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August 10, 1984

Everett A. Wick
High Level Waste
Licensing Management Branch
Division of Waste Management
Mail Stop SS 965
U. S. Nuclear Regulatory Commission
Washington, DC 20555

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Dear Mr. Wick:

This is in reply to your letter of June 21, 1984 to Dr. Soo regarding our request of NRC sponsoring of a paper for presentation at the Materials Research Society Meeting in Boston this fall.

For easier reference, we have organized this letter to show your specific comments and our answers to them as follows:

COMMENT

As stated in Dr. Pescatore's letter, the theme of the paper is that the sorption capacity of the packing material is a controlling factor in the transport of radionuclides out of the waste package and the engineered barriers.

This then is true (1) only if packing material is used (some waste package designs do not employ packing material), (2) only if a critical density is achieved when the packing material is installed around the waste package, and (3) only as long as the packing material maintains its design permeability, i.e., does not crack or change chemically.

Response

- (1) We certainly agree with this observation.
- (2) We do not quite understand this comment; however, this may be equivalent to (3). Please refer to our response to the latter.
- (3) Even if packing materials crack or change chemically, they will still have a sorption capacity. In the case of extensive cracking, however, there may be channels opened and the theory of transport in fractured media rather than in porous media should be used. This would be mentioned in the paper.

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COMMENT

Dr. Pescatore states that the presently used K_d approach (e.g., the WAPPA code) is non-conservative because it assumes that the packing materials never exhaust their ability to sorb radionuclides.

If the packing material is designed so that it has the capacity to "sorb" the entire radionuclide inventory of the waste package, the "presently used K_d approach" may not be non-conservative (for example, the quantity of a zeolite packing material needed to sorb the waste package inventory was calculated by Schweitzer et. al., several years ago). If the packing material has less than total sorption capacity the "presently used K_d approach" appears non-conservative.

Response

An original contribution of the paper is that sorption capacity and retardation are local concepts. A porous medium may have different degrees of saturation along its dimensions. Thus, greater saturation of the sites will occur next to the waste form while areas further away will be saturated to a lesser extent. Because of this gradient in medium saturation, retardation will be minimum close to the waste form surface and greater further away from it. The K_d approach presupposes that sites will always be available locally anywhere. This results in a constant retardation factor across the medium, which is not true and may not predict nuclides breakthrough times conservatively.

This will be shown numerically in the paper.

COMMENT

It is our understanding that measurements of distribution coefficient (K_d 's) for packing materials and geologic media have produced results that vary by several orders of magnitude and that poor agreement exists on K_d values. This uncertainty in sorption capacity calls into question the practicality of considering sorption capacity of the packing material when estimating radionuclide transport.

Response

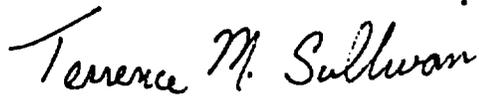
We do agree that K_d 's as have been measured so far show a large variability. Nevertheless, the DOE still plans on using them. DOE's DP-001 reports how the measured values should be treated in order to make them conservative. That approach is totally arbitrary as it involves scale factors without consideration of maximum sorption capacity, thus it may or it may not work. Indeed, in its sorption studies, the DOE never mentions the maximum sorption capacity of the medium. We will comment on this in the paper.

We believe this letter resolves your comments. Please advise us if you think otherwise.

Thank you for your consideration.

Sincerely,


Claudio Pescatore



Terrence M. Sullivan

CP:ep

cc. T. Johnson, NRC
M. S. Davis
W. Kato
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NRC Docket Control