**Supplementary Materials**

**Characterization of Age-Based Trends to Identify Chemical Biomarkers of Higher Levels in Children**

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Attached Files

“NHANES - Quadratic Regression Results 1a.xlsx” contains the regression statisticis of all covariates from the nonlinear regression models for 141 chemical biomarkers.

**Contents**

[**1. Types of Datasets for Chemical Exposure Biomarkers** 4](#_Toc525603879)

[**Table S1**. NHANES laboratory techniques and corresponding reference by individual or group of chemical biomarkers. 4](#_Toc525603880)

[**Table S2**. Detection frequency (%) by NHANES chemical exposure biomarker along with the sample size of participants below the LOD, above the LOD, and exceeding the upper measurement limit. 6](#_Toc525603881)

[**Table S3**. Percentage of participants above LOD (%) by NHANES Cycles for chemical biomarkers. 16](#_Toc525603882)

[**Table S4**. Limit of Detection (LOD) by NHANES Cycles for chemical biomarkers. 21](#_Toc525603883)

[**Table S5**. Indicator of measurements exclusion by NHANES Cycles for chemical biomarkers. 25](#_Toc525603884)

[**Figure S1.** PCB 196 concentrations across the life-stages stratified by NHANEs cycles for Cycle 2 and 3. 27](#_Toc525603885)

[**Figure S2.** PCB 196 concentrations across the life-stages stratified for only Cycle 3. 28](#_Toc525603886)

[**Table S6**. Corresponding NHANES codename, CAS NO., and chemical family classification for each chemical biomarker. 28](#_Toc525603887)

[**Table S7**. References for half-lives of inorganic substances for which the half-life could not be estimated by the QSAR models. Half-Lives (hours) were used in the analysis. 34](#_Toc525603888)

[**Table S8**. References on regulation, legislation, and restriction dates of substances. 40](#_Toc525603889)

[**Table S9**. Linear regression statistics when survey weights were accounted in the generalized linear models for 1-pyrene, Mono-isobutyl phthalate, Aldrin, and PCB 209. 43](#_Toc525603890)

[**2. Age-Based Trends, Half-Lives, and Restriction Dates** 44](#_Toc525603891)

[**Table S10**. Maximum composite half-life in hours and log-transformed half-life for chemical biomarkers. 44](#_Toc525603892)

[**Table S11.** Linear regression results pertaining to age by chemical biomarker. 50](#_Toc525603893)

[**Table S12.** Latest restriction date, decade, and period by chemicals. 56](#_Toc525603894)

[**Table S13.** Linear regression results pertaining to cycle and resulting time trend categorization by chemical biomarker. 62](#_Toc525603895)

[**Figure S3**. Characteristics of the 144 NHANES chemical exposure biomarkers from 16 classes for ranges of cycle coefficients 70](#_Toc525603896)

[**3. Influence of Temporal Determinants on Age-Based Trends** 71](#_Toc525603897)

[**Figure S4**. Association between linear age coefficients and chemical persistency in the human body for 144 substances with colors indicating the time trend trajectories 71](#_Toc525603898)

[**4. Age-Based Trends by Chemical Class** 71](#_Toc525603899)

[**Text S1**. Pooled serum concentrations observed for four age groups in 2005-2008. 71](#_Toc525603900)

[**Figure S5**. Violin plots of PFOA concentrations partitioned by age groups 72](#_Toc525603901)

[**Figure S6.** Violin plots of urinary cadmium concentrations partitioned by age groups 73](#_Toc525603902)

# **1. Types of Datasets for Chemical Exposure Biomarkers**

## **Table S1**. NHANES laboratory techniques and corresponding reference by individual or group of chemical biomarkers.

|  |  |  |
| --- | --- | --- |
| **Biomarker(s)** | **Laboratory Techniques** | **Reference** |
| Creatinine in urine | Jaffe rate reaction  CX3 analyzer | Brown B. 1982. Creatinine measurement module operating and service instructions. Beckman Instruments 54. |
| Antimony, Arsenic, Barium, Beryllium, Cadmium, Cesium, Cobalt, Lead, Manganese, Molybdenum, Platinum, Strontium, Thallium, Tin, Tungsten, and Uranium in urine | Urine Multi-Element inductively coupled-plasma dynamic reaction cell-mass spectrometry (ICP-DRC-MS) | NCHS. 2012. Laboratory procedure manual: Antimony, arsenic, barium, beryllium, cadmium, cesium, cobalt, lead, manganese, molybdenum, platinum, strontium, thallium, tin, tungsten, and uranium. Available: <https://wwwn.cdc.gov/nchs/data/nhanes/2011-2012/labmethods/uhm_g_met_heavy_metals.pdf.> |
| Cadmium, mercury, manganese, and lead in blood | Inductively coupled-plasma dynamic reaction cell-mass spectrometry (ICP-DRC-MS) | NCHS. 2016. Laboratory procedure manual: Cadmium, lead, manganese, mercury, and selenium. Available: <https://wwwn.cdc.gov/nchs/data/nhanes/2013-2014/labmethods/PbCd_H_MET.pdf.> |
| Copper, selenium, and zinc in serum | Serum Multi-Element inductively coupled-plasma dynamic reaction cell-mass spectrometry (ICP-DRC-MS) | NCHS. 2011. Laboratory procedure manual: Zinc, copper and selenium. Available: <https://wwwn.cdc.gov/nchs/data/nhanes/2013-2014/labmethods/CUSEZN_H_met.pdf.> |
| Inorganic Mercury, Methyl Mercury, Ethyl Mercury in blood | Triple Spike Isotope Dilution Gas Chromatography-Inductively  Coupled Plasma Dynamic Reaction Cell  Mass Spectrometry (TSID-GC-ICP-DRC-MS) | NCHS. 2016. Laboratory procedure manual: Inorganic mercury, methyl mercury, ethyl mercury. Available: <https://wwwn.cdc.gov/nchs/data/nhanes/2011-2012/labmethods/ihgem_met_g_mercuryspecies.pdf.> |
| Iodine and mercury in urine | Inductively Coupled Plasma Dynamic Reaction Cell Mass Spectrometry (ICP-DRC-MS) | NCHS. 2011. Laboratory procedure manual: Iodine & mercury. Available: <https://wwwn.cdc.gov/nchs/data/nhanes/2011-2012/labmethods/uiouhg_g_met_iodine_mercury.pdf.> |
| Arsenobetaine, Arsenocholine,  Trimethylarsine Oxide, Monomethylarsonic Acid, Dimethylarsinic Acid, Arsenous (III) Acid, Arsenic (V) Acid | High Performance Liquid Chromatography  Inductively Coupled Plasma Dynamic Reaction Cell Mass Spectrometry (HPLC-ICP-DRC-MS) | NCHS. 2011. Laboratory procedure manual: Speciated arsenics. Available: <https://wwwn.cdc.gov/nchs/data/nhanes/2013-2014/labmethods/UAS_UASS_H_MET.pdf.> |
| Acrylamide and glycidamide in blood | Liquid Chromatography Tandem Mass  Spectrometry (LC-MS/MS) | NCHS. 2016. Laboratory procedure manual: Acrylamide and glycidamide. Available: <https://www.cdc.gov/nchs/data/nhanes/nhanes_03_04/l06age_c_met.pdf.> |
| Atrazine and its metabolites in urine | Solid phase extraction coupled with high performance liquid chromatography tandem mass spectrometry (SPE-HPLC-MS/MS) | NCHS. 2013. Laboratory procedure manual: Atrazine. Available: <https://wwwn.cdc.gov/nchs/data/nhanes/2007-2008/labmethods/UAM_E_met.pdf.> |
| N,N-diethyl-3 methylbenzamide, N,Ndiethyl-3-hydroxymethylbenzamide, and 3-diethyl-carbamoyl benzoic acid in urine | Online solid phase extraction high performance liquid chromatography tandem mass spectrometry (Online-SPE-HPLC/+APCI MS/MS) | NCHS. 2017. Laboratory procedure manual: N,N-diethyl-3-methylbenzamide, N,N diethyl-3-hydroxymethylbenzamide, and 3-diethyl-carbamoyl benzoic acid. Available: <https://wwwn.cdc.gov/nchs/data/nhanes/2013-2014/labmethods/DEET_H_met.pdf.> |
| Benzophenone-3, bisphenol A, 2,4-dichlorophenol, 2,5-dichlorophenol, methyl-, ethyl-, propyl-, and butyl parabens, triclosan in urine | Online solid phase  extraction coupled to high-performance liquid chromatography–isotope  dilution tandem mass spectrometry (MS/MS) w (Online SPE-HPLC-Isotope dilution-MS/MS) | NCHS. 2013. Laboratory procedure manual: Benzophenone-3, bisphenol a, 2,4-dichlorophenol, 2,5-dichlorophenol, methyl-, ethyl-, propyl-, and butyl parabens, triclosan. Available: <https://wwwn.cdc.gov/nchs/data/nhanes/2011-2012/labmethods/eph_g_met.pdf.> |
| Melamine and cyanuric acid in urine | Solid phase extraction coupled with high performance liquid chromatography tandem mass spectrometry (SPE-HPLC-MS/MS) | NCHS. 2010. 2003-2004 data documentation, codebook, and frequencies: Melamine - urine (surplus) (SSMEL\_C). Available: <https://wwwn.cdc.gov/nchs/nhanes/2003-2004/SSMEL_C.htm.> |
| Brominated flame retardants (BFRs) in blood | Solid phase extraction coupled with gas chromatography isotope dilution high resolution mass spectrometry (SPE-GC/IDHRMS) | NCHS. 2007. 2003-2004 data documentation, codebook, and frequencies: Brominated flame retardants (BFRs) (L28PBE\_C). Available: <https://wwwn.cdc.gov/Nchs/Nhanes/2003-2004/L28PBE_C.htm.> |
| Serum cotinine and urinary NNAL | Isotope dilution-high performance liquid chromatography atmospheric pressure chemical ionization tandem mass spectrometry (ID HPLC-APCI MS/MS) | NCHS. 2013. 2011-2012 data documentation, codebook, and frequencies: Cotinine - serum & total NNAL - urine (COTNAL\_G). Available: <https://wwwn.cdc.gov/Nchs/Nhanes/2011-2012/COTNAL_G.htm.> |
| Acephate, Methamidophos, Omethoate, Dimethoate, Ethylenethiourea and Propylenethiourea in urine | Isotope dilution-high performance liquid chromatography atmospheric pressure chemical ionization tandem mass spectrometry (ID HPLC-APCI MS/MS) | NCHS. 2009. Laboratory procedure manual: Acephate, methamidophos, omethoate, dimethoate, ethylenethiourea and propylenethiourea - urine. Available: <https://wwwn.cdc.gov/nchs/data/nhanes/2005-2006/labmethods/carb_op_met_carbamates.pdf.> |
| Polychlorinated biphenyls (PCBs), dioxins, and furans in serum | High-resolution gas chromatography/ isotope-dilution high-resolution mass spectrometry (HRGC/ID-HRMS) | NCHS. 2008. 2003-2004 data documentation, codebook, and frequencies: Dioxins, furans, & coplanar PCBs (L28DFP\_C). Available: <https://wwwn.cdc.gov/Nchs/Nhanes/2003-2004/L28DFP_C.htm.> |
| Organochlorine pesticides in serum | High-resolution gas chromatography/ isotope-dilution high-resolution mass spectrometry (HRGC/ID-HRMS) | NCHS. 2008. 2003-2004 data documentation, codebook, and frequencies: Pesticides - organochlorine metabolites - serum (surplus) (L28OCP\_C). Available: <https://wwwn.cdc.gov/Nchs/Nhanes/2003-2004/L28OCP_C.htm.> |
| Diakyl phosphate metabolites of organophosphate insecticides in urine | Lyophilization and chemical derivation followed by isotope-dilution gas chromatography–tandem mass spectrometry (ID GC–MS/MS) | NCHS. 2012. 2007-2008 data documentation, codebook, and frequencies: Organophosphate insecticides - diakyl phosphate metabolites - urine (OPD\_E). Available: <https://wwwn.cdc.gov/Nchs/Nhanes/2007-2008/OPD_E.htm.> |
| Nitrate, perchlorate, and thiocyanate in urine | Ion chromatography coupled with electrospray tandem mass spectrometry (IC-MS/MS) | NCHS. 2016. Laboratory procedure manual: Perchlorate, nitrate, and thiocyanate. Available: <https://wwwn.cdc.gov/nchs/data/nhanes/2013-2014/labmethods/PERNT_H_MET.pdf.> |
| Polyfluoroalkyl Chemicals (PFCs) | Online-solid phase extraction coupled to high performance liquid chromatography-turbo ion spray ionization-tandem mass spectrometry (online SPE-HPLC-TIS-MS/MS) | NCHS. 2012. Laboratory procedure manual: Polyfluoroalkyl substances. Available: <https://wwwn.cdc.gov/nchs/data/nhanes/2013-2014/labmethods/PFAS_H_MET.pdf.> |
| Phthalates and a metabolite of DINCH (1,2-Cyclohexane dicarboxylic acid diisononyl ester) in urine | High performance liquid chromatography-electrospray ionization-tandem mass spectrometry (HPLC-ESI-MS/MS) | NCHS. 2016. Laboratory procedure manual: Phthalates and phthalate alternative metabolites. Available: <https://wwwn.cdc.gov/nchs/data/nhanes/2013-2014/labmethods/PHTHTE_H_MET_Phthalates.pdf.> |
| Phytoestrogens in urine | High performance liquid chromatography-atmospheric pressure photoionization-tandem mass spectrometry (HPLC-APPI-MS/MS) | NCHS. 2013. 2009-2010 data documentation, codebook, and frequencies: Phytoestrogens - urine (PHYTO\_F). Available: <https://wwwn.cdc.gov/Nchs/Nhanes/2009-2010/PHYTO_F.htm.> |
| Pyrethroids, herbicides, and organophosphorus insecticides in urine | High-performance liquid chromatography with a gradient elution program coupled with a triple quadrupole mass spectrometer with a heated electrospray ionization source | NCHS. 2014. 2009-2010 data documentation, codebook, and frequencies: Pyrethroids, herbicides, & op metabolites - urine (UPHOPM\_F). Available: <https://wwwn.cdc.gov/Nchs/Nhanes/2009-2010/UPHOPM_F.htm.> |
| Sulfonylurea herbicides | High-performance Liquid Chromatography Tandem Mass Spectrometry (HPLC- MS/MS) | NCHS. 2011. 2007-2008 data documentation, codebook, and frequencies: Pesticides - current use - urine (formerly priority pesticides, non-persistent pesticide metabolites) (UPP\_E). Available: <https://wwwn.cdc.gov/Nchs/Nhanes/2007-2008/UPP_E.htm.> |
| Polycyclic aromatic hydrocarbons (PAHs) | Isotope Dilution Gas  Chromatography/Tandem Mass Spectrometry (GC-MS/MS) | NCHS. 2013. Laboratory procedure manual: Monohydroxy-polycyclic aromatic hydrocarbons (OH\_PAHs). Available: <https://wwwn.cdc.gov/nchs/data/nhanes/2011-2012/labmethods/pah_g_met.pdf.> |
| Volatile Organic Compounds (VOCs) &  Trihalomethanes/MTBE | Headspace Solid-Phase Microextraction  with Benchtop gas chromatography  and mass spectrometry (SPME-GC-MS) | NCHS. 2011. Laboratory procedure manual: Volatile organic compounds (VOCs) & trihalomethanes/mtbe - blood. Available: <https://wwwn.cdc.gov/nchs/data/nhanes/2013-2014/labmethods/VOCWB_H_VOCWBS_H_met.pdf.> |

## **Table S2**. Detection frequency (%) by NHANES chemical exposure biomarker along with the sample size of participants below the LOD, above the LOD, and exceeding the upper measurement limit.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Chemical Name** | **Number of participants with levels below LOD** | **Number of Participants with levels above LOD** | **Number of participant with levels exceeding the upper limit** | **Percent - Detection Rate** | **Exclude** |
| Bensulfuron methyl | 7483 | 0 | 0 | 0 | Yes |
| Foramsulfuron | 7212 | 0 | 0 | 0 | Yes |
| Halosulfuron | 7371 | 0 | 0 | 0 | Yes |
| Mesosulfuron methyl | 7555 | 0 | 0 | 0 | Yes |
| Primisulfuron methyl | 7127 | 0 | 0 | 0 | Yes |
| Rimsulfuron | 7407 | 0 | 0 | 0 | Yes |
| Sulfometuron methyl | 7123 | 0 | 0 | 0 | Yes |
| Thifensulfuron methyl | 7484 | 0 | 0 | 0 | Yes |
| Triasulfuron | 7337 | 0 | 0 | 0 | Yes |
| Triflusulfuron methyl | 7483 | 0 | 0 | 0 | Yes |
| Blood 1,1-Dichloroethane | 13426 | 0 | 0 | 0 | Yes |
| Blood 1,1-Dichloroethene | 13277 | 0 | 0 | 0 | Yes |
| Blood cis-1,2-Dichloroethene | 13470 | 0 | 0 | 0 | Yes |
| Blood 1,1,2-Trichloroethane | 13243 | 0 | 0 | 0 | Yes |
| Blood 1,2-Dibromo-3-chloropropane | 10396 | 0 | 0 | 0 | Yes |
| Atrazine | 2588 | 0 | 0 | 0 | Yes |
| Blood 1,1,1,2-tetrachloroethane | 11967 | 0 | 0 | 0 | Yes |
| Blood 1,2-dibromoethane | 11780 | 0 | 0 | 0 | Yes |
| Blood 1,4-Dioxane | 8392 | 0 | 0 | 0 | Yes |
| Blood aaa-Trifluorotoluene | 3204 | 0 | 0 | 0 | Yes |
| Blood Vinyl Bromide | 3152 | 0 | 0 | 0 | Yes |
| Blood Nitrobenzene | 16063 | 1 | 0 | 0.0062251 | Yes |
| Blood Hexachloroethane | 12587 | 1 | 0 | 0.007944074 | Yes |
| Blood 1,2,3-trichloropropane | 11789 | 1 | 0 | 0.008481764 | Yes |
| Oxasulfuron | 7528 | 1 | 0 | 0.013281976 | Yes |
| Chlorsulfuron | 7084 | 1 | 0 | 0.014114326 | Yes |
| Blood 1,1,2,2-Tetrachloroethane | 12102 | 3 | 0 | 0.024783147 | Yes |
| Prosulfuron | 7272 | 2 | 0 | 0.027495188 | Yes |
| Blood 1,2-Dichloropropane | 13315 | 4 | 0 | 0.030032285 | Yes |
| Blood 1,2-Dichlorobenzene | 16125 | 5 | 0 | 0.03099814 | Yes |
| Sulfosulfuron | 7511 | 3 | 0 | 0.039925472 | Yes |
| Metsulfuron methyl | 7485 | 3 | 0 | 0.040064103 | Yes |
| Desisopropyl atrazine | 2444 | 1 | 0 | 0.040899796 | Yes |
| O-methoate | 7653 | 4 | 0 | 0.052239781 | Yes |
| Blood trans-1,2-Dichloroethene | 13388 | 10 | 0 | 0.074638006 | Yes |
| SISM | 2478 | 2 | 0 | 0.080645161 | Yes |
| Nicosulfuron | 7307 | 7 | 0 | 0.095706864 | Yes |
| Desethyl atrazine | 2479 | 3 | 0 | 0.120870266 | Yes |
| Ethametsulfuron methyl | 7404 | 9 | 0 | 0.121408337 | Yes |
| Endrin | 4007 | 5 | 0 | 0.124626122 | Yes |
| Blood Chlorobenzene | 16402 | 21 | 0 | 0.127869451 | Yes |
| Blood Dibromomethane | 13194 | 18 | 0 | 0.136239782 | Yes |
| Aldrin | 4215 | 6 | 0 | 0.142146411 | Yes |
| Propylenethio urea | 7646 | 11 | 0 | 0.143659397 | Yes |
| 1,2,3,7,8,9-hxcdf | 4954 | 8 | 0 | 0.161225312 | Yes |
| Blood 1,1,2,2-Tetrachloroethane | 1233 | 2 | 0 | 0.16194332 | Yes |
| N-Acel-S-(1,2-dichlorovinl)-L-Cys | 3015 | 5 | 0 | 0.165562914 | Yes |
| N-Acetyl-S-(trichlorovinyl)-L-Cys | 3015 | 5 | 0 | 0.165562914 | Yes |
| Blood Diethyl Ether | 3036 | 6 | 0 | 0.197238659 | Yes |
| N-Ace-S-(dimethylphenyl)-L-Cys | 3014 | 6 | 0 | 0.198675497 | Yes |
| Dimethoate | 7637 | 19 | 0 | 0.248171369 | Yes |
| Blood 1,3-Dichlorobenzene | 16131 | 47 | 0 | 0.290517987 | Yes |
| Blood Methylene Chloride | 15121 | 45 | 0 | 0.296716339 | Yes |
| N-Acel-S-(2,2-Dichlorvinyl)-L-Cys | 3011 | 9 | 0 | 0.298013245 | Yes |
| Urinary beryllium | 10570 | 39 | 0 | 0.367612405 | Yes |
| Blood Chloroethane | 3182 | 12 | 0 | 0.375704446 | Yes |
| Blood isopropylbenzene | 11916 | 52 | 0 | 0.434491979 | Yes |
| Diaminochloroatrazine | 2576 | 12 | 0 | 0.463678516 | Yes |
| Methamidaphos | 7505 | 38 | 0 | 0.503778338 | Yes |
| Surplus sera PFDO | 1580 | 11 | 0 | 0.691389063 | Yes |
| 2-isopropoxyphenol | 7242 | 56 | 0 | 0.767333516 | Yes |
| Blood Tetrahydrofuran | 3051 | 26 | 0 | 0.844978876 | Yes |
| 1,2,3,7,8-pncdf | 4978 | 46 | 0 | 0.915605096 | Yes |
| Urinary Trimethylarsine Oxide | 13545 | 133 | 0 | 0.972364381 | Yes |
| Blood 1,1,1-Trichloroethane | 16366 | 170 | 0 | 1.02805999 | Yes |
| Blood Carbon Tetrachloride | 17148 | 193 | 0 | 1.112969264 | Yes |
| dibromovinyl-dimeth prop carboacid | 9956 | 119 | 0 | 1.181141439 | Yes |
| Blood Octane | 3087 | 38 | 0 | 1.216 | Yes |
| Blood 1,2-Dichloroethane | 16336 | 204 | 0 | 1.23337364 | Yes |
| Mono-n-octyl phthalate | 10367 | 139 | 0 | 1.323053493 | Yes |
| Blood Trichloroethene | 17478 | 243 | 1 | 1.376819772 | Yes |
| Blood Hexane | 8709 | 124 | 0 | 1.403826559 | Yes |
| 2,3,7,8-tcdf | 4929 | 71 | 0 | 1.42 | Yes |
| Gamma-hexachlorocyclohexane | 5948 | 91 | 0 | 1.506871999 | Yes |
| Atrazine mercapturate | 7324 | 114 | 0 | 1.532670073 | Yes |
| Blood Ethyl Acetate | 3091 | 49 | 0 | 1.560509554 | Yes |
| N-A-S-(1-HydrxMet)-2-Prpn)-L-Cys | 2970 | 50 | 0 | 1.655629139 | Yes |
| Blood Methylcyclopentane | 3090 | 53 | 0 | 1.686286987 | Yes |
| Blood Cyclohexane | 2953 | 51 | 0 | 1.697736352 | Yes |
| Acephate | 7412 | 130 | 0 | 1.723680721 | Yes |
| Blood Heptane | 3041 | 58 | 0 | 1.871571475 | Yes |
| Perfluorobutane sulfonic acid | 12370 | 249 | 0 | 1.973214993 | Yes |
| 2,4,5-T | 12335 | 277 | 0 | 2.196320964 | Yes |
| Acetochlor mercapturate | 2941 | 67 | 0 | 2.227393617 | Yes |
| Mercury, ethyl | 12698 | 318 | 0 | 2.443146896 | Yes |
| o,p'-DDT | 5720 | 174 | 0 | 2.952154734 | Yes |
| Urinary Arsenic acid | 16374 | 535 | 0 | 3.163995505 | Yes |
| 5-Formyl-tetrahydrofolic acid | 7224 | 242 | 0 | 3.241360836 | Yes |
| Metolachlor mercapturate | 2946 | 101 | 0 | 3.314735806 | Yes |
| Diethyldithiophosphate | 7250 | 249 | 0 | 3.320442726 | Yes |
| 1,2,3,4,7,8,9-hpcdf | 2972 | 104 | 0 | 3.381014304 | Yes |
| fluoro-phenoxybenzoic acid | 9956 | 376 | 0 | 3.639179249 | Yes |
| Carbofuranphenol | 7127 | 287 | 0 | 3.871054761 | Yes |
| chloro-hydro-meth-chromen-one/ol | 2858 | 117 | 0 | 3.932773109 | Yes |
| Blood 1,1,1-Trichloroethene | 274 | 11 | 1 | 4.195804196 | Yes |
| 2-(N-ethyl-PFOSA) acetate | 9948 | 503 | 0 | 4.812936561 | Yes |
| Urinary Arsenocholine | 16080 | 848 | 0 | 5.009451796 | Yes |
| 2,2',4-tribromodiphenyl ether | 1892 | 100 | 0 | 5.020080321 | Yes |
| 5,10-Methenyl-tethrofolic acid | 7087 | 379 | 0 | 5.076346102 | Yes |
| 2,3,4,6,7,8-hxcdf | 4715 | 265 | 0 | 5.321285141 | Yes |
| Mono-cyclohexyl phthalate | 9919 | 587 | 0 | 5.587283457 | Yes |
| Perfluorododecanoic acid | 11864 | 755 | 0 | 5.983041445 | Yes |
| diethamino-methpyrimidin-ol/one | 2774 | 207 | 0 | 6.943978531 | Yes |
| DEET | 14303 | 1124 | 0 | 7.28592727 | Yes |
| Urinary platinum | 9810 | 798 | 0 | 7.522624434 | Yes |
| PCB128 | 5615 | 487 | 0 | 7.980989839 | Yes |
| Ethylenethio urea | 6659 | 666 | 0 | 9.092150171 | Yes |
| Urinary 4-tert-octylphenol | 7146 | 755 | 0 | 9.555752436 | Yes |
| Perfluorooctane sulfonamide | 9398 | 1053 | 0 | 10.07559085 | Yes |
| 1,2,3,4,6,7,8,9-ocdf | 4412 | 523 | 0 | 10.59777102 | Yes |
| PCB189 | 3675 | 440 | 0 | 10.69258809 | Yes |
| DHD | 9173 | 1203 | 0 | 11.59406322 | Yes |
| Perfluoroheptanoic acid | 10987 | 1632 | 0 | 12.93287899 | Yes |
| Blood furan | 10149 | 1595 | 0 | 13.58140327 | Yes |
| 3,4,4',5-tcb | 4260 | 698 | 0 | 14.07825736 | Yes |
| Surplus sera PFHP | 1367 | 224 | 0 | 14.07919547 | Yes |
| Oxypyrimidine | 4194 | 692 | 0 | 14.16291445 | Yes |
| Surplus sera PFUA | 1354 | 237 | 0 | 14.89629164 | Yes |
| Blood Tetrachloroethene | 14555 | 2605 | 4 | 15.20041948 | Yes |
| 2,2',3,4,4',5',6-heptabrophenl ether | 1674 | 319 | 0 | 16.00602107 | Yes |
| 2,3,7,8-tcdd | 4145 | 857 | 0 | 17.13314674 | Yes |
| Blood 2,5-Dimethylfuran | 13382 | 3083 | 0 | 18.72456726 | Yes |
| Br. iso perfluorooctanoate | 1757 | 408 | 0 | 18.84526559 | Yes |
| Oxypyrimidine | 4278 | 1057 | 0 | 19.81255858 | Yes |
| Mercury, inorganic | 30582 | 7700 | 0 | 20.11389165 | Yes |
| N-Ac-S-(2-Hydrxy-3-butnyl)-L-Cys | 2407 | 613 | 0 | 20.29801325 | Yes |
| Urinary Arsenous acid | 13199 | 3729 | 0 | 22.02859168 | Yes |
| PCB167 | 4729 | 1341 | 0 | 22.092257 | Yes |
| trans dichlorovnl-dimeth carboacid | 8045 | 2287 | 0 | 22.13511421 | Yes |
| PCB157 | 4704 | 1345 | 0 | 22.23508018 | Yes |
| 2,3',4,4'-tetrabromodiphenyl ether | 1550 | 449 | 0 | 22.46123062 | Yes |
| Mirex | 4666 | 1395 | 0 | 23.01600396 | Yes |
| PCB195 | 3064 | 986 | 0 | 24.34567901 | Yes |
| Trichloroethene | 484 | 160 | 0 | 24.8447205 | Yes |
| 1,2,3,7,8,9-hxcdd | 3708 | 1269 | 0 | 25.49728752 | Yes |
| 2,2',3,4,4'-pentabromphenyl ether | 1488 | 512 | 0 | 25.6 | Yes |
| PCB172 | 4430 | 1548 | 0 | 25.89494814 | Yes |
| Malathion diacid | 5282 | 1961 | 0 | 27.07441668 | Yes |
| MHNC | 3757 | 1417 | 0 | 27.38693467 | Yes |
| Dimethyldithiophosphate | 5549 | 2115 | 0 | 27.59655532 | Yes |
| O-Phenyl phenol | 7534 | 2892 | 0 | 27.73834644 | Yes |
| Mono-isononyl phthalate | 11286 | 4394 | 0 | 28.02295918 | Yes |
| 1,2,3,4,7,8-hxcdd | 2219 | 881 | 0 | 28.41935484 | Yes |
| Blood Bromoform | 8247 | 3334 | 1 | 28.7946814 | Yes |
| MTBE | 452 | 192 | 0 | 29.8136646 | Yes |
| Surplus sera PFDE | 1111 | 480 | 0 | 30.16970459 | Yes |
| 2,4,6-trichlorophenol | 7270 | 3156 | 0 | 30.27047765 | Yes |
| PCB178 | 4209 | 1909 | 0 | 31.20300752 | Yes |
| PCB101 | 4195 | 1938 | 0 | 31.59954345 | Yes |
| PCB177 | 4116 | 1926 | 0 | 31.87686197 | Yes |
| 2,4,5-trichlorophenol | 7085 | 3341 | 0 | 32.04488778 | Yes |
| 1,2,3,7,8-pncdd | 3376 | 1653 | 0 | 32.86935773 | Yes |
| Pentachlorophenol | 1553 | 801 | 0 | 34.02718777 | Yes |
| Alachor mercapturate | 1265 | 677 | 0 | 34.86096807 | Yes |
| PCB66 | 3935 | 2144 | 0 | 35.26895871 | Yes |
| PCB151 | 2697 | 1480 | 0 | 35.43212832 | Yes |
| Hexachlorobenzene | 3826 | 2114 | 0 | 35.58922559 | Yes |
| Blood Benzene | 10907 | 6352 | 0 | 36.80398633 | Yes |
| Diethylphosphate | 4819 | 2860 | 0 | 37.24443287 | Yes |
| cis dichlorovnl-dimeth carboacid | 3124 | 1875 | 0 | 37.5075015 | Yes |
| Butyl paraben | 8150 | 4926 | 0 | 37.67207097 | Yes |
| PCB87 | 2605 | 1585 | 0 | 37.82816229 | Yes |
| Urinary Triclocarban | 1640 | 1046 | 0 | 38.94266567 | Yes |
| PCB105 | 3721 | 2380 | 0 | 39.00999836 | Yes |
| PCB52 | 3239 | 2107 | 0 | 39.41264497 | Yes |
| PCB183 | 3690 | 2430 | 0 | 39.70588235 | Yes |
| Urinary Monomethylacrsonic acid | 10099 | 6828 | 0 | 40.33792166 | Yes |
| N-Ace-S-(phenl-2-hydxyetl)-L-Cys | 1792 | 1228 | 0 | 40.66225166 | Yes |
| Perfluoroundecanoic acid | 7475 | 5144 | 0 | 40.76392741 | Yes |
| Dimethylphosphate | 4538 | 3184 | 0 | 41.23284123 | Yes |
| Diethylthiophosphate | 4420 | 3226 | 0 | 42.19199581 | Yes |
| Blood Styrene | 5380 | 3943 | 3 | 42.31181643 | Yes |
| PCB149 | 2383 | 1797 | 0 | 42.99043062 | Yes |
| p,p'-DDT | 3367 | 2582 | 0 | 43.40225248 | Yes |
| Heptachlor Epoxide | 3284 | 2527 | 0 | 43.48649114 | Yes |
| 1,2,3,6,7,8-hxcdf | 2826 | 2176 | 0 | 43.50259896 | Yes |
| Blood Dibromochloromethane | 6583 | 5196 | 0 | 44.11240343 | Yes |
| PCB110 | 2303 | 1877 | 0 | 44.90430622 | Yes |
| Ethyl paraben | 7156 | 5920 | 0 | 45.27378403 | Yes |
| Blood o-Xylene | 9557 | 7951 | 1 | 45.41664287 | Yes |
| Blood Ethylbenzene | 9277 | 7974 | 1 | 46.22652446 | Yes |
| Blood MTBE | 6075 | 5208 | 51 | 46.40021175 | Yes |
| PCB206 | 2167 | 1908 | 0 | 46.82208589 | Yes |
| N-Acetyl-S-(phenyl)-L-Cysteine | 1560 | 1460 | 0 | 48.34437086 | Yes |
| PCB156 | 3117 | 2966 | 0 | 48.7588361 | Yes |
| Urinary Mn | 3236 | 3087 | 0 | 48.82176182 | Yes |
| Mono-n-methyl phthalate | 6118 | 6877 | 0 | 52.92035398 | No |
| Blood 1,4-Dichlorobenzene | 7845 | 9108 | 24 | 53.79042234 | No |
| 2,2',4,4',5,6'-hexabromphenyl ether | 904 | 1110 | 0 | 55.1142006 | No |
| 2,4-D | 3650 | 4967 | 0 | 57.64187 | No |
| Urinary Arsenobetaine | 7514 | 9413 | 0 | 55.60938146 | No |
| Blood Bromodichloromethane | 4740 | 7002 | 0 | 59.63208993 | No |
| Beta-hexachlorocyclohexane | 2436 | 3707 | 0 | 60.34510825 | No |
| Urinary Total NNAL | 8760 | 13723 | 0 | 61.03722813 | No |
| Dieldrin | 1498 | 2613 | 0 | 63.56117733 | No |
| Oxychlordane | 2127 | 3761 | 0 | 63.87567935 | No |
| N-Ace-S-(2-Hydroxyethyl)-L-Cys | 1071 | 1949 | 0 | 64.53642384 | No |
| Urinary Bisphenol F | 949 | 1733 | 0 | 64.61595824 | No |
| 2,3,4,7,8-pncdf | 1084 | 2017 | 0 | 65.04353434 | No |
| 2-thoxothazlidne-4-carbxylic | 1055 | 1965 | 0 | 65.06622517 | No |
| Benzene | 222 | 425 | 0 | 65.6877898 | No |
| N-Ac-S-(2-carbmo-2-hydxel)-L-Cys | 1036 | 1984 | 0 | 65.69536424 | No |
| Blood cadmium | 7378 | 14550 | 0 | 66.35352061 | No |
| 1,4-dichlorobenzene | 205 | 439 | 0 | 68.16770186 | No |
| 1,2,3,4,7,8-hcxdf | 967 | 2122 | 0 | 68.69537067 | No |
| Tetrachloroethene | 196 | 446 | 0 | 69.47040498 | No |
| 2-(N-methyl-PFOSA) acetate | 3670 | 8446 | 0 | 69.70947507 | No |
| 3,3',4,4',5,5'-hxcb | 928 | 2161 | 0 | 69.95791518 | No |
| 2,2',4,4',5-pentabromphenyl ether | 590 | 1395 | 0 | 70.27707809 | No |
| Mono-(2-ethyl)-hexyl phthalate | 4640 | 11039 | 0 | 70.40627591 | No |
| 3-fluoranthene | 636 | 1600 | 0 | 71.55635063 | No |
| Perfluorodecanoic acid | 3537 | 9082 | 0 | 71.97083763 | No |
| 3-phenoxybenzoic acid | 2754 | 7469 | 0 | 73.06074538 | No |
| Mono-3-hydroxy-n-butyl phthalate | 722 | 1959 | 0 | 73.06975009 | No |
| 2,2',4,4',5,5'-hexabromobiphenyl | 547 | 1485 | 0 | 73.08070866 | No |
| Urinary antimony | 4385 | 12546 | 0 | 74.10076192 | No |
| Paranitrophenol | 2110 | 6173 | 0 | 74.52613787 | No |
| PCB153 | 1506 | 4622 | 0 | 75.42428198 | No |
| N-Acetyl-S-(n-propyl)-L-Cysteine | 724 | 2222 | 0 | 75.42430414 | No |
| Dimethylthiophosphate | 1865 | 5851 | 0 | 75.82944531 | No |
| Urinary Triclosan | 3642 | 11951 | 0 | 76.64336561 | No |
| Trans-nonachlor | 1414 | 4760 | 0 | 77.09750567 | No |
| Cotinine | 7150 | 24526 | 0 | 77.42770552 | No |
| PCB194 | 399 | 1436 | 0 | 78.25613079 | No |
| Blood Chloroform | 2351 | 8866 | 5 | 79.0500802 | No |
| Mercury, total | 7951 | 30650 | 0 | 79.40208803 | No |
| Mercury, methyl | 2600 | 10416 | 0 | 80.02458513 | No |
| Chloroform | 128 | 523 | 0 | 80.33794163 | No |
| 2,4,4'-tribromodiphenyl ether | 386 | 1601 | 0 | 80.57372924 | No |
| Urinary Dimethylarsonic acid | 2981 | 13947 | 0 | 82.39012287 | No |
| 1,2,3,4,6,7,8,9-ocdd | 503 | 2519 | 0 | 83.35539378 | No |
| DEET acid | 1723 | 8639 | 0 | 83.37193592 | No |
| Urinary mercury | 1661 | 8628 | 0 | 83.85654583 | No |
| Urinary uranium | 2683 | 14248 | 0 | 84.15332821 | No |
| Blood m-/p-Xylene | 2671 | 14778 | 2 | 84.69428686 | No |
| Tetrahydrofolic acid | 1123 | 6338 | 0 | 84.94839834 | No |
| 1,2,3,6,7,8-hxcdd | 451 | 2654 | 0 | 85.47504026 | No |
| PCB199 | 257 | 1604 | 0 | 86.19022031 | No |
| PCB196 | 249 | 1629 | 0 | 86.74121406 | No |
| 3,5,6-trichloropyridinol | 1307 | 9033 | 0 | 87.35976789 | No |
| Urinary tungsten | 2073 | 14839 | 0 | 87.74243141 | No |
| 4-phenanthrene | 915 | 6689 | 0 | 87.96685955 | No |
| Tin | 741 | 5582 | 0 | 88.28087933 | No |
| Surplus sera PFOA | 1809 | 14563 | 0 | 88.95065 | No |
| Urinary cadmium | 2353 | 19719 | 0 | 89.33943458 | No |
| 1,2,3,4,6,7,8-hpcdf | 326 | 2751 | 0 | 89.40526487 | No |
| t,t-Muconic acid | 236 | 2006 | 0 | 89.47368421 | No |
| 2,4-dichlorophenol | 1613 | 13988 | 0 | 89.66091917 | No |
| Urinary Bisphenol S | 268 | 2414 | 0 | 90.00745712 | No |
| 3,3',4,4',5-pncb | 277 | 2809 | 0 | 91.02397926 | No |
| PCB209 | 136 | 1718 | 0 | 92.66450917 | No |
| N-Acetyl-S-(2-cyanoethyl)-L-Cyst | 215 | 2805 | 0 | 92.8807947 | No |
| Urinary Bisphenol A | 1097 | 14496 | 0 | 92.96479189 | No |
| Ethylbenzene | 44 | 598 | 0 | 93.14641745 | No |
| o-Xylene | 44 | 602 | 0 | 93.18885449 | No |
| Surplus sera EPAH | 108 | 1483 | 0 | 93.21181647 | No |
| Toluene | 43 | 595 | 0 | 93.26018809 | No |
| 2,2',4,4',5,5'-hexabromphenyl ether | 124 | 1915 | 0 | 93.91858754 | No |
| Mono-2-hydroxy-iso-butyl phthlte | 161 | 2520 | 0 | 93.99477807 | No |
| 2,2',4,4',6-pentabromdphenyl ether | 122 | 1918 | 0 | 94.01960784 | No |
| Blood Toluene | 764 | 12892 | 7 | 94.40825587 | No |
| O-DMA | 410 | 7334 | 0 | 94.70557851 | No |
| Propyl paraben | 665 | 12411 | 0 | 94.9143469 | No |
| Mono(carboxynonyl) phthalate | 559 | 12516 | 0 | 95.72466539 | No |
| Urinary lead | 722 | 16210 | 0 | 95.73588472 | No |
| Surplus sera PFNA | 67 | 1524 | 0 | 95.78881207 | No |
| 2-Methylhippuric acid | 115 | 2905 | 0 | 96.19205298 | No |
| 2-Amnothiazolne-4-carbxylic acid | 110 | 2910 | 0 | 96.35761589 | No |
| Mono-(3-carboxypropyl) phthalate | 570 | 15110 | 0 | 96.36479592 | No |
| m,p-Xylene | 23 | 623 | 0 | 96.43962848 | No |
| PCB170 | 63 | 1825 | 0 | 96.66313559 | No |
| Urinary Benzophenone-3 | 437 | 15156 | 0 | 97.1974604 | No |
| Surplus sera MPAH | 38 | 1553 | 0 | 97.61156505 | No |
| 1,2,3,4,6,7,8-hpcdd | 71 | 3023 | 0 | 97.70523594 | No |
| Surplus sera PFSA | 35 | 1556 | 0 | 97.80012571 | No |
| PCB187 | 40 | 1849 | 0 | 97.8824775 | No |
| 2,2',4,4'-tetrabromphenyl ether | 41 | 1975 | 0 | 97.96626984 | No |
| N-Ace-S-(2-hydroxypropyl)-L-Cys | 56 | 2964 | 0 | 98.14569536 | No |
| Glycideamide | 277 | 14741 | 0 | 98.15554668 | No |
| Perfluorohexane sulfonic acid | 219 | 12400 | 0 | 98.26452175 | No |
| Mono-isobutyl phthalate | 268 | 15412 | 0 | 98.29081633 | No |
| 2,5-dichlorophenol | 265 | 15336 | 0 | 98.30139094 | No |
| N-A-S-(4-hydrxy-2butn-l-yl)-L-Cys | 51 | 2969 | 0 | 98.31125828 | No |
| Urinary barium | 283 | 16649 | 0 | 98.32860855 | No |
| PCB146 | 30 | 1864 | 0 | 98.41605069 | No |
| Mono(carboxyoctyl) phthalate | 203 | 12872 | 0 | 98.44741874 | No |
| Urinary total Arsenic | 203 | 13456 | 0 | 98.51380042 | No |
| Mono-n-butyl phthalate | 232 | 15448 | 0 | 98.52040816 | No |
| Mono-benzyl phthalate | 208 | 15472 | 0 | 98.67346939 | No |
| HRDHG Hair Mercury - MDL | 30 | 2537 | 0 | 98.83132061 | No |
| 2-phenanthrene | 146 | 13133 | 0 | 98.90051962 | No |
| 3-phenanthrene | 138 | 13127 | 0 | 98.9596683 | No |
| 3-fluorene | 165 | 15751 | 0 | 98.96330736 | No |
| Urinary cobalt | 151 | 16780 | 0 | 99.10814482 | No |
| Perfluorononanoic acid | 112 | 12507 | 0 | 99.11244948 | No |
| Lin. perfluorooctane sulfonate . | 19 | 2146 | 0 | 99.12240185 | No |
| Phenylglyoxylic acid | 26 | 2994 | 0 | 99.13907285 | No |
| PCB180 | 15 | 1881 | 0 | 99.20886076 | No |
| Linear perfluorooctanoate | 17 | 2148 | 0 | 99.2147806 | No |
| Mono-(2-ethyl-5-oxohexl) phthalate nt | 122 | 15558 | 0 | 99.22193878 | No |
| Mandelic acid | 22 | 2998 | 0 | 99.27152318 | No |
| Methyl paraben | 93 | 12983 | 0 | 99.28877333 | No |
| N-Acetyl-S-(2-Carbxyethyl)-L-Cys | 21 | 2999 | 0 | 99.30463576 | No |
| PCB49 | 12 | 1864 | 0 | 99.36034115 | No |
| N-Acetyl-S-(benzyl)-L-Cysteine | 18 | 3002 | 0 | 99.40397351 | No |
| 1-pyrene | 79 | 13218 | 0 | 99.40588103 | No |
| Urinary thallium | 98 | 16834 | 0 | 99.42121427 | No |
| Blood lead | 114 | 21814 | 0 | 99.48011675 | No |
| 2 & 3-Hydroxyphenanthrene | 12 | 2638 | 0 | 99.54716981 | No |
| Acrylamide | 67 | 14891 | 0 | 99.55207915 | No |
| Surplus sera PFOS | 73 | 16299 | 0 | 99.55412 | No |
| Enterodiol | 32 | 7712 | 0 | 99.58677686 | No |
| Mono(2ethyl5hydroxyhexyl) phthalate | 64 | 15616 | 0 | 99.59183673 | No |
| Perfluorooctanoic acid | 34 | 10417 | 0 | 99.67467228 | No |
| 1-phenanthrene | 42 | 15952 | 0 | 99.73740153 | No |
| Surplus sera PFHS | 4 | 1587 | 0 | 99.7485858 | No |
| Urinary nitrate | 49 | 24378 | 0 | 99.7994023 | No |
| Perfluorooctane sulfonic acid | 20 | 10431 | 0 | 99.80863075 | No |
| Equol | 13 | 7730 | 0 | 99.83210642 | No |
| N-Ace-S-(N-methlcarbamoyl)-L-Cys | 5 | 3015 | 0 | 99.83443709 | No |
| PCB44 | 3 | 1887 | 0 | 99.84126984 | No |
| p,p'-DDE | 9 | 6209 | 0 | 99.85525893 | No |
| Mono-2-ethyl-5carboxypentyl phthalate cm | 18 | 15662 | 0 | 99.88520408 | No |
| Urinary thiocyanate | 25 | 24398 | 0 | 99.89763747 | No |
| N-Ace-S-(2-carbamoylethyl)-L-Cys | 3 | 3017 | 0 | 99.90066225 | No |
| Mono-ethyl phthalate | 15 | 15665 | 0 | 99.90433673 | No |
| 1-napthol | 14 | 15894 | 0 | 99.91199397 | No |
| Strontium | 5 | 6315 | 0 | 99.92088608 | No |
| Enterolactone | 6 | 7738 | 0 | 99.92252066 | No |
| 3-Methipurc acd & 4-Methipurc acid | 2 | 3018 | 0 | 99.93377483 | No |
| N-Ace-S-(3-Hydroxypropyl)-L-Cys | 2 | 3018 | 0 | 99.93377483 | No |
| Daidzein | 5 | 7739 | 0 | 99.93543388 | No |
| N-Ace-S- (3,4-Dihidxybutl)-L-Cys | 1 | 3019 | 0 | 99.96688742 | No |
| Urinary molybdenum | 5 | 16927 | 0 | 99.97047012 | No |
| 2-fluorene | 4 | 15972 | 0 | 99.97496244 | No |
| 9-fluorene | 3 | 13322 | 0 | 99.97748593 | No |
| 2-napthol | 2 | 15983 | 0 | 99.98748827 | No |
| Urinary perchlorate | 2 | 24425 | 0 | 99.99181234 | No |
| PCB74 | 0 | 1898 | 0 | 100 | No |
| PCB118 | 0 | 1887 | 0 | 100 | No |
| PCB28 | 0 | 1866 | 0 | 100 | No |
| PCB138 | 0 | 1896 | 0 | 100 | No |
| N-A-S-(3-hydrxprpl-1-metl)-L-Cys | 0 | 3020 | 0 | 100 | No |
| 5-Methyl-tetrahydrofolic acid | 0 | 7454 | 0 | 100 | No |
| Blood manganese | 0 | 13135 | 0 | 100 | No |
| Urinary cesium | 0 | 16931 | 0 | 100 | No |

