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Mr. Samuel J. Chilk
Secretary of the Commission
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTENTION: Docketing and Service Branch

Dear Secretary Chilk:

Enclosed for filing are the Comments of the Natural Resources Defense Council, Inc. on the Nuclear Regulatory Commission's Draft Generic Environmental Impact Statement on Uranium Milling (NUREG 0511) and the Proposed Accompanying Regulations. 44 Fed. Reg. 50012 (August 24, 1979).

Overall, NRDC believes that implementation of the recommendations in the draft statement and proposed regulations will mark a substantial improvement in the regulations of the uranium milling industry. As set forth fully in our comments, NRDC believes, however, that in a number of instances the draft statement and proposed regulations omit consideration of crucial regulatory and technical issues. In other instances, the draft statement and proposed regulations fail to discuss adequately those issues that are addressed. To rectify these deficiencies, NRDC requests that the Nuclear Regulatory Commission prepare and circulate for public review and comment, a supplement to the draft statement and proposed regulations.

Sincerely,

Helene Linker
Helene Linker

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Enclosure:

Acknowledged by card. 11/9

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COMMENTS OF THE NATURAL RESOURCES DEFENSE COUNCIL
ON THE NUCLEAR REGULATORY COMMISSION'S
DRAFT GENERIC ENVIRONMENTAL IMPACT STATEMENT
ON URANIUM MILLING (NUREG-0511)
AND PROPOSED REGULATIONS
44 FED. REG. 50012 (AUGUST 24, 1979)

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Submitted by,
Helene Linker
Georgia Yuan
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October 19, 1979

I. INTRODUCTION.

The Natural Resources Defense Council (NRDC) submits the following comments on the draft Generic Environmental Impact Statement on Uranium Milling (GEIS) prepared by the U.S. Nuclear Regulatory Commission (NRC)^{1/} and on the accompanying proposed regulations.^{2/} Because the draft GEIS and proposed regulations are integrally related, NRDC's comments address these documents collectively.

The draft GEIS and accompanying regulations have been prepared in substantial part in response to an NRDC petition for rulemaking filed with the NRC in 1975 requesting, inter alia, that agency to undertake a comprehensive review of the uranium milling operations in the United States and the regulatory system governing those operations.^{3/} NRDC believes that implementation of the recommendations in the draft GEIS and proposed regulations that have resulted from that review will mark a substantial improvement in the operation and regulation of the uranium milling industry. In particular, NRDC supports the NRC's recognition that in the past radioactive waste disposal techniques utilized at mill sites have been inadequate. NRDC also supports the NRC's assumption of immediate and concurrent licensing jurisdiction over by-product materials in the agreement states.

^{1/} NUREG-0511 (April, 1979).

^{2/} 44 Fed. Reg. 50012 (August 24, 1979).

^{3/} Petition of the Natural Resources Defense Council Re Generic Environmental Impact Statement on Uranium Milling (March 28, 1975). See, 40 Fed. Reg. 20983 (May 14, 1975).

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NRDC believes, however, that although an improvement over past practices, the draft GEIS and proposed regulations do not go far enough. The draft GEIS and proposed regulations are intended to provide a comprehensive analysis of uranium milling operations nationwide. These generic documents should provide sufficient guidance so that individual EIS's prepared on a site-specific basis need not duplicate the analysis, so that decisions based on these individual EIS's are consistent with one another, and, most importantly, so that the added protection possible under the improved analysis and regulations will be fully achieved in practice. As currently drafted these documents fail to provide a sufficiently detailed and comprehensive analysis. As such, they fail to fulfill the requirements of the National Environmental Policy Act (NEPA), 42 U.S.C. §§ 4321 et seq., and the Atomic Energy Act (AEA) as amended by the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), 42 U.S.C. §§ 2011, et seq., as amended, 42 U.S.C. §§ 7901, et seq.

The deficiencies in the draft GEIS and proposed regulations fall into the following major categories: (1) These documents fail to discuss adequately the implementation of the various disposal options that are considered, and they fail to consider a full range of reasonable options; (2) These documents underestimate the environmental impacts associated with the disposal of uranium mill tailings leading to an undervaluation of disposal options assuring greater long-term isolation of radionuclides; (3) These documents fail to address adequately the history of the

agreement state program or the regulatory measures to be utilized in the agreement states prior to and subsequent to November 8, 1981; (4) The proposed regulations fail to give adequate guidance in that they merely paraphrase the provisions of the MTRCA in a number of instances or fail to address at all a number of regulatory issues. To be adequate under NEPA and the AEA, the draft GEIS and proposed regulations must be revised in the manner set forth more fully below. In the revision, particular attention should be focused on the health benefits potentially provided by alternative 7, 8 and 9 in the draft GEIS. In evaluating these options, an improved procedure from the simple, vague conclusions of "the staff" in the draft GEIS is needed.

We recommend that the NRC prepare and submit for public comment a brief draft supplement to the draft GEIS, and that it also publish for comment revised proposed regulations, reflecting the comments below. A further round of review and comment is required, because the deficiencies in the environmental analysis and proposed regulations are fundamental. Omission of a full opportunity for comments on an improved draft would effectively foreclose the opportunities for public participation mandated by NEPA and endorsed by the Commission itself.

II. THE DRAFT GEIS AND PROPOSED REGULATIONS FAIL TO DISCUSS ADEQUATELY IMPLEMENTATION OF THE VARIOUS DISPOSAL OPTIONS THAT ARE CONSIDERED OR TO CONSIDER A FULL RANGE OF OPTIONS.

1. The draft GEIS and proposed regulations fail to provide sufficient guidance for the implementation and selection of below-grade disposal options.

The NRC's discussion of mill tailings disposal options provides insufficient guidance to future decision-makers who will choose between the so-called "prime" options (below-grade) and the above-grade option. Obviously lacking from the discussion are: (1) specific criteria for identifying and evaluating site conditions which preclude below-grade disposal; and (2) specific guidance for choosing among below-grade options.

