

Biomonitoring California Designated Chemicals March 2024

The following is a list of designated chemicals for Biomonitoring California.^a Designated chemicals consist of those substances that are included in the Centers for Disease Control and Prevention's (CDC's) biomonitoring studies^b and additional chemicals that are recommended by the Scientific Guidance Panel (SGP) for Biomonitoring California. Designated chemicals are the pool of chemicals from which the SGP can recommend priority chemicals for biomonitoring.

Targets for measurement in biomonitoring studies could include the parent chemical, metabolites and other chemical products formed in the body or the environment (e.g., hemoglobin adduct; environmental degradation product). The approach for biomonitoring a chemical may change as methods development proceeds. For some of the parent chemicals listed below, metabolites or other targets for measurement are shown indented underneath. Chemicals are grouped into categories (like "metals" and "pesticides"); some are included in more than one category. The Program determines the chemicals that are actually biomonitored and the appropriate targets for measurement. To jump to each footnote referenced in the list below, click on the relevant number.

Acrylamide

Acrylamide hemoglobin adducts
Glycidamide hemoglobin adducts
N-Acetyl-S-(2-carbamoyl-2-hydroxyethyl)-L-cysteine
N-Acetyl-S-(2-carbamoylethyl)-L-cysteine

2-Aminonaphthalene
o-Anisidine
2,6-Dimethylaniline
o-Toluidine

Aldehydes¹

Benzaldehyde
Butyraldehyde
Crotonaldehyde
Decanaldehyde
Formaldehyde
 Formaldehyde hemoglobin adducts
Heptanaldehyde
Hexanaldehyde
Isopentanaldehyde
Nonanaldehyde
Octanaldehyde
Pentanaldehyde
Propanaldehyde
o-Tolualdehyde

Aromatic Diamines¹

4,4'-Diaminodiphenylmethane
1,5-Diaminonaphthalene
2,4-Diaminotoluene
2,6-Diaminotoluene
p-Phenylenediamine

Antimicrobials used in Food Production ²

Aromatic Amines¹

4-Aminobiphenyl
1-Aminonaphthalene

Brominated and Chlorinated Organic Compounds used as Flame Retardants ²

Allyl 2,4,6-tribromophenyl ether (ATE)
2,2-Bis(bromomethyl)-1,3-propanediol
Bis(2-chloroethyl) (2-chloroethyl)phosphonate
2,2-Bis(chloromethyl)trimethylene bis[bis(2-chloroethyl)phosphate]
Bis(2-ethyl-1-hexyl)tetrabromophthalate (TBPH)
Bis(hexachlorocyclopentadieno)cyclooctane (Dechlorane Plus)
1,2-Bis(2,4,6-tribromophenoxy)ethane (BTBPE)
2-Bromoallyl 2,4,6-tribromophenyl ether (BATE)
Chlorendic acid
Chlorinated paraffins
Decabromodiphenylethane (DBDPE)
1,2-Dibromo-4-(1,2-dibromoethyl)cyclohexane (TBECH)

- a. California Environmental Contaminant Biomonitoring Program, codified at Health and Safety Code section 105440 et seq.
- b. Known collectively as the National Reports on Human Exposure to Environmental Chemicals program.

2,4-Dibromophenol
2,3-Dibromopropyl-2,4,6-tribromophenyl ether (DPTE)
2-Ethyl-1-hexyl-2,3,4,5-tetrabromobenzoate (TBB)
2,3,4,5-Tetrabromobenzoic acid (TBBA)
N,N'-Ethylenebis(tetrabromophthalimide)
Hexabromobenzene (HBB)
2,2',4,4',5,5'-Hexabromobiphenyl (PBB 153)
Hexabromocyclododecane (HBCD)
Hexachlorocyclopentadienyl-dibromocyclooctane
2-Hydroxypropyl 2-(2-hydroxyethyl)ethyl tetrabromophthalate
Isobutoxypentabromocyclododecanes (iBPBCDs)
Octabromotrimethylphenylindane (OBIND)
Pentabromoethylbenzene (PBEB)
Pentabromophenol (PBP)
Pentabromotoluene (PBT)
1,1'-Sulfonylbis[3,5-dibromo-4-(2,3-dibromopropoxy) benzene
Tetrabromobisphenol A (TBBPA)
Tetrabromobisphenol A bis(2,3-dibromopropyl) ether (TBBPA-DBPE)
Tetrabromobisphenol A bis(2-hydroxyethyl) ether
Tetrabromobisphenol A diallyl ether
Tetrabromophthalic acid, mixed esters
Tetrabromophthalic anhydride
2,3,5,6-Tetrabromo-*p*-xylene
Tetrachlorophthalic anhydride
2,4,6-Tribromophenol
Tribromoneopentylalcohol
Tris(2-chloroethyl)phosphate (TCEP)
Bis(2-chloroethyl)phosphate (BCEP)
Tris(1-chloro-2-propyl)phosphate (TCPP)
Bis(1-chloro-2-propyl)phosphate (BCPP)
Tris(2,3-dibromopropyl) isocyanurate
Tris(2,3-dibromopropyl)phosphate (TDBPP)
Tris(1,3-dichloro-2-propyl)phosphate (TDCPP)
Bis(1,3-dichloro-2-propyl)phosphate (BDCPP)
Tris(2,3-dichloro-1-propyl)phosphate
Tris(tribromoneopentyl)phosphate
2,4,6-Tris(2,4,6-tribromophenoxy)-1,3,5-triazine

Polybrominated diphenyl ethers (PBDEs)

