GreenWorld Innovations Corp.

Taking care of the world's hydrocarbon and PFAS problems with responsible, green solutions

DE-OIL-IT™ Hydrocarbon Degrader

De-Oil-It eliminates PFAS "forever chemicals" 99%

In a study conducted April – June, 2024 the EPA 1633 PFAS Isotope based analysis concluded that De-Oil-It eliminated the 18 critical PFAS analyte man-made "forever chemical" compounds by 99%.

This analysis was carried out by Eurofins Environmental Testing facility in Lancaster, PA. The job number was 410-174845-1 and was finalized June 19, 2024.

EPA 1633 PFAS analysis uses an extraordinarily accurate analysis method using isotopes which is much more sensitive than reagent element detection. This analysis sequence tests 40 of the most concerning PFAS elements known; while there are hundreds of kinds of "forever chemicals", these 40 chemical compounds have been linked to carcinogenic, immune system compromise, liver and thyroid problems to list a few health hazards.

PFAS, short for per- and polyfluoroalkyl substances, are a large group of manufactured substances that do not occur naturally in the environment and are resistant to heat, water, and oil. PFAS has been used in a range of industrial and everyday consumer products, such as surface coating for carpeting and upholstery, food paper wrappings, nonstick cookware and fire-fighting foams. PFAS has been widely used since the 1940s, and thought to be nearly indestructible, PFAS have been found both in the environment and in blood samples of people tested.

Specifically, Perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA), two types of the PFAS group, are no longer manufactured or imported into the United States; however, there could be some imported goods containing trace amounts of these substances remaining in the U.S

Greenworld Innovations is the worldwide master distributor and blender of De-Oil-It
info@gwi.world (407) 574-3898

GreenWorld Innovations Corp.

Taking care of the world's hydrocarbon and PFAS problems with responsible, green solutions

DE-OIL-IT™ Hydrocarbon Degrader

EPA 1633 tests 18 analytes and up to 24 surrogate compounds. The Eurofin PFAS test facility data concludes that the 18 analytes were eliminated 99% by De-Oil-It; you can think analytes as product chemistry ingredients; these 18 analytes are regarded as the most concerning "forever chemicals" due to their environmental affects and adverse health effects. (see list at end of brochure).

EPA 1633 PFAS in water analysis DOI treated

		SAMPLE - 1			SAMPLE - 2		
Analyte	**CAS #**	**537.1**	**1633**	**% Reduced**	**537.1**	**1633**	**% Reduced**
Perfluorohexanoic acid - Na salt (PFHxA)	2923-26-4	2,000.00	6.70	99.67%	2,000.00	6.40	99.68%
Perfluoroheptanoic acid (PFHpA)	375-85-9	2,000.00	5.80	99.71%	2,000.00	5.70	99.72%
Perfluorooctanoic acid (PFOA)	335-67-1	2,000.00	7.40	99.63%	2,000.00	7.20	99.64%
Perfluorononanoic acid (PFNA)	375-95-1	2,000.00	7.90	99.61%	2,000.00	7.00	99.65%
Perfluorodecanoic acid - Na salt (PFDA)	3830-45-3	2,000.00	6.70	99.67%	2,000.00	6.00	99.70%
Perfluorododecanoic acid - Na salt (PFDoA)	307-67-5	2,000.00	7.70	99.62%	2,000.00	7.80	99.61%
Perfluorotridecanoic acid (PFTrA)	72629-94-8	2,000.00	6.20	99.69%	2,000.00	6.70	99.67%
Perfluorotetradecanoic acid (PFTeA)	376-06-7	2,000.00	8.00	99.60%	2,000.00	5.50	99.73%
Perfluorobutanesulfonate - K salt (PFBS)	29420-49-3	2,000.00	6.10	99.70%	2,000.00	6.70	99.67%
Perfluorohexanesulfonate - K salt, mixed isomers (PFHxS)	3871-99-6	2,000.00	6.90	99.66%	2,000.00	5.40	99.73%
Perfluoroocatnesulfonate, mixed isomers (PFOS)	1763-23-1	2,000.00	5.70	99.72%	2,000.00	6.40	99.68%
N-methylperfluorooctanesulfonamidoacetic acid - mixed isomers (N-MeFOSAA)	2355-31-9	2,000.00	6.20	99.69%	2,000.00	5.70	99.72%
N-ethyl perfluorooctanesulfonamidoacetic acid - mixed isomers (N-EtFOSAA)	2991-50-6	2,000.00	6.10	99.70%	2,000.00	5.40	99.73%
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA	13252-13-6	2,000.00	5.30	99.74%	2,000.00	5.10	99.75%
Dodecafluoro-3H-4,8-dioxanonanoic acid (DONA)	919005-14-4	2,000.00	6.70	99.67%	2,000.00	6.30	99.69%
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid - K salt (9Cl-PF3ONS)	73606-19-6	2,000.00	7.20	99.64%	2,000.00	6.70	99.67%
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid - K salt (11Cl-PF3OUDS)	83329-89-9	2,000.00	5.30	99.74%	2,000.00	5.30	99.74%
Perfluoroundecanoic acid - Na salt (PFUnA	60871-96-7	2,000.00	8.10	99.60%	2,000.00	n/a	n/a