The NRC states in the draft GEIS that the "prime" option for safe disposal of uranium mill tailings is below-grade disposal. (p. 12-1).^{4/} NRDC supports the utilization of below-grade disposal as a prime option. However, the draft GEIS and proposed regulations allow for the utilization of above-grade disposal without providing sufficient guidance as to when this option should be used. The draft GEIS and proposed regulations state:

"In some instances, below-grade disposal may not be the most environmentally sound approach, such as might be the case if a high quality groundwater formation is relatively close to the surface or not very well isolated by overlying soils or rock. Also geologic and topographic conditions might make full, below-grade impracticable, for example, bedrock may be sufficiently near surface that blasting would be required to excavate a disposal pit at excessive cost, and

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^{4/} Unless indicated otherwise all page numbers refer to the draft GEIS.

more suitable alternative sites are not available." (draft GEIS at 12-1; 44 Fed. Reg. 50012, 50020).

Unfortunately, the draft GEIS and accompanying regulations do not provide specific guidance so that the decision-maker can determine when groundwater is "relatively close to the surface" or "not very well isolated" so as to preclude below-grade disposal. Rather, the draft GEIS and proposed regulations merely defer the ultimate decision to case-by-case determinations noting, "[i]n these cases, it must be demonstrated that an above-grade disposal program will provide reasonably equivalent isolation of the tailings from natural erosional forces." (P. 12-1; 44 Fed. Reg. 50020). Detailed guidelines for determining when an above-grade disposal system provides "reasonably equivalent isolation" also are not presented in the draft GEIS and proposed regulations.

Similarly, the draft GEIS and proposed regulations fail to provide any specific guidance as to which of the several below-grade disposal options evaluated should be used in any given instance. Instead, these decisions are left to individual EIS's and review of license applications. Clearly, site-specific characteristics will affect the ultimate choice of a disposal option; but it is not sufficient for the draft GEIS and proposed regulations merely to defer this decision to the future without additional guidance. Rather, the draft GEIS and proposed regulations should prioritize the below-grade disposal options and establish site selection criteria for the below-grade disposal options so

that based on these generic criteria future decision-makers and the public can determine easily when below-grade disposal will be appropriate and which below-grade disposal option is best suited to a particular site. Since each of the six below-grade alternatives identified in the draft GEIS (see chapter 8, alternatives 2, 3, 4, 5, 7, 8) assumes a specific set of sub-surface conditions and depth to groundwater, the NRC should outline the specific geologic, groundwater, and topographic conditions for which each of the below-grade options is acceptable.

Another major ambiguity that needs to be resolved generically is the determination of the availability of suitable alternative sites. Because the major health problems posed by uranium milling are connected with inadequate disposal of tailings, the consideration of alternative disposal sites should be extensive. The NRC should consider seriously a requirement that uranium mills be located so that the tailings can be disposed of below-grade safely. In other words, in contrast with past bad practices, mills should be sited on the basis of safely disposing of tailings and not on the nearness of uranium ore. This issue is discussed further below.

The lack of specific site selection criteria for the various below-grade options is particularly striking when contrasted with the relatively detailed site selection criteria provided for the above-grade disposal option. (p. 12-1, and Technical Criterion 4, 44 Fed. Reg. 50020). Indeed, the contrast in detail in the discussion of below-grade and above-grade options raises

questions whether the below-grade disposal options will indeed receive adequate consideration, particularly because the regulations do not require an extensive search for alternative mill sites. The above-grade disposal criteria suggest that it is possible to mitigate future erosional problems inherent in above-grade options by providing appropriate siting criteria.^{5/} No comparable siting criteria exist for the below-grade options.

Below-grade disposal options must be utilized only when proper siting conditions prevail. The NRC must therefore balance its discussion of the prime options and the above-grade option by providing guidelines for assuring an extensive search for below-grade sites, and a set of detailed criteria for evaluating sites for below-grade disposal and utilization of design features which can be used to mitigate site-specific groundwater and sub-surface features. Finally, the NRC must compare the prime options with the above-grade options and give specific criteria for establishing when the prime options can be abandoned in favor of above-grade disposal

2. The NRC prematurely rejects alternative disposal options, which include fixation or changes in ore processing, without sufficient documentation of its reasons for rejecting them.

There is the possibility of significant releases of radio-nuclides into the general environment through groundwater con-

^{5/} For example, it is stated that siting of above-grade sites must utilize topographic features which provide "good wind protection" implying that adequate protection from wind erosion can be obtained from topographic features. Such criteria are misleading because they fail to define "good" protection and fail to take into account the fact that future wind conditions are completely unknown.

tamination in the case of sub-surface disposal, and by erosion of overburden in the instance of above-grade disposal. Changes in the form of mill tailings, however, may provide greater assurance of long-term isolation of hazardous radionuclides. Nonetheless, the NRC has rejected two possible disposal alternatives (Nos. 7 and 9) based on modified forms of tailings, without thorough presentations of these technologies or explanations for rejecting them. In light of the increased safety that these options may provide, the NRC should include in the draft GEIS (1) a more thorough evaluation of treatments for mill tailings, (2) a more detailed description of the research and development program (R&D) needed to develop such techniques to the stage of commercial readiness, and (3) a suggested timetable for completion of such an R&D program. This information should be evaluated and compared with the other disposal options suggested in the draft GEIS.

The draft GEIS identifies two potential techniques for altering the form of uranium mill tailings: fixation in a cement or asphalt (alternative 7) and the substitution of nitric acid as a leaching agent (alternative 9), thereby removing the bulk of the radium and thorium from the tailings. (p. 3-24). These alterations of the tailings' physical and chemical forms are attractive for increasing the likelihood of long-term isolation. The cement or asphalt fixation of alternative 7 may vastly reduce the possibility

of contamination of air and groundwater. Because of these advantages, the fixation of tailings ranks among the highest for minimizing airborne emissions and seepage to groundwater. (p. 9-42).