2,2',4-Tribromodiphenyl ether (BDE 17)
2,4,4'-Tribromodiphenyl ether (BDE 28)
2,2',4,4'-Tetrabromodiphenyl ether (BDE 47)
2,3',4,4'-Tetrabromodiphenyl ether (BDE 66)
2,2',3,4,4'-Pentabromodiphenyl ether (BDE 85)
2,2',4,4',5-Pentabromodiphenyl ether (BDE 99)
2,2',4,4',6-Pentabromodiphenyl ether (BDE 100)
2,2',4,4',5,5'-Hexabromodiphenyl ether (BDE 153)
2,2',4,4',5,6'-Hexabromodiphenyl ether (BDE 154)
2,2',3,4,4',5',6-Heptabromodiphenyl ether (BDE 183)
2,2',3,3',4,4',5,6'-Octabromodiphenyl ether (BDE 196)
2,2',3,3',4,4',6,6'-Octabromodiphenyl ether (BDE 197)
2,2',3,3',4,5',6,6'-Octabromodiphenyl ether (BDE 201)

2,2',3,3',5,5',6,6'-Octabromodiphenyl ether (BDE 202)
2,2',3,4,4',5,5',6-Octabromodiphenyl ether (BDE 203)
2,2',3,3',4,4',5,5',6-Nonabromodiphenyl ether (BDE 206)
2,2',3,3',4,4',5,6,6'-Nonabromodiphenyl ether (BDE 207)
2,2',3,3',4,5,5',6,6'-Nonabromodiphenyl ether (BDE 208)
2,2',3,3',4,4',5,5',6,6'-Decabromodiphenyl ether (BDE 209)

Hydroxy-PBDEs (Metabolites of PBDEs)

4'-Hydroxy-BDE 17
4-Hydroxy-BDE 42
3-Hydroxy-BDE 47
5-Hydroxy-BDE 47
6-Hydroxy-BDE 47
4'-Hydroxy-BDE 49
2'-Hydroxy-BDE 68
4-Hydroxy-BDE 90
5'-Hydroxy-BDE 99
6'-Hydroxy-BDE 99
3-Hydroxy-BDE 100
5'-Hydroxy-BDE 100
4'-Hydroxy-BDE 101
4'-Hydroxy-BDE 103

Chlorine

Chlorotyrosine adducts
3-Chlorotyrosine
3,5-Dichlorotyrosine

Cyclosiloxanes ²

Decamethylcyclopentasiloxane (D5)
Dodecamethylcyclohexasiloxane (D6)
Octamethylcyclotetrasiloxane (D4)

Diesel Exhaust ³

1-Nitropyrene
6-Hydroxy-1-nitropyrene
8-Hydroxy-1-nitropyrene

Diglycidyl Ethers of *p,p'*-Bisphenols ²

Bisphenol A diglycidyl ether (BADGE)
Bisphenol F diglycidyl ether (BFDGE)

Disinfection By-Products (Trihalomethanes) ¹

Bromodichloromethane
Dibromochloromethane
Tribromomethane (Bromoform)
Trichloromethane (Chloroform)

Environmental Phenols ¹

Benzophenone-3
4-*t*-Octylphenol
o-Phenylphenol

***p,p'*-Bisphenols** ²

Bisphenol A
Bisphenol AF (BPAF)
Bisphenol B (BPB)
Bisphenol F (BPF)
Bisphenol S (BPS)
4,4'-Sulfonylbis[2-(2-propen-1-yl)phenol] (TGSA)

Brominated phenols ^{1, 4}

2,4-Dibromophenol
Pentabromophenol (PBP)
Tetrabromobisphenol A (TBBPA)
2,4,6-Tribromophenol

Chlorinated phenols ^{1, 5}

2,4-Dichlorophenol
2,5-Dichlorophenol
Pentachlorophenol
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
Triclosan

Parabens ¹

Butylparaben ⁶
Ethylparaben
Methylparaben
n-Propylparaben

Related chemicals

Triclocarban ⁷

Heterocyclic Amines ¹

3-Amino-1,4-dimethyl-5*H*-pyrido[4,3-*b*]indole
(Trp-P-1)
2-Aminodipyrido[1,2-*a*:3',2'-*d*]imidazole (Glu-P-2)
2-Amino-6-methyldipyrido[1,2-*a*:3',2'-*d*]imidazole
(Glu-P-1)
2-Amino-3-methylimidazo[4,5-*f*]quinoline (IQ)
2-Amino-1-methyl-6-phenylimidazo[4,5-*b*]pyridine
(PhIP)
2-Amino-3-methyl-9*H*-pyrido[2,3-*b*]indole
(MeA- α -C)
2-Amino-9*H*-pyrido[2,3-*b*]indole (A- α -C)
1-Methyl-3-amino-5*H*-pyrido[4,3-*b*]indole (Trp-P-2)
1-Methyl-9*H*-pyrido[3,4-*b*]indole (Harman)
9*H*-Pyrido[3,4-*b*]indole (Norharman)

Metals ¹

Antimony
Arsenic
Arsenic (V) acid
Arsenobetaine
Arsenocholine

Arsenous (III) acid
Dimethylarsinic acid
Monomethylarsonic acid
Trimethylarsine oxide

Barium
Beryllium
Cadmium
Cesium
Chromium
Cobalt
Copper
Lead
Manganese
Mercury
Ethyl mercury
Methyl mercury
Molybdenum
Nickel
Platinum
Selenium
Strontium
Thallium
Tin
Tungsten
Uranium
Zinc