Greenworld Innovations is the worldwide master distributor and blender of De-Oil-It
info@gwi.world (407) 574-3898

Of the remaining test elements, surrogates, **De-Oil-It treatment on PFAS contaminated drinking water registered NON-DETECTION of the tested presence of surrogates**. This is a very significant result because surrogates can be created during a cleaning process, such as through remediation efforts; when a PFAS analyte is being degraded (i.e. broken down into smaller much less toxic and sized elements) it is very possible to have fragments reattach and form what is referred as "surrogates".

The presence of surrogates indicates at least two problems

- Possible inefficiency of the cleaning method / product
- Possible inadequate shipping protocol to get sample to the lab

Given that De-Oil-It **tested NON-DETECT for surrogates strongly suggests a highly efficient degrading process that De-Oil-It has been known for**. De-Oil-It is well regarded in oil spill remediation cleanup efforts; in over 350 large oil spill cleanup projects supervised and closed by the EPA, De-Oil-It reduced original hydrocarbon contamination to NON-DETECTION. The significance of this non-detection is there is no longer soil samples that show hydrocarbon contamination; this means that the biohazard has been completely eliminated "in-situ" (which means: at the site), otherwise during conventional oil cleanup remediation efforts at the end of the project it is common to require backhoes for example to remove the treated oil spill because of the threat of a pending biohazard; these extra steps, labor and time, are not necessary when using De-Oil-It saving money.

Note that **De-Oil-It is on the EPA managed NCP list** (National Contingency Plan for USA navigable water oil spill emergency response under CFAR 40 regulations) **as SW-73, a Surface Washing agent**. In addition, **De-Oil-It's RTF3 formula**, specific for algae elimination and control while still maintaining hydrocarbon and other contamination treatment options, **was awarded in 2022 a 10-year permit, #SBIR 1643**, that allows for cleaning / remediation efforts near-by and into the Florida aquifer and well water sources, now that exudes environmentally safe practices like no other product on the market.

De-Oil-It's RTF3 formula has also been part of 3 grants and proven through laboratory analysis at the Mote Red Tide Technology Facility in Sarasota**, eliminates algae toxin within 15 minutes** (this covers fresh-water "blue-green algae" as well as Red Tide), RTF3 also kills the algae cells and complete inactivates phosphate and nitrates so they are no longer a nutrient responsible for harmful algae bloom ("HAB") development and acceleration.

GreenWorld Innovations Corp.

Taking care of the world's hydrocarbon and PFAS problems with responsible, green solutions

