



## Total Oxidisable Precursor Assay (TOP) at Envirolab for PFAS

The TOP assay for PFAS is now available at Envirolab. The assay determines the potential production of routinely analysed PFAS daughter compounds after persulphate oxidation with alkali activation. Currently non-determinable precursors can biotransform to environmentally persistent PFAS compounds (e.g. PFOS and PFOA), the TOP Assay can reveal the capacity for such in situ transformations.

### Total Oxidisable Precursor Assay (TOP)

The assay is based on the Houtz and Sedlak approach from 2012 (Department of Civil and Environmental Engineering, University of California at Berkeley). Unidentified PFAS precursors, present in environmentally impacted areas, can oxidise under aerobic conditions to perfluoroalkyl carboxylic (PFCAs) and sulphonic acids (PFSA) and intermediates.

Houtz and Sedlak showed that the precursors, Perfluorooctanesulphonamides (FOSAs) and Perfluorooctanesulphonamidoethanols (FOSEs) are thermalised to yield PFOA primarily. Envirolab has mimicked this assay in Ultra High Purity Water (UHP) and Sydney Creek water. Table 1 shows the products of persulphate oxidation of five analytes, FOSA, alkylated FOSAs and alkylated FOSEs. The spiked precursors were no longer detectable post oxidation in either water sample.

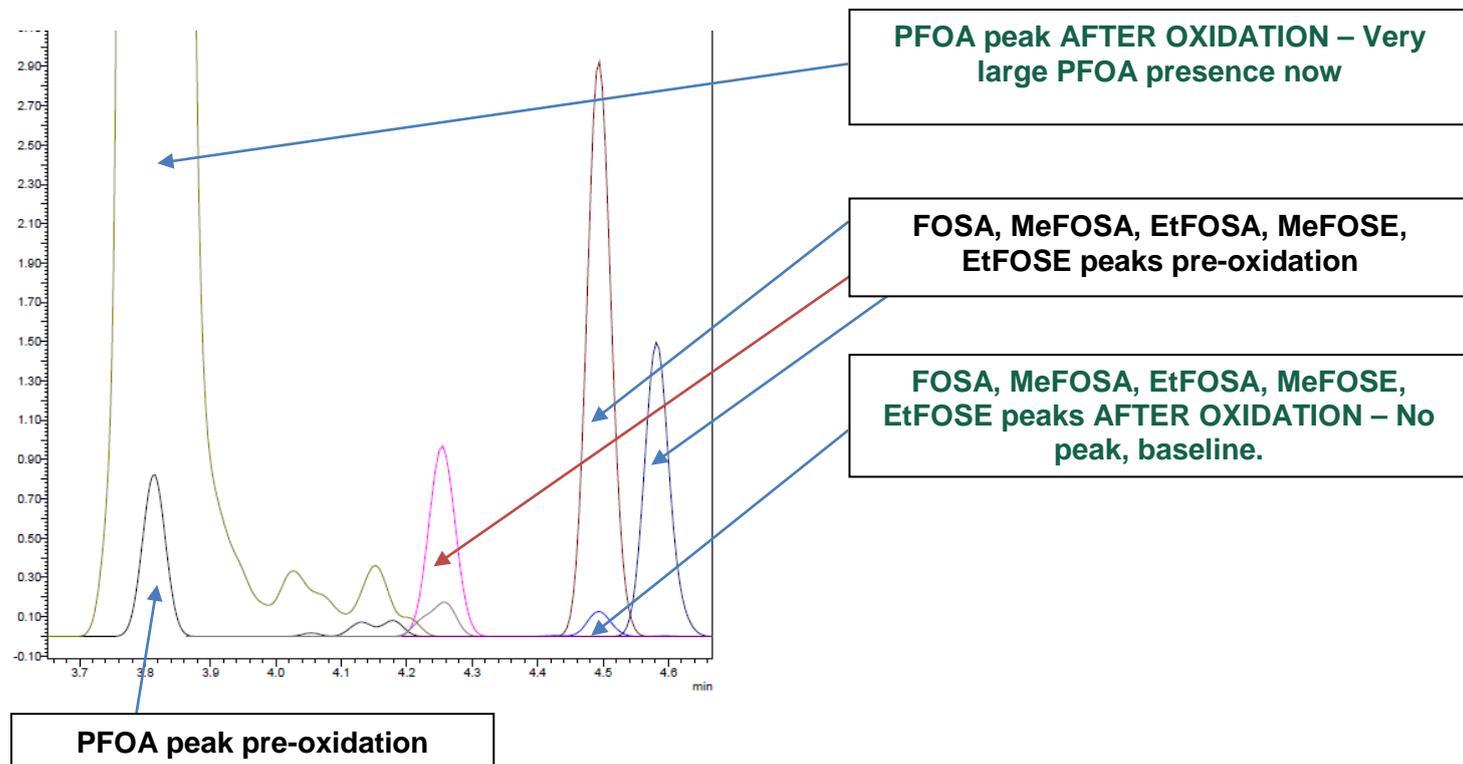
**Table 1: Distribution of daughter products for a 4µg/L mixed FOSA/FOSE spike into two water matrices after oxidation.**

	UHP Spike TOP	Creek Spike TOP1
Perfluorooctane sulphonic acid (PFOS)	6%	1%
Perfluorobutanoic acid (PFBA)	1%	1%
Perfluorohexanoic acid (PFHxA)	2%	2%
Perfluoroheptanoic acid (PFHpA)	4%	3%
Perfluorooctanoic acid (PFOA)	87%	89%

<sup>1</sup> other unquantifiable trace perfluoroalkyl carboxylic acids presence, hence sum <100%

Table 1 illustrates that PFOA is the predominant oxidation product for the FOSA and FOSE precursors.

## Spiked Creekwater before and after oxidation, PFOA daughter product



Envirolab then conducted the TOP assay on a highly impacted AFFF water sample. There were some interesting outcomes to the TOP assay. Table 2, below shows the increased concentrations of three Perfluorinated carboxylic acids, PFBA, PFHpA and PFOA (others may be apparent that are not currently quantifiable, e.g. C5 and <C4 carboxylic acids).

The TOP assay on this sample also shows the increased concentrations of the 6:2 and 8:2 Fluorotelomer Sulphonates (FTS) after the first TOP assay. In this instance the very high level of PFAS and other organic solvents in the AFFF may exhibit partial oxidation i.e. the complete oxidation of such a highly impacted sample may be incomplete and further increases in daughter end products may be feasible. Therefore a second treatment with activated persulphate was carried out.

**Table 2: Significant measurable PFAS changes after repeat TOP assays of an AFFF impacted water sample.**

RESULTS µg/L	PFBA	PFHpA	PFOA	6:2 FTS	8:2 FTS	SUM
AFFF impacted sample pre-TOP Assay	180	22	47	21	270	540
AFFF impacted sample post-TOP Assay 1st Amendment	580	40	83	300	1000	2003
Percent Increase %	222	82	77	1316	270	271
AFFF impacted sample post-TOP Assay 2nd Amendment	1600	81	109	364	3210	536
Overall Percent Increase %	789	268	133	1618	1089	893%

Note, the PFOS level was consistent at 3-3.5mg/L- Note, other PFAS may be produced that are not currently measurable in our PFAS suite.

**FOR FURTHER INFORMATION AND TECHNICAL ASSISTANCE CONTACT**  
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