**Non-Halogenated Aromatic
Phosphates** ²

Bisphenol A bis(diphenyl phosphate)
Butylated triphenyl phosphate
Butyldiphenyl phosphate
2-*t*-Butylphenyl diphenyl phosphate
4-*tert*-butylphenyl diphenyl phosphate
4-((*Tert*-butyl)phenyl)phenyl phosphate
(tBPPP)
Dibutylphenyl phosphate
2-Ethylhexyl diphenyl phosphate
Isodecyl diphenyl phosphate
2-Isopropylphenyl diphenyl phosphate (IPPP)
2-((Isopropyl)phenyl)phenyl phosphate
(IPPPP)
Isopropylated triphenyl phosphate
Resorcinol bis(diphenyl phosphate)
Tribenzyl phosphate (TBzP)
Dibenzyl phosphate (DBzP)
Tricresyl phosphate (TCP)
Dicresyl phosphates (DCPs)
Tri-*o*-cresylphosphate (ToCP)
Di-*o*-cresylphosphate (DoCP)
Tri-*p*-cresylphosphate (TpCP)
Di-*p*-cresylphosphate (DpCP)
Triphenyl phosphate (TPP)
Diphenyl phosphate (DPhP)

Organophosphate Flame Retardants (OPFRs) [1](#)

Tri-*n*-butyl phosphate (TBuP)

Dibutyl phosphate (DBuP)

Additional OPFRs are listed under the categories "Brominated and Chlorinated Organic Compounds used as Flame Retardants" and

"Non-Halogenated Aromatic Phosphates."

Perchlorate and Other Anions [8](#)

Perchlorate

Other Anions

Nitrate

Thiocyanate

Perfluoroalkyl and Polyfluoroalkyl Substances (PFASs) and Other Substances with Carbon-Fluorine Bonds [2](#)

Ammonium 4,8-dioxa-3*H*-perfluorononanoate (ADONA)

Bis(perfluorohexyl)phosphinic acid (6:6 PFPiA)

Bis(perfluorooctyl)phosphinic acid (8:8 PFPiA)

6:2 Chlorinated polyfluorinated ether sulfonic acid (F-53B major)

8:2 Chlorinated polyfluorinated ether sulfonic acid (F-53B minor)

9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid

N-Ethyl-*N*-(2-hydroxyethyl)perfluoro octanesulfonamide phosphate diester

N-Ethyl-*N*-(2-hydroxyethyl)perfluoro octanesulfonamide phosphate monoester

N-Ethyl-perfluorooctane sulfonamido acetic acid (Et-PFOSA-AcOH)

6:2 Fluorotelomer acetate

8:2 Fluorotelomer acetate

10:2 Fluorotelomer acetate

6:2 Fluorotelomer acrylate

8:2 Fluorotelomer acrylate

10:2 Fluorotelomer acrylate

5:3 Fluorotelomer carboxylic acid (5:3 FTCA)

6:2 Fluorotelomer carboxylic acid (6:2 FTCA)

7:3 Fluorotelomer carboxylic acid (7:3 FTCA)

8:2 Fluorotelomer carboxylic acid (8:2 FTCA)

10:2 Fluorotelomer carboxylic acid (10:2 FTCA)

6:2 Fluorotelomer phosphate diester (6:2 diPAP)

6:2/8:2 Fluorotelomer phosphate diester

8:2 Fluorotelomer phosphate diester (8:2 diPAP)

6:2 Fluorotelomer phosphate monoester (6:2 PAP)

8:2 Fluorotelomer phosphate monoester (8:2 PAP)

4:2 Fluorotelomer sulfonic acid (4:2 FTS)

6:2 Fluorotelomer sulfonic acid (6:2 FTS)

8:2 Fluorotelomer sulfonic acid (8:2 FTS)

6:2 Fluorotelomer unsaturated carboxylic acid (6:2 FTUCA)

8:2 Fluorotelomer unsaturated carboxylic acid (8:2 FTUCA)

10:2 Fluorotelomer unsaturated carboxylic acid (10:2 FTUCA)

N-Methyl-perfluorooctane sulfonamido acetic acid (Me-PFOSA-AcOH)

Perfluorobutane sulfonic acid (PFBS)

Perfluorobutanoic acid (PFBA)

Perfluorodecane sulfonic acid (PFDS)

Perfluorodecanoic acid (PFDeA, PFDA)

Perfluorodecylphosphonic acid

Perfluoro-3,6-dioxaheptanoic acid

Perfluoro-3,6-dioxa-4-methyl-7-octene sulfonic acid

Perfluorododecanoic acid (PFDoA, PFDoDA)

Perfluoro(2-ethoxyethane) sulfonic acid

Perfluoroethylcyclohexane sulfonic acid

Perfluoroheptane sulfonic acid (PFHpS)

Perfluoroheptanoic acid (PFHpA)

Perfluorohexadecanoic acid

Perfluorohexane sulfonic acid (PFHxS)

Perfluorohexanoic acid (PFHxA)

Perfluorohexylperfluorooctylphosphinic acid (6:8 PFPiA)

Perfluorohexylphosphonic acid (PFHxPA)

Perfluoro-4-methoxybutanoic acid

Perfluoro-3-methoxypropanoic acid

Perfluoro-2-methyl-3-oxahexanoic acid (GenX)

Perfluorononane sulfonic acid (PFNS)

Perfluorononanoic acid (PFNA)

Perfluorooctadecanoic acid

Perfluorooctane sulfonamide (PFOSA, PFOSAm)

Perfluorooctane sulfonic acid (PFOS), including linear and branched isomers

Perfluorooctanoic acid (PFOA), including linear and branched isomers

Perfluorooctylphosphonic acid (PFOPA)

Perfluoropentane sulfonic acid (PFPeS)

Perfluoropentanoic acid (PFPeA)

Perfluorotetradecanoic acid (PFTeDA)

Perfluorotridecanoic acid

Perfluoroundecanoic acid (PFUA, PFUnDA)

Pesticides [1](#), [9](#)

Carbamate Insecticides [1](#)

