS - APPENDIX K

Item	GEIS Ref.	GEIS Estimate	Comment
	K-1		
Water Spray	1.1	$11,800/yr.	(1) More than 3MM/day may be needed in areas or periods of high evaporation. (2) Capital underestimated - instead of $38,000 may cost $75,000-$150,000.
Windblock	1.2	$52,000	(1) Cost and feasibility related to wind force. (2) Maintenance cost needed. (?)
	3.0		Transporation costs and environmental risks of hauling slurry inadequately considered.
Tailings Slope Watering	4.0	$30,000/yr.	(1) Watering requirements will vary site to site and season to season more or less than 0.3 CM/day. (2) Truck cost more likely to be $150,000 instead of $56,000.
	K-3		
Removal and Compaction of 0.6M of topsoil	Par-1	$0.80/M	Probably ranges over $0.80-$1.30/M.
Preparation and Installation of Clay Liner	Par-3	$1.30/M	Probably ranges over $1.30-$2.50/M.
	K-4		
Table K-4.1 Unit Costs	Table 4.1	as given	Many "Selected Values" for unit costs are probably at low end of industry experience upper range in 1978 probably 50-100% highe Consequently, the costing of alternatives is not representative of industry costs.

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CHAPTER TWELVE

Proposed Regulatory Actions

Technical Siting and Design Requirements

Section 12.2.1 provides that "cover material must not include mine waste or rock that contains elevated levels of radium: overburden and soils used for cover must be essentially the same, as far as radioactivity is concerned, as surrounding soils."

Comment

There is presently no guideline or definition of "elevated levels of radium." The proposed EPA guideline for hazardous waste materials recommends a level of 5pCi/gm of Radium-226. Based on a recent study of variability associated with analytical techniques for soil with Radium-226 averaging 5pCi/g (see attached results), the standard deviations ranged from 1.5 to 4.3 pCi/gm. It is apparent that present analytical methods are not capable of determining such low levels of Radium-226 with any statistical significance and/or confidence.

Recommendation

It is recommended that a value of at least 10pCi/g of Ra-226 on the basis of an area weighted average, be used to define elevated levels of Radium. This value is conservative when considering that the attached analytical study performed for the Wyoming Department of Environmental Quality demonstrates a value of 20pCi/gm of Radium-226 will result in a maximum dose of 20 mrem/year, based on grazing being the historical and projected land use in most areas of uranium mining and milling.

POOR ORIGINAL

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Analytical Study of Radium in Soil Samples

Radium-226, pCi/gram

Sample No.	A	B	C	D	E	F	G	H	I	J	Mean	Standard Deviation
	Laboratory Designation											
1	5.5 ± 0.2	2.48 ± 0.05	8.6 ± 2.5	1.64 ± 0.45	0.00 ± 0.02	1.05 ± 0.28	1.72 ± .04	2.0 ± .25	2.83 ± .69	3.3 ± 1.7	2.91	± 2.4
2	7.1 ± 1.3	2.10 ± 0.05	7.9 ± 2.3	1.40 ± 0.46	0.45 ± 0.01	1.08 ± 0.27	1.57 ± .03	2.2 ± .25	2.02 ± .61	2.7 ± 1.6	2.85	± 2.5
3	8.7 ± 0.9	5.33 ± 0.12	9.2 ± 2.7	3.46 ± 0.62	2.2 ± 0.1	6.44 ± 0.71	2.14 ± .04	4.9 ± .38	5.59 ± .92	5.1 ± 2.1	5.31	± 2.3
4	14.6 ± 0.3	8.9 ± 0.2	16.6 ± 4.8	6.85 ± 0.80	3.9 ± 0.1	9.74 ± 0.81	3.94 ± .06	8.4 ± .50	10.01 ± 1.19	6.6 ± 2.5	8.95	± 4.1
5	7.8 ± 0.5	2.86 ± 0.06	8.2 ± 2.4	1.94 ± 0.52	1.3 ± 0.1	1.54 ± 0.36	2.16 ± .04	2.8 ± .30	2.22 ± .63	1.3 ± 1.3	3.21	± 2.5
6	10.1 ± 1.5	2.45 ± 0.06	10.4 ± 3.0	2.59 ± 0.56	2.0 ± 0.1	3.45 ± 0.50	3.01 ± .05	4.3 ± .36	4.34 ± .82	4.5 ± 1.9	4.72	± 3.0
7	5.1 ± 0.4	3.94 ± 0.08	5.9 ± 1.7	2.01 ± 0.49	1.1 ± 0.1	2.27 ± 0.41	1.86 ± .04	2.3 ± .27	2.97 ± .71	2.5 ± 1.5	3.00	± 1.5
8	6.4 ± 0.6	3.31 ± 0.07	5.4 ± 1.6	2.38 ± 0.46	0.41 ± 0.01	1.82 ± 0.36	2.58 ± .05	3.0 ± .30	3.24 ± .73	2.7 ± 1.7	3.12	± 1.7
9	11.7 ± 1.7	9.1 ± 0.2	11.7 ± 3.4	6.78 ± 0.78	1.0 ± 0.1	1.12 ± 0.30	2.67 ± .05	9.3 ± .53	8.98 ± 1.13	11.4 ± 2.8	7.38	± 4.2
10	13.5 ± 1.4	13.1 ± 0.2	16.2 ± 4.7	9.74 ± 0.88	6.8 ± 0.1	7.40 ± 0.72	9.86 ± .11	12.3 ± .61	12.59 ± 1.32	14.4 ± 3.2	11.59	± 3.0

