AUG 24 1981

NOTE TO: Steve Eilperin
Sheldon Trubatch

FROM: Hubert J. Miller

SUBJECT: ANALYSES OF AMC AND KERR-McGEE BRIEFS

Attached as promised is the analysis of specific points revised in the industry briefs in the mill tailings case as it stands as of today. There are several parts. First, some general points are made concerning arguments in the industry briefs. The detailed comments on all of the specific arguments made by industry are presented.

Hubert J. Miller

Attachments: As stated

PERIOD OF CONCERN

Perhaps the most fundamental issue in this case relates to the period of concern--the industry wants to take a short term, expedicious view of the problem. The Congress viewed it otherwise in UMTRCA.

Mill tailings will remain hazardous for many thousands of years. (Thorium has a half-life of 80,000 years.) Congress clearly recognized the longevity of the hazards in passing UMTRCA and in establishing the directions it wanted taken in disposal of mill tailings waste.

In passing UMTRCA, the Congress found that the potential and significant health hazards posed by tailings "require that every reasonable effort be made to provide for the stabilization, disposal and control..." of "...such tailings in order to prevent or minimize radon diffusion into the environment and to prevent or minimize other environmental hazards from such tailings."* Congress also made it clear that solutions to tailings problems must be permanent, given the longevity of the hazards involved. UMTRCA calls for eliminating, to the extent practicable, the need for long term maintenance and monitoring of tailings disposal areas.

NRC regulations are based upon the need for very long term containment. Thick earthen covers, protected from erosion to assure there is little need for ongoing care of the disposal sites, are prescribed.

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*P.L. 95-604, UMTRCA, Findings and Purposes, Sec. 2(a). In Committee Report House of Representatives Report 95-1480, Part 2) on P.L. 95-604, the view that tailings disposal must be done in a way that will stay put was clearly expressed: "The Committee does not want to visit this problem again with additional aid. The remedial action must be done right the first time."

Viewed as a shorter term problem, less control than prescribed by the regulations is appropriate. But this would ~~be to~~ fly in the face of reality and the mandate of Congress.

RISK AND COST-BENEFIT EVALUATION

The Industry alleges essentially that the regulation is not a health based standard -- that NRC made no finding that there was a significant risk with mill tailings which requires regulation. They allege the risks to individuals from tailings are, in fact, insignificant when compared with other risks commonly faced. Furthermore, they allege that there is no relationship between the costs and benefits of the required levels of control.

The following points are made in rebuttal:

1. "Not a risk based regulation"

The staff performed an extremely careful and complete evaluation of the potential health risks posed by tailings (6.2.8, 6.3.8, 9.2.8, 9.3.8, 9.4, 12.3, App. G): This included evaluation of:

- risks to individuals living near mills
- risks to populations (in the Western mining/milling regions and beyond)

This was done to conform to the long-standing principles of radiation protection as espoused by the international and national radiation protection bodies (ICRP and NCRP) that:

- risks to individuals must be kept within acceptable levels (within appropriate limits)
- all exposures (cumulative health effects and risks to populations) shall be reduced to as low as reasonably achievable

If the allegation were true--that this is not a health based regulation--the supporting technical basis would be empty of such extensive health risk evaluations. The contrary is of course true.

On the basis of its evaluation of potential health impacts, it was concluded that "certain actions should be taken to ensure public health and safety..." (p. 12-1). That is, a finding was made that there is a significant risk posed by tailings. The question then became "what level of tailings containme and risk reduction is appropriate?" To do this, a full range of control measures were evaluated, ranging from virtually no control to essentially complete control of emissions (radon is the principal potential contributor to risk) (12.3.4, 9.3.& 11.3).

2. "Potential Health Risks are Insignificant"

Potential pathways of exposures are described in 6.2.8.2.2 (see also 3.2 of Summary). They include generally:

- direct exposure to radiation in air and on ground
- inhalation of radiation in lungs
- ingestion of contaminated foodstuffs

Radon is an inert mobile gas and (along with its daughter products) is, thus, the greatest potential contributor to exposures.

If tailings are used in construction of structures, exposures to occupants can be excessive. Such exposures are indicated by estimates presented in 9.3.8 (Table 9.11). A structure constructed on tailings (it would not have to be a tailings pile) results in predicted exposures of 0.5 WL. This exposure level is much higher than levels which have been established as acceptable levels of risk in other cases:

Surgeon General for Grand Junction Cleanup	0.01 WL - 0.05 WL[a]
US EPA Florida Phosphate Guidance	0.005 WL[a] - 0.02 WL[b]
10 CFR 20	0.033 WL[a]

(a) above background
(b) inclusive of background

This calculated level is comparable to actual measured levels in structures contaminated with tailings. One such structure was recently measured to have levels of about 0.7 WL, which is 20 times higher than existing allowable exposure levels (10 CFR 20).

The industry inappropriately focuses on risks to average individuals in the population at large far from the tailings pile, as opposed to maximally exposed individuals in trying to show risks are insignificant (e.g., Kerr-McGe pp. 6-8). This is not consistent with basic radiation protection principles stated above (protect most exposed individual).

