

Attachment 8

Laboratory Assessments

Attachment 8 – NHANES Laboratory Assessments
Attachment 8a - Laboratory Analytes by Age Group

Test Name	Sample	Matrix
Ages 1-2		
Complete Blood Count	Full	Whole blood
Erythrocyte Folate	Full	Whole blood
Hepatitis B Surface Antibody (Anti-HBs) 2 years and older	Full	Serum
Serum Folate	Full	Serum
Vitamin D	Full	Serum
Ages 3-5		
Complete Blood Count	Full	Whole blood
Erythrocyte Folate	Full	Whole blood
Fatty Acids (polyunsaturated, monounsaturated, and saturated)	Full	Serum
Hepatitis Profile**	Full	Serum
Serum Folate	Full	Serum
Vitamin D	Full	Serum
Ages 6-11		
Albumin/Creatinine	Full	Urine
Caffeine	One-third	Urine
Cholesterol (Total)/ High Density Lipoprotein Cholesterol (HDL)	Full	Serum
Complete Blood Count	Full	Whole blood
Estradiol	Full	Serum
Erythrocyte Folate	Full	Whole blood
Fluoride, plasma	Full	Plasma EDTA
Fluoride, water	Full	Water
Fatty Acids (polyunsaturated, monounsaturated, and saturated)	Full	Plasma EDTA
Hepatitis Profile**	Full	Serum
Serum Folate	Full	Serum
Sex hormone binding globin	Full	Serum
Testosterone	Full	Serum
Tissue transglutaminase (TTG)/Endomysial antibody (EMA)	Full	Serum
Urine flow rate	Full	Urine
Vitamin D	Full	Serum
Ages 12-19		
Albumin/Creatinine	Full	Urine
Biochemistry Profile*	Full	Serum
Caffeine	One-third	Urine
Chlamydia trachomatis (14-19 years)	Full	Urine
Cholesterol (Total)/ High Density Lipoprotein Cholesterol (HDL)	Full	Serum
Complete Blood Count	Full	Whole blood
Erythrocyte Folate	Full	Whole blood
Estradiol	Full	Serum
Fluoride, plasma	Full	Plasma EDTA
Fluoride, water	Full	Water
Glucose (Oral Glucose Tolerance Test)	One-half	Plasma Na2F

Test Name	Sample	Matrix
Glucose, fasting	One-half	Plasma Na2F
Glycohemoglobin	Full	Whole blood
Fatty Acids (polyunsaturated, monounsaturated, and saturated)	One-half	Serum
Hepatitis Profile**	Full	Serum
Herpes Simplex Virus (HSV) (14-19 years)	Full	Serum
Human Immunodeficiency Virus Antibody (18-19 years)	Full	Serum
Human Papilloma Virus (14-19 years)	Full	Serum
Human Papilloma Virus (Females and Males 14-19 years)	Full	Swab
Human Papilloma Virus (14-19 years)	Full	Rinse
Methylmalonic acid (MMA) (19 years)	Full	Serum
Insulin	One-half	Serum
Serum Folate	Full	Serum
Sex hormone binding globulin	Full	Serum
Testosterone	Full	Serum
Tissue transglutaminase (TTG)/Endomysial antibody (EMA)	Full	Serum
Triglycerides/Low Density Lipoprotein Cholesterol/Apolipoprotein B	One-half	Serum
Trichomonas vaginalis (14-19 years)	Full	Urine
Urine flow rate	Full	Serum
Vitamin D	Full	Serum
Vitamin B ₁₂ (19+ years)	Full	Serum
Ages 20 and older		
Albumin/Creatinine	Full	Urine
Biochemistry Profile*	Full	Serum
Caffeine	One-third	Urine
Chlamydia trachomatis (20-39 years)	Full	Urine
Cholesterol (Total)/ High Density Lipoprotein Cholesterol (HDL)	Full	Serum
Complete Blood Count	Full	Whole blood
Erythrocyte Folate	Full	Whole blood
Estradiol	Full	Serum
Glucose (Oral Glucose Tolerance Test)	One-half	Plasma Na2F
Glucose, fasting	One-half	Plasma Na2F
Glycohemoglobin	Full	Whole blood
Fatty Acids (polyunsaturated, monounsaturated, and saturated)	One-half	Serum
Hepatitis Profile **	Full	Serum
Herpes Simplex Virus (HSV) (20-49 years)	Full	Serum
Human Immunodeficiency Virus antibody (20-59 years)	Full	Serum
Human Papilloma Virus (20-59 years)	Full	Serum
Human Papilloma Virus (Females and Males 20-59 years)	Full	Swab
Human Papilloma Virus (20-69 years)	Full	Rinse
Insulin	One-half	Serum
Methylmalonic acid (20+ years)	Full	Serum
Serum Folate	Full	Serum
Sex hormone binding globulin	Full	Serum
Testosterone	Full	Serum
Tissue transglutaminase (TTG)/Endomysial antibody (EMA)	Full	Serum