Alternative 9 also offers great long-term advantages, because the concentrations of long-lived radionuclides, including thorium-230, in the bulk of the tailings potentially can be decreased to levels comparable to those in surrounding soils.^{6/} This means that the consequences of failure in the means for providing isolation would be substantially reduced. In light of the likelihood of such failures over the hundreds of thousands of years of concern, this advantage is very important.

Given these obvious benefits, the draft statement's perfunctory rejection of alternatives 7 and 9, based solely on asserted higher cost and uncertainties related to implementation of the technologies, is unjustified. In particular, the objection that the concentrates following nitric acid leaching will still require disposal, is beside the point.^{7/} The goal

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^{6/}A recent report states that nitric acid leaching removes up to 98% of the radium-226 and thorium-230, leaving a residue that contains 17 to 60 picocuries of radium, and less of thorium, per gram of tailings. For the lower concentrations, this is about an order of magnitude greater than that in surrounding soils, but about the same level as a standard proposed for building materials in the United Kingdom. [Ryon, A.D., Hurst, F.J., and Seely, F.G., Nitric Acid Leaching of Radium and Other Significant Radionuclides from Uranium Ores and Tailings, ORNL/TM-5944, p. 2 (1977).]

^{7/}The analysis of alternative 9 is further flawed because disposal of the concentrates is assumed to be only 30 feet below the surface. (p. 9-37). These concentrates, however, pose a long-term hazard similar to high-level wastes and should, therefore, be disposed of deep underground.

of the leaching process is to put the great bulk of the tailings into a form that would reduce the long-term hazards posed by the natural radionuclides in them. This purpose is particularly important because above-ground storage would be permitted by the proposed regulations. Almost inevitably, tailings stored near the surface will become dispersed widely before their long-lived radioactivity has decreased much. By chemically treating the tailings to remove the long-lived radionuclides before dispersal, adverse health impacts in the distant future will be largely eliminated. This advantage of alternative 9 is not fairly and fully treated in the draft GEIS.

The discussion in the draft GEIS also mentions without elaboration that the nitrates resulting from nitric acid leaching ". . . pose a more severe environmental problem than anion species formed from conventional . . . processes." (p. 12-8). The draft GEIS should have presented a more detailed analysis of this problem. The elaboration of the nitrate problem should be contrasted with the following recent conclusion on the effects of sulfate salts, from a standard milling process, on the movement of contaminants in tailings piles:

"In contrast to the common concept of downward 'leaching', the general trend of material transfer within the piles is from the interior to the exterior, where salts and contaminants precipitate. Wind and runoff transport these salts from the surface of the tailings to surrounding areas, possibly producing areas containing high concentrations of contaminants. The salts can move through soil cover and destroy vegetation." 8/

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3/Markos, G., "Geochemistry and Effects of Salts on the Transfer of Contaminants in Uranium Mill Tailings in the Western United States", in Geological Society of America Meeting, November 5-8, 1979, San Diego, California, Abstracts with Programs, Volume II (No. 7), p. 472 (August 1979).

Furthermore, practical experience with the dispersal of radioactivity from waste storage sites should be presented when evaluating the advantages of alternatives 7 and 9 in comparison to near-surface disposal techniques. For instance, at a uranium ore storage depot and supply plant, higher concentrations of radium-226 were found than were assumed in the draft GEIS (p. 5-4).^{9/} And, at the former Vitro Rare Metals Plant, a recent survey revealed high radium concentrations in the soil at depths up to 18 feet.^{10/} This finding suggests that radium may be more mobile than assumed in the draft GEIS. A third example is another storage site, where a much smaller inventory of uranium decay products than in mill tailings piles could cause potential health hazards.^{11/} These examples and others suggest that confining radioactivity contained in near-surface piles is difficult over long periods of time. They support the prediction that the radioactivity in mill tailings piles left near the surface will be widely dispersed within a short period compared to the period required for the radioactivity to decay to levels acceptable for release.

Alternatives 7 and 9 have also been given short shrift in the draft GEIS through a skewed cost comparison with the

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^{9/} DOE, Division of Environmental Control Technology, Radiological Survey of the Middlesex Sampling Plant, Middlesex, N.J., DOE/EV-00051, p. 14 (November 1977). See also Tables 14, 24, 27 and Figure 18.

^{10/} DOE, Radiological Survey of the Former Vitro Rare Metals Plant, Canonsburg, PA, DOE/EV-00053 (April 1978).

^{11/} DOE, Radiological Survey of the Ashland Oil Company (Former Hoist Property, Tonawanda, N.Y.), DOE/EV-00054, and Radiological Survey of the Seaway Industrial Park, Tonawanda, N.Y., DOE/EV-00056 (May 1978).

other disposal alternatives considered in the draft GEIS. In particular, implementation of the increased monitoring costs associated with the other less secure disposal alternatives have not been taken into account. For example, the initial disposal cost entailed by alternative 7 is higher than most other options. Without fixation, however, the potential for removal of radionuclides by groundwater seepage and surface erosion are greater, and the costs of monitoring for these events would increase the cost of options not using cement fixation. This increased monitoring cost has not been factored into the cost estimate comparison of alternatives in the draft statement. If the costs of each option had been broken down into components, including monitoring costs, the cost differences among the nine alternatives would not have been so great, and options 7 and 9 would have appeared economically more viable. Additionally, factored into the cost/benefit balance should be full recognition of the substantial likely reduction in future ill-health effects provided by the initially more costly alternative.

There are technical uncertainties remaining in the leaching technique and some problems that need solving. Although these difficulties are insufficient to support the outright rejection adopted by the NRC staff, they do need addressing. The NRC staff should assess what additional development work is needed, and describe how it is going to be done. 1435 128

In sum, the NRC should provide a fuller discussion of the technical and economic feasibility of fixation and nitric acid

leaching before dismissing these options due to technological uncertainties. This expanded analysis must include (1) the specific R&D program necessary for implementation of the techniques; (2) a realistic time schedule for completion; (3) a set of criteria for comparing the environmental impacts of these alternatives with others after the R&D is completed; and (4) a more realistic analysis of the cost of these disposal options as compared with the other options presented in the GEIS.

