STREAMGO

A Full Service Water Company

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DEMONSTRATION REPORT– JUNIPER RIDGE LANDFILL LEACHATE PFAS TREATMENT

Site Location – Old Town,ME

Presented to – Casella

December 2025

Report Summary

StreamGo was requested to complete a PFAS removal demonstration through the use of Nano-Fractionation technologies. The demonstration targeted removal of six identified PFAS compounds (PFOS, PFOA, PFNA, PFHpA, PFHxS, PFDA) below 20 ng/L. Further the system provided would also demonstrate StreamGo's PFAS destruction technologies on the produced fractionation concentrate.

The full-scale automated demonstration unit was on site for 6 weeks. Daily operation of the system was limited to daytime hours while operators were present. Operating for these time periods produces 7,000 – 10,000 gpd under fully auto-mated run conditions. The system treated approximately 116,000 gallons total while on site. StreamGo completed numerous mirror samplings, sending one set to Maine Laboratories and one set to Pace Laboratories. This report and subsequent proposed designs are based on the Maine results as they produce lower more accurate readings. Comparison charts have been included within the report of both lab results.

Primary Nano Fractionation

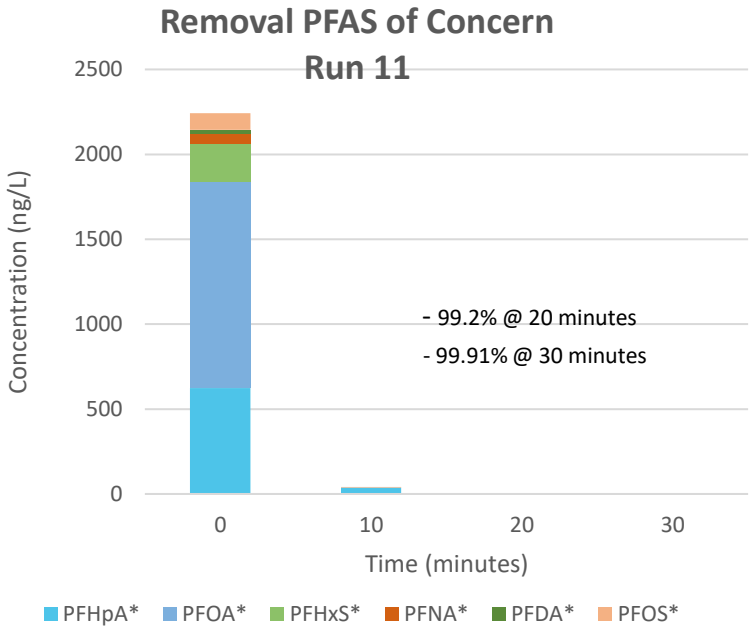
StreamGo performed 10 Primary Nano-Fractionation test runs under varying operation parameters.

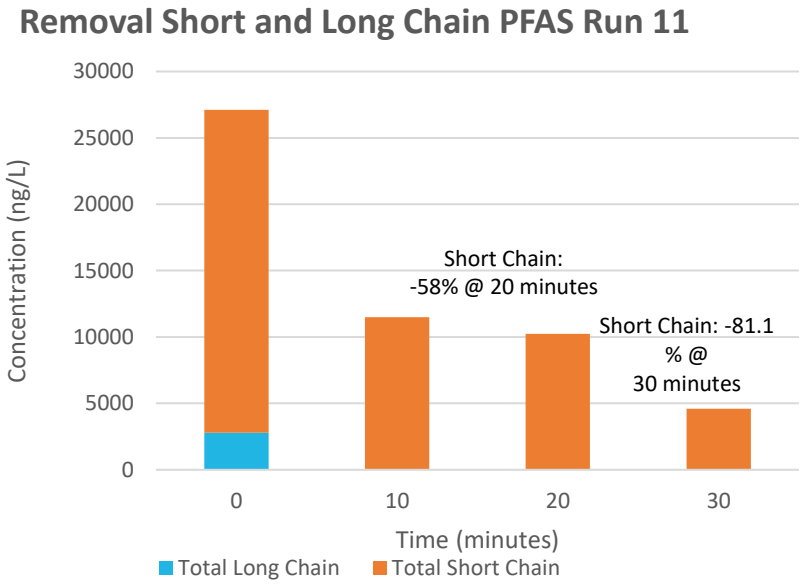
The system met the target 20 ng/L limit for the target compounds 9 out of 9 times when utilizing nano-bubble injection. The system did not meet the removal parameters on the one run that utilized micro-bubble injection in place of nano-bubble.

The optimum run conditions were identified in run #11 utilizing high airflow nano-bubble injection with low airflow micro-bubbe injection and indirect foam management. This operating condition produced the required removals in under 20 minutes of treatment time and achieved non-detect removals in under 30 mins.

Long Chains were removed to non-detect levels and short chains removed by 81.1%, resulting in a total PFAS removal rate of 83% in under 30 minutes.

Primary foamate production was approximately 2-3% of raw water flows. In the full-scale application treating 150,000 gpd it is expected the system would produce up to 4,500 gpd of primary foamate requiring next step secondary fractionation.





Report Summary

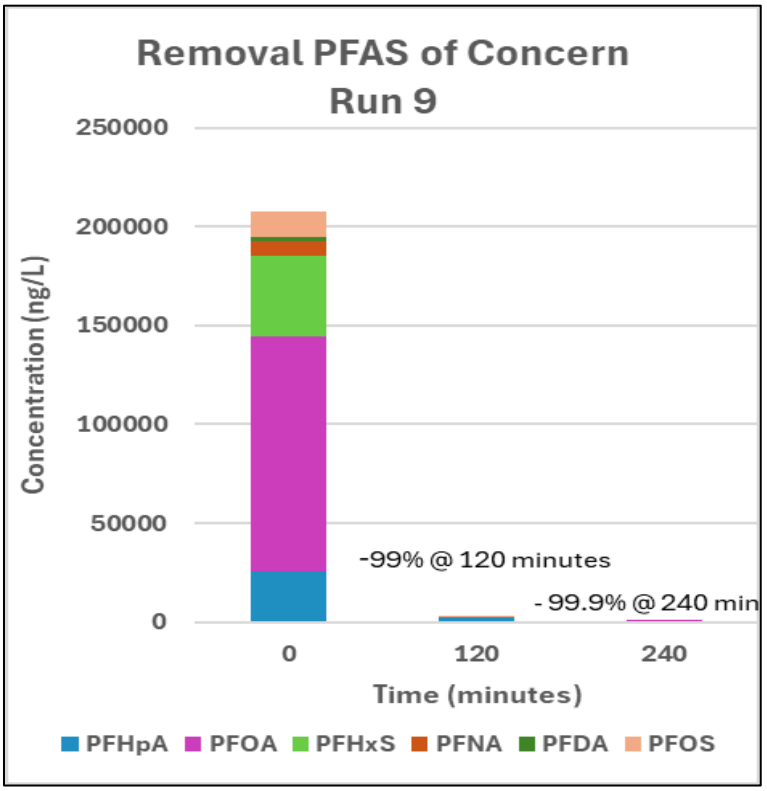
Secondary Nano-Fractionation

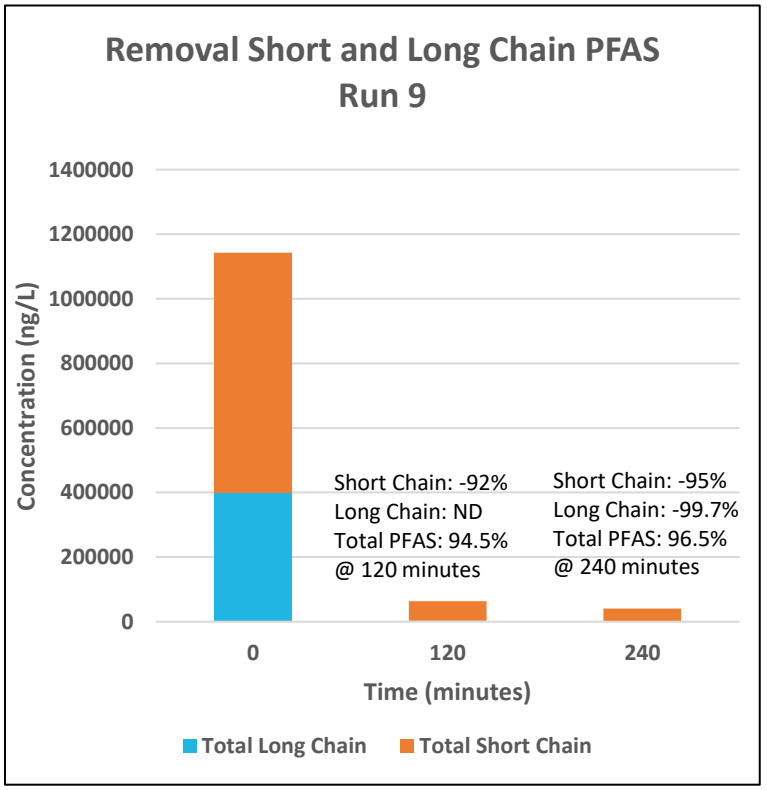
StreamGo performed 3 secondary nano-fractionation test runs under varying operation parameters. The system achieved over 90% removal of the target PFAS compounds in under 180 mins.

