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March 25, 1980

Dr. David M. Rosenbaum
Deputy Assistant Administrator
for Radiation Programs (ANR 458)
U.S. Environmental Protection Agency
401 M Street, SW.
Washington, DC 20460

Dear Dr. Rosenbaum:

As you are aware, I participated, as a member of the Interagency Working Group for the development of Federal Guidance for radioactive waste disposal criteria, in a meeting held on the 18th of December, 1979, to discuss the draft materials provided by Dr. Augustine with his letter of November 27, 1979.* Following that meeting we prepared comments on the draft criteria, which have not yet been transmitted to you. In view of the time that has lapsed since that meeting, I. Craig Roberts contacted Dr. Augustine to see if the comments would still be useful and was advised to send the comments even though there is some question as to whether the criteria will be published. We hope they will be useful to your staff in developing the EPA high level radioactive waste standard.

We understand the magnitude of the job of writing generic guidance for disposal of radioactive wastes, and we appreciate the hard work which EPA has done. However, based upon careful critical review of the draft standard, we have concluded that the guidance is inappropriate. Our reasons are as follows: First, insufficient attention has been given to low-level radioactive wastes (LLW) in the development of this guidance. The recommendations are intended to apply to all radioactive wastes. However, the guidance simply has not been thought through in the area of LLW. Because the guidance is inapplicable in these areas, it can be anticipated that Federal agencies will find that the guidance should not be followed. We believe that every effort should be made to adopt guidance that can be implemented, not simply to reduce the prospect of legal challenge to agency practice, but more importantly to assure a unified unambiguous approach to serving the public interest in this area. Second, the guidance as written would require a risk assessment to be used by Federal agencies as the primary tool in making any decision involving the generation or disposal of radioactive wastes. The NRC has invested considerable time and resources exploring the applicability of the tools and methods of quantitative risk assessment. While these tools and techniques are very useful in assisting the decisionmaker to understand the nuances of a problem and the ramifications of possible decisions, they are neither sufficiently developed nor definitive to provide that understanding or make those decisions. The results of any risk assessment must be weighed against the assumptions and uncertainties involved in attaining that result. Third, the guidance does not stand on its own. Both

*The materials enclosed with Dr. Augustine's letter were: Federal Register notice, draft No. 21, November 14, 1979; Federal Guidance Background Report, draft No. 3, November 19, 1979, and Response to Public Comments document, draft No. 4, November 20, 1979.

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the background document and the response to comments document must be studied and interpreted to understand the intent of the guidance. Moreover, there are several instances at which the guidance appears to be inconsistent with the background document. These points are discussed in detail below.

Recommendation 5 could be interpreted to require that mill tailings be disposed of in a very deep location. This conclusion is reached because the guidance would not permit reliance beyond 100 years on physical and institutional barriers to prevent human intrusion into tailings piles. Yet the long-lived hazard associated with mill tailings is much longer than 100 years. Hence, because institutional controls are not permitted for mill tailings, the only method of protection against human intrusion "allowed" by the guidance would be deep disposal.

Yet, the large volume and low level of radioactivity of mill tailings make it unreasonable to require deep disposal. Disposal of tailings in deep uranium mines may be possible in some cases, but the expense of requiring deep burial in all cases would be excessive with no concomitant increase in protection of the public health and safety. As evaluated and discussed in our generic environmental impact statement (GEIS) on uranium milling (NUREG-0511), the consequences of the intrusion event would not be acute health effects; continuous exposure to tailings would be required to cause any perceivable health effects. It would be unreasonable for one or several future human intrusion events exclusively to drive the solution to the mill tailings disposal problem. Furthermore, the GEIS conclusions are in consonance with the Uranium Mill Tailings Radiation Control Act of 1979 (PL-95-604) and call for Federal land ownership of mill tailings disposal sites. Federal land ownership is itself not a control. However, it provides the opportunity to exercise active control as needed. With recognition that Federal land ownership cannot be expected to persist for as long as the tailings will remain hazardous the Congress nonetheless required such ownership because for as long as the opportunity to exercise active control can be provided it is prudent to do so. This is consistent with the discussion in the EPA Background Report, page 14. We suggest that if EPA publishes this guidance the section on Institutional Controls and Section IV of the background document clearly state that deep disposal of uranium and phosphate mill tailings is not the intent. We further urge EPA to recognize a distinction between such "active" controls as monitoring or maintenance of facilities and "passive" controls including maintenance of land-use records or persistence of identifying markers or monuments. We believe that the "passive" controls ought to be given appropriate weight when considering the prospect of human intrusion.

