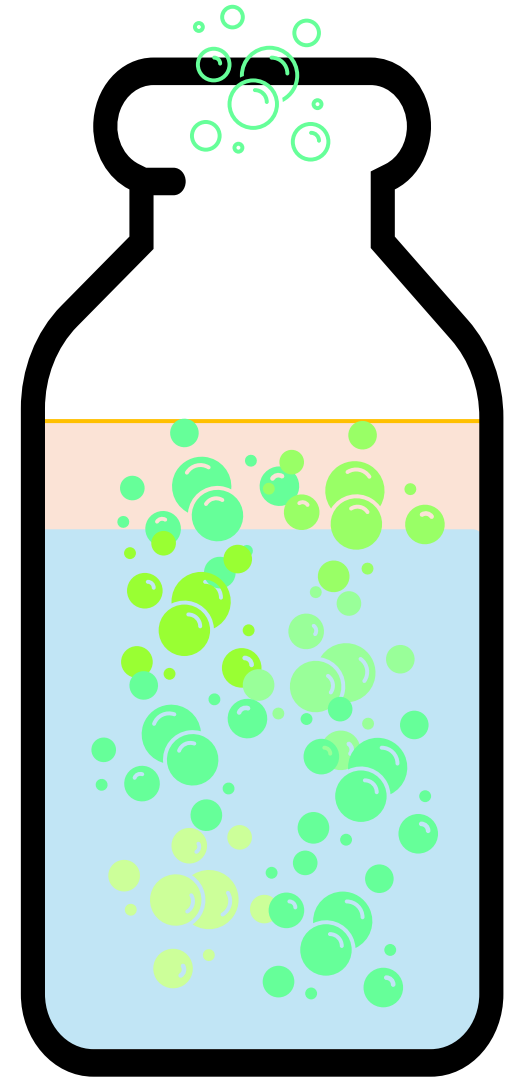


# In Sum

- 1FFC definition is helping guide the conversation but we need to remember that each chemical has its own unique risk and all 7+ million PFAS are not the same.
- There are no mystery ingredients in pesticide products.
- Harmful PFAS are not allowed in pesticides.
- What was true 10+ years ago is not true now.
- We are much further along in understanding PFAS in pesticides than in any other chemical product (aside from maybe medicine).



# Differing definitions

“PFAS” definitions differ OECD & EPA (TSCA) are the two prevalent definitions.

EPA: ~12,000 compounds

OECD: ~15,000 to 25 million compounds

(In the old days, Buck et al. 2011 defined PFAS as a group of about 300-400 compounds.)

# Differing definitions

OECD

PFASs are defined as fluorinated substances that contain at least one **fully fluorinated methyl or methylene carbon atom (without any H/Cl/Br/I atom attached to it)**, i.e. with a few noted exceptions, any chemical with at least a perfluorinated methyl group ( $-CF_3$ ) or a perfluorinated methylene group ( $-CF_2-$ ) is a PFAS.

MN & ME

(q) "Perfluoroalkyl and polyfluoroalkyl substances" or "PFAS" means a class of fluorinated organic chemicals containing at least one fully fluorinated carbon atom.

EPA's  
OPP

In 2023, EPA's Office of Pollution Prevention and Toxics (OPPT) in a final rule defined PFAS as a chemical containing at least one of these three structures:

1.  $R-(CF_2)-CF(R')R''$ , where both the  $CF_2$  and  $CF$  moieties are saturated carbons
1.  $R-CF_2OCF_2-R'$ , where  $R$  and  $R'$  can either be  $F$ ,  $O$ , or saturated carbons
1.  $CF_3C(CF_3)R'R''$ , where  $R'$  and  $R''$  can either be  $F$  or saturated carbons.

# Regrettable substitutions

When PFOA and PFOS were withdrawn from the US market 20 years ago...

...they were simply replaced with similar chemicals

...which also have health effects

The intention of the 1FFC definition is to avoid additional “regrettable substitutions”.

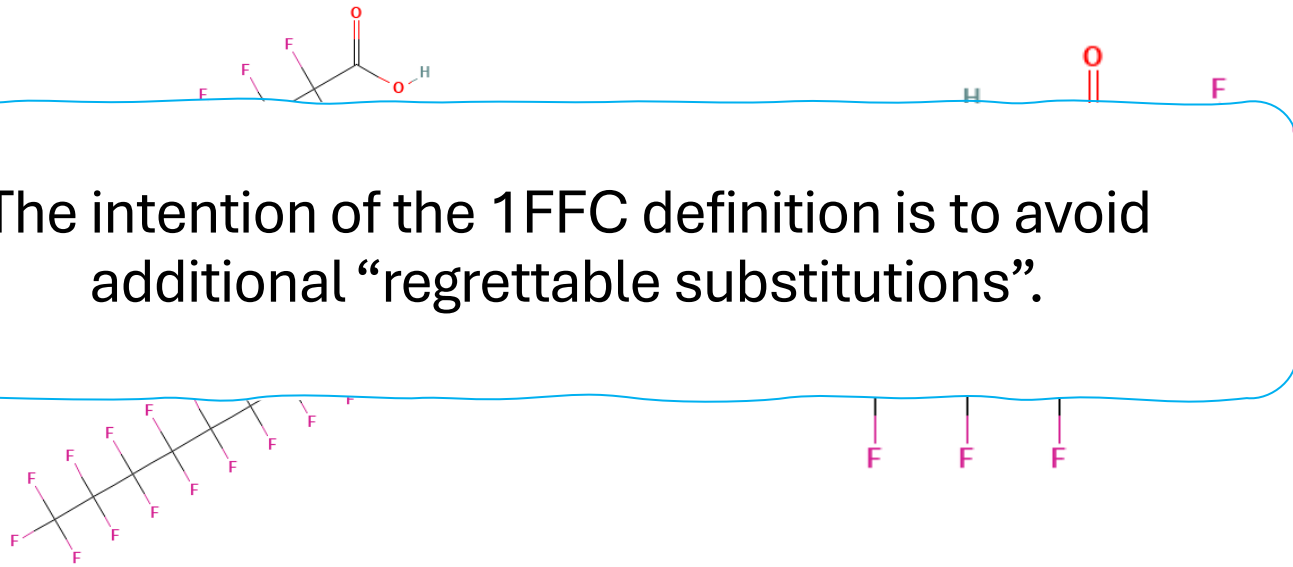
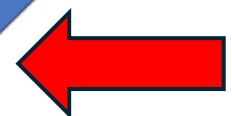


