HLWYM HEmails

From: Scott Painter
Sent: Thursday, December 08, 2005 12:35 PM
To: Richard Codell; David Pickett
Cc: Andy Campbell; Bret Leslie; Christopher Grossman; John Bradbury; Keith Compton; Timothy McCartin
Subject: RE: Colloid model

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Dick:

Recall that we have two colloid models, which are basically independent. One represents transport enhancement due to natural colloids, the other represents transport due to irreversible binding to anthropogenic colloids.
The abstractions, which are broadly consistent with available data, are for fast and reversible attachment of radionuclides to the natural colloids, and irreversible binding to anthropogenic colloids.

The input colloid concentrations are used for the natural colloid model only. With fast reversible sorption, permanent removal of colloids (e.g.
accumulation at interfaces) has no effect at all on radionuclide transport, because of the fast desorption rate. Natural colloids simply reduce interaction between radionuclides and the stationary minerals, thus reducing retardation. Preliminary TPA runs suggest that natural colloids contribute very little to enhancing dose.

The input colloid concentrations are not used for the irreversible model.
Instead we calculate a release rate for radionuclides bound to mobile anthropogenic colloids. In the revised abstraction, this release rate will be greatly reduced compared to the last iteration of the abstraction. The colloid-bound radionuclide mass is then transported through the system. We do have permanent removal at interfaces in the UZ for the anthropogenic model. At any one interface, the removed fraction is relatively modest, but the reduction effect does become significant when the transport path crosses several interfaces. At the moment we are neglecting removal at one interface
-- the tuff/alluvium contact. We are also neglecting the possibility that very slow desorption from colloids could cause the permanently removed colloids to become secondary sources. The neglect of this process is a non-conservative assumption, but we don't expect it to be significant.
However, if the abstraction is changed to include more permanent filtration, then the possibility of the permanently removed colloids becoming secondary sources would need to be re-examined.

Scott Painter
David Pickett

-----Original Message-----
From: Richard Codell [mailto:RBC@nrc.gov]
Sent: Wednesday, December 07, 2005 4:21 PM
To: dpickett@cnwra.swri.edu; spainter@cnwra.swri.edu
Cc: Andy Campbell; Bret Leslie; Christopher Grossman; John Bradbury; Keith Compton; Timothy McCartin
Subject: Colloid model

Scott and Dave:

I was trying to trace through a recent version of the szft model, and it wasn't clear to me that the mass balance for the colloids was being properly accounted. It seems that the reversible colloid model is just used to come up with a retardation coefficient that can then be used in the transport model (NEFTRAN). What troubles me, and I have not completely thought this through, is that in transitioning from one hydrogeologic unit to the next,

the sampled colloid concentration changes, because they are each sampled independently. Suppose for example you have a flow column with two rock types. Rock A has a high colloid concentration and rock b has a low colloid concentration, but the Kds for the two rocks are identical. The equivalent retardation in rock A will be lower because there is more opportunity for the radionuclide to travel on the colloid, and rock B will be higher.

However, what happens at the interface between the rock types? Since you are suddenly dropping to a lower colloid concentration, this implies that colloids suddenly drop out; i.e., they must accumulate at the interface. Since you are assuming instantaneous equilibrium between water, rock and colloid, the dynamics of the transfer among water, colloid and rock in your model is not a factor, and this accumulation of mass at the interface is not taken into account. I think the problem is especially troubling however for irreversible colloids, since in this case the colloid removal would also have to remove radionuclides irreversibly at the interface. Has anyone thought of this conundrum, and if so, how do we get around it?

Dick

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