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General Comment

See attachment

Attachments

Codell-nureg-2175 comments

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U.S. Nuclear Regulatory Commission
Washington DC 20555-0001
Re: Comments on 10CFR61 Guidance, Draft NUREG-2175

Introduction

Thank you for an opportunity to comment on the guidance given in draft NUREG-2175, and by implication, the proposed rule on low-level radioactive waste. I will restrict my comments to the issue of disposal of depleted uranium (DU) in shallow landfill sites, using the Energy Solutions Clive facility in the desert west of Salt Lake City, Utah as an example.

This review will focus on the applicability of the proposed 10CFR61 regulations, as characterized in draft NUREG-2175, with regard to the disposal of depleted uranium in landfill-type repositories designed for low-level radioactive waste. Depleted uranium (DU) is characterized as class A low level waste because of its low specific activity. However, the fact the its specific activity increases with time, its large quantity designated for disposal, and long half life, treating DU as low-level waste can be problematic.

Inadvertent Intruder Scenario

I recognize that the most significant potential for doses that could exceed the current regulatory standards in the case of shallow land burial of DU would be from the intruder scenario. In this scenario, the waste remains concentrated, allowing the build-up of radioactive decay products, especially radon. Although the Clive repository site is presently located in inhospitable land, with little fresh water that could support a viable farming economy, such might not be the case under a climate change scenario. Given the long lifetime of DU waste, it is feasible that at some time in the future, even if the shallow-land repository remains intact, the site may support human habitation, especially if the currently arid to semi-arid climate in the west desert were to become appreciably cooler. A cooler climate would lead to more precipitation along with more infiltration leading to improved groundwater and possibly surface water at the site.

The problem gets progressively worse with time, as more radionuclides build into the DU waste. Although the intruder scenario is possible, even likely, I believe that only a handful of people could be exposed above dose limits for various reasons because of safeguards built into the repository (e.g., the placement of rock armor that would foil deep trenching without advanced machinery). In any event it should not be NRC's job to protect every individual against acts they commit themselves.

Non-Intruder Scenarios

I believe that the intruder analysis receives a lot of importance because it Is one of the only (perhaps the only) scenario where the current or proposed dose limits could be exceeded for shallow land DU disposal. However, I also believe that it diverts attention away from the potential exposure of many more people from scenarios where the shallow land repository is destroyed as a result of a climate change that causes significantly lower temperatures and higher precipitation. Steve Nelson, a highly regarded professor of geochemistry and geology at Brigham Young University and former chairman of the Utah Radiation Control Board, makes a convincing case for the total destruction of above-ground landfills at the Clive site resulting from wave action and submersion in a likely return of a freshwater lake (i.e., Lake Bonneville) due to climate change. This is not a low-probability event. The return to a paleoclimate is likely, as are the forces that could destroy the repository.

The destruction of the repository is a fundamental scenario for the risk assessment being conducted by Energy Solutions (Neptune) at the behest of the State of Utah, and reviewed by the State's contractor (SCA). While there have been many questions about the Neptune study, I believe that it is basically sound, and that differences in opinion between the parties involved can and are being worked out. The most significant conclusions of the SCA study appear to be that other than the intruder scenario, doses that could be received by members of the general public upon the destruction of the repository are small, but potentially to many people. Furthermore, allowing a site with so much hazardous material to be simply destroyed and released to the environment, with potentially unknown consequences, which apparently could be permitted under current regulations, seems particularly egregious. One could propose a performance assessment where the waste would be deliberately disposed by dumping it all in the sea (regardless of international treaties that prohibit such a practice), or allowing small quantities to be released into large rivers over an extended period of time. Each case would result in only low doses to individuals, but would be bad practices nevertheless.

Regulatory Criteria other than Dose to an Individual

The current regulations are tied to the maximum dose to an individual. It appears that a significant factor in the choice of individual dose over collective dose is one of convenience, e.g., it Is difficult to attach a hazard to a collective dose, whereas an individual maximum dose is more easily calculated and certified to be in compliance with a regulation.

- **Collective or population dose as a regulatory criterion**

Large numbers of people could be exposed as a result of the destruction of the repository and the dispersal of its contents across the land, in the lake, and into rivers that serve large populations, and eventually into the sea. This begs the question about whether one should also consider a "population dose" or "collective dose", along with a dose to an individual as a regulatory basis.

