From:	Warfel, Michael (ECY)
To:	Clint Jacob; Nicholas J. Kuffel - B-K
Cc:	Jenny Green
Subject:	Voluntary Cleanup Program (VCP) NW3119, FMH Materials Handling Solutions / Beckwith & Kuffel, Inc.
Date:	Monday, September 9, 2024 3:18:35 PM
Attachments:	image001.png image002.png

Hello Clint:

Ecology reviewed *Addendum No. 2, Work Plan, Enhanced Biotic and Abiotic Trichloroethene Degradation*, dated September 5, 2024, and sends this VCP Technical Assistance opinions as concurrence with the proposed work. It is our understanding that the injections will be completed under the existing Underground Injection Control (UIC) registration for site number 33669, which is in effect until September 1, 2025.

Ecology appreciates the efforts of Beckwith & Kuffel in pursuing Site cleanup through the VCP.

Sincerely,

Michael R. (Mike) Warfel, LG, LHG, RG
Site Manager, Voluntary Cleanup Program
Department of Ecology Northwest Region Office (NWRO)
Physical Address: 15700 Dayton Ave N, Shoreline, WA 98133
Mailing Address: PO Box 330316, Shoreline, WA 98133-9716
Reception (24 hour) number: (206) 594-0000
Direct (Cell): (425) 324-1892
Fax: (206) 366-7810
Email: michael.warfel@ecy.wa.gov
Ecology web site: https://ecology.wa.gov/

From: Clint Jacob <CJacob@landauinc.com>
Sent: Thursday, September 5, 2024 2:33 PM
To: Warfel, Michael (ECY) <MWAR461@ECY.WA.GOV>; Nicholas J. Kuffel - B-K <nkuffel@b-k.com>
Cc: Jenny Green <JGreen@landauinc.com>
Subject: RE: Beckwith and Kuffel April 2024 monitoring data

External Email

Hi Mike-

Attached is the work plan. Please let me know if you have any questions/concerns. Im glad to get on a call to discuss the project and this focused injection event.

Thanks
Clint

Clint Jacob, PE, LG
DIRECTOR, ENVIRONMENTAL REMEDIATION
M: (360) 536-2095| cjacob@landauinc.com

From: Warfel, Michael (ECY) <MWAR461@ECY.WA.GOV>
Sent: Friday, August 30, 2024 5:35 AM
To: Nicholas J. Kuffel - B-K <nkuffel@b-k.com>; Clint Jacob <CJacob@landauinc.com>
Cc: Jenny Green <JGreen@landauinc.com>
Subject: RE: Beckwith and Kuffel April 2024 monitoring data

You are very welcome!

Michael R. (Mike) Warfel, LG, LHG, RG
Site Manager, Voluntary Cleanup Program
Department of Ecology Northwest Region Office (NWRO)
Physical Address: 15700 Dayton Ave N, Shoreline, WA 98133
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From: Nicholas J. Kuffel - B-K <nkuffel@b-k.com>
Sent: Thursday, August 29, 2024 5:28 PM
To: Clint Jacob <CJacob@landauinc.com>; Warfel, Michael (ECY) <MWAR461@ECY.WA.GOV>
Cc: Jenny Green <JGreen@landauinc.com>
Subject: RE: Beckwith and Kuffel April 2024 monitoring data

External Email

Thank you for the input Mike, we appreciate it!
Nick

Nicholas J. Kuffel, P.E. | Vice President - Operations & Engineering | **Beckwith & Kuffel** | **Granich Engineered Products** | **Delta P Pump**
P: 206.767.6700 | F: 206.767.6230 | E: nkuffel@b-k.com

From: Clint Jacob <CJacob@landauinc.com>

Sent: Thursday, August 29, 2024 1:44 PM
To: Warfel, Michael (ECY) <MWAR461@ECY.WA.GOV>
Cc: Nicholas J. Kuffel - B-K <nkuffel@b-k.com>; Jenny Green <JGreen@landauinc.com>
Subject: RE: Beckwith and Kuffel April 2024 monitoring data

Great. Thanks Mike.

We're just wrapping up the work plan addendum this week, then over to Nick for client review. We should get it to you for review during the week of 9/9.
best
Clint

Clint Jacob, PE, LG
DIRECTOR, ENVIRONMENTAL REMEDIATION
M: (360) 536-2095| cjacob@landauinc.com

From: Warfel, Michael (ECY) <MWAR461@ECY.WA.GOV>
Sent: Thursday, August 29, 2024 1:32 PM
To: Clint Jacob <CJacob@landauinc.com>
Cc: Nicholas J. Kuffel - B-K <nkuffel@b-k.com>; Jenny Green <JGreen@landauinc.com>
Subject: RE: Beckwith and Kuffel April 2024 monitoring data

Hi Clint:

Thanks for the update. Sounds like a good approach. I look forward to receiving the work plan addendum, which I will review and provide feedback in the form of a VCP Technical Assistance email.

Mike

Michael R. (Mike) Warfel, LG, LHG, RG
Site Manager, Voluntary Cleanup Program
Department of Ecology Northwest Region Office (NWRO)
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From: Clint Jacob <CJacob@landauinc.com>

Sent: Wednesday, August 7, 2024 11:13 AM
To: Warfel, Michael (ECY) <MWAR461@ECY.WA.GOV>
Cc: Nicholas J. Kuffel - B-K <nkuffel@b-k.com>; Jenny Green <JGreen@landauinc.com>
Subject: FW: Beckwith and Kuffel April 2024 monitoring data

External Email

Hi Mike-

I hope you are having a great summer. I heard in your VM that you are just back to the office today, so Im sure you are digging out.

