

From: [Shane Kostka](#)
To: [Winslow, Frank \(ECY\)](#)
Cc: [Preston, Bill](#); [Piper Roelen](#)
Subject: RE: Tiger Oil update - Ecology concurrence on second injection round
Date: Tuesday, August 22, 2023 10:23:19 AM
Attachments: [image001.png](#)

Frank,

Apologies for this belated update on the Tiger Oil injection. The injection generally proceeded smoothly. As anticipated, several of the target wells for the second injection were not able to accept the full design volume (2,500 gallons at 67 grams of Klozur per liter). The leftover volume was injected into IW-4, IW-1 and IW-8 (as discussed in your email below), and additional volume was injected into select target wells (especially surrounding IW-4; IW-5 and IW-9, downgradient of IW-4, were injected prior to injecting to IW-4). The below table outlines the volumes and percent of design volume for the first and second injections:

Location	Volume Injected (gal)		Percent of design volume	
	First injection	Second injection	First injection	Second injection
IW-1	1114	1805	45%	NA *
IW-2	3196	2988	128%	120%
IW-3	2147	0	86%	0% *
IW-4	3215	3453	129%	138%
IW-5	3135	2661	125%	106%
IW-6	3770	0	151%	0% *
IW-7	3214	0	129%	0% *
IW-8	1319	626	53%	NA *
IW-9	3182	2805	127%	112%
IW-10	2505	1554	100%	62%
IW-11	3386	2736	135%	109%
IW-12	780	1967	31%	79%
IW-13	2559	2712	102%	108%
IW-14	886	1335	35%	53%
IW-15	3174	0	127%	0% *
IW-16	3344	0	134%	0% *
IW-17	972	0	39%	0% *
IW-18	3511	390	140%	16%

*= well was not part of second injection design

The first post injection groundwater monitoring event was conducted almost exactly 3 months after completing the first injection. Based on the low pH, high conductivity, and high ORP measured in groundwater during the first post injection groundwater monitoring event, it is likely Klozur was still present and active (indicating further contaminant reduction likely occurred following the sampling event) at the time groundwater was sampled. As such, Landau suggests waiting 4 months after the second injection to perform the second post injection groundwater monitoring event so that the Klozur will have ample time to react and groundwater samples will be representative of actual conditions post injection. This would put the second monitoring event occurring in the middle of November 2023.

The wells sampled during the first post injection monitoring event were injection wells IW-1, -2, -3, -4, -8, -9,

-10, -12, -14, -15, -17, and -18 and monitoring wells N1MW-6R, -7R, -8, and -9 (you note below that N1MW-6R, N1MW-7R, and N1MW-9 would likely serve as the CPOCs). Landau suggests sampling the same set of wells during the next performance monitoring event for consistency. We intend to sample all wells for NWTPH_Gx and BTEX.

Please let me know if you would like to discuss.

Thanks,

Shane Kostka, LG

SENIOR GEOLOGIST

D: (509) 444-9428 | M: (208) 819-1965 | skostka@landauinc.com



From: Winslow, Frank (ECY) <fwin461@ECY.WA.GOV>
Sent: Thursday, June 22, 2023 9:47 AM
To: Shane Kostka <SKostka@landauinc.com>
Cc: Preston, Bill <Bill.Preston@yakimawa.gov>; Piper Roelen <proelen@landauinc.com>
Subject: RE: Tiger Oil update - Ecology concurrence on second injection round

Hi Shane,

Thank you for your email. We look forward to the sampling results following injection round #2. If I recall correctly, we allowed for approximately 2-3 months following injection round #1 prior to sampling and would anticipate the same for monitoring following injection round #2.

Here is some additional feedback from Ecology – **we note that the portion of this feedback highlighted below may be of interest to the City.**

With respect to injectate volumes, I would urge to consider injection of a greater volume of injectate at IW-14 since that location had:

1. A considerably greater mass of remaining source contamination (14,000 ug/L GRO).
2. A lower post-injection DO reading.
3. Is upgradient of the remainder of the plume, so any residual oxidant would be expected to migrate downgradient to further treat downgradient contamination.

Of the downgradient injection points (mentioned for injection of leftover volume in your below email), IW-8 would appear to be the highest priority for additional injection based on the remaining DRO in that well (3,100 µg/L). The slight exceedance at IW-3 would appear to likely be addressed through the second injection at upgradient location IW-18, so IW-3 should probably be a lower priority for injection. Although IW-1 is upgradient and did not have a cleanup level exceedance, if additional injection was performed there, it would have added value of migrating east to the former tank pit area. Injection at IW-6 would appear to be of limited value, since it is located cross gradient to compliance monitoring well locations.

Ecology is optimistic that further concentration declines have likely occurred subsequent to the January 2023 sampling round, and that this second injection round is generally expected to be the final one. Ecology notes

that the groundwater contamination at the Site is believed to have undergone significant natural attenuation, with the contaminant plume significantly smaller than in the 1980s when it extended well beyond First Street. The injection rounds have been targeting recalcitrant source mass that has been resistant to biodegradation. We anticipate that following injection round #2, any remaining contamination will likely naturally attenuate, although the exact time-frame for achieving cleanup levels at all locations throughout the Property is highly uncertain.

Following the post-injection round #2 monitoring event, Ecology will review the data to assess potential for Ecology issuing a no further action (NFA) determination. If some residual contamination remains above cleanup levels following injection round #2, Ecology will examine options for NFA such as recording an environmental covenant (EC) on the property, and possibly, application of conditional points of compliance (CPOCs). Although we recognize that the City would prefer to have an NFA issued without an EC, this may be the most appropriate and practicable route toward achieving a NFA determination. Such an EC would prohibit drinking water wells on the Property.

