Data Processing:

Concentrations measurements were obtained from J. Lang as measured. Raw measurements for each PFAS were left censored according to the LoQ for each chemical. For exploratory data analysis, single value imputation was used for display, with non-detect and zero measurements replaced by 1/10 the compounds LoQ and measurements <LoQ imputed as the LoQ/sqrt(2).

Concentration over time was modeled for each PFAS where the maximum abundance over the measurement period exceeded 10ng/L and the PFAS was previously determined to be widely prevalent (REF Lang). Of the 70 PFAS screened for, 16 exhibited a high enough prevalence and concentration to be suitably modeled. Summary statistics for all measurements of these PFAS are in Table “Modeled\_PFAS”. A graphical representation of the raw concentration measurements for these 16 PFAS is in “Graphical\_Summary”. Each line represents one reactor replicate, colored by biotic or abiotic reactor type.

Measured concentrations were corrected for the volume change of repeated sampling by multiplying by the dilution factor at each measurement date. Left censored non-detect and sub LOQ measurements were multi-value imputed using a truncated log-normal distribution from the *fitdistrplus* package in R. Briefly, the log transformed measurements that exceeded the LoQ were fit using *fitdistrplus* and the distribution was extended into the censored concentration levels. The censored measurements were then assigned a random index and fit to the truncated distribution.

Concentration corrected, log transformed, and zero value imputed data matrixes were modeled using a linear mixed effects model implemented by the *lmer* package. Models contained fixed effects for the Days Elapsed since the reactor initiation with categorical reactor type (abiotic or live) and trash sampling event (coded as “Season”), as well as a random slope and intercept by Reactor. Linear mixed model fits were optimized by restricted maximum likelihood and estimated p-values were calculated using Satterthwaite’s t-test method implemented in the *lmerModLmerTest* package. A summary table with estimated parameters and associated p-values is in “model estimates”.

Parameter interpretation:

Intercept – Intercept values are log transformed average estimates of the background level of PFAS when the reactor was initiated. On average the PFAS PFBA, PFPeA, PFOA, PFDA, FHEA, FHUEA, FPePA, FHpPA, PFHxS, MeFBSAA, FTS.6.2, diPAP.6.2, and diPAP.6.2.8.2 have background PFAS concentrations that are statistically significantly different from zero.

Season(Spring,Summer,Winter) – These are modeling specific factors that modify the slope of the regression line based on the sampling event. The Fall sampling event is treated as the comparison sample. Any PFAS with a significant Season parameter has statistically significant variation between the sampling events.

Days.Elapsed – This parameter is the slope of the PFAS production regression of the form ln([PFAS]) ∝ Days.Elapsed for an abiotic reactor in absence of other correction factors. Statistically significant Days.Elapsed parameters indicate some level of abiotic PFAS production over time, likely due to chemical leaching. The PFAS with significant abiotic production rates were diPAP.6.2, diPAP.6.2.8.2, FHEA, FHpPA, FPePA, FTS.6.2, MeFBSAA, PFHpA, PFHxA, PFOA, and PFPeA

Biotype – This parameter corrects the regression slope for additional biotic effects on PFAS production. Significant parameters indicate production or consumption of the PFAS through biotic activity. PFAS showing significant variation between biotic and abiotic reactor types were diPAP.6.2, diPAP.6.2.8.2, FHEA, FPePA, PFDA, and PFNA.

Results:

Of the 16 PFAS detectable and widely occurring PFAS 13/16 have detectable levels of PFAS in reactors prior to landfill degradation. When treated abiotically, 6/16 exhibited an increase in their overall concentration as the result of chemical/physical leaching. With biotic treatment 11/16 show a statistically significant change in their PFAS production rates compared to abiotic treatment only. Two PFAS (PFBA and PFPeA) show lower rates of PFAS production with biotic treatment compared to abiotic, while the remaining nine show a statistically significant increase in PFAS production over abiotic treatment. Variation between sampling events (Season) is significant, with 9/16 have a statistically significant variation by Season, indicating that the non-homogenous feedstock for the reactor has a significant effect on the long term PFAS production levels.