



Comments on the Draft NRC Rule on Disposal of High-Level Radioactive Waste in a Proposed Repository at Yucca Mountain, Nevada

by Arjun Makhijani 30 June 1999

The Nuclear Regulatory Commission's (NRC) regulations on high-level waste disposal and licensing actions based on them will affect future generations profoundly since some of the radionuclides that these wastes contain have half-lives of hundreds of thousands of years or longer. The draft rule published by the NRC would apply to Yucca Mountain, the only repository now being considered for high-level waste, including spent fuel in the United States. This draft rule represents a considerably relaxation of the repository performance requirements relative to the rule it replaces (10 CFR 60). While IEER has long called for more stringent requirements for the performance of the engineered barriers than the NRC has previously required, we believe that the relaxation of specific repository performance criteria is unwarranted.

The following are the rest of IEER's specific comments on the draft rule.

1. The promulgation of this rule is premature because the Environmental Protection Agency standard on which it is to be based and which it must support has not yet been promulgated. A draft 10 CFR 63 should be re-issued for comment after the final EPA standard has been adopted. If the premises of the present draft 10 CFR 63 are substantially compatible with the future EPA standard, then it may not be necessary to re-issue a draft 10 CFR 63. In any case, a final 10 CFR 63 should come after a final EPA rule.
2. In promulgating the rule, the NRC has abandoned the idea of 10 CFR 60 that the geologic setting should be the primary isolation mechanism. It is IEER's view that the engineered barriers and the geologic setting should independently be able to meet the standard for limiting doses to the public. This is because the estimation of the performance of either the engineered barriers or the repository is quite uncertain. If each one is required to meet the waste isolation requirements on its own, the two systems can serve as back-ups to one another. One level of redundancy is common in engineering projects of far lesser consequence than a repository that, if built, will contain a large fraction of the world's plutonium. Allowing primary reliance on engineered barriers for waste isolation is inappropriate. The fact that the DOE is considering metal canisters in an oxidizing geologic setting makes this decision all the more questionable, especially given the uncertainties as to heat loading and humidity levels in the repository. The NRC should require that the engineered barriers and the geologic setting be designed as redundant features in waste isolation and that the suitability of Yucca Mountain be established in this light. The NRC should also require the engineered barriers to take fundamental cognizance of the fact that Yucca Mountain is an oxidizing environment. This feature takes on special meaning in the light of the recent DOE decision to abandon research on ceramic layers for the waste canisters, which might function more effectively than metal in an oxidizing environment.
3. There is no reasonable basis to assume that the present economic conditions for irrigation well drilling will prevail even for a few hundred years, let alone for thousands of years. There is also no reasonable basis to assume that the economic conditions for the use of farmland prevalent



today will prevail even for a few hundred years, let alone for thousands of years. Soil conditions regarded as marginal today might not be so regarded in the not too distant future. These factors should be combined with the potential for climate assumed by the Department of Energy in its Viability Assessment. When seen in this light, the NRC's assumption that doses should be calculated at 20 km from Yucca Mountain because Amargosa Valley farming is 30 kilometers away is arbitrary, instead of being reasonably conservative as claimed. Doses should be calculated at the closest downstream point that is not on the Yucca Mountain slope not only because farming could occur there, but because water drawn in that area may be pumped elsewhere for use.

4. There is no basis to assume that future recoverable groundwater resources will be limited to 150-meter depth characteristic of the present day wells in the area. This restriction should be relaxed, especially in light of the scarcity of water resources in the region.
5. The Draft rule makes no mention of the dissent in the 1995 National Research Council report on Yucca Mountain, and the extensive controversy regarding the selection of the critical group. The NRC should conduct and publish its own evaluation of the controversy rather than simply accepting the majority version of it, particularly since the dissenter is one of the most eminent nuclear engineers in the United States. Specifically, the NRC should address why it rejects the generally accepted idea that the subsistence farmer should be the one to be protected, given the uncertainty about future lifestyles. It should be noted that the phrase "subsistence farmer" does not denote any particular level of income. It is quite possible that, with technological change, people will be able to live well and consume essentially locally grown food as a matter of preference. While the trends over much of the century have been in the contrary direction, the rise of organic farming, farmers' markets, and the reaction against genetically engineered foods in some parts of the world may be a harbinger of things to come. There is no basis for the NRC to have rejected the subsistence farmer model of radiation protection in favor of assuming that present day diets will remain typical. The latter assumption can be shown to be highly unlikely if one looks at historical evolution of diets and the fact that diets continue to evolve. It stretches credulity and is contrary to historical experience to suggest that using present-day patterns for future diets is the best way to proceed for estimating repository impacts. One reason that the subsistence farmer approach is far better than the approach in the draft NRC rule is that it can be made protective of health without requiring a prediction of future diets.
6. The 25 millirem dose limit in the draft rule is not compatible with the EPA limit of 25 millirem from all nuclear fuel cycle activities. It is unreasonable to assume that there will be no additional doses to the maximally exposed individual from any other fuel cycle activity other than Yucca Mountain. It is disingenuous for the NRC to imply (on page 8644) that its proposed limit of 25 millirem is compatible with the range of 2 millirem to 20 millirem that the EPA is working with. It is clearly outside of the EPA range and would be incompatible with an EPA standard within that limit. A figure in the middle of the EPA range should have been chosen for a draft rule, in light of the decision to publish the draft rule ahead of the EPA rule. Hence, for the present, the NRC dose limit in 10 CFR 63 should be lowered to 10 millirem, which is approximately in the middle of the EPA range and which is also in line with the recommendation of the 1983 National Research Council panel on waste isolation. This dose limit should be applied to the subsistence farmer at the base of Yucca Mountain downstream from the repository. A sub-limit of 4 millirem corresponding to the EPA drinking water standard should also be included in the rule.
7. The NRC's adoption of 1 millirem as a negligible dose is not appropriate in relation to carbon-14. Carbon-14, when taken up by vegetation that is consumed by pregnant women, would cross the placenta and potentially affect developing fetuses. The specific effect would be different in



various stages of formation; at certain stages, there would be a material difference between male and female fetuses. Before adopting a negligible dose concept, the NRC should carefully examine whether small quantities of carbon-14 might adversely affect fetuses if the dose occurs early on or at some other particularly inopportune time during their development. Non-cancer effects, such as miscarriages and fetal abnormalities, should be carefully considered for fetal exposure, in addition to the potential for fetal and post-natal cancer.

8. The NRC's rejection of the 1995 National Research Council recommendation that compliance be assessed at the time of maximum exposure is arbitrary. The EPA is required to follow the National Research Council's recommendations. Since the EPA has not yet issued a draft standard, the NRC should assume that the recommendation regarding the compliance period will correspond to the 1995 National Research Council recommendation. All calculations that have been done on doses indicate that dose limits at periods of 100,000 years or a few hundred thousand years would be far higher than at 10,000 years. The National Research Council 1995 recommendation echoes an earlier 1983 recommendation along the same lines. The NRC should adopt it. The matter of the difficulty of estimating doses for long time periods should be addressed by placing uncertainty bounds on the calculations.
9. While the prediction of human intrusion is indeed difficult, the NRC has failed to take into account those factors regarding human intrusion that are well-known. The presence of significant ground-water resources in an area where these resources are scarce greatly increases the likelihood of human intrusion. While the proposed rule is for Yucca Mountain alone, it would be scientifically inappropriate for the NRC to fail to take into account in its analysis that the human intrusion likelihood in the vicinity of Yucca Mountain is far higher than at other potential repository sites.