The optimum run conditions were identified in Run #9 utilizing medium airflow nano-bubble injection with high airflow micro-bubble injection and indirect foam management. This operating condition produced 98.9% removal of the target PFAS compounds in under 120 mins.

Long chains were removed to non-detect levels and short chains removed by 92%, resulting in a Total PFAS removal rate of 94.5% in under 120 mins.

Secondary foamate was produced at approximately 3% of feed volumes. For the full-scale application of 150,000 gpd raw flow, producing 4,500 gpd primary foamate, it is expected 135 gallons of secondary foamate or final concentrate would be produced daily for destruction.





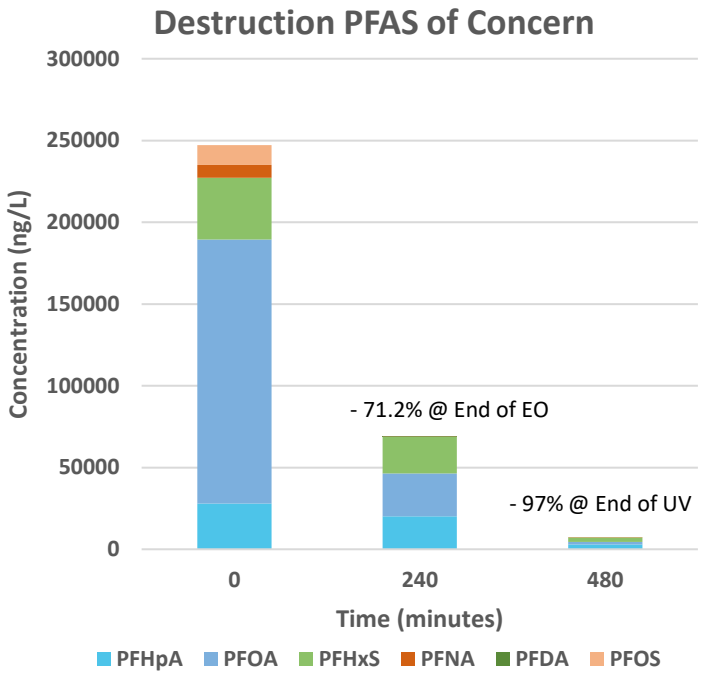
Report Summary

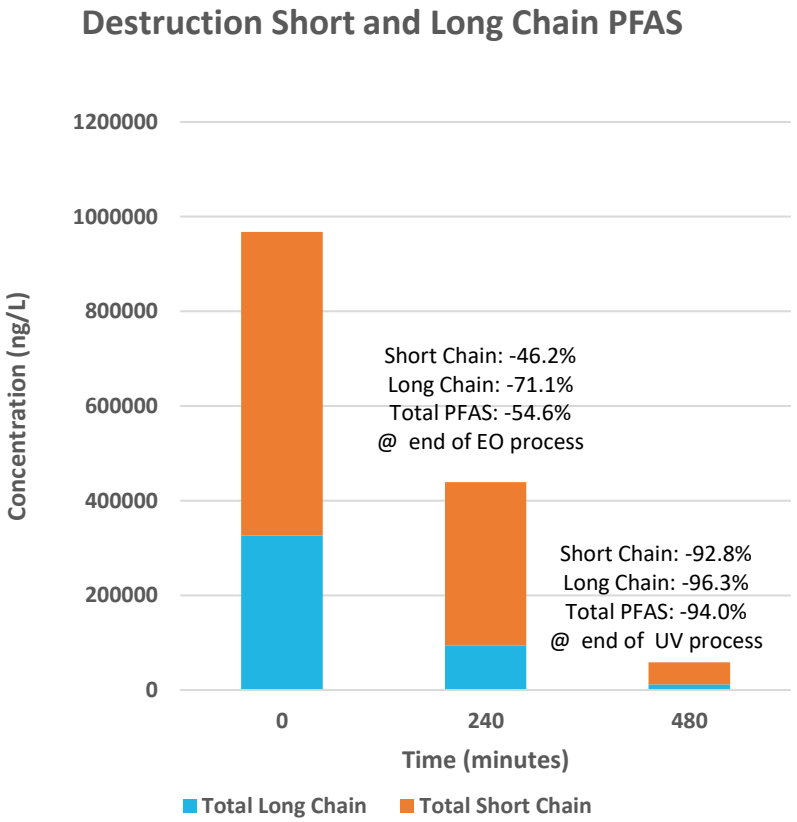
Destruction

StreamGo performed two destruction test runs. One on our mobile bench scale unit and one full scale system test. Both tests used UF membrane pre-filtered concentrate from the secondary fractionation process. The test runs consisted of 4 hours of Electro-Oxidation treatment followed by 4 hours of UV Catalytic Reduction.

The electro oxidation process is effective in reducing long chain PFAS compounds reducing the target PFAS compounds by 71.2%. The following UV reductive process has a much greater effect on the more difficult compounds enhancing destruction of the target PFAS compounds to 97%.

Electro-Oxidation destroyed 46.2% of short chains, 71.1% of long chains and 54.6% of total PFAS compounds. The UV reduction process further enhanced destruction levels to 92.8% of short chains, 96.3% of long chains, and 94.0% of total PFAS compounds. .



