Message

From: Dan Pope [DPope@css-inc.com]
Sent: 3/25/2017 6:17:11 PM
To: Davis, Eva [Davis.Eva@epa.gov]; Bo Stewart [Bo@praxis-enviro.com]; d'Almeida, Carolyn K. [dAlmeida.Carolyn@epa.gov]; Brasaemle, Karla [KBrasaemle@TechLawInc.com]; Steve Willis [steve@uxopro.com]; Cosler, Doug [DCosler@TechLawInc.com]; Eleanor Jennings [ejennings@teci.pro]; Arvind Kutty [AKutty@TechLawInc.com]; Wayne Miller (Miller.Wayne@azdeq.gov) [Miller.Wayne@azdeq.gov]
Subject: RE: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward
Attachments: ST12 Path Forward - Phased Implementation 3-24-2017-DFP.docx

A few quick notes on the Path Forward doc.

From: Davis, Eva [mailto:Davis.Eva@epa.gov]
Sent: Friday, March 24, 2017 12:31 PM
To: Bo Stewart; d'Almeida, Carolyn K.; Brasaemle, Karla; Dan Pope; Steve Willis; Cosler, Doug; Eleanor Jennings; Arvind Kutty; Wayne Miller (Miller.Wayne@azdeq.gov)
Subject: RE: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

All –

I have updated the document with Dan's and Bo's comments, and added requirements for completion of the characterization and for recirculation for containment during the field phase. And I have taken a stab at a cover letter to be signed by the managers, to which this full document would be attached. I hope someone will help me out by doing one more review – I'd like to then get it to Loren first thing Monday.

Eleanor – in reading over your proposed lab work, isn't that 3 bio tests and one set of proposed geochemical testing? The geochemical parameters listed (with the possible exception of ferrous iron, if it is not determined via ICP metals analysis) are already included in Addendum #2 in the baseline (Table 5-1). I wonder if we can leave off the list and just refer to the planned geochemical testing as part of the baseline? Are all of the microbial tests you are asking for already listed in Table 5-1 for 6 - 12 months following initiation of EBR? If so, we might point out that we are not asking for new tests, only that they be provided as part of the baseline (as we discussed with them during the last call).

Doug – can you help us with the issue on modeling? Dan suggested adding how using the wrong parameters in the model affects the results. You had talked about that some during the call. Also, is your write up for Carolyn completed so that it can be shared with the rest of us?

Eva

From: Bo Stewart [mailto:Bo@praxis-enviro.com]
Sent: Wednesday, March 22, 2017 9:20 PM
To: Davis, Eva <Davis.Eva@epa.gov>; d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>; Brasaemle, Karla <KBrasaemle@TechLawInc.com>; 'Dan Pope' <DPope@css-inc.com>; Steve Willis <steve@uxopro.com>; Cosler, Doug <DCosler@TechLawInc.com>; Eleanor Jennings <ejennings@teci.pro>; Arvind Kutty <AKutty@TechLawInc.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>
Subject: Re: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

Attached are suggested additions/edits based on field results from the previous ST012 mass transfer testing (including bromide tracer testing) and the Mobile et al. paper.

On 3/22/2017 1:28 PM, Davis, Eva wrote:

It has gotten very dense, but as Dan has pointed out, if we don't hit them with everything we've got, they are going to blow us off entirely (which they will probably still try to do, even with all the concerns we are laying in front of them). Actually after see Phil at the Feb meeting, and seeing in his letter signature that he is a P.E., I'm a little more hopeful that we can get his attention on the technical issues. I will try to draft a short Executive Summary to add to the front – look for it in the morning.

From: d'Almeida, Carolyn K.
Sent: Wednesday, March 22, 2017 3:23 PM
To: Davis, Eva <Davis.Eva@epa.gov>; Brasaemle, Karla <KBrasaemle@TechLawInc.com>; 'Dan Pope' <DPope@css-inc.com>; Steve Willis <steve@uxopro.com>; Cosler, Doug <DCosler@TechLawInc.com>; Eleanor Jennings <ejennings@teci.pro>; Arvind Kutty <AKutty@TechLawInc.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>
Cc: Bo Stewart (bo@praxis-enviro.com) <bo@praxis-enviro.com>
Subject: RE: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

It does seem a bit dense; Can we also summarize with a list of specific bullets of what we are asking for that could be listed in either the management cover letter or a summary section to this proposal

Carolyn d'Almeida
Remedial Project Manager
Federal Facilites Branch (SFD 8-1)
US EPA Region 9
(415) 972-3150

"Because a waste is a terrible thing to mind..."