Kerr-McGee compares risks to average individuals with the annualized risk of one in 1,000,000 that NRC used in NUREG-0586, the draft GEIS on Decommissioning (see Kerr-McGee, p. 8, F.N. 1).* Kerr-McGee does not say in their brief that in NUREG-0586 this level is cited as an appropriate upper limit of risk acceptability for the most exposed individuals--~~certainly not for individuals at any distance from the site.~~ In fact, the annualized risks associated with exposure levels in structures on tailings, as cited above (0.5 WL to 0.7 WL), are about one in 200 chances of premature cancer deaths. This is much higher than the acceptable risk levels cited in NUREG-0586. (Risk estimates given here are made using estimators presented in App.G-7.)

Also, large numbers of premature cancer deaths would occur from the releases of radon that will continue to occur from the tailings for many thousands of years.

Clearly, tailings are hazardous. They pose a significant risk.

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* ICRP 26 refers to annualized risks in range of 10^{-5} to 10^{-6} as being an upper limit of acceptability. Wilson (AMC, p. 22, F.N. 42 and Kerr-McGee, p. 7) cites 10^{-5} as an appropriate upper limit in an occupational exposure setting.

3. "There is no relationship between costs and benefits of the proposed radon control levels"

In developing the regulations, the costs and benefits of a full range of racon control levels were considered. As noted above, these were evaluated in terms of long-standing radiation protection principles (ICRP, NCRP, NRC in 10 CFR 20). (See §12.3.4.1, p. 12-12, GEIS.)

Furthermore, the mandate of Congress in passing UMTRCA was followed.

The rationale supporting the specific limits in the regulation (2 pCi and 3m) is presented in 12.3.4. Summaries are found in §5.2.2 and 9 of the summary. The following additional information is presented concerning the points made in these GEIS sections and the industry briefs.

a. While the strictly numerical cost-effectiveness analysis developed in the GEIS was not utilized as the sole basis for establishing the numerical requirements in the regs, it supports them. If the cost-effectiveness balance point recommended by industry in commenting on the GEIS* is used, Table 12.5 (attached) shows the prescribed level to be reasonable and appropriate. This is the case if the inevitable degradation of tailings cover performance that will occur is accounted for and if health effects over only one thousand to several thousand of the many thousands of years

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* $250K to $500K per health effect averted. (AMC comments on draft GEIS. Also, see p. 38, AMC brief.) Wilson recommends using $1000K per health effect averted.

the tailings will be hazardous are considered. More specifically, this is based on the estimate that when tailings are covered to a 2 pCi/m^2-sec level (this level is to be achieved on the calculated basis as prescribed in Criterion 6), vegetation and other mechanisms would lead to levels which are really about 10 pCi/m^2-sec on average, ~~over the long term.~~ The estimate of health effects used in generating the cost-effectiveness information in Table 12.5 is based upon the assumption that there will be no degradation in cover performance over the very long term.

[NOTE: Industry might try to rebut this with reference to Cohen's comments on draft GEIS (AMC comments) that health effects should be discounted to account for the real growth of invested funds that could be applied to others risk aversion in the future. In response to this, however, it should be noted that the increase in value of health effects will tend to be more a function of real productivity and economic growth than with inflation. (See Vern Rogers' paper on this, attached.) Therefore, discounting of health effects is inappropriate.]

In no way can the industry say we did anything but perform a serious, careful and comprehensive study of cost and benefits of various levels of control.

b. The following tabulates risks to nearby individuals at the 2 pCi/m^2-sec level and makes comparisons with various established limits (taken from Table 12.2 and App. G-7 risk estimation):

	WL exposure	Risk*
On pile	0.004	4×10^{-5}
At fencepost	0.0001	10^{-6}

* Average annualized risk level

It can be seen that these risk levels are higher than, or are comparable to, those cited above as being acceptable (i.e. $10^{-5} - 10^{-6}$). Also, these are based upon the assumption that there is no degradation of cover over time. The risks would increase as piles degrade.

c. Industry claims that the selection of radon flux and tailings cover requirements was arbitrary because of the statements in §12.3.4 (p. 12-12) re, "the guiding principle..." Clearly implicit from the extensive evaluations of health impacts to individuals and populations is that the goal was to reduce potential health risks to near those which would exist naturally from radon releases. As evidenced by analyses in §12.3.4, over the long term, serious potential health risks are posed. The use of natural variability in radon flux rates to select a final radon flux limit was the least arbitrary way of picking a numerical limit from among a narrow range of closely lying alternative numbers, viz. 1 to 5 pCi/m^2-sec. (See other discussion on cost benefit.)

The industry claims that barring of ongoing active maintenance as a required element of an acceptable tailings and management program is based solely upon the theory that the government will fail. It cannot be denied that continuity of government and institutional controls over the many thousands of years that the tailings will remain hazardous, is uncertain at best. More important than this, however, is that continued effectiveness of such controls are uncertain. It is not acceptable to bequeath to future generations a virtually endless commitment to costly care of tailings piles.

The only experience of government control of tailings sites has been very poor. In the relatively short time since the Monticello pile has been covered and fenced by the government, there has been degradation of the pile covers, evidence of breakdown in fence controls (animals have apparently gotten onto the site and destroyed vegetation).