3. The draft GEIS and proposed regulations fail to consider a full range of alternatives in their consideration of uranium mill tailings disposal options.

The draft statement fails to evaluate the full range of reasonable alternatives that would allow greater utilization of the preferred option of below-grade disposal. In particular, the draft GEIS omits serious consideration of the following two categories of alternatives: (1) transporting dried tailings to other individual sites or to a regional repository for several mills, and (2) siting new mills only where the prime option can be utilized.

Concerning the first category, a few of the alternatives identified in Chapter 8 (alternatives 2, 3, 7) do include transportation to other sites. All of these alternatives, however, are limited to the use of pipelines for transportation of slurries to existing open pit mines. This alternative is only one of several possibilities for below-grade disposal away from mills. Other specific alternatives not identified in the draft GEIS that should have been considered include:

1. Transporting tailings to a specifically excavated pit at a suitable site away from the mill;

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2. Transporting tailings to an excavated pit or open pit mine specifically sited as a regional repository for several mills; and
3. Transporting tailings to other mill sites.

The importance of considering options using transportation other than slurries by pipeline to another site is emphasized by the consideration of options utilizing a variety of transportation forms in a recent environmental impact statement for the Moab uranium mill.^{12/} In the Moab EIS, five of the ten alternatives include transportation to environmentally preferable sites that are seven and fifteen miles from the mill. The transportation modes considered were trucking of dry tailings and contaminated soil, piping hydraulically mined existing tailings, and a combination conveyor and railroad system.^{13/} Though these alternatives were rejected in the Moab EIS analysis, based on site-specific characteristics, in this generic draft statement the NRC should have included such options and provided detailed guidance for site-specific EIS's and review of license applications for determining when, if ever, these options should be utilized.

Secondly, greater consideration should have been given to siting new mills only at locations appropriate for below-grade disposal. The draft GEIS and proposed regulations state that primary emphasis in site-selection should be given to tailings isolation.

^{12/} NRC, Final Environmental Statement, Moab Uranium Mill, NUREG-0453, pp. 10-3 to 10-9 (January 1979).

^{13/} Id. at 10-5, 6.

"In the selection of mill sites, primary emphasis should be given to isolation of tailings, a matter having potential long-term impacts, as opposed to consideration only of short-term convenience or benefits, such as minimization of transportation or land acquisition costs." (P. 12-1; 44 Fed. Reg. 50020).

The siting of new mills was not included in the discussion of tailings management disposal options in the draft GEIS, however. A consideration of this mill siting option in the draft statement and proposed regulations should have included specific criteria that must be taken into account when the NRC and agreement states review license applications for new mills.

In summary, the NRC revision of the draft GEIS must include a broader consideration of alternatives that favor utilization of the identified "prime" option, below-grade disposal. The present statement considers too narrow a range of transportation options to other sites and fails to discuss adequately restricting the siting of new mills to locations that can utilize below-grade disposal.

4. The draft GEIS and proposed regulations fail to discuss adequately implementation of the proposed disposal criteria to tailings piles at existing sites in agreement and non-agreement states.
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The regulations establish that the NRC will exercise immediate licensing authority over tailings piles in agreement and non-agreement states. NRDC supports the Commission's interpretation of the UMTRCA in this regard. NRDC has already submitted detailed comments to the NRC setting forth its legal

analysis of this interpretation of the UMTRCA.^{14/}

While NRDC supports the NRC's assumption of licensing jurisdiction over tailings piles, the draft GEIS and proposed regulations fail to address with adequate specificity how the disposal requirements will be made applicable to existing sites. At best, these documents give vague assurances that existing licenses will be reviewed and modified in accordance with the regulatory requirements.

The draft GEIS, for example, contains only the most minimal discussion of implementation of the disposal criteria at existing sites. In a single paragraph of discussion on this issue (p. 12-24, § 12.4) the staff acknowledges that the regulatory actions set forth in the document were "developed primarily in consideration of what can be done in prospective milling operations." The staff goes on to suggest that these regulatory requirements should, however, "be incorporated to the maximum extent reasonably achievable at existing sites," but declines to suggest how these requirements will be implemented at any given site. Finally, the staff points out technical constraints utilizing alternative disposal methods where large volumes of tailings already exist and financial constraints on incorporating these disposal criteria at sites where additional disposal costs were not incorporated into the price of the product as the tailings were generated. This discussion

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Comments of the Natural Resources Defense Council Concerning the Timing of the Requirements of the Uranium Mill Tailings Radiation Control Act of 1978 with Respect to By-Product and Source Material Licenses, submitted to the NRC, 4-10 (March 20, 1979).

raises serious questions as to the extent the staff will indeed determine that remedial actions are feasible at existing sites.

The regulations themselves provide no stronger commitment to apply the improved disposal criteria at existing sites. Indeed, the regulations do not specifically address implementation of the proposed criteria at existing sites. Rather, it is only in the preamble to the regulations that there is any discussion of the application of these criteria to remedial sites. (44 Fed. Reg. 50015). This preamble discussion, again, gives vague assurances, but no firm commitment, that revised tailings disposal criteria will be incorporated into licenses for existing sites when these licenses are renewed or amended.

With respect to licenses issued in non-agreement states, the preamble notes that "existing active mill licenses have been reviewed or are being reviewed under the provisions of the National Environmental Policy Act (NEPA) and that all NRC licenses presently contain, or will contain, requirements for tailings reclamation, mill and site cleanup, and surety arrangements to cover these costs." (44 Fed.Reg. 50012).

With respect to application of these disposal criteria to active sites in agreement states, the preamble notes, without documentation that "there presently exist Agreement State regulations and requirements governing the control of tailings . . . that appear adequate to protect the public health and safety" until the licenses expire or are renewed, and that "[t]he Commission intends to review each application under the NEPA process and impose any necessary requirements as may be necessary to protect the public health and safety." (Id.).