Benfuracarb

Carbofuranphenol

Carbaryl

1-Hydroxynaphthalene [10](#)

2-Hydroxynaphthalene [10](#)

Carbofuran

Carbofuranphenol

Carbosulfan

Carbofuranphenol

Furathiocarb

Carbofuranphenol

Propoxur
2-Isopropoxyphenol

Fungicides ¹

Captafol
Tetrahydrophthalimide
Captan
Phthalimide
Tetrahydrophthalimide
Chlorothalonil
Dichloran
Folpet
Phthalimide
Iprodione
Mancozeb
Ethylene thiourea
Maneb
Ethylene thiourea
Metalaxyl
Metiram
Ethylene thiourea
Nabam
Ethylene thiourea
Pentachlorophenol
o-Phenylphenol
Propineb
Propylene thiourea
Thiram
Ethylene thiourea
Ziram
Ethylene thiourea

Herbicides - Substituted Ureas ¹

Bensulfuron-methyl
Chlorimuron-ethyl
Chlorsulfuron
Diuron
Ethametsulfuron-methyl
Foramsulfuron
Halosulfuron
Iodosulfuron
Linuron
Mesosulfuron-methyl
Metsulfuron-methyl
Nicosulfuron
Oxasulfuron
Primisulfuron-methyl
Prosulfuron
Rimsulfuron
Sulfometuron-methyl
Sulfosulfuron
Thifensulfuron-methyl
Triasulfuron
Triflusulfuron-methyl
Non-specific metabolites
Dimethoxy pyrimidine
Dimethyl pyrimidine
Methyl methoxytriazine

Neonicotinoid Insecticides ¹

Acetamiprid
N-Desmethyl-acetamiprid
Clothianidin
Imidacloprid
5-Hydroxy-imidacloprid
Thiacloprid

Organochlorine Pesticides ¹

Aldrin
Dieldrin
Chlordane
trans-Nonachlor
Oxychlordane
Dichlorodiphenyltrichloroethane (DDT) (including *p,p'*-DDT and *o,p'*-DDT)
p,p'-Dichlorodiphenyldichloroethene (*p,p'*-DDE)
Dieldrin
Endosulfan
Endosulfan-ether
Endosulfan-lactone
Endosulfan-sulfate
Endrin
Heptachlor
Heptachlor epoxide
Hexachlorobenzene
Pentachlorophenol
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
Hexachlorocyclohexanes (HCH) (including *beta*-HCH and *gamma*-HCH [lindane])
Pentachlorophenol
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
Methoxychlor
Dihydroxy methoxychlor
Monohydroxy methoxychlor
Mirex
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol

Organophosphorus Pesticides ²

Acephate
Azinphos methyl
Dimethyldithiophosphate
Dimethylphosphate
Dimethylthiophosphate
Bensulide
Chlorethoxyphos
Diethylphosphate
Diethylthiophosphate
Chlorpyrifos
Diethylphosphate
Diethylthiophosphate
3,5,6-Trichloro-2-pyridinol (TCPy)
Chlorpyrifos methyl
Dimethylphosphate
Dimethylthiophosphate
3,5,6-Trichloro-2-pyridinol (TCPy)

Coumaphos
3-Chloro-7-hydroxy-4-methyl-2H-chromen-2-one/ol
Diethylphosphate
Diethylthiophosphate
Diazinon
Diethylphosphate
Diethylthiophosphate
2-Isopropyl-4-methyl-6-hydroxypyrimidine (IMPY)
Dichlorvos (DDVP)
Dimethylphosphate
Dicrotophos
Dimethylphosphate
Dimethoate
Dimethyldithiophosphate
Dimethylphosphate
Dimethylthiophosphate
Omethoate
Disulfoton
Diethyldithiophosphate
Diethylphosphate
Diethylthiophosphate
Ethion
Diethyldithiophosphate
Diethylphosphate
Diethylthiophosphate
Ethoprop
Fenitrothion
Dimethylphosphate
Dimethylthiophosphate
Fenthion
Dimethylphosphate
Dimethylthiophosphate
Glufosinate-ammonium
3-Methylphosphinopropionic acid (3-MPPA)
Glyphosate
Aminomethylphosphonic acid (AMPA)
Isazophos-methyl
5-Chloro-1,2-dihydro-1-isopropyl-[3H]-1,2,4-triazol-3-one
Dimethylphosphate
Dimethylthiophosphate
Malathion
Dimethyldithiophosphate
Dimethylphosphate
Dimethylthiophosphate
Malathion dicarboxylic acid
Methamidophos
Methidathion
Dimethyldithiophosphate
Dimethylphosphate
Dimethylthiophosphate
Methyl parathion
Dimethylphosphate
Dimethylthiophosphate
p-Nitrophenol
Naled
Dimethylphosphate

Oxydemeton-methyl
Dimethylphosphate
Dimethylthiophosphate
Parathion (Ethyl parathion)
Diethylphosphate
Diethylthiophosphate
p-Nitrophenol
Phorate
Diethyldithiophosphate
Diethylphosphate
Diethylthiophosphate
Phosmet (Imidan)
Dimethyldithiophosphate
Dimethylphosphate
Dimethylthiophosphate
Pirimiphos-methyl
2-(Diethylamino)-6-methylpyrimidin-4-ol/one
Dimethylphosphate
Dimethylthiophosphate
Sulfotep
Diethylphosphate
Diethylthiophosphate
Temephos
Dimethylphosphate
Dimethylthiophosphate
Terbufos
Diethyldithiophosphate
Diethylphosphate
Diethylthiophosphate
Tetrachlorvinphos
Dimethylphosphate
Tribufos

Quaternary Ammonium Herbicides and Pesticides

Refer to the category Quaternary Ammonium Compounds (QACs) for the QA herbicides and other members of this class, some of which are registered as pesticides for antimicrobial applications.