Participating Laboratories: 2 Government
3 Commercial
5 Company

May 7, 1979

Sample Preparation

Samples were dried at 105° C to a constant weight. Organic material such as twigs, leaves and roots was removed. No large rocks were included when the samples were received. Small stones (1/4" diameter and smaller) were included as part of the sample when present.

Since these samples were relatively small samples at the time of collection (250-500 grams), the customary steps of successive size-reduction accompanied by splitting and blending prior to pulverizing was omitted. The entire sample was pulverized in a Braun pulverizer and passed through a U.S. standard testing sieve, No. 200. Each pulverized sample was carefully blended in a bottle blender prior to withdrawing the individual pulps which were distributed for assay.

Reporting of Results

This test is basically a test of precision, i.e., the ability of individual laboratories to assay the same sample. No attempt was made to quantify the radium content of the samples prior to distribution, although a lot of effort was spent trying to make sure the samples were carefully blended and split. Results are reported in tabular form as the laboratories reported to us.

One additional column shows the statistical mean and the standard deviation from statistical mean. Only the reported value was used in calculating the mean; the reported deviation was not considered. A Hewlett-Packard calculator was used to calculate the $\bar{x}$ and S, the formula for this being:

$$\sigma = \sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n-1}} \qquad \bar{x} = \frac{\Sigma x}{n}$$

CHAPTER TWELVE

Proposed Regulatory Actions

Control of Radon to Background Levels

Section 12.3.3.2 provides that "the level of $2pCi/m^2$-sec was selected over other comparable control levels (such as 1 or 3-$5pCi/m^2$-sec) because this level appears best to meet the objective of reducing fluxes to levels which are within the range occurring naturally from soils."

Comment

There appears to be no rational basis for the choice of $2pCi/m^2$-sec above background as the allowable flux over reclaimed tailings sites. This flux limit is neither achievable nor is it within the good faith of the principle.

On the basis of variabilities seen in the environs of uranium milling as well as variations in analytical determination of Rn-222 flux, present analytical technology and methodology for determining Radon-222 flux are inadequate for such fine distinctions as between a background flux of $1pCi/m^2$-sec and $3pCi/m^2$-sec, representing $2pCi/m^2$-sec above background.

There is inconsistency between the recommendations: the Environmental Protection Agency's recommendations of 5pCi/gm of Ra-226 in waste rock as proposed in the Resource Conservation and Recovery Act and the proposed flux limit of $2pCi/m^2$-sec over tailings disposal areas.

Assuming a mining/milling company uses overburden and topsoil material having an average of 5pCi/gm of Radium-226 to cover open pit areas, the Rn-222 flux solely as a result of cover material over these reclaimed overburden sites would be approximately $5pCi/m^2$-sec. If this material, at a depth of 3 meters, covers material having a Radium-226 concentration of from 5pCi/gm to 200pCi/gm the Rn-222 flux would be $3.5pCi/m^2$-sec to $10pCi/m^2$-sec respectively. It is entirely possible therefore that the flux in the surrounding reclaimed mined area will be greater than that allowable over the tailings disposal area.

The limit of $2pCi/m^2$-sec for Rn-222 flux over reclaimed tailings disposal sites, is in part based on the scenario of houses being built on reclaimed areas. Based on the historical and projected locations of uranium mines and mills, and the availability of water for housing development in these areas, the possibility of housing in these locations is indeed remote. Furthermore, the best prior land use for most areas has been established as grazing.