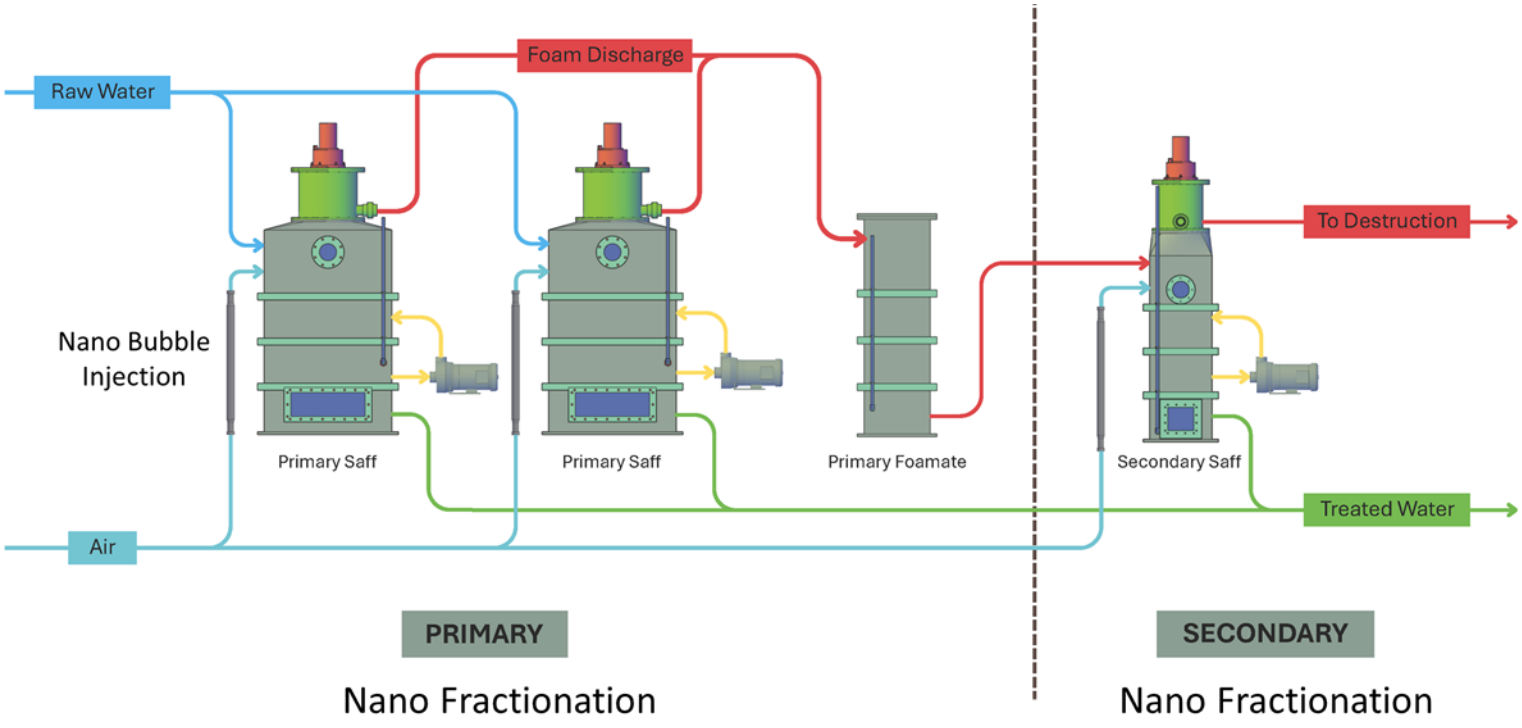


Statement of Qualifications

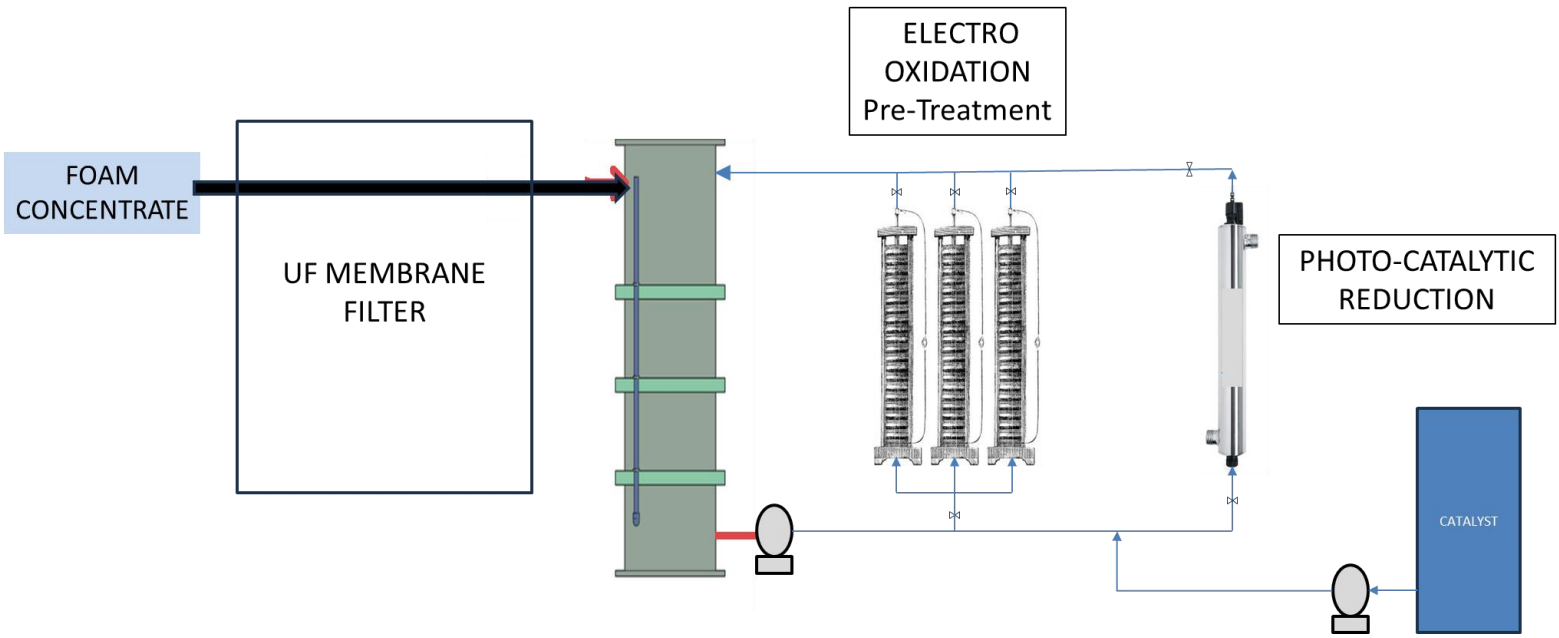
TREATMENT PROCESS

StreamGo's will rely on its proven and proprietary Nano-Fractionation process for the removal and concentration of the raw landfill leachate streams. The resulting PFAS concentrate will then go through membrane filtration and electro-oxidation pre-treatments prior to our final UV catalyst-based deconstruction process. Below is an illustration of the process in general.

PFAS Removal & Concentration



PFAS Foam Concentrate Destruction



JUNIPER RIDGE LANDFILL LEACHATE PFAS REMOVAL DEMONSTRATION

Juniper Ridge Landfill PFAS Removal Demonstration

StreamGo was requested to complete a PFAS removal demonstration through the use of Nano-Fractionation technologies. The demonstration targeted removal of six identified PFAS compounds (PFOS, PFOA, PFNA, PFHpA, PFHxS, PFDA) below 20 ng/L. Further the system provided would also demonstrate StreamGo's PFAS destruction technologies on the produced fractionation concentrate.

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StreamGo's demonstration approach is to complete a series of combinations of variables to identify the best treatment approach for full-scale applications and for future regulations along with the data to support adoption. StreamGo decides the best approach based on regulatory removal requirements and efficiency.

Regulatory removal requirements have been evolving as more research continues to be completed on the impacts of the PFAS class of compounds, the detection capabilities of laboratories, the treatment technologies, and the ability to economically implement solutions. StreamGo thus begins with best-in-class removal technologies and implements those technologies in the most efficient and affordable manner.

When it comes to landfill leachate PFAS treatment, foam fractionation has repeatedly proved itself as the technology of choice. While drinking water applications have the options of RO, Ion-Exchange, and Activated Carbon, leachate's high organic, oils, and mineral contents quickly saturate, scale and plug these technologies. Foam fractionation's advantage is the ability for these competing conditions to simply pass through to technologies more suited for their treatment.

StreamGo's Nano-Fractionation system is the evolution of foam fractionation. This evolution was based on the simple principle that smaller bubbles produced higher removal rates of both long and small chain PFAS. The basis of these improvements is that a smaller bubble creates higher surface areas and packing density improving contact with the PFAS compounds. Secondly, nano bubbles are much more structurally capable and resist coalescing allowing larger quantities of air bubbles to be introduced and a more violent mixing action maximizing contact between the bubbles and the PFAS compounds.

Juniper Ridge Landfill PFAS Removal Demonstration

StreamGo's proprietary work with nano-bubbles creates the unique opportunity to make adjustments to the process unlike pre-existing foam fractionation systems. This includes bubble size, air flows, and foam management. These adjustments allow us to optimize contact and flow rates increasing removal efficiency.

StreamGo performed 10 Primary Nano-Fractionation test runs under varying operation parameters.

The first variable adjusted is bubble size. StreamGo demonstrates removal rates by using micro bubbles alone, nano-bubbles alone, and through the combination. While nano-bubbles are superior for collection of PFAS compounds, micro-bubbles are still used to help optimize flow rates of the bubbles to the collection hood.

Secondly, airflow is adjustable on bubble generation systems increasing or decreasing bubble production rates, allowing supercharging of tank saturation rates while balancing against pump cavitation.

Lastly the foam management system optimizes the exhausting of the foamate flow from the collection head. High PFAS strength leachate can produce foam volumes that inhibit the rate of removal. Think of this as adding dual exhaust to car to improve performance. New foam cannot be collected into the hood if the existing foam is not out of the way.

This report overlays the results of these different approaches the best approach can be identified. In total the system met the target 20 ng/L limit for the target compound 9 out of 9 times when utilizing nano-bubble injection. The system did not meet the removal parameters on the one run that utilized micro-bubble injection in place of nano-bubble.

The optimum run conditions were identified in run #11 utilizing high airflow nano-bubble injection with low airflow micro-bubbe injection and indirect foam management. This operating condition produced the required removals in under 20 minutes of treatment time and achieved non-detect removals in under 30 mins.

Juniper Ridge Landfill PFAS Removal Demonstration

General Summary of PFAS Compounds Breakdown Within Streams

PFAS Name	Carbon No.	Classification	Influent Leachate (ng/L)	Primary Foamate (ng/L)	Secondary Foamate (ng/L)
PFBA	**4**	**Short**	6318	9083	12377
PFMPA	**3**	**Short**	0	0	0
3:3 FTCA	**6**	**Short**	0	0	0
PFPeA	**5**	**Short**	2136	3411	4118
PFMBA	**5**	**Short**	0	0	0
4:2 FTS	**6**	**Long**	0	0	0
NFDHA	**5**	**Short**	0	0	0
PFHxA	**6**	**Short**	3330	19691	24236
PFBS	**4**	**Short**	2522	7409	10099
HFPO-DA	**6**	**Short**	0	0	0
5:3 FTCA	**8**	**Short**	13874	304498	571409
PFEESA		**Short**	0	16.8	0
*PFHpA**	**7**	**Short**	501	11575	28008
PFPeS	**5**	**Short**	29.2	597	1565
ADONA	**7**	**Short**	0	0	0
6:2 FTS	**8**	**Long**	207	3342	79411
*PFOA**	**8**	**Long**	1402	27460	361351
*PFHxS**	**6**	**Long**	203	4759	37790
7:3 FTCA	**10**	**Long**	577	8147	24522
*PFNA**	**9**	**Long**	60.7	852	7798
PFHpS	**7**	**Long**	0	51.8	0
8:2 FTS	**10**	**Long**	0	112	0
NMeFOSAA	**11**	**Long**	53.8	334.0	3161
*PFDA**	**10**	**Long**	22.1	166	310
NEtFOSAA	**12**	**Long**	12.6	97.2	0
*PFOS**	**8**	**Long**	113	992	12289
PFUnA	**11**	**Long**	0	13.6	0
PFNS	**9**	**Long**	0	0	0
PFDoA	**12**	**Long**	0	18.9	30.8
PFOSA	**8**	**Long**	0	21.3	80.7
PFDS	**10**	**Long**	0	0	0
		Total PFAS	31361	402648	1178556
		PFAS of Concern	2302	45804	447546
		Concentration Increase Total PFAS		13	38
		Concentration Increase PFAS of Concern		20	194
PFAS of Concern					