While the Commission's intentions to incorporate the revised disposal criteria at existing sites are good, the non-specific discussion of the implementation in the draft GEIS and the proposed regulations will not suffice. To be adequate, this implementation process must be discussed in the regulations themselves, not only in the preamble to the regulations. In these regulations, the Commission must make a firm commitment to review all licenses issued in non-agreement and agreement states prior to November, 1981, to determine if these existing licenses comply with the recommendations for disposal programs in the generic environmental impact statement. The Commission must further commit to ensuring that remedial action will be conducted at these active sites if this evaluation discloses that the existing disposal techniques are inadequate. Finally, the regulations should make clear that the financial burden for the remedial action will fall on the mill operator. To avoid a situation where additional tailings are generated without adequate financial arrangements to cover the costs of the action, the Commission should require that mill operators at existing sites post a bond to cover the cost of remedial action for any additional waste generated prior to a Commission review of the site and implementation of remedial action.

III. THE DRAFT GEIS UNDERESTIMATES THE ENVIRONMENTAL IMPACTS ASSOCIATED WITH DISPOSAL OF URANIUM MILL TAILINGS.

1. The analysis of environmental impacts from the mill tailings disposal options identified in the draft GEIS is inadequate, because it fails realistically to address climatic and geologic changes that will inevitably take place over the long time period the radionuclides must be contained.

The draft GEIS fails to discuss with specificity the exceedingly long time frame over which the tailings must be isolated. Rather, mill tailings disposal is more generally referred to as "a long-term waste management problem" (p. 2). Since the parent isotope in the mill tailings is thorium-230 with a half-life of 80,000 years, the mill tailings will lose their toxicity very slowly. The discussion of disposal options in the draft GEIS, unfortunately, fails to focus on the 80,000 year half-life of thorium-230. Consequently, the draft GEIS does not adequately consider either the impacts of groundwater contamination or exposure of tailings from erosion that will occur in the below-grade and above-grade disposal options, respectively, over the many tens of thousands of years that the thorium-230 will continue to be a significant source of hazardous decay products.

Substantial climatic and hydrologic changes will undoubtedly occur over the very long time period that the radionuclides in tailings must be contained. Geologists often consider the long-term climatic changes in terms of the next glaciation:

"It is now predicted that the long-term trend for the next 20,000 years is toward extensive glaciation in the Northern Hemisphere . . . Mean precipitation and evaporation differ markedly between

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glacial and inter-glacial times. We cannot assume that an area that is arid today will remain so during a glacial cycle. This is most obviously the case in Utah and Nevada, where, during the recent glacial epochs, there was a pronounced pluvial environment." ^{15/}

Nevertheless, in the draft GEIS consideration of post-operational groundwater seepage from the base case tailings disposal site unrealistically assumes that future hydrologic conditions, such as rainfall, runoff and permeability, remain the same:

"After mill operations cease, seepage from the tailings would be substantially reduced because of the cessation of discharge of water from the mill. It is shown in Appendix E that the permanent seepage rate caused by precipitation (consisting of relatively pure water) falling on the uncovered, abandoned tailings would be about $1.12 \times 10^4 \text{ m}^3/\text{yr}$ ($f \times 10^5 \text{ ft}^3/\text{yr}$), about 5% of the rate during the 15-year operational period." (p. 6-9).

Similarly, the analysis of groundwater contamination for the nine disposal alternatives assumes constant conditions (p. 9-18).

Because of the long time period that that the tailings must be contained, such assumptions of constant conditions are inappropriate. The need for more sophisticated analysis of groundwater quality in light of the long periods of time the tailings remain toxic was emphasized by a group of researchers studying active mill sites:

"The stark contrast between a typical 20-year mill life and an 80,000 year

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^{15/} Environmental Protection Agency, Report of an Ad Hoc Panel of Earth Scientists -- State of Geologic Knowledge Regarding Potential Transport of High-Level Radioactive Waste From Deep Continental Repositories, EPA 1520/4-78-004 at 38 (1978).

half-life for the dominant radionuclide (thorium-230) necessitates a much greater forward look than is now evident in waste disposal practices and preservation of groundwater quality." 16/

The potential extent of radionuclide movement that must be anticipated under changing climatic conditions is highlighted by the discussion in Appendix E. Here the NRC quotes a preliminary finding of a field study in West Chicago showing that radium and thorium moved at a rate of about 2 meters per year. (pp. E-20, E-21). Though the NRC appears to be citing this case in support of the slow movement of radionuclides, in wet conditions, an extrapolation of these figures demonstrates that in the relatively short time period of 10,000 years, the radionuclides could potentially move 20 kilometers. The failure to address the climatic changes and consequent potential substantial movement of the radionuclides over tens of thousands of years has resulted in an inadequate analysis of long-term hazards posed by even the below-grade disposal options.

Similarly, the failure to specifically take into account the long time period required for containment has unrealistically colored the feasibility of above-grade disposal options. The NRC assumes that above-grade disposal can be demonstrated to "provide reasonably equivalent isolation of the tailings from natural erosional forces." (p. 12-1). Inherent in this statement is the assumption that mitigation against erosion can be

16/ Kaufman, R.F., Eadie, G.G., and Russell, C.R., "Effects of Uranium Mining and Milling on Groundwater in the Grants Mineral Belt, New Mexico," Ground Water, 14 (No. 5), p. 307 (1976). 1435 137

maintained for many tens of thousands of years. Based on information about climatic changes given in the draft GEIS itself, this assumption appears unreasonable.

"Predictions about future climates are integral to the evaluation of long-term stability of structures placed on the earth's surface. One scenario of future climates . . . has the earth heating up in the near future. This heating is expected to end after a few hundred years and the world would proceed towards a new ice age." (p. 9-34).