## **Table S3**. Percentage of participants above LOD (%) by NHANES Cycles for chemical biomarkers.

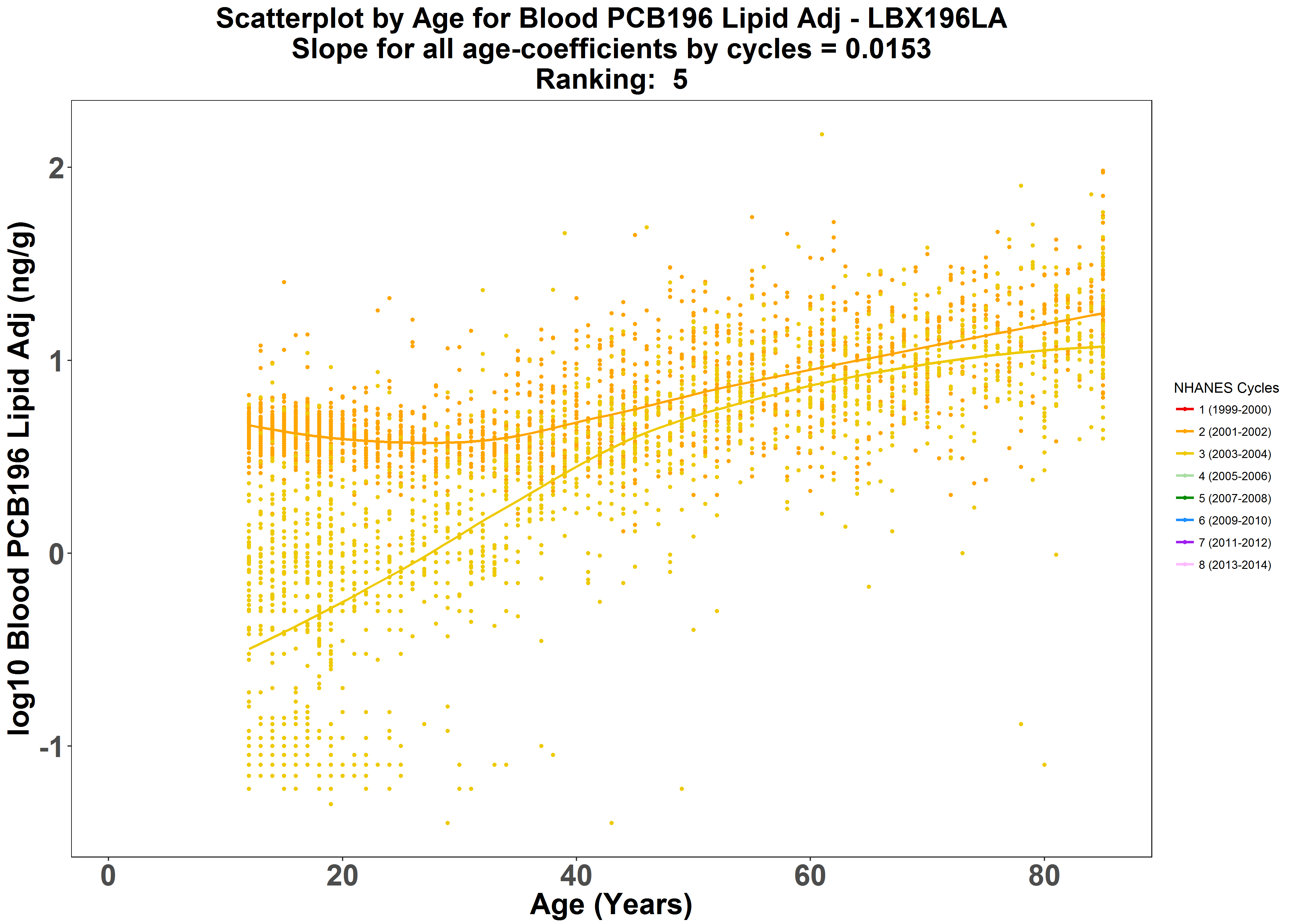
|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Percentage of Participants below LOD by NHANES cycles** | | | | | | | |
| **Codename** | **Comment Name** | **Cycle 1** | **Cycle 2** | **Cycle 3** | **Cycle 4** | **Cycle 5** | **Cycle 6** | **Cycle 7** | **Cycle 8** |
| LBD146LC | PCB146 comment code | 23.9 | 32.5 | 98.4 | N/A | N/A | N/A | N/A | N/A |
| LBD028LC | PCB28 comment code | 1.9 | N/A | 100.0 | N/A | N/A | N/A | N/A | N/A |
| URD24DLC | 2,4-D comment code | 56.1 | 27.9 | 66.1 | N/A | 39.8 | 74.0 | N/A | N/A |
| URDMNMLC | Mono-n-methyl phthalate comment code | N/A | N/A | 57.5 | 40.8 | 38.7 | 62.9 | 64.4 | N/A |
| LBDVDBLC | Blood 1,4-Dichlorobenzene Comment Code | 88.8 | 51.8 | 54.2 | 46.5 | 65.6 | 55.4 | 58.3 | 43.8 |
| LBDWNOLC | Nitrate, water comment code | N/A | N/A | N/A | 54.6 | N/A | N/A | N/A | N/A |
| LBDBR8LC | 2,2',4,4',5,6'-hexabromphenyl ether comt | N/A | N/A | 55.1 | N/A | N/A | N/A | N/A | N/A |
| LBDF03LC | 2,3,4,7,8-pncdf comment code | 39.6 | 65.4 | 64.8 | N/A | N/A | N/A | N/A | N/A |
| URDUABLC | Urinary Arsenobetaine comment code | N/A | N/A | 66.7 | 67.1 | 55.9 | 60.3 | 44.6 | 43.6 |
| LBDF04LC | 1,2,3,4,7,8-hcxdf comment code | 37.2 | 82.0 | 60.0 | N/A | N/A | N/A | N/A | N/A |
| LBD099LC | PCB99 comment code | 30.3 | 44.7 | 99.9 | N/A | N/A | N/A | N/A | N/A |
| LBD194LC | PCB194 comment code | N/A | 42.3 | 78.3 | N/A | N/A | N/A | N/A | N/A |
| LBDVBMLC | Blood Bromodichloromethane Comment Code | 94.9 | 98.6 | 75.6 | 71.7 | 75.8 | N/A | N/A | 12.1 |
| LBD187LC | PCB187 comment code | 39.2 | 45.9 | 97.9 | N/A | N/A | N/A | N/A | N/A |
| LBD196LC | PCB196 comment code | N/A | 37.8 | 86.7 | N/A | N/A | N/A | N/A | N/A |
| LBDWBFLC | Water Bromoform Comment Code | 69.5 | 60.4 | 55.1 | N/A | N/A | N/A | N/A | N/A |
| LBDBHCLC | Beta-hexachlorocyclohexane comment code | 64.8 | 53.6 | 63.9 | N/A | N/A | N/A | N/A | N/A |
| LBD199LC | PCB199 comment code | N/A | 40.3 | 86.2 | N/A | N/A | N/A | N/A | N/A |
| URDNALLC | Urinary Total NNAL comment code | N/A | N/A | N/A | N/A | 57.6 | 55.6 | 70.4 | N/A |
| LBDHXCLC | 3,3',4,4',5,5'-hxcb comment code | 47.5 | 88.6 | 57.7 | N/A | N/A | N/A | N/A | N/A |
| LBD170LC | PCB170 comment code | 38.0 | 52.9 | 96.7 | N/A | N/A | N/A | N/A | N/A |
| LBD074LC | PCB74 comment code | 37.8 | 51.8 | 100.0 | N/A | N/A | N/A | N/A | N/A |
| LBDMPAHL | 2-(N-methyl-PFOSA) acetate comment | 97.6 | N/A | 26.8 | 82.5 | 69.5 | 75.9 | 53.9 | 44.5 |
| LBDDIELC | Dieldrin comment code | N/A | 47.1 | 81.8 | N/A | N/A | N/A | N/A | N/A |
| LBD118LC | PCB118 comment code | 40.2 | 54.0 | 100.0 | N/A | N/A | N/A | N/A | N/A |
| LBDOXYLC | Oxychlordane comment code | 54.6 | 62.3 | 73.5 | N/A | N/A | N/A | N/A | N/A |
| URDHEMLC | N-Ace-S-(2-Hydroxyethyl)-L-Cys comt | N/A | N/A | N/A | N/A | N/A | N/A | 64.5 | N/A |
| URDBPFLC | Urinary Bisphenol F comment | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 64.6 |
| URDPARLC | Paranitrophenol comment code | 24.5 | 53.1 | N/A | N/A | 92.6 | 80.9 | N/A | N/A |
| URDTTCLC | 2-thoxothazlidne-4-carbxylic comt | N/A | N/A | N/A | N/A | N/A | N/A | 65.1 | N/A |
| LBDZBZLC | Benzene comment | 65.7 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| URDGAMLC | N-Ac-S-(2-carbmo-2-hydxel)-L-Cys comt | N/A | N/A | N/A | N/A | N/A | N/A | 65.7 | N/A |
| LBDBCDLC | Blood cadmium comment code | N/A | N/A | N/A | N/A | N/A | 61.4 | 68.8 | 71.0 |
| LBDPFDEL | Perfluorodecanoic acid comment | 30.2 | N/A | 27.7 | 76.6 | 68.2 | 94.6 | 85.1 | 79.0 |
| LBDZDBLC | 1,4-dichlorobenzene comment | 68.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| LBDD03LC | 1,2,3,6,7,8-hxcdd comment code | 40.0 | 92.9 | 80.5 | N/A | N/A | N/A | N/A | N/A |
| LBDZTELC | Tetrachloroethene comment | 69.5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| LBDBR5LC | 2,2',4,4',5-pentabromphenyl ether comt | N/A | N/A | 70.3 | N/A | N/A | N/A | N/A | N/A |
| URDMHPLC | Mono-(2-ethyl)-hexyl phthalate comment | N/A | N/A | 70.1 | 68.8 | 67.1 | 77.4 | 76.7 | 62.4 |
| LBD180LC | PCB180 comment code | 43.6 | 69.1 | 99.2 | N/A | N/A | N/A | N/A | N/A |
| LBD138LC | PCB138 comment code | 35.4 | 79.4 | 100.0 | N/A | N/A | N/A | N/A | N/A |
| URDOPMLC | 3-phenoxybenzoic acid comment code | 71.2 | 77.4 | N/A | N/A | 68.8 | 73.4 | N/A | N/A |
| SDUMHBPL | Mono-3-hydroxy-n-butyl phthalate cmt | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 73.1 |
| LBDBB1LC | 2,2',4,4',5,5'-hexabromobiphenyl comment | N/A | N/A | 73.1 | N/A | N/A | N/A | N/A | N/A |
| LBDF08LC | 1,2,3,4,6,7,8-hpcdf comment code | 45.5 | 89.5 | 89.3 | N/A | N/A | N/A | N/A | N/A |
| URDUSBLC | Urinary antimony comment code | N/A | N/A | 62.6 | 86.7 | 80.9 | 74.3 | 62.3 | 78.6 |
| LBDD07LC | 1,2,3,4,6,7,8,9-ocdd comment code | 62.6 | 81.7 | 84.4 | N/A | N/A | N/A | N/A | N/A |
| LBD153LC | PCB153 comment code | 40.4 | 84.4 | 100.0 | N/A | N/A | N/A | N/A | N/A |
| URDBPMLC | N-Acetyl-S-(n-propyl)-L-Cysteine comt | N/A | N/A | N/A | N/A | N/A | N/A | 75.4 | N/A |
| LBDPCBLC | 3,3',4,4',5-pncb comment code | 50.6 | 88.0 | 93.0 | N/A | N/A | N/A | N/A | N/A |
| URDOP3LC | Dimethylthiophosphate Comment Code | N/A | N/A | 78.6 | 73.1 | 75.9 | N/A | N/A | N/A |
| URDTRSLC | Urinary Triclosan comment | N/A | N/A | 74.1 | 80.5 | 80.2 | 76.8 | 71.9 | 76.2 |
| LBDTNALC | Trans-nonachlor comment code | 70.9 | 73.8 | 87.0 | N/A | N/A | N/A | N/A | N/A |
| LBDCOTLC | Cotinine comment code | N/A | 77.4 | N/A | N/A | 82.6 | 76.7 | 72.9 | N/A |
| LBDVCFLC | Blood Chloroform Comment Code | 100.0 | 96.4 | 93.4 | 94.9 | 82.5 | N/A | N/A | 48.9 |
| LBDTHGLC | Mercury, total comment code | N/A | N/A | N/A | 74.5 | 76.9 | 77.2 | 92.9 | 74.3 |
| LBDBGMLC | Mercury, methyl comment code | N/A | N/A | N/A | N/A | N/A | N/A | 83.7 | 74.5 |
| URDMU2LC | MU2 caffeine comment code | N/A | N/A | N/A | N/A | N/A | 80.2 | N/A | N/A |
| LBDZCFLC | Chloroform comment | 80.3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| LBDBR2LC | 2,4,4'-tribromodiphenyl ether comment | N/A | N/A | 80.6 | N/A | N/A | N/A | N/A | N/A |
| URDUDALC | Urinary Dimethylarsonic acid comment | N/A | N/A | 87.4 | 88.5 | 85.4 | 80.7 | 79.5 | 75.4 |
| LBDD05LC | 1,2,3,4,6,7,8-hpcdd comment code | 59.7 | 98.6 | 97.1 | N/A | N/A | N/A | N/A | N/A |
| URDDEALC | DEET acid comment code | N/A | N/A | N/A | N/A | 75.2 | 92.5 | 83.6 | 81.6 |
| URDUHGLC | Urinary mercury comment code | N/A | N/A | 81.0 | 92.6 | N/A | N/A | 96.3 | 66.4 |
| URDUURLC | Urinary uranium comment code | N/A | N/A | 70.2 | 92.9 | 92.5 | 93.0 | 74.9 | 82.4 |
| LBDVXYLC | Blood m-/p-Xylene Comment Code | 96.6 | 96.5 | 98.4 | 97.8 | 87.6 | 82.7 | 81.2 | 63.5 |
| LBDSF4LC | Tetrahydrofolic acid comment code | N/A | N/A | N/A | N/A | N/A | N/A | 84.9 | N/A |
| LBDWCFLC | Water Chloroform Comment Code | 83.7 | 88.1 | 84.1 | N/A | N/A | N/A | N/A | N/A |
| LBDWCMLC | Water Dibromochloromethane Comment Code | 86.1 | 87.0 | 84.1 | N/A | N/A | N/A | N/A | N/A |
| LBDWP8LC | Perchlorate, water comment code | N/A | N/A | N/A | 85.6 | N/A | N/A | N/A | N/A |
| URDCPMLC | 3,5,6-trichloropyridinol comment code | 93.1 | 78.6 | N/A | N/A | 95.9 | 84.7 | N/A | N/A |
| HRDHGLC | HRXHG Hair Mercury Comment - MQL | 87.6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| LBDWBMLC | Water Bromodichloromethane Comment Code | 83.8 | 90.4 | 87.3 | N/A | N/A | N/A | N/A | N/A |
| URDUTULC | Urinary tungsten comment code | N/A | N/A | 82.7 | 92.5 | 92.8 | 89.8 | 86.5 | 83.3 |
| URDP19LC | 4-phenanthrene comment code | N/A | N/A | 91.3 | 96.2 | N/A | N/A | 79.5 | N/A |
| URDUSNLC | Tin comment code | N/A | N/A | N/A | N/A | N/A | N/A | 86.1 | 90.3 |
| URDMU7LC | MU7 caffeine comment code | N/A | N/A | N/A | N/A | N/A | 88.4 | N/A | N/A |
| URDUCDLC | Urinary cadmium comment code | 96.5 | 96.0 | 91.1 | 89.9 | 89.9 | 89.3 | 80.5 | 84.5 |
| URDMUCLC | t,t-Muconic acid comment code | N/A | N/A | N/A | N/A | N/A | N/A | 89.5 | N/A |
| URDDCBLC | 2,4-dichlorophenol comment | N/A | N/A | 84.9 | 91.6 | 91.4 | 88.1 | 86.2 | 95.3 |
| URDBPSLC | Urinary Bisphenol S comment | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 90.0 |
| URDMX7LC | MX7 caffeine comment code | N/A | N/A | N/A | N/A | N/A | 90.8 | N/A | N/A |
| LBD209LC | PCB209 Comment Code | N/A | N/A | 92.7 | N/A | N/A | N/A | N/A | N/A |
| URDMX4LC | MX4 caffeine comment code | N/A | N/A | N/A | N/A | N/A | 92.8 | N/A | N/A |
| URDCYMLC | N-Acetyl-S-(2-cyanoethyl)-L-Cyst comt | N/A | N/A | N/A | N/A | N/A | N/A | 92.9 | N/A |
| URDBPHLC | Urinary Bisphenol A comment | N/A | N/A | 93.5 | 92.9 | 93.6 | 92.0 | 89.7 | 96.0 |
| LBDZEBLC | Ethylbenzene comment | 93.1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| LBDZOXLC | o-Xylene comment | 93.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| LBDZTOLC | Toluene comment | 93.3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| URDMU6LC | MU6 caffeine comment code | N/A | N/A | N/A | N/A | N/A | 93.7 | N/A | N/A |
| LBDBR7LC | 2,2',4,4',5,5'-hexabromphenyl ether comt | N/A | N/A | 93.9 | N/A | N/A | N/A | N/A | N/A |
| SDUHIBPL | Mono-2-hydroxy-iso-butyl phthlte cmt | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 94.0 |
| LBDBR6LC | 2,2',4,4',6-pentabromdphenyl ether comt | N/A | N/A | 94.0 | N/A | N/A | N/A | N/A | N/A |
| LBDVTOLC | Blood Toluene Comment Code | 98.7 | 95.4 | 95.0 | 97.0 | 94.6 | 87.2 | N/A | 95.8 |
| URDDMALC | O-DMA comment code | N/A | N/A | N/A | 95.6 | 93.2 | 95.2 | N/A | N/A |
| URDPPBLC | Propyl paraben comment | N/A | N/A | N/A | 93.8 | 94.8 | 92.9 | 94.2 | 98.8 |
| URDP10LC | 1-pyrene comment code | N/A | N/A | 99.4 | 99.8 | 99.5 | 99.4 | 99.0 | 76.4 |
| URDMX5LC | MX5 caffeine comment code | N/A | N/A | N/A | N/A | N/A | 95.7 | N/A | N/A |
| URDCNPLC | Mono(carboxynonyl) phthalate comment | N/A | N/A | N/A | 91.1 | 90.4 | 98.9 | 99.2 | 98.8 |
| URDUPBLC | Urinary lead comment code | N/A | N/A | 84.8 | 97.6 | 98.0 | 97.2 | 96.4 | 99.0 |
| URD2MHLC | 2-Methylhippuric acid comment code | N/A | N/A | N/A | N/A | N/A | N/A | 96.2 | N/A |
| URDATCLC | 2-Amnothiazolne-4-carbxylic acid comt | N/A | N/A | N/A | N/A | N/A | N/A | 96.4 | N/A |
| URDMC1LC | Mono-(3-carboxypropyl) phthalate cmt | N/A | N/A | 98.6 | 96.9 | 97.6 | 97.2 | 98.4 | 89.7 |
| LBDZXYLC | m,p-Xylene comment | 96.4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| URDMU4LC | MU4 caffeine comment code | N/A | N/A | N/A | N/A | N/A | 96.8 | N/A | N/A |
| URDMU5LC | MU5 caffeine comment code | N/A | N/A | N/A | N/A | N/A | 97.0 | N/A | N/A |
| URDBP3LC | Urinary Benzophenone-3 comment | N/A | N/A | 97.1 | 97.3 | 96.1 | 98.0 | 98.0 | 96.8 |
| URDAMULC | AAMU comment code | N/A | N/A | N/A | N/A | N/A | 97.5 | N/A | N/A |
| LBDBR3LC | 2,2',4,4'-tetrabromphenyl ether comment | N/A | N/A | 98.0 | N/A | N/A | N/A | N/A | N/A |
| LBDIGELC | Serum total IgE antibody comment code | N/A | N/A | N/A | 98.1 | N/A | N/A | N/A | N/A |
| URDHP2LC | N-Ace-S-(2-hydroxypropyl)-L-Cys comt | N/A | N/A | N/A | N/A | N/A | N/A | 98.1 | N/A |
| LBDGLYLC | Glycideamide comment code | N/A | N/A | 97.8 | 98.5 | N/A | N/A | N/A | N/A |
| LBDSF6LC | Mefox oxidation product comment code | N/A | N/A | N/A | N/A | N/A | N/A | 98.3 | N/A |
| URDMIBLC | Mono-isobutyl phthalate comment code | N/A | N/A | 97.5 | 97.9 | 98.2 | 99.8 | 99.0 | 97.3 |
| URD14DLC | 2,5-dichlorophenol comment | N/A | N/A | 98.7 | 98.9 | 99.0 | 98.0 | 96.7 | 98.4 |
| URDMB3LC | N-A-S-(4-hydrxy-2butn-l-yl)-L-Cys comt | N/A | N/A | N/A | N/A | N/A | N/A | 98.3 | N/A |
| URDUBALC | Urinary barium comment code | N/A | N/A | 92.8 | 98.9 | 99.0 | 99.6 | 99.2 | 99.7 |
| LBDPFHSL | Perfluorohexane sulfonic acid comment | 99.7 | N/A | 97.7 | 95.9 | 99.2 | 99.4 | 98.4 | 98.8 |
| URDCOPLC | Mono(carboxyoctyl) phthalate comment | N/A | N/A | N/A | 96.0 | 96.4 | 99.8 | 100.0 | 99.9 |
| LBDWIOLC | Iodide, water comment code | N/A | N/A | N/A | 98.5 | N/A | N/A | N/A | N/A |
| URDUASLC | Urinary total Arsenic comment code | N/A | N/A | 98.9 | 99.3 | 99.6 | 99.5 | 95.7 | N/A |
| URDMBPLC | Mono-n-butyl phthalate comment code | N/A | N/A | 99.5 | 99.7 | 99.3 | 99.6 | 94.4 | 98.4 |
| URDMZPLC | Mono-benzyl phthalate comment code | N/A | N/A | 99.7 | 98.9 | 98.2 | 99.5 | 98.2 | 97.6 |
| URDMU3LC | MU3 caffeine comment code | N/A | N/A | N/A | N/A | N/A | 98.7 | N/A | N/A |
| LBDPFNAL | Perfluorononanoic acid comment | 95.8 | N/A | 98.3 | 99.1 | 99.5 | 99.8 | 99.3 | 98.8 |
| HRDHGLC2 | HRDHG Hair Mercury Comment - MDL | 98.8 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| URDP07LC | 2-phenanthrene comment code | N/A | N/A | 98.8 | 99.7 | 99.6 | 98.8 | 97.9 | N/A |
| URDP05LC | 3-phenanthrene comment code | N/A | N/A | 99.8 | 99.8 | 99.9 | 98.5 | 97.2 | N/A |
| URDP03LC | 3-fluorene comment code | N/A | N/A | 99.8 | 99.8 | 99.8 | 98.7 | 98.4 | 97.5 |
| URDMX6LC | MX6 caffeine comment code | N/A | N/A | N/A | N/A | N/A | 99.0 | N/A | N/A |
| URDUCOLC | Urinary cobalt comment code | N/A | N/A | 96.3 | 99.6 | 99.8 | 99.4 | 99.4 | 99.9 |
| URDPHGLC | Phenylglyoxylic acid comment code | N/A | N/A | N/A | N/A | N/A | N/A | 99.1 | N/A |
| URDMOHLC | Mono-(2-ethyl-5-oxohexl) phthalate comnt | N/A | N/A | 99.2 | 99.0 | 98.3 | 99.7 | 99.6 | 99.5 |
| URDMADLC | Mandelic acid comment code | N/A | N/A | N/A | N/A | N/A | N/A | 99.3 | N/A |
| URDMPBLC | Methyl paraben comment | N/A | N/A | N/A | 99.1 | 99.7 | 99.4 | 98.9 | 99.4 |
| URDCEMLC | N-Acetyl-S-(2-Carbxyethyl)-L-Cys comt | N/A | N/A | N/A | N/A | N/A | N/A | 99.3 | N/A |
| LBD049LC | PCB49 Comment Code | N/A | N/A | 99.4 | N/A | N/A | N/A | N/A | N/A |
| URDMX2LC | MX2 caffeine comment code | N/A | N/A | N/A | N/A | N/A | 99.4 | N/A | N/A |
| URDBMALC | N-Acetyl-S-(benzyl)-L-Cysteine comt | N/A | N/A | N/A | N/A | N/A | N/A | 99.4 | N/A |
| URDUTLLC | Urinary thallium comment code | N/A | N/A | 99.3 | 99.9 | 99.5 | 99.5 | 99.3 | 99.2 |
| LBDBPBLC | Blood lead comment code | N/A | N/A | N/A | N/A | N/A | 99.7 | 98.9 | 100.0 |
| URDP25LC | 2 & 3-Hydroxyphenanthrene Comment Code | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 99.5 |
| LBDACRLC | Acrylamide comment code | N/A | N/A | 99.9 | 99.2 | N/A | N/A | N/A | N/A |
| URDETDLC | Enterodiol comment code | N/A | N/A | N/A | 99.9 | 99.3 | 99.5 | N/A | N/A |
| URDMHHLC | Mono(2ethyl5hydroxyhexyl) phthalate cmt | N/A | N/A | 99.7 | 99.6 | 99.2 | 99.9 | 99.8 | 99.3 |
| URDGNSLC | Genistein comment code | N/A | N/A | N/A | 99.1 | 100.0 | 100.0 | N/A | N/A |
| LBDPFOAL | Perfluorooctanoic acid comment | 99.9 | N/A | 99.6 | 99.6 | 99.9 | 99.8 | 99.5 | 59.0 |
| URDP06LC | 1-phenanthrene comment code | N/A | N/A | 100.0 | 100.0 | 100.0 | 99.8 | 99.9 | 98.8 |
| URDMX3LC | MX3 caffeine comment code | N/A | N/A | N/A | N/A | N/A | 99.8 | N/A | N/A |
| URDNO3LC | Urinary nitrate comment code | N/A | N/A | N/A | 99.8 | 99.9 | 99.7 | 99.7 | 99.8 |
| URDEQULC | Equol comment code | N/A | N/A | N/A | 99.8 | 99.8 | 99.9 | N/A | N/A |
| LBDPFOSL | Perfluorooctane sulfonic acid comment | 100.0 | N/A | 99.9 | 99.9 | 99.9 | 99.8 | 99.6 | 98.8 |
| URDAMCLC | N-Ace-S-(N-methlcarbamoyl)-L-Cys comt | N/A | N/A | N/A | N/A | N/A | N/A | 99.8 | N/A |
| LBD044LC | PCB44 Comment Code | N/A | N/A | 99.8 | N/A | N/A | N/A | N/A | N/A |
| LBDPDELC | p,p'-DDE comment code | 99.9 | 99.9 | 99.7 | N/A | N/A | N/A | N/A | N/A |
| URDECPLC | Mono-2-ethyl-5carboxypentyl phthalate cm | N/A | N/A | 100.0 | 100.0 | 99.9 | 100.0 | 99.7 | 99.8 |
| URDSCNLC | Urinary thiocyanate comment code | N/A | N/A | N/A | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 |
| URDAAMLC | N-Ace-S-(2-carbamoylethyl)-L-Cys comt | N/A | N/A | N/A | N/A | N/A | N/A | 99.9 | N/A |
| URDMEPLC | Mono-ethyl phthalate comment code | N/A | N/A | 100.0 | 99.8 | 100.0 | 100.0 | 99.9 | 99.8 |
| URDP01LC | 1-napthol comment code | N/A | N/A | 99.9 | 99.8 | 100.0 | 100.0 | 99.9 | 99.8 |
| URDUSRLC | Strontium comment code | N/A | N/A | N/A | N/A | N/A | N/A | 99.9 | 99.9 |
| URDETLLC | Enterolactone comment code | N/A | N/A | N/A | 100.0 | 99.8 | 100.0 | N/A | N/A |
| URD34MLC | 3-Methipurc acd & 4-Methipurc acid comt | N/A | N/A | N/A | N/A | N/A | N/A | 99.9 | N/A |
| URDHPMLC | N-Ace-S-(3-Hydroxypropyl)-L-Cys comt | N/A | N/A | N/A | N/A | N/A | N/A | 99.9 | N/A |
| URDDAZLC | Daidzein comment code | N/A | N/A | N/A | 100.0 | 99.9 | 99.9 | N/A | N/A |
| LBDSF2LC | Folic acid comment code | N/A | N/A | N/A | N/A | N/A | N/A | 99.9 | N/A |
| URDDHBLC | N-Ace-S- (3,4-Dihidxybutl)-L-Cys comt | N/A | N/A | N/A | N/A | N/A | N/A | 100.0 | N/A |
| URDUMOLC | Urinary molybdenum comment code | N/A | N/A | 99.9 | 100.0 | 99.9 | 100.0 | 100.0 | 100.0 |
| URDP04LC | 2-fluorene comment code | N/A | N/A | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9 |
| URDP17LC | 9-fluorene comment code | N/A | N/A | 100.0 | 100.0 | 100.0 | 100.0 | 99.9 | N/A |
| URDP02LC | 2-napthol comment code | N/A | N/A | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| URDUP8LC | Urinary perchlorate comment code | N/A | N/A | N/A | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| URDUCSLC | Urinary cesium comment code | N/A | N/A | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| URDMU1LC | MU1 caffeine comment code | N/A | N/A | N/A | N/A | N/A | 100.0 | N/A | N/A |
| URDMX1LC | MX1 caffeine comment code | N/A | N/A | N/A | N/A | N/A | 100.0 | N/A | N/A |
| LBDBSELC | Blood selenium comment code | N/A | N/A | N/A | N/A | N/A | N/A | 100.0 | 100.0 |
| LBDBMNLC | Blood manganese comment code | N/A | N/A | N/A | N/A | N/A | N/A | 100.0 | 100.0 |
| LBDSF1LC | 5-Methyl-tetrahydrofolic acid comt | N/A | N/A | N/A | N/A | N/A | N/A | 100.0 | N/A |
| URDPMMLC | N-A-S-(3-hydrxprpl-1-metl)-L-Cys comt | N/A | N/A | N/A | N/A | N/A | N/A | 100.0 | N/A |