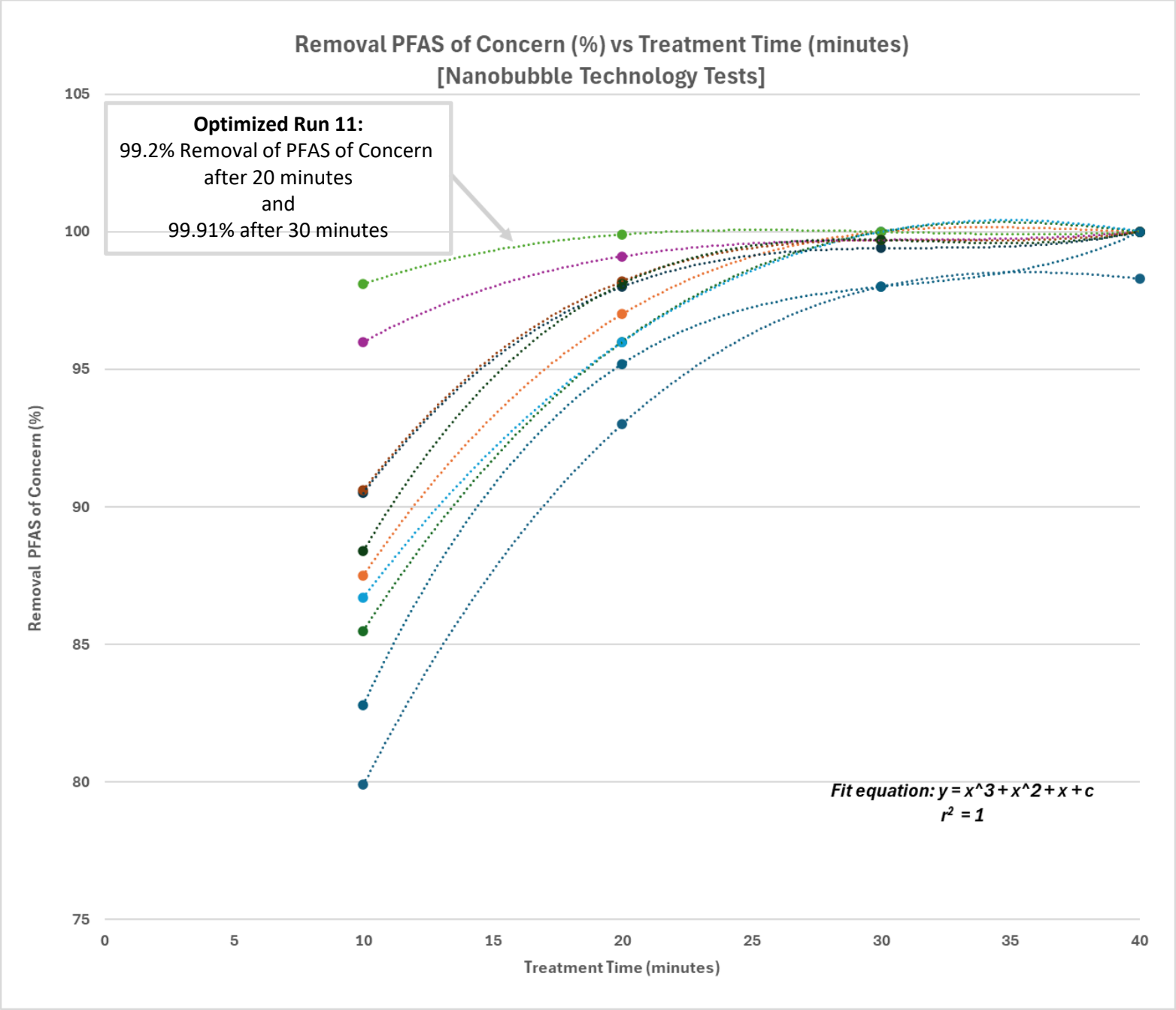
Juniper Ridge Landfill PFAS Removal Demonstration

Primary Fractionator Multiple Test Conditions

Run #	Conditions	SAFF
Run1_S1	Nano Only (Low) + Direct Vacuum	1
Run4_S1	Nano (Low) + BP1 (Low) + Direct Vacuum	1
Run5_S1	Nano (Low) + BP1 (Low)+ Direct Vacuum	1
Run6_S1	CTAB (1 ppm) + Nano (Low) + BP1 (Low) + Direct Vacuum	1
Run10_S1	Nano (Medium) + BP1 (Medium + Indirect Vacuum	1
Run11_S1	Nano (High) + BP1 (Low) + Indirect Vacuum	1
Run12_S1	Nano (High)+ BP1 (Low)+ Indirect Vacuum	1
Run13_S1	Nano (Low)+ BP1 (Medium) + BP2 (Medium) + Direct Vacuum	1
Run14_S1	Nano (Low) + BP1 (Medium) + BP2 (Medium) + Direct Vacuum + Indirect Vacuum	1
Run17_S1	BP1 (Medium) + Direct Vacuum (1800 sec)	1

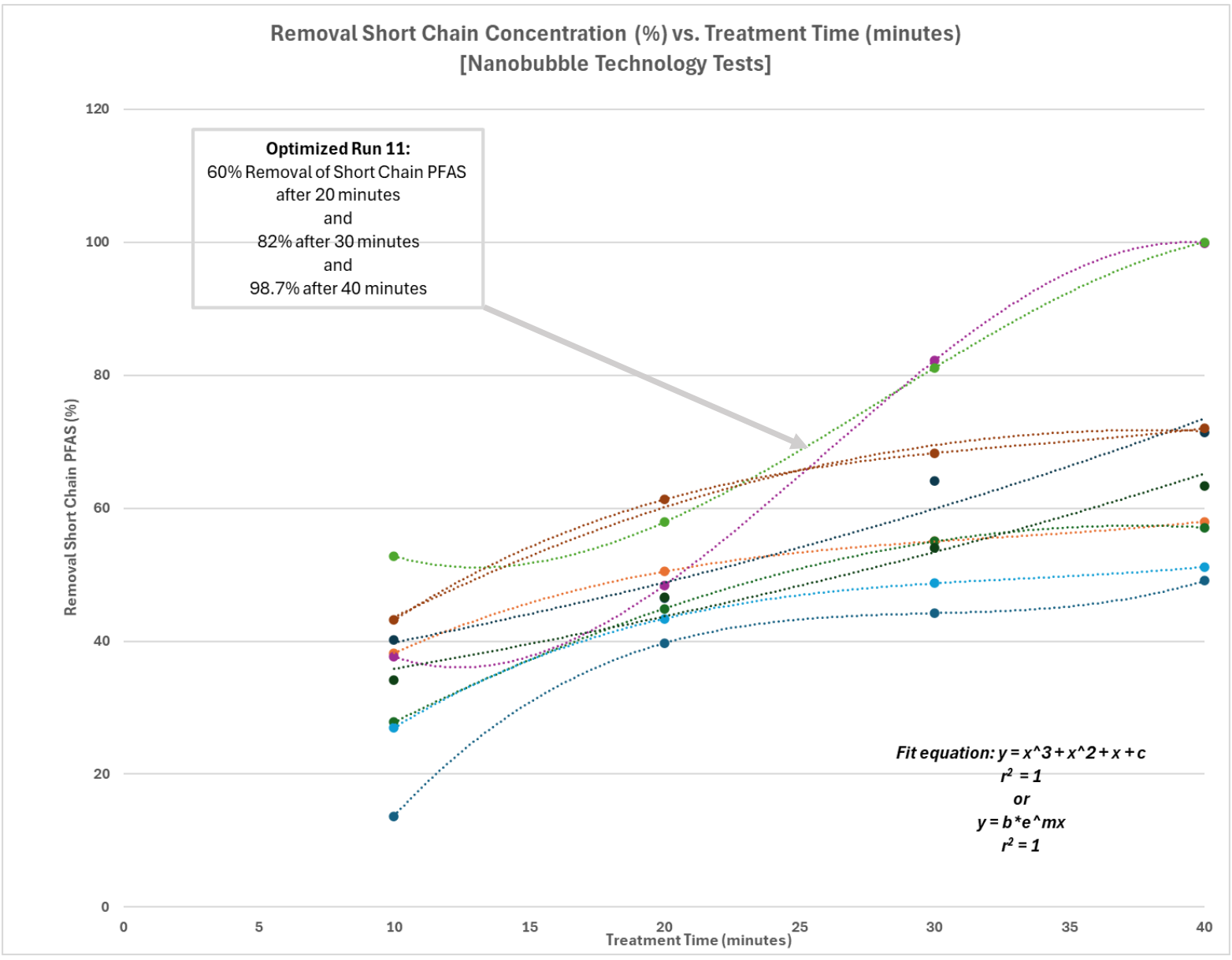
Juniper Ridge Landfill PFAS Removal Demonstration