As mentioned in the VM that I left you this morning, the data for the site is looking very good and we would like to proceed with a focused injection **September 23 through October 4, 2024** before the rains set in. The focused injection will target the area around MW-11, located on the Wooldridge property, which remains our highest TCE concentration well.

I include here a summary of the most recent data, with maps and the cumulative data table.

This will a focused reinjection within the larger area previously injected in 2022. We will reinject near the 18 locations on Woodridge property plus the 5 adjacent locations on SeaMar property. The 2022 injection was detailed in the Addendum No. 1 to the work plan dated July 22, 2022. We plan to provide a very short addendum No. 2 with injection quantities and locations described, incorporating by reference the Addendum No. 1, which provides more extensive site background, description of degradation mechanisms, etc. We are working around some vacations here in August, so plan to get that short work plan addendum to you in early September.

Please reach out with any questions or concerns.
Thanks
Clint

Clint Jacob, PE, LG
DIRECTOR, ENVIRONMENTAL REMEDIATION
M: (360) 536-2095| cjacob@landauinc.com

From: Clint Jacob
Sent: Friday, May 24, 2024 2:48 PM
To: Nicholas J. Kuffel - B-K <nkuffel@b-k.com>
Subject: RE: April 2024 monitoring data

Hi Nick-

Weve got the data tabulated from the end of the April sampling event and I have had a chance to review. I know you had some great insights on the data last time around in July 2023. Im sure you will reach some you own conclusions from the data, but I offer the following insights.

- Big overall takeway is that conditions continue to improve. Treatment to this point has been very effective. I draw your attention to the "Ave Chlor Plot". Highlights:
    - TCE which started at over 75% molar fraction is now percent 6%
    - Non-toxic end products ethene+ethane, which was just 1% in 2019 is now 45% molar fraction (MF). This MF is approx. double the 20% just prior to the Oct 2022 sitewide EHC injection.
    - With the exception of the temporary bump up in Sept 21, the average total cVOCs (PCE+TCE+cDCE+VC) for site wells has decreased pretty steadily to about only about 25% of what we started with in 2017.
- As shown on "All Wells TCE Plot", TCE concentrations are down at all problem wells following the site injection. A little bump from 28 to 39 ug/L at MW11, which remains the highest TCE concentration well.
- Going well by well for the problem wells, referring to "Bio Summary" table:
    - MW12- very good cVOC decreases, 99.5% TCE concentration reduction following site-wide injection. Continuing strong reducing conditions (sulfate-reducing to methanogenic). Now that TOC has dropped off substantially making treatment less optimal, we will want to watch for possible cVOC rebound at this upgradient end of the plume.
    - **MW11- remains our highest concentration TCE well**. Despite >90 TCE concentration decrease since just before the first EHC injection on Wooldridge, we may be hitting a plateau for TCE or possible rebound. cDCE is not being proportionally converted through VC to EE; cDCE is 88% molar fraction and EE molar fraction has decreased from 21% to 0%. This is known as a cDCE-stall and can be caused by conditions not being reduced enough (although substantial methane continues to be produced, sulfate has not been reduced to lower levels like we have observed at other site wells like MW11, MW7, MW8). As we discussed previously, it was odd that TOC did not increase here after the second injection. The second reason for cDCE stall is that the bacteria required for the cDCE to VC step (*Dehalococcoides*) is not present, but give good conversion to VC and EE at other site wells, and prior EE MF as high as 21%, this is not the case. More injection will likely be needed here.
    - MW10- continued steady TCE concentration decrease due to mass being treated upgradient. No evidence of enhanced bio treatment at this well.
    - SMMW18- good enhanced treatment with conversion through to EE (66 to 80% MF since site wide injection). This good treatment occurs despite only a slight increase in TOC and no drastic sulfate reduction.
    - MW7: great cVOC concentration reduction with EE at 90% molar fraction. After the big jump in TOC in Jan 23, TOC has remained low around 5 or 6 for 14.5

months wo any cVOC rebound.

- SMMW80-similar to MW10, continued steady TCE concentration decrease due to mass being treated upgradient. No evidence of enhanced bio treatment at this well.
- MW8- very good TCE concentration reduction of 99.9% since site-wide injection, no cDCE-stall, and very good conversion to EE (97% molar fraction). Despite pretty low TOC, good sulfate reduction and methanogenesis.
- MW9- continued low to decreasing cVOCs. Despite pretty low TOC, good sulfate reduction and methanogenesis.
- SMMW21-very good TCE concentration reduction of 99.7% since site-wide injection. EE maxed out at 23% molar fraction, but ND now due to only low cVOCs remaining.

Next steps? Everything is looking very at all locations except MW11. Another injection is very likely to be needed here and Im inclined to conduct it this year to avoid seeing concentrations increase again at the various wells downgradient of NW11. I expect we would want to repeat the same approximate injection grid around MW-11, offset a bit to inject between the prior injection grid – we would likely injected18 locations on WDG plus the 5 on SeaMar.

Thanks
Have a great weekend!
Clint

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