## **Table S4**. Limit of Detection (LOD) by NHANES Cycles for chemical biomarkers.

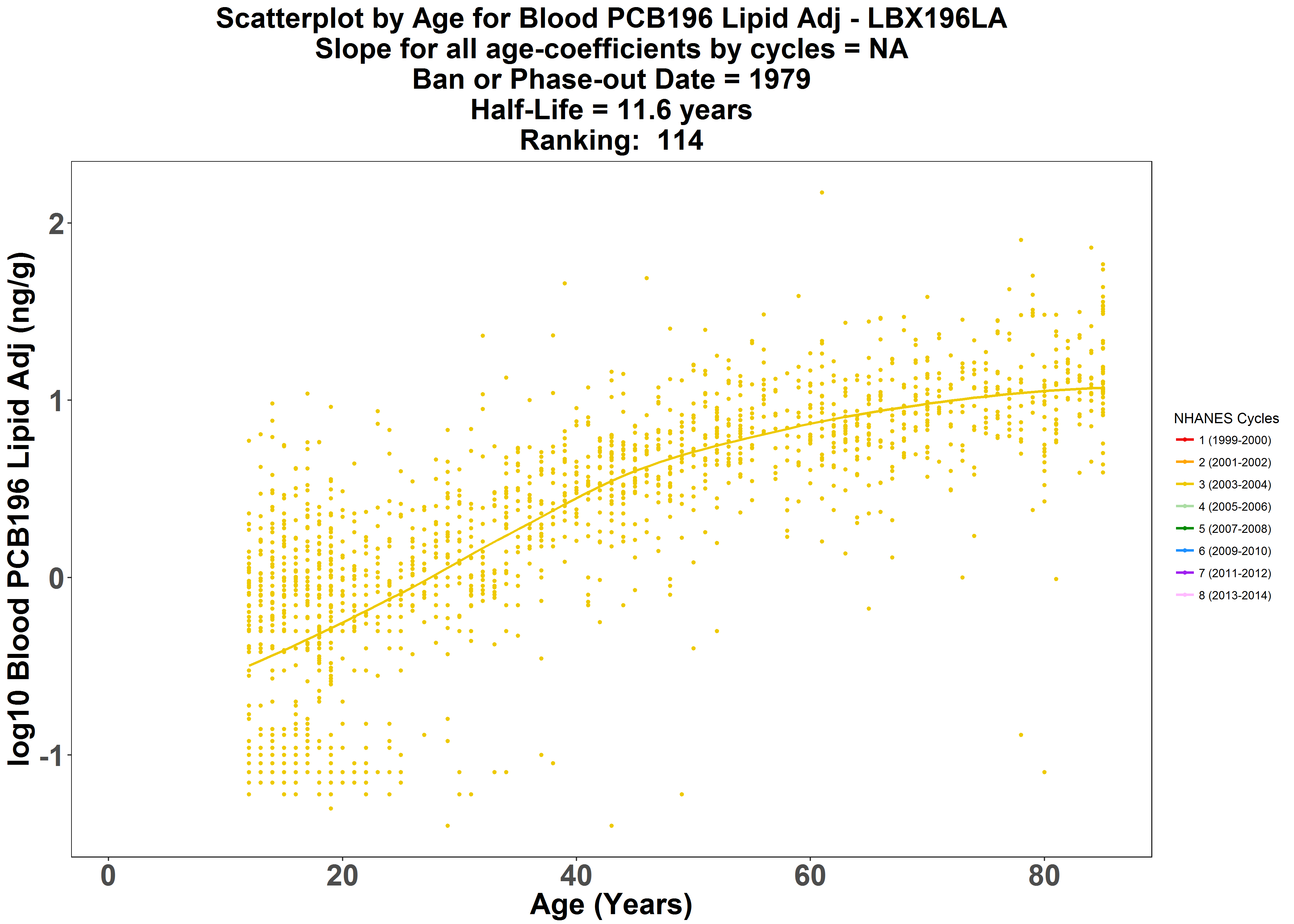
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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **LOD by NHANES Cycles** | | | | | | | |
| **Codename** | **Chemical Name** | **Cycle 1** | **Cycle 2** | **Cycle 3** | **Cycle 4** | **Cycle 5** | **Cycle 6** | **Cycle 7** | **Cycle 8** |
| LBXGLY | Glycideamide (pmoL/G Hb) |  |  | 4.00 | 0.66 |  |  |  |  |
| LBXACR | Acrylamide (pmoL/G Hb) |  |  | 3.00 | 0.11 |  |  |  |  |
| LBXBB1LA | 2,2',4,4',5,5'-hexabromobiphenyl lipid adj (ng/g) |  |  | 0.80 |  |  |  |  |  |
| LBXBR2LA | 2,4,4'-tribromodiphenyl ether lipid adj (ng/g) |  |  | 0.80 |  |  |  |  |  |
| LBXBR8LA | 2,2',4,4',5,6'-hexabromodiphenyl ether lipid adj (ng/g) |  |  | 0.80 |  |  |  |  |  |
| LBXBR6LA | 2,2',4,4',6-pentabromodiphenyl lipid adj (ng/g) |  |  | 1.40 |  |  |  |  |  |
| LBXBR3LA | 2,2',4,4'-tetrabromodiphenyl ether lipid ad (ng/g) |  |  | 4.20 |  |  |  |  |  |
| LBXBR5LA | 2,2',4,4',5-pentabromodiphenyl lipid adj (ng/g) |  |  | 5.00 |  |  |  |  |  |
| LBXBR7LA | 2,2',4,4',5,5'-hexabromodiphenyl ether lipid adj (ng/g) |  |  | 2.20 |  |  |  |  |  |
| LBXD03LA | 1,2,3,6,7,8-hxcdd Lipid Adj (pg/g) | 20.10 | 9.10 | 12.30 |  |  |  |  |  |
| LBXD07LA | 1,2,3,4,6,7,8,9-ocdd Lipid Adj (pg/g) | 329.00 | 319.00 | 218.00 |  |  |  |  |  |
| LBXD05LA | 1,2,3,4,6,7,8-hpcdd Lipid Adj (pg/g) | 55.90 | 10.30 | 13.00 |  |  |  |  |  |
| LBXF04LA | 1,2,3,4,7,8-hxcdf Lipid Adj (pg/g) | 12.70 | 6.50 | 7.40 |  |  |  |  |  |
| LBXF03LA | 2,3,4,7,8-pncdf Lipid Adj (pg/g) | 12.70 | 5.50 | 6.80 |  |  |  |  |  |
| LBXF08LA | 1,2,3,4,6,7,8-hpcdf Lipid Adj (pg/g) | 13.50 | 7.00 | 8.60 |  |  |  |  |  |
| SSMEL | Melamine (ng/mL) |  |  | 0.09 |  |  |  |  |  |
| SSCYA | Cyanuric acid (ng/mL) |  |  | 0.09 |  |  |  |  |  |
| LBXBPB | Lead (ug/dL) | 0.30 | 0.30 | 0.28 | 0.25 | 0.25 | 0.25 | 0.25 | 0.07 |
| LBXBCD | Cadmium (ug/L) | 0.30 | 0.30 | 0.14 | 0.20 | 0.20 | 0.20 | 0.16 | 0.10 |
| LBXTHG | Mercury, total (ug/L) | 0.14 | 0.14 | 0.20 | 0.33 | 0.33 | 0.33 | 0.16 | 0.28 |
| URXUHG | Mercury, urine (ng/mL) | 0.10 | 0.10 | 0.14 | 0.11 | 0.08 | 0.08 | 0.05 | 0.13 |
| URXUBA | Barium, urine (ng/mL) | 0.12 | 0.12 | 0.31 | 0.12 | 0.12 | 0.12 | 0.10 | 0.06 |
| URXUCO | Cobalt, urine (ng/mL) | 0.07 | 0.07 | 0.08 | 0.04 | 0.04 | 0.04 | 0.05 | 0.02 |
| URXUCS | Cesium, urine (ng/mL) | 0.14 | 0.14 | 0.20 | 0.07 | 0.07 | 0.07 | 0.12 | 0.09 |
| URXUMO | Molybdenum, urine (ng/mL) | 0.80 | 0.80 | 1.50 | 0.92 | 0.92 | 0.92 | 0.99 | 0.8 |
| URXUPB | Lead, urine (ng/mL) | 0.10 | 0.10 | 0.33 | 0.10 | 0.10 | 0.10 | 0.08 | 0.03 |
| URXUSB | Antimony, urine (ng/mL) | 0.04 | 0.04 | 0.07 | 0.03 | 0.03 | 0.03 | 0.04 | 0.02 |
| URXUTL | Thallium, urine (ng/mL) | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| URXUTU | Tungsten, urine (ng/mL) | 0.04 | 0.04 | 0.04 | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 |
| URXUUR | Uranium, urine (ng/mL) |  | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| URXUAS | Urinary total Arsenic (µg/L) |  |  | 0.74 | 0.74 | 0.74 | 0.74 | 1.25 | 0.26 |
| URXUAB | Urinary Arsenobetaine (µg/L) |  |  | 0.40 | 0.40 | 0.40 | 0.40 | 1.19 | 1.16 |
| URXUDMA | Urinary Dimethylarsonic acid (µg/L) |  |  | 1.70 | 1.70 | 1.70 | 1.70 | 1.80 | 1.91 |
| URXUCD | Cadmium, urine (ng/mL) | 0.06 | 0.06 | 0.06 | 0.04 | 0.04 | 0.04 | 0.06 | 0.04 |
| LBXBMN | Blood manganese (ug/L) |  |  |  |  |  |  | 1.06 | 0.99 |
| LBXSCU | Serum Copper (ug/dL) |  |  |  |  |  |  | 2.50 | 2.50 |
| LBXSZN | Serum Zinc (ug/dL) |  |  |  |  |  |  | 2.90 | 2.90 |
| LBXBGM | Mercury, methyl (ug/L) |  |  |  |  |  |  | 0.12 | 0.12 |
| URXTRS | Urinary Triclosan (ng/mL) |  |  | 2.30 | 2.30 | 2.30 | 2.30 | 2.30 | 1.70 |
| URXBPS | Urinary Bisphenol S (ug/L) |  |  |  |  |  |  |  | 0.10 |
| URXMPB | Methyl paraben (ng/ml) |  |  |  | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| URXPPB | Propyl paraben (ng/ml) |  |  |  | 0.20 | 0.20 | 0.20 | 0.20 | 0.10 |
| URXBPH | Urinary Bisphenol A (ng/mL) |  |  | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 | 0.20 |
| URXBPF | Urinary Bisphenol F (ug/L) |  |  |  |  |  |  |  | 0.20 |
| URXBP3 | Urinary Benzophenone-3 (ng/mL) |  |  | 0.30 | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 |
| LBXTNALA | Trans-nonachlor Lipid Adj (ng/g) | 14.50 | 10.50 | 7.80 |  |  |  |  |  |
| LBXOXYLA | Oxychlordane Lipid Adj (ng/g) | 14.50 | 10.50 | 7.80 |  |  |  |  |  |
| LBXPDELA | p,p'-DDE Lipid Adj (ng/g) | 18.60 | 8.30 | 7.80 |  |  |  |  |  |
| LBXDIELA | Dieldrin Lipid Adj (ng/g) |  | 10.50 | 7.80 |  |  |  |  |  |
| LBXBHCLA | Beta-hexachlorocyclohexane Lipid Adj (ng/g) | 9.36 | 6.76 | 7.80 |  |  |  |  |  |
| URXCPM | 3,5,6-trichloropyridinol (ug/L) | 0.40 | 0.40 |  |  | 0.10 | 0.10 |  |  |
| URXOP3 | Dimethylthiophosphate (ug/L) | 0.18 | 0.40 | 0.50 | 0.55 | 0.55 |  |  |  |
| URXOPM | 3-phenoxybenzoic acid (ug/L) | 0.10 | 0.10 |  |  | 0.10 | 0.10 |  |  |
| URX14D | 2,5-dichlorophenol (ug/L) |  |  | 0.12 | 0.20 | 0.20 | 0.20 | 0.20 | 0.10 |
| URXDCB | 2,4-dichlorophenol (ug/L) |  |  | 0.17 | 0.20 | 0.20 | 0.20 | 0.20 | 0.10 |
| URXPAR | Paranitrophenol (ug/L) | 0.80 | 0.10 |  |  | 0.10 | 0.10 |  |  |
| URX24D | 2,4-D (ug/L) | 0.95 | 0.20 | 0.10 |  | 0.40 | 0.15 |  |  |
| URXDEA | DEET acid (ug/L) |  |  |  |  | 0.93 | 0.48 | 0.48 | 0.48 |
| URXCNP | Mono(carboxynonyl) phthalate (ng/mL) |  |  |  | 0.60 | 0.50 | 0.20 | 0.20 | 0.20 |
| SSURHIBP | Mono-2-hydroxy-iso-butyl phthlte (ng/mL) |  |  |  |  |  |  |  | 0.40 |
| URXCOP | Mono(carboxyoctyl) phthalate (ng/mL) |  |  |  | 0.70 | 0.70 | 0.20 | 0.20 | 0.30 |
| URXMIB | Mono-isobutyl pthalate (ng/mL) |  | 1.00 | 0.30 | 0.30 | 0.30 | 0.20 | 0.20 | 0.80 |
| URXMHP | Mono-(2-ethyl)-hexyl phthalate (ng/mL) | 1.20 | 1.00 | 0.90 | 1.20 | 1.10 | 0.50 | 0.50 | 0.80 |
| URXMOH | Mono-(2-ethyl-5-oxohexyl) phthalate (ng/mL) |  | 1.10 | 0.50 | 0.70 | 0.60 | 0.20 | 0.20 | 0.20 |
| URXMZP | Mono-benzyl phthalate (ng/mL) | 0.58 | 0.22 | 0.07 | 0.22 | 0.22 | 0.22 | 0.30 | 0.30 |
| URXMHH | Mono-(2-ethyl-5-hydroxyhexyl) phthalate (ng/mL) |  | 1.00 | 0.30 | 0.70 | 0.70 | 0.20 | 0.20 | 0.40 |
| URXECP | Mono-2-ethyl-5-carboxypentyl phthalate (ng/mL) |  |  | 0.30 | 0.60 | 0.50 | 0.20 | 0.20 | 0.40 |
| URXMBP | Mono-n-butyl phthalate (ng/mL) | 0.90 | 1.10 | 0.40 | 0.60 | 0.60 | 0.40 | 0.40 | 0.40 |
| URXMEP | Mono-ethyl phthalate (ng/mL) | 0.79 | 0.59 | 0.26 | 0.53 | 0.46 | 0.40 | 0.60 | 1.20 |
| URXMNM | Mono-n-methyl phthalate (ng/mL) |  | 0.20 | 1.00 | 1.10 | 1.10 | 0.50 | 0.50 |  |
| SSURMHBP | Mono-3-hydroxy-n-butyl phthalate (ng/mL) |  |  |  |  |  |  |  | 0.40 |
| URXMC1 | Mono-(3-carboxypropyl) phthalate (ng/mL) |  | 0.40 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.40 |
| URXDMA | o-Desmethylangolensin (O-DMA) (ng/mL) | 0.20 | 0.40 | 0.20 | 0.20 | 0.20 | 0.20 |  |  |
| URXETL | Enterolactone (ng/mL) | 0.60 | 1.90 | 0.30 | 0.10 | 0.10 | 0.10 |  |  |
| URXETD | Enterodiol (ng/mL) | 0.80 | 1.50 | 0.30 | 0.04 | 0.04 | 0.04 |  |  |
| URXP05 | 3-phenanthrene (ng/L) |  | 3.60 | 5.00 | 5.00 | 5.00 | 10.00 | 10.00 |  |
| URXP06 | 1-phenanthrene (ng/L) |  | 3.50 | 5.00 | 5.00 | 5.00 | 10.00 | 10.00 | 9.00 |
| URXP07 | 2-phenanthrene (ng/L) |  | 3.20 | 5.00 | 5.00 | 5.00 | 10.00 | 10.00 |  |
| URXP19 | 4-phenanthrene (ng/L) |  |  | 5.00 | 5.00 |  |  | 10.00 |  |
| URXP25 | 2 & 3-Hydroxyphenanthrene (ng/L) |  |  |  |  |  |  |  | 10.00 |
| URXP10 | 1-pyrene (ng/L) |  | 3.30 | 5.00 | 5.00 | 5.00 | 10.00 | 10.00 | 70.00 |
| URXP01 | 1-napthol (ng/L) |  | 6.20 | 47.00 | 48.00 | 45.00 | 44.00 | 44.00 | 60.00 |
| URXP02 | 2-napthol (ng/L) |  | 2.40 | 31.00 | 13.00 | 42.00 | 42.00 | 42.00 | 90.00 |
| URXP17 | 9-fluorene (ng/L) |  |  | 5.00 | 5.00 | 5.00 | 10.00 | 10.00 |  |
| URXP03 | 3-fluorene (ng/L) |  | 2.00 | 5.00 | 5.00 | 5.00 | 10.00 | 10.00 | 8.00 |
| URXP04 | 2-fluorene (ng/L) |  | 3.60 | 5.00 | 5.00 | 5.00 | 10.00 | 10.00 | 8.00 |
| LBD199LA | PCB199 Lipid Adj (ng/g) |  | 10.50 | 0.40 |  |  |  |  |  |
| LBX180LA | PCB180 Lipid Adj (ng/g) | 28.20 | 10.50 | 0.40 |  |  |  |  |  |
| LBX209LA | PCB209 Lipid Adj (ng/g) |  |  | 0.70 |  |  |  |  |  |
| LBX146LA | PCB146 Lipid Adj (ng/g) | 12.40 | 10.50 | 0.40 |  |  |  |  |  |
| LBX170LA | PCB170 Lipid Adj (ng/g) | 17.20 | 10.50 | 0.40 |  |  |  |  |  |
| LBX194LA | PCB194 Lipid Adj (ng/g) |  | 10.50 | 0.40 |  |  |  |  |  |
| LBX187LA | PCB187 Lipid Adj (ng/g) | 12.40 | 10.50 | 0.40 |  |  |  |  |  |
| LBX153LA | PCB153 Lipid Adj (ng/g) | 55.60 | 10.50 | 1.10 |  |  |  |  |  |
| LBX196LA | PCB196 Lipid Adj (ng/g) |  | 10.50 | 0.40 |  |  |  |  |  |
| LBX138LA | PCB138 Lipid Adj (ng/g) | 41.10 | 10.50 | 0.40 |  |  |  |  |  |
| LBXHXCLA | 3,3',4,4',5,5'-hxcb Lipid Adj (pg/g) | 27.00 | 11.00 | 15.90 |  |  |  |  |  |
| LBX118LA | PCB118 Lipid Adj (ng/g) | 12.50 | 10.50 | 0.60 |  |  |  |  |  |
| LBX099LA | PCB99 Lipid Adj (ng/g) | 12.50 | 10.50 | 0.60 |  |  |  |  |  |
| LBXPCBLA | 3,3',4,4',5-pcnb Lipid Adj (pg/g) | 23.20 | 10.80 | 13.90 |  |  |  |  |  |
| LBX074LA | PCB74 Lipid Adj (ng/g) | 12.40 | 10.50 | 0.80 |  |  |  |  |  |
| LBX028LA | PCB28 Lipid Adj (ng/g) | 32.40 |  | 1.70 |  |  |  |  |  |
| LBX049LA | PCB49 Lipid Adj (ng/g) |  |  | 0.40 |  |  |  |  |  |
| LBX044LA | PCB44 Lipid Adj (ng/g) |  |  | 0.40 |  |  |  |  |  |
| LBXPFDE | Perfluorodecanoic acid (ng/mL) | 0.20 |  | 0.30 | 0.20 | 0.20 | 0.10 | 0.10 | 0.10 |
| LBXMPAH | 2-(N-methyl-PFOSA) acetate (ng/mL) | 0.17 |  | 0.52 | 0.17 | 0.17 | 0.09 | 0.09 | 0.10 |
| LBXPFNA | Perfluorononanoic acid (ng/mL) | 0.10 |  | 0.10 | 0.10 | 0.08 | 0.08 | 0.08 | 0.10 |
| LBXPFHS | Perfluorohexane sulfonic acid (ng/mL) | 0.10 |  | 0.30 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| LBXPFOA | Perfluorooctanoic acid (ng/mL) | 0.10 |  | 0.20 | 0.10 | 0.10 | 0.10 | 0.10 |  |
| LBXPFOS | Perfluorooctane sulfonic acid (ng/mL) | 0.20 |  | 0.40 | 0.20 | 0.20 | 0.20 | 0.20 |  |
| LBXCOT | Cotinine (ng/mL) | 0.05 | 0.05 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |  |
| URXNAL | NNAL , urine (ng/mL) |  |  |  |  | 1.00 | 0.60 | 0.60 |  |
| LBXVXY | Blood m-/p-Xylene (ng/ml) | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| LBXVDB | Blood 1,4-Dichlorobenzene (ng/ml) | 0.12 | 0.12 | 0.12 | 0.01 | 0.04 | 0.04 | 0.04 | 0.04 |
| LBXVBM | Blood Bromodichloromethane (pg/ml) | 13.60 | 0.23 | 0.62 | 0.62 | 0.62 |  |  | 6.00 |
| URXHEM | N-Ace-S-(2-Hydroxyethyl)-L-cys (ng/mL) |  |  |  |  |  |  | 0.60 |  |
| URXPHG | Phenylglyoxylic acid (ng/mL) |  |  |  |  |  |  | 12.00 |  |
| URXHP2 | N-Ace-S-(2-hydroxypropyl)-L-cys (ng/mL) |  |  |  |  |  |  | 1.30 |  |
| URXMB3 | N-A-S-(4-hydrxy-2butn-l-yl)-L-cys (ng/mL) |  |  |  |  |  |  | 0.60 |  |
| URX34M | 3-methipurc acd & 4-methipurc acd (ng/mL) |  |  |  |  |  |  | 8.00 |  |
| URXBMA | N-Acetyl-S-(benzyl)-L-cysteine (ng/mL) |  |  |  |  |  |  | 0.50 |  |
| URXBPM | N-Acetyl-S-(n-propyl)-L-cysteine (ng/mL) |  |  |  |  |  |  | 1.20 |  |
| URXGAM | N-ac-S-(2-carbmo-2-hydxel)-L-cys (ng/mL) |  |  |  |  |  |  | 9.40 |  |
| URXMAD | Mandelic acid (ng/mL) |  |  |  |  |  |  | 12.00 |  |
| URXAAM | N-Ace-S-(2-carbamoylethyl)-L-cys (ng/mL) |  |  |  |  |  |  | 2.20 |  |
| URXAMC | N-Ace-S-(N-methlcarbamoyl)-L-cys (ng/mL) |  |  |  |  |  |  | 5.50 |  |
| URXATC | 2-amnothiazolne-4-carbxylic acid (ng/mL) |  |  |  |  |  |  | 15.00 |  |
| URXCYM | N-acetyl-S-(2-cyanoethyl)-L-cys (ng/mL) |  |  |  |  |  |  | 0.50 |  |
| URXTTC | 2-thoxothazlidne-4-carbxylic acid (ng/mL) |  |  |  |  |  |  | 3.50 |  |
| URX2MH | 2-Methylhippuric acid (ng/mL) |  |  |  |  |  |  | 5.00 |  |
| URXPMM | N-A-S-(3-hydrxprpl-1-metl)-L-cys (ng/mL) |  |  |  |  |  |  | 2.00 |  |
| URXCEM | N-Acetyl-S-(2-Carbxyethyl)-L-Cys (ng/mL) |  |  |  |  |  |  | 8.00 |  |
| URXHPM | N-Ace-S-(3-Hydroxypropyl)-L-Cys (ng/mL) |  |  |  |  |  |  | 13.00 |  |
| URXDHB | N-Ace-S-(3,4-Dihidxybutl)-L-Cys (ng/mL) |  |  |  |  |  |  | 5.00 |  |
| LBXVTO | Blood Toluene (ng/ml) | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |  | 0.03 |
| LBXNM | Blood Nitromethane (pg/mL) |  |  |  |  | 0.32 |  |  |  |
| LBXVCF | Blood Chloroform (pg/ml) | 10.90 | 2.37 | 2.11 | 2.10 | 2.10 |  |  | 8.00 |
| URXSCN | Urinary thiocyanate (ng/mL) |  | 0.02 |  | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| URXUIO | Iodine, urine (ng/mL) |  | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2.40 |
| URXNO3 | Urinary nitrate (ng/mL) |  | 0.70 |  | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 |
| URXUP8 | Perchlorate, urine (ng/mL) |  | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| LBXGLY | Glycideamide (pmoL/G Hb) |  |  | 4.00 | 0.66 |  |  |  |  |

## **Table S5**. Indicator of excluded measurements by NHANES Cycles for chemical biomarkers.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Percentage of Participants below LOD by NHANES cycles** | | | | | | | |
| **Codename** | **Comment Name** | **Cycle 1** | **Cycle 2** | **Cycle 3** | **Cycle 4** | **Cycle 5** | **Cycle 6** | **Cycle 7** | **Cycle 8** |
| LBXD03 | 1,2,3,6,7,8-hxcdd (fg/g) | X |  |  |  |  |  |  |  |
| LBXD03LA | 1,2,3,6,7,8-hxcdd Lipid Adj (pg/g) | X |  |  |  |  |  |  |  |
| LBXD05 | 1,2,3,4,6,7,8-hpcdd (fg/g) | X |  |  |  |  |  |  |  |
| LBXD05LA | 1,2,3,4,6,7,8-hpcdd Lipid Adj (pg/g) | X |  |  |  |  |  |  |  |
| LBXD07 | 1,2,3,4,6,7,8,9-ocdd (fg/g) | X |  |  |  |  |  |  |  |
| LBXD07LA | 1,2,3,4,6,7,8,9-ocdd Lipid Adj (pg/g) | X |  |  |  |  |  |  |  |
| LBXF03 | 2,3,4,7,8-pncdf (fg/g) | X |  |  |  |  |  |  |  |
| LBXF03LA | 2,3,4,7,8-pncdf Lipid Adj (pg/g) | X |  |  |  |  |  |  |  |
| LBXF04 | 1,2,3,4,7,8-hxcdf (fg/g) | X |  |  |  |  |  |  |  |
| LBXF04LA | 1,2,3,4,7,8-hxcdf Lipid Adj (pg/g) | X |  |  |  |  |  |  |  |
| LBXF08 | 1,2,3,4,6,7,8-hpcdf (fg/g) | X |  |  |  |  |  |  |  |
| LBXF08LA | 1,2,3,4,6,7,8-hpcdf Lipid Adj (pg/g) | X |  |  |  |  |  |  |  |
| URXPAR | Paranitrophenol (ug/L) | X |  |  |  |  |  |  |  |
| LBXHXC | 3,3',4,4',5,5'-hxcb (fg/g) | X |  |  |  |  |  |  |  |
| LBXHXCLA | 3,3',4,4',5,5'-hxcb Lipid Adj (pg/g) | X |  |  |  |  |  |  |  |
| LBXPCB | 3,3',4,4',5-pcnb (pg/g) | X |  |  |  |  |  |  |  |
| LBXPCBLA | 3,3',4,4',5-pcnb Lipid Adj (pg/g) | X |  |  |  |  |  |  |  |
| LBX028 | PCB28 (ng/g) | X |  |  |  |  |  |  |  |
| LBX028LA | PCB28 Lipid Adj (ng/g) | X |  |  |  |  |  |  |  |
| LBD199 | PCB199 (ng/g) | X | X |  |  |  |  |  |  |
| LBD199LA | PCB199 Lipid Adj (ng/g) | X | X |  |  |  |  |  |  |
| LBX180 | PCB180 (ng/g) | X | X |  |  |  |  |  |  |
| LBX180LA | PCB180 Lipid Adj (ng/g) | X | X |  |  |  |  |  |  |
| LBX146 | PCB146 (ng/g) | X | X |  |  |  |  |  |  |
| LBX146LA | PCB146 Lipid Adj (ng/g) | X | X |  |  |  |  |  |  |
| LBX170 | PCB170 (ng/g) | X | X |  |  |  |  |  |  |
| LBX170LA | PCB170 Lipid Adj (ng/g) | X | X |  |  |  |  |  |  |
| LBX194 | PCB194 (ng/g) | X | X |  |  |  |  |  |  |
| LBX194LA | PCB194 Lipid Adj (ng/g) | X | X |  |  |  |  |  |  |
| LBX187 | PCB187 (ng/g) | X | X |  |  |  |  |  |  |
| LBX187LA | PCB187 Lipid Adj (ng/g) | X | X |  |  |  |  |  |  |
| LBX153 | PCB153 (ng/g) | X | X |  |  |  |  |  |  |
| LBX153LA | PCB153 Lipid Adj (ng/g) | X | X |  |  |  |  |  |  |
| LBX196 | PCB196 (ng/g) | X | X |  |  |  |  |  |  |
| LBX196LA | PCB196 Lipid Adj (ng/g) | X | X |  |  |  |  |  |  |
| LBX138 | PCB138 (ng/g) | X | X |  |  |  |  |  |  |
| LBX138LA | PCB138 Lipid Adj (ng/g) | X | X |  |  |  |  |  |  |
| LBX118 | PCB118 (ng/g) | X | X |  |  |  |  |  |  |
| LBX118LA | PCB118 Lipid Adj (ng/g) | X | X |  |  |  |  |  |  |
| LBX099 | PCB99 (ng/g) | X | X |  |  |  |  |  |  |
| LBX099LA | PCB99 Lipid Adj (ng/g) | X | X |  |  |  |  |  |  |
| LBX074 | PCB74 (ng/g) | X | X |  |  |  |  |  |  |
| LBX074LA | PCB74 Lipid Adj (ng/g) | X | X |  |  |  |  |  |  |
| LBXMPAH | 2-(N-methyl-PFOSA) acetate (ng/mL) |  |  | X |  |  |  |  |  |
| URX24D | 2,4-D (ug/L) | X |  |  |  | X |  |  |  |
| URXP10 | 1-pyrene (ng/L) |  |  |  |  |  |  |  | X |
| URXPAR | Paranitrophenol (ug/L) | X |  |  |  |  |  |  |  |



