DUKE POWER COMPANY
POWER BUILDING
422 SOUTH CHURCH STREET, CHARLOTTE, N. C. 28242

WILLIAM O. PARKER, JR.
VICE PRESIDENT
STEAM PRODUCTION

July 14, 1980

TELEPHONE: AREA 704
373-4083

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

Attention: Docketing and Service Branch

Subject: 10 CFR Part 60
Technical Criteria for Regulating Geologic Disposal of High Level Radioactive Waste
File: GS 514.86

Reference: 45 F.R. 31393; May 13, 1980
Advance Notice of Proposed Rulemaking

Dear Mr. Chilk:

By the referenced notice, the Nuclear Regulatory Commission published for public comment an advance notice of proposed rulemaking on the technical criteria for regulating geologic disposal of high level radioactive waste. We understand the published technical criteria are simply draft ones, and as such are not being formally proposed at this time.

Duke Power strongly supports the prompt development of criteria for regulating the disposal of high-level radioactive waste. We believe that public concern in this area is a major obstacle to the continued acceptance of nuclear power in this country and abroad. High-level waste exists now, both from military and civilian sources, and will continue to be generated in the future. Therefore, whatever the future role of nuclear power in our society, a solution to the waste disposal question must ultimately be implemented.

Duke further believes that technology for high-level waste disposal in a conventional, mined geologic facility in salt is currently available and should be implemented by the Federal government on an expedited basis. While the Environmental Protection Agency (EPA) has not yet developed its high-level waste standard (10 CFR 191), Duke believes it is entirely feasible and appropriate for the NRC to develop at this time its regulatory frame work, which will ensure compliance with the EPA standard.

The following represents Duke Power Company's comments on the supplementary information discussion provided in the notice. For reference, the underlined topics below correspond to topic headings set forth in the notice.

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Nature of the Problem

We believe this discussion serves a useful purpose in that it separates consideration of the problem in time, space, natural processes, and human actions, etc., and thus frames the problem in a form more tractable to solution.

We do, however, take exception to a few of the assertions contained in this section. First, it is stated that "[t]he chemical and thermal properties of the waste undoubtedly will have a significant interaction with the rock unit into which they are emplaced." This is true in the case of thermal properties, and eventually we can expect significant chemical interaction. However, the statement creates the wrong impression in that significant chemical interaction can take place only in the presence of water, which through proper repository siting and design, we can expect to be absent during the time frame most important for protection of the public.

Second, the assertion is made that the very fact that we do not have experience with geologic disposal "pose[s] fundamental difficulties." On the contrary, extensive experimental programs, both in the U. S. and abroad, have validated the concept of geologic disposal. The Atomic Energy Commission's report regarding Project Salt Vault, ORNL - 4555, stated

> "With the completion of this experiment, it can be concluded that most of the major technical problems pertinent to the disposal of highly radioactive waste in salt have been resolved. Project Salt Vault successfully demonstrated the feasibility and safety of handling highly radioactive materials in an underground environment. The stability of the salt under the effects of heat and radiation has been shown, as well as the capability of solving minor structural problems by standard mining techniques. The data obtained on the deformational characteristics of salt have made it possible to arrive at a suitable design for a mine disposal facility."

Canadian experiments at Chalk River have provided additional evidence that at least one waste form, glass, can contain waste for long periods of time, even in flowing groundwater. Moreover, this experiment provides additional confidence in our predictive capability regarding the degree of retardation which can be expected in actual geologic settings. In-situ testing conducted by the United States and Sweden at Stripa, in granite formation has provided valuable data on hard, crystalline rock as a disposal medium. Swedish migration experiments at Studsvik have confirmed retardation of two of the most significant fission products, cesium and strontium, provided additional information on sorbent materials which may be used to augment the retardation capability of the natural emplacement medium, and corroborated predictive modeling capability.