Test Name	Sample	Matrix
Triglycerides/Low Density Lipoprotein Cholesterol/Apolipoprotein B	One-half	Serum
Trichomonas vaginalis (20-59 years)	Full	Urine
Urine flow rate	Full	Urine
Vitamin B ₁₂ (19+ years)	Full	Serum
Vitamin D	Full	Serum
*Biochemistry Profile		
Albumin		
Alkaline phosphatase		
Aspartate aminotransferase (AST)		
Alanine aminotransferase (ALT)		
Blood urea nitrogen (BUN)		
Bicarbonate (HCO ₃)		
Total calcium		
Total cholesterol		
Chloride		
CPK		
Creatinine		
Globulin		
Glucose		
v-glutamyltransferase (GGT)		
Iron		
Potassium		
Lactate dehydrogenase (LDH)		
Sodium		
Osmolality		
Phosphorus		
Total Bilirubin		
Total protein		
Triglycerides		
Uric acid		
**Hepatitis Profile		
Hepatitis A antibody (Anti-HAV)		
Hepatitis B Core antibody (Anti-HBc)		
Hepatitis B Surface Antibody (Anti-HBs)		
Hepatitis B Surface Antigen (HbsAg)		
Hepatitis C Antibody (Anti-HCV)		
Hepatitis C HCV genotype		
Hepatitis C Ribonucleic Acid (HCV-RNA)		
Anti-HCV Supplemental Test (RIBA)		
Hepatitis D antibody (anti-HDV)		
Hepatitis E antibody (anti-HEV)		

Attachment 8 – NHANES Laboratory Assessments
Attachment 8b - Laboratory Analytes by Survey Year

All urine based and packed cells analyses are done on a 1/3 sample of participants ages 6 and older unless otherwise noted. All blood based (whole blood, serum, plasma) analyses are done on a 1/3 sample of participants ages 12 and older unless otherwise noted.

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
Tobacco Biomarkers: Cotinine and Nicotine Analogs				
Cotinine ⁰	serum	•	•	•
Cotinine	urine			•
Anabasine	urine			•
Anatabine	urine			•
Cotinine-n-oxide	urine			•
Hydroxycotinine	serum			•
Hydroxycotinine	urine			•
Norcotinine	urine			•
Menthol	urine			•
Nicotine	urine			•
Nicotine-1'N-oxide	urine			•
1-(3-Pyridyl)-1-butanol-4-carboxylic Acid	urine			•
1-(3-Pyridyl)-1-butanone-4-carboxylic Acid	urine			•
Nornicotine	urine			•
Tobacco Biomarkers: Aldehydes				
Acetaldehyde	serum			•
Acrolein	serum			•
Benzaldehyde	serum			•
Butyraldehyde	serum			•

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
Crotonaldehyde	serum			•
Decanal	serum			•
Furaldehyde	serum			•
Heptanal	serum			•
n-Hexanal	serum			•
Isovaleraldehyde	serum			•
Nonanal	serum			•
2-Nonenal	serum			•
Octanal	serum			•
o-Tolualdehyde	serum			•
Pentanal	serum			•
Propionaldehyde	serum			•
Tobacco Biomarkers: Aromatic Amines				
1-Aminonaphthalene	urine			•
2-Aminonaphthalene	urine			•
2-Aminobiphenyl	urine			•
3-Aminobiphenyl	urine			•
4-Aminobiphenyl	urine			•
Anisidine	urine			•
Benzidine	urine			•
2,6-Dimethylaniline	urine			•
o-Toluidine	urine			•
p-Toluidine	urine			•