We do not have to argue failure of the government (i.e., buck the Constitution and A. Lincoln, pp. 51,32) to see the wisdom and necessity of avoiding situations requiring ongoing active care and maintenance.

Moreover, the avoidance of ongoing active care is wholly consistent with the mandate of UMTRCA.

The industry has taken an unrealistic and expedinet short-term view of the mill tailings problems.

COST ESTIMATES

The extensive steps taken in evaluating costs should be made clear in the brief. A strong impression can be made on the Court by reviewing what was done as clearly laid out in the GEIS (App. K, Chapter 11, §12.3.4). The staff carefully identified all those factors which could vary and affect costs and it considered these in its cost-benefit evaluations. These variable factors included, for example:

- volumes, areas, thicknesses of tailings piles
- size of mills
- ore grades processed
- moisture, porosity and other properties of earthern materials used in covering piles
- earn rates, equipments rates, material costs and availability

(App. K, Chapter 11, Chapter 12, see esp. §12.3.4.5, Variability in Costs of Radon Control; very specific cites can be given to sections on costs.)

In developing cost estimates, the staff considered basic earthmoving and construction cost data applicable to the mining and milling regions, as well as obtained quotes from vendors and suppliers. Virtually all cost estimates were reevaluated by an independent contractor in going from the draft to the final GEIS. From this extensive review, the bases for cost estimates are considered to be sound.

Our cost estimates have been shown to be consistent with those reported by mill operators in numerous actual licensing cases (i.e., unit cost estimates are essentially the same).

AMC BRIEF

Detailed Analysis and Response to Industry Allegations

1. pg. 5 - It is stated that UMTRCA requires that land be transferred. There is no mention of the "unless it can be determined ..." which emphasizes Congress' ultimate goal that minimal control be necessary.

2. pgs. 8, 9 - It is stated that the "risks from uncontrolled uranium mill tailings are comparable to such commonly undertaken activities as smoking one cigarette in a lifetime or driving one time a year to the corner drug store."

Response - Such arguments are invalid, since if tailings piles are uncontrolled, they will release radon essentially forever. The risks compared with smoking one cigarette, etc. are only those which result from one year's release of radon. Therefore, the industry is comparing apples and oranges.

3. pg. 9 - footnote 21 - It is stated that "No scientific studies have been performed which measure health effects at low doses to which the general population is exposed. NRC concedes that linear dose response calculations are "not intended to predict actual health effects but rather to give a basis for setting conservative exposure standards." NRC's Uranium Fuel Cycle Study at A-7. Linear extrapolations generally yield conservative results (2 FGEIS, Appdx. A at 34), and " [e]pidemoiologic data currently available would not rule out a value of zero for the risk from incremental additional exposure of the very low levels expected for the general public from uranium milling operations..." (2 FGEIS, Appdx. A at 32)."

Response - See response to questions 10 and 11 from the Stratton Subcommittee. (Ed Branagan may provide additional information on this specific issue.)

4. pg. 10 - footnote 23 - Industry refers to NRC "refusal" to extend comment period and subsequent addition of scientific documents into the record. (Letter referred to was not from Daniel Martin but from John Martin.)

Response - Refer to H. Miller affidavit on 19 documents and reassert that the basis for the regulations is contained in the GEIS. Moreover, the industry statement suggests that we withheld documents; we did not. NRC extended the period of public comment on the GEIS which contained verbatum the technical and financial criteria contained in the rules. The total period of public comment on the substantive parts of the rule and their detailed technical basis was ____ days.

5. pg. 10 and footnotes 24 and 25 - Industry discussion of tremendous volume of comments submitted.

Response - We should reiterate that all comments were carefully considered in finalizing the GEIS and the regulations. These comments and staff response to them are documented in Appendix A. Changes were made where it was considered appropriate in response to comments. In fact, on the specific issues raised here--risk estimates--NRC revised some aspects of its risk estimation procedures as a result of industry comments. It also updated power projections in response to industry comments. More complete list of comments resulting in changes can be given.

6. pg. 10 - It is asserted that the risk from uranium milling and tailings disposal is a tiny fraction of the risk from background radiation.

Response - Although the risk to the individual in the population at large (i.e., far from the mill) may be a fraction of the risk from background radiation, risk to nearby individuals can be very high and cumulative population risks can be very large. These are avoidable risks. The level of risk reduction stipulated in the regulations was determined based upon the long-standing principles of radiation protection espoused by the international and national radiation protection organizations such as ICRP and NCRP: (a) that exposures to nearby individuals be within acceptable limits, and (b) that all exposures be reduced to as low as reasonably achievable. This involved consideration of a full range of cost and public health perspectives for varying degrees of control as documented in the GEIS. (See Section 12.3 of the GEIS; see also the general discussion above.)

7. pg. 11 and footnote 26 - Industry asserts that "compared to risks faced by people in their everyday lives, the risk from uranium milling is small."

Response - Refer to responses to #2 and #6 above. Further, such risks are avoidable.

8. pg. 11 and footnote 27 - AMC claims NRC seriously underestimated costs and neglected to include many significant and obvious costs (e.g., NRC assumed cover material would be available free of charge).