Figure 2-1. Health Effect Endpoints Examined in Epidemiological Studies

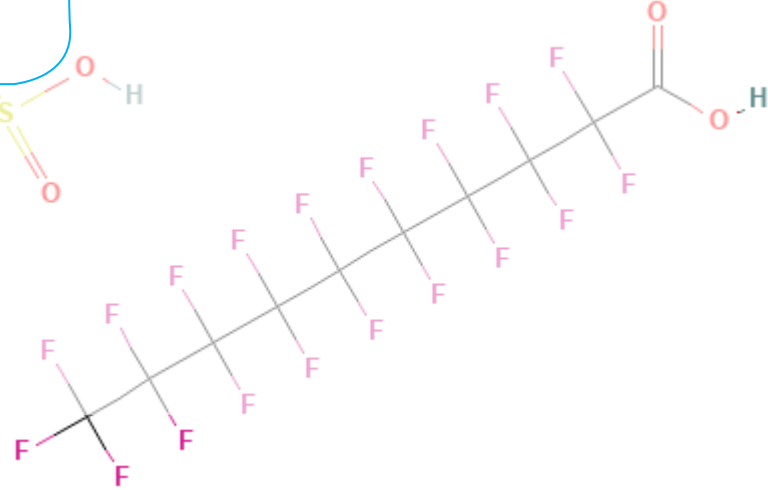
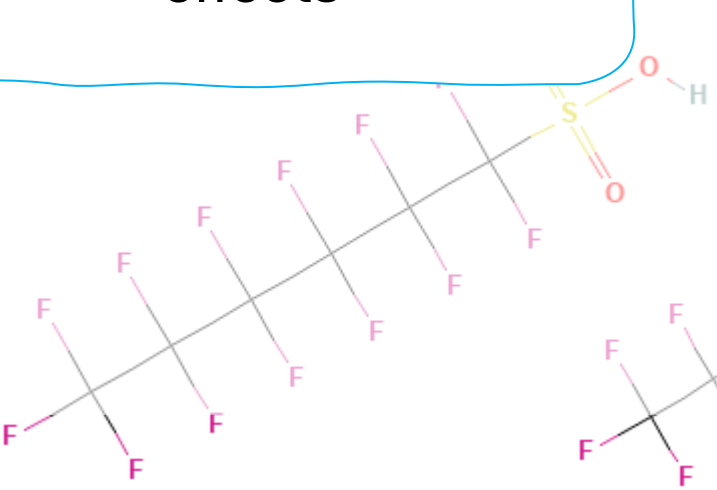
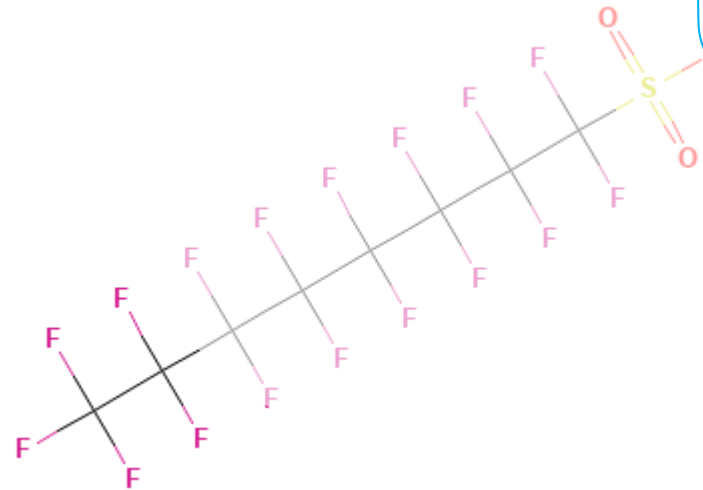
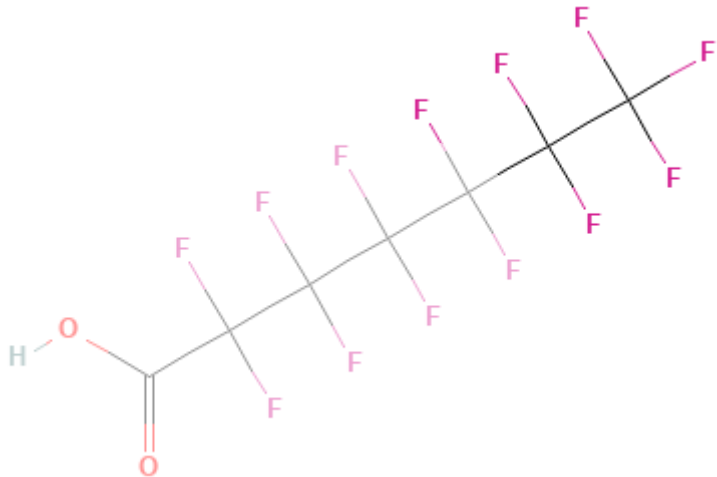
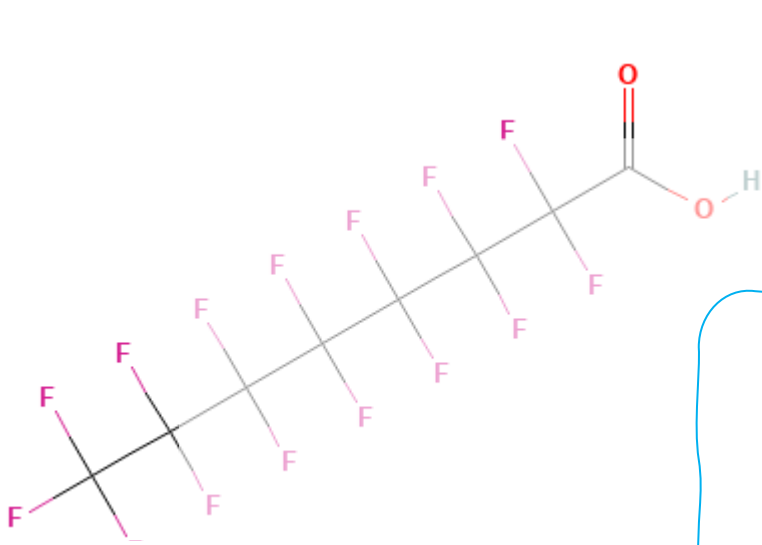
All of these are different types of PFAS

Health Effect Endpoint	Perfluoroalkyl												
	PFOA	PFOS	PFHxS	PFNA	PFDA	PFUnA	PFHpA	PFBS	PFBA	PFDoDA	PFHxA	FOSA	
Body weight	•	•	•	•	•	•					•		•
Respiratory	•												
Cardiovascular	•	•	•	•	•	•	•	•	•	•	•	•	•
Gastrointestinal		•											
Hematological	•	•											
Musculoskeletal	•	•	•	•									
Hepatic	•	•	•	•	•	•	•	•	•	•			
Renal	•	•	•	•	•			•		•	•		
Dermal													
Ocular													
Endocrine	•	•	•	•	•	•				•			
Immunological	•	•	•	•	•	•	•	•		•	•	•	
Neurological	•	•	•	•									
Reproductive	•	•	•	•	•	•		•		•	•	•	
Developmental	•	•	•	•	•	•	•		•	•			•
Other noncancer	•	•	•	•	•	•	•						•
Cancer	•	•	•	•	•	•	•			•			•

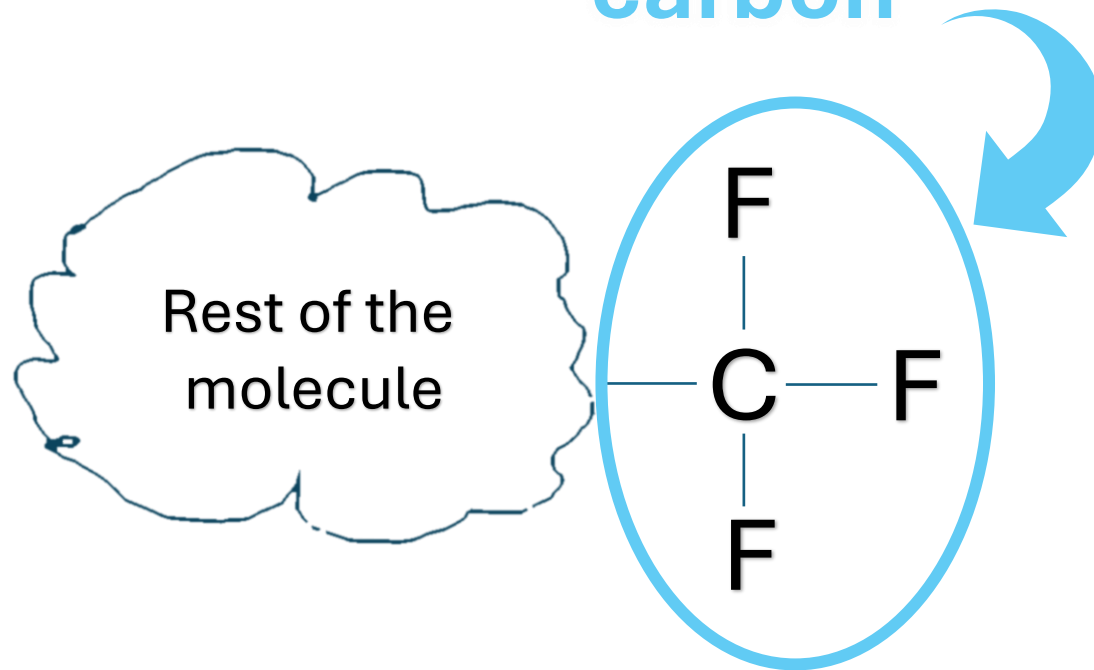


FOSA = perfluorooctane sulfonamide; PFBA = perfluorobutanoic acid; PFBS = perfluorobutane sulfonic acid; PFDA = perfluorodecanoic acid; PFDoDA = perfluorododecanoic acid; PFHpA = perfluoroheptanoic acid; PFHxA = perfluorohexanoic acid; PFHxS = perfluorohexane sulfonic acid; PFNA = perfluorononanoic acid; PFOA = perfluorooctanoic acid; PFOS = perfluorooctane sulfonic acid; PFUnA = perfluoroundecanoic acid