In lieu of housing being developed on tailings disposal areas, the radioisotope of concern becomes Radium-226, rather than Rn-222 with potential exposure pathways to people through ingestion of Radium-226 via food chains. A detailed analytical report performed for the Wyoming Department of Environmental Quality indicates that 20pCi/gm of Radium-226 in the upper six feet of cover (rooting depth) will produce a maximum dose of 20 mrem/year to a child eating meat and drinking milk from cattle grazing on such an area.

Recommendation

Any proposed limit on Rn-flux should be based on an area weighted average over the entire tailings disposal area.

On the basis of the above-cited inconsistencies which will occur as a result of implementation of both EPA and NRC regulations, as well as the prior best use of land areas in projected uranium mining and milling locations, RME recommends that the Rn-222 flux of proposed cover material available on site for reclamation be used to establish the background flux for tailing disposal areas.

RME would also recommend that other goals or objectives for radiation control from tailings should be considered such as dose limits, radium in soil concentrations or other mechanisms.

CHAPTER TWELVE

Proposed Regulatory Actions

Long-Term Uncertainties and Cost-Benefit Balancing

Section 12.3.3.6 indicates that "the staff considered, but decided it would not be reasonable, to attempt to making a fully 'monetized' balancing of costs and benefits in recommending the proposed limits on radon attenuation, which is a very long-term problem."

Comment

By Executive Order number 10244, it is mandated that agencies review the economic impact of proposed regulations. Based on the proposed regulations of 2pCi/m^2-sec of Rn-222 flux from reclaimed tailings disposal areas in addition to the idea that cover material not include mine waste or rock that contains "elevated levels of radium," an enhanced financial burden on the uranium mining industry is foreseen in hauling cover material.

It is, therefore, necessary that NRC thoroughly justify and identify the economic impact of this proposed control since it is used in a proposed regulation.

APPENDIX G

Section 3.2--Radon

Comment

The flux from tailings assumed in the calculation of 1pCi radon 222/m^2-sec/pCi radium 226/gram in soil of $4.7 \times 10^{-2} cm^2$/sec is not consistent with that reported in Appendix P of $1 \times 10^{-2} cm^2$/sec. Using $1 \times 10^{-2} cm^2$ per sec to determine the flux of radon 222 off of the tailings area, per 1pCi radium 226 per gram of soil, the flux is 0.46pCi per m^2/sec rather than 1pCi per m^2/sec.

Recommendation

There needs to be both consistency and justification of the values used within the GEIS.

APPENDIX G

Section G-3, 4 and 5

Comment

The values for yield density (Y_v) of 0.75 kg per m^2 and the value of feed ingestion rate (Q) of 50 kg per day appear to be much too high for the Steppe deserts of the West. The State of Wyoming, for example, estimates an average yield density of 0.22 kg per m^2 with 20 inches of rainfall and a feed ingestion rate of 30 lbs. per day for both range cattle and feed cattle.

APPENDIX G

Table G-3.2--Environmental Transfer Coefficients

Comment

The Environmental Transfer Coefficients given in Table G-3.2 differ significantly from those used in the U.S. NRC Draft Regulatory Guide, Task RH 802-4 (1979).

Recommendation

There needs to be consistency in the values used for various U.S. NRC documents. However, beyond consistency, the values must reflect the most accurate scientifically accepted information available.

APPENDIX G

Appendix G-1.1--Inhalation Dose Conversion Factors for Particulates

Section 1.1 of Appendix G-5 provides that "...these dose conversion factors have been computed by Argonne National Laboratory's UDAD computer code in accordance with the Task Group Lung model (TGLM) of the International Commission on Radiological Protection."

Comment

Atmospheric concentrations and size distributions of airborne particles must be known in order to calculate potential inhalation exposures. The calculation of inhalation doses presented in the GEIS is stated to be based on the recommendations of the ICRP Task Group on Lung Dynamics (p. G-41). However, the estimation of source terms for airborne particulates presented in Appendix G-1 appears to have ignored some of the pertinent advice and information presented by the TGLD:

> "Dusts must be treated as distributions. A review of the literature points out the prevalence, importance and utility of the log-normal distribution; therefore, it will be presumed applicable for all dusts." (TGLD, 1966, p. 175)

The ICRP Task Group on Lung Dynamics (1966) provided a detailed discussion of the relationship between count median aerodynamic diameter (CMAD) and mass median aerodynamic diameter (MMAD). The deposition fractions for inhaled particles are based on MMADs. If it is assumed that the radioactivity is uniformly distributed in the mass of all particles from a given source, then the activity median aerodynamic diameter (AMAD) will be the same as the MMAD. The most recent revision of the ICRP lung model (ICRP-30, 1979) describes the deposition fractions as functions of the AMAD.