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
Quinoline	urine			•
Tobacco Biomarkers: Heterocyclic Amines				
Norharman	urine			•
Harman	urine			•
3-Amino-1,4-dimethyl-5H-pyrido[4,3-b]indole (Trp-P-1)	urine			•
1-Methyl-3-amino-5H-pyrido[4,3-b]indole (Trp-P-2)	urine			•
2-Amino-3-methyl-9H-pyrido[2,3-b]indole (MeA-α-C)	urine			•
2-Amino-1-methyl-6-phenylimidazo[4,5-b]pyridine (Ph1P)	urine			•
2-Amino-9H-pyrido[2,3-b]indole (A-α-C)	urine			•
2-Amino-3-methylimidazo[4,5-f]quinoline (IQ)	urine			•
2-Amino-6-methyldipyrido[1,2-a:3',2'-d]imidazole (Glu-P1)	urine			•
2-Aminodipyrido[1,2-a:3',2'-d]imidazole (GLU-P2)	urine			•
Tobacco Biomarkers: TSNAs				
4-(Methylnitrosamino)-1-(3-pyridyl)-1-Butanol (NNAL) ¹	urine	•	•	•
N'-Nitrosanatabine (NAT) ¹	urine			•
N'-Nitrosanabasine (NAB) ¹	urine			•
4-(N-methylnitrosoamino)-4-(3-pyridyl) butanal (NNA) ¹	urine			•
4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK) ¹	urine			•
N'-Nitrosornicotine (NNN) ¹	urine			•
Tobacco Biomarkers: N-Nitrosamines				
N-Nitrosodiethylamine (NDEA)	urine			•
N-nitrosodimethylamine (NDMA)	urine			•
N-Nitrosoethylmethylamine (NMEA)	urine			•

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
N-nitrosomorpholine (NMOR)	urine			•
N-Nitrosopiperidine (NPIP)	urine			•
N-Nitrosopyrrolidine (NPYR)	urine			•
Metals				
Lead ²	whole blood	•	•	•
Lead	urine	•	•	•
Cadmium ²	whole blood	•	•	•
Cadmium	urine	•	•	•
Manganese ²	whole blood		•	•
Selenium ²	whole blood		•	•
Mercury (total) ²	whole blood	•	•	•
Mercury (ethyl) ²	whole blood		•	•
Mercury (methyl) ²	whole blood		•	•
Mercury (inorganic) ²	whole blood	•	•	•
Mercury	urine	•	•	•
Iodine	urine	•	•	•
Arsenic (total)	urine	•	•	•
Arsenous (III) acid	urine	•	•	•
Arsenic (V) acid	urine	•	•	•
Monomethylarsonic acid	urine	•	•	•
Dimethylarsinic acid	urine	•	•	•
Arsenobetaine	urine	•	•	•
Arsenocholine	urine	•	•	•

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
Trimethylarsine oxide	urine	•	•	•
Antimony	urine	•	•	•
Barium	urine	•	•	•
Cesium	urine	•	•	•
Cobalt	urine	•	•	•
Manganese	urine		•	•
Molybdenum	urine	•	•	•
Strontium	urine		•	•
Tin	urine		•	•
Thallium	urine	•	•	•
Tungsten	urine	•	•	•
Uranium	urine	•	•	•
Copper ³	serum		•	•
Selenium ³	serum		•	•
Zinc ³	serum		•	•
Phthalates and Phthalate Alternatives				
Mono-ethyl phthalate	urine	•	•	•
Mono-n-butyl phthalate	urine	•	•	•
Mono-iso-butyl phthalate	urine	•	•	•
Mono-benzyl phthalate	urine	•	•	•
Mono-2-ethylhexyl phthalate	urine	•	•	•
Mono-(2-ethyl-5-oxohexyl) phthalate	urine	•	•	•
Mono-(2-ethyl-5-hydroxyhexyl) phthalate	urine	•	•	•

