

HLWYM HEmails

From: Scott Painter
Sent: Tuesday, January 04, 2005 4:01 PM
To: Richard Codell
Subject: RE: Colloid filtration

Hi Dick,

I agree that a potential longer timeframe makes the colloid issue more important. Colloid retardation alone is enough to take care of the issue for 10,000 years, but may not be enough for longer time frames.

Scott

-----Original Message-----

From: Richard Codell [mailto:RBC@nrc.gov]
Sent: Wednesday, December 22, 2004 4:18 PM
To: spainter@cnwra.swri.edu
Subject: RE: Colloid filtration

Scott:

Thanks for the quick response. I will be on the lookout for any information on colloid filtration. The reason this is coming up now is we have renewed concern about plutonium colloids given that the rule limiting calculations to 10,000 years has been remanded. Some simple calculations show that with a realignment of dose factors using FGR 13 rather than FGR 11, plutonium becomes relatively more important. DOE's FEIS calculations show a significant contribution from Pu242 peaking at 400,000 years, but it's even worse when you consider shorter waste package failure times for which Pu239 is still important. I think there will be new emphasis on the colloid model to help us resolve the issue.

Dick

>>> Scott Painter <spainter@cnwra.swri.edu> 12/22/04 04:20PM >>>

Dick:

Perhaps I was too severe in saying that "no evidence exists for colloid immobilization for the time scales of interest". However, I think my main conclusion -- that we really don't have sufficient technical basis to take credit for permanent immobilization of natural colloids in the saturated zone -- is still correct.

We need to be careful to define what I mean by "generated". Clearly colloids are continually removed from mobile water and continually released to the mobile water. For CFT, it makes a big difference whether the released colloid is newly generated from some fragmentation process or one that has simply been immobile for a few years. In the latter case, the newly mobile colloid could be loaded with plutonium. I don't think the field measurements can distinguish between a colloid that is newly generated and one that is newly mobile after being immobile for a few years.

I agree that the observation of a change in colloid types at interfaces between different rock types is interesting. We would need information on flow rates to interpret it.

The model has permanent filtration (we are not "ignoring" it). We presented results on sensitivity to the filtration rate. The key point is that radionuclide transport is sensitive to the rate of desorption from colloids, and even a relative slow rate of desorption from colloids is enough to offset the benefits of permanent filtration. The physical picture is this:
radionuclide hitches a ride on a colloid, colloid is removed, radionuclide desorbs, radionuclide attaches to another mobile colloid ...

If we invoke permanent filtration then we MUST have better data on rate of radionuclide desorption from colloids. My opinion is that since we can't constrain the filtration rate or the rate of desorption from colloids, we don't have a basis for invoking filtration.

Scott

-----Original Message-----

From: Richard Codell [mailto:RBC@nrc.gov]
Sent: Wednesday, December 22, 2004 1:42 PM
To: SPAINTER@cnwra.swri.edu
Cc: Andy Campbell; Gregory Hatchett; Suchandra Ghosh; Timothy McCartin
Subject: Colloid filtration

Scott:

I was reading your colloid letter report from June 2004 "Colloid-facilitated transport in the saturated zone: Process-level sensitivity analysis" and wanted to comment on the part dealing with colloid filtration. On page 4-2 you comment that "... no evidence exists for colloid immobilization for the time scales of interest (hundreds to thousands of years)". This seems to be too severe a statement since on page 2-1 you acknowledge that "...Colloid concentration is assumed to be constant in time and space, implying that colloid filtration is balanced by colloid generation" (my emphasis). I think this statement is generally the case. The observation that colloid concentration remains steady could be interpreted as meaning that either (1) none are removed, or (2) that at least rock colloids are continually being generated and removed. The observation on page 4 that anthropogenic colloids will be more thoroughly removed than natural colloids is consistent with the second point of view, since there is no mechanism to generate iron oxyhydroxide colloids once you are removed from the area where the iron is degrading. By ignoring the generation and removal of natural colloids, you are ignoring the important mechanism of filtration in the model.

I discussed this very point with Bill Murphy several years ago. I don't have specific references, but he told me of observations in the field of ground water flow across the boundary between two distinct rock types. They observed colloids of the first rock type in the groundwater of the first rock and the colloids of the second rock type in the groundwater of the second rock. Colloid concentrations were nearly constant in each rock type. If colloids were not removed (as you assume), then they should have detected the colloids of the first rock in the groundwater of the second rock. The only consistent explanation for this observation is that rock colloids are continually being created and removed in the rock.

I don't know where to find the reference to this observation other than by asking Bill Murphy, but its an interesting bit of information if true. It would portend a significant amount of colloid removal if true. I would be interested in hearing your thoughts on this matter.

Dick Codell

Richard B. Codell, Ph.D.
Senior Hydraulic Engineer
Division of High-Level Waste Repository Safety Office of Nuclear Material Safety and Safeguards U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville MD 20852
Phone 301-415-8167
Fax 301-415-5399
EMail RBC@NRC.GOV

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