For an aerosol distribution having a CMAD of 1.0 μm and a geometric standard deviation of 2.0, the MMAD (and by inference the AMAD) is 4.2 μm. The fractional deposition in the various regions of the respiratory tract, is, therefore, highly dependent upon the known or assumed particle size distribution. The attached figures compare the recommended models for deposition as a function of AMAD and the table provides the most recent retention parameters for particles having an AMAD of 1 μm.

The estimation of the release rate of dust from ore storage pads and grinding operations illustrates the inadequacy and arbitrary nature of the calculations presented in the GEIS.

> "The combined actions of wind and machinery may produce an airborne flux in excess of 0.1 g per kilogram of ore processed." (p. G-2)

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For an assumed ore processing rate of 6.6×10^5 MT/yr, the total mass released to the atmosphere might therefore be assumed to be 66 MT/yr.

> "however, much of it is of a particle size greater than 100 μm and therefore will be transported only a short distance. Preliminary data, shown in Figure G-1.1, from measurements on a composite ore sample from one mine suggest that about 95% of the ore mass consists of particles greater than 100 μm in diameter." (p. G-2)

The discussion does not go on to point out that Figure G-1.1 also indicates that about 99.6% of the particles are greater than 50 μm in diameter. By extrapolation of the curve in Figure G-1.1, one might estimate that at least 99.99% of the particles exceed 1 μm in diameter.

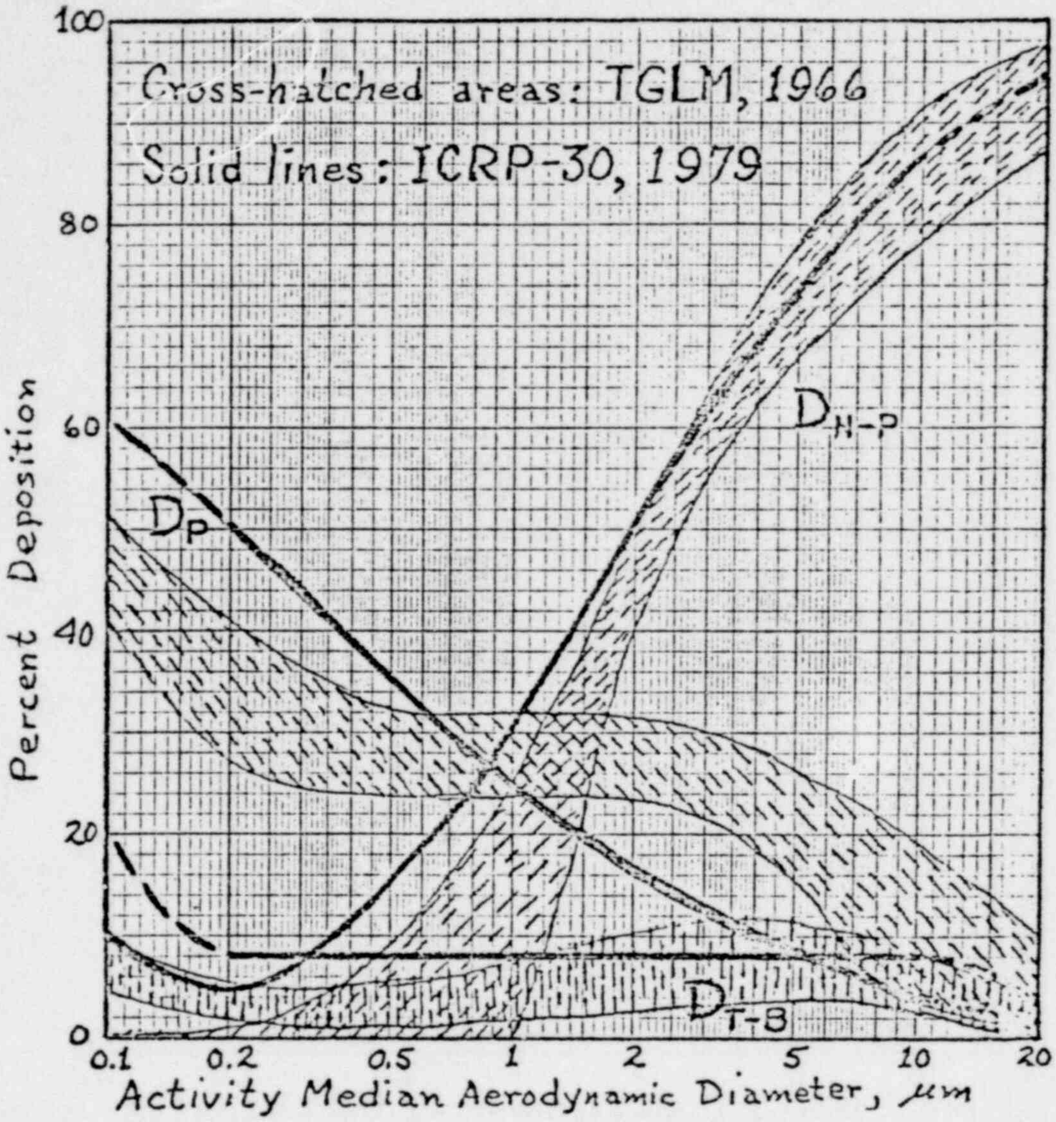
Since the mass of a particle is proportional to the cube of the diameter, it is obvious that the smallest particles (e.g., less than 5 um) in a distribution having a MMAD of 500 um (as indicated in Figure G-1.1) must account for an exceedingly small fraction of the total mass. In spite of this obvious implication of the data, the source term was assumed as follows:

> "the staff has assumed a release rate of one metric ton (1.1 ST) per year having a particle diameter of only 1.0 μm. This is a somewhat arbitrary choice which is believed to be conservative with respect to radiation dose estimates." (p. G-2)

If the data in Figure G-1.1 had been plotted as a log-normal distribution, as recommended by the TGLD, this gross error in the source term estimate for ore dust would have been obvious and avoidable. Similar discrepancies appear to have been incorporated into the equivalent estimates of dust release rates from tailings piles.

Recommendation

Since reference was made to the Task Group Lung model (TGLM) of the International Commission on Radiological Protection, in the dose conversion factors, it is necessary that, per the TGLM recommendation, utilization be made of log-normal distribution data and analyses for estimating source terms for airborne particulates. In addition, the size distribution parameters must be stated explicitly.


Cross-hatched areas: TGLM, 1966
Solid lines: ICRP-30, 1979
D_{N-P}
D_P
D_{T-B}
Percent Deposition
0
20
40
60
80
100
0.1
0.2
0.5
1
2
5
10
20
Activity Median Aerodynamic Diameter, μm

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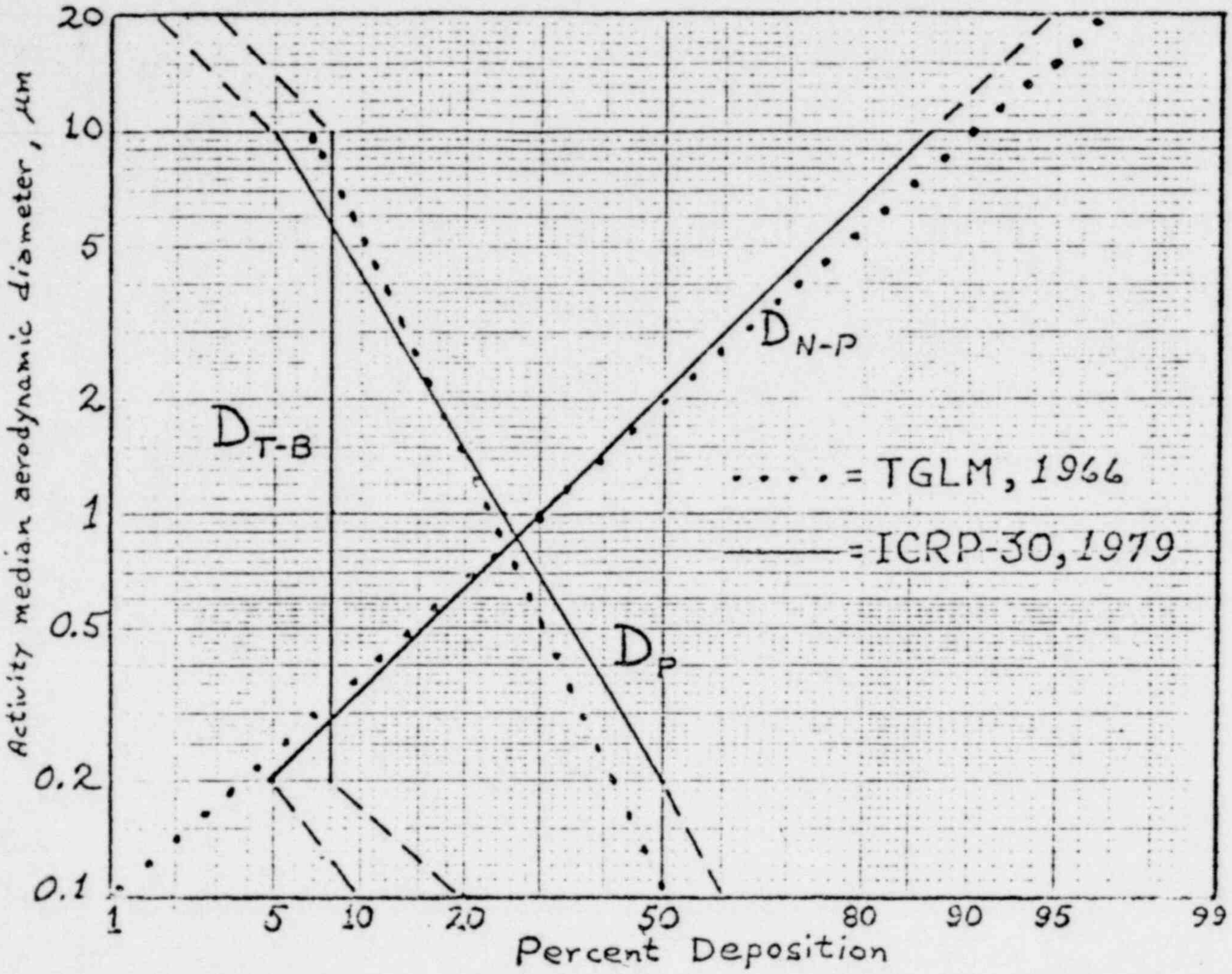
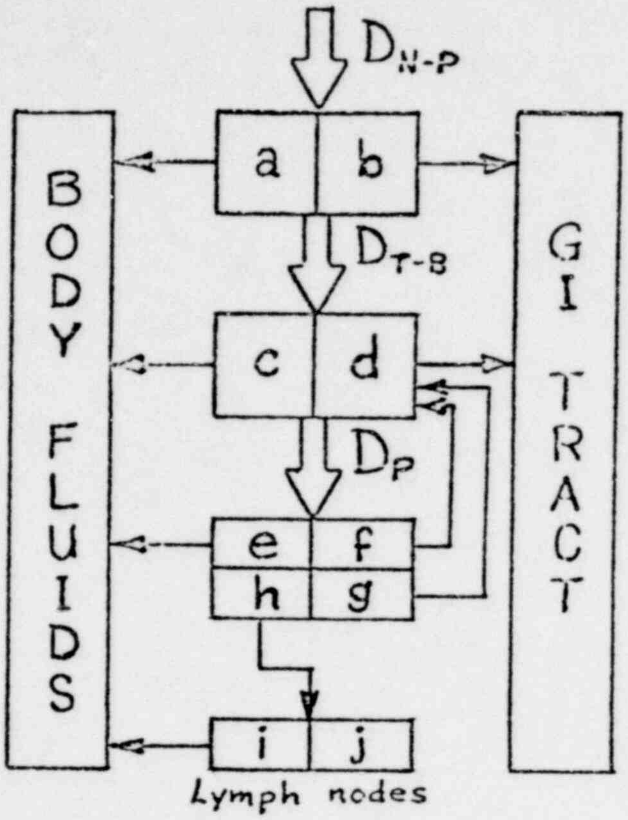

Activity median aerodynamic diameter, μm
20
10
5
2
1
0.5
0.2
0.1
1
5
10
20
50
80
90
95
99
Percent Deposition
D_{T-B}
D_{N-P}
D_P
= TGLM, 1966
= ICRP-30, 1979



Transportability or Retention Classification		D		W		Y	
Region	Compartment	T(day)	F	T(day)	F	T(day)	F
N-P	a	0.01	0.5	0.01	0.1	0.01	0.01
D_{N-P} = 0.30*	b	0.01	0.5	0.40	0.9	0.40	0.99
T-B	c	0.01	0.95	0.01	0.5	0.01	0.01
D_{T-B} = 0.08*	d	0.2	0.05	0.2	0.5	0.2	0.99
P	e	0.5	0.8	50.	0.15	500.	0.05
	f	n.a.	n.a.	1.0	0.4	1.0	0.4
D_P = 0.25*	g	n.a.	n.a.	50.	0.4	500.	0.4
	h	0.5	0.2	50.	0.05	500.	0.15
L	i	0.5	1.0	50.	1.0	1000.	0.9
	j	n.a.	n.a.	n.a.	n.a.	∞	0.1

* Deposition fractions are for AMAD = 1 μm.