DE-OIL-IT™ Hydrocarbon Degrader

EPA 1633 PFAS in water analysis DOI treated - Surrogates

		SAMPLE - 1	SAMPLE - 2
Analyte	**CAS #**	**1633**	**1633**
Perfluorobutonoic acid (PFBA)	375-22-4	ND	ND
Perfluoropentanoic acid (PFPeA)	2706-90-3	ND	ND
Perfluoropentansulfonic acid (PFPeS)	375-73-5	ND	ND
Perfluoroheptanesulfonic acid (PFHpS)	206-800-8	ND	ND
Perfluorononanesulfonic acid (PFNS)	98789-57-2	ND	ND
Perfluorodedecansulfonic acid (PFDS)	335-77-3	ND	ND
Perfluorododecansulfonic acid (PFDoS)	1763-23-1	ND	ND
1H,1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2FTS)	757124-72	ND	ND
1H,1H, 2H, 2H-Perfluorooctane sulfonic acid (6:2FTS)	27619-97-2	ND	ND
1H,1H, 2H, 2H-Perfluorodecane sulfonic acid (8:2FTS)	39108-34-4	ND	ND
Perfluorooctanesulfonatemide acid (PFOSA)	754-91-6	ND	ND
N-methylperfluorooctane sulfonamide acid (NMeFOSA)	31506-32-8	ND	ND
N-ethylperfluorooctane sulfonamide (NEtFOSA)	4151-50-2	ND	ND
N-methylperfluorooctane sulfonamidoethanol (NMeFOEA)	24448-09-7	ND	ND
N-ethylperfluorooctane sulfonamidoethanol (NEtFOEA)	4151-50-7	ND	ND
Perflouro-3-methoxyypropanoic acid (PFMPA)	377-73-1	ND	ND
Perflouro-4-methoxyybutanoic acid (PFMBA)	863090-89-5	ND	ND
Nonaflouro-3,6dioxaheptanoic acid (NFDHA)	151772-58-6	**ND**	**ND**
Perflouro (2-ethoxyethane) sulfonic acid (PFEESA)	113507-82-7	ND	ND
3-Perflouroproplyproanoic acid (3:3 FTCA)	356-02-5	ND	ND
3-Perflouropentylyproanoic acid (5:3 FTCA)	914637-49-3	ND	ND
3-Perflouroheptylproanoic acid (7:3 FTCA)	206-798-9	ND	ND

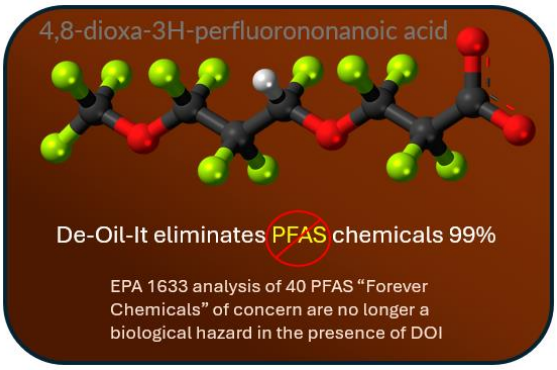
NFDHA is the "canary in the mine" and is highly indicative of problems above ND

ND = Non-Detect

GreenWorld Innovations Corp.

Taking care of the world's hydrocarbon and PFAS problems with responsible, green solutions

DE-OIL-IT™ Hydrocarbon Degrader



PFAS ANALYTES TESTED WITH EPA 1633 METHOD

These are the 18 critical PFAS ("forever chemicals") that are required testing under EPA 1633 PFAS Analysis; in all cases De-Oil-It degrades all these critical ingredients of man-made chemicals regarded as harmful to the environment as well as endangering human health (not to mention other life forms).

11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid - K salt (11Cl-PF3OUDS)

CAS #: 83329-89-9

11Cl-PF3OUDS can cause serious health effects, including cancer, endocrine disruption, accelerated puberty, liver and immune system damage, and thyroid changes. There are several municipalities that have found traces in drinking water.

9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid - K salt (9Cl-PF3ONS)

CAS #: 73606-19-6

Highly flammable liquid and vapor which is toxic if swallowed, in contact with skin, or if inhaled, causes skin irritation Causes serious eye irritation Causes damage to organs (central nervous system, eyes, heart, liver, kidneys) (Inhalation, Dermal, oral). This acid is found in manufacturing water run-off

Dodecafluoro-3H-4,8-dioxanonanoic acid (DONA)

CAS #: 919005-14-4

DONA has been found in has been found in bottled water and watersheds. This chemical affects liver and hemoglobin

Greenworld Innovations is the worldwide master distributor and blender of De-Oil-It
info@gwi.world (407) 574-3898

N-ethyl perfluorooctanesulfonamidoacetic acid - mixed isomers (N-EtFOSAA)

CAS #: 2991-50-6

Accumulation of N-ethyl perfluorooctane sulfonamido acetic acid (N-EtFOSAA) in the plants of seven species, namely alfalfa, lettuce, maize, mung bean, radish, ryegrass, and soybean from biosolids-amended soil (i.e. fertilizer developed by defecation waste). Reported health effects, including cancer, endocrine disruption, accelerated puberty, liver and immune system damage, and thyroid changes, like many PFOS chemicals.