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
Mono-(3-carboxypropyl) phthalate	urine	•	•	•
Mono-(2-ethyl-5-carboxypentyl) phthalate	urine	•	•	•
Mono-(2,6-dimethyl-6-carboxyhexyl) phthalate	urine	•	•	•
Mono-(2,7-dimethyl-7-carboxyheptyl) phthalate	urine	•	•	•
Cyclohexane 1,2-dicarboxylic acid, mono hydroxyisononyl ester (MINCH)	urine		• surplus	•
Polycyclic Aromatic Hydrocarbons				
2-Hydroxyfluorene	urine	•	•	•
3-Hydroxyfluorene	urine	•	•	•
9-Hydroxyfluorene	urine	•	•	•
1-Hydroxyphenanthrene	urine	•	•	•
2-Hydroxyphenanthrene	urine	•	•	•
3-Hydroxyphenanthrene	urine	•	•	•
4-Hydroxyphenanthrene	urine	•	•	•
1-Hydroxypyrene	urine	•	•	•
1-Hydroxynaphthalene (1-Naphthol)	urine	•	•	•
2-Hydroxynaphthalene (2-Naphthol)	urine	•	•	•
Organophosphate Insecticides: Dialkyl Phosphate Metabolites				
Dimethylphosphate	urine	•	•	•
Dimethylthiophosphate	urine	•	•	•
Dimethyldithiophosphate	urine	•	•	•
Diethylphosphate	urine	•	•	•
Diethylthiophosphate	urine	•	•	•
Diethyldithiophosphate	urine	•	•	•

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
Organophosphate Insecticides: Specific Pesticides and Metabolites				
Malathion dicarboxylic acid	urine	•	•	•
3,5,6-Trichloro-2-pyridinol	urine	•	•	•
2-Isopropyl-4-methyl-6-hydroxypyrimidine	urine	•	•	•
para-Nitrophenol	urine	•	•	•
Pyrethroid Pesticides				
cis-3-(2,2-Dichlorovinyl)-2,2-dimethylcyclopropane carboxylic acid	urine	•	•	•
trans-3-(2,2-Dichlorovinyl)-2,2-dimethylcyclopropane carboxylic acid	urine	•	•	•
3-Phenoxybenzoic acid	urine	•	•	•
4-Fluoro-3-phenoxybenzoic acid	urine	•	•	•
cis-3-(2,2-Dibromovinyl)-2,2-dimethylcyclopropane carboxylic acid	urine	•	•	•
Organochlorine Pesticides				
Hexachlorobenzene	serum	Pool	Pool	
<i>beta</i> -Hexachlorocyclohexane	serum	Pool	Pool	
<i>gamma</i> -Hexachlorocyclohexane	serum	Pool	Pool	
<i>p,p'</i> -DDT	serum	Pool	Pool	
<i>p,p'</i> -DDE	serum	Pool	Pool	
Oxychlordane	serum	Pool	Pool	
<i>trans</i> -Nonachlor	serum	Pool	Pool	
Mirex	serum	Pool	Pool	
Other Pesticides				
N,N-diethyl-3-methylbenzamide (DEET)	urine	•	•	•
N-ethyl-3-methylbenzamide (Desethyl DEET)	urine	•	•	•

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
N,N-diethyl-3-hydroxymethylbenzamide (Desethyl hydroxy DEET)	urine	•	•	•
2,5-Dichlorophenol	urine	•	•	•
Other Herbicides				
2,4,5-Trichlorophenoxyacetic acid	urine	•	•	•
2,4-Dichlorophenoxyacetic acid	urine	•	•	•
2,4-Dichlorophenol	urine	•	•	•
Halogenated Phenolic Compounds				
2,4,5-Trichlorophenol	urine	•	•	
2,4,6-Trichlorophenol	urine	•	•	
Pentachlorophenol	serum	•	•	•
5-Chloro-2-(2,4-dichlorophenoxy)-phenol (Triclosan)	serum	•	•	
Perfluorinated Compounds				
Perfluorooctanoic acid	serum	•	•	•
Perfluorooctane sulfonic acid	serum	•	•	•
Perfluorohexane sulfonic acid	serum	•	•	•
2-(N-Methyl-perfluorooctane sulfonamido) acetic acid	serum	•	•	•
Pefluorodecanoic acid	serum	•	•	•
Perfluorobutane sulfonic acid	serum	•	•	•
Perfluorononanoic acid	serum	•	•	•
Perfluoroundecanoic acid	serum	•	•	•
Environmental Phenols				
Bisphenol A	urine	•	•	•
Benzophenone-3 (2-Hydroxy-4-methoxybenzophenone)	urine	•	•	•

