EnviroMail™

Issue #126 - Updated

September 2019

Total Organic Fluorine (TOF) for Compliance with QLD Waste Disposal Guideline ERA 60 - Now NATA Accredited

Introduction

ALS recently announced new testing capabilities for the analysis Total Organic Fluorine (TOF), refer to EnviroMail #125 for more details. ALS is pleased to announce it is **now NATA Accredited** for this analysis. The initial aim of providing TOF analysis was to service the waste disposal industry in Queensland, more specifically the ERA 60 guideline values for landfill leachate and the total allowable contaminant levels in soils used as cover material.

ERA 60 Waste Disposal Limits for TOF

The ERA 60 guideline limits are provided below together with the current ALS limits of reporting (LOR). ALS LORs provide a considerable safety margin to ensure compliance with the stated limits for soils and landfill leachate not reused on or offsite. ALS is working to refine methodology to provide lower limits of reporting to also meet the limit for reuse of landfill leachate (0.0003mg/L).

Maximum total contaminant levels in soils as cover material

	MCL (mg/kg)	ALS LOR (mg/kg)
TFOC (not including PFOS & PFOA)	10	1

Allowable Leaching Contaminant Levels

	Clay Lined (mg/L)	MCL Double Lined (mg/L)	ALS LOR (mg/L)
TFOC (not reused on/off-site)	0.05	0.05	0.02
TFOC (reused on/off-site)	0.0003	0.0003	In development

Note, ERA 60 uses the term Total Fluorinated Organic Compounds (TFOC). This is equivalent to Total Organic Fluorine (TOF), noting that the concentration for TOF is expressed as fluorine.

ERA 60 Waste Disposal Limits for PFOS & PFOA

For soils used as cover material, the guideline includes separate limits for Perfluorooctane sulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA), with the TFOC limit excluding contribution from PFOS and PFOA. Targeted analysis of PFOS and PFOA (by ALS method EP231) would typically be required to meet these criteria (see below).

Maximum total contaminant levels in soils as cover material

	MCL (mg/kg)	ALS EP231 LOR (mg/kg)
Perfluorooctane sulfonic acid (PFOS))	6	0.0002
Perfluorooctanoic acid (PFOA)	16	0.0002

TOF as a Screen for PFOS & PFOA

There is however opportunity to use the TOF result alone as a screening measure for the soil limits without the need to specifically analyse for PFOS and PFOA. This approach takes the conservative assumption that all of the organic fluorine measured is present as either PFOS or PFOA. As PFOS has the lower guideline limit, this would form the determining factor in this screening approach. A TOF concentration greater than 3.88 mg/kg would be required to produce an equivalent PFOS concentration above the 6mg/kg limit. See examples provided below. This screening approach provides an economical option, where direct analysis of PFOS and PFOA may not be required.

Table 1: ERA 60 Waste Disposal – TOF as screen for PFOS & PFOA examples

Analyte	Units	ERA 60 Limit	Sample 1	Sample 2	Sample 3
TOF	mg/kg	10	2.0	4.1	12.4
TOF as PFOS	mg/kg	6	3.1	6.3	19.2
TOF as PFOA	mg/kg	16	2.9	6.0	18.0

- Direct PFOS and PFOA analysis may be warranted for Samples 2 and 3 to confirm whether PFOS/PFOA are actually present at concentrations that exceed the limits.

- Measurement Uncertainty (MU) should always be considered when comparing data against guideline limits.

ALS Packages for ERA 60 – Soils

ALS offers two packages to accommodate the scenarios detailed above; a **comprehensive suite** which includes analysis of TOF as well as direct analysis of PFOS and PFOA (by ALS method EP231); and a **basic suite** which includes TOF analysis with stoichiometric conversion of the TOF concentration to PFOS and PFOA. Refer to example reports below. In order for the appropriate parameters to be reported, the chain-of-custody (COC) must state that sample analysis is for compliance against the ERA 60 guideline. If a particular package is not requested, the comprehensive suite will be provided as default.

TOF excluding PFOS & PFOA
= PFOS & PFOA expressed as fluorine, subtracted from TOF
= [TOF] – ([PFOS] x 0.646) – ([PFOA] x 0.688)

Comprehensive Suite

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	ERA 60 Comprehensive	ERA 60 Comprehensive
				Client sampling date / time	14-Jun-2019 08:00	14-Jun-2019 08:00
Compound	CAS Number	LOR	Unit		EB1915398-003	EB1915398-004
					Result	Result
EA055: Moisture Content (Dried @ 105-110°C)						
Moisture Content	----	0.1	%		<0.1	<0.1
EP040: Total Organic Fluorine (TOF)						
ø Total Organic Fluorine	----	1.0	mg/kg		<1.0	15.0
ø TOF excluding PFOS & PFOA	----	1.0	mg/kg		<1.0	9.9
EP231A: Perfluoroalkyl Sulfonic Acids						
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		<0.0002	2.40
EP231B: Perfluoroalkyl Carboxylic Acids						
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		<0.0002	5.10

Basic (Screening) Suite

TOF as PFOA = [TOF] / 0.688

TOF as PFOS = [TOF] / 0.646

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	ERA 60 Basic	ERA 60 Basic
				Client sampling date / time	14-Jun-2019 08:00	14-Jun-2019 08:00
Compound	CAS Number	LOR	Unit		EB1915398-001	EB1915398-002
					Result	Result
EA055: Moisture Content (Dried @ 105-110°C)						
Moisture Content	----	0.1	%		<0.1	<0.1
EP040: Total Organic Fluorine (TOF)						
ø Total Organic Fluorine	----	1.0	mg/kg		<1.0	4.1
ø TOF as Perfluorooctanoic acid (PFOA)	----	1.5	mg/kg		<1.5	6.0
ø TOF as Perfluorooctane sulfonic acid (PFOS)	----	1.5	mg/kg		<1.5	6.3

ALS METHOD CODE

EP040

SAMPLING CONTAINERS

Water/AFFF Product	60mL HDPE plastic bottle (Unpreserved), grey label
Soil/Sediment	200mL HDPE plastic specimen jar (Unpreserved), grey label

Note – for soils/sediments, the same specimen jar can be used for both PFAS and TOF analysis. A separate 60mL bottle is required for waters if also testing for PFAS.

HOLDING TIME

28 days

NATA ACCREDITATION

Accredited

References

ALS Enviromail™ #125 – ALS now NATA Accredited for Total Organic Fluorine (TOF)

Environmental Protection (Waste ERA Framework) Queensland. ERA 60 - Waste Disposal Guideline.