We could cite other experimental evidence which points to the acceptability of the geologic disposal concept. However, it is most instructive to point to the Oklo uranium mine site in the Republic of Gabon. Here we have approximately two billion years of "experience" with geologic disposal of about 6 tons of fission products from a natural chain reaction (which, incidentally, took place in an environment saturated, or nearly so, with water). Investigators here concluded that most of the fission products remained essentially immobile

over periods of their half-lives and that the actinides, particularly plutonium, were also essentially contained.

Thus, we do not believe the fact that we do not now have an operating, commercial scale repository for high-level radioactive waste should be equated to "no experience...with geologic disposal."

Third, we would take issue with the statement "the problem of human intrusions, intentional or inadvertant moots much of the previous discussions, since there is no way to limit the variety of conceivable human activities which might compromise a forgotten repository." We would emphasize that the primary goal of nuclear waste management is to protect the general public's supplies of air and water. Attainment of this goal is dominated by the fission product content of the waste, the toxicity of which decays to that of the original one body from which the uranium came after only a few hundred years. Viewed in this light, the problem of intrusion becomes much more tractable. Further, safety analyses conducted for waste repositories treat natural events much more severe than that which would reasonably be expected from human intrusion, thereby bounding the problem. Finally, we assess the intrusional scenarios to produce minimal risk since we have to assume two unlikely circumstances with respect to society's continuity: 1) that the location and nature of the repository is lost, and 2) the technology for radiation detection is lost.

Underlying principles

We particularly agree with the statement that "[t]he analyses and requirements must reflect a degree of examination and control which corresponds to the importance to safety of any given technical area." This concept is central to our understanding of the "systems approach" as advocated by the Interagency Review Group and the technical community at large. We would strongly suggest strict adherance to this principle will result in efficiencies in program implementation and regulation, as well as a more cost-effective waste management system.

Considerations

The discussion defines the term "systems approach" as "relat[ing] to the set of natural and engineered barriers which would function to contain and isolate the waste from the biosphere..." While this statement is true, we believe a "systems approach" means something more. The fundamental precept upon which this approach is founded is that the requirements for each barrier, or element of the system, should be formulated only in the context of its contribution to the performance of the overall system.

We agree with the discussion pointing out the "three primary barriers of the waste disposal system: the geologic setting; the design configuration of the repository, including the waste emplacement scheme and engineered barriers; and the waste package." We would point out however, consistent with the concept of a systems approach, additional engineered barriers between the waste package and the host geologic medium should not be a regulatory requirement unless they are shown to be necessary for overall system performance. Also, with respect to the three barriers delineated in the discussion, any analysis of health and environmental impact must also include the effects of dilution in the accessible environment and other processes comprising the pathways of radioisotopes to man. In a manner of speaking, this may also be regarded as a "barrier."

With respect to the discussion regarding minimum performance standards, we agree that such standards are sometimes appropriate. For instance, during handling and emplacemnet, the waste package must retain its integrity under normal and hypothetical accident conditions, for protection of operating personnel. However, the danger in the widespread use of minimum performance standards for each element of the system is that, if too stringently set, they can defeat the systems approach concept which looks to overall system performance as the only meaningful figure of merit.

The discussion regarding the adequacy of favorable of unfavorable site characteristics to impose proper technical restrictions raises the question as to whether it may be appropriate to impose general site acceptability criteria or to determine site accepatbility on a case-by-case basis. We believe a search for sites is quite properly guided by site suitability criteria; however, at the stage where a potential site must be analyzed for ultimate acceptability it is our view that such a determination should be made on a case-by-case basis. This, we feel, is consistent with the systems approach concept.

With respect to the discussion as to whether regulations should codify models to be used in licensing analyses or simply allow their use, it is our view that some degree of codification will be required. In the absence of such codification, the licensing proceeding will be unduly complicated and extend not only to whether the repository meets all applicable criteria, a question quite properly addressed in such a proceeding, but also to the question as to whether the analytical models perform adequately and as they are intended.