Primary Fractionator Results for PFAS of Concern Under Multiple Test Conditions



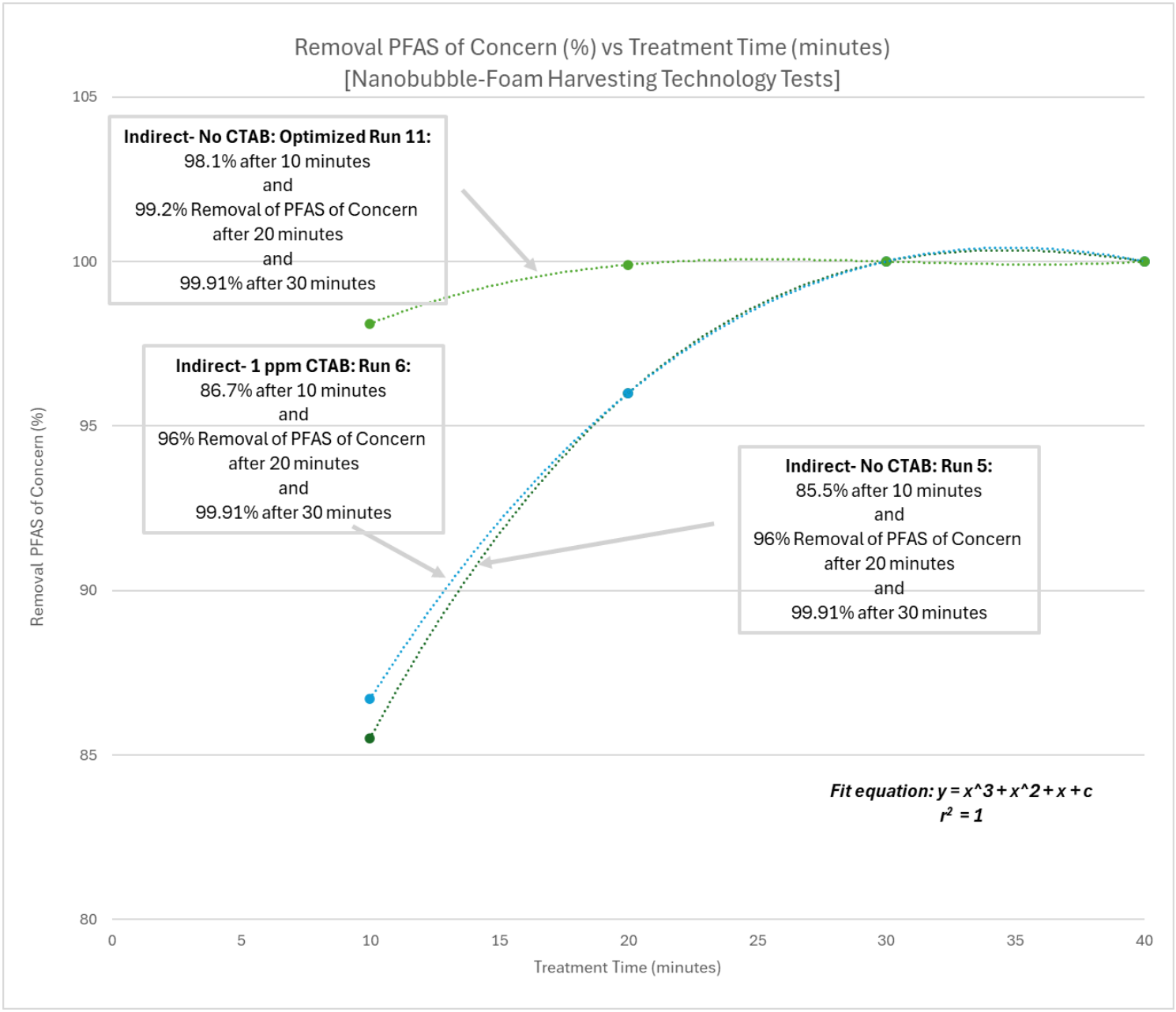
Juniper Ridge Landfill PFAS Removal Demonstration

Primary Fractionator Results for Short Chain Under Multiple Test Conditions



Juniper Ridge Landfill PFAS Removal Demonstration

Primary Fractionator Results PFAS of Concern With/Without Surfactant Addition



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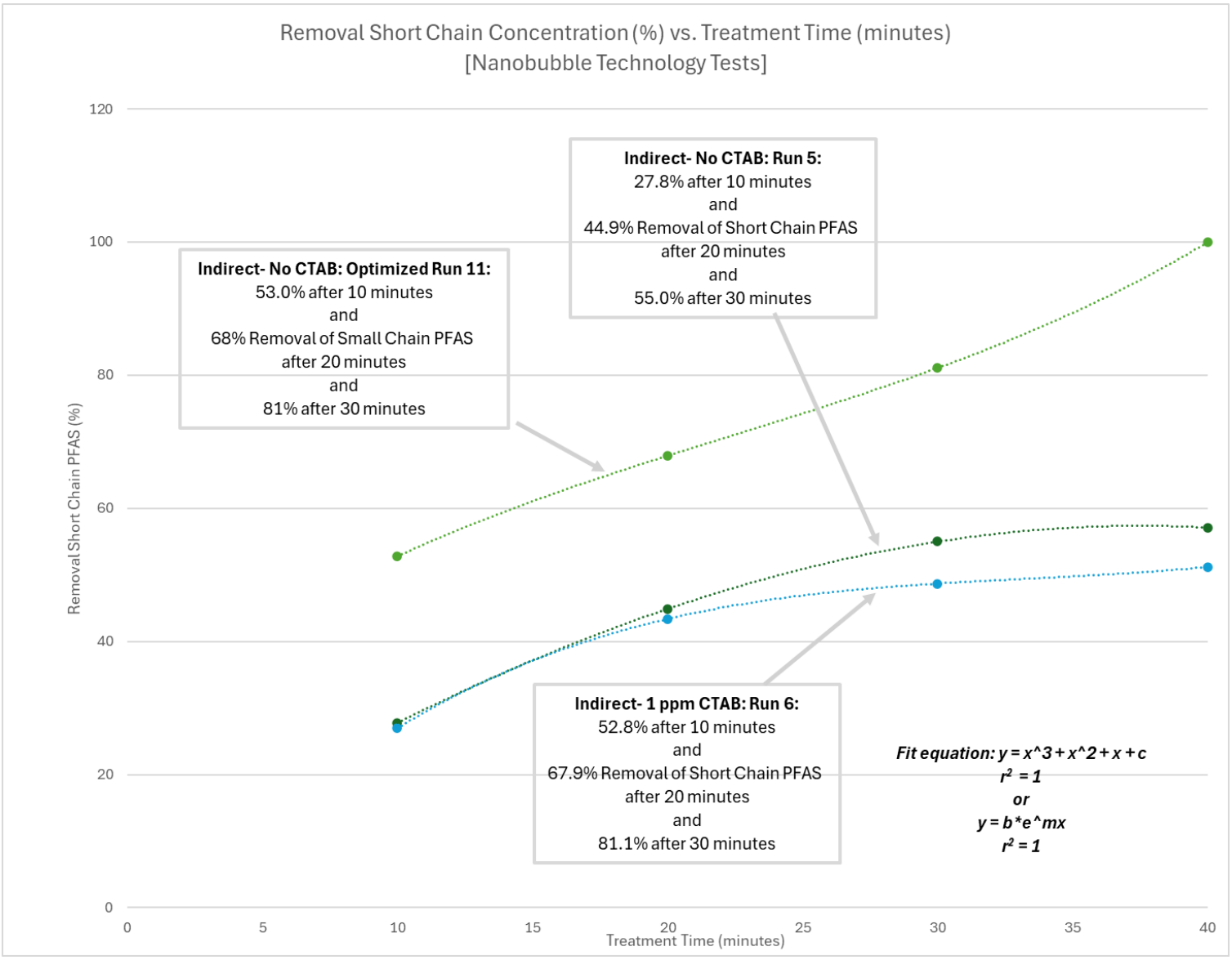
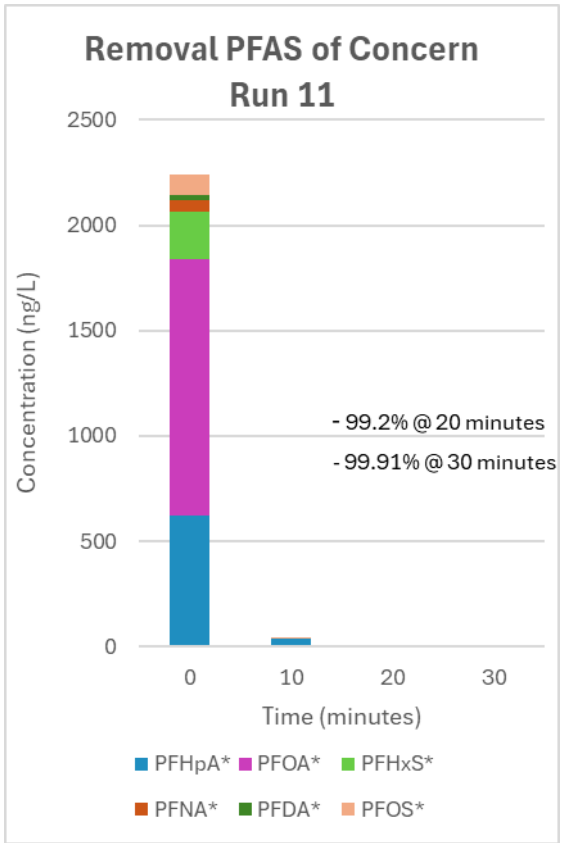
Primary Fractionator Results Short Chain PFAS With/Without Surfactant Addition

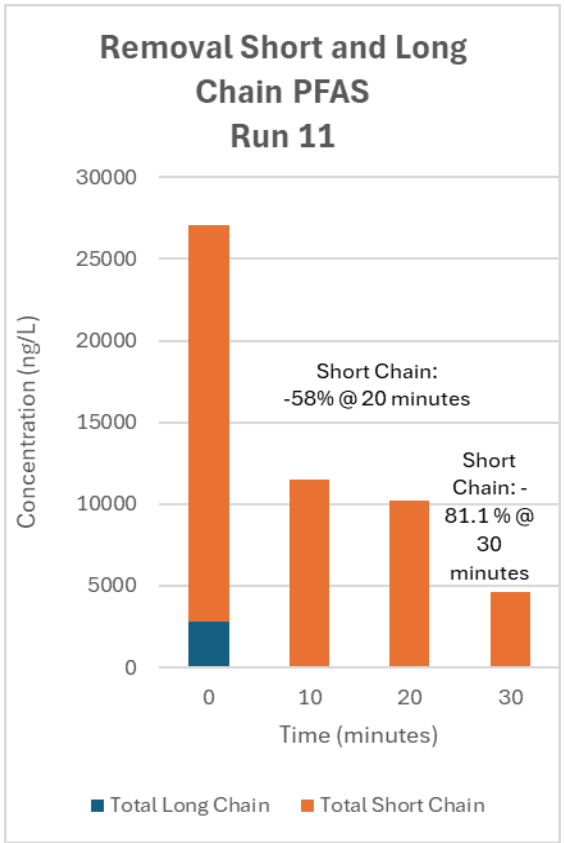


Juniper Ridge Landfill PFAS Removal Demonstration

Primary Fractionation Optimized Run #11 Results
(High Air Flow Nano/No Surfactant/Low Micro 15 min End)