## **Figure S1.** PCB 196 concentrations across the life-stages stratified by NHANEs cycles for Cycle 2 and 3.



## **Figure S2.** PCB 196 concentrations across the life-stages stratified for only Cycle 3.

## **Table S6**. , calculated , and calculated fold difference when = 5 years and = 31.88 years for all chemical biomarkers, which are ranked by the fold difference of chemical biomarker levels between a child of 5 years and an adult of 31.88 years () in descending order.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Codename** | **Chemical Name** |  |  | **schildren** | **Fold Difference ()** |
| URXMZP | Mono-benzyl phthalate (ng/mL) | -9.67E-03 | 2.14E-04 | 0.415 | 2.598 |
| URXDMA | o-Desmethylangolensin (O-DMA) (ng/mL) | -7.51E-03 | 1.88E-04 | 0.338 | 2.176 |
| URXMC1 | Mono-(3-carboxypropyl) phthalate (ng/mL) | -7.14E-03 | 2.01E-04 | 0.337 | 2.173 |
| URXATC | 2-amnothiazolne-4-carbxylic acid (ng/mL) | -6.48E-03 | 1.90E-04 | 0.312 | 2.049 |
| URXUTU | Tungsten, urine (ng/mL) | -6.89E-03 | 1.48E-04 | 0.292 | 1.960 |
| URXCPM | 3,5,6-trichloropyridinol (ug/L) | -4.71E-03 | 2.24E-04 | 0.288 | 1.942 |
| SSURHIBP | Mono-2-hydroxy-iso-butyl phthlte (ng/mL) | -6.28E-03 | 1.61E-04 | 0.285 | 1.927 |
| URXMBP | Mono-n-butyl phthalate (ng/mL) | -5.43E-03 | 1.79E-04 | 0.275 | 1.884 |
| LBXBR7LA | 2,2',4,4',5,5'-hexabromodiphenyl ether lipid adj (ng/g) | -6.59E-03 | 1.21E-04 | 0.264 | 1.839 |
| URXDEA | DEET acid (ug/L) | -6.42E-03 | 1.20E-04 | 0.260 | 1.818 |
| URXMOH | Mono-(2-ethyl-5-oxohexyl) phthalate (ng/mL) | -5.64E-03 | 1.44E-04 | 0.256 | 1.803 |
| URXECP | Mono-2-ethyl-5-carboxypentyl phthalate (ng/mL) | -5.21E-03 | 1.46E-04 | 0.245 | 1.760 |
| SSURMHBP | Mono-3-hydroxy-n-butyl phthalate (ng/mL) | -4.18E-03 | 1.71E-04 | 0.236 | 1.721 |
| URXUMO | Molybdenum, urine (ng/mL) | -4.68E-03 | 1.41E-04 | 0.228 | 1.689 |
| URXMHH | Mono-(2-ethyl-5-hydroxyhexyl) phthalate (ng/mL) | -4.89E-03 | 1.19E-04 | 0.217 | 1.650 |
| URXPAR | Paranitrophenol (ug/L) | -3.35E-03 | 1.70E-04 | 0.213 | 1.632 |
| LBXBR5LA | 2,2',4,4',5-pentabromodiphenyl lipid adj (ng/g) | -4.92E-03 | 1.05E-04 | 0.208 | 1.614 |
| URXUIO | Iodine, urine (ng/mL) | -2.79E-03 | 1.76E-04 | 0.202 | 1.594 |
| URXOP3 | Dimethylthiophosphate (ug/L) | -2.70E-03 | 1.76E-04 | 0.200 | 1.584 |
| LBXBR3LA | 2,2',4,4'-tetrabromodiphenyl ether lipid ad (ng/g) | -4.67E-03 | 9.96E-05 | 0.197 | 1.576 |
| URXCOP | Mono(carboxyoctyl) phthalate (ng/mL) | -5.01E-03 | 8.47E-05 | 0.196 | 1.570 |
| URXMNM | Mono-n-methyl phthalate (ng/mL) | -3.65E-03 | 1.32E-04 | 0.194 | 1.562 |
| URXMIB | Mono-isobutyl pthalate (ng/mL) | -4.58E-03 | 9.55E-05 | 0.192 | 1.556 |
| LBXPFHS | Perfluorohexane sulfonic acid (ng/mL) | -3.01E-03 | 1.40E-04 | 0.182 | 1.520 |
| LBXMPAH | 2-(N-methyl-PFOSA) acetate (ng/mL) | -2.65E-03 | 1.49E-04 | 0.179 | 1.510 |
| URXCNP | Mono(carboxynonyl) phthalate (ng/mL) | -3.93E-03 | 9.99E-05 | 0.178 | 1.506 |
| URXUCO | Cobalt, urine (ng/mL) | -3.64E-03 | 1.02E-04 | 0.172 | 1.485 |
| LBXBR6LA | 2,2',4,4',6-pentabromodiphenyl lipid adj (ng/g) | -4.17E-03 | 7.85E-05 | 0.169 | 1.475 |
| URXHEM | N-Ace-S-(2-Hydroxyethyl)-L-cys (ng/mL) | -4.59E-03 | 5.97E-05 | 0.166 | 1.467 |
| URXUP8 | Perchlorate, urine (ng/mL) | -2.74E-03 | 1.09E-04 | 0.153 | 1.421 |
| URXETL | Enterolactone (ng/mL) | -1.80E-03 | 1.39E-04 | 0.149 | 1.409 |
| URXP10 | 1-pyrene (ng/L) | -4.12E-03 | 2.88E-05 | 0.131 | 1.354 |
| LBXBR8LA | 2,2',4,4',5,6'-hexabromodiphenyl ether lipid adj (ng/g) | -2.94E-03 | 7.24E-05 | 0.131 | 1.353 |
| LBX049LA | PCB49 Lipid Adj (ng/g) | -3.12E-03 | 6.07E-05 | 0.128 | 1.342 |
| URXBPH | Urinary Bisphenol A (ng/mL) | -2.88E-03 | 6.60E-05 | 0.125 | 1.334 |
| URXTTC | 2-thoxothazlidne-4-carbxylic acid (ng/mL) | -2.31E-03 | 8.27E-05 | 0.122 | 1.324 |
| LBX044LA | PCB44 Lipid Adj (ng/g) | -2.84E-03 | 5.97E-05 | 0.119 | 1.317 |
| URXUBA | Barium, urine (ng/mL) | -3.42E-03 | 3.60E-05 | 0.118 | 1.312 |
| URXUSB | Antimony, urine (ng/mL) | -2.67E-03 | 6.28E-05 | 0.117 | 1.310 |
| URXDHB | N-Ace-S-(3,4-Dihidxybutl)-L-Cys (ng/mL) | -1.27E-03 | 1.12E-04 | 0.115 | 1.304 |
| URXNAL | NNAL , urine (ng/mL) | -2.24E-03 | 7.03E-05 | 0.111 | 1.291 |
| LBXF08LA | 1,2,3,4,6,7,8-hpcdf Lipid Adj (pg/g) | -2.15E-03 | 7.07E-05 | 0.109 | 1.284 |
| URX14D | 2,5-dichlorophenol (ug/L) | -4.78E-04 | 1.31E-04 | 0.107 | 1.281 |
| URXOPM | 3-phenoxybenzoic acid (ug/L) | -1.74E-03 | 6.93E-05 | 0.097 | 1.250 |
| URXDCB | 2,4-dichlorophenol (ug/L) | -7.03E-04 | 1.04E-04 | 0.094 | 1.242 |
| URXNO3 | Urinary nitrate (ng/mL) | -2.66E-03 | 2.96E-05 | 0.093 | 1.238 |
| URX24D | 2,4-D (ug/L) | -1.22E-03 | 7.55E-05 | 0.087 | 1.222 |
| LBX028LA | PCB28 Lipid Adj (ng/g) | -1.10E-03 | 7.63E-05 | 0.085 | 1.215 |
| LBXGLY | Glycideamide (pmoL/G Hb) | -2.61E-03 | 1.53E-05 | 0.081 | 1.206 |
| URXUUR | Uranium, urine (ng/mL) | -9.01E-04 | 7.21E-05 | 0.076 | 1.192 |
| URXUTL | Thallium, urine (ng/mL) | -1.83E-03 | 2.40E-05 | 0.067 | 1.166 |
| URXBMA | N-Acetyl-S-(benzyl)-L-cysteine (ng/mL) | -3.74E-04 | 7.75E-05 | 0.066 | 1.164 |
| URXP05 | 3-phenanthrene (ng/L) | -9.75E-04 | 5.23E-05 | 0.064 | 1.159 |
| LBXVDB | Blood 1,4-Dichlorobenzene (ng/ml) | -3.98E-04 | 4.82E-05 | 0.046 | 1.111 |
| LBXBR2LA | 2,4,4'-tribromodiphenyl ether lipid adj (ng/g) | -4.72E-04 | 4.37E-05 | 0.044 | 1.107 |
| URXUCS | Cesium, urine (ng/mL) | -3.65E-04 | 4.58E-05 | 0.043 | 1.104 |
| URXAAM | N-Ace-S-(2-carbamoylethyl)-L-cys (ng/mL) | -1.08E-03 | 1.74E-05 | 0.042 | 1.100 |
| URXMHP | Mono-(2-ethyl)-hexyl phthalate (ng/mL) | -2.18E-03 | -2.45E-05 | 0.041 | 1.099 |
| URXETD | Enterodiol (ng/mL) | -3.72E-04 | 4.14E-05 | 0.040 | 1.096 |
| URXUPB | Lead, urine (ng/mL) | 1.51E-03 | 1.10E-04 | 0.039 | 1.095 |
| LBXPFOA | Perfluorooctanoic acid (ng/mL) | -5.80E-05 | 2.97E-05 | 0.023 | 1.054 |
| URX34M | 3-methipurc acd & 4-methipurc acd (ng/mL) | 7.96E-04 | 5.81E-05 | 0.021 | 1.049 |
| URXBPF | Urinary Bisphenol F (ug/L) | -1.08E-04 | 2.16E-05 | 0.019 | 1.044 |
| SSCYA | Cyanuric acid (ng/mL) | 8.50E-04 | 5.46E-05 | 0.017 | 1.039 |
| LBXBMN | Blood manganese (ug/L) | -8.32E-04 | -9.03E-06 | 0.016 | 1.037 |
| LBXVCF | Blood Chloroform (pg/ml) | -3.96E-04 | 5.94E-06 | 0.015 | 1.035 |
| URXPHG | Phenylglyoxylic acid (ng/mL) | 5.81E-04 | 4.01E-05 | 0.013 | 1.031 |
| LBXACR | Acrylamide (pmoL/G Hb) | -7.18E-04 | -1.19E-05 | 0.011 | 1.025 |
| LBXSCU | Serum Copper (ug/dL) | 1.19E-04 | 7.37E-06 | 0.002 | 1.005 |
| LBXSZN | Serum Zinc (ug/dL) | -7.65E-05 | -1.16E-06 | 0.001 | 1.003 |
| URXP03 | 3-fluorene (ng/L) | -1.19E-04 | -1.11E-05 | -0.005 | 0.989 |
| URXSCN | Urinary thiocyanate (ng/mL) | -1.09E-03 | -6.86E-05 | -0.020 | 0.955 |
| URXP19 | 4-phenanthrene (ng/L) | 5.15E-04 | -1.63E-05 | -0.026 | 0.943 |
| URXUDMA | Urinary Dimethylarsonic acid (µg/L) | 1.26E-03 | 8.43E-06 | -0.028 | 0.938 |
| URXP06 | 1-phenanthrene (ng/L) | 1.11E-03 | -7.23E-06 | -0.035 | 0.922 |
| LBXBPB | Lead (ug/dL) | 3.89E-03 | 8.72E-05 | -0.042 | 0.909 |
| URXCEM | N-Acetyl-S-(2-Carbxyethyl)-L-Cys (ng/mL) | 3.01E-03 | 5.26E-05 | -0.043 | 0.906 |
| SSMEL | Melamine (ng/mL) | 3.01E-03 | 3.89E-05 | -0.053 | 0.886 |
| LBXNM | Blood Nitromethane (pg/mL) | 1.93E-03 | -2.03E-06 | -0.053 | 0.885 |
| LBXPFOS | Perfluorooctane sulfonic acid (ng/mL) | 2.89E-03 | 3.27E-05 | -0.054 | 0.883 |
| URXP04 | 2-fluorene (ng/L) | 1.40E-03 | -2.36E-05 | -0.055 | 0.882 |
| URXBPS | Urinary Bisphenol S (ug/L) | 2.08E-03 | -2.58E-06 | -0.058 | 0.875 |
| URXPMM | N-A-S-(3-hydrxprpl-1-metl)-L-cys (ng/mL) | 2.85E-03 | 2.23E-05 | -0.060 | 0.870 |
| URX2MH | 2-Methylhippuric acid (ng/mL) | 1.60E-03 | -2.60E-05 | -0.062 | 0.867 |
| LBXVXY | Blood m-/p-Xylene (ng/ml) | 1.52E-03 | -3.36E-05 | -0.065 | 0.861 |
| LBXVBM | Blood Bromodichloromethane (pg/ml) | 1.23E-03 | -4.78E-05 | -0.068 | 0.856 |
| URXP02 | 2-napthol (ng/L) | 1.54E-03 | -4.08E-05 | -0.071 | 0.849 |
| LBXPFNA | Perfluorononanoic acid (ng/mL) | 2.27E-03 | -2.83E-05 | -0.081 | 0.829 |
| URXP01 | 1-napthol (ng/L) | 4.09E-03 | 3.82E-05 | -0.082 | 0.827 |
| URXP25 | 2 & 3-Hydroxyphenanthrene (ng/L) | 1.53E-03 | -5.82E-05 | -0.083 | 0.826 |
| URXBP3 | Urinary Benzophenone-3 (ng/mL) | -6.64E-04 | -1.50E-04 | -0.091 | 0.811 |
| LBXVTO | Blood Toluene (ng/ml) | 2.57E-03 | -3.24E-05 | -0.092 | 0.808 |
| URXP17 | 9-fluorene (ng/L) | 2.86E-03 | -2.95E-05 | -0.098 | 0.797 |
| URXUAS | Urinary total Arsenic (µg/L) | 3.37E-03 | -1.06E-05 | -0.098 | 0.797 |
| URXP07 | 2-phenanthrene (ng/L) | 2.59E-03 | -5.18E-05 | -0.107 | 0.782 |
| LBXPFDE | Perfluorodecanoic acid (ng/mL) | 3.45E-03 | -5.77E-05 | -0.135 | 0.734 |
| LBXF04LA | 1,2,3,4,7,8-hxcdf Lipid Adj (pg/g) | 5.84E-03 | 2.91E-05 | -0.136 | 0.731 |
| URXGAM | N-ac-S-(2-carbmo-2-hydxel)-L-cys (ng/mL) | 3.27E-03 | -7.50E-05 | -0.142 | 0.721 |
| URXCYM | N-acetyl-S-(2-cyanoethyl)-L-cys (ng/mL) | 3.68E-03 | -7.80E-05 | -0.155 | 0.700 |
| URXTRS | Urinary Triclosan (ng/mL) | 2.96E-03 | -1.16E-04 | -0.163 | 0.686 |
| URXMAD | Mandelic acid (ng/mL) | 4.00E-03 | -8.60E-05 | -0.170 | 0.676 |
| URXMPB | Methyl paraben (ng/ml) | 4.50E-03 | -7.57E-05 | -0.176 | 0.667 |
| URXHPM | N-Ace-S-(3-Hydroxypropyl)-L-Cys (ng/mL) | 4.78E-03 | -7.39E-05 | -0.182 | 0.658 |
| LBXDIELA | Dieldrin Lipid Adj (ng/g) | 6.70E-03 | -1.99E-05 | -0.195 | 0.639 |
| URXMEP | Mono-ethyl phthalate (ng/mL) | 4.95E-03 | -8.60E-05 | -0.195 | 0.638 |
| LBXF03LA | 2,3,4,7,8-pncdf Lipid Adj (pg/g) | 8.48E-03 | 4.00E-05 | -0.199 | 0.632 |
| URXUHG | Mercury, urine (ng/mL) | 4.61E-03 | -1.09E-04 | -0.202 | 0.627 |
| URXAMC | N-Ace-S-(N-methlcarbamoyl)-L-cys (ng/mL) | 6.61E-03 | -6.21E-05 | -0.222 | 0.599 |
| LBXBCD | Cadmium (ug/L) | 7.31E-03 | -4.97E-05 | -0.232 | 0.586 |
| URXPPB | Propyl paraben (ng/ml) | 4.92E-03 | -1.41E-04 | -0.234 | 0.584 |
| URXBPM | N-Acetyl-S-(n-propyl)-L-cysteine (ng/mL) | 5.23E-03 | -1.63E-04 | -0.259 | 0.551 |
| LBX099LA | PCB99 Lipid Adj (ng/g) | 1.00E-02 | 1.22E-05 | -0.260 | 0.550 |
| URXMB3 | N-A-S-(4-hydrxy-2butn-l-yl)-L-cys (ng/mL) | 7.49E-03 | -8.33E-05 | -0.262 | 0.548 |
| LBXPCBLA | 3,3',4,4',5-pcnb Lipid Adj (pg/g) | 1.01E-02 | -4.80E-06 | -0.276 | 0.530 |
| URXUAB | Urinary Arsenobetaine (µg/L) | 7.96E-03 | -9.59E-05 | -0.283 | 0.521 |
| LBX118LA | PCB118 Lipid Adj (ng/g) | 1.19E-02 | 4.10E-05 | -0.290 | 0.513 |
| LBXD05LA | 1,2,3,4,6,7,8-hpcdd Lipid Adj (pg/g) | 9.44E-03 | -5.05E-05 | -0.290 | 0.513 |
| LBX074LA | PCB74 Lipid Adj (ng/g) | 1.25E-02 | 6.26E-05 | -0.290 | 0.512 |
| URXHP2 | N-Ace-S-(2-hydroxypropyl)-L-cys (ng/mL) | 7.77E-03 | -1.52E-04 | -0.318 | 0.480 |
| LBXTHG | Mercury, total (ug/L) | 8.76E-03 | -1.83E-04 | -0.368 | 0.429 |
| LBXD07LA | 1,2,3,4,6,7,8,9-ocdd Lipid Adj (pg/g) | 1.19E-02 | -6.70E-05 | -0.369 | 0.428 |
| LBXOXYLA | Oxychlordane Lipid Adj (ng/g) | 1.41E-02 | 1.02E-05 | -0.370 | 0.426 |
| LBXHXCLA | 3,3',4,4',5,5'-hxcb Lipid Adj (pg/g) | 1.40E-02 | 3.19E-06 | -0.373 | 0.423 |
| LBX209LA | PCB209 Lipid Adj (ng/g) | 1.80E-02 | 1.16E-04 | -0.400 | 0.398 |
| LBXBHCLA | Beta-hexachlorocyclohexane Lipid Adj (ng/g) | 1.53E-02 | 8.75E-06 | -0.405 | 0.394 |
| URXUCD | Cadmium, urine (ng/mL) | 1.44E-02 | -9.23E-05 | -0.452 | 0.353 |
| LBXBGM | Mercury, methyl (ug/L) | 1.10E-02 | -2.23E-04 | -0.457 | 0.349 |
| LBXD03LA | 1,2,3,6,7,8-hxcdd Lipid Adj (pg/g) | 1.62E-02 | -5.10E-05 | -0.471 | 0.338 |
| LBXTNALA | Trans-nonachlor Lipid Adj (ng/g) | 1.75E-02 | -5.37E-05 | -0.508 | 0.310 |
| LBXPDELA | p,p'-DDE Lipid Adj (ng/g) | 1.84E-02 | -1.19E-04 | -0.580 | 0.263 |
| LBX138LA | PCB138 Lipid Adj (ng/g) | 1.98E-02 | -1.11E-04 | -0.613 | 0.244 |
| LBX153LA | PCB153 Lipid Adj (ng/g) | 2.15E-02 | -1.28E-04 | -0.670 | 0.214 |
| LBX146LA | PCB146 Lipid Adj (ng/g) | 2.26E-02 | -1.31E-04 | -0.703 | 0.198 |
| LBXBB1LA | 2,2',4,4',5,5'-hexabromobiphenyl lipid adj (ng/g) | 2.10E-02 | -2.71E-04 | -0.761 | 0.174 |
| LBX187LA | PCB187 Lipid Adj (ng/g) | 2.60E-02 | -1.88E-04 | -0.836 | 0.146 |
| LBX180LA | PCB180 Lipid Adj (ng/g) | 2.79E-02 | -2.21E-04 | -0.908 | 0.124 |
| LBX170LA | PCB170 Lipid Adj (ng/g) | 2.84E-02 | -2.52E-04 | -0.946 | 0.113 |
| LBX196LA | PCB196 Lipid Adj (ng/g) | 3.07E-02 | -2.68E-04 | -1.020 | 0.096 |
| LBXCOT | Cotinine (ng/mL) | 1.61E-02 | -8.17E-04 | -1.024 | 0.095 |
| LBD199LA | PCB199 Lipid Adj (ng/g) | 3.34E-02 | -2.61E-04 | -1.086 | 0.082 |
| LBX194LA | PCB194 Lipid Adj (ng/g) | 3.67E-02 | -3.34E-04 | -1.228 | 0.059 |

## **Table S7**. Corresponding NHANES codename, CAS NO., and chemical classification for each chemical biomarker.

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| --- | --- | --- | --- | --- |
| **Codename** | **Chemical Name** | **CAS NO.** | **Chemical Class** | **Chemical Class Shortened** |
| LBXGLY | Glycideamide (pmoL/G Hb) | 5694-00-8 | Acrylamide | Acrylamide |
| LBXACR | Acrylamide (pmoL/G Hb) | 79-06-1 | Acrylamide | Acrylamide |
| LBXBB1LA | 2,2',4,4',5,5'-hexabromobiphenyl lipid adj (ng/g) | 59080-40-9 | Brominated Flame Retardants (BFR) | BFRs |
| LBXBR2LA | 2,4,4'-tribromodiphenyl ether lipid adj (ng/g) | 41318-75-6 | Brominated Flame Retardants (BFR) | BFRs |
| LBXBR8LA | 2,2',4,4',5,6'-hexabromodiphenyl ether lipid adj (ng/g) | 207122-15-4 | Brominated Flame Retardants (BFR) | BFRs |
| LBXBR6LA | 2,2',4,4',6-pentabromodiphenyl lipid adj (ng/g) | 189084-64-8 | Brominated Flame Retardants (BFR) | BFRs |
| LBXBR3LA | 2,2',4,4'-tetrabromodiphenyl ether lipid ad (ng/g) | 5436-43-1 | Brominated Flame Retardants (BFR) | BFRs |
| LBXBR5LA | 2,2',4,4',5-pentabromodiphenyl lipid adj (ng/g) | 60348-60-9 | Brominated Flame Retardants (BFR) | BFRs |
| LBXBR7LA | 2,2',4,4',5,5'-hexabromodiphenyl lipid adj (ng/g) | 68631-49-2 | Brominated Flame Retardants (BFR) | BFRs |
| LBXD03LA | 1,2,3,6,7,8-hxcdd Lipid Adj (pg/g) | 57653-85-7 | Dioxins | Dioxins |
| LBXD07LA | 1,2,3,4,6,7,8,9-ocdd Lipid Adj (pg/g) | 3268-87-9 | Dioxins | Dioxins |
| LBXD05LA | 1,2,3,4,6,7,8-hpcdd Lipid Adj (pg/g) | 35822-46-9 | Dioxins | Dioxins |
| LBXF04LA | 1,2,3,4,7,8-hxcdf Lipid Adj (pg/g) | 70648-26-9 | Furans | Furans |
| LBXF03LA | 2,3,4,7,8-pncdf Lipid Adj (pg/g) | 57117-31-4 | Furans | Furans |
| LBXF08LA | 1,2,3,4,6,7,8-hpcdf Lipid Adj (pg/g) | 67562-39-4 | Furans | Furans |
| SSMEL | Melamine (ng/mL) | 108-78-1 | Melamine | Melamine |
| SSCYA | Cyanuric acid (ng/mL) | 108-80-5 | Melamine | Melamine |
| LBXBPB | Lead (ug/dL) | 7439-92-1 | Metals | Metals |
| LBXBCD | Cadmium (ug/L) | 7440-43-9 | Metals | Metals |
| LBXTHG | Mercury, total (ug/L) | 7439-97-6 | Metals | Metals |
| URXUHG | Mercury, urine (ng/mL) | 7439-97-6 | Metals | Metals |
| URXUBA | Barium, urine (ng/mL) | 7440-39-3 | Metals | Metals |
| URXUCO | Cobalt, urine (ng/mL) | 7440-48-4 | Metals | Metals |
| URXUCS | Cesium, urine (ng/mL) | 7440-46-2 | Metals | Metals |
| URXUMO | Molybdenum, urine (ng/mL) | 7439-98-7 | Metals | Metals |
| URXUPB | Lead, urine (ng/mL) | 7439-92-1 | Metals | Metals |
| URXUSB | Antimony, urine (ng/mL) | 7440-36-0 | Metals | Metals |
| URXUTL | Thallium, urine (ng/mL) | 7440-28-0 | Metals | Metals |
| URXUTU | Tungsten, urine (ng/mL) | 7440-33-7 | Metals | Metals |
| URXUUR | Uranium, urine (ng/mL) | 7440-61-1 | Metals | Metals |
| URXUAS | Urinary total Arsenic (µg/L) | 7440-38-2 | Metals | Metals |
| URXUAB | Urinary Arsenobetaine (µg/L) | 64436-13-1 | Metals | Metals |
| URXUDMA | Urinary Dimethylarsonic acid (µg/L) | 75-60-5 | Metals | Metals |
| URXUCD | Cadmium, urine (ng/mL) | 7440-43-9 | Metals | Metals |
| LBXBMN | Blood manganese (ug/L) | 7439-96-5 | Metals | Metals |
| LBXSCU | Serum Copper (ug/dL) | 7440-50-8 | Metals | Metals |
| LBXSZN | Serum Zinc (ug/dL) | 7440-66-6 | Metals | Metals |
| LBXBGM | Mercury, methyl (ug/L) | 22967-92-6 | Metals | Metals |
| URXSCN | Urinary thiocyanate (ng/mL) | 302-04-5 | Other | Other |
| URXUIO | Iodine, urine (ng/mL) | 7553-56-2 | Other | Other |
| URXNO3 | Urinary nitrate (ng/mL) | 14797-55-8 | Other | Other |
| URXUP8 | Perchlorate, urine (ng/mL) | 14797-73-0 | Other | Other |
| URXTRS | Urinary Triclosan (ng/mL) | 3380-34-5 | Personal Care & Consumer Product Compounds | PCCPCs |
| URXBPS | Urinary Bisphenol S (ug/L) | ‎80-09-1 | Personal Care & Consumer Product Compounds | PCCPCs |
| URXMPB | Methyl paraben (ng/ml) | 99-76-3 | Personal Care & Consumer Product Compounds | PCCPCs |
| URXPPB | Propyl paraben (ng/ml) | 94-13-3 | Personal Care & Consumer Product Compounds | PCCPCs |
| URXBPH | Urinary Bisphenol A (ng/mL) | 80-05-7 | Personal Care & Consumer Product Compounds | PCCPCs |
| URXBPF | Urinary Bisphenol F (ug/L) | 620-92-8 | Personal Care & Consumer Product Compounds | PCCPCs |
| URXBP3 | Urinary Benzophenone-3 (ng/mL) | 131-57-7 | Personal Care & Consumer Product Compounds | PCCPCs |
| LBXTNALA | Trans-nonachlor Lipid Adj (ng/g) | 39765-80-5 | Pesticides | Pesticides |
| LBXOXYLA | Oxychlordane Lipid Adj (ng/g) | 27304-13-8 | Pesticides | Pesticides |
| LBXPDELA | p,p'-DDE Lipid Adj (ng/g) | 72-55-9 | Pesticides | Pesticides |
| LBXDIELA | Dieldrin Lipid Adj (ng/g) | 60-57-1 | Pesticides | Pesticides |
| LBXBHCLA | Beta-hexachlorocyclohexane Lipid Adj (ng/g) | 319-85-7 | Pesticides | Pesticides |
| URXCPM | 3,5,6-trichloropyridinol (ug/L) | 6515-38-4 | Pesticides | Pesticides |
| URXOP3 | Dimethylthiophosphate (ug/L) | 1112-38-5 | Pesticides | Pesticides |
| URXOPM | 3-phenoxybenzoic acid (ug/L) | 3739-38-6 | Pesticides | Pesticides |
| URX14D | 2,5-dichlorophenol (ug/L) | 583-78-8 | Pesticides | Pesticides |
| URXDCB | 2,4-dichlorophenol (ug/L) | 120-83-2 | Pesticides | Pesticides |
| URXPAR | Paranitrophenol (ug/L) | 100-02-7 | Pesticides | Pesticides |
| URX24D | 2,4-D (ug/L) | 94-75-7 | Pesticides | Pesticides |
| URXDEA | DEET acid (ug/L) | 72236-23-8 | Pesticides | Pesticides |
| URXCNP | Mono(carboxynonyl) phthalate (ng/mL) | 26761-40-0 | Phthalates | Phthalates |
| SSURHIBP | Mono-2-hydroxy-iso-butyl phthlte (ng/mL) | 64339-39-5 | Phthalates | Phthalates |
| URXCOP | Mono(carboxyoctyl) phthalate (ng/mL) | 898544-09-7 | Phthalates | Phthalates |
| URXMIB | Mono-isobutyl pthalate (ng/mL) | 30833-53-5 | Phthalates | Phthalates |
| URXMHP | Mono-(2-ethyl)-hexyl phthalate (ng/mL) | 4376-20-9 | Phthalates | Phthalates |
| URXMOH | Mono-(2-ethyl-5-oxohexyl) phthalate (ng/mL) | 40321-98-0 | Phthalates | Phthalates |
| URXMZP | Mono-benzyl phthalate (ng/mL) | 2528-16-7 | Phthalates | Phthalates |
| URXMHH | Mono-(2-ethyl-5-hydroxyhexyl) phthalate (ng/mL) | 40321-99-1 | Phthalates | Phthalates |
| URXECP | Mono-2-ethyl-5-carboxypentyl phthalate (ng/mL) | 40809-41-4 | Phthalates | Phthalates |
| URXMBP | Mono-n-butyl phthalate (ng/mL) | 131-70-4 | Phthalates | Phthalates |
| URXMEP | Mono-ethyl phthalate (ng/mL) | 2306-33-4 | Phthalates | Phthalates |
| URXMNM | Mono-n-methyl phthalate (ng/mL) | 4376-18-5 | Phthalates | Phthalates |
| SSURMHBP | Mono-3-hydroxy-n-butyl phthalate (ng/mL) | 57074-43-8 | Phthalates | Phthalates |
| URXMC1 | Mono-(3-carboxypropyl) phthalate (ng/mL) | 66851-46-5 | Phthalates | Phthalates |
| URXDMA | o-Desmethylangolensin (O-DMA) (ng/mL) | 21255-69-6 | Phytoestrogens | Phytoestrogens |
| URXETL | Enterolactone (ng/mL) | 78473-71-9 | Phytoestrogens | Phytoestrogens |
| URXETD | Enterodiol (ng/mL) | 80226-00-2 | Phytoestrogens | Phytoestrogens |
| URXP05 | 3-phenanthrene (ng/L) | 605-87-8 | Polyaromatic Hydrocarbons (PAH) | PAHs |
| URXP06 | 1-phenanthrene (ng/L) | 2433-56-9 | Polyaromatic Hydrocarbons (PAH) | PAHs |
| URXP07 | 2-phenanthrene (ng/L) | 605-55-0 | Polyaromatic Hydrocarbons (PAH) | PAHs |
| URXP19 | 4-phenanthrene (ng/L) | 7651-86-7 | Polyaromatic Hydrocarbons (PAH) | PAHs |
| URXP25 | 2 & 3-Hydroxyphenanthrene (ng/L) | 605-55-0 | Polyaromatic Hydrocarbons (PAH) | PAHs |
| URXP10 | 1-pyrene (ng/L) | 129-00-0 | Polyaromatic Hydrocarbons (PAH) | PAHs |
| URXP01 | 1-napthol (ng/L) | 90-15-3 | Polyaromatic Hydrocarbons (PAH) | PAHs |
| URXP02 | 2-napthol (ng/L) | 135-19-3 | Polyaromatic Hydrocarbons (PAH) | PAHs |
| URXP17 | 9-fluorene (ng/L) | 484-17-3 | Polyaromatic Hydrocarbons (PAH) | PAHs |
| URXP03 | 3-fluorene (ng/L) | 6344-67-8 | Polyaromatic Hydrocarbons (PAH) | PAHs |
| URXP04 | 2-fluorene (ng/L) | 2443-58-5 | Polyaromatic Hydrocarbons (PAH) | PAHs |
| LBD199LA | PCB199 Lipid Adj (ng/g) | 52663-75-9 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBX180LA | PCB180 Lipid Adj (ng/g) | 35065-29-3 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBX209LA | PCB209 Lipid Adj (ng/g) | 2051-24-3 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBX146LA | PCB146 Lipid Adj (ng/g) | 51908-16-8 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBX170LA | PCB170 Lipid Adj (ng/g) | 35065-30-6 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBX194LA | PCB194 Lipid Adj (ng/g) | 35694-08-7 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBX187LA | PCB187 Lipid Adj (ng/g) | 52663-68-0 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBX153LA | PCB153 Lipid Adj (ng/g) | 35065-27-1 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBX196LA | PCB196 Lipid Adj (ng/g) | 42740-50-1 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBX138LA | PCB138 Lipid Adj (ng/g) | 35065-28-2 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBXHXCLA | 3,3',4,4',5,5'-hxcb Lipid Adj (pg/g) | 32774-16-6 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBX118LA | PCB118 Lipid Adj (ng/g) | 31508-00-6 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBX099LA | PCB99 Lipid Adj (ng/g) | 38380-01-7 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBXPCBLA | 3,3',4,4',5-pcnb Lipid Adj (pg/g) | 57465-28-8 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBX074LA | PCB74 Lipid Adj (ng/g) | 32690-93-0 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBX028LA | PCB28 Lipid Adj (ng/g) | 7012-37-5 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBX049LA | PCB49 Lipid Adj (ng/g) | 41464-40-8 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBX044LA | PCB44 Lipid Adj (ng/g) | 41464-39-5 | Polychlorinated Biphenyls (PCB) | PCBs |
| LBXPFDE | Perfluorodecanoic acid (ng/mL) | 335-76-2 | Per- and Polyfluoroalkyl Substances (PFAS) | PFASs |
| LBXMPAH | 2-(N-methyl-PFOSA) acetate (ng/mL) | 2355-31-9 | Per- and Polyfluoroalkyl Substances (PFAS) | PFASs |
| LBXPFNA | Perfluorononanoic acid (ng/mL) | 375-95-1 | Per- and Polyfluoroalkyl Substances (PFAS) | PFASs |
| LBXPFHS | Perfluorohexane sulfonic acid (ng/mL) | 355-46-4 | Per- and Polyfluoroalkyl Substances (PFAS) | PFASs |
| LBXPFOA | Perfluorooctanoic acid (ng/mL) | 335-67-1 | Per- and Polyfluoroalkyl Substances (PFAS) | PFASs |
| LBXPFOS | Perfluorooctane sulfonic acid (ng/mL) | 1763-23-1 | Per- and Polyfluoroalkyl Substances (PFAS) | PFASs |
| LBXCOT | Cotinine (ng/mL) | 486-56-6 | Smoking Related Compounds | SRCs |
| URXNAL | NNAL , urine (ng/mL) | 76014-81-8 | Smoking Related Compounds | SRCs |
| LBXVXY | Blood m-/p-Xylene (ng/ml) | 108-38-3/106-42-3 | Volatile Organic Compounds (VOC) | VOCs |
| LBXVDB | Blood 1,4-Dichlorobenzene (ng/ml) | 106-46-7 | Volatile Organic Compounds (VOC) | VOCs |
| LBXVBM | Blood Bromodichloromethane (pg/ml) | 75-27-4 | Volatile Organic Compounds (VOC) | VOCs |
| URXHEM | N-Ace-S-(2-Hydroxyethyl)-L-cys (ng/mL) | 15060-26-1 | Volatile Organic Compounds (VOC) | VOCs |
| URXPHG | Phenylglyoxylic acid (ng/mL) | 611-73-4 | Volatile Organic Compounds (VOC) | VOCs |
| URXHP2 | N-Ace-S-(2-hydroxypropyl)-L-cys (ng/mL) | 75-56-9 | Volatile Organic Compounds (VOC) | VOCs |
| URXMB3 | N-A-S-(4-hydrxy-2butn-l-yl)-L-cys (ng/mL) | 106-99-0 | Volatile Organic Compounds (VOC) | VOCs |
| URX34M | 3-methipurc acd & 4-methipurc acd (ng/mL) | 27115-49-7 | Volatile Organic Compounds (VOC) | VOCs |
| URXBMA | N-Acetyl-S-(benzyl)-L-cysteine (ng/mL) | 19542-77-9 | Volatile Organic Compounds (VOC) | VOCs |
| URXBPM | N-Acetyl-S-(n-propyl)-L-cysteine (ng/mL) | 106-94-5 | Volatile Organic Compounds (VOC) | VOCs |
| URXGAM | N-ac-S-(2-carbmo-2-hydxel)-L-cys (ng/mL) | 79-06-1 | Volatile Organic Compounds (VOC) | VOCs |
| URXMAD | Mandelic acid (ng/mL) | 90-64-2 | Volatile Organic Compounds (VOC) | VOCs |
| URXAAM | N-Ace-S-(2-carbamoylethyl)-L-cys (ng/mL) | 81690-92-8 | Volatile Organic Compounds (VOC) | VOCs |
| URXAMC | N-Ace-S-(N-methlcarbamoyl)-L-cys (ng/mL) | 103974-29-4 | Volatile Organic Compounds (VOC) | VOCs |
| URXATC | 2-amnothiazolne-4-carbxylic acid (ng/mL) | 16899-18-6 | Volatile Organic Compounds (VOC) | VOCs |
| URXCYM | N-acetyl-S-(2-cyanoethyl)-L-cys (ng/mL) | 74514-75-3 | Volatile Organic Compounds (VOC) | VOCs |
| URXTTC | 2-thoxothazlidne-4-carbxylic acid (ng/mL) | 20933-67-9 | Volatile Organic Compounds (VOC) | VOCs |
| URX2MH | 2-Methylhippuric acid (ng/mL) | 42013-20-7 | Volatile Organic Compounds (VOC) | VOCs |
| URXPMM | N-A-S-(3-hydrxprpl-1-metl)-L-cys (ng/mL) | 33164-70-4 | Volatile Organic Compounds (VOC) | VOCs |
| URXCEM | N-Acetyl-S-(2-Carbxyethyl)-L-Cys (ng/mL) | 51868-61-2 | Volatile Organic Compounds (VOC) | VOCs |
| URXHPM | N-Ace-S-(3-Hydroxypropyl)-L-Cys (ng/mL) | 23127-40-4 | Volatile Organic Compounds (VOC) | VOCs |
| URXDHB | N-Ace-S-(3,4-Dihidxybutl)-L-Cys (ng/mL) | 144889-50-9 | Volatile Organic Compounds (VOC) | VOCs |
| LBXVTO | Blood Toluene (ng/ml) | 108-88-3 | Volatile Organic Compounds (VOC) | VOCs |
| LBXNM | Blood Nitromethane (pg/mL) | 75-52-5 | Volatile Organic Compounds (VOC) | VOCs |
| LBXVCF | Blood Chloroform (pg/ml) | 67-66-3 | Volatile Organic Compounds (VOC) | VOCs |