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
Antiseptics				
Triclocarban (TCC)	urine		•	•
Triclosan (2,4,4'-Trichloro-2'-hydroxyphenyl ether)	urine	•	•	•
Methyl paraben	urine	•	•	•
Ethyl paraben	urine	•	•	•
Propyl paraben	urine	•	•	•
Butyl paraben	urine	•	•	•
Polychlorinated Dibenzo-<i>p</i>-dioxins and Dibenzofurans				
1,2,3,4,6,7,8,9-Octachlorodibenzo- <i>p</i> -dioxin (OCDD)	serum	Pool	Pool	Pool
1,2,3,4,6,7,8-Heptachlorodibenzo- <i>p</i> -dioxin (HpCDD)	serum	Pool	Pool	Pool
1,2,3,4,7,8-Hexachlorodibenzo- <i>p</i> -dioxin (HxCDD)	serum	Pool	Pool	Pool
1,2,3,6,7,8-Hexachlorodibenzo- <i>p</i> -dioxin (HxCDD)	serum	Pool	Pool	Pool
1,2,3,7,8,9-Hexachlorodibenzo- <i>p</i> -dioxin (HxCDD)	serum	Pool	Pool	Pool
1,2,3,7,8-Pentachlorodibenzo- <i>p</i> -dioxin (PeCDD)	serum	Pool	Pool	Pool
2,3,7,8-Tetrachlorodibenzo- <i>p</i> -dioxin (TCDD)	serum	Pool	Pool	Pool
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	serum	Pool	Pool	Pool
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	serum	Pool	Pool	Pool
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	serum	Pool	Pool	Pool
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	serum	Pool	Pool	Pool
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	serum	Pool	Pool	Pool
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	serum	Pool	Pool	Pool
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	serum	Pool	Pool	Pool

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	serum	Pool	Pool	Pool
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	serum	Pool	Pool	Pool
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	serum	Pool	Pool	Pool
Polybrominated Dibenzo-<i>p</i>-dioxins and Dibenzofurans				
2,3,7,8-Tetrabromodibenzo- <i>p</i> -dioxin (TBDD)	serum	Pool	Pool	Pool
1,2,3,7,8-Pentabromodibenzo- <i>p</i> -dioxin (PeBDD)	serum	Pool	Pool	Pool
1,2,3,4,7,8-Hexabromodibenzo- <i>p</i> -dioxin (HxBDD)	serum	Pool	Pool	Pool
1,2,3,6,7,8-Hexabromodibenzo- <i>p</i> -dioxin (HxBDD)	serum	Pool	Pool	Pool
1,2,3,7,8,9-Hexabromodibenzo- <i>p</i> -dioxin (HxBDD)	serum	Pool	Pool	Pool
1,2,3,4,6,7,8,9-Octabromodibenzo- <i>p</i> -dioxin (OBDD)	serum	Pool	Pool	Pool
2,3,7,8-Tetrabromodibenzofuran (TBDF)	serum	Pool	Pool	Pool
1,2,3,7,8-Pentabromodibenzofuran (PeBDF)	serum	Pool	Pool	Pool
2,3,4,7,8-Pentabromodibenzofuran (PeBDF)	serum	Pool	Pool	Pool
1,2,3,4,7,8-Hexabromodibenzofuran (HxBDF)	serum	Pool	Pool	Pool
1,2,3,4,6,7,8-Heptabromodibenzofuran (HpBDF)	serum	Pool	Pool	Pool
1,2,3,4,6,7,8,9-Octabromodibenzofuran (OBDF)	serum	Pool	Pool	Pool
Dioxin-like Polychlorinated Biphenyls - cPCBs				
3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	serum	Pool	Pool	Pool
3,4,4',5-Tetrachlorobiphenyl (PCB 81)	serum	Pool	Pool	Pool
3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	serum	Pool	Pool	Pool
3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	serum	Pool	Pool	Pool
Dioxin-like Polychlorinated Biphenyls - mPCBs				
2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	serum	Pool	Pool	Pool