More flexibility is needed in evaluating the length of reliance on both "active" and "passive" controls. The 100 years is totally arbitrary. The period of reliance ought to fit both the type of waste and the particular control.

Another example of an inapplicable requirement is the recoverability provision of recommendation 6. If applied to low-level waste as indicated in the discussion in the background report, this provision would prove impracticable for some waste types either because of economic costs or because of the radiation

exposures associated with the added waste processing and handling. Consideration should be made of the practicability of recoverability provisions as well as their effect on waste isolation. It would also be helpful to define more precisely the intent of this recommendation since the provisions to facilitate recovery for corrective measures could be substantially different from those intended to preserve possible resource values of wastes.

Although there appears to be no similar advantage for mill tailings, both LLW and HLW disposal could benefit from some "aging" prior to emplacement. Yet the guidance exhorts agencies to dispose of the waste without undue delay. Although at the December 18 meeting it was agreed that "undue delay" should not be interpreted to mean immediate, recommendation 3 might be construed not only to rule out aging of waste but also to rule out storage of short-lived radioactive wastes for decay as an alternative to disposal. For waste nuclides with half-lives on the order of months, storage may represent a lower radiological hazard than the transportation and handling operations necessary for disposal. Similarly, for nuclides such as Co-60 with half-lives of a few years, reductions in transportation and handling hazards may more than offset the hazards involved in storage for several years.

Recommendation 9 appears to limit the consequences of all credible events to a small percentage of background regardless of the likelihood of occurrence or the type of waste involved. This seems overly restrictive for some events (e.g., intruder scenarios) for which the true likelihood of occurrence is unknown, but credible. If the small percentage of background criterion were used to evaluate the maximum individual exposures from all credible events for all wastes, most, if not all, waste disposal concepts would be judged to be unacceptable. If the guidance is intended to be binding, even binding in the FRC sense, this sort of criterion would seem to need an Environmental Impact Statement because of its environmental implications.

Reliance on risk assessment in the guidance (e.g., third paragraph on page 4) presents fundamental difficulties - philosophical and technical. To begin, there is the question of what is "acceptable risk" and the way the guidance proceeds to answer the question. Any risk, regardless of its magnitude, is acceptable or unacceptable only in terms of the expected benefits accrued from taking that risk. Hence, in defining what may be acceptable risk, one necessarily must ask what is expected in return. A risk assessment generally operates narrowly only on the "cost" side. The question of benefit never is considered. Yet, without consideration of benefit the cost/benefit balancing, which is the bulwark of all NEPA decisionmaking, cannot be done. We realize that the guidance does not explicitly exclude consideration of benefit. Neither does it direct such consideration, however. It is our concern that through the discussions in the background document, the implication is made that only risk is or should be considered in determining what is acceptable. Logically, such an implication can only lead to a judgment that the only acceptable risk is the absolute minimum risk, regardless of costs of obtaining the minimum. The benefit which accrues from the risk of disposal is not related to any intrinsic value of the wastes. Rather, the benefit arises precisely because the wastes have been disposed of. The fact that some may argue that this is an indirect benefit, especially when considering future generations, makes

this benefit no less real. To realize this benefit, however, the guidance must permit disposal. Hence, in establishing guidance as to what "risk is acceptable," the benefit of disposal must be weighed against both the cost of risk and the cost of attaining a level of risk.