These are the chemicals  
that with known health  
effects



# Good example of a fully fluorinated carbon



OECD

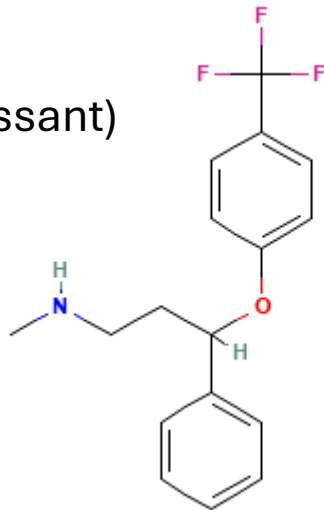
MN

ME

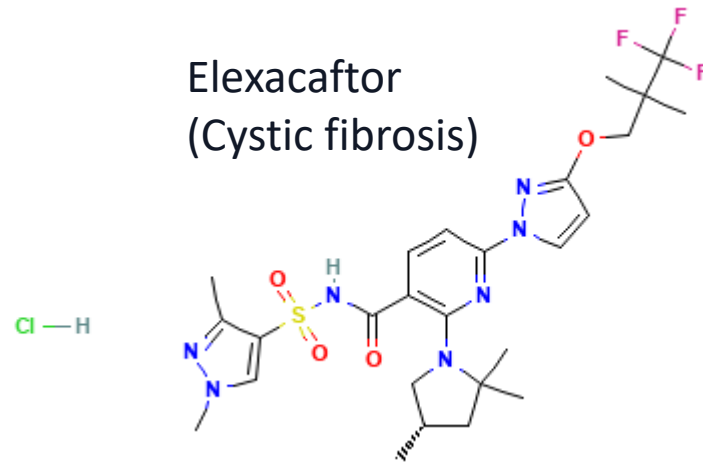
EPA OPP

# 1FFC PFAS definition pulls in several medicines and pesticide active ingredients

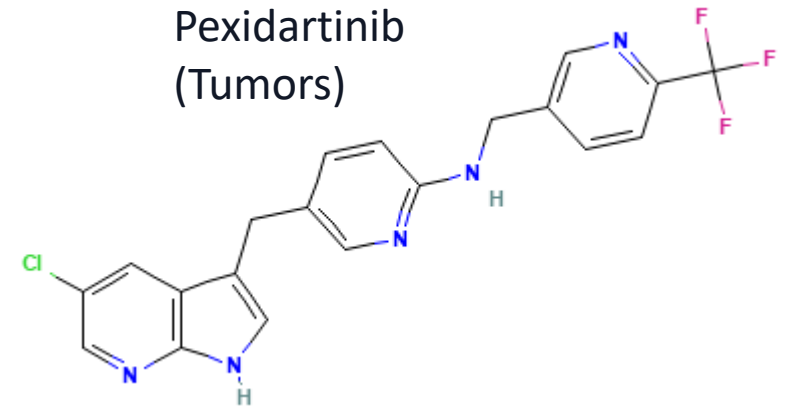
Prozac  
(Anti-depressant)



Elexacaftor  
(Cystic fibrosis)

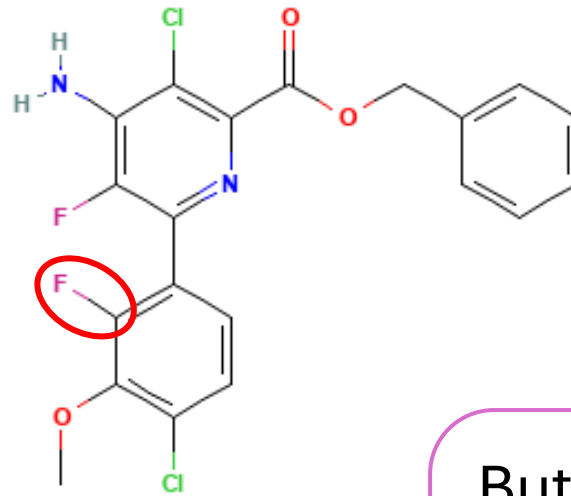


Pexidartinib  
(Tumors)



# ProcellaCOR –florpyrauxifen-benzyl

In Minnesota  
florpyrauxifen-benzyl  
is a PFAS



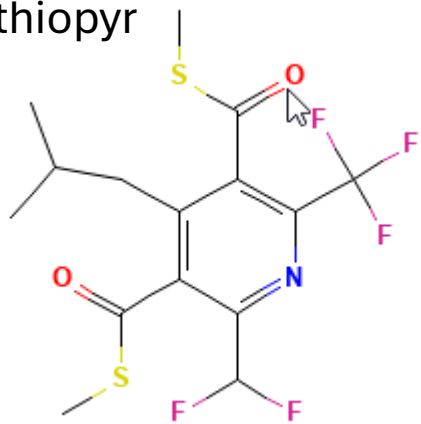
In Maine  
florpyrauxifen-benzyl  
is NOT a PFAS

But... Minnesota and  
Maine have the same  
PFAS definition  
*verbatim*

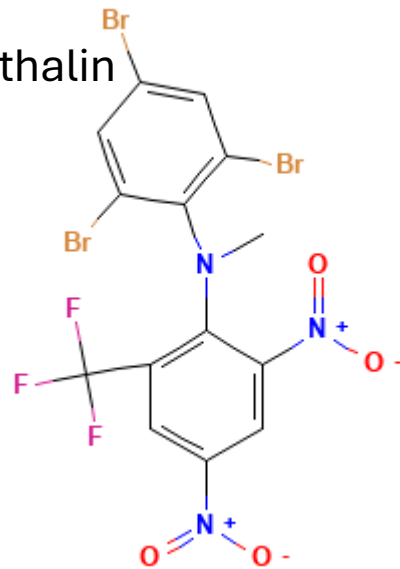
# 1 FFC PFAS definition pulled in several medicines and 56 pesticide active ingredients

-All pesticides now classified as PFAS have been tested for health effects prior to registration. The safety profile of these compounds has not changed.

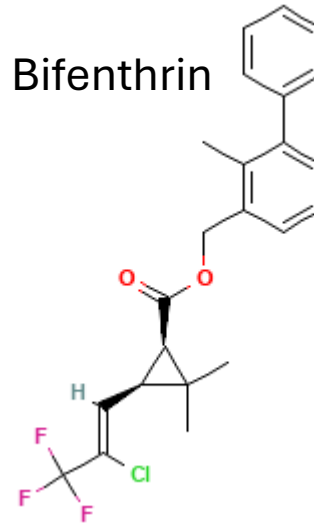
Dithiopyr



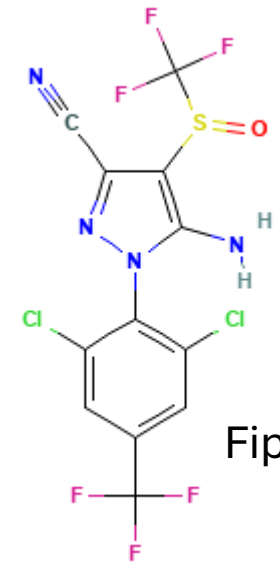
Bromethalin



Bifenthrin



Fipronil



# Examples of PFAS-pesticides in Maine

Acifluorfen-sodium	Ethalfluralin	Flutolanil	Norflurazon	Pyrasulfotole	Tralopyril
Benfluralin	Fipronil	Fluvalinate	Novaluron	Pyridalyl	Trifloxystrobin
Bicyclopyrone	Fluazifop-P-butyl	Fomesafen	Noviflumuron	Pyrifluquinazon	Triflumizole
Bifenthrin	Fludioxonil	Fomesafen-sodium	Oxathiapiprolin	Pyroxasulfone	Trifluralin
Broflanilide	Fluensulfone	$\gamma$ -Cyhalothrin	Oxyfluorfen	Saflufenacil	Triflusulfuron-methyl
Bromethalin	Flufenacet	Hexaflumuron	Penoxsulam	Tefluthrin	$\lambda$ -Cyhalothrin
Chlorfenapyr	Fluopicolide	Hydramethylnon	Penthiopyrad	Tembotrione	
Cyflufenamid	Fluopyram	Indoxacarb	Picoxystrobin	Tetraconazole	
Cyflumetofen	Fluridone	Lactofen	Prodiamine	Tetraniliprole	
Dithiopyr	Flurprimidol	Mefentrifluconazole	Prosulfuron	Tiafenacil	

Minnesota has 93 a.i.s. compared to Maine's 56.