Pyrethroid Pesticides

Allethrin
cis/trans-Dimethylvinylcyclopropane carboxylic diacid
Bifenthrin
Cyfluthrin
cis-3-(2,2-Dichlorovinyl)-2,2-dimethylcyclopropane carboxylic acid (*cis*-DCCA)
trans-3-(2,2-Dichlorovinyl)-2,2-dimethylcyclopropane carboxylic acid (*trans*-DCCA)
4-Fluoro-3-phenoxybenzoic acid
Cyhalothrin (including *lambda*- and *gamma*-)
3-Phenoxybenzoic acid (3-PBA)
Cypermethrin (including *cis*- and *trans*-)
cis-3-(2,2-Dichlorovinyl)-2,2-dimethylcyclopropane carboxylic acid (*cis*-DCCA)

trans-3-(2,2-Dichlorovinyl)-2,2-dimethylcyclopropane carboxylic acid (*trans*-DCCA)
3-Phenoxybenzoic acid (3-PBA)
Cyphenothrin
Deltamethrin
cis-3-(2,2-Dibromovinyl)-2,2-dimethylcyclopropane carboxylic acid (*cis*-DBCA)
3-Phenoxybenzoic acid (3-PBA)
Esbiothrin
Esfenvalerate
Etofenprox
Fenpropathrin
3-Phenoxybenzoic acid (3-PBA)
Fenvalerate
Imiprothrin
Metofluthrin
Permethrin (including *cis*- and *trans*-)
cis-3-(2,2-Dichlorovinyl)-2,2-dimethylcyclopropane carboxylic acid (*cis*-DCCA)
trans-3-(2,2-Dichlorovinyl)-2,2-dimethylcyclopropane carboxylic acid (*trans*-DCCA)
3-Phenoxybenzoic acid (3-PBA)
Phenothrin (Sumithrin)
Prallethrin
Pyrethrin 1
cis/trans-Dimethylvinylcyclopropane carboxylic diacid
Resmethrin
cis/trans-Dimethylvinylcyclopropane carboxylic diacid
Tetramethrin
Tralomethrin
3-Phenoxybenzoic acid (3-PBA)

Other Herbicides

Acetochlor
Acetochlor mercapturate
Alachlor
Alachlor mercapturate
Atrazine
Atrazine mercapturate
Diaminochlorotriazine
Desethylatrazine
Desisopropylatrazine
Desisopropylatrazine mercapturate
Hydroxyatrazine
Dacthal
2,4-Dichlorophenoxyacetic acid (2,4-D), salts and esters
2,4-Dichlorophenoxyacetic acid
2,4-Dichlorophenol
Metolachlor
Metolachlor mercapturate
Pendimethalin
2,4,5-Trichlorophenoxyacetic acid (2,4,5-T), salts and esters

2,4,5-Trichlorophenoxyacetic acid
Trifluralin

Other Pesticides

1,4-Dichlorobenzene (*p*-Dichlorobenzene)
2,5-Dichlorophenol
N,N-Diethyl-3-methylbenzamide (DEET)
3-Diethylcarbamoyl benzoic acid (DCBA)
3-Ethylcarbamoyl benzoic acid (ECBA)
N,N-Diethyl-3-(hydroxymethyl) benzamide (DHMB)
Fipronil
Octhilinone

ortho-Phthalates ²

Benzylbutyl phthalate (BzBP)
Mono-benzyl phthalate (MBzP)
Mono-*n*-butyl phthalate (MnBP)
Diallyl phthalate
Di-*n*-butyl phthalate (DnBP)
Mono-*n*-butyl phthalate (MnBP)
Mono-3-hydroxybutyl phthalate (MHBP)
Di-isobutyl phthalate (DIBP)
Mono-isobutyl phthalate (MIBP)
Mono-2-methyl-2-hydroxypropyl phthalate
Dicyclohexyl phthalate (DCHP)
Mono-cyclohexyl phthalate (MCHP)
Diethyl phthalate (DEP)
Mono-ethyl phthalate (MEP)
Di-2-ethylhexyl phthalate (DEHP)
Mono-(2-carboxymethylhexyl) phthalate
Mono-(2-ethyl-5-carboxypentyl) phthalate (MECPP)
Mono-2-ethylhexyl phthalate (MEHP)
Mono-(2-ethyl-5-hydroxyhexyl) phthalate (MEHHP)
Mono-(2-ethyl-5-oxohexyl) phthalate (MEOHP)
Di-*n*-hexyl phthalate
Di-isodecyl phthalate (DIDP)
Mono-(carboxynonyl) phthalate (MCNP)
Di-isooheptyl phthalate
Di-isononyl phthalate (DINP)
Mono-(carboxyoctyl) phthalate (MCOP)
Mono-(hydroxyisononyl) phthalate
Mono-isononyl phthalate (MINP)
Mono-(oxoisononyl) phthalate
Dimethyl phthalate (DMP)
Mono-methyl phthalate (MMP)
Di-*n*-octyl phthalate (DnOP)
Mono-(3-carboxypropyl) phthalate (MCPP)
Mono-*n*-octyl phthalate (MnOP)
Di-*n*-pentyl phthalate
Di-2-propylheptyl phthalate
Diundecyl phthalate
Di-isoundecyl phthalate
Di-isotridecyl phthalate

Phthalate Alternatives ¹

1,2-Cyclohexane dicarboxylic acid, diisononyl ester (DINCH)

Cyclohexane-1,2-dicarboxylic acid mono carboxyisooctyl ester (MCOCH)

Cyclohexane-1,2-dicarboxylic acid-mono (hydroxy-isononyl ester) (MHNCH)