If CPOCs are needed, I would anticipate that N1MW-6R, N1MW-7R, and N1MW-9 would likely serve as the CPOCs. **Hence, sampling of those monitoring wells following injection round #2 would be appropriate.** Ecology generally requests four consecutive quarters of groundwater monitoring data below cleanup levels prior to issue of a NFA. However, if an EC is needed, one option may be continued monitoring following issue of a NFA determination. We have been applying a 15 month interval (four rounds in 5 years) as one approach for post-NFA monitoring. The need for continued monitoring beyond that point would be assessed during the 5-year periodic review performed by Ecology.

Please let me know if you have any questions regarding this feedback.

Thanks, Frank

Frank P. Winslow, LHG

WA Expedited VCP Site Manager
Department of Ecology – Toxics Cleanup Program
1250 W. Alder Street, Union Gap, WA 98903
(509) 424-0543 (cell)

Frank.Winslow@ecy.wa.gov

From: Shane Kostka <SKostka@landauinc.com>
Sent: Wednesday, June 21, 2023 10:45 PM
To: Winslow, Frank (ECY) <fwin461@ECY.WA.GOV>
Cc: Preston, Bill <Bill.Preston@yakimawa.gov>; Piper Roelen <proelen@landauinc.com>
Subject: Tiger Oil update - Ecology concurrence on second injection round

Frank,

I wanted to introduce myself and let you know that I will be taking the lead on this project. We recently received approval from the property owner to perform the second injection and the tentative schedule is to perform the injection July 10-18. Equipment and supplies including the storage containers would be delivered the week of July 3 and are anticipated to be removed by July 21. As Jeff notes below, the second injection will be focused on the 10 injection wells proximate to the former excavated area with the same target injectate concentration and volume as the first injection. Based on the volume those 10 wells were

able to accept during the first injection, we anticipate leftover volume which would be injected to wells IW-8 (GRO above CUL), IW-3 (GRO CUL dependent on benzene), IW-1 (upgradient of IW-4), and IW-6 (proximate to N1MW-6R and N1MW-9). Attached is the table showing pre- and post-injection groundwater GRO concentrations and field parameters and the figure showing the wells to be injected (circled in red) as well as the wells which may be injected depending on the leftover volume from the target wells (circled in blue). We will include BTEX as part of the analytical for the next post-injection monitoring round.

Please let me know if the proposed schedule is acceptable and feel free to reach out if you have any questions.

Thank you,

Shane Kostka, LG

SENIOR GEOLOGIST

D: (509) 444-9428 | M: (208) 819-1965 | skostka@landauinc.com



From: Winslow, Frank (ECY) <fwin461@ECY.WA.GOV>
Sent: Monday, April 24, 2023 2:38 PM
To: Jeffrey Menken <jmenken@landauinc.com>
Subject: RE: Tiger Oil update - Ecology concurrence on second injection round

Hi Jeff,

Ecology concurs that the data suggest that a second injection round is warranted. Please proceed with reinjection as your schedule dictates.

The reason(s) for the increases at IW-4, IW-9, and IW-10 (and in particular, the significant increase at IW-4) are curious. It kind of begs the question if there may be a potential need for injection west of IW-4, although I would hate to do another drilling mob if we don't have to. Any hypothesis for what is going on at IW-4, IW-9, and IW-10? Maybe the injection at these locations mobilized some residual NAPL in the vicinity of IW-4? I assume a greater injectate mass/volume at these three locations may be warranted? I would recommend reinjecting in all injection wells that had cleanup level exceedances in January 2023.

By the way, in my checking benzene concentrations in groundwater, it looks like the last data was in October 2021 with a maximum detection of 9.2 µg/L. If the cleanup level difference between 800 and 1,000 µg/L could make a difference in terms of achieving cleanup levels for GRO in groundwater, it may be worth including BTEX as part of the next post-injection monitoring round. The four months following injection to do the post-injection monitoring round appears reasonable.

In addition to the GRO decrease in most wells, the positive ORP and DO are also encouraging – hopefully in addition to oxidation of the gasoline we are also seeing some biodegradation taking place.

Thanks, Frank

Frank P. Winslow, LHG

WA Expedited VCP Site Manager
Department of Ecology – Toxics Cleanup Program

1250 W. Alder Street, Union Gap, WA 98903
(509) 424-0543 (cell)

Frank.Winslow@ecy.wa.gov

From: Jeffrey Menken <jmenken@landauinc.com>
Sent: Monday, April 24, 2023 9:48 AM
To: Winslow, Frank (ECY) <fwin461@ECY.WA.GOV>
Subject: Tiger Oil update

Hi Frank,

I think I'm past due for an update on Tiger Oil. I spent some extra time looking at the results of this and planning next steps. We saw a really good response in most wells with about ½ the wells now below cleanup limits. But a couple of wells showed slight increases and one showed a significant increase which again, spurred some extra consideration on our end. In addition, the pH readings and conductivities indicated that at the time of sampling, the product was still present and reacting so additional time was needed to allow those processes to proceed

I've attached a brief table and a figure summarizing the pre- and post-sample results from the first injection event. Based on these results it looks like there's still an area near the former excavation where high concentrations are still showing up so we think we should proceed with the 2nd round of injections, focusing on that area. The figure shows some red circles around wells we recommend injecting into. We could also hit IW-8 and IW-6 to the northeast, 3 of the target (red) wells didn't accept the full volume last time so if that's the case again, we could use any leftover chemical in those while we're out.

I've discussed this with Bill and he indicated as long as you were on-board with proceeding with this plan then we should move forward. Do you have some time for a quick discussion?

Jeffrey Menken, RG, LG (he/him/his)

ASSOCIATE GEOLOGIST

D: (503) 542-1091 | M: (217) 553-0729 | jmenken@landauinc.com



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