There seems to be an attempt to extend our notions of what may or may not be "acceptable risk" to future generations. For example, in the first paragraph on page 5 of the draft guidance, it is stated that we should not impose any greater risk on future generations than that which we are willing to accept. While in fact, our generation incurs little risk from disposal, and future generations take virtually all the risk, presumably it is a level of risk which this generation would be willing to take. However, that does not make the risk acceptable for future generations. Moreover, not only are we deciding what level of risk to impose on future generations by disposing of the wastes, we are doing everything we can to make that decision irreversible, even to the extent that our disposal concepts in effect impose a high cost of risk on future generations who may wish to countervene our decision. Would we actually be willing to take that level of risk? If we wished to take the same risk as we would impose on future generations, then long-term surface or near surface storage would more equitably distribute the risks as well as afford future generations opportunity to correct our mistakes. An appropriate objective with respect to future generations might be to minimize the impact of present decisions upon them. In any case, if we are going to assign "acceptable" risks to future generations, we may as well be consistent and assign the "benefit" they derive from not having to worry over what to do with our radioactive wastes.

We have problems with the use of quantitative risk assessment in the guidance in three areas. First, there appears to be a good deal of imprecise language which casts doubt on whether the use of quantitative risks assessment has been thought through. For example, in the second paragraph on page 4 there is a statement to the effect that natural and engineered barriers can be used to lessen the probability of disruptive events. In this statement, the word "event" can refer to either events which potentially might disrupt the repository, or events which in fact do disrupt the repository. If the former is the type of event being discussed, then the statement is inappropriate since barriers do not change probabilities that such initiating events will occur. Rather, the effectiveness of barriers, like the "effectiveness of controls" (third paragraph, page 4), is a measure of their ability to mitigate the consequences of disturbing events, or to make the repository insensitive to them so that if they occur the repository will not be disturbed. The ability to alter nature's dice is beyond our ken.

Another example of imprecise language appears in recommendation 9. It is suggested in that recommendation that there exists a category of events about which we can be certain that they will not occur within some period. This simply is not true. It is virtually impossible to be absolutely certain that any physically possible event will not occur. In fact, given enough time or enough chances, any physically possible event is virtually certain to occur. "Rare" events do occur, and the fact that people may be around to observe a rare event does not alter its likelihood, only our perception of its likelihood--perhaps. However, the events of issue here are not only those for which the

recurrence interval is orders of magnitude longer than the period of concern for the repository. Also at issue are those events which can be discounted because they themselves have overriding consequences. In this case the incremental increase in consequence because we have disposed of waste is the proper decision standard when weighing whether to consider an event which would have significant consequences of its own, irrespective of its likelihood.

In recommendation 7 it is stated that all the risks from disposal should be evaluated. All risks from any enterprise are seldom, if ever, knowable to man. The evaluation never can be complete. Hence, the real problem is how to make reasonable, prudent, and balanced judgments when we know that the analysis is incomplete and there may be significant considerations omitted.

Our second technical problem arises from the suggestion in the third paragraph on page 4 and in recommendation 8 of the draft guidance that risk assessment, presumably a quantitative risk assessment, be the primary decision tool used by Federal agencies when dealing with the disposal of radioactive wastes. The result of applying the calculus of risk assessment alone, be it qualitative or quantitative, cannot be the determinant of decisions involving the public health and safety. Each assumption, each simplification, each approximation made in order to develop or use the tools of risk assessment is made because we are ignorant--either ignorant of how to solve the problem or, what is far worse, ignorant of what is the problem. Construction of the quantitative descriptions of the geologic, hydrologic, and geochemical processes which will or will not occur, and which will be the cause of success or failure of waste disposal, requires many such assumptions, simplifications, and approximations. Moreover, each assumption, simplification, approximation, further removes the risk assessment from reality, from nature. This ignorance cannot be reflected properly in bounding calculations, "error" bands, or conservative assumptions. Yet, this ignorance must be weighed and evaluated in adjudging not only the quality of the risk assessment but also what other considerations and tools are appropriate or needed to describe whether the enterprise under scrutiny is worthwhile altogether. For this reason, in making its decisions regarding radioactive waste disposal, the NRC will employ a variety of tools and methods, those of risk assessment among them. However, calculation of consequences never will be considered apart from judgments such as what is good practice, what initiating events are important from either an analytical or safety perspective, or what lends confidence to a calculation. Further, the result of such calculations never will be presented as representing the risk of some action. Such results well may be indicative of risk, but that is not the same as risk. Further, as it clearly is impossible to consider all events which could affect the isolation of disposed wastes, the particular "events" to which the tools and methods of risk assessment are applied will reflect the NRC's judgment in weighing other relevant factors as to how those tools and methods shall be used. Although at the December 18th meeting, there appeared to be general agreement as to the efficacy of this approach, which we believe to be consistent with your letter of December 21, 1979, to Dr. Vesely of the NRC's Probabilistic Analysis Staff, it is of such preeminent importance that we believe that it should be restated here.