Di-2-ethylhexyl terephthalate (DEHTP)

Mono-2-ethyl-5-carboxypentyl terephthalate (MECPTP)

Mono-2-ethyl-5-hydroxyhexyl terephthalate (MEHHTP)

Phytoestrogens ¹

Daidzein

O-Desmethylangolensin

Equol

Enterodiol

Enterolactone

Genistein

Polychlorinated Biphenyls (PCBs), Dioxin-Like ¹

Coplanar PCBs ¹

3,4,4',5-Tetrachlorobiphenyl (PCB 81)

3,3',4,4',5-Pentachlorobiphenyl (PCB 126)

3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)

Mono-ortho-Substituted PCBs ¹

2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)

2,3,4,4',5-Pentachlorobiphenyl (PCB 114)

2,3',4,4',5-Pentachlorobiphenyl (PCB 118)

2',3,4,4',5-Pentachlorobiphenyl (PCB 123)

2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)

2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)

2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)

2,2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)

Polychlorinated Biphenyls (PCBs), Non-Dioxin-Like ¹

2,2',5-Trichlorobiphenyl (PCB 18)

2,4,4'-Trichlorobiphenyl (PCB 28)

2,2',3,5'-Tetrachlorobiphenyl (PCB 44)

2,2',4,5'-Tetrachlorobiphenyl (PCB 49)

2,2',5,5'-Tetrachlorobiphenyl (PCB 52)

2,3',4,4'-Tetrachlorobiphenyl (PCB 66)

2,4,4',5-Tetrachlorobiphenyl (PCB 74)

2,2',3,4,5'-Pentachlorobiphenyl (PCB 87)

2,2',4,4',5-Pentachlorobiphenyl (PCB 99)

2,2',4,5,5'-Pentachlorobiphenyl (PCB 101)

2,3,3',4',6-Pentachlorobiphenyl (PCB 110)

2,2',3,3',4,4'-Hexachlorobiphenyl (PCB 128)

2,2',3,4,4',5'-Hexachlorobiphenyl (PCB 138)

2,2',3,4',5,5'-Hexachlorobiphenyl (PCB 146)

2,2',3,4',5',6-Hexachlorobiphenyl (PCB 149)

2,2',3,5,5',6-Hexachlorobiphenyl (PCB 151)

2,2',4,4',5,5'-Hexachlorobiphenyl (PCB 153)

2,3,3',4,4',6-Hexachlorobiphenyl (PCB 158)

2,2',3,3',4,4',5-Heptachlorobiphenyl (PCB 170)

2,2',3,3',4,5,5'-Heptachlorobiphenyl (PCB 172)

2,2',3,3',4,5',6'-Heptachlorobiphenyl (PCB 177)

2,2',3,3',5,5',6-Heptachlorobiphenyl (PCB 178)

2,2',3,4,4',5,5'-Heptachlorobiphenyl (PCB 180)

2,2',3,4,4',5',6-Heptachlorobiphenyl (PCB 183)

2,2',3,4',5,5',6-Heptachlorobiphenyl (PCB 187)

2,2',3,3',4,4',5,5'-Octachlorobiphenyl (PCB 194)

2,2',3,3',4,4',5,6-Octachlorobiphenyl (PCB 195)

2,2',3,3',4,4',5,6-Octachlorobiphenyl (PCB 196)

2,2',3,3',4,5,5',6-Octachlorobiphenyl (PCB 199)

2,2',3,4,4',5,5',6-Octachlorobiphenyl (PCB 203)

2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (PCB 206)

2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (PCB 209)

Polychlorinated Biphenyls (PCBs)

Hydroxy-PCBs (Metabolites of PCBs) ¹¹

4-Hydroxy-PCB 107

4-Hydroxy-PCB 120

4'-Hydroxy-PCB 130

3'-Hydroxy-PCB 138

4-Hydroxy-PCB 146

3-Hydroxy-PCB 153

4'-Hydroxy-PCB 172

3'-Hydroxy-PCB 180

4-Hydroxy-PCB 187

4'-Hydroxy-PCB 193

Polychlorinated Dibenzo-*p*-dioxins ¹

1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin

1,2,3,4,7,8-Hexachlorodibenzo-*p*-dioxin

1,2,3,6,7,8-Hexachlorodibenzo-*p*-dioxin

1,2,3,7,8,9-Hexachlorodibenzo-*p*-dioxin

1,2,3,4,6,7,8,9-Octachlorodibenzo-*p*-dioxin

1,2,3,7,8-Pentachlorodibenzo-*p*-dioxin

2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD)

Polychlorinated Dibenzofurans ¹

1,2,3,4,6,7,8-Heptachlorodibenzofuran

1,2,3,4,7,8,9-Heptachlorodibenzofuran

1,2,3,4,7,8-Hexachlorodibenzofuran

1,2,3,6,7,8-Hexachlorodibenzofuran

1,2,3,7,8,9-Hexachlorodibenzofuran

2,3,4,6,7,8-Hexachlorodibenzofuran

1,2,3,4,6,7,8,9-Octachlorodibenzofuran

1,2,3,7,8-Pentachlorodibenzofuran

2,3,4,7,8-Pentachlorodibenzofuran

2,3,7,8-Tetrachlorodibenzofuran

Polycyclic Aromatic Hydrocarbons (PAHs) ¹

Benz[a]anthracene
1-Hydroxybenz[a]anthracene
3-Hydroxybenz[a]anthracene
9-Hydroxybenz[a]anthracene
Benzo[a]pyrene
3-Hydroxybenzo[a]pyrene
Benzo[c]phenanthrene
1-Hydroxybenzo[c]phenanthrene
2-Hydroxybenzo[c]phenanthrene
3-Hydroxybenzo[c]phenanthrene
Chrysene
1-Hydroxychrysene
2-Hydroxychrysene
3-Hydroxychrysene
4-Hydroxychrysene
6-Hydroxychrysene
Fluoranthene
3-Hydroxyfluoranthene
Fluorene
2-Hydroxyfluorene
3-Hydroxyfluorene
9-Hydroxyfluorene
Naphthalene
1-Hydroxynaphthalene
2-Hydroxynaphthalene
Phenanthrene
1-Hydroxyphenanthrene
2-Hydroxyphenanthrene
3-Hydroxyphenanthrene
4-Hydroxyphenanthrene
9-Hydroxyphenanthrene
Pyrene
1-Hydroxypyrene