# Pesticide Risk Assessment

Every  
Pesticide  
is  
Evaluated

**Table A-1. Isocycloseram Terrestrial and Aquatic Non-target Organism Data Requirements to Support Section 3 New Active Ingredients.**

Guideline Number - Study Type		Required	Data Requirement Status	MRID	DER Classification	Comments
<b>Birds (surrogates for terrestrial amphibians and reptiles)</b>						
850.2100 - Avian Acute Oral Toxicity Test	Passerine	Yes	Complete	51229403	Supplemental	Studies are scientifically sound but supplemental due to the lack of analytical verification and/or less than the recommended OCSPP sample size. However, no additional data are needed at this time.
	Upland Game or Waterfowl	Yes	Complete	51229401 and 51229402	Supplemental	
850.2200 - Avian Sub-acute Dietary Toxicity Test	Waterfowl	Yes	Complete	51229404	Acceptable	NA
	Upland Game Bird	Yes	Complete	51229405	Acceptable	
850.2300 - Avian Reproduction Test	Waterfowl	Yes	Complete	51229407	Acceptable	NA
	Upland Game Bird	Yes	Complete	51229406	Acceptable	
<b>Mammals</b>						
850.2400 - Wild Mammal Toxicity Testing		No <sup>1</sup>	Not Triggered	NA	NA	NA
850.2500 - Field Testing for Terrestrial Wildlife		No <sup>1</sup>	Not Triggered	NA	NA	NA
<b>Aquatic Invertebrates Acute Toxicity (Water-Column Exposure)</b>						
850.1010 - Aquatic Invertebrate Acute Toxicity Test, Freshwater Daphnids		Yes	Complete	51229415	Acceptable	NA
850.1025 - Oyster Acute Toxicity Test (Shell Deposition)		Yes	Complete	51229452	Acceptable	NA
850.1035 - Mysid Acute Toxicity Test		Yes	Complete	51229453	Acceptable	NA
850.1045 - Penaeid Acute Toxicity Test		No <sup>1</sup>	Not Triggered	51229508	Acceptable	Not triggered but submitted
850.1055 - Bivalve Acute Toxicity Test (Embryo-Larval)		No <sup>1</sup>	Not Triggered	NA	NA	NA
<b>Fish Acute Toxicity (surrogates for aquatic-phase amphibians)</b>						
850.1075 - Freshwater Fish Acute Toxicity Test	Coldwater species	Yes	Complete	51229409	Acceptable	NA
	Warmwater species	Yes	Complete	51229410	Acceptable	
850.1075 - Saltwater Fish Acute Toxicity Test		Yes	Complete	51229454	Acceptable	NA
<b>Aquatic Invertebrate Chronic Toxicity</b>						
850.1300 - Daphnid Chronic Toxicity Test		Yes	Complete	51229420	Acceptable	NA
850.1350 - Mysid Chronic Toxicity Test		Yes	Complete	51229455	Acceptable	NA
<b>Fish Chronic Toxicity</b>						

Guideline Number - Study Type		Required	Data Requirement Status	MRID	DER Classification	Comments
850.1400 - Freshwater Fish Early Life Stage (ELS) Toxicity Test		Yes	Complete	51229412	Acceptable	NA
850.1400 - Estuarine/ Marine Fish Early Life Stage (ELS) Toxicity Test		Yes	Complete	51229413	Acceptable	NA
850.1500 - Fish Life Cycle Toxicity Test	Freshwater	Yes	Waived	NA	NA	NA
	Estuarine/Marine	No <sup>1</sup>	Not Triggered	NA	NA	
<b>Bioconcentration Factor (BCF) Study</b>						
850.1710 - Oyster Bioconcentration Factor (BCF)		No <sup>1</sup>	Waived	NA	NA	NA
850.1730 - Fish Bioconcentration Factor (BCF)		Yes	Complete	51229414, 51229701	Acceptable	NA
<b>Aquatic Invertebrates Acute Toxicity (Benthic Exposure)</b>						
850.1735 - Spiked Whole Sediment 10-Day Toxicity Test, Freshwater Invertebrates	Midge	Yes	Waived	NA	NA	Waived; chronic spiked whole sediment studies submitted in lieu of sub-chronic studies.
	Freshwater Amphipod	Yes	Waived	NA	NA	
850.1740 - Spiked Whole Sediment 10-Day Toxicity Test, Saltwater Invertebrates		Yes	Waived	NA	NA	
Non-guideline - Whole sediment: chronic (28-65-Day life cycle) Toxicity Test	Freshwater midge	Yes	Complete	51229509	Acceptable	NA
	Freshwater amphipod	Yes	Complete	51229532	Acceptable	
	Estuarine/Marine amphipod	Yes	Complete	51229425	Acceptable	
<b>Other Aquatic Studies</b>						
850.1850 - Aquatic food chain transfer		No <sup>1</sup>	Not Triggered	NA	NA	NA
850.1950 - Field testing for aquatic organisms		No <sup>1</sup>	Not Triggered	NA	NA	NA
<b>Terrestrial Invertebrate Toxicity (Surrogate for both <i>Apis</i> and non-<i>Apis</i> bees)</b>						
850.3020 (OECD Test Guideline 214)- Honey Bee Adult Acute Contact Toxicity Test		Yes	Complete	51229428	Supplemental	Study is scientifically sound but supplemental due to doses not being analytically verified. No additional studies are needed at this time.
OECD Test Guideline 213 - Honey Bee Adult Acute Oral (AAO) Toxicity Test <sup>2</sup>		Yes	Complete	51229428	Supplemental	

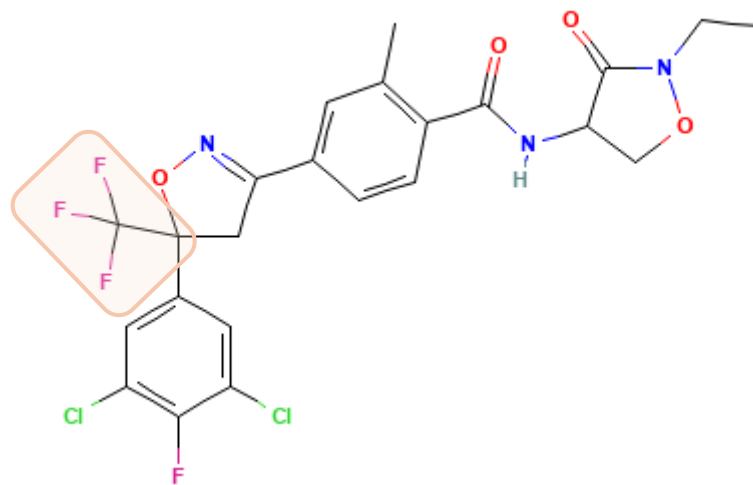
Guideline Number - Study Type	Required	Data Requirement Status	MRID	DER Classification	Comments
OECD Test Guideline 237 - Larval Honey Bee Acute Oral (LAO) (single dose) Toxicity Test	Yes <sup>2</sup>	Complete	51229435	Acceptable	NA
OECD Guidance Document 239 - Larval Honey Bee Chronic Oral (LCO) (repeat dose) Toxicity Test	Yes <sup>2</sup>	Complete	51229436	Acceptable	NA
OECD Test Guideline 245 - Honey Bee Adult Chronic Oral (ACO) (repeat dose) Toxicity Test	Yes <sup>2</sup>	Complete	51229434	Acceptable	NA
850.3030 - Honey Bee Toxicity of Residues on Foliage	Yes <sup>2</sup>	Complete	51229429, 51229430, 51229431, 51229432, 51229433	Acceptable/ Supplemental	MRIDS 51229429, 51229431, and 51229432 are classified as scientifically sound and acceptable while MRIDS 51229430 and 51229433 are scientifically sound but supplemental due to studies not evaluating up to the maximum application rates.
OECD Guidance Document 75- Honey Bee Colony Brood Test (Enclosure Study) Under Semi-field Conditions	Yes <sup>2</sup>	Complete	51229437, 51229438, 51229439, 51229440, 51229442, 51229443, 51229444, 51229441, 51229530	Supplemental/ Unacceptable	All studies (except for 51229438, 51229437, and 51229441) are classified as scientifically sound but supplemental. Please refer to specific DERs for more information. Three of the studies (51229438, 51229437, and 51229441) are unacceptable. No additional studies are needed at this time.
Non-guideline Field Trial of Residues in Pollen/Nectar	Yes <sup>2</sup>	Complete	51229437, 51229438, 51229440, 51229442, 51229443, 51229441, 51229530	Supplemental/ Unacceptable	All studies (except for 51229438, 51229437, and 51229441) are classified as scientifically sound but supplemental. Please refer to specific DERs for more information. Three of the studies (51229438, 51229437, and 51229441) are unacceptable. No additional studies are needed at this time.
Non-guideline Semi-field Colony Feeding Study (Oomen <i>et al.</i> 1992)	Yes <sup>2</sup>	Complete	51229510	Supplemental	This study is scientifically sound but is classified as supplemental since a

Guideline Number - Study Type	Required	Data Requirement Status	MRID	DER Classification	Comments
					negative control was not conducted to account for the 2% acetone used as a carrier in the 50% sucrose solution. No additional studies are needed at this time.
850.3040 - Field Testing for Pollinators	No <sup>1</sup>	Not Triggered	NA	NA	NA

NA =not applicable

<sup>1</sup> Per 40 CFR Part 158 or other guidance documents, specified conditions to require the study are not met.

