

August 5, 2019

via email: Kevin.Garon@chemours.com Brian.D.Long@chemours.com

Mr. Kevin Garon Principal Project Director Chemours Corporate Remediation Group Charlotte, NC

Mr. Brian D. Long Plant Manager Chemours – Fayetteville Works Fayetteville, NC

Subject: Old Outfall 002 GAC Pilot Study Interim Results Report Chemours Fayetteville, North Carolina Facility

Dear Mr. Garon,

Parsons Infrastructure (Parsons) is pleased to present this interim report summarizing results obtained todate during operation of the Old Outfall 002 (OOF2) GAC pilot treatment system.

Parsons prepared a preliminary design of a pilot-scale treatment system to treat water collected from Old Outfall 002, Option B location. The pilot treatment system incorporates batch pretreatment to remove nuisance iron and solids, followed by continuous treatment through granular activated carbon (GAC) arranged in a series of four columns to remove PFAS. The system was designed to allow treatment through two series of columns simultaneously, allowing a comparison either in pretreatment conditions (e.g., testing at two different pH values) or in the type of GAC (e.g., regenerated versus virgin F400). The treatment system is in an unused Chemours warehouse space just north of the DuPont manufacturing facility at Fayetteville Works.

Parsons proceeded with construction of the pilot treatment system beginning the week of May 27, 2019. Construction included a FRAC tank for influent water storage; water is collected from the proposed dam location using a trash pump and transferred to the pilot system location using a water truck. Construction of the pilot treatment plant (with the exception of installation of bag filters and connection of the GAC columns on the 2nd treatment train) was completed on June 12th and commissioned with distilled water.

A Pre-Startup Safety Review (PSSR) was performed with Chemours during which the following items were identified:

- Covers for mixer openings on tanks
- Marking tape on all lines
- Conduit ramps for cords and tubing on floor
- Better securement of line to pH adjustment tank T-005
- Isolation of floor drain with sand bags

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Kevin Garon Chemours Corporate Remediation Group Old Outfall 002 GAC Pilot Study Interim Results Report – Fayetteville, NC August 5, 2019 Page 2 of 5

The pilot treatment started up on Friday, June 14th when the first batch of Old Outfall 002 water was treated including aeration, pH adjustment to around 8 s.u., and settling. Following settling the water was pumped through bag filters BF-01A/01B to Batch Holding Tank T-003. Pumping through the GAC columns was then initiated and the pumping rate adjusted to provide a target flow rate of 0.11 gpm (0.42 L/min). In tandem with startup, the PSSR items were addressed; spill-adsorbent socks ("pigs") were placed in lieu of sand bags with Chemours' approval.

Pumping has been maintained continuously through the GAC columns along the 1st train ('A' Train). Several minor items have been addressed during the early period of operation as outlined below:

- Early in the operation, a noticeable pressure drop was observed in the 1st column, and a slightly reduced flow rate resulted. Troubleshooting revealed iron deposition in the 1st column. The iron and a minor amount of carbon were removed.
- The use of glass wool alone to support the GAC columns, which was typical during bench-scale column studies, has proven problematic. The glass wool was found to be compressing into the column effluent opening thereby causing the pressure buildup. The quantity of glass wool was reduced in the 1st two columns and supplemented with marble chips and gravel to prevent localized compression. Following this replacement, the pressure was significantly reduced.
- Vinyl tubing from the GAC column metering pump to and between the columns was replaced with 100 psi rated reinforced tubing.

Parsons developed a sampling schedule intended to (1) provide information on breakthrough of target constituents through the four columns; and (2) provide relevant pretreatment information including iron, TSS, and TOC removal. In summary:

- Table 3+ samples including HFPO-DA have been collected daily in the effluent from the 1st GAC column, from the 2nd GAC column at least three times per week, and from the 3rd and 4th GAC Columns twice per week. Table 3+ samples have been submitted for on-site analysis.
- EPA Mod 537 MAX samples have been collected 2 3 times per week from each GAC column and submitted to TestAmerica Sacramento, CA.
- Table 3+ and EPA Mod 537 MAX samples are being collected weekly from influent and from each pretreated batch.
- TOC samples are being collected along with PFAS samples from the columns. Total iron, total iron (field-filtered), TSS, and TOC are also being collected weekly from influent and from pretreated batches.