N-methylperfluorooctanesulfonamidoacetic acid - mixed isomers (N-MeFOSAA)

CAS #: 2355-31-9

N-MeFOSAA has been found primarily in watersheds (an area or ridge of land that separates waters flowing to different rivers basins or seas)

Perfluorobutanesulfonate - K salt (PFBS)

CAS #: 29420-49-3

The following group of PFAS chemicals has been known to be manufactured for common products such as non-stick and stain- resistant consumer products, food packaging, fire-fighting foam, and industrial processes. PFAS chemicals pose health issues including skin irritation and if PFAS chemicals are consumed in some manner other health issues include but are not limited to endocrine, liver, thyroid, and immune system damage.

Perfluorodecanoic acid - Na salt (PFDA)

CAS #: 3830-45-3

PFDA fluorosurfactant has been used in industry, with applications as wetting agent and flame retardant. Same PFAS health effects as other chemical health evaluation already presented in several other analyte compounds tested under EPA 1633 and all other post ceding 537.1 analytes in this document.

Perfluorododecanoic acid - Na salt (PFDoA)

CAS #: 307-67-5

PFDoA Breakdown product of stain- and grease-proof coatings on food packaging, couches, carpets, including Stainmaster. Highly persistent and bioaccumulative.

Perfluoroheptanoic acid (PFHpA)

CAS #: 375-85-9

PFHpA belongs to a class of chemicals called perfluoroalkyls which are often applied to consumer products such as water or stain protectant or surface coating. PFHpA was found in consumer products including cosmetics and children's sportswear and outdoor clothing. Among the previously documented health risks in preceding 537.1 chemicals, PFHpA is known to cause liver enlargement which is due to chronic inflammation and in many cases leads to diagnosis as stage 1 liver cancer potential

Perfluorohexanesulfonate - K salt, mixed isomers (PFHxS)

CAS #: 3871-99-6

Produced since the 1950s, perfluorinated compounds (PFCs) are used in the production of antifouling paints, nonstick cookware, and waterproof clothing. Has been found passed in the placenta to the developing baby in the womb

Perfluorohexanoic acid - Na salt (PFHxA)

CAS #: 2923-26-4

PFHxA has been found to accumulate in agricultural crops and has been detected in household dust, soils, food products, and surface, ground, and drinking water. Perfluorohexanoic acid does not seem to persistently bioaccumulate in the manner of many other PFAS chemicals as it degrades under a variety of conditions; this is part why EPA 1633 tests beyond this list of 18 analytes in reference to testing up to 22 surrogates created during degrading processes.

Perfluorononanoic acid (PFNA)

CAS #: 375-95-1

PFNA has been used to make fluoropolymers, a coating that can resist heat, water, and chemicals; thus, PFNA can be present in products including carpets, food-contact papers, and cleaning and polishing products. Low levels of PFNA are detected in aqueous film-forming foam (AFFF) for fire suppression. PFNA is also a breakdown product of other PFAS. The top reported health risk is liver damage.

Perfluoroocatnesulfonate, mixed isomers (PFOS)

CAS #: 1763-23-1

PFOS was the key ingredient in Scotchgard, a fabric protector made by 3M, and related stain repellents; contact with these products can cause skin irritation and if absorbed by the skin leads to usually reported PFAS health related problems. What is interesting about PFOS is it is a C8 compound; meaning it contains eight carbon atoms; the interesting element is many overstate the "forever" nomenclature and since PFAS is PFOS and/or PFOA (and the other 16 analytes listed in this document as part of 537.1) declare De-Oil-It couldn't possibly break this compound down. The Eurofins analysis completely disproves this notion (99% breakdown) ; and you should note that De-Oil-It has the same prowess with hydrocarbons with proof of degrading up to C40 chemically architected compounds that are naturally occurring. This overstating "forever-ness" is also interesting because the sampling and shipping protocol for PFAS analysis requires sending samples on ice. See previous discussions in this document in which the SERDP study requires shipping on ice because PFAS chemicals are known to degrade in presence of heat (therefore the need to test presence of surrogates to understand if natural degrading has taken place of if the cleaning agent was inefficient).