NRC seems to have settled on the individual dose only, but there is no universal consensus on this approach. There appears in the open literature still a division of opinion about the use of

individual doses vs. collective doses as regulatory limits. See for example the Wikipedia article on linear no threshold dose models (https://en.wikipedia.org/wiki/Linear_no-threshold_model). NRC actually recognizes population dose as a potential factor in siting a repository:

> *"A linear no-threshold (LNT) dose-response relationship is used to describe the relationship between radiation dose and the occurrence of cancer. This dose-response model suggests that any increase in dose, no matter how small, results in an incremental increase in risk. The U.S. Nuclear Regulatory Commission (NRC) accepts the LNT hypothesis as a conservative model for estimating radiation risk."(http://www.nrc.gov/about-nrc/radiation/health-effects/rad-exposure-cancer.html)*

Also, several places in NUREG-2175 allude to factors other than maximum dose to an individual that could be applied to regulation of a repository; e.g.,

> *"As discussed in Section 7.0, the performance period analyses may include metrics other than dose (e.g., concentration, fluxes). See Section 7.0 for more detail."*

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> *"...or other metrics such as concentrations of radioactivity in the environment and flux rates to the environment."*

- **Use of ALARA as a regulatory criterion**

Page 6-9, discussed person-rem and collective dose:

> *"ALARA is defined as "making every reasonable effort to maintain exposures to radiation as far below the dose limits in this part as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to the state of technology, the economics of improvement in relation to benefits to public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest."*

Section 7.4.1.1.3 defines ALARA:

> *The analyses should demonstrate that a reasonable attempt has been made through site selection, facility design, and waste acceptance to minimize releases to the public to extent reasonably achievable for the performance period.*

I believe that these passages in the guidance and the regulation would exclude the Clive facility from consideration for DU disposal because in this case, the choice of a low-level site is clearly not reasonable to minimize releases to the public for the time frame of paleoflooding.

- **Use of climate change and geologic stability in siting**

Significant climate change could occur at the site, based on geophysical observations, on the order of tens of thousands of years. I believe that another factor that should be used along with dose is geologic stability of the site. In the case of the Clive site, the stability issue has to do with the return of a large lake leading to destruction of above-ground facilities and dispersion of the stored waste.

NRC recognizes stability several places in NUREG-2175 and the draft rule; e.g.

> ***10 CFR Part 61.50(a)(4)(iv)****: Areas must be avoided where surface geologic processes such as mass wasting, erosion, slumping, landsliding, or weathering occur with such frequency and extent to significantly affect the ability of the disposal site to meet the performance objectives of Subpart C of this part, or may preclude defensible modeling and prediction of long-term impacts.*

This subpart may not be directly applicable to paleoflooding, but can reasonably be included.

The NUREG also states:

> *In addition, paleoflood data may provide evidence of large, dynamic floods, similar to the "outburst" floods that occur when the water of dammed glacial lakes are suddenly unobstructed. Such massive, violent floods could destroy a disposal site located close to the surface and thereby fail to meet the site stability performance objective (i.e., 10 CFR 61.44)."*

and:

> *"In the absence of available specific dating studies, a general assumption can usually be made that the features are the result of the last glacial period, which ended about 10,000 years ago. Fortuitously, the general 10,000 year age assumption coincides with the 10,000 year protective assurance period for a LLW facility."*

This coincidence with the 10,000-year regulatory period for the protective phase is a little too convenient in that it is a potential point for ignoring the very important processes that could destroy the Clive repository after 10,000 years.

I believe that future stability should be a basis for rejecting a site for DU disposal, irrespective of maximum individual dose or even collective dose.

Conclusions

I believe that the regulations and the NUREG should be made less ambiguous and more forceful in setting regulatory and site selection attributes for the disposal of large quantities of depleted uranium in near-surface landfills. In particular, NRC should consider the following factors in their regulations and guidance:

- There should be firmer regulatory guidance for the use of criteria other than the maximum dose to an individual such as the inadvertent intruder. This guidance should include criteria such as population or collective dose, ALARA, and geologic stability standards;

- Setting the upper limit of the performance period at 10,000 years in an unfortunate coincidence with the approximate time period for the return of a paleoclimate to the desert southwest, with a much wetter climate including large, deep lakes. This time period is critical to setting a criterion that a site in the Great Basin such as Clive is geologically unstable and therefore inappropriate for the disposal of DU in the near surface. The time period should be more generally stated to include the likely return period for a paleoclimate. Future geologic stability, irrespective of dose, should be a siting criterion for disposal of DU.

Sincerely

Richard Codell