PFAS Name	Run11_S1				MDL
	0	10	20	30	(ng/L)
PFBA	3507	3004	3670	2519	7.6
PFPeA	1932	2071	2001	753	4.5
PFHxA	4346	2997	2187	744	1.9
PFBS	3747	2451	2128	477	1.8
5:3 FTCA	10134	911	237	114	68.0
PFEESA	3.07	0	0	0	2.6
*PFHpA**	623	37.9	2.25	0	2.4
PFPeS	21.3	7.28	0	0	2.8
6:2 FTS	249	0	0	0	10.0
*PFOA**	1216	0	0	0	4.9
*PFHxS**	224	0	0	0	2.0
7:3 FTCA	800	0	0	0	49.5
*PFNA**	57.9	0	0	0	3.6
8:2 FTS	11.5	0	0	0	9.1
NMeFOSAA	89.7	6.33	4.69	0	3.9
*PFDA**	22.7	0	0	0	2.6
NEtFOSAA	20.1	0	0	0	3.1
*PFOS**	99.6	4.18	0	0	2.8
PFOSA	5.06	0	0	0	2.5
NMeFOSE	58.2	0	0	0	24.2





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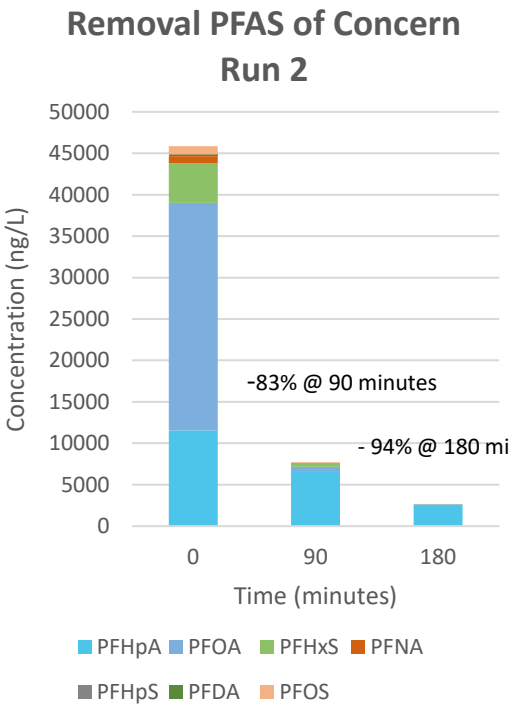
The optimum run conditions were identified in run #11 utilizing high airflow nano-bubble injection with low airflow micro-bubbe injection and indirect foam management. This operating condition produced the required removals in under 20 minutes of treatment time and achieved non-detect removals in under 30 mins.

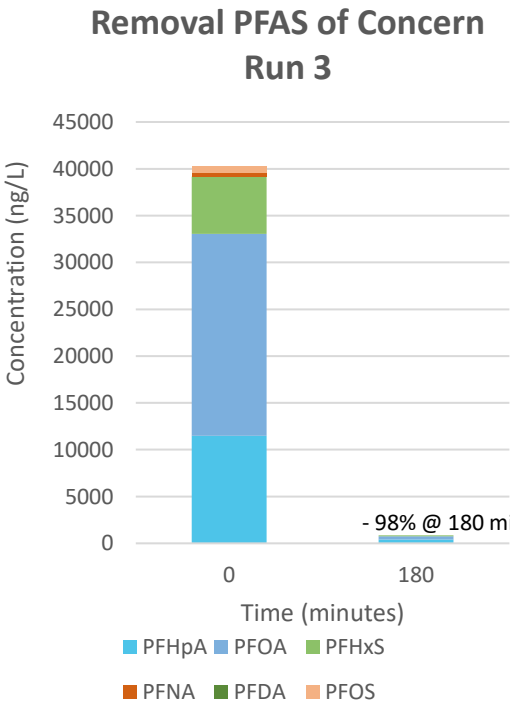
Juniper Ridge Landfill PFAS Removal Demonstration

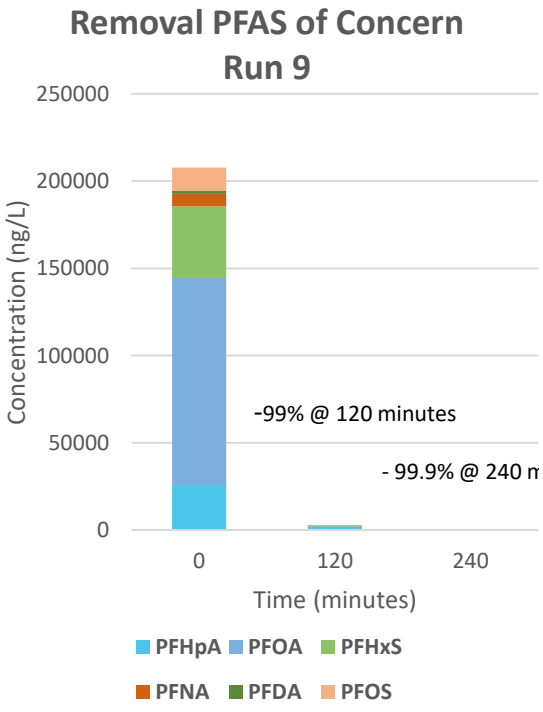
Secondary Fractionator Multiple Test Conditions

StreamGo's completed three Secondary Nano-Fractionation test runs comparing the use of micro bubble pumps to help improve flow while using indirect foam management to create lower foamate generation and increase vacuum impacts.

Run #	Conditions	SAFF
Run2_S2	Nano Only (Low) + Direct Vacuum	2
Run3_S2	Nano (High) + BP1 (High)) + Direct Vacuum	2
Run9_S2	Nano (Medium) + BP1 (High) + Indirect Vacuum	2

