Open Questions from Live delivery of Practical Models to Support Remediation Strategy Decision-Making - Part 1
October 11, 2012, 2:00 PM - 4:00 PM, EDT (18:00-20:00 GMT)

Question: Slide 22: Might have mentioned: 1. Remedies were not "optimized" after they started.
This is another reason for historical underperformance of remedies and we can add it to the list in the future.

Question: Slide 22: 2. If remedial objectives take time to achieve, that is simply the way the earth works.
Agree. The intention of the bullet was to make this very point – remedies have historically been perceived as unsuccessful (even when they are working as expected) because the RAOs and timeframes are sometimes not technically linked – for example, RAOs set to 5 ug/L for a pump-and-treat with an arbitrary 30 year timeframe. That does not mean that pump-and-treat does not work, it just means that an unrealistic and unachievable goal was set.

Question: Slide 33: The RAO is set by the NCP and is not controlled by the PREDICTION that a model makes. Especially a model that is not tested with performance monitoring through time and space.
Agree – the RAO is set by the NCP and implemented by regulators – we emphasized that several times in our discussion. Importantly, regulators have reasonable authority in developing appropriate and relevant remediation goals for each site. A model PREDICTION does not control the RAO, rather it is a tool to inform the deliberation and decision process.

Question: there is no boundary between the source zone and plume zone, how do we know how big the source zone is?
forget about the question, I think there is no answer
This is a site conceptual model decision and should be based on data.

Question: How well are these models accepted by the regulatory community (State and Federal)? Is there wide spread acceptance?
This is a good question, because these models were developed relatively recently. REMChlor and REMFuel were developed by EPA and ESTCP to assist in evaluating sites and planning for remediation. These models are a significant upgrade to Biochlor and Bioscreen which have been used at a large number of sites, according to our surveys. We anticipate that REMChlor and REMFuel represent the next generation tools (because of features that allow independent source and plume remediation, actions in different plume segments and different time periods, etc.). Over the past couple of years, REMChlor has been rolled out to several EPA regions and state regulators as well as to environmental service companies.

Question: am I correct that the test cell had no advection? How did you move your alcohol flood?
Water was pumped into wells at one end of the cell and extracted from the other end so there was forced advection for the flooding and rinsing during the field campaign.

Question: Is there a license agreement, or statement, that IT Licensing folks can look at to confirm that the software is for open use.
Since this is EPA developed software, it is distributed on the CSMoS website. The Center for Subsurface Modeling Support (CSMoS) provides public domain groundwater and vadose zone modeling software and services to public agencies and private companies throughout the

United States. CSMoS is located at the EPA's Robert S. Kerr Center for Environmental Research in Ada, Oklahoma. You could check with CSMoS for specific license agreement information.
http://www.epa.gov/nrmrl/gwerd/csmos/models/remchlor.html
http://www.epa.gov/nrmrl/gwerd/csmos/models/remfuel.html

Question: Sites that are 1.0 or greater take much longer to reach low levels?
If gamma > 1, a site takes longer to clean up because the concentration goes down rapidly at first (e.g., as permeable layers flush out in a heterogeneous setting). After that, mass washes out slowly controlled by matrix diffusion and the associated low concentrations that do not carry much contaminant.

Question: How much mass removal to get 99.9% reduction in PCE in gw
Near the source, the required mass reduction would be a function of gamma using the equation on slide 48 (see example calculation results below). For distant wells out in the plume, the required source mass removal would be a combination function of source and plume interactions. For a 99.9% reduction in gw concentration in/near the source, the required mass reduction would be 99.9% (gamma = 1), 99.9999 (gamma = 0.5), and 96.84% (gamma = 2).

Question: Interesting! Apparently, the higher the GAMMA, the better it is to wait to cleanup. But that assumes a static adsorption model where DNAPL will not adsorb further into the low K zones.
Good points – it is not better to wait and clean-up! Besides the issues identified in your comments, the plume is developing during this period (that is where some of the source mass has gone for the delayed remediation case).

Question: On slide Source Zone Architecture: Have you got the gamma < and > symbols switched? As shown do they go with the list of bullets?
The < and > signs are correct.

Question: Can REMCHLOR be linked w an inverse calibration algorithm (PEST) to predict a viable range of gamma function?
We don't have a direct way to link the REMChlor GUI to PEST, but you could probably do it with the Fortran source code (which we can provide). Alternately, the model PREMChlor can be used to do a forward probabilistic simulation with variable GAMMA. We can send you that model if you wish.

Question: Will a future presentation address how to structure and optimize the site investigation to more efficiently get the data needed to use the models more effectively?
We will touch on these issues in the future sessions. We do not have a detailed module or deep discussion of tools (e.g., MAROS)

Question: Practical Models to Support Remediation Strategy Decision-Making - I missed the beginning and introduction- Will you discuss remediation models in the vadose zone as well? and combined soil and GW remediation technologies?
We are not planning to discuss vadose models (in this workshop we address the performance of the soil cleanup using a remediation time-period and removal fraction (typically provided by a supplemental model). We do plan to discuss combined soil and groundwater remedies.

Question: What if I have jet fuel mixed with TCE floating on first groundwater?
You can use REMChlor to simulate the TCE, with this approach: 1) just use the mass of TCE in the source; 2) probably use a gamma=1.0 to represent partitioning from an LNAPL; 3) having higher decay coefficients for the solvents in the plume zone closest to the source.

Then if benzene is of interest, you could use REMFuel to simulate the hydrocarbon: 1) just use the mass of benzene in the source; 2) probably use a gamma=1.0 to represent partitioning from an LNAPL; 3) having an anaerobic decay coefficient for the benzene in the plume zone closest to the source.
You could also use REMFuel to do the entire problem, but it will only simulate one TCE daughter product (DCE), which might not be enough.

Question: Can either of these models be used or maintain viability for highly soluble contaminants (i.e. ethanol)
Yes, it will work for any chemical that dissolves in groundwater. For ethanol, the Co value would likely be very high due to it's high solubility. It would also probably have a high plume decay rate.
We have used the model to simulate tritium transport, which also has a high solubility.

Question: How do you model the plumes in different aquifers, such as in overburden verses fractured bedrock?
This would likely require a numerical model for a complete picture.

Question: For source area pits located in areas with clay, fractures etc. does it make sense to use a gamma of 1 or 2?
This heterogeneous setting would likely have gamma > 1. A nominal value of 1.5 might be good with lower/upper bounds of 1 and 2.

Question: What version of "Microsoft Net Framework" should we be using?
4.0 works on a Windows 7 machine.