Parsons has received Table 3+ analytical data for samples through July 22, 2019. The results to-date are summarized in Table 1. The results are summarized as follows:

- PFMOAA started to break through the 1^{st} column on 6/26/19.
- PMPA started to break through the 1st column on 6/30/19; the rate of breakthrough relative to its column influent concentration is similar to PFMOAA.
- HFPO-DA started to break through the 1st column on 7/2/19; the rate of breakthrough relative to its column influent concentration is slower than PFMOAA.



Kevin Garon Chemours Corporate Remediation Group Old Outfall 002 GAC Pilot Study Interim Results Report – Fayetteville, NC August 5, 2019 Page 3 of 5

- A number of other compounds have started to break through the 1st column on the dates indicated below; the rates of breakthrough relative to their column influent concentrations are slower than PFMOAA:
 - o PF02HxA: 7/2/19
 - PEPA: 7/3/19
 - PF030A: 7/9/19 (one detection 7/3/19 followed by additional period of non-detect)
 - o NVHOS: 7/11/19
 - PF05DA: 7/19/19
- No compounds have broken through the 2nd, 3rd, or 4th columns.
- PFMOAA concentrations decreased by 40% during pretreatment; several other of the more predominant compounds decreased by lower percentages. Parsons will investigate losses through other pathways as part of the overall pilot treatment study.

Operation with the current influent batch will continue with the immediate objective of observing PFMOAA to break through completely through the 1^{st} column and start to break through the 2^{nd} column.

Parsons has collected a 2nd influent batch in a separate FRAC tank in preparation for the next experiment. The next experiment will include the operation of two GAC column trains in parallel; the experiment will likely compare treatment between F400 GAC (same baseline conditions as 1st study for repeatability) with a regenerated bituminous coal-based variant (Calgon DSR-A).

Parsons is pleased work with Chemours to provide support for this project. If you have any comments or concerns regarding this interim update report, please contact me at (315) 552-9729 (office) or 315-403-3606 (mobile).

Sincerely,

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Ted Schoenberg, PhD, PE Senior Engineer / Project Manager

cc: Les Cordone, PE Michael Robinson, PE Adway Biniwale, PE Kyle King, PE Ben Krause Project 449338 File

Sample	Date	PFINUAA	РМРА	HFPU-UA	РЕРА	PFUZHXA	PFU3UA	PF-U4UA	PFUSUA	EVE ACIO	нуаго еvе
		(dqd)	(ddd)	(ddd)	(ddd)	(dqd)	(dqd)	(ddd)	(ddd)	(ddd)	(ddd)
INFLUENT	Average	35.8	2.9	4.1	0.62	14.9	2.6	0.82	4.1	2.9	14.9
PRE-A*	Average	20.2	2.7	4.5	0.67	15.6	2.9	16.0	4.1	2.8	14.8
GAC 1A	6/14-6/26	< 0.0106	< 0.0048	< 0.0117	< 0.0235	< 0.0048	< 0.0092	< 0.0082	< 0.0070	< 0.0052	< 0.0020
	6/27	0.027	< 0.0048	< 0.0117	< 0.0235	< 0.0048	< 0.0092	< 0.0082	< 0.0070	< 0.0052	< 0.0020
	6/28	0.074	0.026	< 0.0117	< 0.0235	< 0.0048	< 0.0092	< 0.0082	< 0.0070	< 0.0052	< 0.0020
	6/29	0.19	0.074	< 0.0117	< 0.0235	< 0.0048	< 0.0092	< 0.0082	< 0.0070	< 0.0052	< 0.0020
	6/30	0.39	0.14	< 0.0117	< 0.0235	< 0.0048	< 0.0092	< 0.0082	< 0.0070	< 0.0052	< 0.0020
	7/01	99.0	0.23	< 0.0117	< 0.0235	< 0.0048	< 0.0092	< 0.0082	< 0.0070	< 0.0052	< 0.0020
	7/02	68.0	0.35	0.027	< 0.0235	0.017	< 0.0092	< 0.0082	< 0.0070	< 0.0052	< 0.0020
	7/03	2.92	0.80	0.19	0.057	0.20	0.034	0.012	< 0.0070	< 0.0052	0.0030
	7/05	3.52	0.82	0.048	0.032	690.0	< 0.0092	< 0.0082	< 0.0070	< 0.0052	< 0.0020
	7/06	4.50	1.03	0.10	0.051	0.12	< 0.0092	< 0.0082	< 0.0070	< 0.0052	< 0.0020
	7/07	5.02	1.06	0.081	0.049	0.10	< 0.0092	< 0.0082	< 0.0070	< 0.0052	< 0.0020
	7/08	5.50	1.04	0.020	< 0.0235	0.047	< 0.0092	< 0.0082	< 0.0070	< 0.0052	< 0.0020
	60/2	8.88	1.43	0.25	0.097	0:30	0.027	< 0.0082	< 0.0070	< 0.0052	0.0040
	7/10	7.59	1.66	0:30	0.14	98.0	0.031	< 0.0082	< 0.0070	< 0.0052	0.0050
	7/11	8.90	1.78	0.27	0.13	0.32	0.026	< 0.0082	< 0.0070	< 0.0052	0.0030
	7/12	8.80	1.80	0.38	0.15	0.52	0.049	0.010	< 0.0070	< 0.0052	0.0060
	7/13	8.10	1.66	0.29	0.13	0.42	0.033	< 0.0082	< 0.0070	< 0.0052	0.0040
	7/14	8.76	1.71	0.31	0.12	0.48	0.034	< 0.0082	< 0.0070	< 0.0052	0.0040
	7/15	10.6	1.93	0.44	0.16	0.73	0.049	< 0.0082	< 0.0070	< 0.0052	0.0060
	7/17	12.3	2.01	0.50	0.17	0.93	0.063	< 0.0082	< 0.0070	< 0.0052	0.0070
	7/19	13.9	2.26	0.68	0.28	1.50	0.10	< 0.0082	0.0076	< 0.0052	< 0.0020
	7/20	15.2	2.15	0.83	0.29	1.93	0.14	< 0.0082	0.0092	< 0.0052	< 0.0020
	7/22	18.4	2.31	0.77	0.29	1.96	0.12	< 0.0082	0.0076	< 0.0052	< 0.0020
GAC 2A	6/14 - 7/22	< 0.0106	< 0.0048	< 0.0117	< 0.0235	< 0.0048	< 0.0092	< 0.0082	< 0.0070	< 0.0052	< 0.0020
GAC 3A	6/14 - 7/22	< 0.0106	< 0.0048	< 0.0117	< 0.0235	< 0.0048	< 0.0092	< 0.0082	< 0.0070	< 0.0052	< 0.0020
GAC 4A	6/14-7/22	< 0.0106	< 0.0048	< 0.0117	< 0.0235	< 0.0048	< 0.0092	< 0.0082	< 0.0070	< 0.0052	< 0.0020
* Influent con	* Influent concentration to GAC columns										

