

public exposure. This means that the limiting concentrations could be very high if we relied solely on the various modeling scenarios we have identified. In some cases the limiting concentrations from modeling may exceed the maximum concentrations established by the NRC for Class A low-level radioactive waste (see 10 CFR 61.55). In these cases, we believe that it might be appropriate to set the concentration limit equal to the Class A maximum value.

It is important to use credible modeling scenarios to the extent possible to establish the capability of the RCRA-C technology for radionuclide containment and isolation, and not to rely on the Class A restriction or other such considerations, except in special cases. We are concerned that it could be very difficult for us and NRC to justify a "simplified" regulatory approach if a significant number of radionuclides were at their Class A maximum values. That is, it would be less likely that the resulting concentration limits would be appropriate for disposal in RCRA-C facilities in the absence of significant NRC licensing criteria. In any event, it would defeat the purpose of simplifying LAMW disposal to require RCRA-C facilities to undergo a complicated licensing process.

b. Waste Form and Packaging. An important factor in this analysis is waste treatment prior to disposal. Mixed waste must undergo treatment for its hazardous constituents to comply with the RCRA land disposal restrictions of 40 CFR part 268. Treated RCRA waste often is solidified or stabilized in some type of encapsulating medium to prevent migration of the remaining hazardous constituents. Cement/concrete is the most common encapsulating medium because of its ready availability, cost, and experience in its use. Other encapsulating technologies, such as vitrification or use of polymers or ceramics, are less common but may be more effective than cement/concrete at binding mobile constituents. There are no such treatment requirements for Class A LLRW, other than restrictions on liquid content (although LLRW must be treated "to reduce to the maximum extent practicable" the hazard from non-radiological material). The modeling is expected to consider various waste forms. Of the available encapsulating technologies, we would consider use of cement/concrete as the most conservative case. Though a common practice, stabilization is not necessarily a requirement for compliance with land disposal restrictions. If solidification or

stabilization is not the treatment standard for a particular hazardous constituent, RCRA requires that the solidified waste form be tested to show that it meets the prescribed treatment standard. We request comment on whether it is reasonable to assume a stabilized waste form as a treatment of choice for LAMW and whether a rule should require waste stabilization. Such a requirement, however, could make the disposal of bulk low-activity waste in RCRA C landfills prohibitively expensive. (Bulk wastes could include such items as soil, demolition debris, and slag or other industrial process residuals.) Alternatively, it may be appropriate to have a different set of concentration limits for disposal of bulk wastes.

As stated earlier, we request comment on the possibility of individual disposal facilities developing alternative concentration limits. The performance of less-common encapsulating technologies could be a factor in permitting such alternative calculations. However, there are limited data available compared to the extensive literature available on cement/concrete. In addition to comment, we request information regarding the long-term performance of encapsulating technologies, particularly as they pertain to radionuclides.

Waste containers also provide a barrier against radionuclide releases, as well as adding structural stability to the waste form. Containers are typically drums or boxes, made of metal or polymer. It is not unusual for RCRA treatment to result in a waste form that is solidified inside a container (for example, mixing ash or other treatment residue with cement). NRC regulations require Class B and C LLRW to be in containers; if Class A waste is not in containers, it must be segregated from the waste that is in containers. We request comment on the need to specify container requirements in the rule.

c. Activity Caps. As stated above, under our basic concept, wastes with radionuclide concentrations higher than established in the rule would not be eligible for disposal in the RCRA-C disposal cell. However, waste with higher concentrations might be acceptable if the total number of curies in the disposal cell remained below a certain level (in conjunction with or in lieu of concentration limits). This could mean placing limits on the total curies of radionuclides disposed of at a site, inventory limits on specific radionuclides, or waste volume limitations (as an indirect and more conservative method to limit activity, since not all the waste would be

expected to contain the maximum radionuclide concentrations). Further, because modeling the performance of facilities over the long term involves estimates of the inventory of radionuclides present at site closure, limits of this type would help reduce uncertainty in those estimates. We request comment on this issue. We also request comment on how facilities could demonstrate compliance with such activity limits, how such demonstrations might relate to on-going operations at a RCRA-C facility, and the limitations to such an approach.

d. Unity Rule. Overall doses to a receptor could be limited through a "sum of fractions" approach similar to the methodology used in 10 CFR 61.55. Under this approach, a disposal facility could accept waste containing multiple radionuclides only if the sum of the fractions of the individual radionuclide concentration limits did not exceed one (or "unity"). For example, a disposal facility could not accept waste containing radionuclides X, Y, and Z at concentrations $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{3}$ of their individual concentration limits because $\frac{1}{2} + \frac{1}{3} + \frac{1}{3} > 1$. Concentration tables might be based on several methods of analysis, such as long-term performance assessment and worker exposure, and a simple sum of fractions approach may not be the most appropriate way to account for the different methods used to derive waste concentrations. It is also possible that peak exposures from different radionuclides in a long-term performance assessment may be separated by hundreds of years (given differences in half-life and environmental mobility), indicating that summing may not be appropriate even if the exposure mechanisms are the same. NRC derived its tables in 10 CFR part 61 from a common analysis for all radionuclides,¹⁴ and issued separate tables for short- and long-lived radionuclides. As we are coordinating this effort with NRC, we request comment regarding alternative methods to accomplish the same goal of limiting overall doses.

5. Risk or Dose Basis for a LAMW Standard

The modeling described in section II.D.3 will be designed to protect members of the public during the operating life of the disposal facility and beyond. By modeling long-term facility performance, ground water and future residents near the disposal facility will be protected. Basing radionuclide

¹⁴ See Draft Environmental Impact Statement on 10 CFR part 61, NUREG-0782, Vol. 2, Section 7-2, September 1981.