## **Text S1. Overestimation of QSARs half-lives for PFASs and Other Estimation Methods**

The estimated persistency of PFASs varies drastically from 3.5 years to 220 years. The half-lives of PFOS (4.80 years) and PFOA (5.42 years) from Arnot et al, 2014 Training Dataset are comparable with other estimated half-lives such as 5 years for PFOS (Olsen et al. 2007) and 2.3 (Bartell et al. 2010) to 4 years (Olsen et al. 2007) for PFOA. In addition, the QSAR-estimated half-life of PFHxS (7.29 years) is comparable to 8.5 years (Olsen et al. 2007). A one-compartment model was used to estimate the half-lives for PFASs in a sample of Chinese volunteers in Shijiazhuang and Handan and estimated 0.38 to 20 years for the half-life of PFNA (Zhang et al. 2013) and 1.2 to 60 years for PFDA (Zhang et al. 2013), which are very different from the QSAR-estimated half-lives of PFNA (45.03 years) and PFDA (205.82 years). There are no measured or estimated half-lives for 2-(N-methyl-PFOSA) acetate in human.

This model is a screening-level, fragment-based QSAR that for instance, focuses on “fragments” of the compound i.e. F-C bond. Since PFNA have several of these bonds and such bonds are associated with high persistency, the QSAR predicted a higher persistency for these cases. In addition, half-life of PFOS, PFOA, and PFHxS were the only ones used in the training set to train the QSAR model to predict half-lives for PFASs. So all of these stipulations can lead to overestimations for some of the predictions.

Thus to address these overestimations, we looked at different literature sources for the half-lives and defined a hierarchy to determine more reasonable half-lives for these substances. When multiple human biomonitoring-based half-lives are available for a given chemical, the median of all available half-lives is used, or else we perform an extrapolation from animal data using the ratio of the half-life of PFOSA to the half-life of PFOS from rat (10.6 and 30 days, respectively) and rainbow trout (6 and 16.9 days, respectively) (Brandsma et al. 2011; Martin et al. 2010). So the extratpolation factors were 0.355 for rainbow trouts and 0.353 for rats.

## **Table S8**. Authorship for half-lives of PFASs with other estimation or extrapolation methods.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Studies** | **Type of HL** | **Types** | **LBXPFDE** | **LBXMPAH** | **LBXPFNA** | **LBXPFHS** | **LBXPFOA** | **LBXPFOS** |
| Arnot et al., 2014 | intrinsic | Training Dataset |  |  |  | 7.3 | 5.4 | 4.8 |
| QSAR | 205.8 | 45 | 45 | 2.2 | 9.9 | 45 |
| Olsen et al., 2017 | apparent |  |  |  |  | 7.3 | 3.5 | 4.8 |
| Bartell et al., 2010 | intrinsic |  |  |  |  |  | 2.3 |  |
| Zhang et al., 2013 | renal and menstrual clearance | Young Females | 4.2 |  | 1.5 | 2.3 | 1.8 | 6 |
| renal clearance | All Males and Older Females | 9.2 |  | 3.5 | 29 | 1.7 | 18 |
| Gomis et al., 2017 | intrinsic | Female Australian |  |  |  |  | 1.8 | 5 |
| Male Australian |  |  |  |  | 2 | 4.9 |
| Female US |  |  |  |  | 2.1 | 3.3 |
| Male US |  |  |  |  | 2.4 | 3.8 |
| Wong et al., 2018 | intrinsic | Male |  |  |  |  |  | 4.7 |
| Female (exclude loss from menstruation) |  |  |  |  |  | 3.7 |
| Female (include loss from menstruation) |  |  |  |  |  | 4 |
| Russell et al., 2015 | intrinsic |  |  |  |  |  | 2.4 |  |
| Gomis et al., 2016 | intrinsic |  |  |  |  |  | 2.4 |  |
| Brede et al., 2010 | intrinsic |  |  |  |  |  | 3.26 |  |
| Spliethoff et al., 2008 | apparent |  |  |  |  |  |  | 4.4 |
| D’Eon and Mabury, 2011 | apparent |  |  |  |  |  |  | 5.4 |
| Olsen et al., 2012 | apparent |  |  |  |  |  |  | 4.3 |
| Glynn et al., 2012 | apparent |  |  |  |  |  |  | 8.2 |
| Yeung et al., 2013 | apparent |  |  |  |  |  |  | 4.55 |
| Worley et al., 2017 | intrinsic |  |  |  |  | 15.5 | 3.9 | 3.3 |
| Conglomerated Estimation or Animal-Human Extrapolation | years |  | 6.7 | 1.664653 | 2.5 | 7.3 | 2.35 | 4.7 |
| hours |  | 58692 | 14582.36 | 21900 | 63948 | 20586 | 41172 |
| log10 hours |  | 4.768579 | 4.163828 | 4.340444 | 4.805827 | 4.313572 | 4.614602 |

## **Table S9**. References for half-lives of inorganic substances for which the half-life could not be estimated by the QSAR models. Half-Lives (hours) were used in the analysis.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Chemical** | **References for Half-Lives** | **Half-Lives (units)** | **Half-Lives (hours)** | **Biological Compartments** |
| Propineb | Watson M. IPCS INCHEM - PROPINEB. Available: http://www.inchem.org/documents/jmpr/jmpmono/v93pr16.htm. | 20 days | 480 | Body |
| Arsenic | Bradberry SM, Harrison WN, Beer ST, Vale JA. 1997. IPCS INCHEM - arsenic acid. Available: <http://www.inchem.org/documents/ukpids/ukpids/ukpid41.htm.> | 60 hours | 60 | Blood, Serum, Plasma |
| ATSDR. 2007. Toxicological profile for arsenic. Available: <https://www.atsdr.cdc.gov/ToxProfiles/tp2.pdf.> | 4 hours  3 hours  60 hours  40 hours | 4  3  60  40 | Blood, Serum, Plasma  Blood, Serum, Plasma  Body  Body |
| Arsenic Acid | National Center for Biotechnology Information. Pubchem compound database cid=234: Arsenic acid. Available: <https://pubchem.ncbi.nlm.nih.gov/compound/234.> | 35 hours  2.40 days | 35  57.6 | Blood, Serum, Plasma  Body |
| Arsenobetaine | Lehmann B, Ebeling E, Alsen-Hinrichs C. 2001. Kinetics of arsenic in human blood after a fish meal. Gesundheitswesen (Bundesverband der Arzte des Offentlichen Gesundheitsdienstes (Germany)) 63:42-48. | 63 hours | 63 | Blood, Serum, Plasma |
| Methanearsonic acid | ATSDR. 2007. Toxicological profile for arsenic. Available: <https://www.atsdr.cdc.gov/ToxProfiles/tp2.pdf.> | 4.90 hours  4.20 hours | 4.9  4.2 | Blood, Serum, Plasma  Blood, Serum, Plasma |
| Trimethylarsine Oxide | CDC. 2009. Fourth national report on human exposure to environmental chemicals. Available: <https://www.cdc.gov/exposurereport/pdf/fourthreport.pdf.> | 4 days  2 days | 96  48 | Body  Body |
| Antimony | ATSDR. 2017. Toxicological profile for antimony and compounds. Available: <https://www.atsdr.cdc.gov/ToxProfiles/tp23.pdf.> | 62 days  47 days  1.99 hours | 1488  1128  1.99 | Lung  Lung  Blood, Serum, Plasma |
| Gerhardsson L, Brune D, Nordberg GF, Wester PO. 1982. Antimony in lung, liver and kidney tissue from deceased smelter workers. Scandinavian journal of work, environment & health 8:201-208. | 100 days  36 days | 2400  864 | Body  Body |
| Barium | Bastarache E. Barium and compounds / toxicology. Available: <https://digitalfire.com/4sight/hazards/ceramic_hazard_barium_and_compounds__toxicology_321.html.> | 20 hours  2 hours | 20  2 | Body  Body |
| Ayres DC, Hellier DG. 1997. Dictionary of environmentally important chemicals. Available: half life blood&f=false. | 50 days | 1200 | Bones |
| Beryllium | ATSDR. 2002. Toxicological profile for beryllium. Available: <https://www.atsdr.cdc.gov/toxprofiles/tp4.pdf.>. | 400 days  300 days  833 days  8 weeks  2 weeks | 9600  7200  19992  1344  336 | Body  Body  Lung  Blood, Serum, Plasma  Blood, Serum, Plasma |
| CDC. 2009. Fourth national report on human exposure to environmental chemicals. Available: <https://www.cdc.gov/exposurereport/pdf/fourthreport.pdf.> | 450 days | 10800 | Bones |
| Cacodylic Acid | National Center for Biotechnology I. Pubchem compound database cid=2513: Cacodylic acid. Available: <https://pubchem.ncbi.nlm.nih.gov/compound/2513.> | 92 days  90 days  76 days | 2208  2160  1824 | Blood, Serum, Plasma  Blood, Serum, Plasma  Blood, Serum, Plasma |
| Cadmium | Scoullos M, Vonkeman GH, Thornton I, Makuch Z. 2001. Mercury — cadmium — lead handbook for sustainable heavy metals policy and regulation. 1st ed:Springer Netherlands. | 30 years | 262800 | Body |
| Bernhoft RA. 2013. Cadmium toxicity and treatment. The Scientific World Journal 2013. | 128 days  75 days  25 years | 3072  1800  219000 | Blood, Serum, Plasma  Blood, Serum, Plasma  Body |
| Cesium | ATSDR. 2004. Toxicological profile for cesium. Available: <https://www.atsdr.cdc.gov/ToxProfiles/tp157.pdf.> | 150 days  135 days  110 days  110 days  93 days  90 days  84 days  83 days  73 days  72 days  70 days  67 days  66 days  58 days  50 days  47 days  46 days | 3600  3240  2640  2640  2232  2160  2016  1992  1752  1728  1680  1608  1584  1392  1200  1128  1104 | Body  Body  Body  Body  Body  Body  Body  Body  Body  Body  Body  Body  Body  Body  Body  Body  Body |
| CDC. 2009. Fourth national report on human exposure to environmental chemicals. Available: <https://www.cdc.gov/exposurereport/pdf/fourthreport.pdf.> | 70 days  109 days | 1680  2616 | Body  Body |
| Cobalt | Tvermoes BE, Unice KM, Paustenbach DJ, Finley BL, Otani JM, Galbraith DA. 2014. Effects and blood concentrations of cobalt after ingestion of 1 mg/d by human volunteers for 90 d. The American journal of clinical nutrition 99:632-646. | 36 days  22 days | 864  528 | Blood, Serum, Plasma  Blood, Serum, Plasma |
| ATSDR. 2004. Toxicological profile for cobalt. Available: <https://www.atsdr.cdc.gov/toxprofiles/tp33.pdf.> | 99.50 days | 2388 | Body |
| CDC. 2009. Fourth national report on human exposure to environmental chemicals. Available: <https://www.cdc.gov/exposurereport/pdf/fourthreport.pdf.> | 2 years  1 year | 17520  8760 | Lung  Lung |
| Copper | Johnson PE, Milne DB, Lykken GI. 1992. Effects of age and sex on copper absorption, biological half-life, and status in humans. The American journal of clinical nutrition 56:917-925. | 33 days  13 days | 792  312 | Body  Body |
| Lyon TDB, Fell GS, Gaffney D, McGaw BA, Russell RI, Park RHR, et al. 1995. Use of a stable copper isotope in the differential diagnosis of wilson's disease. Clinical Science 88:727 LP-732. | 14 days  26 days | 336  624 | Blood, Serum, Plasma  Blood, Serum, Plasma |
| Lead | ATSDR. 2007. Toxicological profile for lead. Available: <https://www.atsdr.cdc.gov/ToxProfiles/tp13.pdf.> | 27 years | 236520 | Bones |
| ATSDR. Toxguide for lead. Available: <https://www.atsdr.cdc.gov/toxguides/toxguide-13.pdf.> | 30 days | 720 | Blood, Serum, Plasma |
| National Research Council Committee on Measuring Lead in Critical P. 1993. 4, biologic markers of lead toxicity. Available: <https://www.ncbi.nlm.nih.gov/books/NBK236462/.> | 25 days | 600 | Blood, Serum, Plasma |
| Barbosa F, Tanus-Santos JE, Gerlach RF, Parsons PJ. 2005. A critical review of biomarkers used for monitoring human exposure to lead: Advantages, limitations, and future needs. Environmental Health Perspectives 113:1669-1674. | 30 years  10 years | 262800  87600 | Bones  Bones |
| Rahde AF. 1994. Ipcs inchem - lead, inorganic. Available: <http://www.inchem.org/documents/pims/chemical/inorglea.htm#SectionTitle:6.3> Biological half-life by route of exposure. | 30 days  20 days  30 years  20 years | 720  480  262800  175200 | Blood, Serum, Plasma  Blood, Serum, Plasma  Bones  Bones |
| Oregon Department of Human Services. Health effects of lead exposure. Available: <http://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/HEALTHYNEIGHBORHOODS/LEADPOISONING/MEDICALPROVIDERSLABORATORIES/Documents/introhealtheffectsmedicalprovider.pdf.> | 30 years  25 years | 262800  219000 | Bones  Bones |
| CDC. 2016. Biomonitoring summary: Lead. Available: <https://www.cdc.gov/biomonitoring/Lead_BiomonitoringSummary.html.> | 2 months  1 month | 1440  720 | Blood, Serum, Plasma  Blood, Serum, Plasma |
| NCHS. 2012. Laboratory procedure manual: Cadmium, Lead, Manganese, Mercury, and Selenium. Available:  [https://www.cdc.gov/nchs/data/nhanes/nhanes\_11\_12/PbCd\_G\_met\_blood%20metals.pdf.](https://wwwn.cdc.gov/nchs/data/nhanes/2013-2014/labmethods/PbCd_H_MET.pdf.) | 30 days | 720 | Blood, Serum, Plasma |
| Swedish Chemicals Agency. 2012. Proposal for harmonised classification and labelling: Lead. Available: <https://echa.europa.eu/documents/10162/13626/lead_clh_proposal_en.pdf.> | 40 days | 960 | Blood, Serum, Plasma |
| Dobbs MR. 2009. Clinical neurotoxicology: Syndromes, substances, environments. Available: <https://books.google.com/books/about/Clinical_Neurotoxicology.html?id=Pmcy24y2HyMC.> | 36 days | 864 | Blood, Serum, Plasma |
| Manganese | O’Neal SL, Zheng W. 2015. Manganese toxicity upon overexposure: A decade in review. Current environmental health reports 2:315-328. | 8 years  9 years | 70080  78840 | Bones  Bones |
| Santamaria AB. 2008. Manganese exposure, essentiality & toxicity. The Indian journal of medical research 128:484-500. | 42 days  10 days | 1008.00  240.00 | Blood, Serum, Plasma  Blood, Serum, Plasma |
| Mayo Foundation for Medical E, Research. Test ID: MNB - manganese, blood. Available: <https://www.mayomedicallaboratories.com/test-catalog/Clinical+and+Interpretive/89120.> | 40 days | 960 | Body |
| O’Neal SL, Hong L, Fu S, Jiang W, Jones A, Nie LH, et al. 2014. Manganese accumulation in bone following chronic exposure in rats: Steady-state concentration and half-life in bone. Toxicology Letters 229:93-100. | 8.50 years | 74460 | Bones |
| Mercury | ATSDR. 2000. Managing hazardous material incidents: Mercury (hg). Available: <https://www.atsdr.cdc.gov/mhmi/mmg46.pdf.> | 90 days  60 days | 2160  1440 | Body  Body |
| US EPA. 1984. Mercury health effects update. Available: <https://pubchem.ncbi.nlm.nih.gov/compound/mercury#section=Biological-Half-Life.> | 30 days  70 days  50 days | 720  1680  1200 | Blood, Serum, Plasma  Body  Body |
| Hyman MH. 2004. The impact of mercury on human health and the environment. 10:70-75. | 18 years  1 year | 157680  8760 | Bones  Bones |
| ATSDR. 1999. Toxicological profile for mercury. Available: <https://www.atsdr.cdc.gov/ToxProfiles/tp46.pdf.> | 45 days  40.50 days  36 days | 1080  972  864 | Blood, Serum, Plasma  Blood, Serum, Plasma  Body |
| Ethyl Mercury | WHO. 2006. Statement on thiomersal. Available: <http://www.who.int/vaccine_safety/committee/topics/thiomersal/statement_jul2006/en/.> | 1 week | 168 | Blood, Serum, Plasma |
| University of Minnesota E, Occupational H. Mercury: Dose, absorption, distribution, biotransformation, and excretion of mercury. Available: <http://enhs.umn.edu/current/5103_spring2003/mercury/mercdose.html.> | 50 days | 1200 | Body |
| Methyl Mercury | Jo S, Woo HD, Kwon H-J, Oh S-Y, Park J-D, Hong Y-S, et al. 2015. Estimation of the biological half-life of methylmercury using a population toxicokinetic model. International Journal of Environmental Research and Public Health 12:9054-9067. | 88.8 days  71.6 days  35.1 days  52.8 days | 2131.20  1718.40  842.40  1267.20 | Blood, Serum, Plasma  Blood, Serum, Plasma  Blood, Serum, Plasma  Blood, Serum, Plasma |
| WHO. 2006. Statement on thiomersal. Available: http://www.who.int/vaccine\_safety/committee/topics/thiomersal/statement\_jul2006/en/. | 1.5 months | 1080 | Blood, Serum, Plasma |
| ATSDR. 1999. Toxicological profile for mercury. Available: https://www.atsdr.cdc.gov/ToxProfiles/tp46.pdf. | 65 days  48 days | 1560  1152 | Blood, Serum, Plasma  Blood, Serum, Plasma |
| CDC. 2009. Fourth national report on human exposure to environmental chemicals. Available: <https://www.cdc.gov/exposurereport/pdf/fourthreport.pdf.> | 50 days | 1200 | Body |
| Inorganic Mercury | CDC. 2016. Biomonitoring summary: Mercury. Available: <https://www.cdc.gov/biomonitoring/Mercury_BiomonitoringSummary.html.> | 3 weeks  1 week | 504  168 | Blood, Serum, Plasma  Blood, Serum, Plasma |
| ATSDR. 2000. Managing hazardous material incidents: Mercury (hg). Available: <https://www.atsdr.cdc.gov/mhmi/mmg46.pdf.> | 15 days  28 days  60 days  60 days | 360  672  1440  1440 | Blood, Serum, Plasma  Blood, Serum, Plasma  Body  Body |
| Molybdenum | ATSDR. 2017. Toxicological profile for molybdenum. Available: <https://www.atsdr.cdc.gov/ToxProfiles/tp212.pdf.> | 6.60 hours | 6.60 | Blood, Serum, Plasma |
| Vyskočil, Adolf, and Claude Viau. "Assessment of molybdenum toxicity in humans." Journal of Applied Toxicology 19.3 (1999): 185-192. | 19 hours | 19 | Body |
| Perchlorate | Srinivasan A, Viraraghavan T. 2009. Perchlorate: Health effects and technologies for its removal from water resources. International Journal of Environmental Research and Public Health 6:1418-1442. | 8 hours  6 hours | 8  6 | Blood, Serum, Plasma  Blood, Serum, Plasma |
| Crump KS, Gibbs JP. 2005. Benchmark calculations for perchlorate from three human cohorts. Environmental Health Perspectives 113:1001-1008. | 7.50 hours | 7.50 | Blood, Serum, Plasma |
| ATSDR. 2008. Toxicological profile for perchlorates. Available: <https://www.atsdr.cdc.gov/ToxProfiles/tp162.pdf.> | 8 hours | 8 | Blood, Serum, Plasma |
| WHO. 2004. Perchlorate in Drinking-water Background document for development of WHO Guidelines for Drinking-water Quality. Available: http://www.who.int/water\_sanitation\_health/water-quality/guidelines/chemicals/perchlorate-background-jan17.pdf | 6 hours  9.30 hours | 6  9.30 | Blood, Serum, Plasma  Blood, Serum, Plasma |
| Platinum | Herr CEW, Jankofsky M, Angerer J, Kuster W, Stilianakis NI, Gieler U, et al. 2003. Influences on human internal exposure to environmental platinum. Journal of exposure analysis and environmental epidemiology 13:24-30. | 720 days | 17280 | Body |
| Thallium | AcuteTox. Thallium sulfate. Available: <http://www.acutetox.eu/pdf_human_short/66-Thallium> sulphate revised.pdf. | 8 days | 192 | Blood, Serum, Plasma |
| Quest Diagnostics. Thallium, blood. Available: <http://www.questdiagnostics.com/testcenter/testguide.action%3Fdc%3DTH_Thallium.> | 4 days  2 days | 96  48 | Blood, Serum, Plasma  Blood, Serum, Plasma |
| Thiomersal | Burbacher, Thomas M. et al. “Comparison of Blood and Brain Mercury Levels in Infant Monkeys Exposed to Methylmercury or Vaccines Containing Thimerosal.” Environmental Health Perspectives 113.8 (2005): 1015–1021. PMC. Web. 6 Sept. 2018. | 8.60 days | 206.40 | Blood, Serum, Plasma |
| Tungsten | Lemus R, Venezia CF. 2015. An update to the toxicological profile for water-soluble and sparingly soluble tungsten substances. Critical reviews in toxicology 45:388-411. | 67 days  6 days | 1608  144 | Body  Body |
| ATSDR. 2005. Toxicological profile for tungsten. Available: <https://www.atsdr.cdc.gov/toxprofiles/tp186.pdf.> | 23 years  4 years  100 days | 201480  35040  2400 | Bones  Bones  Bones |
| Uranium | ATSDR. 2013. Toxicological profile for uranium. Available: <https://www.atsdr.cdc.gov/ToxProfiles/tp150.pdf.> | 200 days  70 days  240 days  110 days  2 weeks  1 week | 4800  1680  5760  2640  336  168 | Bones  Bones  Lungs  Lungs  Body  Body |
| Zinc | INCHEM I. IPCS INCHEM - ZINC. Available: <http://www.inchem.org/documents/jecfa/jecmono/v17je33.htm.> | 500 days  300 days | 12000  7200 | Body  Body |
| Nriagu J. 2007. Zinc deficiency in human health. School of Public Health. | 280 days | 6720 | Body |

## **Table S10**. References on regulation, legislation, and restriction dates of substances.

|  |  |
| --- | --- |
| **Chemical** | **References for Ban/Phase-out Dates** |
| Acephate | US EPA. 2017. Food and pesticides. Available: <https://www.epa.gov/safepestcontrol/food-and-pesticides.> |
| Aldrin/Endrin | ATSDR. 2011. Toxic substances portal - aldrin/dieldrin. Available: <https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=56.>  US EPA. 2006. Procedures for the derivation of equilibrium partitioning sediment benchmarks (esbs) for the protection of benthic organisms: Endrin. Available: |
| Azinphos-Methyl | Gilbert S. 2014. Azinphos-methyl. Available: <http://www.toxipedia.org/display/toxipedia/Azinphos-Methyl.> |
| Bisphenol A (BPA) | Houlihan J, Lunder S, Jacob A. 2008. Timeline: Bpa from invention to phase-out. Available: <https://www.ewg.org/research/timeline-bpa-invention-phase-out#.WjsfefmnEdU.> |
| Cadmium | Spencer J. 2008. Toys 'R' us, mattel phase out cadmium batteries. The Wall Street Journal. |
| Carbofuran | Foley S. 2009. Carbofuran. Available: <http://www.toxipedia.org/display/toxipedia/Carbofuran.>  US EPA. 2011. Carbofuran cancellation process. Available: <https://archive.epa.gov/pesticides/reregistration/web/html/carbofuran_noic.html#revocation.> |
| Carbon Tetrachloride | ATSDR. 2015. Toxic substances portal - carbon tetrachloride. Available: <https://www.atsdr.cdc.gov/phs/phs.asp?id=194&tid=35.> |
| Chlorobenzene | ATSDR. 2011. Toxic substances portal - chlorobenzene. Available: <https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=87.> |
| Chlordane | ATSDR. 2015. Toxic substances portal - chlordane. Available: <https://www.atsdr.cdc.gov/phs/phs.asp?id=353&tid=62.> |
| Chlorpyrifos | US EPA. 2017. Ingredients used in pesticide products: Chlorpyrifos. Available: <https://www.epa.gov/ingredients-used-pesticide-products/chlorpyrifos.> |
| Chlorpyrifos-Methyl | US EPA. 2000. Chlorpyrifos-methyl facts. Available: <https://www3.epa.gov/pesticides/chem_search/reg_actions/reregistration/fs_PC-059102_1-Oct-00.pdf.> |
| Cyanide | Jensen J. Ban on cyanide mining in montana with initiative 137. Available: <http://meic.org/issues/mining-in-montana/hardrock-and-cyanide-mining-in-montana/ban-on-cyanide-mining-in-montana-with-initiative-137/.>  Representatives of Wisconsin. 2001. 2001 Assembly Bill 95. Available: <http://docs.legis.wisconsin.gov/2001/related/proposals/ab95.> |
| Diazinon | Gilbert S. 2014. Diazinon. Available: <http://www.toxipedia.org/display/toxipedia/Diazinon.> |
| Disulfoton and Methamidophos | US EPA. 2009. Disulfoton and methamidophos; product cancellation order. Available: <https://www3.epa.gov/pesticides/chem_search/reg_actions/reregistration/frn_UG-2_23-Sep-2009.pdf.> |
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| Dioxins and dioxin-like compounds | US EPA. 1995. Municipal waste combustors. |
| 1,2-Dibromo-3-Chloropropane | US EPA. 2000. 1,2-dibromo-3-chloropropane (DBCP). Available: <https://www.epa.gov/sites/production/files/2016-09/documents/1-2-dibromo-3-chloropropane.pdf.> |
| 1,2-Dibromoethane | ATSDR. 2011. Toxic substances portal - 1,2-dibromoethane. Available: <https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=131.> |
| Dichlorvos (DDVP) | US EPA. 1995. Dichlorvos (ddvp); deletion of certain uses and directions. Available: <https://www.federalregister.gov/documents/1995/04/19/95-9166/dichlorvos-ddvp-deletion-of-certain-uses-and-directions.> |
| Ethyl Chloride | US EPA. Ethyl chloride (chloroethane). Available: <https://www.epa.gov/sites/production/files/2016-09/documents/ethyl-chloride.pdf.> |
| Ethylene Oxide | Gilbert S. 2009. Ethylene oxide (eto). Available: <http://www.toxipedia.org/pages/viewpage.action?pageId=2822700.> |
| Formaldehyde | Thomas K. 2014. The ‘no more tears’ shampoo, now with no formaldehyde. New York Times. |
| Heptachlor | ATSDR. 2015. Toxic substances portal - heptachlor/heptachlor epoxide. Available: <https://www.atsdr.cdc.gov/phs/phs.asp?id=743&tid=135.>  Extension Toxicology Network. 1996. Pesticide information profile - heptachlor. Available: <http://extoxnet.orst.edu/pips/heptachl.htm.>  Gilbert S. 2014. Heptachlor. Available: <http://www.toxipedia.org/display/toxipedia/Heptachlor#Heptachlor-ATSDRPublicHealthStatement.> |
| Hexachlorobenzene | ATSDR. 2015. Toxicological profile for hexachlorobenzene. Available: <https://www.atsdr.cdc.gov/ToxProfiles/tp90.pdf.> |
| Hexachlorocyclohexanes | ASTDR. 2005. Toxicological profile for alpha-, beta-, gamma-, and delta-hexachlorocyclohexane. Available: <https://www.atsdr.cdc.gov/toxprofiles/tp43.pdf.>  ATSDR. 2005. 5. Production, import/export, use, and disposal: Hexachlorocyclohexane. Available: <https://www.atsdr.cdc.gov/ToxProfiles/tp43-c5.pdf.> |
| Hexachloroethane | National Toxicology Program. 1994. Seventh annual report on carcinogens: Hexachloroethane. Available: <https://ntp.niehs.nih.gov/ntp/roc/content/profiles/hexachloroethane.pdf.>  ATSDR. 2015. Toxic substances portal - hexachloroethane. Available: <https://www.atsdr.cdc.gov/phs/phs.asp?id=868&tid=169.> |
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| Mercury | US EPA. 1996. Mercury-containing and rechargeable battery management act of 1996. Available: <https://www.congress.gov/104/plaws/publ142/PLAW-104publ142.pdf.>  Mohapatra SP, Nikolova I, Mitchell A. 2007. Managing mercury in the great lakes: An analytical review of abatement policies. Journal of environmental management 83:80-92. |
| Methyl parathion | Jaga K, Dharmani C. 2006. Methyl parathion: An organophosphate insecticide not quite forgotten. Reviews on environmental health 21:57-67. |
| Metiram | Schneider K. 1992. E.P.A., in a reversal, lifts a ban on farm chemicals. New York Times. |
| Mirex | OEHHA. 2016. Mirex. Available: <https://oehha.ca.gov/chemicals/mirex.> |
| Methyl Tertiary Butyl Ether (MTBE) | American Cancer Society. 2014. MTBE and cancer risk. Available: <https://www.cancer.org/cancer/cancer-causes/mtbe.html.> |
| Parabens | Franklin K. 2016. Johnson & Johnson meets ingredient commitments. Chemical Watch: Global Risk & Regulation News. |
| Polybrominated Biphenyls (PBBs) | ATSDR. 2015. Toxic substances portal - polybrominated biphenyls (PBBs). Available: <https://www.atsdr.cdc.gov/PHS/PHS.asp?id=527&tid=94.> |
| Polybrominated diphenyl ether (PBDE) | Guardia MJL, Hale RC, Harvey E. 2006. Detailed polybrominated diphenyl ether (pbde) congener composition of the widely used penta-, octa-, and deca-pbde technical flame-retardant mixtures. Environmental science & technology 40:6247-6254.  US EPA. 2010. An exposure assessment of polybrominated diphenyl ethers (pbde) (final). Available: <https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=210404.> |
| Polychlorinated biphenyls (PCBs) | US EPA. 1979. EPA bans PCB manufacture; phases out uses. Available: <https://archive.epa.gov/epa/aboutepa/epa-bans-pcb-manufacture-phases-out-uses.html.> |
| Perfluorinated compounds, including Perfluoroalkyl and Polyfluoroalkyl Substances (PFASs) | US EPA. 2016. Risk management for per- and polyfluoroalkyl substances (PFASs) under tsca. Available: <https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/risk-management-and-polyfluoroalkyl-substances-pfass.>  Buck RC, Franklin J, Berger U, Conder JM, Cousins IT, de Voogt P, et al. 2011. Perfluoroalkyl and polyfluoroalkyl substances in the environment: Terminology, classification, and origins. Integrated environmental assessment and management 7:513-541.  Fromme H, Becher G, Hilger B, Völkel W. 2016. Brominated flame retardants – exposure and risk assessment for the general population. International Journal of Hygiene and Environmental Health 219:1-23.  Butenhoff JL, Olsen GW, Pfahles-Hutchens A. 2006. The applicability of biomonitoring data for perfluorooctanesulfonate to the environmental public health continuum. Environmental Health Perspectives 114:1776-1782.  US EPA. 2003. Perfluoroalkyl sulfonates; significant new use rule.  US EPA. 2002. Perfluoroalkyl sulfonates; significant new use rule; final rule and supplemental proposed rule. Available: <https://www.federalregister.gov/documents/2002/12/09/02-31011/perfluoroalkyl-sulfonates-significant-new-use-rule.> |
| Phthalates | US Consumer Product Safety Commission. 2015. Phthalates. Available: <https://www.cpsc.gov/Business--Manufacturing/Business-Education/Business-Guidance/Phthalates-Information.>  Hileman B. 2007. California bans phthalates in toys for children. Chemical & Engineering News 85:12.  Szabo L. 2007. Hospitals move to phase out chemical. ABC News. |
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| Thallium | Staff of the Nonferrous Metals Division. 1972. Thallium. Available: <http://digicoll.library.wisc.edu/cgi-bin/EcoNatRes/EcoNatRes-idx?type=goto&id=EcoNatRes.MinYB1972v1&page=1358&isize=XL.> |
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| Trichloroethylene | Gilbert S. 2014. Trichloroethylene. Available: <http://www.toxipedia.org/display/toxipedia/Trichloroethylene.> |
| Tungsten | Kiger PJ. 2013. U.S. Phase-out of incandescent light bulbs continues in 2014 with 40-, 60-watt varieties. National Geographic. |
| Styrene | United Press International. 1988. Berkeley widens ban on foam food containers. Los Angeles Times. |