Quaternary Ammonium Compounds (QACs) ²

Alkyltrimethyl ammonium compounds (ATMACs) ²

C20-22-Alkyltrimethyl ammonium chlorides
Behentrimonium chloride
Cetrimonium bromide
Cetrimonium chloride

Benzylalkyldimethyl ammonium compounds (BACs) ²

Alkyl(60%C14, 30%C16, 5%C18, 5%C12) dimethylbenzyl ammonium chloride
C12-14-Alkyl(ethylbenzyl)dimethyl ammonium chlorides
Benzalkonium chloride ¹²
Benzyl-C12-18-alkyldimethyl ammonium chlorides
Cetalkonium chloride

Dialkyldimethyl ammonium compounds (DADMACs) ²

Di-C14-18-alkyldimethyl ammonium chlorides
Didecyldimethyl ammonium carbonate
Didecyldimethyl ammonium chloride
Dioctyldimethyl ammonium chloride
Quaternium 18
Quaternium 24
Quaternium 34

Esterquats ²

Esterquat 1

Polyquaternium compounds (Polyquats) ²

Polyquaternium 42

QA Herbicides ²

Diquat dibromide
Paraquat dichloride

Other QACs ²

Benzethonium chloride
Cetylpyridinium chloride
(Oxydi-2,1-ethanediyl)bis(coco alkyl)dimethyl ammonium dichlorides
Quaternium 15

Sex Steroid Hormones and Binding Protein¹

Estradiol, Total
Sex hormone-binding globulin (SHBG)
Testosterone, Total

Synthetic Hormones used in Food Production ²

Melengestrol acetate
Trenbolone acetate
Zeranol

Synthetic Polycyclic Musks ²

4-Acetyl-1,1-dimethyl-6-tert-butylindan (ADBI)
6-Acetyl-1,1,2,3,3,5-hexamethylindane (AHMI)
7-Acetyl-1,1,3,4,4,6-hexamethyl-tetrahydronaphthalene (AHTN)
5-Acetyl-1,1,2,6-tetramethyl-3-isopropylindan (ATII)
Acetyethyltetramethyltetralin (AETT)
6,7-Dihydro-1,1,2,3,3-pentamethyl-4[5H]indanone (DPMI)
1,3,4,6,7,8-Hexahydro-4,6,6,7,8,8-hexamethyl-cyclopenta[g]-2-benzopyran (HHCB)

Terpenes

α -Pinene
 β -Pinene
Limonene

**Tetramethyl
Acetyloctahydronaphthalenes ²**

1-(1,2,3,4,6,7,8,8a-Octahydro-2,3,8,8-tetramethyl-2-naphthalenyl)ethanone (alpha isomer)
1-(1,2,3,4,5,6,7,8-Octahydro-2,3,8,8-tetramethyl-2-naphthalenyl)ethanone (beta isomer; OTNE)
1-(1,2,3,5,6,7,8,8a-Octahydro-2,3,8,8-tetramethyl-2-naphthalenyl)ethanone (gamma isomer)
1-(1,2,3,4,5,6,7,8-Octahydro-2,3,5,5-tetramethyl-2-naphthalenyl)ethanone

**Tobacco Smoke and Tobacco Product
Use**

Tobacco Alkaloids and Metabolites

Anabasine
Anatabine
Nicotine
 Cotinine
 Cotinine *N*-oxide
 4-Hydroxy-4-(3-pyridyl)-butanoic acid
 trans-3'-Hydroxycotinine (Hydroxycotinine)
 Norcotinine
 Nicotine *N'*-oxide
 Nornicotine

Tobacco-Specific Nitrosamines (TSNAs)

NAB (*N'*-Nitrosoanabasine)
NAT (*N'*-Nitrosoanatabine)
NNK (4-[Methylnitrosamino]-1-[3-pyridyl]-1-butanone)
 NNAL (4-[Methylnitrosamino)-1-(3-pyridyl)-1-butanol)
NNN (*N'*-Nitrosornicotine)

Volatile Organic Compounds ¹

Acrolein
 N-Acetyl-S-(2-carboxyethyl)-L-cysteine
 N-Acetyl-S-(3-hydroxypropyl)-L-cysteine
Acrylonitrile
 N-Acetyl-S-(1-cyano-2-hydroxyethyl)-L-cysteine
 N-Acetyl-S-(2-cyanoethyl)-L-cysteine
 N-Acetyl-S-(2-hydroxyethyl)-L-cysteine
Benzene
 N-Acetyl-S-(phenyl)-L-cysteine
 t,t-Muconic acid
 Phenylmercapturic acid
Benzonitrile
1-Bromopropane
 N-Acetyl-S-(*n*-propyl)-L-cysteine
1,3-Butadiene
 N-Acetyl-S-(3,4-dihydroxybutyl)-L-cysteine
 N-Acetyl-S-(2-hydroxy-3-butenyl)-L-cysteine
 N-Acetyl-S-(4-hydroxy-2-butenyl)-L-cysteine
 N-Acetyl-S-(1-hydroxymethyl-2-propenyl)-L-cysteine

