HLWYM HEmails

From: Gordon Wittmeyer
Sent: Thursday, July 03, 2003 12:21 PM
To: David Pickett
Subject: RE: UZ filtration of colloids with irreversible attachment

Follow Up Flag: Follow up
Flag Status: Flagged

David:

I think that your current conceptual and mathematical model for estimating the colloid filtering efficiency is quite clever and quite well-done. Most of the models for filter efficiency fail to account for any distribution of pore sizes and instead rely on a single value. These other formulae may be okay if you use a low percentile value from the pore-size distribution, such as the 10th, etc.

Thanks,
Gordon

-----Original Message-----
From: David Pickett [mailto:dpickett@cnwra.swri.edu]
Sent: Thursday, July 03, 2003 10:42 AM
To: Gordon Wittmeyer
Subject: FW: UZ filtration of colloids with irreversible attachment

Gordon,

Below is my email to Ron on the filter factors (with a leter correction), and I've attached the Excel spreadsheet I used.

David

-----Original Message-----
From: David Pickett [mailto:dpickett@cnwra.swri.edu]
Sent: Friday, May 23, 2003 6:53 PM
To: Ronald Janetzke
Cc: Scott Painter; Sitakanta Mohanty
Subject: FW: UZ filtration of colloids with irreversible attachment

Correction to first paragraph: the value I gave you is the proportion of colloids removed - _not_ the factor by which they are reduced.

David

-----Original Message-----
From: David Pickett [mailto:dpickett@cnwra.swri.edu]
Sent: Friday, May 23, 2003 6:46 PM
To: Ronald Janetzke
Cc: Sitakanta Mohanty; Scott Painter
Subject: UZ filtration of colloids with irreversible attachment

Ron,

Here is a first set of numbers for colloid filtration factors for the five matrix UZ units. It is my understanding that the number you want is the factor by which colloid content is reduced for a given matrix unit, due to permanent physical filtration. It is also my understanding that this factor will be applied only to the irreversible species (Ja, Jc, Jp, Jt), and will not apply to that portion of flow that is in fractures.

My approach was straightforward and conservative. I started with the TSPA colloid size distribution shown in Table 6-88 of the TSPA-SR MOdel Report.
I treated the tabulated colloid sizes of 6, 50, 100, 200, and 450 as discrete, so that each colloid size constituted 20 percent of the population.

I then went to Table 6 in ANL-NBS-HS-000026, Rev 00 (same as Table 6-87 in the TSPA-SR Model Report), containing pore size distributions for UZ units.
Note that the table says they are "cumulative probabilities for colloid transport," but the preponderance of evidence is that they are cumulative pore size distributions. For a given colloid size, the table shows what proportion of pores are smaller. The simple physical filtration model is that the proportion of colloids of a given size removed in a UZ unit is equal to the proportion of pores that are smaller than the colloid.
Basically, each UZ unit acts as a single filter.

To correspond to the TPA UZ units, I grouped the DOE units as follows (in consultation with Fedors):

TSw = TSW4 through TSW9
CHnv = CH1, CHV
CHnz = CHZ, CH6, PP4
PPw = PP3, PP2
UCF = PP1
BFw = BF3

For each of the five discrete colloid sizes, I then averaged the cumulative pore size probability for the DOE units to get a single value for the TPA units. This is conservative, because it could be argued that a single subunit with the smallest pore size distribution could control colloid filtration in a unit. The resulting cumulative pore size probability was used for the proportion of colloids of that size removed. For the first UZ unit (TSw), the proportions removed of each size were scaled by 20 percent (the population of each colloid size), then all five values were combined for a total removal proportion. Note a conservatism here: I did not correct for the different masses of the different colloid sizes. The removal factor simply corresponds to _number_ of colloids. Larger colloids are more readily removed, and they would likely carry more radionuclides per colloid.

For each subsequent unit, the total removal summation calculation accounts for the fact that the colloid size distribution has changed due to filtration in the overlying unit. As colloids are filtered, the proportion of smaller colloids goes up in the underlying unit. This causes the factors to be smaller for the lower units than they would have been with the starting 20-percent-each colloid distribution. (But don't worry: the new proportions are always scaled to one, so your filtration factors can be applied as you intend.)

This is probably pretty confusing and poorly explained, but I hope it gives you an idea. I'll carefully document and explain it to you later. But here are the numbers:

TSw = 0.65
CHnv = 0.50
CHnz = 0.57
PPw = 0.19
UCF = 0.25
BFw = 0.18

This is a starting point. My intention is to play with these numbers using better models later. For example, there are model rates of permanent removal in a paper Scott is writing that I would hope to adapt to the TPA

framework for a sensitivity analysis. Also, I will take a more careful look at the pore size values used for each unit.

David

Hearing Identifier: HLW_YuccaMountain_Hold_EX
Email Number: 707

Mail Envelope Properties (013401c3417f$1fd3c490$c8c8a281)

Subject: RE: UZ filtration of colloids with irreversible attachment
Sent Date: 7/3/2003 12:21:13 PM
Received Date: 7/3/2003 12:15:07 PM
From: Gordon Wittmeyer

Created By: gwitt@cnwra.swri.edu

Recipients:
"David Pickett" <dpickett@cnwra.swri.edu>
Tracking Status: None

Post Office: cnwra.swri.edu

Files	**Size**	**Date & Time**
MESSAGE	5057	7/3/2003 12:15:07 PM

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received: Follow up