## **Table S11**. Linear regression statistics when survey weights were accounted in the generalized linear models for 1-pyrene, Mono-isobutyl phthalate, Aldrin, and PCB 209.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Linear Regression Statistics** | **1-pyrene** | **Mono-isobutyl Phthalate** | **Aldrin** | **PCB 209** |
| unweighted\_age\_coefficient | -3.56E-03 | -2.74E-03 | -1.79E-03 | 2.10E-02 |
| weighted\_age\_coefficient | -3.25E-03 | -2.63E-03 | -1.84E-03 | 2.23E-02 |
| age\_standard\_error | 1.90E-04 | 2.07E-04 | 1.52E-04 | 1.01E-03 |
| age\_t\_score | -1.71E+01 | -1.27E+01 | -1.21E+01 | 2.21E+01 |
| age\_p\_value | 4.41E-29 | 2.87E-21 | 6.41E-11 | 9.79E-08 |
| gender\_coefficient | 5.00E-02 | 8.82E-02 | 5.00E-03 | -3.04E-02 |
| gender\_standard\_error | 8.85E-03 | 8.99E-03 | 6.37E-03 | 2.14E-02 |
| gender\_t\_score | 5.65E+00 | 9.81E+00 | 7.85E-01 | -1.42E+00 |
| gender\_p\_value | 2.17E-07 | 1.40E-15 | 4.41E-01 | 1.99E-01 |
| PIR\_coefficient | -8.25E-03 | -8.38E-03 | -6.40E-04 | -1.32E-02 |
| PIR\_standard\_error | 2.64E-03 | 3.49E-03 | 1.67E-03 | 7.38E-03 |
| PIR\_t\_score | -3.13E+00 | -2.40E+00 | -3.84E-01 | -1.79E+00 |
| PIR\_p\_value | 2.40E-03 | 1.86E-02 | 7.05E-01 | 1.17E-01 |
| mex\_coefficient | 3.13E-02 | 1.01E-01 | -3.56E-03 | -1.50E-01 |
| mex\_standard\_error | 1.12E-02 | 2.12E-02 | 7.09E-03 | 4.11E-02 |
| mex\_t\_score | 2.80E+00 | 4.74E+00 | -5.02E-01 | -3.65E+00 |
| mex\_p\_value | 6.42E-03 | 8.60E-06 | 6.21E-01 | 8.14E-03 |
| hispanic\_coefficient | 3.42E-02 | 1.43E-01 | -4.57E-02 | 2.15E-02 |
| hispanic\_standard\_error | 1.77E-02 | 2.70E-02 | 1.49E-02 | 4.20E-02 |
| hispanic\_t\_score | 1.93E+00 | 5.29E+00 | -3.07E+00 | 5.12E-01 |
| hispanic\_p\_value | 5.73E-02 | 9.69E-07 | 5.76E-03 | 6.25E-01 |
| black\_coefficient | -6.88E-02 | 8.74E-02 | 2.87E-02 | 1.15E-01 |
| black\_standard\_error | 1.31E-02 | 1.67E-02 | 5.04E-03 | 2.42E-02 |
| black\_t\_score | -5.24E+00 | 5.23E+00 | 5.69E+00 | 4.76E+00 |
| black\_p\_value | 1.16E-06 | 1.21E-06 | 1.19E-05 | 2.06E-03 |
| other\_coefficient | 5.14E-03 | 8.84E-02 | -6.76E-03 | 2.47E-02 |
| other\_standard\_error | 1.81E-02 | 2.56E-02 | 1.66E-02 | 4.82E-02 |
| other\_t\_score | 1.81E-02 | 3.45E+00 | -4.07E-01 | 5.12E-01 |
| other\_p\_value | 2.84E-01 | 8.81E-04 | 6.88E-01 | 6.25E-01 |
| Cycle\_coefficient | 7.77E-01 | 8.75E-02 | -2.42E-01 | N/A |
| Cycle\_standard\_error | 4.14E-03 | 3.98E-03 | 7.35E-03 | N/A |
| Cycle\_t\_score | 1.82E+01 | 2.19E+01 | -3.29E+01 | N/A |
| Cycle\_p\_value | 6.03E-31 | 1.53E-36 | 1.51E-19 | N/A |
| cotinine\_coefficient | 1.15E-01 | -4.30E-03 | -3.72E-03 | 1.86E-03 |
| cotinine\_standard\_error | 3.34E-03 | 3.44E-03 | 1.53E-03 | 4.11E-03 |
| cotinine\_t\_score | 3.43E+01 | -1.25E+00 | -2.43E+00 | 4.53E-01 |
| cotinine\_p\_value | 3.50E-51 | 2.16E-01 | 2.44E-02 | 6.64E-01 |

# **2. Age-Based Trends, Half-Lives, and Restriction Dates**

## **Table S12**. Maximum composite half-life in hours, log-transformed half-life, and types of methods on how the half-lives were determined for each chemical biomarker.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NHANES Codename** | **Chemical Name (units)** | **Maximum Composite Half-Lives (hours)** | **Log 10(Maximum Composite Half-Lives)** | **Method Types to Find or Estimate Half-Lives** |
| LBXGLY | Glycideamide (pmoL/G Hb) | 4.716143 | 0.673587 | Estimated by QSARs |
| LBXACR | Acrylamide (pmoL/G Hb) | 2.238721 | 0.35 | Estimated by QSARs |
| LBXBB1LA | 2,2',4,4',5,5'-hexabromobiphenyl lipid adj (ng/g) | 56940 | 4.755417 | Arnot et al., 2014 Training Set |
| LBXBR2LA | 2,4,4'-tribromodiphenyl ether lipid adj (ng/g) | 26400 | 4.421604 | Arnot et al., 2014 Training Set |
| LBXBR8LA | 2,2',4,4',5,6'-hexabromodiphenyl ether lipid adj (ng/g) | 18214.72 | 4.260422 | Arnot et al., 2014 Training Set |
| LBXBR6LA | 2,2',4,4',6-pentabromodiphenyl lipid adj (ng/g) | 14831.67 | 4.17119 | Arnot et al., 2014 Training Set |
| LBXBR3LA | 2,2',4,4'-tetrabromodiphenyl ether lipid ad (ng/g) | 13818.15 | 4.14045 | Arnot et al., 2014 Training Set |
| LBXBR5LA | 2,2',4,4',5-pentabromodiphenyl lipid adj (ng/g) | 12699.6 | 4.10379 | Arnot et al., 2014 Training Set |
| LBXBR7LA | 2,2',4,4',5,5'-hexabromodiphenyl lipid adj (ng/g) | 6194.411 | 3.792 | QSAR |
| LBXD03LA | 1,2,3,6,7,8-hxcdd Lipid Adj (pg/g) | 244555 | 5.388377 | Arnot et al., 2014 Training Set |
| LBXD07LA | 1,2,3,4,6,7,8,9-ocdd Lipid Adj (pg/g) | 66104.34 | 4.82023 | Arnot et al., 2014 Training Set |
| LBXD05LA | 1,2,3,4,6,7,8-hpcdd Lipid Adj (pg/g) | 39400.41 | 4.595501 | Arnot et al., 2014 Training Set |
| LBXF04LA | 1,2,3,4,7,8-hxcdf Lipid Adj (pg/g) | 60954.86 | 4.785008 | Arnot et al., 2014 Training Set |
| LBXF03LA | 2,3,4,7,8-pncdf Lipid Adj (pg/g) | 51002.33 | 4.70759 | Arnot et al., 2014 Training Set |
| LBXF08LA | 1,2,3,4,6,7,8-hpcdf Lipid Adj (pg/g) | 22792.4 | 4.35779 | Arnot et al., 2014 Training Set |
| SSMEL | Melamine (ng/mL) | 3.404082 | 0.532 | Estimated by QSARs |
| SSCYA | Cyanuric acid (ng/mL) | 2.238721 | 0.35 | Estimated by QSARs |
| LBXBPB | Lead (ug/dL) | 262800 | 5.419625 | Literature |
| LBXBCD | Cadmium (ug/L) | 262800 | 5.419625 | Literature |
| LBXTHG | Mercury, total (ug/L) | 157680 | 5.197777 | Literature |
| URXUHG | Mercury, urine (ng/mL) | 157680 | 5.197777 | Literature |
| URXUBA | Barium, urine (ng/mL) | 1200 | 3.079181 | Literature |
| URXUCO | Cobalt, urine (ng/mL) | 17520 | 4.243534 | Literature |
| URXUCS | Cesium, urine (ng/mL) | 3600 | 3.556303 | Literature |
| URXUMO | Molybdenum, urine (ng/mL) | 19 | 1.278754 | Literature |
| URXUPB | Lead, urine (ng/mL) | 262800 | 5.419625 | Literature |
| URXUSB | Antimony, urine (ng/mL) | 2400 | 3.380211 | Literature |
| URXUTL | Thallium, urine (ng/mL) | 192 | 2.283301 | Literature |
| URXUTU | Tungsten, urine (ng/mL) | 201480 | 5.304232 | Literature |
| URXUUR | Uranium, urine (ng/mL) | 5760 | 3.760422 | Literature |
| URXUAS | Urinary total Arsenic (µg/L) | 60 | 1.778151 | Literature |
| URXUAB | Urinary Arsenobetaine (µg/L) | 98 | 1.991226 | Literature |
| URXUDMA | Urinary Dimethylarsonic acid (µg/L) | 2243 | 3.350829 | Literature |
| URXUCD | Cadmium, urine (ng/mL) | 262800 | 5.419625 | Literature |
| LBXBMN | Blood manganese (ug/L) | 78840 | 4.896747 | Literature |
| LBXSCU | Serum Copper (ug/dL) | 792 | 2.898725 | Literature |
| LBXSZN | Serum Zinc (ug/dL) | 12000 | 4.079181 | Literature |
| LBXBGM | Mercury, methyl (ug/L) | 3360 | 3.526339 | Literature |
| URXSCN | Urinary thiocyanate (ng/mL) | 4.477442 | 0.65103 | Estimated by QSARs |
| URXUIO | Iodine, urine (ng/mL) | 744 | 2.871573 | Literature |
| URXNO3 | Urinary nitrate (ng/mL) | 1.588547 | 0.201 | Estimated by QSARs |
| URXUP8 | Perchlorate, urine (ng/mL) | 9.3 | 0.968483 | Literature |
| URXTRS | Urinary Triclosan (ng/mL) | 254.0973 | 2.405 | Estimated by QSARs |
| URXBPS | Urinary Bisphenol S (ug/L) | 7.144963 | 0.854 | Estimated by QSARs |
| URXMPB | Methyl paraben (ng/ml) | 2.09894 | 0.322 | Estimated by QSARs |
| URXPPB | Propyl paraben (ng/ml) | 2.09894 | 0.322 | Estimated by QSARs |
| URXBPH | Urinary Bisphenol A (ng/mL) | 2 | 0.30103 | Arnot et al., 2014 Training Set |
| URXBPF | Urinary Bisphenol F (ug/L) | 1.96336 | 0.293 | Estimated by QSARs |
| URXBP3 | Urinary Benzophenone-3 (ng/mL) | 1.202264 | 0.08 | Estimated by QSARs |
| LBXTNALA | Trans-nonachlor Lipid Adj (ng/g) | 685510.4 | 5.836014 | Estimated by QSARs |
| LBXOXYLA | Oxychlordane Lipid Adj (ng/g) | 624539.5 | 5.79556 | Estimated by QSARs |
| LBXPDELA | p,p'-DDE Lipid Adj (ng/g) | 77236.13 | 4.887821 | Arnot et al., 2014 Training Set |
| LBXDIELA | Dieldrin Lipid Adj (ng/g) | 36525.47 | 4.562596 | Arnot et al., 2014 Training Set |
| LBXBHCLA | Beta-hexachlorocyclohexane Lipid Adj (ng/g) | 3365.348 | 3.52703 | Estimated by QSARs |
| URXCPM | 3,5,6-trichloropyridinol (ug/L) | 197.6464 | 2.295889 | Estimated by QSARs |
| URXOP3 | Dimethylthiophosphate (ug/L) | 117.1998 | 2.068927 | Estimated by QSARs |
| URXOPM | 3-phenoxybenzoic acid (ug/L) | 67.02382 | 1.826229 | Estimated by QSARs |
| URX14D | 2,5-dichlorophenol (ug/L) | 39.88466 | 1.600806 | Estimated by QSARs |
| URXDCB | 2,4-dichlorophenol (ug/L) | 35.81212 | 1.55403 | Estimated by QSARs |
| URXPAR | Paranitrophenol (ug/L) | 13.95087 | 1.144601 | Estimated by QSARs |
| URX24D | 2,4-D (ug/L) | 32.9997 | 1.51851 | Arnot et al., 2014 Training Set |
| URXDEA | DEET acid (ug/L) | 9.29979 | 0.968473 | Estimated by QSARs |
| URXCNP | Mono(carboxynonyl) phthalate (ng/mL) | 10.35214 | 1.01503 | Estimated by QSARs |
| SSURHIBP | Mono-2-hydroxy-iso-butyl phthlte (ng/mL) | 5.936395 | 0.773523 | Estimated by QSARs |
| URXCOP | Mono(carboxyoctyl) phthalate (ng/mL) | 5.176068 | 0.714 | Estimated by QSARs |
| URXMIB | Mono-isobutyl pthalate (ng/mL) | 1.75945 | 0.245377 | Estimated by QSARs |
| URXMHP | Mono-(2-ethyl)-hexyl phthalate (ng/mL) | 1.117285 | 0.048164 | Estimated by QSARs |
| URXMOH | Mono-(2-ethyl-5-oxohexyl) phthalate (ng/mL) | 1.117285 | 0.048164 | Estimated by QSARs |
| URXMZP | Mono-benzyl phthalate (ng/mL) | 1.093676 | 0.038889 | Estimated by QSARs |
| URXMHH | Mono-(2-ethyl-5-hydroxyhexyl) phthalate (ng/mL) | 1.022749 | 0.009769 | Estimated by QSARs |
| URXECP | Mono-2-ethyl-5-carboxypentyl phthalate (ng/mL) | 0.990511 | -0.00414 | Estimated by QSARs |
| URXMBP | Mono-n-butyl phthalate (ng/mL) | 0.951643 | -0.02153 | Estimated by QSARs |
| URXMEP | Mono-ethyl phthalate (ng/mL) | 0.951643 | -0.02153 | Estimated by QSARs |
| URXMNM | Mono-n-methyl phthalate (ng/mL) | 0.951643 | -0.02153 | Estimated by QSARs |
| SSURMHBP | Mono-3-hydroxy-n-butyl phthalate (ng/mL) | 0.866928 | -0.06202 | Estimated by QSARs |
| URXMC1 | Mono-(3-carboxypropyl) phthalate (ng/mL) | 0.837084 | -0.07723 | Estimated by QSARs |
| URXDMA | o-Desmethylangolensin (O-DMA) (ng/mL) | 3.116994 | 0.493736 | Estimated by QSARs |
| URXETL | Enterolactone (ng/mL) | 0.820352 | -0.086 | Estimated by QSARs |
| URXETD | Enterodiol (ng/mL) | 0.412098 | -0.385 | Estimated by QSARs |
| URXP05 | 3-phenanthrene (ng/L) | 10.13458 | 1.005806 | Estimated by QSARs |
| URXP06 | 1-phenanthrene (ng/L) | 10.13458 | 1.005806 | Estimated by QSARs |
| URXP07 | 2-phenanthrene (ng/L) | 10.13458 | 1.005806 | Estimated by QSARs |
| URXP19 | 4-phenanthrene (ng/L) | 10.13458 | 1.005806 | Estimated by QSARs |
| URXP25 | 2 & 3-Hydroxyphenanthrene (ng/L) | 10.13458 | 1.005806 | Estimated by QSARs |
| URXP10 | 1-pyrene (ng/L) | 8.830799 | 0.946 | Estimated by QSARs |
| URXP01 | 1-napthol (ng/L) | 6.424005 | 0.807806 | Estimated by QSARs |
| URXP02 | 2-napthol (ng/L) | 6.424005 | 0.807806 | Estimated by QSARs |
| URXP17 | 9-fluorene (ng/L) | 5.480988 | 0.738859 | Estimated by QSARs |
| URXP03 | 3-fluorene (ng/L) | 1.689685 | 0.227806 | Estimated by QSARs |
| URXP04 | 2-fluorene (ng/L) | 1.689685 | 0.227806 | Estimated by QSARs |
| LBD199LA | PCB199 Lipid Adj (ng/g) | 2023998 | 6.30621 | Arnot et al., 2014 Training Set |
| LBX180LA | PCB180 Lipid Adj (ng/g) | 451554.3 | 5.65471 | Arnot et al., 2014 Training Set |
| LBX209LA | PCB209 Lipid Adj (ng/g) | 303598.5 | 5.4823 | Arnot et al., 2014 Training Set |
| LBX146LA | PCB146 Lipid Adj (ng/g) | 233539.3 | 5.36836 | Arnot et al., 2014 Training Set |
| LBX170LA | PCB170 Lipid Adj (ng/g) | 226996.9 | 5.35602 | Arnot et al., 2014 Training Set |
| LBX194LA | PCB194 Lipid Adj (ng/g) | 170215.9 | 5.231 | Estimated by QSARs |
| LBX187LA | PCB187 Lipid Adj (ng/g) | 136442.9 | 5.134951 | Arnot et al., 2014 Training Set |
| LBX153LA | PCB153 Lipid Adj (ng/g) | 129038.7 | 5.11072 | Arnot et al., 2014 Training Set |
| LBX196LA | PCB196 Lipid Adj (ng/g) | 101199.9 | 5.00518 | Arnot et al., 2014 Training Set |
| LBX138LA | PCB138 Lipid Adj (ng/g) | 84739.08 | 4.928084 | Arnot et al., 2014 Training Set |
| LBXHXCLA | 3,3',4,4',5,5'-hxcb Lipid Adj (pg/g) | 73872.02 | 4.86848 | Arnot et al., 2014 Training Set |
| LBX118LA | PCB118 Lipid Adj (ng/g) | 45459.01 | 4.65762 | Arnot et al., 2014 Training Set |
| LBX099LA | PCB99 Lipid Adj (ng/g) | 30359.85 | 4.4823 | Arnot et al., 2014 Training Set |
| LBXPCBLA | 3,3',4,4',5-pcnb Lipid Adj (pg/g) | 14646.56 | 4.165736 | Arnot et al., 2014 Training Set |
| LBX074LA | PCB74 Lipid Adj (ng/g) | 8552.045 | 3.93207 | Arnot et al., 2014 Training Set |
| LBX028LA | PCB28 Lipid Adj (ng/g) | 5284.107 | 3.722972 | Arnot et al., 2014 Training Set |
| LBX049LA | PCB49 Lipid Adj (ng/g) | 1046.887 | 3.0199 | Arnot et al., 2014 Training Set |
| LBX044LA | PCB44 Lipid Adj (ng/g) | 948.7452 | 2.97715 | Arnot et al., 2014 Training Set |
| LBXPFDE | Perfluorodecanoic acid (ng/mL) | 58692 | 4.768578909 | Conglomerated Estimation |
| LBXMPAH | 2-(N-methyl-PFOSA) acetate (ng/mL) | 14582.35905 | 4.163827787 | Anima-Human Extrapolation |
| LBXPFNA | Perfluorononanoic acid (ng/mL) | 21900 | 4.340444115 | Conglomerated Estimation |
| LBXPFHS | Perfluorohexane sulfonic acid (ng/mL) | 63948 | 4.805826966 | Conglomerated Estimation |
| LBXPFOA | Perfluorooctanoic acid (ng/mL) | 20586 | 4.313571968 | Conglomerated Estimation |
| LBXPFOS | Perfluorooctane sulfonic acid (ng/mL) | 41172 | 4.614601964 | Conglomerated Estimation |
| LBXCOT | Cotinine (ng/mL) | 17.30103 | 1.238072 | Arnot et al., 2014 Training Set |
| URXNAL | NNAL , urine (ng/mL) | 2.203265 | 0.343067 | Estimated by QSARs |
| LBXVXY | Blood m-/p-Xylene (ng/ml) | 31.62105 | 1.499976 | Arnot et al., 2014 Training Set |
| LBXVDB | Blood 1,4-Dichlorobenzene (ng/ml) | 21.9786 | 1.342 | Estimated by QSARs |
| LBXVBM | Blood Bromodichloromethane (pg/ml) | 18.40772 | 1.265 | Estimated by QSARs |
| URXHEM | N-Ace-S-(2-Hydroxyethyl)-L-cys (ng/mL) | 7.353935 | 0.86652 | Estimated by QSARs |
| URXPHG | Phenylglyoxylic acid (ng/mL) | 4.400217 | 0.643474 | Estimated by QSARs |
| URXHP2 | N-Ace-S-(2-hydroxypropyl)-L-cys (ng/mL) | 4.954844 | 0.69503 | Estimated by QSARs |
| URXMB3 | N-A-S-(4-hydrxy-2butn-l-yl)-L-cys (ng/mL) | 4.477442 | 0.65103 | Estimated by QSARs |
| URX34M | 3-methipurc acd & 4-methipurc acd (ng/mL) | 4.824392 | 0.683443 | Estimated by QSARs |
| URXBMA | N-Acetyl-S-(benzyl)-L-cysteine (ng/mL) | 4.594688 | 0.662256 | Estimated by QSARs |
| URXBPM | N-Acetyl-S-(n-propyl)-L-cysteine (ng/mL) | 4.477442 | 0.65103 | Estimated by QSARs |
| URXGAM | N-ac-S-(2-carbmo-2-hydxel)-L-cys (ng/mL) | 4.477442 | 0.65103 | Estimated by QSARs |
| URXMAD | Mandelic acid (ng/mL) | 4.005215 | 0.602626 | Estimated by QSARs |
| URXAAM | N-Ace-S-(2-carbamoylethyl)-L-cys (ng/mL) | 3.992602 | 0.601256 | Estimated by QSARs |
| URXAMC | N-Ace-S-(N-methlcarbamoyl)-L-cys (ng/mL) | 3.992602 | 0.601256 | Estimated by QSARs |
| URXATC | 2-amnothiazolne-4-carbxylic acid (ng/mL) | 3.992602 | 0.601256 | Estimated by QSARs |
| URXCYM | N-acetyl-S-(2-cyanoethyl)-L-cys (ng/mL) | 3.992602 | 0.601256 | Estimated by QSARs |
| URXTTC | 2-thoxothazlidne-4-carbxylic acid (ng/mL) | 3.992602 | 0.601256 | Estimated by QSARs |
| URX2MH | 2-Methylhippuric acid (ng/mL) | 3.867926 | 0.587478 | Estimated by QSARs |
| URXPMM | N-A-S-(3-hydrxprpl-1-metl)-L-cys (ng/mL) | 3.615931 | 0.55822 | Estimated by QSARs |
| URXCEM | N-Acetyl-S-(2-Carbxyethyl)-L-Cys (ng/mL) | 3.483236 | 0.541983 | Estimated by QSARs |
| URXHPM | N-Ace-S-(3-Hydroxypropyl)-L-Cys (ng/mL) | 3.483236 | 0.541983 | Estimated by QSARs |
| URXDHB | N-Ace-S-(3,4-Dihidxybutl)-L-Cys (ng/mL) | 3.213711 | 0.507007 | Estimated by QSARs |
| LBXVTO | Blood Toluene (ng/ml) | 2.576321 | 0.411 | Estimated by QSARs |
| LBXNM | Blood Nitromethane (pg/mL) | 2.238721 | 0.35 | Estimated by QSARs |
| LBXVCF | Blood Chloroform (pg/ml) | 1.5 | 0.176091 | Arnot et al., 2014 Training Set |