Perfluorooctanoic acid (PFOA)

CAS #: 335-67-1

PFOA based chemistry used worldwide as an industrial surfactant in chemical processes and as a material feedstock. PFOA has been linked to carcinogenic causing health problems. Note that this man-

made compound is also 8 carbon units adding to the misconception that C8 and the "forever" branding of PFAS chemicals is somehow thought to be the lowest common denominator to not be able to break down this component. De-oil-It reduced PFOS and PFOA certified 537.1 control standard by 99%.

Perfluorotetradecanoic acid (PFTeA)

CAS #: 376-06-7

PFTeA can be found in industrial and commercial products including photographic films, firefighting foam, some detergents and insecticides. This chemical structure is 14 carbon units in length, was reduced by 99%. Like all other PFAS chemicals this compound can cause internal body health issues as well as irritation of the skin

Perfluorotridecanoic acid (PFTrA)

CAS #: 72629-94-8

PFTrA is utilized in the creation of plastics. It is also used as a stain and greaseproof coating for furniture, packaging and carpet. The health risks of PFTrA are the same as other PFAS analytes but also is known to create skin irritation.

Perfluoroundecanoic acid - Na salt (PFUnA)

CAS #: 60871-96-7

Like, PFTrA, PFUnA is utilized is used as a stain and greaseproof coating for furniture, packaging and carpet, but not as much in formation of plastics. The health risks of PFTrA are the same as other PFAS analytes but also is known to create skin irritation.

Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA)

CAS #: 13252-13-6

HFPO-DA is particularly dangerous as it exhibits little to no biodegrading capabilities and is not usually water soluble. The primary use is to release surface tension, so it is used for heavy duty degreasers and as an adjunct to help cleaners remove items from surfaces.

Taking care of the world's hydrocarbon and PFAS problems with responsible, green solutions

PFAS SURROGATES TESTED WITH EPA 1633 METHOD

Perfluorobutonoic acid (PFBA)
CAS #: 375-22-4
PFBA is a breakdown product of other PFAS used in stain-resistant fabrics, paper food packaging, and carpets. PFBA was also used for manufacturing photographic film.

Perfluoropentanoic acid (PFPeA)
CAS #: 2706-90-3
PFPeA is a breakdown product of PFAS used for stain and grease-proof coatings on food packaging, couches, and carpets

Perfluoropentansulfonic acid (PFPeS)
CAS #: 375-73-5
PFPeS is a breakdown product of PFAS used in many industrial products most notably carpets, rugs, upholstery, non-stick cookware, and leather products

Perfluoroheptanesulfonic acid (PFHpS)
CAS #: 206-800-8
PFHpS is a breakdown product of PFAS used for stain and grease-proof coatings on food packaging, couches, and carpets

Perfluorononanesulfonic acid (PFNS)
CAS#: 38789-57-2
PFNS is a breakdown product of PFAS used in the production of non-stick, stain repellent, and chemically inert coatings

Perfluorodedecansulfonic acid (PFDS)
CAS #: 335-77-3
PFDS is a breakdown product of PFAS used in the production of non-stick, stain repellent, and chemically inert coatings; the alarm over PFDS includes chemical build up found in lake trout

Perfluorododecanesulfonic acid (PFDoS)
CAS#: 1763-23-1
PFDoS is a breakdown product of PFAS and has been found in trace amounts in many food preservation sources; note that sometimes this compound is listed as an analyte but is created during the purposeful creation of PFAS for industrial purposes

1H,1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2FTS)
CAS #: 757124-72-4
4:2FTS is a breakdown product of PFAS chemical reactions in the creation of products made with PFAS, while there are no specific recordings of product lists containing this compound unfortunately has been found in drinking water from various processed sources (municipality, bottled, etc.)