From: Davis, Eva
Sent: Wednesday, March 22, 2017 12:01 PM
To: d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>; Brasaemle, Karla <KBrasaemle@TechLawInc.com>; 'Dan Pope' <DPope@css-inc.com>; Steve Willis <steve@uxopro.com>; Cosler, Doug <DCosler@TechLawInc.com>; Eleanor Jennings <ejennings@teci.pro>; Arvind Kutty <AKutty@TechLawInc.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>
Cc: Bo Stewart (bo@praxis-enviro.com) <bo@praxis-enviro.com>
Subject: RE: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

Carolyn –

good luck with the VI problem.

Attached is the latest version – cleaned up for us. I have tried to incorporate all the recommended changes, some I had to tweak, so it would be great if all of you could take another look. There are still 2 outstanding issues that I am aware of – the modeling stuff (#7 under agency concerns) and Dan's comment WU21 about depletion of TEA. Earlier today I sent out the figures I was looking at when I wrote that statement, I'd appreciate it if the rest of you will fact check that for me.

I hope we are close –

Eva

From: d'Almeida, Carolyn K.
Sent: Wednesday, March 22, 2017 1:28 PM
To: Henning, Loren <Henning.Loren@epa.gov>; Brasaemle, Karla <KBrasaemle@TechLawInc.com>; 'Dan

Pope' <DPope@css-inc.com>; Davis, Eva <Davis.Eva@epa.gov>; Steve Willis <steve@uxopro.com>; Cosler, Doug <DCosler@TechLawInc.com>; Eleanor Jennings <ejennings@teci.pro>; Arvind Kutty <AKutty@TechLawInc.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>
Cc: Bo Stewart (bo@praxis-enviro.com) <bo@praxis-enviro.com>
Subject: RE: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

Eva,

Just want to express appreciation for all of your help pulling this together; and to let you all know that I have a sudden potential emergency vapor intrusion situation on one of my other sites that will have to take precedence over this for the next couple of weeks. I trust you guys to carry on as I move into OSC mode.

Carolyn d'Almeida
Remedial Project Manager
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"Because a waste is a terrible thing to mind..."

From: Henning, Loren
Sent: Wednesday, March 22, 2017 11:22 AM
To: d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>; Brasaemle, Karla <KBrasaemle@TechLawInc.com>; 'Dan Pope' <DPope@css-inc.com>; Davis, Eva <Davis.Eva@epa.gov>; Steve Willis <steve@uxopro.com>; Cosler, Doug <DCosler@TechLawInc.com>; Eleanor Jennings <ejennings@teci.pro>; Arvind Kutty <AKutty@TechLawInc.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>
Cc: Bo Stewart (bo@praxis-enviro.com) <bo@praxis-enviro.com>
Subject: RE: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

I agree ☺. Thanks.

From: d'Almeida, Carolyn K.
Sent: Wednesday, March 22, 2017 11:20 AM
To: Brasaemle, Karla <KBrasaemle@TechLawInc.com>; 'Dan Pope' <DPope@css-inc.com>; Davis, Eva <Davis.Eva@epa.gov>; Steve Willis <steve@uxopro.com>; Cosler, Doug <DCosler@TechLawInc.com>; Eleanor Jennings <ejennings@teci.pro>; Henning, Loren <Henning.Loren@epa.gov>; Arvind Kutty <AKutty@TechLawInc.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>
Cc: Bo Stewart (bo@praxis-enviro.com) <bo@praxis-enviro.com>
Subject: RE: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

And me

Suggest taking Loren off distribution list until we have a final product

Carolyn d'Almeida
Remedial Project Manager
Federal Facilites Branch (SFD 8-1)
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(415) 972-3150

"Because a waste is a terrible thing to mind..."