Response - In determining the cost of cover material, the NRC included the GEIS the cost of excavating, hauling on site, depositing, spreading compacting, and the resurfacing with previously stripped topsoil. In addition, the costs of revegetation of the cover material source area were considered. The FGEIS does not include costs for obtaining the cover material because the majority of the uranium mills in the agreement and non-agreement states are located in areas of strip mining operations or on existing large tracts of land where earth cover materials are readily available (see 9.3.8.4 of FGEIS).

The footnote sounds as if the major cost of obtaining earthen materials for covering tailings is related to "ownership" of the borrow material itself and that we grossly underestimated costs by assuming the material is "free". As noted above, in most cases vast tracts of lands are controlled by the operators. In any case, in the wide-open western milling regions, costs for the earth itself are negligible compared to costs cited above. [NOTE: In cases of strip mining, the volumes of earth being handled are many times greater than that required for covering the tailings piles and, with plans that coordinate mining activities with tailings disposal, the unit costs are likely to be lower than assumed by NRC. Cite NUREGs in record w.r.t. stripping ratios--overburden to ore.]

9. AMC commented that NRC's regulations are premature (being issued prior EPA standards).

Response - Refer to Response to Kerr-McGee's Opposition to Motion for

10. page 11 - AMC claims substantial changes may be required as a result of later EPA Standards. NRC cannot know what the final EPA Standards will be. Industry costs resulting from changes could be substantial.

Response - Again, refer to Motion for Stay reponse, point out EPA propose Inactive Site Standards are essentially the same as NRC's with respect to radon control, and note that majority of costs will not be incurred for existing operations until the time of mill closure. (This latter point is certainly true at existing mills.)

11. Industry on page 12 - The FGEIS contained changes from the DGEIS (e.g., a new Appendix U presenting a limited cost-effectiveness analysis, risk estimates were lower by approximately a factor of two, and cost estimates were raised).

Response - As indicated in #5 above, changes were made in going from draft to final in response to comments where appropriate. The cost-benefit discussion contained in §12.3 of the DGEIS was expanded upon and a new Appendix U was added to the FGEIS. As explained on page A-12, estimates of uranium demand and procuction were revised and lowered -- total risk estimates are reduced proportionately. As indicated on page 40 of the FGEIS Summary and page K-10, cost estimates were reviewed in finalizing the GEIS. They increased by an amount which in large measure can be attributed to the inflation which occurred subsequent to issuance of the DGEIS. (Petroleum-based operations and materials increased by large amounts, as much as 100% in some cases).

Report what is in GEIS on inapplicability/inappropriateness of numerical cost-benefit for the long-term tailings waste disposal problem. NRC approach was least arbitrary.

12. page 12 - AMC asserts NRC refused to address the question of significant risk. NRC adopted a policy assumption to return disposal sites to its perception of conditions of surrounding lands.

Response - See general comment above.

13a. page 14 - footnote 31 - AMC notes that NRC acknowledges that at the two picocurie level the soil used to cover the tailings may contribute a "substantial fraction" of the total surface radon release (1 FGEIS at 9-26).

Response - It should be further noted, however, as also indicated on pg. 9-26, that, as delineated clearly in Criterion 6, in the calculation of the thickness of cover required the contribution from the cover itself to the surface radon flux is ignored (i.e., the soil contribution is considered to be background exhalation).

13b. In footnote 31 - AMC also states that at the radon limit established by the regulations, radon releases will "result in minute (if not insignificant)" levels of risk beyond those occurring naturally (1 FGEIS at 12-15). Reduction of radon flux to a few $pCi/m^2/sec$ as required by the regulations would reduce the contribution of mill tailings to about 0.00002 of the dose (exposure) to the U.S. population (1978) from natural soil surfaces and vegetation (evapotranspiration) (1 FGEIS at 12-15).

Response - As further noted on the same page (12-15), this perspective of risks to individuals in the population at large by itself does not lead conclusively to a given level of radon control. Further, it ignores the risks associated with cumulative exposures and other perspectives examined, such as risks to near and maximally exposed individuals. Most significantly, ~~it is~~ if added up over long time periods a very large avoidable risk is found.

14a. page 14 - paragraph 2, sentence 2 omits the fact that the regulations require restoring of potential use before milling operations to the maximum extent practicable. This is not a flat requirement as is suggested.

14b. page 14 - AMC states that Criteria 5 and 7 depart significantly from the regulations as proposed. Interested parties were not given an opportunity to comment on the new requirements.

Response - The changes made to Criterion 5 which the AMC refers to -- that at existing sites groundwater use be restored to the maximum extent practicable -- were made in response to comments made by a number of individuals (e.g. Wyoming Outdoor Council #110 and the Wyoming Department of Environmental Quality #105) at the public hearings. [Denver hearing transcript page 67 "...uses for which waters are suitable should be retained."] Thus, as indicated on page A-41 of the FGEIS, this criterion was clarified by stating that steps be taken to the maximum extent practicable, "the major objective being to assure that current or potential groundwater uses are preserved." [illegible]

The changes referred to in Criterion 1 were made in response to comments requesting clarification of how the requirements applied to existing facilities (e.g., see comment #47 - NRDC). ~~We recognized that full restoration may not be practicable at existing mills.~~

15. page 15 - AMC asserts NRC failed to make a finding of significant risk.