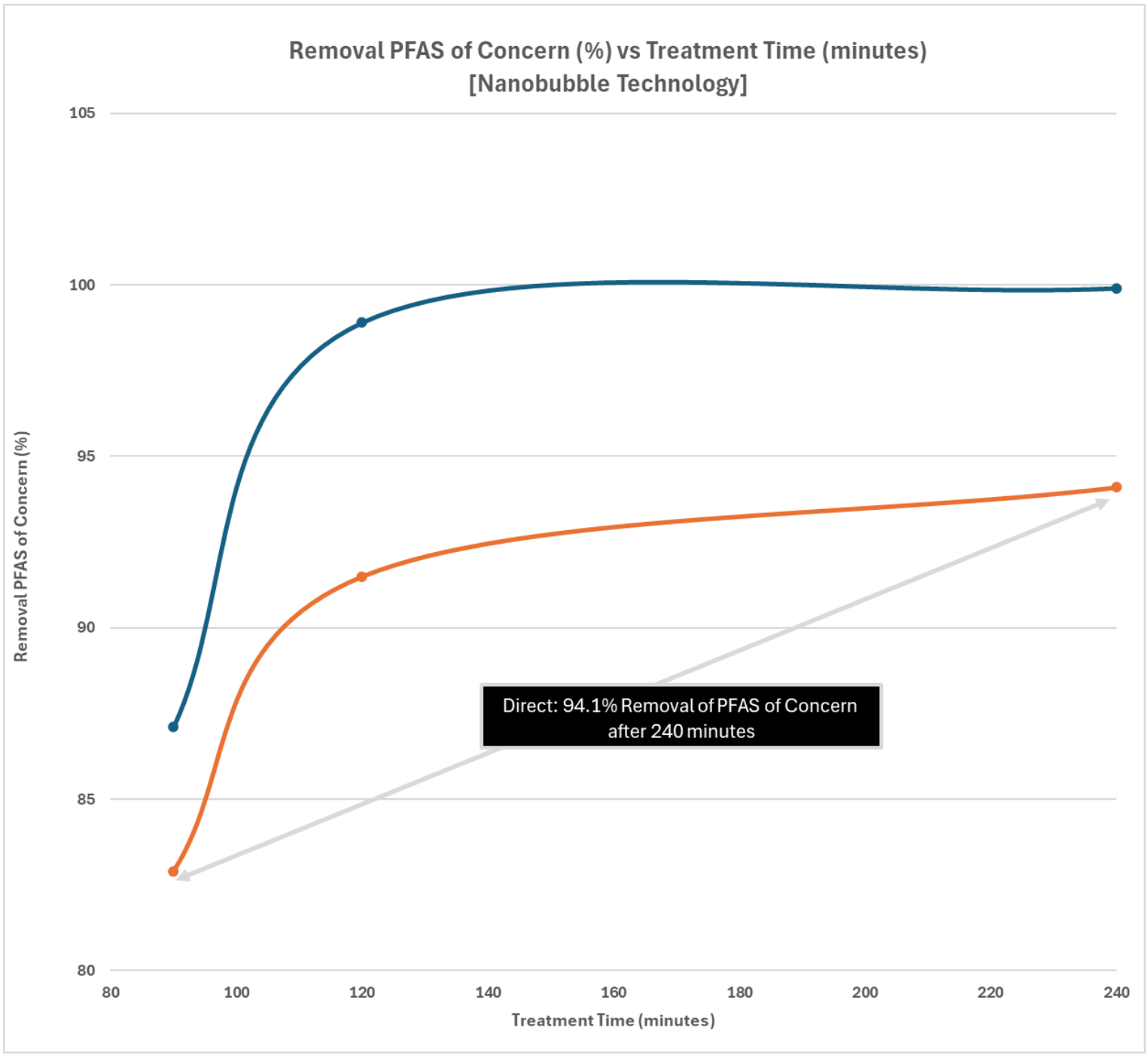






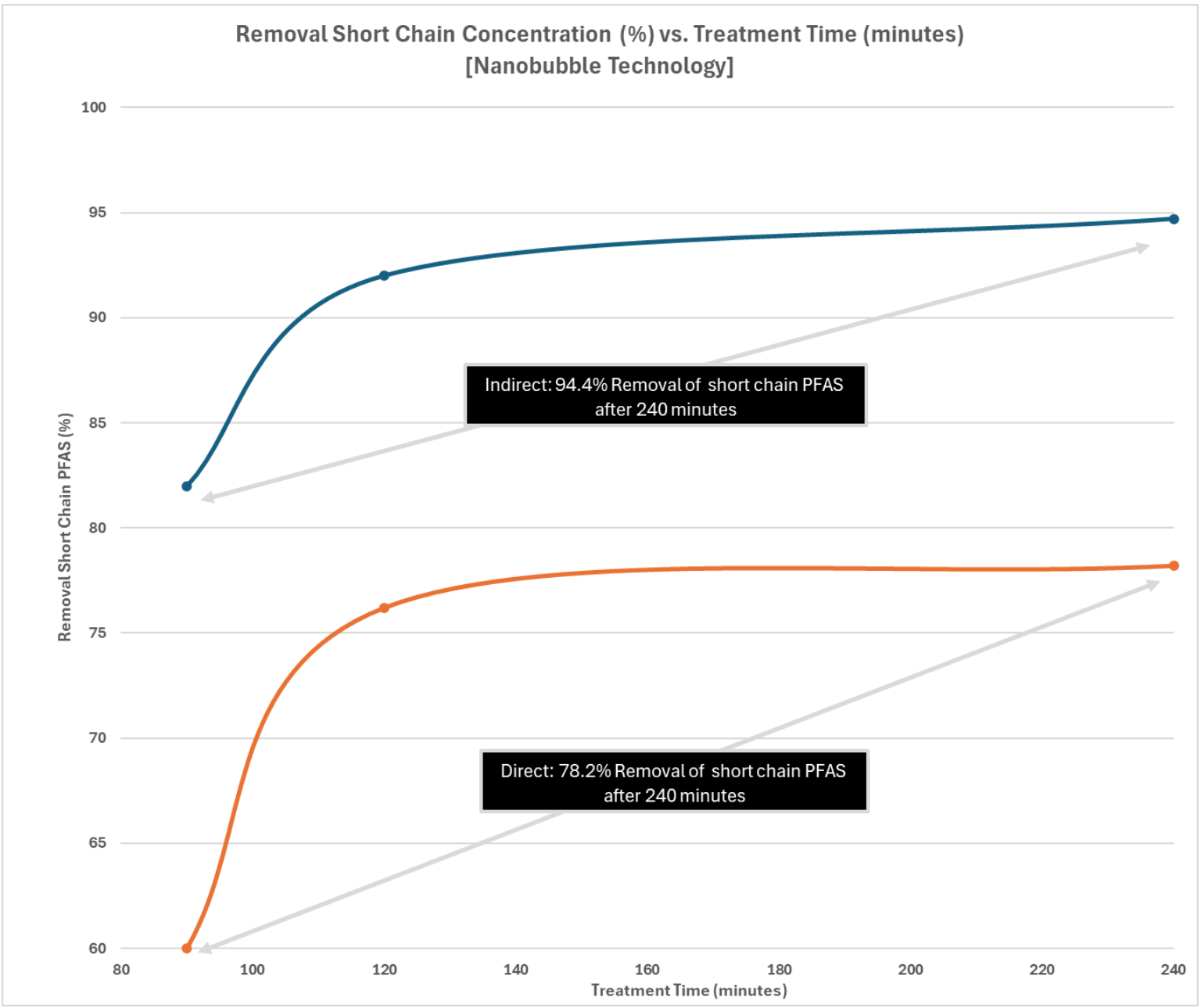
Juniper Ridge Landfill PFAS Removal Demonstration

Secondary Fractionator Results PFAS of Concern
Direct vs Indirect Foamate Removals



Juniper Ridge Landfill PFAS Removal Demonstration

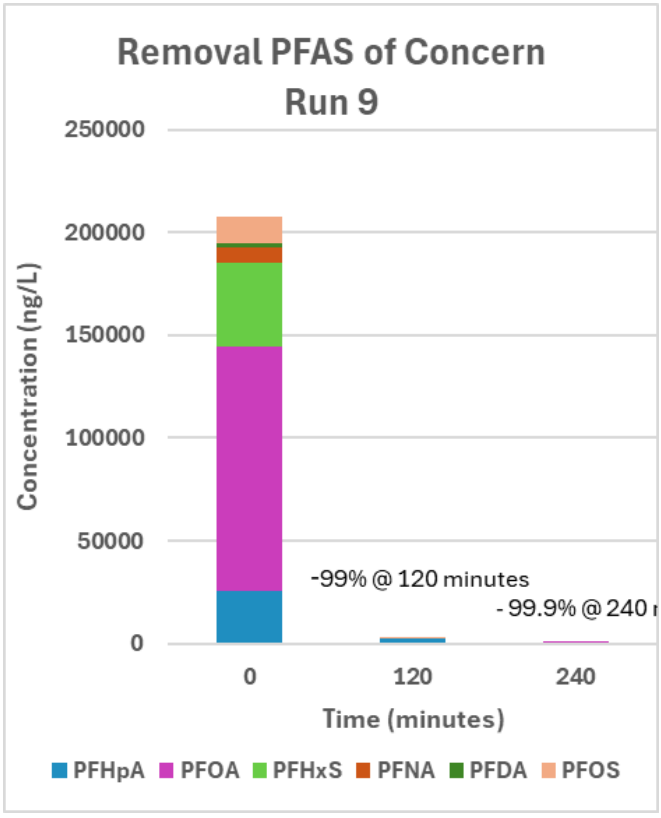
Secondary Fractionator Results Short Chain PFAS
Direct vs Indirect Foamate Removals

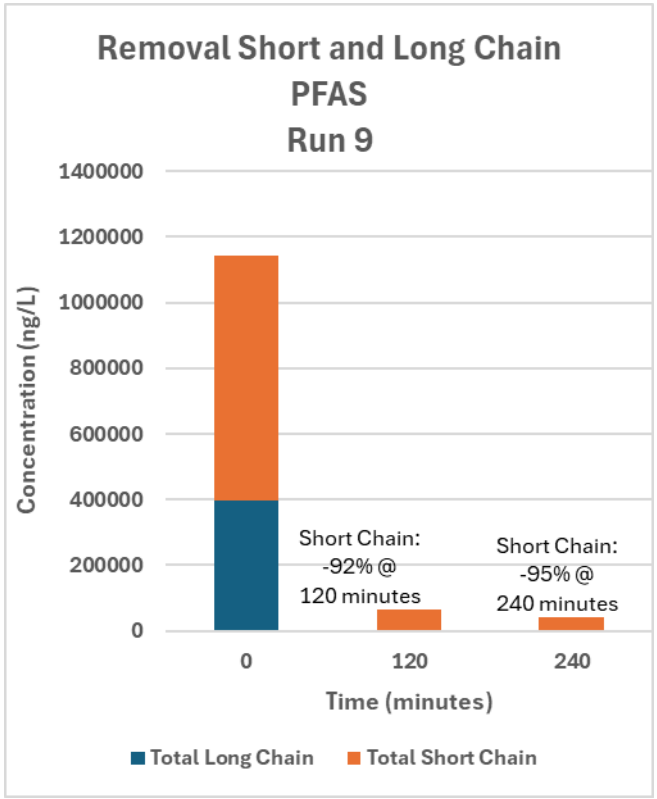


Juniper Ridge Landfill PFAS Removal Demonstration

Secondary Fractionation Optimized Run #9 Results
(High Air Flow Nano/No Surfactant/High Micro 2.5 min Start)

PFAS Name	Run9_S2			MDL
	0	120	240	(ng/L)
PFBA	0	5470	4900	7.6
PFPeA	4695	2113	2902	4.5
PFHxA	19880	24666	22169	1.9
PFBS	7639	8450	7415	1.8
5:3 FTCA	684807	16744	1626	68.0
PFHpA	25812	2082	158	2.4
PFPeS	1700	150	53.4	2.8
6:2 FTS	142636	15.7	0	10.0
PFOA	118610	59	15.9	4.9
PFHxS	41060	43.3	0	2.0
7:3 FTCA	70508	3175	1159	49.5
PFNA	7117	16.3	0	3.6
NMeFOSAA	3620	140	57.2	3.9
PFDA	1804	13.0	0	2.6
PFOS	13224	27.8	0	2.8