From: Brasaemle, Karla [mailto:KBrasaemle@TechLawInc.com]
Sent: Wednesday, March 22, 2017 10:57 AM
To: 'Dan Pope' <DPope@css-inc.com>; Davis, Eva <Davis.Eva@epa.gov>; Steve Willis <steve@uxopro.com>; Cosler, Doug <DCosler@TechLawInc.com>; Eleanor Jennings <ejennings@teci.pro>; d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>; Henning, Loren <Henning.Loren@epa.gov>; Arvind Kutty <AKutty@TechLawInc.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>
Cc: Bo Stewart (bo@praxis-enviro.com) <bo@praxis-enviro.com>
Subject: RE: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

Please also copy me. Thanks.

Karla Brasaemle, P.G.
TechLaw, Inc.

From: Dan Pope [mailto:DPope@css-inc.com]
Sent: Wednesday, March 22, 2017 10:56 AM
To: Davis, Eva; Steve Willis; Cosler, Doug; Eleanor Jennings; d'Almeida, Carolyn K.; Brasaemle, Karla; Henning, Loren; Kutty, Arvind; Wayne Miller (Miller.Wayne@azdeq.gov)
Cc: Bo Stewart (bo@praxis-enviro.com)
Subject: RE: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

I also would like to be copied on the modeler's deliberations.

From: Davis, Eva [mailto:Davis.Eva@epa.gov]
Sent: Wednesday, March 22, 2017 12:01 PM
To: Steve Willis; Cosler, Doug; Eleanor Jennings; d'Almeida, Carolyn K.; Brasaemle, Karla; Dan Pope; Henning, Loren; Arvind Kutty; Wayne Miller (Miller.Wayne@azdeq.gov)
Cc: Bo Stewart (bo@praxis-enviro.com)
Subject: RE: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

I would like to be copied on their emails -

From: Steve Willis [mailto:steve@uxopro.com]
Sent: Wednesday, March 22, 2017 11:56 AM
To: Cosler, Doug <DCosler@TechLawInc.com>; Davis, Eva <Davis.Eva@epa.gov>; Eleanor Jennings <ejennings@teci.pro>; d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>; Brasaemle, Karla <KBrasaemle@TechLawInc.com>; 'Dan Pope' <DPope@css-inc.com>; Henning, Loren <Henning.Loren@epa.gov>; Arvind Kutty <AKutty@TechLawInc.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>
Cc: Bo Stewart (bo@praxis-enviro.com) <bo@praxis-enviro.com>
Subject: RE: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

Both Doug and Bo are working on the model separately. I suggest that they start communicating with each other independently to discuss their efforts and make sure the final letter includes comments/concerns from both.

From: Cosler, Doug [mailto:DCosler@TechLawInc.com]
Sent: Wednesday, March 22, 2017 9:46 AM
To: 'Davis, Eva'; Eleanor Jennings; d'Almeida, Carolyn K.; Brasaemle, Karla; 'Dan Pope'; Henning, Loren;

Kutty, Arvind; Wayne Miller (Miller.Wayne@azdeq.gov); Steve Willis
Subject: RE: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

This paper documents an extensive field test (~2011) at the ST012 site where they measured in situ mass transfer coefficients for BTES dissolution from LNAPL zones into groundwater. This 2016 paper documents a modeling study to estimate the mass transfer rates using data from the 2011 field experiment. Why were these studies not referenced in the AMEC modeling reports ???

Very glad you found the paper, Eva. This paper thoroughly addresses one of our formal model comments: LNAPL dissolution is rate-limited at the ST012 site. AMEC assumed equilibrium between LNAPL and pore water (i.e., infinite mass transfer rate from LNAPL to g.w.). With the measured mass transfer rates at the ST012 site, pore water concentrations leaving LNAPL areas are expected to be 2 to 5 times less than the equilibrium concentrations AMEC assumed in their model (this is demonstrated by sensitivity analyses in the attached ST012 modeling paper).

In other words, the BTEX food source for EBR should be much lower in concentration than what AMEC is assuming. They need to carefully evaluate this with sensitivity analyses.