Response - See general comments above.

16. page 16 - AMC states that NRC failed to balance the benefits of risk reduction against the costs of complying with the regulations.

Response - NRC carefully weighed costs and benefits with various levels of control including a strict numerical effectiveness analysis. Cost-effectiveness considerations are described in Appendix U and Table 12-5 of the FGEIS presents a summary of much of this information. However, the staff did not rely solely on the cost-benefit analysis (although it supports the requirements in the manner described in the general comment above) because it breaks down for the tailings management problem due to long-term uncertainty.

17. page 15 - AMC claims NRC regulations were premature (being issued prior to EPA standards).

Response - See #9 above.

18. page 18 - AMC claims that NRC has statutory obligation to promote the development and use of atomic energy.

Response - This was one of the functions of the Atomic Energy Commissio However, this responsibility was transferred to ERDA (DOE) in the Energy Reorganization Act of 1974. At that time, Congress recognized that promotional and regulatory functions were competing objectives when housed under one roof.

19. page 18 - Radon released from tailings is insignificant compared to that released from natural soils or other sources such as farmers plowing their fields.

Response - Regarding significance of risks, the GEIS establishes risks are significant if uncontrolled. See general comment.

20. page 19 - AMC presents risk estimates for members of the general public and claims that these risks are exceedingly small in comparison with risks from background radiation.

Response - See response to question #6 from the Stratton Committee and general comment above. Population impacts from radon release from milling, when added up over the long periods of time during which the tailings will remain hazardous, are very large (over 1000 years - 6000 deaths will occur). Risks to persons living near a tailings impoundment are significantly higher (over 100 times the "one in a million" benchmark for acceptable risk frequently cited by the industry for cases such as that described in general comments). Note also that persons living "relatively close to a mill" are far from the maximum exposed individuals.

21. page 20 - footnote 38 - AMC asserts that NRC based its regulations on an unrealistic scenario of a person living on top of the tailings piles. They claim this can't happen in view of UMTRCA government land ownership requirements.

Response - See insert to Simpson hearing page 97 (attached). These scenarios were not the basis for setting the limits; however, given the uncertainty concerning effectiveness of tailings containment and institutional controls over the long term, it is not an unrealistic case to consider. Also, it is in fact more unreasonable to avoid evaluating intrusion scenarios in evaluating long-term waste management problems than to consider such scenarios. It is a well established principle of waste management that intrusion and its effects should be considered.

22. page 20 - AMC states that radon concentration generally becomes indistinguishable from background levels at distances of a few miles from tailings piles.

Response - Refer to response to question #27 from the Stratton Committee (attached). Just because you cannot measure it does not mean that it is not there. It does not vanish.

23. pages 20-21 - AMC asserts NRC failed to find significant risk and thus relied on policy assumption to return sites to conditions like background.

Response - See general discussion above.

24. pages 22-25 - AMC asserts that NRC arbitrarily refused to consider comparative risk data presented in comments on DGEIS while at the same time NRC used such data in a Draft Occupational Regulatory Guide and Table S-3 narrative.

Response - The staff was careful to consider a wide range of perspectives in determining what is appropriate control, including comparison of mill releases with other radon releases (12.3.4, Table 12.3; Table 5 of Summary). Again, industry inappropriately looks at average risks. Also, they look at releases from mills for only one year and ignore cumulative health effects.

25. pages 25-26 - AMC asserts that NRC rejected reasonable alternative control measures because they did not achieve policy objective. Most risk reduction achieved in going from 280-100 pCi/m^2-sec. is very small.

Response - This "incremental reduction" results in averting approximately 2000 deaths over a period of 1000 years. Impact of the risk reduction to nearby individuals would hardly be small either. See general comments.

26. page 26 and footnote 53 - AMC asserts NRC must compare risk reduction at incremental control levels to determine point of diminishing returns.

Response - As indicated in #16 above, NRC did perform an incremental cost-effectiveness analysis, but for reasons stated did not rely upon it solely, although it does tend to support limits established. (See 12.3.4.6 of the FGEIS.) See general comments.

27. page 27 - footnote 53 - AMC states that NRC "refused to undertake such an analysis" (cost-effectiveness analysis). This is factually wrong; see general comments.

28. page 28 - AMC asserts NRC was directed by Congress to pursue the goal of promoting atomic energy.

Response - See #18 above.

29. page 29 - AMC asserts Congress was concerned about costs and wanted NRC to consider what was reasonable, particularly with respect to existing sites.

Response - NRC did consider costs; in fact, it performed a detailed cost analysis. Economic impacts on existing sites were specifically considered. Note flexibility in application of most criteria to existing facilities. See specifically §12.4 and statement of considerations.

30. page 31 and footnote 59 - AMC references several statutes and Court rulings related to the requirement for cost-benefit analysis as the basis for regulation.

NOTE: We should try to play up the point made in their references that NEPA clearly does not require a fully monetized consideration of costs and benefits always be done. Further, this Court has upheld EPA's use of cost-effectiveness analysis in setting "best practicable technology" emission standards. While not requiring a fully monetized cost-benefit analysis, the Court noted that EPA had made a serious, careful, and comprehensive study of the costs which compliance with the regulations will impose on the industry. NRC did just this, thus we should receive a similar ruling from the court.