Table 1. GAC Pilot Study Summary of Table 3+ Sample Results (as of 7/22/19)

* Influent concentration to GAC columns

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Samues	Data	R-EVE	NVHOS	PFECA-B	PFECA-G	PES	Byproduct 1	Byproduct 2	Byproduct 4	Byproduct 5	Byproduct 6
סמווואוב	המוב	(dqq)	(dqq)	(dqd)	(ppb)	(dqq)	(dqd)	(ddd)	(dqq)	(ddd)	(dqq)
INFLUENT	Average	0.11	0.64	< 0.0035	< 0.0062	0.0014	0.16	2.6	0.50	0.85	0.62
PRE-A*	Average	< 0.0107	0.65	< 0.0035	< 0.0062	0.0013	0.18	2.6	0.05	0.21	0.57
GAC 1A	6/14 - 6/26	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	6/27	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0048	< 0.0067	< 0.0020
	6/28	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	0.0963	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	6/29	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	0.1009	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	6/30	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	7/01	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	0.1017	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	7/02	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	2/03	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	0.012	< 0.0020
	7/05	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	2/06	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	7/07	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	7/08	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	60/2	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	0.0090	< 0.0020
	7/10	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	0.0070	< 0.0020
	7/11	< 0.0107	0.012	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	7/12	< 0.0107	0.018	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	7/13	< 0.0107	0.014	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	7/14	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	7/15	< 0.0107	0.022	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	7/17	< 0.0107	0.025	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	7/19	< 0.0107	0.049	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	7/20	< 0.0107	0.067	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
	7/22	< 0.0107	0.058	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
GAC 2A	6/14 - 7/09	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
GAC 3A	6/14 - 7/09	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
GAC 4A	6/14 - 7/09	< 0.0107	< 0.0114	< 0.0035	< 0.0062	< 0.0012	< 0.0094	< 0.0073	< 0.0073	< 0.0067	< 0.0020
* Influent conc	* Influent concentration to GAC columns	, columne									

Table 1. GAC Pilot Study Summary of Table 3+ Sample Results (as of 7/22/19)

* Influent concentration to GAC columns