Increased rainfall and/or increased temperatures may decrease the permeability of soils^{17/} and potentially result in increased surface flow and erosion. During the needed period of containment it is certain that the hydrogeologic conditions at the site will change substantially.

"Although some major climatic and geologic changes are certain to occur during the period that the tailings remain hazardous (hundreds of thousands of years), the magnitude and direction of change cannot be determined." (p. 9-33).

Therefore, it appears unreasonable to suppose, as does the draft GEIS, that features such as embankment slopes or vegetative cover will remain stable and continue to provide isolation of radionuclides for the necessary hundreds of thousands of years.

At the least, the NRC should be more candid about the large uncertainties associated with insuring isolation for such long periods of time, even using the proposed above-grade and below-grade disposal options. The NRC has grossly simplified the

^{17/} Davis, S.N. and DeWiest, R.J.M., Hydrogeology, p. 353 (1966).

problems of mill tailings disposal by not considering realistic time frames for tailings isolation. The NRC should assess additional mitigating measures for preventing groundwater seepage associated with below-grade options as described above, and, it must further explain its confidence in any above-grade scheme for ensuring isolation for hundreds of thousands of years.

2. The draft GEIS fails to consider the actual upper limit of cumulative impacts from uranium mill tailings generation.

The NRC has arbitrarily terminated its evaluation of the cumulative impacts of the uranium milling industry at the year 2000. A more appropriate and complete analysis of cumulative impacts resulting from the operation of conventional uranium mills would be based on the total uranium resources of the United States. At the very least, to be consistent with the Department of Energy's (DOE) estimates of future reactor operation,^{18/} the draft GEIS should include an evaluation of the cumulative impacts of tailings generated from mills operating to the year 2040.

The NRC has based its analysis of cumulative impacts on nuclear reactor generating needs. As stated in Chapter 3 of the draft GEIS:

"Nuclear energy growth projections resulting in a nuclear generating capacity of 380 GWe in the year 2000 were used in estimating U.S. uranium production necessary to meet estimated nuclear fuel needs to the year 2000." (p. 3-17).

^{18/} See, DOE, Draft Environmental Impact Statement, Management of Commercially Generated Radioactive Waste, DOE/EIS-0046-D (April, 1979).

In the case of milling, the largest possible cumulative impacts can be calculated from the total tonnage of uranium ore available for mining and milling. Therefore, in lieu of basing impacts on limited assessments of nuclear generating needs, the total uranium resources could be used as an upper limit for the tailings which will be generated by the milling industry. Estimates of uranium reserves and resources, in fact, are given in the draft GEIS. The total, assuming \$50/lb., of all reserves and resources in Table 3.5 is 4.4×10^6 short tons U_3O_8 , which, when milled, produces 2.7×10^9 MT dry tailings.^{19/} Under this reasonable estimate for an upper bound for future mill tailings accumulation, 4.5 times more tailings are produced than considered in the cumulative environmental analysis. (p. 3-17). The NRC should consider this large disparity in possible tailings generation scenarios and prepare an adequate assessment of the potential cumulative adverse health effects resulting from the uranium milling industry.

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This figure is derived from the conversion given in the draft GEIS at 3-4 for metric tons of dry tailings generated per ton of ore, assuming 0.16% U_3O_8 in the ore.

IV. THE DRAFT GEIS AND PROPOSED REGULATIONS FAIL TO DISCUSS ADEQUATELY THE AGREEMENT STATE PROGRAM.

1. The draft GEIS and proposed regulations fail to discuss adequately the history, problems and future prospects of the agreement states program.

The draft GEIS's discussion of uranium milling operations in the agreement state program is insufficient. The documents fail to give any overall assessment of how the agreement state program has been operating or is currently operating. In addition, the document fails to compare the history of operations in agreement states in terms of licensing practices, record of accidents, and types of tailings disposal programs authorized, with the comparable information in non-agreement states. It is only if this information is made available that the public and decision-makers can ultimately determine whether the agreement state program is functioning properly.

Indeed, a review of the various agreement state programs suggests that the present regulatory systems are inadequate both procedurally and substantively.^{20/} In New Mexico, for example, the agreement states with the greatest number of active uranium mills, current state regulations do not provide for the preparation of an independent environmental analysis on a proposed license, for public hearings on a proposed license, for a prohibition on construction, or for an adequate tailings stabilization program. The recent break in the tailings dam at the United Nuclear Church Rock facility

20/ NRC, Workshop on the Federal State Regulations of Uranium Mills, NUREG-CR-0029, p. 2 (Feb. 1978).

demonstrates that past licensing practices in the state have been inadequate. Although New Mexico has recently held hearings to amend its Radiation Protection Regulations, the new regulations have yet to be adopted. At this time it is premature to assume, as does the proposed regulations, that the New Mexico program is "adequate to protect the public health and safety." (44 Fed. Reg. 50012). Rather than glossing over deficiencies in the agreement states' regulation of the uranium milling industry, the draft GEIS should contain a detailed evaluation of the adequacy of the program in each of the agreement states and should contrast this information with the operation of the regulatory program in non-agreement states.

2. The proposed regulations fail to require implementation of section 204 of the UMTRCA to the agreement states' licensing of source material prior to November 8, 1981.

As currently drafted the proposed regulations do not require implementation of the requirements of Section 204 of the UMTRCA until November 1981 in the agreement states' issuance of source material licenses. (Regulation Section 150.31, 44 Fed. Reg. 50024). The failure to address the agreement state's licensing of source material prior to 1981 permits the states to continue until that date their past practices with respect to source material. NRDC believes, however, that the UMTRCA requires states to implement immediately the provisions of section 204 of the UMTRCA with respect to source material licenses. 1435 142

Section 204 of the UMTRCA establishes new substantive and procedural requirements to be followed by the states in their licensing reviews of source and by-product material. Subsection

"o" requires that the state's substantive standards to protect the public health and safety are "equivalent, to the extent practicable, or more stringent, than the standards adopted by the commission for the same purpose. Subsection "o" also sets forth new procedural requirements to be adopted by the Commission in licensing, including opportunity for public hearings, cross examination and most importantly preparation of an environmental analysis on each license with a significant impact on the human environment. These requirements are applicable to the state's licensing of both source and by-product material.