31. page 32 - AMC asserts that the statutory authority requires NRC to promote two goals, one being the promotion of atomic energy.

Response - see #18 above.

32. page 33 - footnote 62 - AMC cites various policy statements and conclusions that cost-benefit balancing is extremely useful in regulatory decisionmaking.

Response - NRC does not debate the appropriateness or usefulness of cost-benefit balancing in decisionmaking on many issues. NRC performed a cost-benefit analysis in the process of developing the mill tailings regulations. As indicated in #16, this included a strictly numerical cost-effectiveness analysis of various control levels. NRC did not rely solely on this numerical analysis (although it tends to support the requirements) because it breaks down for the tailings management problem due to long-term uncertainties involved. (See general comments.)

33. page 33 - AMC asserts that in Benzene the Court found the linear non-threshold theory to be invalid when used as the primary basis for regulation. Based on this they argue that it therefore is invalid when applied to mill tailings.

Response - This argument makes little sense. Simply because a method of analysis is considered to be invalid with regard to one type of hazard or hazardous material by one court does not mean that it might not be entirely appropriate for another type of hazard. In fact, the overwhelming majority of scientific opinion considers the linear non-threshold theory to be appropriate for estimating the health effects from radon associated with mill tailings. (See response to item 3.)

34. page 35 - footnote 66 - AMC states that NRC chose the 2 pCi/m^2-sec level of radon emanation because this level would be within the rang natural background exhalation rates. However, they claim that the l chosen actually reflects an average and NRC has effectively averagec the variability in nature. The range can be as much as ten times gr than the average; thus NRC requires that the radon emanation rate be returned to an average of all soils.

Response - First, the reference is clearly a health-based standard. general comments.) Second, it is factually incorrect to say we cons the average of background rather than a range.

35. page 35 - footnote 67 - AMC asserts that NRC should have presented tc costs for regulations in terms of the percentage price of yellowcake.

Response - Table 4 is misread. Groundwater controls are included in tailings disposal cost estimates, which are virtually 100% of regulat costs. A rigorous statistical analysis was performed (summarized in App. O) which looked at the statistical range. This was done at lease part in response to AMC comments.

36. page 35 - footnote 67 - AMC asserts that based upon NRC's "small fract theory, resulting costs to the electricity consuming public would be a least $100,000,000 per year.

Response - Tom Fleming is providing.

37a. page 35 - AMC claims NRC rejected cost-benefit data because of uncertaint in analysis. They say uncertainty is based on our unreasonableness.

Response - This statement by industry is baffling. The uncertainties NRC is referring to in the GEIS as stated in §12.3.4 are the obvious ones which will exist over the very long periods of time that tailings will remain hazardous. This statement is a sign of unreasonableness on the other side--burying their head in the sand about the long term.

37b. p.35/p.36, F.N. 66 - NRC could have chosen an integration period. The claim EPA has proposed a 1000-year integration period.

Re[illegible] EPA did not say that 1000 years was the period of concern. Th[illegible]sed standard reads for at least 1000 years.

37c. [illegible] - "NRC recognizes that consideration of health effects [illegible]-year integration period is useless because it did not [illegible]present integrated health effects for periods beyond 1000 years [illegible]e vast uncertainties beyond this time."

Res[illegible]e - AMC puts words in our mouth. It is not the same to say "that uncertainty beyond 1000 years is large and makes routine calculation of health effects beyond this time inappropriate" and "beyond 1000 years health effects are so uncertain as to be not appropriate to consider." The industry offers absolutely no convincing reasons for considering only 1000 years. It has no relationship at all with actual hazards. Other commenters argued for longer periods.

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page 36 - AMC claims NRC stated that we must use integration periods beyond 1000 years.

Response - This is factually incorrect. No such statement appears. What is stated is that the period over which health effects should be integrated is highly subjective and commenters recommended use of time periods ranging from very short (100 years) to very long (over 100,000 years). Consideration of a period of at least several thousand years, however, would not seem inappropriate given the hundreds of thousands of years during which the hazard will exist.

38. page 36 - Additional uncertainty stems from future projected population increases. AMC claims that the cited UN study does not support a "dramatic increase" in recent years in the North American population.

Response - G. Gnugnoli is providing. Also, check Lyle Roberts from Argonne. U.S. population was assumed to virtually level off shortly after 2000 (App. G-8, Table 8.10).

39. page 37 - AMC claims that NRC requires prospective reactor licensees to perform a "balancing analysis" as part of S-3. Their argument is that if we expect prospective licensees to make such evaluations it is incongruous for us to argue that it is impossible for us to choose reasonable values to do a strict numerical cost-effectiveness analysis.

Response ~~First~~, NRC does not require reactor licensees to make the cost-benefit decisions like the ones at issue here as this might suggest. The second point is a non sequitur.

40. page 38 - AMC indicates that Table 12-5 demonstrates that cost-benefit analysis can be done to provide necessary information for the reasonable regulation of radon emanation.