We suspect that the impetus to rely so heavily upon the result of risk assessment stems from the experience in the development and use of health-effect models. However, we should keep in mind that although radiation effects have been studied intensively and extensively the effects of low-level radiation as yet are unsettled and that mechanisms which would release disposed wastes to the environment are even less understood.

Our third difficulty with risk assessment is the required projection of risks for each individual Federal action involving generation of radioactive wastes as specified in recommendation 7. In a denial of a recent petition for rule-making, the Commission stated that consistent with its view of the Atomic Energy Act, the risk of future generation of radioactive wastes does not need to be considered in individual licensing actions, as the Commission had considered the question generically and had expressed confidence that the risk was sufficiently low. This position was tested and confirmed in U.S. District Court. The wording of this paragraph would require consideration of the risks from wastes to be generated when licensing any activity under NRC's purview, not simply generation of electricity. Medical, pharmaceutical, and industrial licenses in non-Agreement States, Federal research and development programs, basic research, and any other Federally approved, sponsored, funded, or licensed activity which uses or generates radioactive materials or irradiates materials (e.g., accelerators) presumably would be affected also. It was explained at the December 18th meeting that this provision would apply only generically and only to "new" activities, and that current technologies and individual licensing actions would not be subject to this provision. However, the guidance is not at all clear that the provision is intended to be so limited. Moreover, the value of this recommendation, which moralizes a good deal about generating wastes but offers nothing towards what to do with them, is questionable in guidance on how to dispose of wastes.

As we observed at the opening of this letter, the guidance does not stand on its own. Both the background document and the response to comments are needed if the intent of the guidance is to be comprehended. For example, item c in recommendation 1 would seem to require consideration of and regulation by some other basis than dose to humans. Although this would be impractical if not impossible, the response to a comment in which EPA states that "Protection of the public health and environment includes all organisms, including those more sensitive than humans," would seem to support such an interpretation of item c. We urge EPA not to adventure by departing from the widely held view that radiation protection practices adequate for humans are also adequate to protect the environment.

An apparent inconsistency between the guidance and the supporting documents exists in recommendation 9. The background material argues that a universally acceptable minimum release or exposure level cannot be established. Yet, that is exactly what is done by suggesting in recommendation 9 that a few percent of background would "not be unacceptable." If something is "not unacceptable," it is "acceptable," and therefore a small percentage of background in effect is a universally acceptable minimum.

Another inconsistency appears in recommendation 4. The recommendation calls for "as many of these passive controls [engineered barriers] as reasonably achievable." This seems to be contradictory to and inconsistent with the rationale for this recommendation in the background document in which it is stated that "once basic safety is met, technology should be weighed," and that "engineered barriers used alone can generally be considered only as interim measures for containment." If you can use engineered barriers to trade off against natural barriers, and you cannot rely on engineering anyway, there is no logic to requiring as much of it as is achievable.

Finally the guidance does not set a minimum acceptable level of radiation due to waste disposal, but expects the agencies at which this guidance is directed to do so. However, such agencies likely will set their standards at a "small percentage of background" which EPA finds "not unacceptable."

Because of these difficulties, we strongly urge that publication of this guidance be postponed until the specific waste standards for which EPA has the authority and responsibility are promulgated. At such time, appropriate and comprehensive general guidance if needed can be formulated.

- original signed by KR Goller -

K. R. Goller, Director
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Because of these difficulties, I strongly urge that further work and publication of this guidance be suspended until the specific waste standards for which EPA has the authority and responsibility are promulgated. At such time, appropriate and comprehensive general guidance if needed can be formulated.

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