## **Table S13.** Linear regression results pertaining to age by chemical biomarker.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **NHANES codename** | **Chemical Name (units)** | **Age Coefficient** | **Age Percent Difference** | **Age Standard Error** | **Age T-Score** | **Age p-value** | **FDR adjusted p-value** |
| LBXGLY | Glycideamide (pmoL/G Hb) | -2.32E-03 | -19.2681 | 9.63E-05 | -24.1231 | 5.12E-126 | 1.90E-125 |
| LBXACR | Acrylamide (pmoL/G Hb) | -9.43E-04 | -8.3182 | 7.77E-05 | -12.1420 | 9.34E-34 | 2.09E-33 |
| LBXBB1LA | 2,2',4,4',5,5'-hexabromobiphenyl lipid adj (ng/g) | 1.40E-02 | 262.3491 | 4.88E-04 | 28.6568 | 1.42E-150 | 5.72E-150 |
| LBXBR2LA | 2,4,4'-tribromodiphenyl ether lipid adj (ng/g) | 6.64E-04 | 6.3113 | 4.61E-04 | 1.4404 | 1.50E-01 | 1.61E-01 |
| LBXBR8LA | 2,2',4,4',5,6'-hexabromodiphenyl ether lipid adj (ng/g) | -1.07E-03 | -9.3855 | 4.10E-04 | -2.6080 | 9.18E-03 | 1.08E-02 |
| LBXBR6LA | 2,2',4,4',6-pentabromodiphenyl lipid adj (ng/g) | -2.13E-03 | -17.8383 | 5.22E-04 | -4.0897 | 4.50E-05 | 5.93E-05 |
| LBXBR3LA | 2,2',4,4'-tetrabromodiphenyl ether lipid ad (ng/g) | -2.08E-03 | -17.4520 | 5.15E-04 | -4.0435 | 5.48E-05 | 7.09E-05 |
| LBXBR5LA | 2,2',4,4',5-pentabromodiphenyl lipid adj (ng/g) | -2.21E-03 | -18.3879 | 4.95E-04 | -4.4543 | 8.92E-06 | 1.20E-05 |
| LBXBR7LA | 2,2',4,4',5,5'-hexabromodiphenyl ether lipid adj (ng/g) | -3.46E-03 | -27.2813 | 5.30E-04 | -6.5303 | 8.38E-11 | 1.33E-10 |
| LBXD03LA | 1,2,3,6,7,8-hxcdd Lipid Adj (pg/g) | 1.46E-02 | 285.1838 | 2.78E-04 | 52.7396 | 0.00E+00 | 0.00E+00 |
| LBXD07LA | 1,2,3,4,6,7,8,9-ocdd Lipid Adj (pg/g) | 9.93E-03 | 149.6867 | 2.52E-04 | 39.4131 | 2.46E-271 | 1.51E-270 |
| LBXD05LA | 1,2,3,4,6,7,8-hpcdd Lipid Adj (pg/g) | 7.94E-03 | 107.8320 | 2.72E-04 | 29.2547 | 4.27E-165 | 1.88E-164 |
| LBXF04LA | 1,2,3,4,7,8-hxcdf Lipid Adj (pg/g) | 6.70E-03 | 85.3289 | 2.04E-04 | 32.8415 | 2.22E-201 | 1.08E-200 |
| LBXF03LA | 2,3,4,7,8-pncdf Lipid Adj (pg/g) | 9.66E-03 | 143.4772 | 2.42E-04 | 39.8413 | 2.13E-277 | 1.37E-276 |
| LBXF08LA | 1,2,3,4,6,7,8-hpcdf Lipid Adj (pg/g) | -5.02E-05 | -0.4610 | 2.70E-04 | -0.1856 | 8.53E-01 | 8.53E-01 |
| SSMEL | Melamine (ng/mL) | 4.03E-03 | 44.9647 | 1.94E-03 | 2.0790 | 3.82E-02 | 4.27E-02 |
| SSCYA | Cyanuric acid (ng/mL) | 2.29E-03 | 23.4684 | 9.53E-04 | 2.4007 | 1.68E-02 | 1.93E-02 |
| LBXBPB | Lead (ug/dL) | 5.44E-03 | 64.9908 | 5.00E-05 | 108.6547 | 0.00E+00 | 0.00E+00 |
| LBXBCD | Cadmium (ug/L) | 6.43E-03 | 80.8056 | 4.61E-05 | 139.3489 | 0.00E+00 | 0.00E+00 |
| LBXTHG | Mercury, total (ug/L) | 5.68E-03 | 68.7554 | 9.05E-05 | 62.8100 | 0.00E+00 | 0.00E+00 |
| URXUHG | Mercury, urine (ng/mL) | 2.51E-03 | 26.0315 | 1.74E-04 | 14.4475 | 5.53E-47 | 1.37E-46 |
| URXUBA | Barium, urine (ng/mL) | -2.70E-03 | -22.0119 | 1.45E-04 | -18.5591 | 4.44E-76 | 1.46E-75 |
| URXUCO | Cobalt, urine (ng/mL) | -1.59E-03 | -13.6039 | 1.04E-04 | -15.2965 | 1.90E-52 | 5.15E-52 |
| URXUCS | Cesium, urine (ng/mL) | 5.53E-04 | 5.2290 | 8.21E-05 | 6.7413 | 1.62E-11 | 2.63E-11 |
| URXUMO | Molybdenum, urine (ng/mL) | -1.86E-03 | -15.7685 | 1.11E-04 | -16.8116 | 7.06E-63 | 2.12E-62 |
| URXUPB | Lead, urine (ng/mL) | 3.72E-03 | 40.8769 | 1.10E-04 | 33.6943 | 1.67E-240 | 9.42E-240 |
| URXUSB | Antimony, urine (ng/mL) | -1.41E-03 | -12.2013 | 9.26E-05 | -15.2614 | 3.25E-52 | 8.66E-52 |
| URXUTL | Thallium, urine (ng/mL) | -1.35E-03 | -11.6785 | 8.64E-05 | -15.6104 | 1.57E-54 | 4.52E-54 |
| URXUTU | Tungsten, urine (ng/mL) | -3.91E-03 | -30.2667 | 1.37E-04 | -28.6669 | 3.02E-176 | 1.37E-175 |
| URXUUR | Uranium, urine (ng/mL) | 5.48E-04 | 5.1816 | 1.36E-04 | 4.0354 | 5.48E-05 | 7.09E-05 |
| URXUAS | Urinary total Arsenic (µg/L) | 3.16E-03 | 33.7778 | 1.76E-04 | 17.9662 | 3.21E-71 | 1.01E-70 |
| URXUAB | Urinary Arsenobetaine (µg/L) | 6.02E-03 | 74.1445 | 2.87E-04 | 20.9686 | 7.15E-96 | 2.52E-95 |
| URXUDMA | Urinary Dimethylarsonic acid (µg/L) | 1.43E-03 | 14.1273 | 1.19E-04 | 12.1007 | 1.66E-33 | 3.54E-33 |
| URXUCD | Cadmium, urine (ng/mL) | 1.25E-02 | 216.1998 | 1.12E-04 | 111.9704 | 0.00E+00 | 0.00E+00 |
| LBXBMN | Blood manganese (ug/L) | -9.76E-04 | -8.5942 | 7.58E-05 | -12.8738 | 1.73E-37 | 3.94E-37 |
| LBXSCU | Serum Copper (ug/dL) | 2.56E-04 | 2.3860 | 9.58E-05 | 2.6716 | 7.61E-03 | 9.02E-03 |
| LBXSZN | Serum Zinc (ug/dL) | -9.82E-05 | -0.9001 | 7.71E-05 | -1.2730 | 2.03E-01 | 2.15E-01 |
| LBXBGM | Mercury, methyl (ug/L) | 7.41E-03 | 97.8037 | 2.70E-04 | 27.4379 | 3.07E-157 | 1.27E-156 |
| URXSCN | Urinary thiocyanate (ng/mL) | -2.41E-03 | -19.8935 | 1.26E-04 | -19.1200 | 8.58E-81 | 2.95E-80 |
| URXUIO | Iodine, urine (ng/mL) | 6.39E-04 | 6.0643 | 1.19E-04 | 5.3741 | 7.79E-08 | 1.14E-07 |
| URXNO3 | Urinary nitrate (ng/mL) | -2.09E-03 | -17.4970 | 8.57E-05 | -24.3648 | 2.67E-129 | 1.02E-128 |
| URXUP8 | Perchlorate, urine (ng/mL) | -6.25E-04 | -5.5982 | 1.06E-04 | -5.8815 | 4.12E-09 | 6.39E-09 |
| URXTRS | Urinary Triclosan (ng/mL) | 7.28E-04 | 6.9397 | 3.47E-04 | 2.0995 | 3.58E-02 | 4.04E-02 |
| URXBPS | Urinary Bisphenol S (ug/L) | 2.04E-03 | 20.6357 | 4.57E-04 | 4.4586 | 8.62E-06 | 1.17E-05 |
| URXMPB | Methyl paraben (ng/ml) | 3.08E-03 | 32.7819 | 3.30E-04 | 9.3243 | 1.39E-20 | 2.48E-20 |
| URXPPB | Propyl paraben (ng/ml) | 2.28E-03 | 23.3467 | 4.16E-04 | 5.4768 | 4.45E-08 | 6.60E-08 |
| URXBPH | Urinary Bisphenol A (ng/mL) | -1.61E-03 | -13.7433 | 1.72E-04 | -9.3379 | 1.17E-20 | 2.12E-20 |
| URXBPF | Urinary Bisphenol F (ug/L) | 2.72E-04 | 2.5375 | 5.21E-04 | 0.5224 | 6.01E-01 | 6.19E-01 |
| URXBP3 | Urinary Benzophenone-3 (ng/mL) | -3.56E-03 | -27.9796 | 3.59E-04 | -9.9302 | 3.84E-23 | 7.22E-23 |
| LBXTNALA | Trans-nonachlor Lipid Adj (ng/g) | 1.62E-02 | 342.6100 | 1.77E-04 | 91.3825 | 0.00E+00 | 0.00E+00 |
| LBXOXYLA | Oxychlordane Lipid Adj (ng/g) | 1.43E-02 | 273.4235 | 1.59E-04 | 90.0243 | 0.00E+00 | 0.00E+00 |
| LBXPDELA | p,p'-DDE Lipid Adj (ng/g) | 1.55E-02 | 315.3221 | 2.55E-04 | 60.6527 | 0.00E+00 | 0.00E+00 |
| LBXDIELA | Dieldrin Lipid Adj (ng/g) | 6.20E-03 | 77.0135 | 1.83E-04 | 33.8356 | 7.13E-220 | 3.72E-219 |
| LBXBHCLA | Beta-hexachlorocyclohexane Lipid Adj (ng/g) | 1.55E-02 | 317.1140 | 2.17E-04 | 71.3987 | 0.00E+00 | 0.00E+00 |
| URXCPM | 3,5,6-trichloropyridinol (ug/L) | -8.47E-04 | -7.5085 | 2.43E-04 | -3.4803 | 5.03E-04 | 6.22E-04 |
| URXOP3 | Dimethylthiophosphate (ug/L) | 4.70E-04 | 4.4287 | 3.35E-04 | 1.4035 | 1.60E-01 | 1.71E-01 |
| URXOPM | 3-phenoxybenzoic acid (ug/L) | -5.42E-04 | -4.8677 | 3.01E-04 | -1.7991 | 7.20E-02 | 7.94E-02 |
| URX14D | 2,5-dichlorophenol (ug/L) | 2.05E-03 | 20.7508 | 3.64E-04 | 5.6232 | 1.92E-08 | 2.88E-08 |
| URXDCB | 2,4-dichlorophenol (ug/L) | 1.31E-03 | 12.8277 | 2.55E-04 | 5.1480 | 2.68E-07 | 3.85E-07 |
| URXPAR | Paranitrophenol (ug/L) | -1.28E-04 | -1.1732 | 2.93E-04 | -0.4367 | 6.62E-01 | 6.77E-01 |
| URX24D | 2,4-D (ug/L) | 2.59E-04 | 2.4146 | 2.15E-04 | 1.2042 | 2.29E-01 | 2.41E-01 |
| URXDEA | DEET acid (ug/L) | -4.14E-03 | -31.6862 | 3.95E-04 | -10.4767 | 1.77E-25 | 3.52E-25 |
| URXCNP | Mono(carboxynonyl) phthalate (ng/mL) | -2.05E-03 | -17.1932 | 2.04E-04 | -10.0589 | 1.12E-23 | 2.14E-23 |
| SSURHIBP | Mono-2-hydroxy-iso-butyl phthlte (ng/mL) | -3.45E-03 | -27.2270 | 3.50E-04 | -9.8702 | 1.47E-22 | 2.73E-22 |
| URXCOP | Mono(carboxyoctyl) phthalate (ng/mL) | -3.42E-03 | -26.9952 | 2.47E-04 | -13.8514 | 3.52E-43 | 8.55E-43 |
| URXMIB | Mono-isobutyl pthalate (ng/mL) | -2.74E-03 | -22.3131 | 1.60E-04 | -17.1015 | 6.91E-65 | 2.12E-64 |
| URXMHP | Mono-(2-ethyl)-hexyl phthalate (ng/mL) | -2.65E-03 | -21.6770 | 1.83E-04 | -14.5109 | 2.10E-47 | 5.30E-47 |
| URXMOH | Mono-(2-ethyl-5-oxohexyl) phthalate (ng/mL) | -2.87E-03 | -23.1988 | 1.89E-04 | -15.1771 | 1.33E-51 | 3.41E-51 |
| URXMZP | Mono-benzyl phthalate (ng/mL) | -5.54E-03 | -39.9632 | 1.72E-04 | -32.2381 | 8.41E-221 | 4.56E-220 |
| URXMHH | Mono-(2-ethyl-5-hydroxyhexyl) phthalate (ng/mL) | -2.60E-03 | -21.2705 | 1.96E-04 | -13.2388 | 9.23E-40 | 2.21E-39 |
| URXECP | Mono-2-ethyl-5-carboxypentyl phthalate (ng/mL) | -2.40E-03 | -19.8161 | 1.98E-04 | -12.1050 | 1.61E-33 | 3.54E-33 |
| URXMBP | Mono-n-butyl phthalate (ng/mL) | -1.99E-03 | -16.7394 | 1.54E-04 | -12.9148 | 5.81E-38 | 1.34E-37 |
| URXMEP | Mono-ethyl phthalate (ng/mL) | 3.29E-03 | 35.4561 | 2.14E-04 | 15.4041 | 3.78E-53 | 1.07E-52 |
| URXMNM | Mono-n-methyl phthalate (ng/mL) | -1.11E-03 | -9.7150 | 2.07E-04 | -5.3606 | 8.43E-08 | 1.23E-07 |
| SSURMHBP | Mono-3-hydroxy-n-butyl phthalate (ng/mL) | -1.17E-03 | -10.2548 | 3.23E-04 | -3.6417 | 2.76E-04 | 3.48E-04 |
| URXMC1 | Mono-(3-carboxypropyl) phthalate (ng/mL) | -3.28E-03 | -26.0508 | 1.77E-04 | -18.4692 | 3.04E-75 | 9.76E-75 |
| URXDMA | o-Desmethylangolensin (O-DMA) (ng/mL) | -3.82E-03 | -29.6476 | 3.94E-04 | -9.6944 | 3.78E-22 | 6.91E-22 |
| URXETL | Enterolactone (ng/mL) | 9.33E-04 | 8.9773 | 2.81E-04 | 3.3257 | 8.84E-04 | 1.08E-03 |
| URXETD | Enterodiol (ng/mL) | 4.41E-04 | 4.1436 | 2.63E-04 | 1.6763 | 9.37E-02 | 1.02E-01 |
| URXP05 | 3-phenanthrene (ng/L) | 3.61E-05 | 0.3334 | 1.37E-04 | 0.2647 | 7.91E-01 | 8.03E-01 |
| URXP06 | 1-phenanthrene (ng/L) | 9.73E-04 | 9.3740 | 1.26E-04 | 7.7453 | 1.02E-14 | 1.73E-14 |
| URXP07 | 2-phenanthrene (ng/L) | 1.59E-03 | 15.7253 | 1.36E-04 | 11.6866 | 2.10E-31 | 4.35E-31 |
| URXP19 | 4-phenanthrene (ng/L) | 1.93E-04 | 1.7976 | 1.98E-04 | 0.9793 | 3.27E-01 | 3.42E-01 |
| URXP25 | 2 & 3-Hydroxyphenanthrene (ng/L) | 5.44E-04 | 5.1382 | 2.94E-04 | 1.8502 | 6.44E-02 | 7.15E-02 |
| URXP10 | 1-pyrene (ng/L) | -3.56E-03 | -27.9620 | 1.45E-04 | -24.5735 | 1.53E-130 | 5.98E-130 |
| URXP01 | 1-napthol (ng/L) | 4.83E-03 | 56.0232 | 2.06E-04 | 23.4781 | 1.49E-119 | 5.39E-119 |
| URXP02 | 2-napthol (ng/L) | 7.47E-04 | 7.1187 | 1.47E-04 | 5.0707 | 4.01E-07 | 5.72E-07 |
| URXP17 | 9-fluorene (ng/L) | 2.29E-03 | 23.4841 | 1.49E-04 | 15.4044 | 5.21E-53 | 1.44E-52 |
| URXP03 | 3-fluorene (ng/L) | -3.33E-04 | -3.0206 | 1.40E-04 | -2.3838 | 1.71E-02 | 1.95E-02 |
| URXP04 | 2-fluorene (ng/L) | 9.44E-04 | 9.0886 | 1.29E-04 | 7.3461 | 2.16E-13 | 3.58E-13 |
| LBD199LA | PCB199 Lipid Adj (ng/g) | 2.65E-02 | 1052.6053 | 4.66E-04 | 56.9841 | 0.00E+00 | 0.00E+00 |
| LBX180LA | PCB180 Lipid Adj (ng/g) | 2.21E-02 | 662.9881 | 3.54E-04 | 62.3803 | 0.00E+00 | 0.00E+00 |
| LBX209LA | PCB209 Lipid Adj (ng/g) | 2.10E-02 | 594.5184 | 3.52E-04 | 59.7759 | 0.00E+00 | 0.00E+00 |
| LBX146LA | PCB146 Lipid Adj (ng/g) | 1.92E-02 | 485.7304 | 3.37E-04 | 56.9964 | 0.00E+00 | 0.00E+00 |
| LBX170LA | PCB170 Lipid Adj (ng/g) | 2.17E-02 | 640.8515 | 3.74E-04 | 58.1512 | 0.00E+00 | 0.00E+00 |
| LBX194LA | PCB194 Lipid Adj (ng/g) | 2.79E-02 | 1205.9260 | 5.34E-04 | 52.2846 | 0.00E+00 | 0.00E+00 |
| LBX187LA | PCB187 Lipid Adj (ng/g) | 2.11E-02 | 598.4521 | 3.68E-04 | 57.3873 | 0.00E+00 | 0.00E+00 |
| LBX153LA | PCB153 Lipid Adj (ng/g) | 1.81E-02 | 429.2989 | 3.11E-04 | 58.2286 | 0.00E+00 | 0.00E+00 |
| LBX196LA | PCB196 Lipid Adj (ng/g) | 2.37E-02 | 785.6331 | 4.56E-04 | 51.9144 | 0.00E+00 | 0.00E+00 |
| LBX138LA | PCB138 Lipid Adj (ng/g) | 1.69E-02 | 374.4311 | 3.12E-04 | 54.1378 | 0.00E+00 | 0.00E+00 |
| LBXHXCLA | 3,3',4,4',5,5'-hxcb Lipid Adj (pg/g) | 1.41E-02 | 265.4627 | 2.18E-04 | 64.5897 | 0.00E+00 | 0.00E+00 |
| LBX118LA | PCB118 Lipid Adj (ng/g) | 1.29E-02 | 229.5298 | 3.24E-04 | 39.9989 | 2.76E-250 | 1.62E-249 |
| LBX099LA | PCB99 Lipid Adj (ng/g) | 1.03E-02 | 158.6301 | 3.15E-04 | 32.7726 | 1.22E-184 | 5.73E-184 |
| LBXPCBLA | 3,3',4,4',5-pcnb Lipid Adj (pg/g) | 9.99E-03 | 150.8936 | 2.90E-04 | 34.4833 | 1.33E-218 | 6.71E-218 |
| LBX074LA | PCB74 Lipid Adj (ng/g) | 1.41E-02 | 267.4115 | 2.75E-04 | 51.3066 | 0.00E+00 | 0.00E+00 |
| LBX028LA | PCB28 Lipid Adj (ng/g) | 9.05E-04 | 8.6925 | 2.51E-04 | 3.6056 | 3.20E-04 | 3.99E-04 |
| LBX049LA | PCB49 Lipid Adj (ng/g) | -1.52E-03 | -13.0851 | 3.09E-04 | -4.9224 | 9.34E-07 | 1.32E-06 |
| LBX044LA | PCB44 Lipid Adj (ng/g) | -1.28E-03 | -11.0926 | 2.97E-04 | -4.2913 | 1.87E-05 | 2.49E-05 |
| LBXPFDE | Perfluorodecanoic acid (ng/mL) | 1.97E-03 | 19.8412 | 1.29E-04 | 15.2510 | 5.50E-52 | 1.44E-51 |
| LBXMPAH | 2-(N-methyl-PFOSA) acetate (ng/mL) | 1.17E-03 | 11.3549 | 1.84E-04 | 6.3616 | 2.09E-10 | 3.28E-10 |
| LBXPFNA | Perfluorononanoic acid (ng/mL) | 1.54E-03 | 15.2092 | 1.36E-04 | 11.3323 | 1.32E-29 | 2.71E-29 |
| LBXPFHS | Perfluorohexane sulfonic acid (ng/mL) | 6.03E-04 | 5.7096 | 1.82E-04 | 3.3211 | 9.00E-04 | 1.09E-03 |
| LBXPFOA | Perfluorooctanoic acid (ng/mL) | 7.09E-04 | 6.7491 | 1.24E-04 | 5.7294 | 1.03E-08 | 1.57E-08 |
| LBXPFOS | Perfluorooctane sulfonic acid (ng/mL) | 3.73E-03 | 40.9940 | 1.37E-04 | 27.1772 | 1.75E-157 | 7.48E-157 |
| LBXCOT | Cotinine (ng/mL) | 1.80E-03 | 18.0195 | 2.75E-04 | 6.5508 | 5.78E-11 | 9.26E-11 |
| URXNAL | NNAL , urine (ng/mL) | -9.30E-04 | -8.2088 | 1.23E-04 | -7.5725 | 3.83E-14 | 6.43E-14 |
| LBXVXY | Blood m-/p-Xylene (ng/ml) | 6.84E-04 | 6.4980 | 1.49E-04 | 4.5880 | 4.52E-06 | 6.18E-06 |
| LBXVDB | Blood 1,4-Dichlorobenzene (ng/ml) | 8.07E-04 | 7.7183 | 3.11E-04 | 2.5947 | 9.48E-03 | 1.10E-02 |
| LBXVBM | Blood Bromodichloromethane (pg/ml) | 6.95E-05 | 0.6426 | 2.79E-04 | 0.2494 | 8.03E-01 | 8.09E-01 |
| URXHEM | N-Ace-S-(2-Hydroxyethyl)-L-cys (ng/mL) | -3.44E-03 | -27.1849 | 3.06E-04 | -11.2527 | 1.06E-28 | 2.14E-28 |
| URXPHG | Phenylglyoxylic acid (ng/mL) | 1.35E-03 | 13.2330 | 2.75E-04 | 4.8985 | 1.03E-06 | 1.43E-06 |
| URXHP2 | N-Ace-S-(2-hydroxypropyl)-L-cys (ng/mL) | 4.87E-03 | 56.6051 | 3.98E-04 | 12.2404 | 1.64E-33 | 3.54E-33 |
| URXMB3 | N-A-S-(4-hydrxy-2butn-l-yl)-L-cys (ng/mL) | 5.89E-03 | 72.1047 | 3.43E-04 | 17.1695 | 1.36E-62 | 3.99E-62 |
| URX34M | 3-methipurc acd & 4-methipurc acd (ng/mL) | 1.91E-03 | 19.2155 | 3.97E-04 | 4.8079 | 1.61E-06 | 2.23E-06 |
| URXBMA | N-Acetyl-S-(benzyl)-L-cysteine (ng/mL) | 1.11E-03 | 10.7493 | 3.82E-04 | 2.9044 | 3.71E-03 | 4.47E-03 |
| URXBPM | N-Acetyl-S-(n-propyl)-L-cysteine (ng/mL) | 2.10E-03 | 21.3044 | 5.56E-04 | 3.7701 | 1.67E-04 | 2.12E-04 |
| URXGAM | N-ac-S-(2-carbmo-2-hydxel)-L-cys (ng/mL) | 1.83E-03 | 18.3903 | 2.31E-04 | 7.9430 | 2.94E-15 | 5.05E-15 |
| URXMAD | Mandelic acid (ng/mL) | 2.36E-03 | 24.2441 | 2.68E-04 | 8.7834 | 2.86E-18 | 4.98E-18 |
| URXAAM | N-Ace-S-(2-carbamoylethyl)-L-cys (ng/mL) | -7.47E-04 | -6.6515 | 2.91E-04 | -2.5703 | 1.02E-02 | 1.18E-02 |
| URXAMC | N-Ace-S-(N-methlcarbamoyl)-L-cys (ng/mL) | 5.42E-03 | 64.6833 | 2.80E-04 | 19.3606 | 5.41E-78 | 1.82E-77 |
| URXATC | 2-amnothiazolne-4-carbxylic acid (ng/mL) | -2.83E-03 | -22.9682 | 3.88E-04 | -7.3075 | 3.63E-13 | 5.95E-13 |
| URXCYM | N-acetyl-S-(2-cyanoethyl)-L-cys (ng/mL) | 2.19E-03 | 22.3032 | 3.76E-04 | 5.8168 | 6.75E-09 | 1.04E-08 |
| URXTTC | 2-thoxothazlidne-4-carbxylic acid (ng/mL) | -7.26E-04 | -6.4692 | 4.65E-04 | -1.5604 | 1.19E-01 | 1.29E-01 |
| URX2MH | 2-Methylhippuric acid (ng/mL) | 1.10E-03 | 10.7130 | 3.87E-04 | 2.8584 | 4.29E-03 | 5.13E-03 |
| URXPMM | N-A-S-(3-hydrxprpl-1-metl)-L-cys (ng/mL) | 3.28E-03 | 35.2217 | 3.14E-04 | 10.4243 | 6.08E-25 | 1.19E-24 |
| URXCEM | N-Acetyl-S-(2-Carbxyethyl)-L-Cys (ng/mL) | 4.02E-03 | 44.7956 | 3.04E-04 | 13.2081 | 1.44E-38 | 3.38E-38 |
| URXHPM | N-Ace-S-(3-Hydroxypropyl)-L-Cys (ng/mL) | 3.37E-03 | 36.3719 | 3.24E-04 | 10.3901 | 8.59E-25 | 1.66E-24 |
| URXDHB | N-Ace-S-(3,4-Dihidxybutl)-L-Cys (ng/mL) | 8.74E-04 | 8.3804 | 2.19E-04 | 3.9896 | 6.81E-05 | 8.73E-05 |
| LBXVTO | Blood Toluene (ng/ml) | 1.77E-03 | 17.6917 | 1.96E-04 | 9.0372 | 1.91E-19 | 3.36E-19 |
| LBXNM | Blood Nitromethane (pg/mL) | 1.87E-03 | 18.8482 | 1.55E-04 | 12.0917 | 9.17E-33 | 1.93E-32 |
| LBXVCF | Blood Chloroform (pg/ml) | -2.52E-04 | -2.2959 | 2.80E-04 | -0.9022 | 3.67E-01 | 3.80E-01 |

## **Table S14.** Latest restriction date, decade, and period by chemicals.

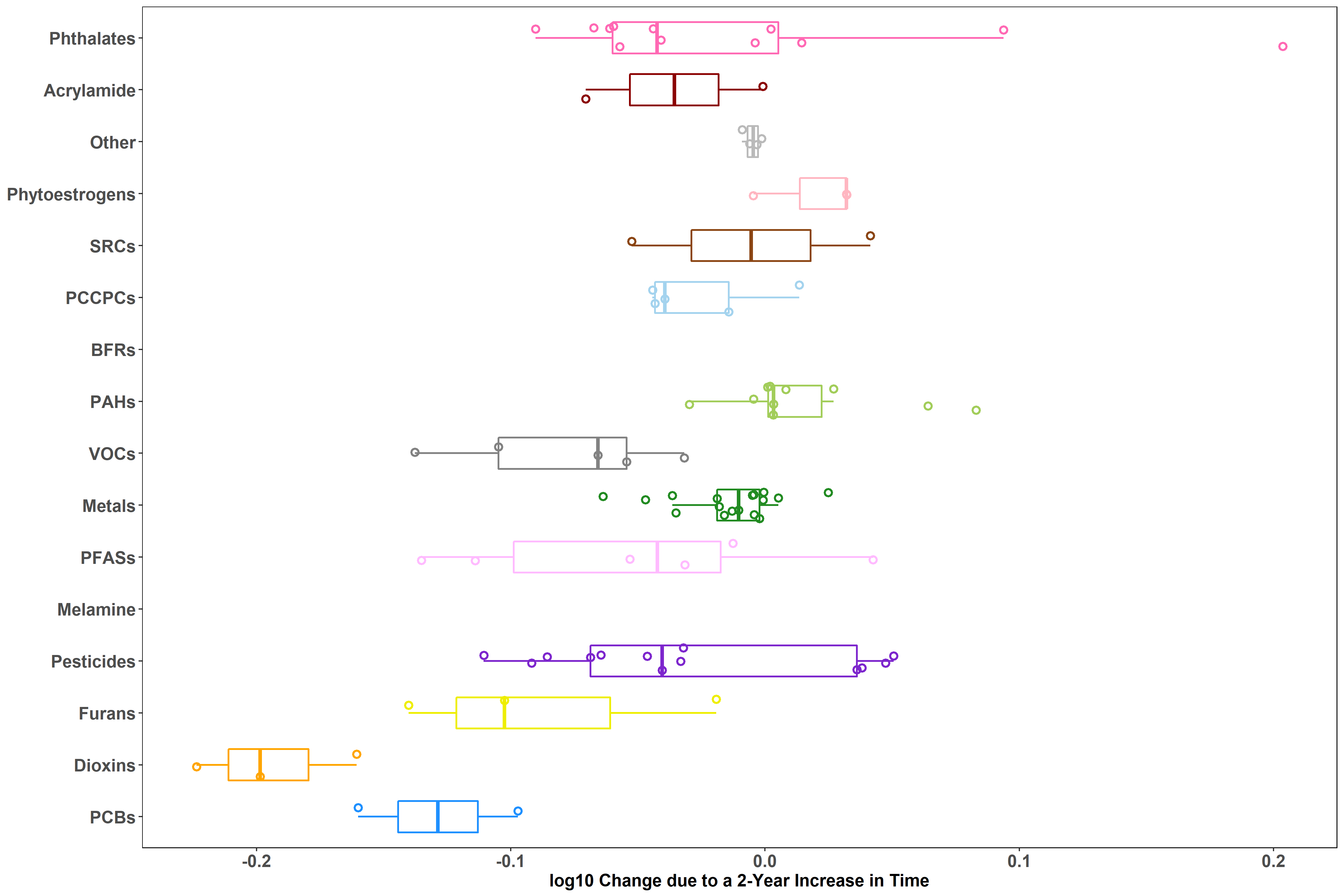
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| --- | --- | --- | --- | --- |
| **NHANES Codename** | **Chemical Name (units)** | **Latest Restriction Date** | **Latest Restriction Decade** | **Latest Restriction Period** |
| LBXGLY | Glycideamide (pmoL/G Hb) | #N/A | No Restrictions | No Restrictions |
| LBXACR | Acrylamide (pmoL/G Hb) | #N/A | No Restrictions | No Restrictions |
| LBXBB1LA | 2,2',4,4',5,5'-hexabromobiphenyl lipid adj (ng/g) | 1979 | 1970s | 1970-1984 |
| LBXBR2LA | 2,4,4'-tribromodiphenyl ether lipid adj (ng/g) | 2004 | 2000s | 2000-2014 |
| LBXBR8LA | 2,2',4,4',5,6'-hexabromodiphenyl ether lipid adj (ng/g) | 2004 | 2000s | 2000-2014 |
| LBXBR6LA | 2,2',4,4',6-pentabromodiphenyl lipid adj (ng/g) | 2004 | 2000s | 2000-2014 |
| LBXBR3LA | 2,2',4,4'-tetrabromodiphenyl ether lipid ad (ng/g) | 2004 | 2000s | 2000-2014 |
| LBXBR5LA | 2,2',4,4',5-pentabromodiphenyl lipid adj (ng/g) | 2004 | 2000s | 2000-2014 |
| LBXBR7LA | 2,2',4,4',5,5'-hexabromodiphenyl lipid adj (ng/g) | 2004 | 2000s | 2000-2014 |
| LBXD03LA | 1,2,3,6,7,8-hxcdd Lipid Adj (pg/g) | 1995 | 1990s | 1985-1999 |
| LBXD07LA | 1,2,3,4,6,7,8,9-ocdd Lipid Adj (pg/g) | 1995 | 1990s | 1985-1999 |
| LBXD05LA | 1,2,3,4,6,7,8-hpcdd Lipid Adj (pg/g) | 1995 | 1990s | 1985-1999 |
| LBXF04LA | 1,2,3,4,7,8-hxcdf Lipid Adj (pg/g) | 1995 | 1990s | 1985-1999 |
| LBXF03LA | 2,3,4,7,8-pncdf Lipid Adj (pg/g) | 1995 | 1990s | 1985-1999 |
| LBXF08LA | 1,2,3,4,6,7,8-hpcdf Lipid Adj (pg/g) | 1995 | 1990s | 1985-1999 |
| SSMEL | Melamine (ng/mL) | #N/A | No Restrictions | No Restrictions |
| SSCYA | Cyanuric acid (ng/mL) | #N/A | No Restrictions | No Restrictions |
| LBXBPB | Lead (ug/dL) | 1995 | 1990s | 1985-1999 |
| LBXBCD | Cadmium (ug/L) | 2008 | 2000s | 2000-2014 |
| LBXTHG | Mercury, total (ug/L) | 1996 | 1990s | 1985-1999 |
| URXUHG | Mercury, urine (ng/mL) | 1996 | 1990s | 1985-1999 |
| URXUBA | Barium, urine (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXUCO | Cobalt, urine (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXUCS | Cesium, urine (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXUMO | Molybdenum, urine (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXUPB | Lead, urine (ng/mL) | 1995 | 1990s | 1985-1999 |
| URXUSB | Antimony, urine (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXUTL | Thallium, urine (ng/mL) | 1972 | 1970s | 1970-1984 |
| URXUTU | Tungsten, urine (ng/mL) | 2012 | 2010s | 2000-2014 |
| URXUUR | Uranium, urine (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXUAS | Urinary total Arsenic (µg/L) | #N/A | No Restrictions | No Restrictions |
| URXUAB | Urinary Arsenobetaine (µg/L) | #N/A | No Restrictions | No Restrictions |
| URXUDMA | Urinary Dimethylarsonic acid (µg/L) | #N/A | No Restrictions | No Restrictions |
| URXUCD | Cadmium, urine (ng/mL) | 2008 | 2000s | 2000-2014 |
| LBXBMN | Blood manganese (ug/L) | #N/A | No Restrictions | No Restrictions |
| LBXSCU | Serum Copper (ug/dL) | #N/A | No Restrictions | No Restrictions |
| LBXSZN | Serum Zinc (ug/dL) | #N/A | No Restrictions | No Restrictions |
| LBXBGM | Mercury, methyl (ug/L) | 1996 | 1990s | 1985-1999 |
| URXSCN | Urinary thiocyanate (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXUIO | Iodine, urine (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXNO3 | Urinary nitrate (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXUP8 | Perchlorate, urine (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXTRS | Urinary Triclosan (ng/mL) | 2016 | No Restrictions | No Restrictions |
| URXBPS | Urinary Bisphenol S (ug/L) | #N/A | No Restrictions | No Restrictions |
| URXMPB | Methyl paraben (ng/ml) | 2015 | No Restrictions | No Restrictions |
| URXPPB | Propyl paraben (ng/ml) | 2015 | No Restrictions | No Restrictions |
| URXBPH | Urinary Bisphenol A (ng/mL) | 2008 | 2000s | 2000-2014 |
| URXBPF | Urinary Bisphenol F (ug/L) | #N/A | No Restrictions | No Restrictions |
| URXBP3 | Urinary Benzophenone-3 (ng/mL) | #N/A | No Restrictions | No Restrictions |
| LBXTNALA | Trans-nonachlor Lipid Adj (ng/g) | 1983 | 1980s | 1970-1984 |
| LBXOXYLA | Oxychlordane Lipid Adj (ng/g) | 1983 | 1980s | 1970-1984 |
| LBXPDELA | p,p'-DDE Lipid Adj (ng/g) | 1959 | 1950s | Before 1970s |
| LBXDIELA | Dieldrin Lipid Adj (ng/g) | 1974 | 1970s | 1970-1984 |
| LBXBHCLA | Beta-hexachlorocyclohexane Lipid Adj (ng/g) | 1976 | 1970s | 1970-1984 |
| URXCPM | 3,5,6-trichloropyridinol (ug/L) | 2000 | 2000s | 2000-2014 |
| URXOP3 | Dimethylthiophosphate (ug/L) | 2000 | 2000s | 2000-2014 |
| URXOPM | 3-phenoxybenzoic acid (ug/L) | #N/A | No Restrictions | No Restrictions |
| URX14D | 2,5-dichlorophenol (ug/L) | #N/A | No Restrictions | No Restrictions |
| URXDCB | 2,4-dichlorophenol (ug/L) | #N/A | No Restrictions | No Restrictions |
| URXPAR | Paranitrophenol (ug/L) | 1998 | 1990s | 1985-1999 |
| URX24D | 2,4-D (ug/L) | #N/A | No Restrictions | No Restrictions |
| URXDEA | DEET acid (ug/L) | #N/A | No Restrictions | No Restrictions |
| URXCNP | Mono(carboxynonyl) phthalate (ng/mL) | 2008 | 2000s | 2000-2014 |
| SSURHIBP | Mono-2-hydroxy-iso-butyl phthlte (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXCOP | Mono(carboxyoctyl) phthalate (ng/mL) | 2008 | 2000s | 2000-2014 |
| URXMIB | Mono-isobutyl pthalate (ng/mL) | 2009 | 2000s | 2000-2014 |
| URXMHP | Mono-(2-ethyl)-hexyl phthalate (ng/mL) | 2007 | 2000s | 2000-2014 |
| URXMOH | Mono-(2-ethyl-5-oxohexyl) phthalate (ng/mL) | 2007 | 2000s | 2000-2014 |
| URXMZP | Mono-benzyl phthalate (ng/mL) | 2009 | 2000s | 2000-2014 |
| URXMHH | Mono-(2-ethyl-5-hydroxyhexyl) phthalate (ng/mL) | 2007 | 2000s | 2000-2014 |
| URXECP | Mono-2-ethyl-5-carboxypentyl phthalate (ng/mL) | 2007 | 2000s | 2000-2014 |
| URXMBP | Mono-n-butyl phthalate (ng/mL) | 2009 | 2000s | 2000-2014 |
| URXMEP | Mono-ethyl phthalate (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXMNM | Mono-n-methyl phthalate (ng/mL) | #N/A | No Restrictions | No Restrictions |
| SSURMHBP | Mono-3-hydroxy-n-butyl phthalate (ng/mL) | 2009 | 2000s | 2000-2014 |
| URXMC1 | Mono-(3-carboxypropyl) phthalate (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXDMA | o-Desmethylangolensin (O-DMA) (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXETL | Enterolactone (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXETD | Enterodiol (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXP05 | 3-phenanthrene (ng/L) | #N/A | No Restrictions | No Restrictions |
| URXP06 | 1-phenanthrene (ng/L) | #N/A | No Restrictions | No Restrictions |
| URXP07 | 2-phenanthrene (ng/L) | #N/A | No Restrictions | No Restrictions |
| URXP19 | 4-phenanthrene (ng/L) | #N/A | No Restrictions | No Restrictions |
| URXP25 | 2 & 3-Hydroxyphenanthrene (ng/L) | #N/A | No Restrictions | No Restrictions |
| URXP10 | 1-pyrene (ng/L) | #N/A | No Restrictions | No Restrictions |
| URXP01 | 1-napthol (ng/L) | #N/A | No Restrictions | No Restrictions |
| URXP02 | 2-napthol (ng/L) | #N/A | No Restrictions | No Restrictions |
| URXP17 | 9-fluorene (ng/L) | #N/A | No Restrictions | No Restrictions |
| URXP03 | 3-fluorene (ng/L) | #N/A | No Restrictions | No Restrictions |
| URXP04 | 2-fluorene (ng/L) | #N/A | No Restrictions | No Restrictions |
| LBD199LA | PCB199 Lipid Adj (ng/g) | 1979 | 1970s | 1970-1984 |
| LBX180LA | PCB180 Lipid Adj (ng/g) | 1979 | 1970s | 1970-1984 |
| LBX209LA | PCB209 Lipid Adj (ng/g) | 1979 | 1970s | 1970-1984 |
| LBX146LA | PCB146 Lipid Adj (ng/g) | 1979 | 1970s | 1970-1984 |
| LBX170LA | PCB170 Lipid Adj (ng/g) | 1979 | 1970s | 1970-1984 |
| LBX194LA | PCB194 Lipid Adj (ng/g) | 1979 | 1970s | 1970-1984 |
| LBX187LA | PCB187 Lipid Adj (ng/g) | 1979 | 1970s | 1970-1984 |
| LBX153LA | PCB153 Lipid Adj (ng/g) | 1979 | 1970s | 1970-1984 |
| LBX196LA | PCB196 Lipid Adj (ng/g) | 1979 | 1970s | 1970-1984 |
| LBX138LA | PCB138 Lipid Adj (ng/g) | 1979 | 1970s | 1970-1984 |
| LBXHXCLA | 3,3',4,4',5,5'-hxcb Lipid Adj (pg/g) | 1979 | 1970s | 1970-1984 |
| LBX118LA | PCB118 Lipid Adj (ng/g) | 1979 | 1970s | 1970-1984 |
| LBX099LA | PCB99 Lipid Adj (ng/g) | 1979 | 1970s | 1970-1984 |
| LBXPCBLA | 3,3',4,4',5-pcnb Lipid Adj (pg/g) | 1979 | 1970s | 1970-1984 |
| LBX074LA | PCB74 Lipid Adj (ng/g) | 1979 | 1970s | 1970-1984 |
| LBX028LA | PCB28 Lipid Adj (ng/g) | 1979 | 1970s | 1970-1984 |
| LBX049LA | PCB49 Lipid Adj (ng/g) | 1979 | 1970s | 1970-1984 |
| LBX044LA | PCB44 Lipid Adj (ng/g) | 1979 | 1970s | 1970-1984 |
| LBXPFDE | Perfluorodecanoic acid (ng/mL) | #N/A | No Restrictions | No Restrictions |
| LBXMPAH | 2-(N-methyl-PFOSA) acetate (ng/mL) | #N/A | No Restrictions | No Restrictions |
| LBXPFNA | Perfluorononanoic acid (ng/mL) | #N/A | No Restrictions | No Restrictions |
| LBXPFHS | Perfluorohexane sulfonic acid (ng/mL) | #N/A | No Restrictions | No Restrictions |
| LBXPFOA | Perfluorooctanoic acid (ng/mL) | 2002 | 2000s | 2000-2014 |
| LBXPFOS | Perfluorooctane sulfonic acid (ng/mL) | 2002 | 2000s | 2000-2014 |
| LBXCOT | Cotinine (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXNAL | NNAL , urine (ng/mL) | #N/A | No Restrictions | No Restrictions |
| LBXVXY | Blood m-/p-Xylene (ng/ml) | #N/A | No Restrictions | No Restrictions |
| LBXVDB | Blood 1,4-Dichlorobenzene (ng/ml) | 1987 | 1980s | 1985-1999 |
| LBXVBM | Blood Bromodichloromethane (pg/ml) | #N/A | No Restrictions | No Restrictions |
| URXHEM | N-Ace-S-(2-Hydroxyethyl)-L-cys (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXPHG | Phenylglyoxylic acid (ng/mL) | 2016 | No Restrictions | No Restrictions |
| URXHP2 | N-Ace-S-(2-hydroxypropyl)-L-cys (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXMB3 | N-A-S-(4-hydrxy-2butn-l-yl)-L-cys (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URX34M | 3-methipurc acd & 4-methipurc acd (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXBMA | N-Acetyl-S-(benzyl)-L-cysteine (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXBPM | N-Acetyl-S-(n-propyl)-L-cysteine (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXGAM | N-ac-S-(2-carbmo-2-hydxel)-L-cys (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXMAD | Mandelic acid (ng/mL) | 2016 | No Restrictions | No Restrictions |
| URXAAM | N-Ace-S-(2-carbamoylethyl)-L-cys (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXAMC | N-Ace-S-(N-methlcarbamoyl)-L-cys (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXATC | 2-amnothiazolne-4-carbxylic acid (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXCYM | N-acetyl-S-(2-cyanoethyl)-L-cys (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXTTC | 2-thoxothazlidne-4-carbxylic acid (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URX2MH | 2-Methylhippuric acid (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXPMM | N-A-S-(3-hydrxprpl-1-metl)-L-cys (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXCEM | N-Acetyl-S-(2-Carbxyethyl)-L-Cys (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXHPM | N-Ace-S-(3-Hydroxypropyl)-L-Cys (ng/mL) | #N/A | No Restrictions | No Restrictions |
| URXDHB | N-Ace-S-(3,4-Dihidxybutl)-L-Cys (ng/mL) | #N/A | No Restrictions | No Restrictions |
| LBXVTO | Blood Toluene (ng/ml) | #N/A | No Restrictions | No Restrictions |
| LBXNM | Blood Nitromethane (pg/mL) | #N/A | No Restrictions | No Restrictions |
| LBXVCF | Blood Chloroform (pg/ml) | #N/A | No Restrictions | No Restrictions |

## **Text S2**. Discussion of regression coefficients.

SI Figure S1 and Table S15 summarize the ranges of average log change in chemical biomarker levels over the NHANES cycles, termed *βcycle* throughout the analysis and discussion. These values are interpreted as the log change in chemical biomarker concentration for a 2-year cycle increase and represent an overall trajectory across the eight NHANES cycles. The distributions of *βcycle’s* are discretized into 5 trend trajectories: highly decreasing (≤ -0.30), moderately decreasing (> -0.30 and ≤ -0.125), slightly decreasing (> -0.125 and ≤ -0.045), stable (> -0.045 and ≤ 0.041), and increasing (> 0.041). The majority of chemical biomarkers have *βcycle’s* between -0.045 and 0.041, implying little or no variation over time. The majority of pesticides and PFASs have negative *βcycle’s*, demonstrating a decrease in chemical biomarker levels over time, while a few pesticides, phthalates, and PAHs have high positive *βcycle’s*, reflecting increasing time trends.