From: Davis, Eva [mailto:Davis.Eva@epa.gov]
Sent: Wednesday, March 22, 2017 9:39 AM
To: Eleanor Jennings <ejennings@teci.pro>; d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>; Brasaemle, Karla <KBrasaemle@TechLawInc.com>; 'Dan Pope' <DPope@css-inc.com>; Henning, Loren <Henning.Loren@epa.gov>; Kutty, Arvind <AKutty@TechLawInc.com>; Cosler, Doug <DCosler@TechLawInc.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>; Steve Willis <steve@uxopro.com>
Subject: RE: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

Thanks for all the input – I will try to get one clean copy for everyone to review one last time. Bo Stewart was inadvertently left off the distribution list – ADEQ may want to forward to him for comments, he is more familiar with TEE modeling efforts and results, some of which are mentioned in this.

Doug, should more be added about the model? I have attached a paper on dissolution measurements made at ST12 which I recently got ahold of – maybe you can interpret it better than I can.

From: Eleanor Jennings [mailto:ejennings@teci.pro]
Sent: Wednesday, March 22, 2017 7:59 AM
To: d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>; Brasaemle, Karla <KBrasaemle@TechLawInc.com>; 'Dan Pope' <DPope@css-inc.com>; Davis, Eva <Davis.Eva@epa.gov>; Henning, Loren <Henning.Loren@epa.gov>; Arvind Kutty <AKutty@TechLawInc.com>; Cosler, Doug <DCosler@TechLawInc.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>; Steve Willis <steve@uxopro.com>
Subject: RE: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

Attached are my edits to the version sent from Carolyn's 7:28 PM (EST) below email – really just a few comments. Just trying to help keep track of which draft is flying around and which draft/version is being responded to.

Attached is also an earlier draft (UXO Pro 2) that may have gotten lost in the shuffle, as it contains everything of mine regarding proposed testing (Steve Willis and I worked on a draft and sent both our

comments in a combined document). This information was requested again in Carolyn's 7:28 PM (EST) draft from below email, thus why I'm thinking the earlier document may have gotten overlooked (a very easy thing to do with all of the drafts, versions, and edits simultaneously floating around).

MANY thanks for helping to compile this – it's a huge job with this many participants, and the efforts are very appreciated. Let me know if there is anything else I can do to help, or to be of assistance,
Eleanor

Eleanor M. Jennings, M.S. PhD
Principal Microbiologist, Biogeochemist

From: d'Almeida, Carolyn K. [mailto:dAlmeida.Carolyn@epa.gov]
Sent: Tuesday, March 21, 2017 7:28 PM
To: Brasaemle, Karla <KBrasaemle@TechLawInc.com>; 'Dan Pope' <DPope@css-inc.com>; Davis, Eva <Davis.Eva@epa.gov>; Henning, Loren <Henning.Loren@epa.gov>; Arvind Kutty <AKutty@TechLawInc.com>; Cosler, Doug <DCosler@TechLawInc.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>; Steve Willis <steve@uxopro.com>; Eleanor Jennings <ejennings@teci.pro>
Subject: RE: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

I added a few things in light blue

Carolyn d'Almeida
Remedial Project Manager
Federal Facilites Branch (SFD 8-1)
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(415) 972-3150

"Because a waste is a terrible thing to mind..."

From: Brasaemle, Karla [mailto:KBrasaemle@TechLawInc.com]
Sent: Tuesday, March 21, 2017 2:25 PM
To: 'Dan Pope' <DPope@css-inc.com>; Davis, Eva <Davis.Eva@epa.gov>; d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>; Henning, Loren <Henning.Loren@epa.gov>; Arvind Kutty <AKutty@TechLawInc.com>; Cosler, Doug <DCosler@TechLawInc.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>; Steve Willis <steve@uxopro.com>; Eleanor Jennings <ejennings@teci.pro>
Subject: RE: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

I made a number of edits and included Carolyn's comment. I also edited the text at the end from Dan's original notes.

Karla Brasaemle, P.G.,
TechLaw, Inc.
415-762-0566

From: Dan Pope [mailto:DPope@css-inc.com]
Sent: Tuesday, March 21, 2017 12:44 PM
To: Davis, Eva <Davis.Eva@epa.gov>; d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>; Brasaemle, Karla <KBrasaemle@TechLawInc.com>; Henning, Loren <Henning.Loren@epa.gov>; Kutty, Arvind <AKutty@TechLawInc.com>; Cosler, Doug <DCosler@TechLawInc.com>; Wayne Miller

(Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>; Steve Willis <steve@uxopro.com>; Eleanor Jennings <ejennings@teci.pro>
Subject: RE: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

My initial notes on Eva's draft document. Mainly I've added the specific references (it's getting hard to keep track of all the site documents!), and a few comments.