<sup>2</sup> Recommended through the EFED guidance on exposure and effects testing for assessing risk to bees (<https://www.epa.gov/sites/default/files/2016-07/documents/guidance-exposure-effects-testing-assessing-risks-bees.pdf>)



## Test Guidelines for Pesticides and Toxic Substances

- [What are Test Guidelines](#)
- [Final Test Guidelines](#)**
- [Draft Test Guidelines](#)
- [Master Lists of Test Guidelines](#)

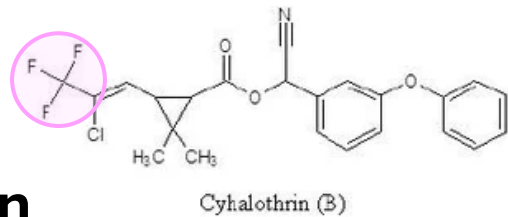
[Contact Us About Test Guidelines for Pesticides and Toxic Substances](#)

# Final Test Guidelines for Pesticides and Toxic Substances

Final test guidelines are generally intended for use in the testing of pesticides and toxic substances, and the development of test data for submission to the EPA. The final test guidelines are organized by series number as follows:

- [810 - Product Performance Test Guidelines](#)
- [830 - Product Properties Test Guidelines](#)
- [835 - Fate, Transport and Transformation Test Guidelines](#)
- [840 - Spray Drift Test Guidelines](#)
- [850 - Ecological Effects Test Guidelines](#)
- [860 - Residue Chemistry Test Guidelines](#)
- [870 - Health Effects Test Guidelines](#)
- [875 - Occupational and Residential Exposure Test Guidelines](#)
- [880 - Biochemicals Test Guidelines](#)
- [885 - Microbial Pesticide Test Guidelines](#)
- [890 - Endocrine Disruptor Screening Program Test Guidelines](#)

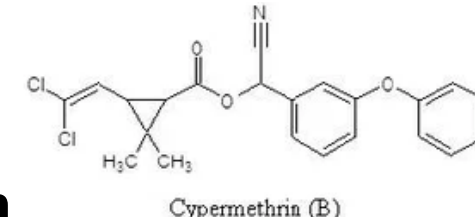
[View a comprehensive list of all final and draft test guidelines for pesticides and toxic substances.](#)



## Cyhalothrin

- Solubility 0.004 mg/L (Low)
- Kow 6.8 (High)
- VP  $1.00 \times 10^{-9}$  (Low)
- Soil halflife 57 days (Moderate)
- BCF 1,950 (Threshold)
- Mammal LD<sub>50</sub> 140 mg/kg (Moderate)
- Mammal Chronic 2.5 mg/kg-bw/d (Moderate)
- Fish LD<sub>50</sub> 0.00046 mg/L (High)
- Not Likely To Be Carcinogenic To Humans.

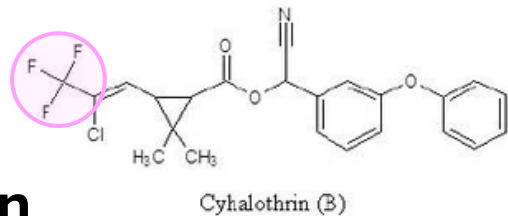
<https://sitem.herts.ac.uk/aeru/ppdb/en/Reports/194.htm>



## Cypermethrin

- Solubility 0.009 mg/L (Low)
- Kow 5.5 (High)
- VP  $6.78 \times 10^{-3}$  (Low)
- Soil halflife 22.1 days (Non-persistent)
- BCF 331 (Threshold)
- Mammal LD<sub>50</sub> 287 mg/kg (Moderate)
- Mammal Chronic 0.5 mg/kg-bw/d (Moderate)
- Fish LD<sub>50</sub> 0.0015 mg/L (High)
- Group C Possible Human Carcinogen.

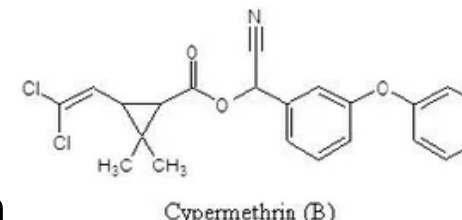
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<https://sitem.herts.ac.uk/aeru/ppdb/en/Reports/197.htm>

Inerts

# EPA's Inert Finder Webpage

An official website of the United States government [Here's how you know](#) ▾

 United States Environmental Protection Agency

Search EPA.gov 🔍

[Environmental Topics](#) ▾ [Laws & Regulations](#) ▾ [Report a Violation](#) ▾ [About EPA](#) ▾

[Home](#) / [Pesticide Registration](#)

## Pesticide Registration

- [About Pesticide Registration](#)
- [Electronic Submission of Applications](#)
- [Pesticide Registration Manual](#)
- [Fees and Waivers](#)
- [Registration Information by Type of Pesticide](#)
  - [— Antimicrobial Registration](#)
  - [— Biopesticide Registration](#)
  - [— Conventional Registration](#)
  - [— Inert Ingredient Regulation](#)
- [Requirements and Guidance](#)
  - [— Data](#)
  - [— Forms](#)
  - [— Labeling](#)

[Contact Us about Pesticide Registration](#)

## Inert Ingredients Overview and Guidance

**On this page:**

- [Inert ingredient listings in InertFinder](#)
  - [Food and nonfood use](#)
  - [Nonfood use only](#)
  - [Fragrance ingredient list](#)
- [Guidance documents for inert ingredients](#)
- [For more information](#)

### Inert Ingredient Databases

#### EPA Databases for individual inert ingredient approvals

For approvals prior to February 1, 2024, EPA's [InertFinder](#) allows users to search for historical individual inert ingredient approvals by chemical name and CAS Reg. No.

For approvals starting on or after February 1, 2024, EPA's [Individual Inert Ingredient Database](#) also allows users to search for newer individual inert ingredient approvals by chemical name and CAS Reg. No.

Inert Ingredients are approved in the following categories:

#### Related Information

[Read EPA's notice on removing 12 inert chemicals identified as PFAS from the approved list of inert ingredients.](#) ↗

#### What are Inert Ingredients?

Most pesticide products contain substances in addition to the active ingredient(s) that are referred to as inert ingredients or sometimes as "other ingredients." An inert ingredient

<https://www.epa.gov/pesticide-registration/inert-ingredients-overview-and-guidance>

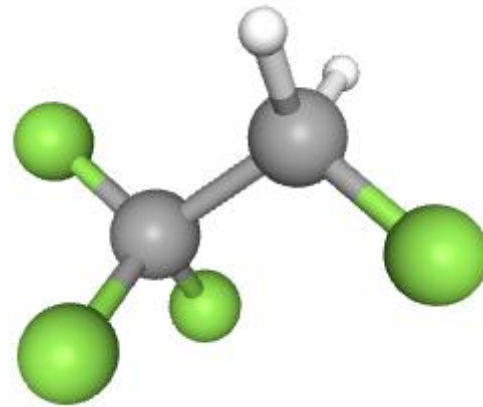
MN went through the EPA Inert Finder database and found these inerts:

**Preliminary list of pesticide inert ingredients that meet the Minnesota Statute (MINN. STAT. 18B.01 Subd. 15(c)) definition of PFAS. Inert ingredients approved by the EPA and included in the InertFinder database as of February 2024 were screened.**

CAS Number	Ingredient Name
63148-56-1	Siloxanes and silicones, Me 3,3,3-trifluoropropyl
88795-12-4	1-Butanol, 4-(ethenyloxy)-, polymer with chlorotrifluoroethene, (ethenyloxy) cyclohexane and ethoxyethene
24937-79-9	Ethene, 1,1-difluoro-, homopolymer
188027-78-3	5H-1,3-Dioxolo[4,5-f]benzimidazole, 6-chloro-5-[(3,5-dimethyl-4-isoxazolyl)sulfonyl]-2,2-difluoro
67786-14-5	2-Naphthalenesulfonic acid, 6-amino-4-hydroxy-5-[[2-(trifluoromethyl)phenyl]azo]-, monosodium s
52238-92-3	Pigment red 242
42557-13-1	Poly(oxy(methyl(3,3,3-trifluoropropyl)silylene)), alpha-(trimethylsilyl)-omega((trimethylsilyl)oxy)-
88485-37-4	Fluxofenim (as a safener)
98-56-6	p-Chlorobenzotrifluoride
29118-24-9	Trans-1,3,3,3-tetrafluoroprop-1-ene
9002-84-0	Teflon
811-97-2	1,1,1,2-Tetrafluoroethane

<https://www.mda.state.mn.us/environment-sustainability/pfas-pesticide-active-inert-ingredients>

# Example inert



1,1,1,2-Tetrafluoroethane

This chemical is on List 4,  
meaning it is allowed in  
organic agriculture.