While we claim no particular expertise in the area of nuclide transport modeling, it is our view based on our present knowledge that the statement "the 'old' models, in which there is the greatest confidence because of their 'proven' use appear to be as qualitative as they are quantitative" is in error. All models have their limitations; they represent, to varying degrees, approximations of reality. The key to the proper use of models does not necessarily lie in their development to the stage of an "elegant theory embodied in a mathematical description which represents a culmination of human thought," but rather in an understanding by the user of the limitations of the model and the sensitivity of the overall model results to approximations internal to the model and uncertainties in input data.

In the discussion on retrievability, the implication is made that one reason for retaining retrievability might be the expectation of future, "improved technologies..., better designs..., operational procedures improved." We strongly suggest the regulations specify that retrievability need be maintained for only that period required for performance checkout. In the case of disposal of spent fuel, further retrievability for resource recovery could be maintained based on an assessment of economic viability, but should not be mandated by regulations.

We have long maintained that the waste ultimately disposed of should be high level waste from reprocessing, rather than spent fuel with its enormous energy content, and we continue to take that position. However, from the standpoint of the Commission's regulations, we hold that repository designs should be required to incorporate retrievability only to the extent and for the period necessary to obtain meaningful data relating to long term safety of the repository.

Questions: Below are our responses to the specific questions raised in the notice.

(1) Does the list of considerations above clearly, adequately, and fully identify the relevant issues involved in disposal of HLW?

Response: First, we understand these considerations to relate only to the technical aspects of the problem, and not to the procedural aspects of the problem which are being addressed separately. Our comments with respect to the latter (10 CFR Part 60, Subparts A-D) were submitted by letter of March 3, 1980. As we have stated at other times and in other forums, we believe the institutional problems associated with nuclear waste management far outweigh the technical ones.

Having noted this, and in the context of our discussions above relating to the "Considerations" section, we believe the considerations identify the major technical issues. However, we are concerned that the discussion of the issues provided in the notice does not reflect our view as to what the term "systems approach" should mean to the regulator. Simply stated, we do not believe the term "systems approach" means simply that the repository is a multicomponent series of barriers, each backstopping the next, but rather extends to the concept that each component of the system should be viewed only in the context of the performance of the whole to produce the desired effect.

Our other concern with respect to this section is the emphasis on the unknown. In our view, the information we lack we currently know how to get. By and large this is in-situ data which we can obtain only by moving forward in a site identification and characterization program. Naturally, there will be some uncertainty in this data, but the effects of uncertainty can be accommodated by conservative analyses. Where models need further development and validation, again it is our understanding that there are no insuperable difficulties; we merely need to proceed to do the necessary work.

(2) Would a rule structured along the lines of the referenced draft rule reasonably deal with issues in an appropriate manner?

Response: The overall structure of the referenced draft rule seems appropriate; however, its content indicates inadequate attention to the systems approach concept. See our specific comments on the draft rule, attached.

(3) In light of the fact that EPA has the responsibility and authority to set the generally applicable environmental standard for radiation in the environment from the disposal of HLW, with what factors/issues should an NRC environmental impact statement on technical criteria deal?

Response: Since the EPA will presumably set generally applicable environmental standards, NRC's environmental impact statement on its technical criteria should examine only those questions related to the environmental impact of the proposed and possible alternative criteria, including cost-benefit analyses and evaluation of resource utilization. NRC's environmental impact statement should not reexamine the programmatic choice of disposal technology, resulting from DOE's own environmental impact statement.

(4) What are the environmental impacts of criteria constructed in accordance with the above cited principles? What alternative criteria exist and what are their impacts?

We have indicated in the discussion contained in the body of this letter, as well as in the attached specific comments on the draft rule, that the major shortcoming of the discussed criteria lies in inadequate attention to what we believe to be the essence of the "systems approach" concept. Regulation of individual components of the system tends to separate the true purpose of regulation, the protection of public health and safety and environment, from reality, that reality being simply the overall performance of the repository system. We would suggest that it is entirely possible to develop reasonable criteria around this concept, and that the result of such an effort would be criteria which regulate exactly what we wish to regulate - population doses - rather than release rates from individual system components which are some steps removed from man.