APPENDIX G

Tables G-5.1 and G-5.2

Tables G-5.1 and G-5.2 list the inhalation dose conversion factors assumed in the GEIS for non-occupational and occupational exposures, respectively. The two tables are in substantial disagreement, excluding the normal correction factors one might expect for differences in exposure times, breathing rates, organ masses, etc. between the two populations. These discrepancies are explained on page G-41 as due to "new experimental data" and the fact that "the staff has not had adequate time to incorporate changes in most of this document. However, occupational exposures have been computed using this more recent data."

Comment

It is unfortunate that in this case, as elsewhere in the GEIS, the supporting studies were not published in referred journals for peer review prior to their adoption by the NRC staff for use in the GEIS. Due to this premature use of unreviewed data, there has been no corroboration or validation of the assumptions used by the NRC.

In contrast with the approach taken by the NRC, the International Commission on Radiological Protection (ICRP) has historically based its recommendations on a composite of data published in the open literature. Instead of relying on an unreferred report of one study by one laboratory for a complete table of dose conversion factors, the ICRP has sought for confirmation of data from many sources, from other countries as well as the U.S. It is hardly surprising that the recommendations of the ICRP are generally accepted by the professional health physics community. Consequently, it is instructive to compare dose conversion factors derived from ICRP publications with those found in the GEIS.

Hoenes and Soldat (1977) calculated age-specific dose conversion factors for the NRC based on ICRP data available at the time. For lung doses from inhalation, they used deposition rates suitable for an aerosol with an activity median aerodynamic diameter (AMAD) of 1 μm, as recommended by the ICRP when aerosol-size distributions are not known. For U-238, they calculated a 50-year dose commitment to the lung of 0.0458 mrem after inhalation of 1pCi. This value also expresses the annual dose at equilibrium after continuous inhalation of 1pCi/yr, since the mean residence time of uranium in the lung is much less than 50 years.

The assumed inhalation rate (ICRP-23, 1975) during "light activity" at work is $0.02m^3$/min. (This value has been used as the average breathing rate for an 8-hour work shift in almost all analyses of inhalation exposure, although it is not stated specifically in the GEIS.) The total annual intake during work hours is, therefore, assumed to be $2400m^3$, and a concentration of 1pCi/m^3 produces a total intake of 2400pCi.

Based on the Hoenes and Soldat conversion factor, the annual dose rate to the lungs, after continuous occupational exposure to 1pCi/m^3 of U-238 would be:

2400pCi/yr x 0.0458 mrem/pCi = 110 mrem/yr

The equivalent dose conversion factor, expressed in the same units as used in the GEIS would be, therefore, 110 mrem/year per pCi/m^3 for continuous occupational exposure.

ICRP Publication 30 (1979) uses a somewhat different approach to calculate the annual limit of intake (ALI). Weighting factors for individual organs are used to calculate doses that produce risks equal to whole body doses. For the lungs, the recommended weighting factor is 0.12. This means that the ICRP considers that a dose to the lungs produces a risk of health effects that is 12% of the risk from an equal dose to the whole body. The ALI values for any radionuclide and any mode of exposure are, therefore, based on the summation of organ doses, multiplied by their respective weighting factors, such that the total committed dose equivalent for 50 years to all organs will not exceed the recommended equivalent whole body dose rate of 5 rems per year. If a material remained only in the lungs, with no transfer to other organs, the recommended limit of dose equivalent to the lungs would be:

$$\frac{5 \text{ rem/yr}}{0.12} = 42 \text{ rem/year}$$

For materials that partially transfer to other organs, the limit of dose to the lungs would be smaller because of the additional doses to other organs. However, for calculation of a dose conversion factor for lungs, the maximum lung dose must be assumed without consideration of other organ doses.

For U-238 in compounds that fall into solubility class Y (retention half-time of 500 days in the lungs), the ICRP now recommends an occupational ALI of 2×10^3Bq, or 5.4×10^4pCi. At an intake rate of 2400m^3/year during working hours, this is equivalent to continuous occupational exposure to a concentration of:

$$\frac{5.4\times10^4\text{pCi/yr}}{2400\text{m}^3\text{/yr}} = 22.5\text{pCi/m}^3$$

The equivalent dose conversion factor assumed by the ICRP is, therefore, calculated to be:

$$\frac{42 \text{ rem/yr}}{22.5\text{pCi/m}^3} = 1.9 \text{ rem/yr per pCi/m}^3$$

or 1900 mrem/yr per pCi/m^3

For non-occupational exposures (Table G-5.1), the dose conversion factor for U-238 in the lung is listed as 2130 mrem/yr per pCi/m^3 of yellowcake dust (particle size = 1.0 μm and density = 8.9 g/cm^3) and 2880 mrem/yr per pCi/m^3 for ore dust (particle size = 1.0 μm and density = 2.4 g/cm^3). Since the GEIS does not state whether these particle sizes refer to CMAD or AMAD, there is no way to verify the calculations of dose conversion factors. If CMADs are intended, then neither type of dust has an AMAD of 1.0 μm. However, if AMADs are intended, the information on densities is extraneous and misleading.