No surprise ingredients

# FIFRA prohibits PFAS contamination

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) ensures consumer protections for pesticide products and mandates that the products contain exactly what was approved when they were registered with EPA, no more and no less. The entire product ingredient list is reviewed by EPA prior to allowing a pesticide product on the market.

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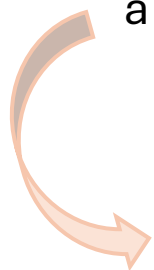


**Federal: 7 U.S.C. 136(j) (FIFRA Section 12(a)(1)(c))**  
Establishes as an unlawful act: composition that differs at the time of distribution or sale from its composition as described ... with its registration

**Federal: 40 CFR § 158.167**  
Requires all impurities of toxicological significance to be reported and accepted as part of product registration

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## **Federal: 40 CFR § 159.179(b)**

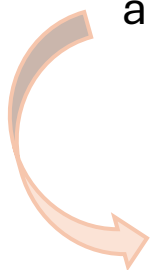
As per its current PFAS-Packaging website EPA states, "EPA considers any level of PFAS to be potentially toxicologically significant."



<https://www.epa.gov/pesticides/pfas-packaging>

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**Federal: 7 U.S.C. 136(d) (FIFRA Section 6(a)(2)) & 12(a)(1)(c)**

Requires registrants to report impurities and prohibits composition of the product that differs from that registered with the Agency

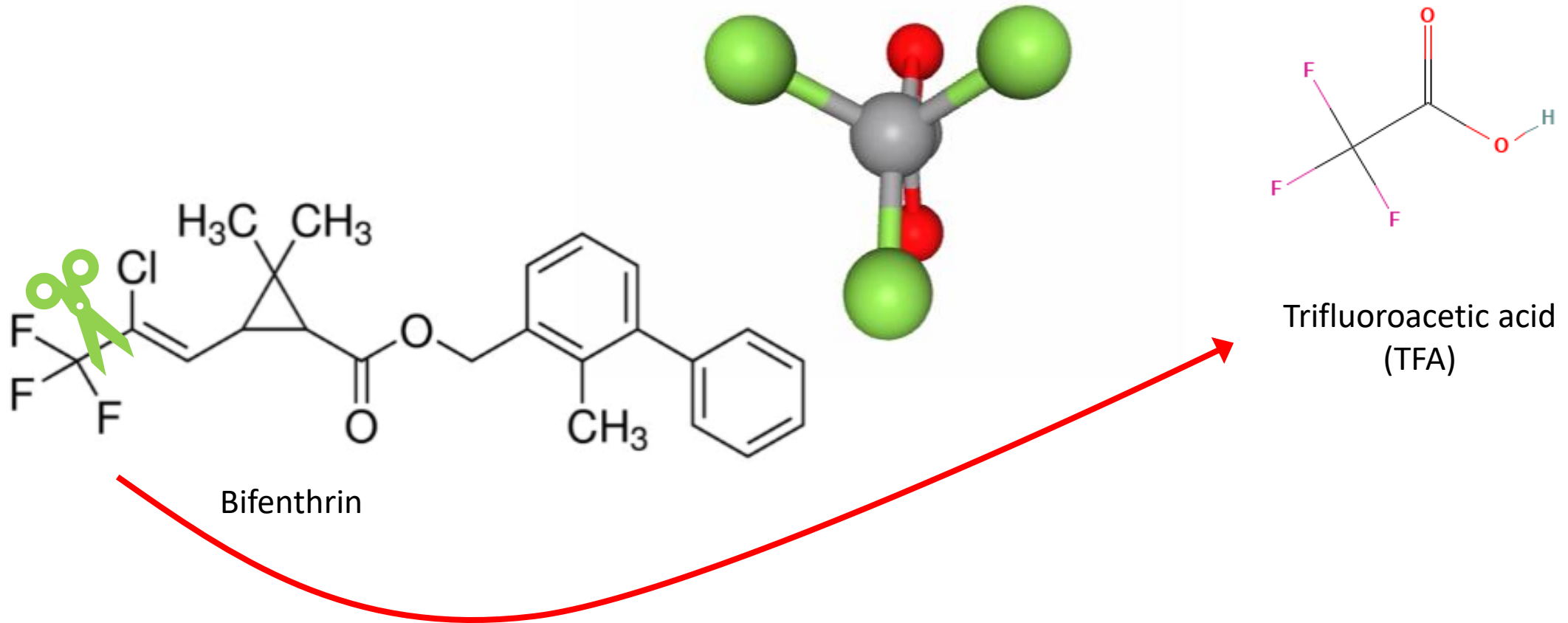
**Federal: 40 CFR § 159.155(a)(5)**

Information about impurities must be received by EPA no later than the 30<sup>th</sup> calendar day after the registrant first possesses or knows of the information



# Breakdown

# When they do break down where does the PFAS-part go?



# When they do break down where does the PFAS-part go?

- There is registration data on breakdown
- Sometimes TFA is formed but not 100% of the time, some pesticides ~30%.

## Example levels of concern in drinking water:

PFOS	4 ppt (VT)
HFPO-DA	10 ppt (VT)
TFA	2,200-10,000 ppt (European Countries)