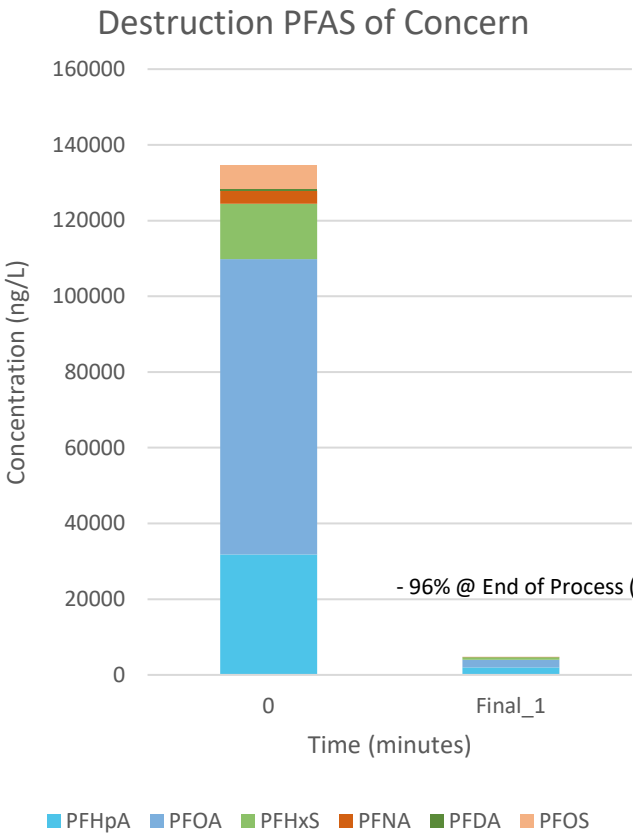


Juniper Ridge Landfill PFAS Removal Demonstration

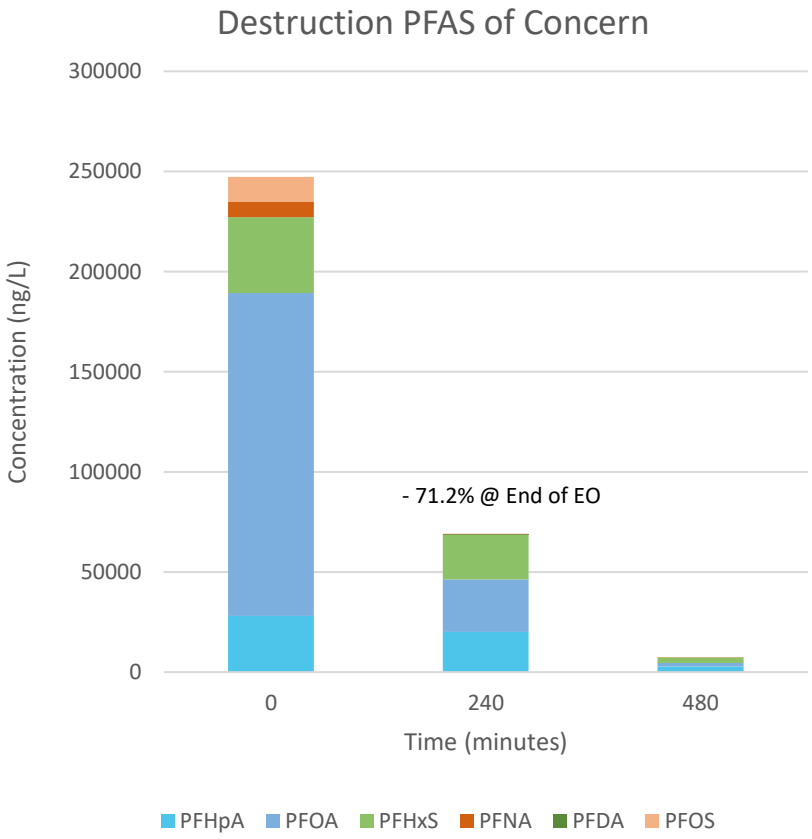
Destruction Multiple Test Conditions

StreamGo's completed two destruction tests while on site. One test was on our smaller bench top system housed within a Utility trailer that treats 3 gallons at a time. The second was with the full scale system housed within our demonstration unit that processes 60-100 gallons per cycle.

Benchtop



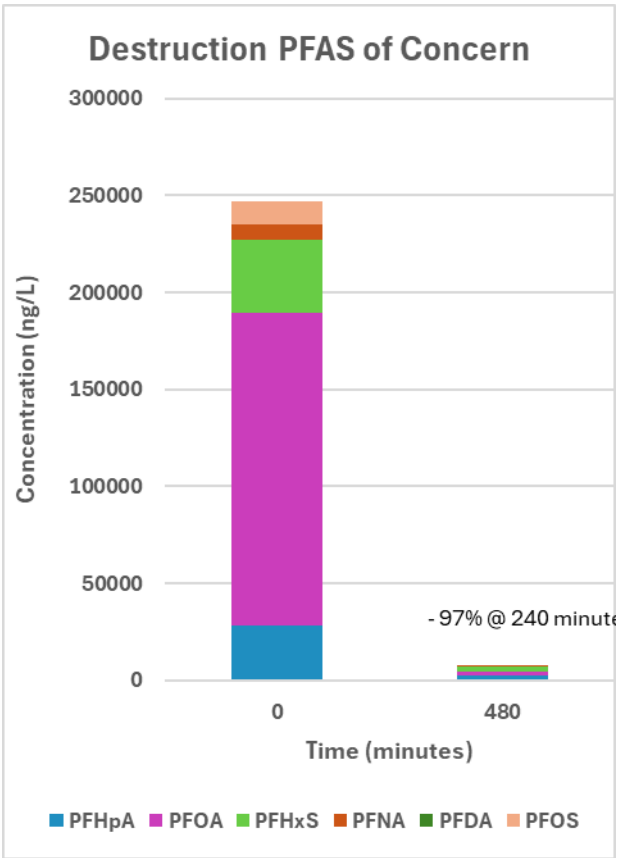
Full Scale

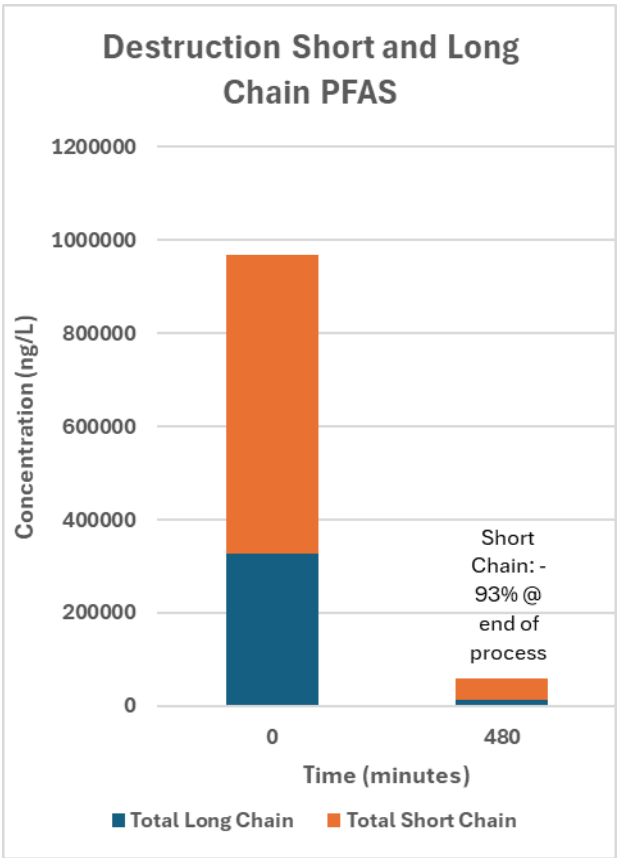


Juniper Ridge Landfill Removal Demonstration

Destruction Pilot Scale Testing

PFAS Name	EO Start 0	EO Finish 240	UV Midway 360	UV End 480	MDL (ng/L)
PFBA	2377	5259	9963	2413	7.6
3:3 FTCA	0	127	92.9	0	67
PFPeA	4118	12622	35520	8058	18.13
4:2 FTS	0	448	819	225	46.92
PFHxA	24236	25384	36696	8547	2
PFBS	10099	6692	7429	1505	1.8
5:3 FTCA	571409	272715	12004	22736	68
PFHpA	28008	20104	9609	2849	2
PFPeS	1565	1751	1856	334	2.8
6:2 FTS	79411	40832	16325	5699	10
PFOA	161351	26233	2419	1747	4.9
PFHxS	37790	22295	11540	2689	2
7:3 FTCA	24522	4025	501	1671	3.6
PFNA	7798	229	25.0	7.1	3.9
PFHpS	0	13.3	0	0	11
8:2 FTS	0	52.1	0	0	3
NMeFOSAA	3161	29.3	0	33.9	2.8
PFDA	0	34.4	0	0.0	10.5
PFOS	12289	244	0	0.0	12.6
PFOSA	0	13.0	0	14.1	9.9





Juniper Ridge Landfill PFAS Removal Demonstration

Destruction Results Short Chain, Long Chain & PFAS of Concern