Since Section 274o of UMTRCA makes all provisions of the amendment effective immediately upon enactment of the UMTRCA except as otherwise provided, the question becomes whether any other provision of the UMTRCA provides for a deferral of these requirements in the states' source material licensing review. The close review of the UMTRCA amendments indicates that no such deferral is provided with respect to source material licensing. Neither Section 204(h) nor any other provision of the UMTRCA provides for such a grace period for the states to implement the substantive and procedural requirements of the UMTRCA with respect to source material licensings. NRDC submits, therefore, that the plain language of the UMTRCA requires immediate implementation of the requirements of section 204o to the licensing of source material in agreement states. The proposed regulations should require such immediate implementation rather than deferring application of section 204o requirements until November, 1981.

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3. The proposed regulations dealing with agreement state regulation of by-product and source material after 1981 fail to provide adequate guidance.

Section 150.31 of the proposed regulations sets forth standards for the agreement state licensing of by-product material and activities resulting in the production of by-product material after November 8, 1981, and permits agreement states to license such material if and only if the licensing process in these states conforms to conditions imposed by the NRC. While the intent of these regulations are sound, section 150.31 provides little extra guidance to that provided in the statutory language of the UMTRCA concerning the state's obligations. In essence, section 150.31 of the regulations merely restates the requirements of section 204 of the UMTRCA. To provide sufficient guidance the regulations should interpret the language of the statute.

Specifically, section 150.31(b) of the regulations repeats section 204(o)(2) of the UMTRCA and requires the agreement states to adopt standards "which are equivalent, to the extent practicable, or more stringent than, standards adopted and endorsed by the Commission for the same purpose . . ." No guidance is provided on the definition of the terms "to the extent practicable" and the question of what contingencies, if any, would justify a state's imposition of standards less than those imposed by the federal government. To be adequate the regulations should specify what standards and criteria will be applied in making this determination.

Similarly, section 150.31(c)(3) should provide additional guidance concerning the preparation of the environmental analysis which must accompany each license. As presently drafted, the

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regulations recite the UMTRCA verbatim, but fail to make clear that such an analysis must be an independently documented assessment prepared either by the NRC or by the states. Although the draft GEIS [at 23] and the legislative history of the UMTRCA establishes that such an independent analysis is the most appropriate, the regulations as currently drafted do not explicitly state this. To avoid any future question that something short of such an independent analysis, such as an analysis by the applicant, will suffice, the independent analysis requirement must be made clear.

Finally, additional guidance should be given in regulation 150.31(c)(4) as to the type of construction activity, if any, that will be permitted prior to the completion of the environmental analysis prepared pursuant to 150.31(c)(3). As currently drafted the regulations prohibit "major" construction; however, no definition is provided as to what constitutes "major." Definition of the term is essential to avoid the situation where a substantial commitment of resources have been made, and substantial momentum towards pursuing the proposed project have been generated, under the guise of minor construction.

A stringent definition of the term "major" is also most appropriate to ensure that construction policies in non-agreement states and agreement states will be consistent after November, 1981. Section 40.32 of the proposed regulations deals with the issuance of specific NRC licenses in non-agreement states and prohibits "commencement of construction of the plant or facility in which the activity will be conducted" prior to completion of the environmental review.

No distinction is made between major or minor construction activities. To ensure consistent approaches in agreement and non-agreement states, the regulations must address and clarify this issue.

4. The proposed regulations and draft GEIS fail to establish a review and revocation process for agreement state programs subsequent to November 8, 1981.

The proposed regulations require that by November 8, 1981 the agreement states bring their programs for licensing by-product and source material into compliance with section 204 of the UMTRCA. (Regulations § 150.31, 44 Fed. Reg. 50024). The proposed regulations, however, fail to address the manner in which agreement state programs will be monitored for compliance or the mechanism and criteria that will be utilized in revoking the state's agreement, or portion thereof, if the state fails to comply fully with these requirements. Such a review, and revocation of the agreement, is clearly contemplated by section 204 of the UMTRCA which amends section 274 of the AEA (1) to require the NRC to undertake periodic reviews of the agreement state programs to ensure compliance with the requirements of section 204, and (2) permits the NRC to revoke a portion of the agreement state's licensing jurisdiction, rather than the entire agreement, in the event the state's program is found to be inadequate.

To be adequate, the proposed regulations must address this review and revocation issue. The regulations should specify the frequency with which the NRC will review agreement state programs to ensure compliance, the specific standards the state's program

will be judged by, the procedures that will be utilized to permit the public to participate in an NRC initiated review and to request the NRC to initiate such a review and/or revocation process.

Although the NRC has taken the position that agreement state compliance with section 204 of the UMTRCA is not required until November 8, 1981, it is essential that the regulations put into place prior to that time have the mechanisms for ensuring such compliance. Given the time required to draft proposed regulations, circulate them for public review and comment, and finally adopt them, the NRC should develop at this juncture the regulations dealing with the review and revocation process in agreement states.

V. THE PROPOSED REGULATIONS ARE INADEQUATE IN THAT THEY MERELY PARAPHRASE THE UMTRCA OR FAIL TO ADDRESS OTHER REGULATORY TOPICS AT ALL.

1. The proposed regulations dealing with source and by-product material ownership fail to provide sufficient guidance.

The regulations dealing with site and by-product material ownership fail to provide any additional guidance to that provided in the UMTRCA as to when and how land transfers will be affected and when use of the surface or subsurface estates of such transferred land will be permitted. (Regulations, Appendix to Part 40 III, 44 Fed. Reg. 50022). In essence, criterion 11 of the regulations merely recites the language of the UMTRCA. While NRDC supports the land ownership concepts embodied in the UMTRCA legislation, regulations implementing that legislation should amplify the statutory mandate and provide guidance as to how the statutory requirements will be implemented. Only if this additional guidance is provided can the public determine whether the proposed mechanisms are adequate.