The dose conversion factors for occupational exposures (Table G-5.2) are based on an assumption of much greater solubility of yellowcake in the lung than used for the non-occupational factors in Table G-5.1. This assumption, based on one NRC-sponsored study, results in much lower lung dose conversion factors but higher bone dose conversion factors. The solubility classes upon which the dose conversion factors for occupational exposures are based have not been reviewed and verified by the scientific community; they are based solely upon a single study by one laboratory and may not be representative of typical conditions throughout the industry.

Although the preceding examples of inconsistencies and possible errors in inhalation dose conversion factors in the GEIS are based on only one radionuclide, i.e. U-238, they illustrate a fundamental problem. The values are not in agreement with those produced two years earlier in another study performed by the same laboratory for the NRC, nor do they agree with the most recent publication of the ICRP. In summary, the inhalation dose conversion factors used in the GEIS are inconsistent with those generally accepted by the scientific community and should not be considered to be valid until the assumptions are validated or the inconsistencies are resolved.

Recommendation

For a valid peer review of the dose conversion factors and, thereby, the dose commitment estimates in the GEIS, only data and calculational methods that have been previously published and therefore reviewed and accepted by the scientific community should be used.

APPENDIX G

Section G-5.3--Ingestion Doses

Table G-5.5 lists the ingestion dose conversion factors assumed in the GEIS for both occupational and non-occupational exposures. With the correction that has been applied to the values for Ra-226, the values agree with those published by Hoenes and Soldat (1977). Both sets of values are based on ICRP physiological and metabolic parameters published in ICRP 2 (1959), ICRP 10 (1968) and ICRP 10A (1971).

Comment

More recent data contained in ICRP 30 (1979) ought to be used for calculation of these dose conversion factors. For example, for radium-226 (one of the most important nuclides for ingestion dose determination), the fraction absorbed by the blood from the gastro-intestinal tract is given as 0.3 in ICRP 2, 10 and 10A. However, ICRP 30 adopts a value of 0.2, based on the most reliable, recent data. This difference in an underlying metabolic assumption would change the calculated dose conversion factor by one-third.

A change in ICRP data which would have the opposite effect is the revised value for absorption by the blood of uranium from the GI tract. ICRP 2 assumed this fraction to be less than 10^{-4}; ICRP 10 adopted a value of less than 10^{-2}. However, ICRP 30 adopts values of 0.05 for hexavalent compounds of uranium and 0.002 for tetravalent compounds. Therefore, greater systemic uptake of uranium is now considered to be possible for ingested uranium in hexavalent compounds.

The retention functions, i.e. the mathematical expressions that describe the retention of radionuclides in the human body, have also been revised by the ICRP for some radionuclides. The retention of radium was described in detail in ICRP 20 (1973). Although not stated explicitly in the GEIS, it is believed that this retention function was used for calculating dose conversion factors for ingested radium. The retention function for radium given in ICRP 20 is endorsed in ICRP 30.

On the other hand, the retention function for uranium has been revised in ICRP 30 from that given in ICRP 10. The function in ICRP 10 is given as:

$$R(t) = 0.2\, t^{-0.5} \qquad (\text{for } t > 1 \text{ day})$$

ICRP 30 gives separate retention functions for bone and kidney, the two critical organs, as follows:

$$R_{bone}(t) = 0.2\ e^{-\lambda_1 t} + 0.023\ e^{-\lambda_2 t}$$

where: $\lambda_1 = 0.0347\ \text{day}^{-1}$ (20-day half-life)

$\lambda_2 = 1.39\text{x}10^{-4}\ \text{day}^{-1}$ (5000-day half-life)

$$R_{kidney}(t) = 0.12\ e^{-\lambda_3 t} + 0.00052\ e^{-\lambda_4 t}$$

where: $\lambda_3 = 0.116\ \text{day}^{-1}$ (6-day half-life)

$\lambda_4 = 4.62\text{x}10^{-4}\ \text{day}^{-1}$ (1500-day half-life)

It is not clear that these retention functions were used in the calculation of dose conversion factors in the GEIS. As a consequence, the ingestion dose conversion factors used in the GEIS may be based on physiological and metabolic data that are no longer considered to be accurate.

Recommendation

The most recent retention functions and metabolic parameters (ICRP-30) should be used for calculations of dose conversion factors for ingestion.

References

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