From: Davis, Eva [mailto:Davis.Eva@epa.gov]
Sent: Tuesday, March 21, 2017 9:41 AM
To: d'Almeida, Carolyn K.; Dan Pope; Brasaemle, Karla; Henning, Loren; Arvind Kutty; Cosler, Doug; Wayne Miller (Miller.Wayne@azdeq.gov); Steve Willis; Eleanor Jennings
Subject: FW: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

I've made the first attempt to put forward the reasons why the Agencies believe a phased implementation approach is necessary. I'm leaving the lab and field test descriptions to those who know more about it – please fill it in. I am purposely forwarding Dan's compliation of comments/concerns again, as he made some very good points about expected reactions from the AF/Amec, and we should try to head off those responses now by providing all the information he is suggesting.

From: Dan Pope [mailto:DPope@css-inc.com]
Sent: Monday, March 20, 2017 4:02 PM
To: d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>; Brasaemle, Karla <KBrasaemle@TechLawInc.com>; Davis, Eva <Davis.Eva@epa.gov>; Henning, Loren <Henning.Loren@epa.gov>; Arvind Kutty <AKutty@TechLawInc.com>; Cosler, Doug <DCosler@TechLawInc.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>
Cc: Eleanor Jennings <ejennings@teci.pro>; Steve Willis <steve@uxopro.com>
Subject: Slightly extended DFP Notes on the 3/17/2017 WAFB Conference Call and Path Forward

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From: d'Almeida, Carolyn K. [mailto:dAlmeida.Carolyn@epa.gov]
Sent: Friday, March 17, 2017 5:55 PM
To: Brasaemle, Karla; Dan Pope; Davis, Eva; Henning, Loren; Arvind Kutty; Cosler, Doug; Wayne Miller (Miller.Wayne@azdeq.gov)
Cc: Eleanor Jennings; Steve Willis
Subject: RE: DFP Notes on the 3/17/2017 WAFB Conference Call

I added some afterthoughts in purple to consider how we use results of (ahem) phased implementation to inform the full scale

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From: d'Almeida, Carolyn K. [mailto:dAlmeida.Carolyn@epa.gov]
Sent: Friday, March 17, 2017 3:10 PM
To: Dan Pope <DPope@css-inc.com>; Davis, Eva <Davis.Eva@epa.gov>; Brasaemle, Karla <KBrasaemle@TechLawInc.com>; Henning, Loren <Henning.Loren@epa.gov>; Kutty, Arvind <AKutty@TechLawInc.com>; Cosler, Doug <DCosler@TechLawInc.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>
Cc: Eleanor Jennings <ejennings@teci.pro>; Steve Willis <steve@uxopro.com>
Subject: RE: DFP Notes on the 3/17/2017 WAFB Conference Call

My notes from today:

- Adopt Phased Approach to implementation to collect site specific data to refine model, remedial timeframe estimate and performance criteria.
- Collect samples for microbial analysis to determine bacteria present, evaluate need for bioaugmentation.
- Perform lab testing to evaluate impact of temperature and sulfate loading rates on microbial population
- Incorporate phased implementation in specified areas differentiating between heavy LNAPL areas and dissolved phase areas in LSZ,UWBZ and CZ 3-6 months should be sufficient to evaluate degradation rate in dissolved phase areas, up to a year to evaluate degradation rate in heavy LNAPL areas Will need observation wells spaced within 6 months travel time of injection wells; bromide tracer useful for evaluating flow distribution around well.

Evaluate whether sulfate and tracer reach observation wells, then whether amendment is achieving biodegradation or not

- Update model to verify remedial timeframe, performance evaluation criteria and optimize full scale implementation
- Grid the full treatment area into optimization zones based upon existing conditions identified during characterization: Heavy LNAPL vs dissolved phase, temperature, microbial population, available sulfate, etc for optimized treatment, including possible bioaugmentation
- Install or designate observation wells within gridded optimization zones to evaluate remedy progress

- ADEQ working on alternative model

Carolyn d'Almeida
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"Because a waste is a terrible thing to mind..."