In this instance, for example, criterion 11B should set forth the specific terms and conditions that will be incorporated into licenses to ensure that land transfers will be affected. It is not sufficient merely to state that the necessary terms and conditions will be incorporated into the license. Criterion 11D should specify the process and standards the Commission will utilize in determining when the use of surface and sub-surface estates would not endanger the public health and safety. Criterion 11E dealing with transfer of ownership for licenses in effect on November 8, 1981 should provide detailed guidance as to when the

Commission will require transfer of title and what weight will be given to the status of ownership at the time of transfer review.

2. The draft GEIS and proposed regulations fail to address in an adequate and realistic fashion what the disposal site monitoring program entails.

The NRC's discussion of the post-operational monitoring programs to be implemented at various sites fails to provide sufficient detail concerning the types of measurements to be taken or the time period over which the monitoring program will continue. The lack of specificity makes it virtually impossible for the reader to evaluate the adequacy of the monitoring proposals.

A two-step post-operational monitoring program is envisioned. First there will be monitoring of decommissioning operations at all sites; second, there will be long-term monitoring of the passive care mode or possibly the reduced care mode. In neither instance has the NRC provided specific guidance as to what these monitoring programs will entail. Rather, the draft GEIS suggests that any specific programs must be divided on a site-specific basis. (p. 10-13, § 10.3). Deferral of all specifics to site-specific EIS's is inappropriate. Although the UMTRCA establishes that long-term monitoring will be minimized and eliminated to the maximum extent practicable and the draft GEIS and proposed regulations are aimed to such an approach, a long-term monitoring program is envisioned as a component of the disposal program. As such, adequacy of the nine disposal options considered in the draft GEIS can only

be evaluated with relatively detailed and concrete knowledge of the monitoring program that will accompany each option. Moreover, neither the UMTRCA, draft GEIS, nor proposed regulations suggest that monitoring at the decommissioning phase is to be minimized or eliminated. A full discussion of this portion of the monitoring program is without question necessary.

To the extent that the monitoring programs will be dependent to some degree on the type of disposal technique selected and to site-specific characteristics, the GEIS should develop alternative scenarios to inform the reader and decision-makers what type of monitoring will be undertaken given certain conditions. At a minimum, these alternative monitoring criteria should specify the types of test samples to be taken (i.e., air, water, soil); their frequency; the portion of the site to be monitored; and the time period over which this monitoring program will extend.

Moreover, the vague discussion of long-term monitoring colors the evaluation of disposal alternatives. Nowhere does the draft GEIS clearly and realistically set forth the limitations of the long-term monitoring program. The GEIS should make clear that the tailings remain toxic for tens of thousands of years, that no institutional monitoring program can be implemented for this entire time period, and that realistically the disposal option selected must guarantee containment with an extended monitoring program. Were this information provided, the disposal options might well appear more attractive options, because they offer the prospect of greater assurance of long-term isolation with a "reduced" monitoring program.

3. The prohibition on mill construction should be tied to the issuance of a license for a facility and not merely to completion of the NEPA review.

In its preamble to the proposed regulations the NRC acknowledges that "[W]hen construction of a mill commences, nearly irrevocable commitments are made regarding tailings disposal" and consequently that "prudence requires that specific methods of tailings disposal, mill decontamination, site reclamation, surety arrangements, and arrangements to allow for transfer of site and tailings ownership be worked out and approved before a license is granted." (44 Fed. Reg. 50018.) The intent is to avoid a commitment of resources until all measures necessary to protect the public health and safety have been established.

Section 40.32 of the proposed regulations, dealing with the issuance of specific licenses does not carry this concept to fruition. Section 40.32 of the regulations prohibits the construction of a mill facility until completion of the NEPA review. This revision in the regulations marks a substantial improvement in past NRC practices by eliminating the exemption from such a requirement previously available (see, e.g., 10 C.F.R. 30.33(a)(5)). However, section 40.32 does not go far enough. It is not until the actual licensing of a facility that surety arrangements for decommissioning and long term monitoring are firmly established or that arrangements for ultimate land ownership transfers are firmly worked out. Thus, to provide fuller protection that there will not be an irretrievable commitment of resources without

adequate protection of the public, the commencement of construction for a mill should be prohibited until the issuance of the actual license, not merely until completion of a NEPA review.

4. The draft GEIS and proposed regulations fail to consider steps which must be taken in the event remedial action is needed at a mill tailings disposal site.

The NRC has not considered actions it will take in case remedial action is needed at a mill tailings disposal site. The monitoring programs during the operational and post-operational stages are more concerned with the frequency of measurements than with actions which can and will be taken if containment is lost.

The recent break in the tailings dam at the United Nuclear Church Rock, New Mexico, facility emphasized the need for an evaluation of remedial measures. The failure of the tailings dam on July 16, 1979, released 288 acre-feet of tailings solution and 1100 tons of tailings solids to the surrounding area.^{21/} The facility in question was the most recently licensed uranium mill in the State of New Mexico and had been pointed to as a model facility.

Similarly, the draft GEIS discussion of tailings slurry releases (p. 7-4) makes evident the need to specify remedial actions. This discussion is primarily concerned with potential radiological releases, which the NRC conveniently concludes will be small. However, Table 7.1 shows that 15 accidental

^{21/}United Nuclear Corporation Mining and Milling Division, Stability and Integrity Assessment of Northeast Church Rock Tailings Dam, at 5 (July 20, 1979).

releases of tailings slurries were recorded between 1955 and 1977, with two-thirds of them reaching the "watercourse". The potential for future accidents exists whether or not improved tailings disposal techniques are utilized. Thus, the GEIS must address the problem of remedial action and develop standards for what definitive steps will be taken in case such accidents occur.