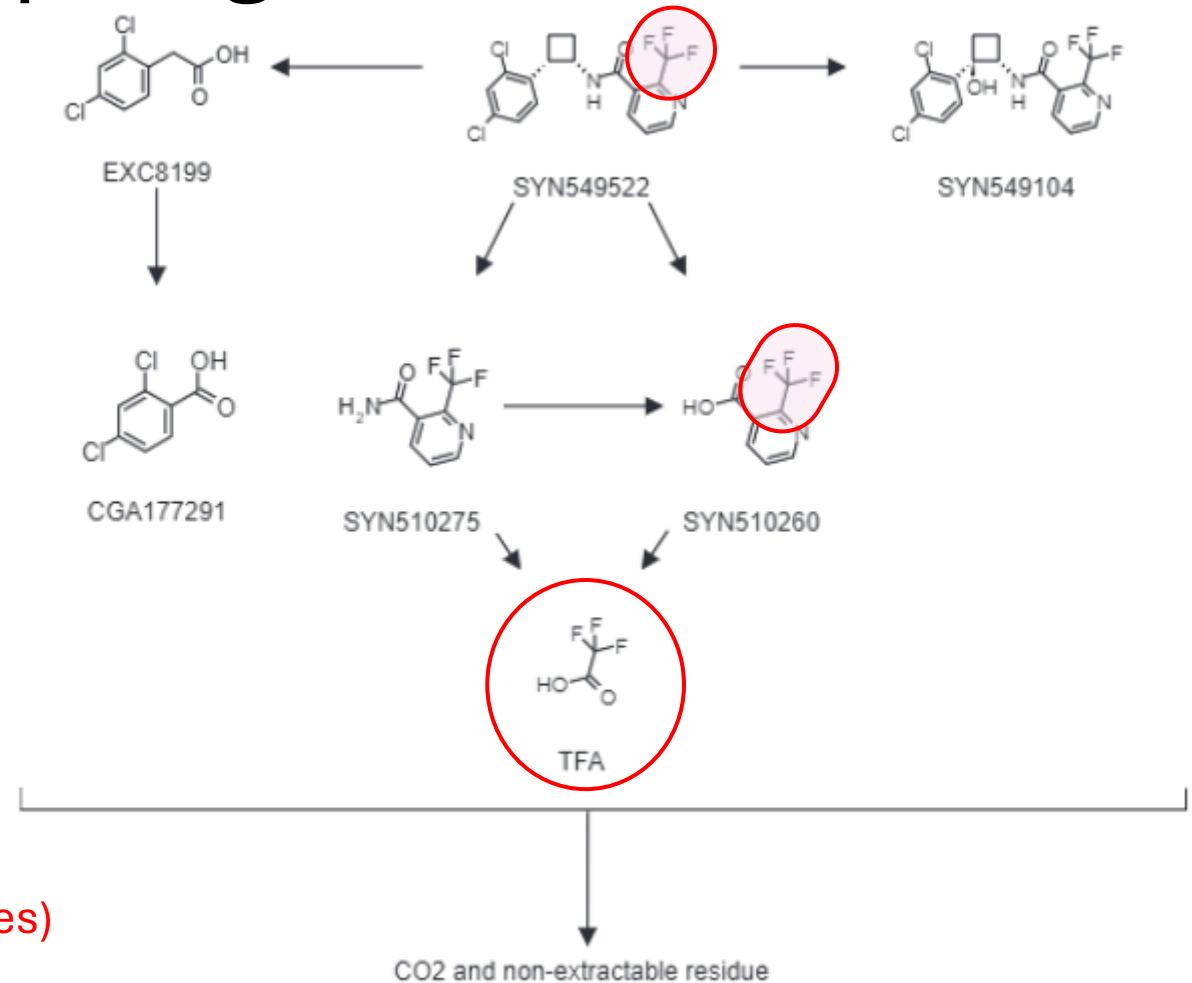
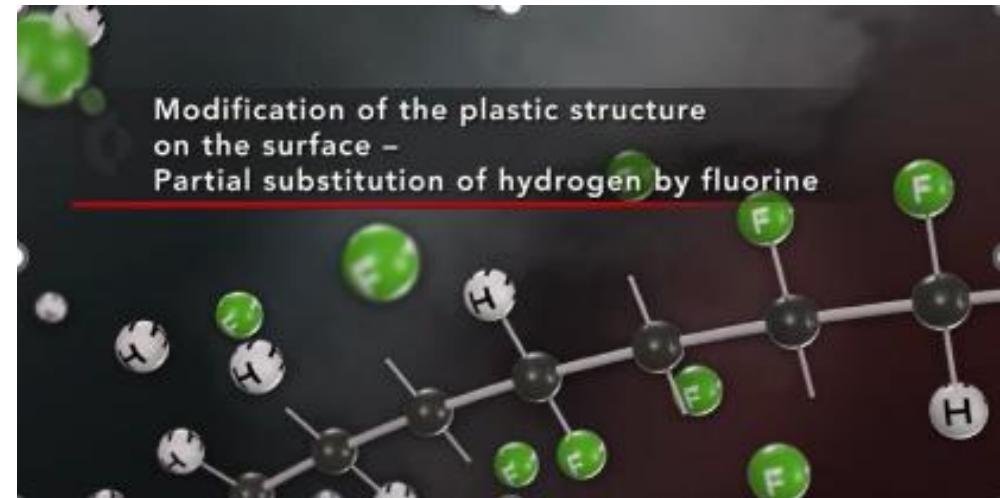


Figure 1. Proposed Metabolic Pathway of Cyclobutrifluram in Soil.

# Fluorinated Containers

# Container fluorination

1 1.0080 H Hydrogen Nonmetal																	2 4.00260 He Helium Noble Gas	
3 7.0 Li Lithium Alkali Earth Metal	4 9.012183 Be Beryllium Alkaline Earth Metal																	10 20.180 Ne Neon Noble Gas
11 22.9897693 Na Sodium Alkali Earth Metal	12 24.305 Mg Magnesium Alkaline Earth Metal																	18 39.9 Ar Argon Noble Gas
19 39.0983 K Potassium Alkali Earth Metal	20 40.08 Ca Calcium Alkaline Earth Metal	21 44.95591 Sc Scandium Transition Metal	22 47.867 Ti Titanium Transition Metal	23 50.9415 V Vanadium Transition Metal	24 51.996 Cr Chromium Transition Metal	25 54.93804 Mn Manganese Transition Metal	26 55.84 Fe Iron Transition Metal	27 58.93319 Co Cobalt Transition Metal	28 58.693 Ni Nickel Transition Metal	29 63.55 Cu Copper Transition Metal	30 65.4 Zn Zinc Transition Metal	31 69.723 Ga Gallium Post Transition Metal	32 72.63 Ge Germanium Metalloid	33 74.92158 As Arsenic Metalloid	34 78.97 Se Selenium Nonmetal	35 79.90 Br Bromine Halogen	36 83.80 Kr Krypton Noble Gas	
37 85.468 Rb Rubidium Alkali Earth Metal	38 87.62 Sr Strontium Alkaline Earth Metal	39 88.90584 Y Yttrium Transition Metal	40 91.22 Zr Zirconium Transition Metal	41 92.90637 Nb Niobium Transition Metal	42 95.95 Mo Molybdenum Transition Metal	43 96.906926 Tc Technetium Transition Metal	44 101.1 Ru Ruthenium Transition Metal	45 102.9055 Rh Rhodium Transition Metal	46 106.42 Pd Palladium Transition Metal	47 107.868 Ag Silver Transition Metal	48 112.41 Cd Cadmium Transition Metal	49 114.818 In Indium Post Transition Metal	50 118.71 Sn Tin Post Transition Metal	51 121.760 Sb Antimony Metalloid	52 127.6 Te Tellurium Metalloid	53 126.9045 I Iodine Halogen	54 131.29 Xe Xenon Noble Gas	
55 132.9054520 Cs Cesium Alkali Earth Metal	56 137.33 Ba Barium Alkaline Earth Metal	72 178.49 Hf Hafnium Transition Metal	73 180.9479 Ta Tantalum Transition Metal	74 183.84 W Tungsten Transition Metal	75 186.207 Re Rhenium Transition Metal	76 190.2 Os Osmium Transition Metal	77 192.22 Ir Iridium Transition Metal	78 195.08 Pt Platinum Transition Metal	79 196.96657 Au Gold Transition Metal	80 200.59 Hg Mercury Transition Metal	81 204.383 Tl Thallium Post Transition Metal	82 207 Pb Lead Post Transition Metal	83 208.98040 Bi Bismuth Metalloid	84 208.98243 Po Polonium Metalloid	85 209.98715 At Astatine Metalloid	86 222.01758 Rn Radon Noble Gas		
87 223.01973 Fr Francium Alkali Earth Metal	88 226.02541 Ra Radium Alkaline Earth Metal	104 267.102 Rf Rutherfordium Transition Metal	105 268.126 Db Dubnium Transition Metal	106 269.128 Sg Seaborgium Transition Metal	107 270.123 Bh Bohrium Transition Metal	108 269.136 Hs Hassium Transition Metal	109 277.134 Mt Meitnerium Transition Metal	110 282.166 Ds Darmstadtium Transition Metal	111 282.169 Rg Roentgenium Transition Metal	112 286.179 Cn Copernicium Transition Metal	113 286.182 Nh Nihonium Post Transition Metal	114 290.192 Fl Flerovium Post Transition Metal	115 290.196 Mc Moscovium Post Transition Metal	116 293.205 Lv Livermorium Post Transition Metal	117 294.211 Ts Tennessine Halogen	118 295.216 Og Oganesson Noble Gas		
57 138.9055 La Lanthanum Lanthanide	58 140.116 Ce Cerium Lanthanide	59 140.90766 Pr Praseodymium Lanthanide	60 144.24 Nd Neodymium Lanthanide	61 144.91276 Pm Promethium Lanthanide	62 150.4 Sm Samarium Lanthanide	63 151.964 Eu Europium Lanthanide	64 157.2 Gd Gadolinium Lanthanide	65 158.92535 Tb Terbium Lanthanide	66 162.500 Dy Dysprosium Lanthanide	67 164.93033 Ho Holmium Lanthanide	68 167.26 Er Erbium Lanthanide	69 168.93422 Tm Thulium Lanthanide	70 173.05 Yb Ytterbium Lanthanide	71 174.9668 Lu Lutetium Lanthanide				
89 227.02775 Ac Actinium Actinide	90 232.038 Th Thorium Actinide	91 231.03688 Pa Protactinium Actinide	92 238.02891 U Uranium Actinide	93 237.048172 Np Neptunium Actinide	94 244.06420 Pu Plutonium Actinide	95 244.06380 Am Americium Actinide	96 247.07535 Cm Curium Actinide	97 247.07031 Bk Berkelium Actinide	98 247.07599 Cf Californium Actinide	99 252.0830 Es Einsteinium Actinide	100 257.09511 Fm Fermium Actinide	101 258.09843 Md Mendelevium Actinide	102 259.10100 No Nobelium Actinide	103 261.103 Lr Lawrencium Actinide				