Response - Yes. See the general discussion above. Table 12-5 presents the "results of a cost effectiveness analysis" (footnote 72) which, if one considers the long term nature of the tailings management problem, clearly supports the requirements as reasonable. This should be used in responding to charge that we failed to perform such an analysis. However, for the reasons stated in the general discussion and in the GEIS, the results of this analysis were not relied upon solely.

41. page 38 - AMC claims that we stated in Appendix U that we were unable to choose the cost per health effect since this would involve "moral judgements."

Response - NRC did not make such a statement. Rather, to the contrary, we stated that selections of monetary values for health effects could be made. However, the optimimzation methodology would still break down for the case of the uranium mill tailings disposal problem largely due to the impossibility of correlating containment performance uniquely with all applicable costs. That is, uncertainty over the long term prevents its sole use in establishing limits.

42. page 38 - AMC asserts that using NRC's central value, the acceptable range of radon releases is 9.7 pCi for a 1000 year integration period.

Response - As explained in the general discussion, this unrealistically assumes a perfect cover over a long period of time.

43. page 39 - AMC argues that such an analysis can provide useful information which can be used as benchmarks in evaluating the reasonableness of the regulation.

Response - OK. Give perspective if 5 or 10,000 years is assumed, which, of course, is reasonable if you consider the long term nature of the hazard. Also, consider degradation and the selected numbers are seen to be reasonable.

44. page 40 - AMC asserts that using NRC's figures, costs for complying with tailings disposal alone would be between $760,000,000 and $1,521,000,000.

Response - Industry has combined several partial cost figures from the GEIS with extreme misinterpretations of the rules to support the contenti that the rules are excessively costly. Figures in GEIS ($10-21 x 10^6) for very conservative mill, which involve extensive measures not applicab at existing mills, such as below grade burial and seepage control liners, are used to multiply by the number of "model mill" equivalents projected to be operating in the year 2000. Seventy-six mills are assumed. To the extent there will be existing mills which will not incur the same costs for lining systems and so on. costs will be greatly reduced. For assessment purposes the GEIS assumed that the model mill would operate for about 15 years. This leads to projecting more new mills than there will actually be. Kerr-McGee, for example, has operated for nearly 20 years and is projecting as much as 20 years further operation. Also, because of the problems of speculating about actual numbers of mills, mill sizes and lifetimes, the staff put the costs and economic impacts of meeting the regulations in terms of unit mill output and electricity costs. Looked at in this way, costs are seen to be small fractions of mill revenues and will mean negligible difference in electricit bills. Due to these factors, the total industry cost (for mills which are operating by the year 2000) is probably about one half the figure cited by industry. Note also, that ~~even at operating mills,~~ the upper limit cost estimates ($21 x 10^6) are ~~not likely to pertain at any real mill, even new mills.~~

45. page 40 - AMC asserts that NRC figures indicate that costs for operational controls on the mill itself would be between $25,016,000 and $314,025,000.

Response - The upper estimate is based on extremely costly control alternatives briefly evaluated and rejected in the GEIS. (Dust control option costing 3.6×10^6 per mill vs. the existing, acceptable option costing $32,000 per mill is used. Costs are exaggerated by a factor of 100!) (Appendix K-1.)

46. page 40 - AMC asserts that total costs imposed on industry for complying with the regulations would range from $880,000,000 to nearly $2,000,000,000.

Response - This method is invalid because it considers only costs for new mills and not existing ones as discussed above. It also considers the absurd costs for neglected alternatives (see #45). It is because of the problem of projecting an actual mix of mills (i.e., new and old mills, mills which require extensive groundwater control measures and those which do not) that total industry-wide costs were not computed in the GEIS for tailings disposal. Instead, economic impacts were presented as fractional costs (percentage of yellowcake costs).

The primary costs of tailings disposal will be associated with tailings cover, recontouring and erosion protection. At an existing mill with an above grade impoundment, these will be:

- about 4×10^6 for cover costs (3m of cover)
- about 2×10^6 for recontouring and erosion protection (sides are covered with rock and the slopes are made much flatter than would be necessary)

(Appendix K-9, for 3m of cover.)

They may counter with $9 x 10^6 upper limit cost if there is 5m of cover, or the $8-$13 x 10^6 costs for importing cover materials.

The most likely cost for existing mills would be about $5 million ($4 million for cover and $1 million for erosion protection).

We will have to discuss how to project total costs for a likely industry mix.

47. page 40 - AMC asserts that nowhere does NRC summarize its cost estimates in such a manner.

Response - See response to #46.

48. page 40 - AMC claims that NRC estimates that the costs of its various alternative disposal options permissible under the regulations would range from $10,000,000 to $21,000,000 per mill.

Response - These are costs presented in Table 12.1 for new mills with, essentially, very conservative assumption about digging of below-grade pits, lining of pit walls, and so on.

49. page 40 - AMC asserts that is is ridiculous to require that such vast sums be expended to reduce already miniscule risks (which are low when compared with other generally accepted risks).

Response - See response to other comparative risk statements #2, 6, 7, etc. Further, as indicated in the FGEIS, the costs for complying with the regulations are estimated to a few percent of the product price. Although, as AMC indicates, risks to the individual in the population at large from one year's exposure may be small when compared with risks from background radiation or other accepted risks, this ignores the perspective of risks to maximally exposed individuals or the basic principles of radiation protection that such risks are avoidable and thus should be reduced to as low as reasonably achievable.