Please find attached Duke's specific comments on the draft rule. We should note that we have not had an opportunity to review the support and rationale document which the NRC generated in conjunction with this draft.

Duke is currently participating in the development of more extensive comments on this draft rule, in conjunction with the Utility Nuclear Waste Management Group. We appreciate the opportunity to submit these comments to the Commission, and hope they may be useful in the development of effective technical criteria for high-level waste disposal.

Very truly yours,

William O. Parker, Jr.

Attachment

Specific Comments on 10CFR Part 60

Draft Technical Criteria for Regulating Geologic
Disposal of High-Level Radioactive Waste

45 F. R. 3193-31408

60.101 (e) Why the presumption of saturated media?

60.111 (a) (3) The retrievability requirement is unclear. What is the rationale behind a retrievability requirement which extends 50 years beyond emplacement of the last waste? Can the retrievability aspects of repository design, construction, and operation be relaxed if decommissioning is planned before the expiration of such a 50 year period? At any rate, such a period is far longer than that required for gathering of in-situ data confirming the acceptability of the disposal scheme.

60.111 (c) (1)-(2) The specific performance requirements placed on the waste package (including waste form) and underground facility violates the concept of a systems approach - overall repository performance is the appropriate figure of merit.

60.111 (c) (3)-(4) This section deals with the overall performance of the engineered system and the performance of the geologic environment. Again, the discussion ignores our view of the systems concept. In any event, however, it would seem inappropriate to regulate a release rate per year, based in terms of a fraction of the inventory present at some given time. Such a criterion is unrelated to impact on public safety and the environment, since a greater fractional release rate from a small repository might well be less in absolute magnitude than a smaller fractional release rate from a larger repository.

In sections (4) (i) and (ii), the term "long term" needs to be defined. In section (4)(iii), we have the same problem of inconsistency with the systems approach concept, but in any event, do not understand how the specified travel time is directly related to public health effects, and cannot ascertain from what point the 1000 years is measured. From the waste package to the accessible environment? From the repository boundary (undisturbed geology) to the accessible environment?

60.121(c) We believe it realistic to assume that institutional controls will last beyond 100 years.

60.122 (a)(8) The question of avoidance of natural resources has, in our view, been somewhat overemphasized. We find it difficult to envision a future civilization with the capability to bore 2000 ft. deep holes, which at the same time is unable to detect radioactivity. Even this unlikely set of circumstances is of concern only if all records of repository location and content are lost.

60.122 (b)(1) Again we have the problem of an overemphasis on recoverable resources. While we see the need to limit the possibility of future adverse human activities at the repository site, the draft criteria are much too

stringent and could well eliminate otherwise superior sites, especially in salt. In particular, the criterion that "drilling for whatever purpose to depths below the lower limit of the accessible environment" shall "give rise to a presumption that the geologic repository will not meet the performance objectives" is particularly inappropriate.

60.132 (b)(2) We do not see the logic in requiring that full scale retrieval facilities be built on the surface. To the extent the retrieval option is considered necessary for repository performance checkout, the surface facility should be designed and constructed to allow full scale retrieval facilities to be added if deemed necessary in the future. We simply cannot conceive of a situation where we find ourselves so much in error as to the actual performance of the repository system that we find it necessary to immediately remove waste; rather, we would have time to act to put in place any surface facilities required.

Certainly the capability of retrieving small numbers of canisters should be incorporated into the surface facilities, and the design of such facilities should include the capability for expansion, but any further requirement for such full-scale facilities to be actually constructed at the outset would result in an unjustifiable expenditure of funds.

60.132 (c)(2)(iv) In paragraph (a), the requirement for shaft and borehole sealing "as soon after they have served their operational purpose as is practicable" seems to be inconsistent with the retrievability requirement. With respect to paragraph (b), we would suggest that the requirement that sealed shafts and boreholes provide at least as good a barrier to radionuclide migration as does the undisturbed rock ignores the concept of a systems approach.