1H,1H, 2H, 2H-Perfluorooctane sulfonic acid (6:2FTS)
CAS #: 27619-97-2
6:2FTS is a breakdown product of PFAS chemical reactions in the creation of products made with PFAS, while there are no specific recordings of product lists containing this compound unfortunately has been found in drinking water from various processed sources (municipality, bottled, etc.)

1H,1H, 2H, 2H-Perfluorodecane sulfonic acid (8:2FTS)
CAS #: 39108-34-4
6:2FTS is a breakdown product of PFAS chemical reactions in the creation of products made with PFAS, while there are no specific recordings of product lists containing this compound unfortunately has been found in drinking water from various processed sources (municipality, bottled, etc.)

Perfluorooctanesulfonatemide acid (PFOSA)
CAS #: 754-91-6
PFOSA is a PFAS derivative formed by PFAS manufacturing chemical reactions found to be persistent and phased out by manufacturers in the USA, namely 3M. However, during 2000-2002 this compound was found in many products produced in China

N-methylperfluorooctanesulfonamide acid (NMeFOSA)
CAS #: 31506-32-8
NMeFOSA is a breakdown product of PFAS chemical reactions and is found in trace amounts in a large variety of products usually associated with non-stick product container features

N-ethylperfluorooctanesulfonamide (NEtFOSA)
CAS #: 4151-50-2
NEtFOSA is a breakdown product of PFAS chemical reactions to form more notably insecticides

N-methylperfluorooctanesulfonamidoethanol (NMeFOEA)
CAS #: 24448-09-7
NMeFOEA is a breakdown product of PFAS chemical reactions associated with the manufacturing of lithium-ion batteries, paints, coatings of metals and the fabrication of metal products

N-ethylperfluorooctanesulfonamidoethanol (NEtFOEA)
CAS #: 4151-50-7
NetFOEA is a breakdown product of PFAS during biodegradation of materials in landfills, and has been found in marine sediments

Perflouro-3-methoxyypropanoic acid (PFMPA)
CAS #: 377-73-1
PFMPA is a breakdown product of PFAS due to biodegradation of materials most likely landfills whereby water runoff taints waters utilized for drinking (well waters, etc.)

Perflouro-4-methoxyybutanoic acid (PFMBA)
CAS #: 863090-89-5
PFMBA is a breakdown product of PFAS associated with the combination of methanol release in biodegradation of products manufactured with PFAS; this compound has been found in underground water sources (aquifers) as well as surface waters (lakes, retention ponds, etc.)

Nonaflouro-3,6dioxaheptanoic acid (NFDHA)
CAS #: 151772-58-6
NFDHA is a breakdown product of PFAS manufacturing processes and is especially found with natural degradation of PFAS; for instance, analysis labs require samples to arrive at or as near as possible to 39.2 F, the reason is during transportation, even overnight by Fedex for example, if the temperature raises to above 90 degrees natural breakdown of PFAS will occur. NFDHA is therefore a bellwether "canary in a mine" surrogate that indicates unnatural breakdown of PFAS preventing an accurate measurement of on-site remediation. The presence of NFDHA might also indicate inefficient cleaning compound used in remediation; De-Oil-It registered NON-DETECTION of NFDHA

Perflouro (2-ethoxyethane) sulfonic acid (PFEESA)
CAS # 113507-82-7
PFEESA is a breakdown product of PFAS manufacturing processes and what is unusual is this compound has very limited information available in finds of consumer products, food, and drinking water; but none the less is a known surrogate

3-Perflouroproplyproanoic acid (3:3 FTCA)
CAS #: 356-02-5
3-Perflouropentylyproanoic acid (5:3 FTCA)
CAS #: 914637-49-3
3-Perflouroheptylproanoic acid (7:3 FTCA)
CAS #: 206-798-9
3:3, 5:3, 7:3 FTCA is a breakdown product of PFAS manufacturing processes and what is unusual is this compound has very limited information available in finds of consumer products, food, and drinking water; but none the less is a known surrogate