50. page 41 - AMC asserts that the UDAD code is riddled with uncertainty and the submodels contain unrealistically conservative assumptions. Risk and exposure overestimations are compounded geometrically. Exposures to nearby individual overstated by 40 to 600 (footnote 82).

Response - Dan Martin providing detailed response to the 40 to 600 claim. We should expose this groundless industry claim. It should undermine their credibility. Generally, in making health risk estimates, staff consistently and consciously made best estimates on controlling parameters and factors. It eschewed selecting the "most conservative" values in the range of uncertainty for each parameter but selected central or "best estimates."

The full body of information on the potential health effects from exposures to the kinds of radioactivity associated with tailings was evaluated. Health risk estimates were established based upon the evaluation of the BEIR Committee.

- (See Branagan testimony on how BEIR represents mainstream of scientific thought on health effects from radiation. It is the most authoritative group in the country on health effects. Estimates of potential health effects vary considerably; BEIR sifted through all the data and full range of views of health risk estimators and came up with a balanced conclusion and consensus.)

51. page 42 - AMC asserts that the risk estimators used by NRC in the FGEIS are inconsistent with the risk estimators contemporaneously employed by NRC in other contexts (e.g., GEIS = $230/10^6$/rem, Occupational Guide = $100/10^6$/rem).

Response - See E. Branagan prepared response attached.

52. page 43 -AMC asserts that NRC assumes the cover material can be obtained on site, free of charge. Thus, transportation costs and costs for cover material itself are not included.

Response - See #8.

53. page 43 - AMC claims the amount of cover material required is enormous and would require excavating 4 square miles to a depth of 3 feet.

Response - As stated in the previous response, the amount of material necessary to provide 3 meters of cover is exaggerated and unfounded. AMC postulates a thin stripping of earth to obtain the inflated volumes of cover material that are presented. In obtaining cover the amount of disturbed surface area can be minimized by excavating to realistic depths and/or in [illegible] areas. See comment in response to RTAC industry brief.

54. page 44 - AMC claims NRC has miscalculated the necessary amount of cover material. The underestimate is about 4,000,000 cubic yards of material.

Response - This claim that NRC has miscalculated the amount of cover material is just one example of where the AMC makes unsupported assertions. AMC indicates that the underestimate is 4,000,000 cubic yards of material and that this stems from a failure to consider satisfaction of the slope requirements. What the industry does not say in the brief is that:

(1) the conservative way the staff figured cover requirements in the draft more than accounts for slope recontouring costs and (2) this comment was responded to in very precise and specific terms in the final GEIS. In K-9, the staff evaluated in detail the ramification that slope recontouring would have on cost. This evaluation showed that total costs at the average mill for cover and recontouring (i.e., slope rewerking and covering) would be about 4×10^6, (for 2.8×10^6 cy). Therefore, the industry allegation is seen to wholly unfounded by anyone reading the FGEIS.

55. page 44 - AMC states that the NRC has refused to consider the interest charges on the funds necessary to meet the regulations.

Response - The cost to industry which is directly associated with the NRC regulations for existing tailing piles will be incurred at the end of milling operations. The cover stabilization operation for the existing tailings piles is an operation that will take place at the end of the tailings pile life, which is after the industry has received the income for the milling of the uranium. Therefore, there is no interest charge. In fact, the industry funds to meet the requirements should earn interest until the actual operation takes place.

56. pages 44-45 - AMC asserts that legislative history indicates that NRC must wait for EPA to issue standards before promulgating regulations (Rowe testimony).

Response - Refer to Motion for Stay response, Appendix A, page 87.

57. page 46 - AMC claims that because of NRC proceeding prematurely operators may be required to suffer an intolerable economic burden.

Response - See #10 above.

58. page 46 - AMC states division of authority between EPA and NRC is not new.

Response - Refer to precedent set in Appendix I.

59. page 48 - AMC asserts that Criterion 9 limits the type of financial surety arrangement to the deposit of cash or its equivalent.

Response - This is obviously not true in view of option F "other."

60. pages 48-49 - AMC states that other state and federal agencies permit self-insurance. Even NRC permits a form of pooled self-insurance for reactor operations. NRC's refusal to consider self-insurance is arbitrary.

Response - NRC defined self-insurance as that option which provided no additional assurance to that which already existed through license conditions. The types of arrangements frequently described by the industry - what NRC would call financial tests - could be considered by the staff on a case-by-case basis under provision F of Criterion 9.

61. page 49 - AMC claims there is a lack of any reasonable method of compliance with Criterion 9. The only evidence in the record (the Surety Association letter) indicates that bonds are not available.
Response - With an "other" option provided, it makes little sense to say that no methods of compliance are available. The industry can be creative and propose nearly anything in good faith. Further, Kerr-McGee testified at the New Mexico EIB hearing that they were recently approved for a letter of credit (TR - page ?). Bonds have been written for NRC-licensed mill operators in Wyoming for many years. These bonds are currently in place as indicated on page A-107 of the FGEIS.