## Container fluorination

HDPE, LDPE, and PP plastics

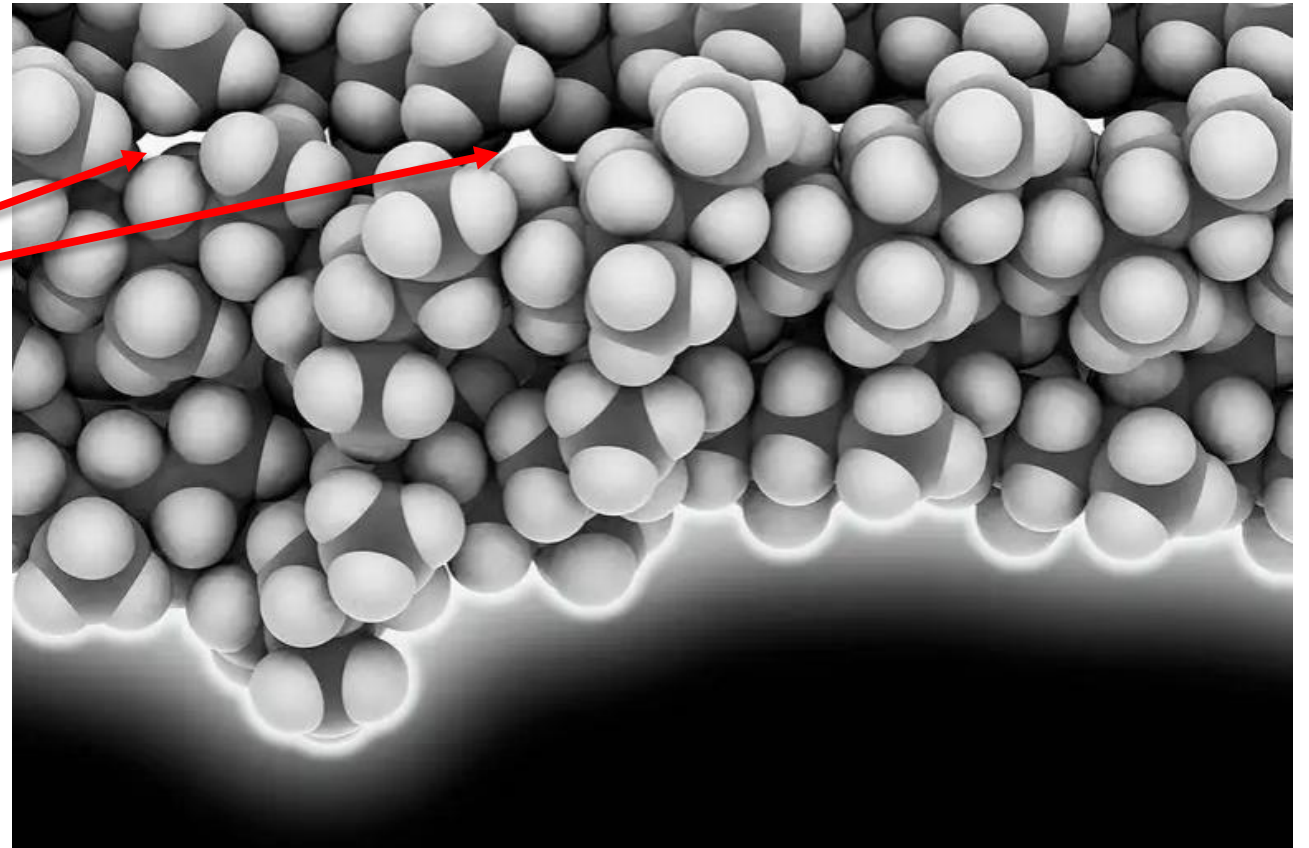
Literally - adding fluorine

# Fluorination has several roles

Fluorination fills gaps in plastic.

- Keeps oxygen out
- Keeps smells in

We have been fluorinating plastics since the 1990s.



# Fluorinated container caused PFAS contamination

- This has been documented to occur.
- The contamination produces several different long-chain PFAS (associated with human health issues); including PFOA
  - Anvil 10+10 story of mosquito spraying in Massachusetts
- PFOA contamination in the ppb concentration range

Abbreviated	Full Name
PFBA	Perfluoro-butanoic acid
PFPeA	Perfluoro-pentanoic acid
PFHxA	Perfluoro-hexanoic acid
PFHpA	Perfluoro-heptanoic acid
PFOA	Perfluoro-octanoic acid
PFNA	Perfluoro-nananoic acid
PFDA	Perfluoro-decanoic acid
PFUdA	Perfluoro-undecanoic acid

# How many containers are fluorinated?

- 20% to 30% ag plastic
- “All products”
- “It’s expensive”

# The Lasee *et al.* 2022 paper is not a credible source for establishing contamination in pesticide products

Promotion of this work by PEER, EWG, CBD, etc. stopped after EPA published details from emails and meetings between Lasee & EPA where the author states he'd sent split samples to two other labs and they were also not able to detect PFAS.



“Dr. Lasee noted that those two laboratories, like EPA, did not find any PFOS. He also informed EPA that he had contacted the JHML (Journal of Hazardous Materials Letters) where the paper was published to retract his publication and he was waiting for a response from the Journal.” p7 [https://www.epa.gov/system/files/documents/2024-05/5-28-24-epa-response-to-peer\\_4-22-24.pdf](https://www.epa.gov/system/files/documents/2024-05/5-28-24-epa-response-to-peer_4-22-24.pdf)

# Relative Mass Contribution

ANR allows up to these concentrations to be land applied with applications rates of tons per acre per year:

**Table 2. PFAS Screening Values (Residual Materials)**

PFAS Compound	Concentration (ug/kg; ppb)
Perfluorooctane sulfonic acid (PFOS)	3.40
Perfluorooctanoic acid (PFOA)	1.60
Perfluoroheptanoic acid (PFHpA)	0.84
Perfluorononanoic acid (PFNA)	0.44
Perfluorohexane sulfonate (PFHxS)	0.38

[https://dec.vermont.gov/sites/dec/files/documents/VTDEC.Final\\_PFAASResiduals.InterimStrategy.2024April.pdf](https://dec.vermont.gov/sites/dec/files/documents/VTDEC.Final_PFAASResiduals.InterimStrategy.2024April.pdf)

In contrast: Anvil10+10 used at maximum label rate of 0.6 oz/acre/year and contaminated at the concentration of 0.2 ppb total PFAS.

# Sources of PFAS

## Sector and function

Paint and coating manufacturing – adhesive and sealant chemicals  
 Industrial gas manufacturing – air conditioners/refrigerations  
 Computer and electronic product manufacturing – solvents for cleaning and degreasing  
 Electrical equipment, appliance, and component manufacturing – functional fluids  
 Fabricated metal product manufacturing – solvents for cleaning and degreasing  
 All other chemical product and preparation manufacturing – fire-fighting foam agents  
 Machinery manufacturing – functional fluids  
 Miscellaneous manufacturing – solvents for cleaning and degreasing  
 Oil and gas drilling – surface active agents  
 Paint and coating manufacturing – adhesives and sealant chemicals  
 Paint and coating manufacturing – finishing agents  
 Paper manufacturing – finishing agents  
**Pesticide, fertilizer, and other agricultural chemical manufacturing – surface active agents**  
 Miscellaneous manufacturing – plating agents and surface treating chemicals  
 Printing ink manufacturing – processing aids, not otherwise listed  
 All other basic inorganic chemical manufacturing – refrigerants (heat transfer fluids)  
 Rubber product manufacturing – rubber compounding  
 Soap, cleaning compound, and toilet preparation manufacturing – surface active agents  
 Textile, apparel and leather manufacturing – finishing agents

Total

Amount [t]	Percent Contribution to Total Loading
0.001	0.00002
138	2.7
1.03	0.02
2180	42.4
0.11	0.002
190	3.7
2180	42.4
0.1	0.002
0.022	0.0004
0.31	0.006
0.005	0.0001
0.005	0.0001
<b>0.07</b>	<b>0.001</b>
1.96	0.04
0.001	0.00002
450	8.8
0.13	0.003
0.12	0.002
0.16	0.003
5142.024	100