From: Dan Pope [mailto:DPope@css-inc.com]
Sent: Friday, March 17, 2017 2:35 PM
To: Davis, Eva <Davis.Eva@epa.gov>; d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>; Brasaemle, Karla <KBrasaemle@TechLawInc.com>; Henning, Loren <Henning.Loren@epa.gov>; Arvind Kutty <AKutty@TechLawInc.com>; Cosler, Doug <DCosler@TechLawInc.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>
Cc: Eleanor Jennings <ejennings@teci.pro>; Steve Willis <steve@uxopro.com>
Subject: DFP Notes on the 3/17/2017 WAFB Conference Call

DFP Notes on the Friday March 17, 2017 WAFB Conference Call:

Loren has said that **performance criteria** are to be emphasized.

Why are regulators proposing a phased implementation?

- Site conditions have changed from those contemplated in the ROD for EBR/MNA
- EBR/MNA has not been tested and proven effective at a site of this size, complexity, and source mass -- particularly in terms of the timeframe contemplated
- Therefore, a phased implementation (initially limited in terms of the volume of the subsurface applied) is indicated for proof of concept, and to provide data for EBR design and performance criteria.

Modeling

AF should provide a predictive modeling approach suited to determining timeframes for EBR and MNA to reach the respective goals for those remedy approaches. This modeling will include items related to performance criteria (timelines, triggers, COC concentrations, etc.)

Pre-injection Analyses

Have AF propose their ideas for pre-injection analysis to assess microbiology and geochemistry initial conditions, for comparison to post-injection analyses.

We can propose our own pre-injection analyses to assess microbiology and geochemistry initial conditions, and try to come to a meeting of the minds with AF.

These pre-injection and post-injection tests (for the phased implementation) would form another set of performance criteria; that is, to determine if the appropriate bug populations are developed to proper levels and activity.

Phased Implementation

A phased implementation, applied to a limited area of the site (but all vertical zones) would be the first major milestone (performance criterion) for success; i.e., if the COCs concentrations are lowered to the required concentrations, and stay there, that would be a major step to indicate feasibility of EBR.

A phased implementation could consist of starting EBR at selected sections of the site (i.e., essentially just a portion of what they have already planned for full-scale EBR, so there would not have to be any major changes in terms of approach). That is, pick wells with substantial LNAPL, at least one well in each of the various vertical zones, have injection wells upgradient of the LNAPL wells, and monitoring wells immediately downgradient of the wells, and inject sulfate, etc., as planned for the full-scale EBR. If AF can timely remediate that well so that the COC GW concentrations in those representative wells and the downgradient monitoring wells

are (and remain over time) below EBR goals, then that would be strong evidence that a full-scale approach could work.

The chosen LNAPL well should have significant LNAPL – more than a sheen – at least two inches of LNAPL fairly consistently, so that actual remediation of GW in contact with substantial LNAPL can be assessed.

Chosen well should be at elevated temperature, to correspond with the general site conditions.

Reagent injections (sulfate, etc.) should reflect those concentrations, rates, volumes, etc. that are proposed for full-scale EBR.

Assuming the phased implementation continues for at least a year, the changes around the injection wells in terms of microbiology, sulfate concentrations, sulfide production, hydrogen sulfide generation, precipitation of iron sulfides, possible aquifer plugging, changes in pH, etc., can be monitored and evaluated for viability of a full-scale remedy, and any likely dangers, showstoppers, etc.

Fouling should be assessed for all wells (injection, LNAPL, monitoring), to determine the likely needs for well reworking, refurbishing, eventual replacement, etc. This is particularly important for the follow-on contractor (after AMEC's contract expires) to have an idea of long-term costs, and how to bid.

The downgradient monitoring transect can not only monitor COC changes, but also assess the geochemical footprint of downgradient locations, which would be pertinent to evaluating possible enlargement of a sulfate/etc. plume at full scale.

Also, the distribution and concentrations of sulfate achieved downgradient of the injection transect is of great interest. The AF model indicates they can get a reasonable (to them) sulfate distribution, but reality in subsurface environments is often different from the models. The field study should designed to provide suitable data to design injection well spacing, injection rates, injection concentrations, pressures, etc., so as to achieve useful sulfate concentrations across the site.

--
Lloyd "Bo" Stewart, PhD, PE
Praxis Environmental Tech., Inc.