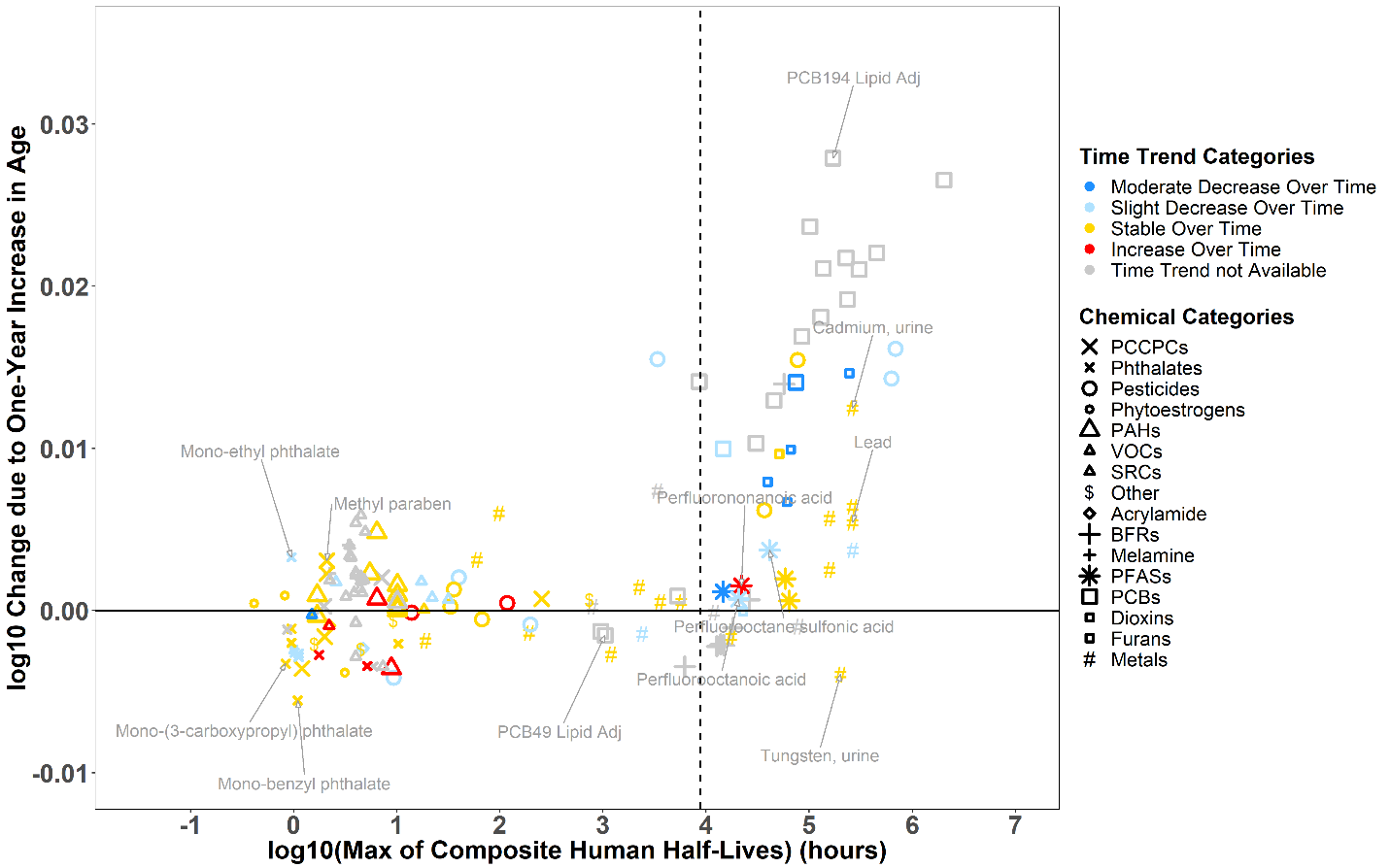
## **Table S15.** Linear regression results pertaining to cycle and resulting time trend categorization by chemical biomarker.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NHANES Codename** | **Chemical Name (units)** | **Cycle Coefficient** | **Time Trend Categories** | **Cycle Percent Difference** | **Cycle Standard Error** | **Cycle T-score** | **Cycle p-value** | **FDR adjusted p-values** |
| LBXGLY | Glycideamide (pmoL/G Hb) | -7.05E-02 | Slight Decrease Over Time | -14.9877 | 0.0043 | -16.2608 | 6.45E-59 | 2.76E-58 |
| LBXACR | Acrylamide (pmoL/G Hb) | -8.38E-04 | Stable Over Time | -0.19287 | 0.0035 | -0.2396 | 8.11E-01 | 1.00E+00 |
| LBXBB1LA | 2,2',4,4',5,5'-hexabromobiphenyl lipid adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBXBR2LA | 2,4,4'-tribromodiphenyl ether lipid adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBXBR8LA | 2,2',4,4',5,6'-hexabromodiphenyl ether lipid adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBXBR6LA | 2,2',4,4',6-pentabromodiphenyl lipid adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBXBR3LA | 2,2',4,4'-tetrabromodiphenyl ether lipid ad (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBXBR5LA | 2,2',4,4',5-pentabromodiphenyl lipid adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBXBR7LA | 2,2',4,4',5,5'-hexabromodiphenyl ether lipid adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBXD03LA | 1,2,3,6,7,8-hxcdd Lipid Adj (pg/g) | -2.24E-01 | Moderate Decrease Over Time | -40.2503 | 0.0119 | -18.8336 | 9.32E-75 | 4.87E-74 |
| LBXD07LA | 1,2,3,4,6,7,8,9-ocdd Lipid Adj (pg/g) | -1.99E-01 | Moderate Decrease Over Time | -36.6946 | 0.0109 | -18.2998 | 8.41E-71 | 4.24E-70 |
| LBXD05LA | 1,2,3,4,6,7,8-hpcdd Lipid Adj (pg/g) | -1.61E-01 | Moderate Decrease Over Time | -30.9261 | 0.0116 | -13.8283 | 3.63E-42 | 1.28E-41 |
| LBXF04LA | 1,2,3,4,7,8-hxcdf Lipid Adj (pg/g) | -1.40E-01 | Moderate Decrease Over Time | -27.5983 | 0.0087 | -16.0869 | 7.70E-56 | 3.19E-55 |
| LBXF03LA | 2,3,4,7,8-pncdf Lipid Adj (pg/g) | -1.92E-02 | Stable Over Time | -4.32858 | 0.0104 | -1.8526 | 6.40E-02 | 1.22E-01 |
| LBXF08LA | 1,2,3,4,6,7,8-hpcdf Lipid Adj (pg/g) | -1.03E-01 | Slight Decrease Over Time | -21.0317 | 0.0116 | -8.8617 | 1.35E-18 | 3.73E-18 |
| SSMEL | Melamine (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| SSCYA | Cyanuric acid (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBXBPB | Lead (ug/dL) | -3.65E-02 | Stable Over Time | -8.05381 | 0.0006 | -62.0307 | 0.00E+00 | 0.00E+00 |
| LBXBCD | Cadmium (ug/L) | -1.88E-02 | Stable Over Time | -4.24298 | 0.0005 | -34.7292 | 3.56E-261 | 5.03E-260 |
| LBXTHG | Mercury, total (ug/L) | -1.60E-02 | Stable Over Time | -3.61133 | 0.0012 | -13.0023 | 1.42E-38 | 4.66E-38 |
| URXUHG | Mercury, urine (ng/mL) | -3.51E-02 | Stable Over Time | -7.76911 | 0.0020 | -17.3490 | 9.53E-67 | 4.63E-66 |
| URXUBA | Barium, urine (ng/mL) | -5.03E-03 | Stable Over Time | -1.15217 | 0.0016 | -3.0526 | 2.27E-03 | 4.58E-03 |
| URXUCO | Cobalt, urine (ng/mL) | -7.27E-04 | Stable Over Time | -0.1672 | 0.0012 | -0.6228 | 5.33E-01 | 9.06E-01 |
| URXUCS | Cesium, urine (ng/mL) | -4.39E-03 | Stable Over Time | -1.00671 | 0.0009 | -4.7615 | 1.94E-06 | 4.48E-06 |
| URXUMO | Molybdenum, urine (ng/mL) | -5.16E-04 | Stable Over Time | -0.11868 | 0.0013 | -0.4112 | 6.81E-01 | 1.00E+00 |
| URXUPB | Lead, urine (ng/mL) | -4.70E-02 | Slight Decrease Over Time | -10.2634 | 0.0012 | -37.8821 | 8.50E-301 | 1.50E-299 |
| URXUSB | Antimony, urine (ng/mL) | -6.37E-02 | Slight Decrease Over Time | -13.6427 | 0.0010 | -60.8056 | 0.00E+00 | 0.00E+00 |
| URXUTL | Thallium, urine (ng/mL) | -4.25E-03 | Stable Over Time | -0.97356 | 0.0010 | -4.3687 | 1.26E-05 | 2.82E-05 |
| URXUTU | Tungsten, urine (ng/mL) | 5.29E-03 | Stable Over Time | 1.225061 | 0.0015 | 3.4302 | 6.05E-04 | 1.24E-03 |
| URXUUR | Uranium, urine (ng/mL) | -1.81E-02 | Stable Over Time | -4.07882 | 0.0018 | -10.3135 | 7.50E-25 | 2.30E-24 |
| URXUAS | Urinary total Arsenic (µg/L) | -1.04E-02 | Stable Over Time | -2.3558 | 0.0027 | -3.7666 | 1.66E-04 | 3.55E-04 |
| URXUAB | Urinary Arsenobetaine (µg/L) | 2.48E-02 | Stable Over Time | 5.887867 | 0.0045 | 5.5367 | 3.15E-08 | 7.65E-08 |
| URXUDMA | Urinary Dimethylarsonic acid (µg/L) | -2.21E-03 | Stable Over Time | -0.50714 | 0.0019 | -1.1920 | 2.33E-01 | 4.06E-01 |
| URXUCD | Cadmium, urine (ng/mL) | -1.29E-02 | Stable Over Time | -2.93154 | 0.0013 | -10.2271 | 1.79E-24 | 5.36E-24 |
| LBXBMN | Blood manganese (ug/L) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBXSCU | Serum Copper (ug/dL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBXSZN | Serum Zinc (ug/dL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBXBGM | Mercury, methyl (ug/L) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXSCN | Urinary thiocyanate (ng/mL) | -3.25E-03 | Stable Over Time | -0.74598 | 0.0020 | -1.6127 | 1.07E-01 | 1.98E-01 |
| URXUIO | Iodine, urine (ng/mL) | -9.04E-03 | Stable Over Time | -2.06109 | 0.0018 | -5.1416 | 2.75E-07 | 6.47E-07 |
| URXNO3 | Urinary nitrate (ng/mL) | -1.32E-03 | Stable Over Time | -0.304 | 0.0014 | -0.9637 | 3.35E-01 | 5.76E-01 |
| URXUP8 | Perchlorate, urine (ng/mL) | -6.09E-03 | Stable Over Time | -1.39182 | 0.0017 | -3.6245 | 2.90E-04 | 6.11E-04 |
| URXTRS | Urinary Triclosan (ng/mL) | -1.43E-02 | Stable Over Time | -3.23119 | 0.0055 | -2.5831 | 9.80E-03 | 1.95E-02 |
| URXBPS | Urinary Bisphenol S (ug/L) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXMPB | Methyl paraben (ng/ml) | -4.43E-02 | Stable Over Time | -9.69464 | 0.0066 | -6.6867 | 2.42E-11 | 6.32E-11 |
| URXPPB | Propyl paraben (ng/ml) | -4.33E-02 | Stable Over Time | -9.4893 | 0.0083 | -5.1891 | 2.16E-07 | 5.16E-07 |
| URXBPH | Urinary Bisphenol A (ng/mL) | -3.94E-02 | Stable Over Time | -8.67851 | 0.0027 | -14.4112 | 1.16E-46 | 4.42E-46 |
| URXBPF | Urinary Bisphenol F (ug/L) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXBP3 | Urinary Benzophenone-3 (ng/mL) | 1.35E-02 | Stable Over Time | 3.161656 | 0.0057 | 2.3669 | 1.80E-02 | 3.52E-02 |
| LBXTNALA | Trans-nonachlor Lipid Adj (ng/g) | -6.87E-02 | Slight Decrease Over Time | -14.6276 | 0.0048 | -14.2743 | 1.97E-45 | 7.14E-45 |
| LBXOXYLA | Oxychlordane Lipid Adj (ng/g) | -9.18E-02 | Slight Decrease Over Time | -19.06 | 0.0044 | -20.7837 | 2.50E-92 | 1.47E-91 |
| LBXPDELA | p,p'-DDE Lipid Adj (ng/g) | -3.22E-02 | Stable Over Time | -7.13597 | 0.0069 | -4.6407 | 3.55E-06 | 8.08E-06 |
| LBXDIELA | Dieldrin Lipid Adj (ng/g) | -3.32E-02 | Stable Over Time | -7.35973 | 0.0078 | -4.2438 | 2.25E-05 | 4.96E-05 |
| LBXBHCLA | Beta-hexachlorocyclohexane Lipid Adj (ng/g) | -8.56E-02 | Slight Decrease Over Time | -17.8986 | 0.0059 | -14.4759 | 1.20E-46 | 4.45E-46 |
| URXCPM | 3,5,6-trichloropyridinol (ug/L) | -6.45E-02 | Slight Decrease Over Time | -13.801 | 0.0026 | -24.5010 | 3.33E-128 | 2.35E-127 |
| URXOP3 | Dimethylthiophosphate (ug/L) | 4.74E-02 | Increase Over Time | 11.54473 | 0.0053 | 8.8750 | 8.09E-19 | 2.28E-18 |
| URXOPM | 3-phenoxybenzoic acid (ug/L) | 3.61E-02 | Stable Over Time | 8.664217 | 0.0033 | 11.0713 | 2.70E-28 | 8.45E-28 |
| URX14D | 2,5-dichlorophenol (ug/L) | -1.11E-01 | Slight Decrease Over Time | -22.4954 | 0.0058 | -19.1051 | 4.37E-80 | 2.37E-79 |
| URXDCB | 2,4-dichlorophenol (ug/L) | -4.05E-02 | Stable Over Time | -8.9038 | 0.0041 | -9.9999 | 1.92E-23 | 5.63E-23 |
| URXPAR | Paranitrophenol (ug/L) | 5.06E-02 | Increase Over Time | 12.34689 | 0.0038 | 13.4384 | 1.15E-40 | 3.84E-40 |
| URX24D | 2,4-D (ug/L) | 3.82E-02 | Stable Over Time | 9.188621 | 0.0028 | 13.5751 | 1.87E-41 | 6.43E-41 |
| URXDEA | DEET acid (ug/L) | -4.64E-02 | Slight Decrease Over Time | -10.1271 | 0.0110 | -4.2067 | 2.63E-05 | 5.70E-05 |
| URXCNP | Mono(carboxynonyl) phthalate (ng/mL) | 2.23E-03 | Stable Over Time | 0.515618 | 0.0041 | 0.5468 | 5.85E-01 | 9.78E-01 |
| SSURHIBP | Mono-2-hydroxy-iso-butyl phthlte (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXCOP | Mono(carboxyoctyl) phthalate (ng/mL) | 2.04E-01 | Increase Over Time | 59.83208 | 0.0049 | 41.1645 | 0.00E+00 | 0.00E+00 |
| URXMIB | Mono-isobutyl pthalate (ng/mL) | 9.39E-02 | Increase Over Time | 24.12645 | 0.0021 | 44.8994 | 0.00E+00 | 0.00E+00 |
| URXMHP | Mono-(2-ethyl)-hexyl phthalate (ng/mL) | -6.11E-02 | Slight Decrease Over Time | -13.1225 | 0.0021 | -29.5302 | 1.53E-186 | 1.66E-185 |
| URXMOH | Mono-(2-ethyl-5-oxohexyl) phthalate (ng/mL) | -6.73E-02 | Slight Decrease Over Time | -14.36 | 0.0025 | -27.3382 | 3.14E-160 | 2.95E-159 |
| URXMZP | Mono-benzyl phthalate (ng/mL) | -4.10E-02 | Stable Over Time | -9.00547 | 0.0019 | -21.0765 | 2.95E-97 | 1.81E-96 |
| URXMHH | Mono-(2-ethyl-5-hydroxyhexyl) phthalate (ng/mL) | -5.96E-02 | Slight Decrease Over Time | -12.8325 | 0.0026 | -23.3180 | 5.98E-118 | 3.83E-117 |
| URXECP | Mono-2-ethyl-5-carboxypentyl phthalate (ng/mL) | -9.03E-02 | Slight Decrease Over Time | -18.7718 | 0.0032 | -28.6516 | 2.87E-174 | 2.89E-173 |
| URXMBP | Mono-n-butyl phthalate (ng/mL) | -4.40E-02 | Stable Over Time | -9.64072 | 0.0017 | -25.2612 | 4.99E-138 | 3.70E-137 |
| URXMEP | Mono-ethyl phthalate (ng/mL) | -5.71E-02 | Slight Decrease Over Time | -12.3192 | 0.0024 | -23.5879 | 6.64E-121 | 4.46E-120 |
| URXMNM | Mono-n-methyl phthalate (ng/mL) | -3.87E-03 | Stable Over Time | -0.8868 | 0.0027 | -1.4330 | 1.52E-01 | 2.78E-01 |
| SSURMHBP | Mono-3-hydroxy-n-butyl phthalate (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXMC1 | Mono-(3-carboxypropyl) phthalate (ng/mL) | 1.44E-02 | Stable Over Time | 3.379001 | 0.0023 | 6.2376 | 4.58E-10 | 1.15E-09 |
| URXDMA | o-Desmethylangolensin (O-DMA) (ng/mL) | 3.21E-02 | Stable Over Time | 7.668073 | 0.0051 | 6.2311 | 4.77E-10 | 1.18E-09 |
| URXETL | Enterolactone (ng/mL) | -4.56E-03 | Stable Over Time | -1.04551 | 0.0036 | -1.2559 | 2.09E-01 | 3.73E-01 |
| URXETD | Enterodiol (ng/mL) | 3.20E-02 | Stable Over Time | 7.655037 | 0.0034 | 9.4067 | 5.94E-21 | 1.71E-20 |
| URXP05 | 3-phenanthrene (ng/L) | -2.97E-02 | Stable Over Time | -6.61767 | 0.0017 | -17.1925 | 1.46E-65 | 6.87E-65 |
| URXP06 | 1-phenanthrene (ng/L) | 1.94E-03 | Stable Over Time | 0.447171 | 0.0016 | 1.2162 | 2.24E-01 | 3.95E-01 |
| URXP07 | 2-phenanthrene (ng/L) | 2.70E-02 | Stable Over Time | 6.417273 | 0.0017 | 15.7273 | 2.97E-55 | 1.20E-54 |
| URXP19 | 4-phenanthrene (ng/L) | -4.45E-03 | Stable Over Time | -1.02031 | 0.0025 | -1.7718 | 7.65E-02 | 1.44E-01 |
| URXP25 | 2 & 3-Hydroxyphenanthrene (ng/L) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXP10 | 1-pyrene (ng/L) | 8.30E-02 | Increase Over Time | 21.04818 | 0.0018 | 45.2180 | 0.00E+00 | 0.00E+00 |
| URXP01 | 1-napthol (ng/L) | 3.39E-03 | Stable Over Time | 0.782808 | 0.0026 | 1.3039 | 1.92E-01 | 3.48E-01 |
| URXP02 | 2-napthol (ng/L) | 6.41E-02 | Increase Over Time | 15.89823 | 0.0019 | 34.3698 | 1.69E-248 | 1.99E-247 |
| URXP17 | 9-fluorene (ng/L) | 8.12E-03 | Stable Over Time | 1.887255 | 0.0023 | 3.5310 | 4.16E-04 | 8.62E-04 |
| URXP03 | 3-fluorene (ng/L) | 9.54E-04 | Stable Over Time | 0.219911 | 0.0018 | 0.5399 | 5.89E-01 | 9.78E-01 |
| URXP04 | 2-fluorene (ng/L) | 3.22E-03 | Stable Over Time | 0.743807 | 0.0016 | 1.9758 | 4.82E-02 | 9.31E-02 |
| LBD199LA | PCB199 Lipid Adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBX180LA | PCB180 Lipid Adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBX209LA | PCB209 Lipid Adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBX146LA | PCB146 Lipid Adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBX170LA | PCB170 Lipid Adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBX194LA | PCB194 Lipid Adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBX187LA | PCB187 Lipid Adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBX153LA | PCB153 Lipid Adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBX196LA | PCB196 Lipid Adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBX138LA | PCB138 Lipid Adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBXHXCLA | 3,3',4,4',5,5'-hxcb Lipid Adj (pg/g) | -1.60E-01 | Moderate Decrease Over Time | -30.8298 | 0.0093 | -17.1769 | 4.73E-63 | 2.15E-62 |
| LBX118LA | PCB118 Lipid Adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBX099LA | PCB99 Lipid Adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBXPCBLA | 3,3',4,4',5-pcnb Lipid Adj (pg/g) | -9.72E-02 | Slight Decrease Over Time | -20.0555 | 0.0124 | -7.8558 | 5.55E-15 | 1.48E-14 |
| LBX074LA | PCB74 Lipid Adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBX028LA | PCB28 Lipid Adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBX049LA | PCB49 Lipid Adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBX044LA | PCB44 Lipid Adj (ng/g) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBXPFDE | Perfluorodecanoic acid (ng/mL) | -1.27E-02 | Stable Over Time | -2.87828 | 0.0015 | -8.4051 | 4.80E-17 | 1.30E-16 |
| LBXMPAH | 2-(N-methyl-PFOSA) acetate (ng/mL) | -1.35E-01 | Moderate Decrease Over Time | -26.7445 | 0.0021 | -65.3396 | 0.00E+00 | 0.00E+00 |
| LBXPFNA | Perfluorononanoic acid (ng/mL) | 4.26E-02 | Increase Over Time | 10.29628 | 0.0016 | 26.7918 | 3.06E-153 | 2.40E-152 |
| LBXPFHS | Perfluorohexane sulfonic acid (ng/mL) | -3.15E-02 | Stable Over Time | -6.99303 | 0.0021 | -14.8102 | 3.74E-49 | 1.46E-48 |
| LBXPFOA | Perfluorooctanoic acid (ng/mL) | -5.31E-02 | Slight Decrease Over Time | -11.5109 | 0.0014 | -36.6414 | 1.83E-277 | 2.87E-276 |
| LBXPFOS | Perfluorooctane sulfonic acid (ng/mL) | -1.14E-01 | Slight Decrease Over Time | -23.1002 | 0.0016 | -70.9713 | 0.00E+00 | 0.00E+00 |
| LBXCOT | Cotinine (ng/mL) | -5.24E-02 | Slight Decrease Over Time | -11.3705 | 0.0032 | -16.2845 | 1.81E-59 | 7.96E-59 |
| URXNAL | NNAL , urine (ng/mL) | 4.15E-02 | Increase Over Time | 10.01464 | 0.0034 | 12.1068 | 1.29E-33 | 4.15E-33 |
| LBXVXY | Blood m-/p-Xylene (ng/ml) | -6.57E-02 | Slight Decrease Over Time | -14.0419 | 0.0019 | -35.1739 | 3.64E-259 | 4.67E-258 |
| LBXVDB | Blood 1,4-Dichlorobenzene (ng/ml) | -1.05E-01 | Slight Decrease Over Time | -21.4465 | 0.0039 | -26.9361 | 1.72E-155 | 1.42E-154 |
| LBXVBM | Blood Bromodichloromethane (pg/ml) | -3.17E-02 | Stable Over Time | -7.04642 | 0.0048 | -6.6611 | 2.90E-11 | 7.43E-11 |
| URXHEM | N-Ace-S-(2-Hydroxyethyl)-L-cys (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXPHG | Phenylglyoxylic acid (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXHP2 | N-Ace-S-(2-hydroxypropyl)-L-cys (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXMB3 | N-A-S-(4-hydrxy-2butn-l-yl)-L-cys (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URX34M | 3-methipurc acd & 4-methipurc acd (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXBMA | N-Acetyl-S-(benzyl)-L-cysteine (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXBPM | N-Acetyl-S-(n-propyl)-L-cysteine (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXGAM | N-ac-S-(2-carbmo-2-hydxel)-L-cys (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXMAD | Mandelic acid (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXAAM | N-Ace-S-(2-carbamoylethyl)-L-cys (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXAMC | N-Ace-S-(N-methlcarbamoyl)-L-cys (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXATC | 2-amnothiazolne-4-carbxylic acid (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXCYM | N-acetyl-S-(2-cyanoethyl)-L-cys (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXTTC | 2-thoxothazlidne-4-carbxylic acid (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URX2MH | 2-Methylhippuric acid (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXPMM | N-A-S-(3-hydrxprpl-1-metl)-L-cys (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXCEM | N-Acetyl-S-(2-Carbxyethyl)-L-Cys (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXHPM | N-Ace-S-(3-Hydroxypropyl)-L-Cys (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| URXDHB | N-Ace-S-(3,4-Dihidxybutl)-L-Cys (ng/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBXVTO | Blood Toluene (ng/ml) | -5.44E-02 | Slight Decrease Over Time | -11.7761 | 0.0028 | -19.2815 | 2.37E-81 | 1.34E-80 |
| LBXNM | Blood Nitromethane (pg/mL) | #N/A | Time Trend not Available | #N/A | #N/A | #N/A | #N/A | #N/A |
| LBXVCF | Blood Chloroform (pg/ml) | -1.38E-01 | Moderate Decrease Over Time | -27.1855 | 0.0050 | -27.6129 | 5.26E-160 | 4.64E-159 |

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## **Figure S3**. Characteristics of the 141 NHANES chemical exposure biomarkers from 16 classes for ranges of cycle coefficients, defined as the percent change in chemical concentration due to a two-year (one NHANES cycle) increase in time. The classes are ranked by the means of class-specific age percent differences (Figure 2C). BFRs, Brominated Flame Retardants; SRCs, Smoking Related Compounds; PAHs, Polycyclic Aromatic Hydrocarbons; PCCPCs, Personal Care and Consumer Product Compounds; VOCs, Volatile Organic Compounds; PFCs, Perfluoroalkyl Chemicals; PCBs, Polychlorinated Biphenyls

# **3. Influence of Temporal Determinants on Age-Based Trends**

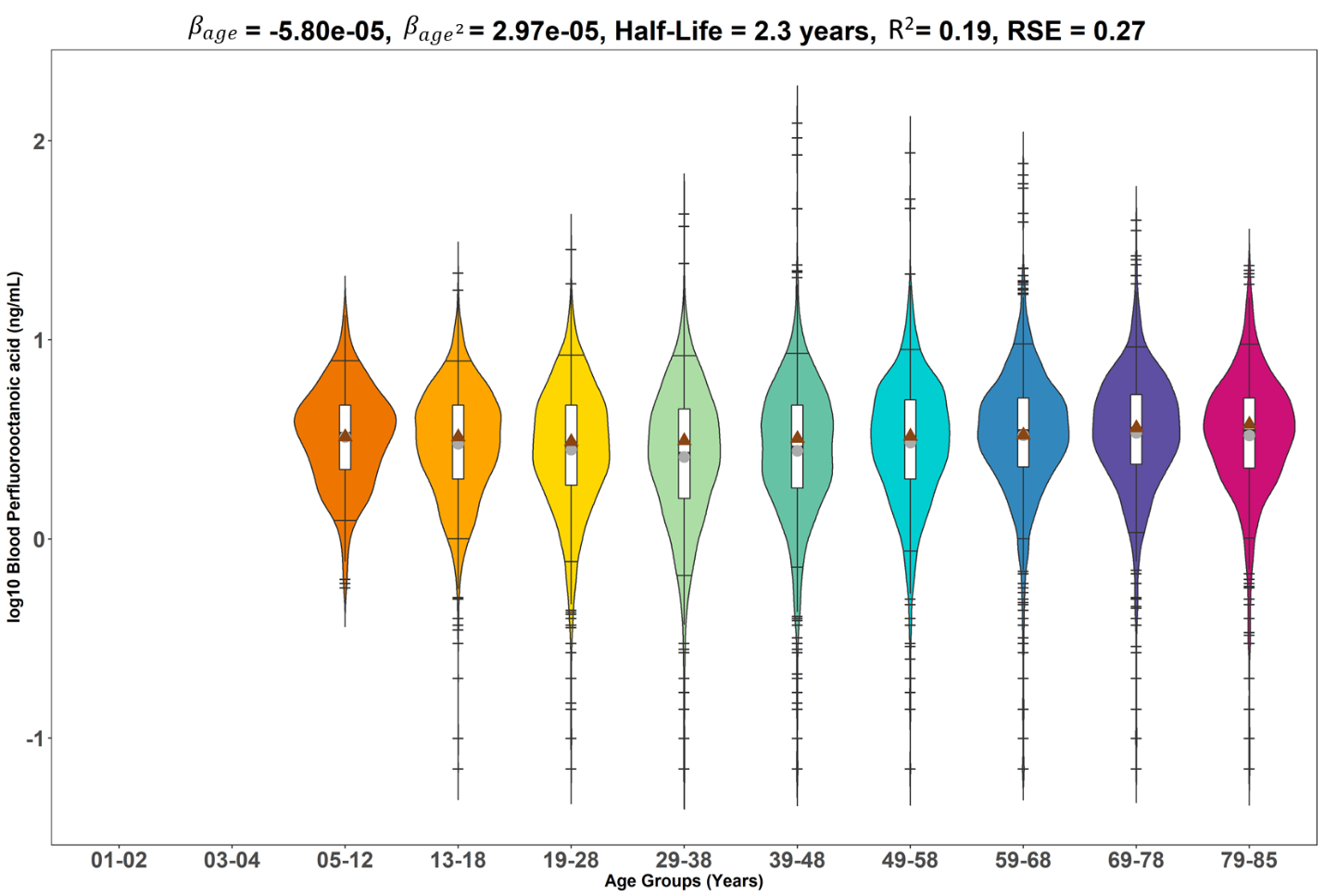
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## **Figure S4**. Association between linear age coefficients and chemical persistency in the human body for 144 substances with colors indicating the time trend trajectories and symbols indicating the different chemical classes. The same abbreviations for the chemical classes are used as those in Figure 2.

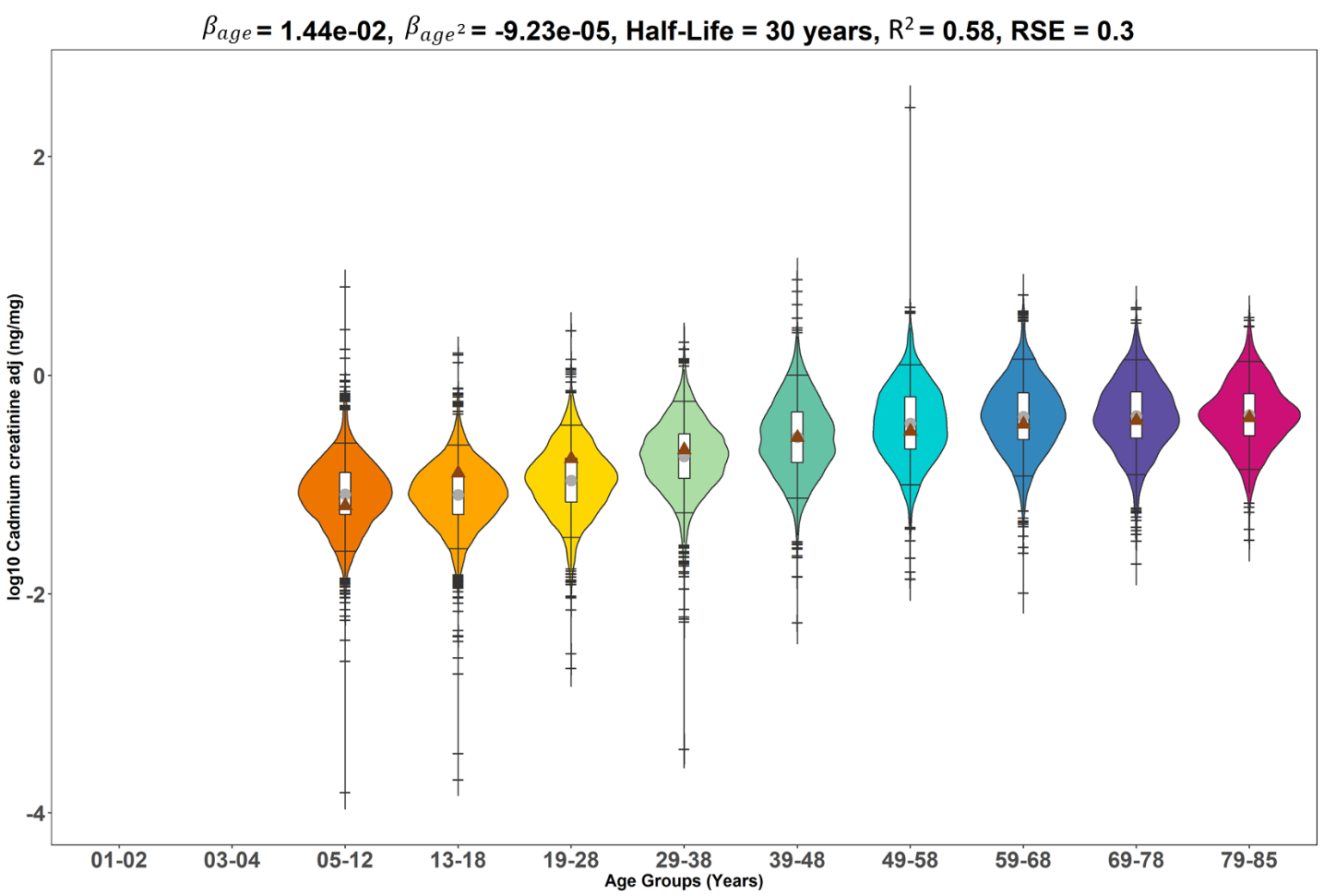
# **4. Age-Based Trends by Chemical Class**

## **Text S3**. Pooled serum concentrations observed for four age groups in 2005-2008.

Though our analysis for PCBs was limited to measurements in 2003-2004, weighted arithmetic means of pooled serum concentrations for four age groups (12-19, 20-39, 40-59, 60+) in 2005-2008 by different race-sex combinations can provide additional insight on the life-stage differences (CDC 2009). Across all race-gender combinations, the weighted arithmetic means for pooled serum levels of PCB 194 are shown to increase with the older age groups, showing approximately a range of 23-fold to 50-fold differences between children and elder pooled samples across the two cycles. Weighted arithmetic means for pooled serum levels of PCB 49 and most of the less persistent PCBs were not available, since the proportion of measurements below the LOD was high in 2005-2008. However, the pooled weight arithmetic means for serum levels of less persistent substances such as PCB 66 and PCB 28 are shown to be only 2 to 5 folds higher in the older age groups compared to the younger age groups.



## **Figure S5**. Violin plots of PFOA concentrations partitioned by age groups to display the distribution with the 5th, 25th, 50th, 75th, and 95th percentiles as indicated by the superimposed boxplot and show the frequency of the urinary cadmium biomarker levels represented by the width of the violins.



## **Figure S6.** Violin plots of urinary cadmium concentrations partitioned by age groups to display the distribution with the 5th, 25th, 50th, 75th, and 95th percentiles as indicated by the superimposed boxplot and show the frequency of the urinary cadmium biomarker levels represented by the width of the violins.

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