Carbon disulfide
 2-Thioxothiazolidine-4-carboxylic acid
Carbon tetrachloride
Chlorobenzene
Chloroethane
Crotonaldehyde
 N-Acetyl-S-(3-hydroxypropyl-1-methyl)-L-cysteine
Cyanide
 2-Aminothiazoline-4-carboxylic acid
Cyclohexane
Dibromomethane
1,2-Dibromo-3-chloropropane (DBCP)
1,2-Dibromoethane
1,2-Dichlorobenzene (*o*-Dichlorobenzene)
1,3-Dichlorobenzene (*m*-Dichlorobenzene)
1,4-Dichlorobenzene (*p*-Dichlorobenzene)
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
cis-1,2-Dichloroethene
trans-1,2-Dichloroethene
Dichloromethane (Methylene chloride)
1,2-Dichloropropane
Diethylether
N,N-Dimethylformamide
 N-Acetyl-S-(*N*-methylcarbamoyl)-L-cysteine
2,5-Dimethylfuran
1,4-Dioxane
Ethyl acetate
Ethylbenzene
 Phenylglyoxylic acid
Ethylene oxide
 N-Acetyl-S-(2-hydroxyethyl)-L-cysteine
 Ethylene oxide hemoglobin adducts
Furan
Furfural
 N-2-Furoylglycine
5-Hydroxymethylfurfural
 5-Hydroxymethyl-2-furancarboxylic acid
 5-Hydroxymethyl-2-furoylglycine
Hexachloroethane
n-Hexane
n-Heptane
Isobutyronitrile
Isoprene
 N-Acetyl-S-(4-hydroxy-2-methyl-2-buten-1-yl)-L-cysteine
 N-Acetyl-S-(2-hydroxy-3-methyl-3-buten-1-yl)-L-cysteine + *N*-Acetyl-S-(2-hydroxy-2-methyl-2-propen-1-yl)-L-cysteine
Isopropylbenzene (Cumene)
Methyl isobutyl ketone
Methyl-*t*-butyl ether (MTBE)
Methylcyclopentane
Nitrobenzene
Nitromethane
Octane

Propylene oxide
 N-Acetyl-*S*-(2-hydroxypropyl)-*L*-cysteine
Styrene
 N-Acetyl-*S*-(1-phenyl-2-hydroxyethyl)-*L*-
 cysteine
 N-Acetyl-*S*-(2-phenyl-2-hydroxyethyl)-*L*-
 cysteine
Mandelic acid
Phenylglyoxylic acid
1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane
Tetrachloroethene (Perchloroethylene)
 N-Acetyl-*S*-(trichlorovinyl)-*L*-cysteine
Tetrahydrofuran
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene (Trichloroethylene)
 N-Acetyl-*S*-(1,2-dichlorovinyl)-*L*-cysteine
 N-Acetyl-*S*-(2,2-dichlorovinyl)-*L*-cysteine
1,2,3-Trichloropropane
 α,α,α -Trifluorotoluene
Toluene
 N-Acetyl-*S*-(benzyl)-*L*-cysteine
Vinyl bromide
Vinyl chloride
 N-Acetyl-*S*-(2-hydroxyethyl)-*L*-cysteine
m-Xylene
 N-Acetyl-*S*-(dimethylphenyl)-*L*-cysteine
 3-Methylhippuric acid
o-Xylene
 N-Acetyl-*S*-(dimethylphenyl)-*L*-cysteine
 2-Methylhippuric acid
p-Xylene
 N-Acetyl-*S*-(dimethylphenyl)-*L*-cysteine
 4-Methylhippuric acid

**Volatile *N*-Nitrosamine Compounds
(VNAs)¹**

N-Nitrosodiethylamine (NDEA)
N-Nitrosoethylmethylamine (NMEA)
N-Nitrosomorpholine (NMOR)
N-Nitrosopiperidine (NPIP)
N-Nitrosopyrrolidine (NPYR)

Notes

- ¹ All members of the chemical group are not designated chemicals; only the specific chemicals listed are designated chemicals.
- ² All members of the chemical group are designated chemicals, including, but not limited to, the chemicals shown.
- ³ Diesel exhaust is a complex mixture that contains many components, one or more of which may be useful as an indicator for biomonitoring.
- ⁴ These brominated phenols are part of the chemical group “brominated and chlorinated organic chemicals used as flame retardants”, which are listed as designated chemicals. The brominated phenols are also included in the category “environmental phenols” because the laboratory measures them with other environmental phenols.
- ⁵ These chlorinated phenols, with the exception of triclosan, are metabolites of certain pesticides that are listed as designated chemicals. These chlorinated phenols are also included in the category “environmental phenols” because the laboratory measures them with other environmental phenols.
- ⁶ Includes *n*-butylparaben and isobutylparaben.
- ⁷ Triclocarban is not a phenol but can be analytically measured with environmental phenols. When it is released into the environment, it is commonly found in the same environmental media as triclosan.
- ⁸ CDC measures nitrate and thiocyanate along with perchlorate, because all three anions can affect iodine uptake by the thyroid.
- ⁹ Fungicides, herbicides, and insecticides are grouped under the general heading of “Pesticides.”
- ¹⁰ 1-Hydroxynaphthalene is the metabolite of both carbaryl and naphthalene. To determine the percent of 1-hydroxynaphthalene attributable to carbaryl alone, 2-hydroxynaphthalene (which is only a metabolite of naphthalene) must also be measured.
- ¹¹ Hydroxy-PCBs are measured as biomarkers of exposure to the listed PCBs.
- ¹² Benzalkonium chloride can also be referred to as alkyldimethylbenzyl ammonium chloride (ADBAC).