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
2,3,3',4,4'-Pentachlorobiphenyl (PCB 114)	serum	Pool	Pool	Pool
2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	serum	Pool	Pool	Pool
2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	serum	Pool	Pool	Pool
2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	serum	Pool	Pool	Pool
2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	serum	Pool	Pool	Pool
2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	serum	Pool	Pool	Pool
2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	serum	Pool	Pool	Pool
Non-dioxin-like Polychlorinated Biphenyls				
2,4,4'-Trichlorobiphenyl (PCB 28)	serum	Pool	Pool	Pool
2,2',3,5'-Tetrachloro biphenyl (PCB 44)	serum	Pool	Pool	Pool
2,2',4,5'-Tetrachloro biphenyl (PCB 49)	serum	Pool	Pool	Pool
2,2',5,5'-Tetrachlorobiphenyl (PCB 52)	serum	Pool	Pool	Pool
2,3',4,4'-Tetrachlorobiphenyl (PCB 66)	serum	Pool	Pool	Pool
2,4,4',5-Tetrachlorobiphenyl (PCB 74)	serum	Pool	Pool	Pool
2,2',3,4,5'-Pentachlorobiphenyl (PCB 87)	serum	Pool	Pool	Pool
2,2',4,4',5-Pentachlorobiphenyl (PCB 99)	serum	Pool	Pool	Pool
2,2',4,5,5'-Pentachlorobiphenyl (PCB 101)	serum	Pool	Pool	Pool
2,3,3',4',6-Pentachlorobiphenyl (PCB 110)	serum	Pool	Pool	Pool
2,2',3,3',4,4'-Hexachlorobiphenyl (PCB 128)	serum	Pool	Pool	Pool
2,2',3,4,4',5' and 2,3,3',4,4',6-Hexachlorobiphenyl (PCB 138 & 158)	serum	Pool	Pool	Pool
2,2',3,4',5,5'-Hexachlorobiphenyl (PCB 146)	serum	Pool	Pool	Pool
2,2',3,4',5',6-Hexachlorobiphenyl (PCB 149)	serum	Pool	Pool	Pool
2,2',3,5,5',6-Hexachlorobiphenyl (PCB 151)	serum	Pool	Pool	Pool

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
2,2',4,4',5,5'-Hexachlorobiphenyl (PCB 153)	serum	Pool	Pool	Pool
2,2',3,3',4,4',5-Heptachlorobiphenyl (PCB 170)	serum	Pool	Pool	Pool
2,2',3,3',4,5,5'-Heptachlorobiphenyl (PCB 172)	serum	Pool	Pool	Pool
2,2',3,3',4,5',6-Heptachlorobiphenyl (PCB 177)	serum	Pool	Pool	Pool
2,2',3,3',5,5',6-Heptachlorobiphenyl (PCB 178)	serum	Pool	Pool	Pool
2,2',3,4,4',5,5'-Heptachlorobiphenyl (PCB 180)	serum	Pool	Pool	Pool
2,2',3,4,4',5,6-Heptachlorobiphenyl (PCB 183)	serum	Pool	Pool	Pool
2,2',3,4',5,5',6-Heptachlorobiphenyl (PCB 187)	serum	Pool	Pool	Pool
2,2',3,3',4,4',5,5'-Octachlorobiphenyl (PCB 194)	serum	Pool	Pool	Pool
2,2',3,3',4,4',5,6-Octachlorobiphenyl (PCB 195)	serum	Pool	Pool	Pool
2,2',3,3',4,4',5,6' and 2,2',3,4,4',5,5',6-Octachlorobiphenyl (PCB 196 & 203)	serum	Pool	Pool	Pool
2,2',3,3',4,5,5',6-Octachlorobiphenyl (PCB 199) (previosuly PCB 201)	serum	Pool	Pool	Pool
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (PCB 206)	serum	Pool	Pool	Pool
2,2',3,3',4,4',5,5',6,6'-Decachloro biphenyl (PCB 209)	serum	Pool	Pool	Pool
Hydroxylated Polychlorinated Biphenyls				
2,3,3',4',5-pentachloro-4-biphenylol (4-HO-CB107) (PCB 105+118)	serum	Pool	Pool	Pool
2,2',3,4',5,5'-hexachloro-4-biphenylol (4-HO-CB146) (PCB 138+153)	serum	Pool	Pool	Pool
2,2',3,4',5,5',6'-heptachloro-4-biphenylol (4-HO-CB187) (PCB 187)	serum	Pool	Pool	Pool
Polybrominated Diphenyl Ethers				
2,2',4'-Tribromodiphenyl ether (BDE 17)	serum	Pool	•	•
2,4,4'-Tribromodiphenyl ether (BDE 28)	serum	Pool	•	•
2,2',4,4'-Tetrabromodiphenyl ether (BDE 47)	serum	Pool	•	•
2,3',4,4'-Tetrabromodiphenyl ether (BDE 66)	serum	Pool	•	•

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
2,2',3,4,4'-Pentabromodiphenyl ether (BDE 85)	serum	Pool	•	•
2,2',4,4',5-Pentabromodiphenyl ether (BDE 99)	serum	Pool	•	•
2,2',4,4',6-Pentabromodiphenyl ether (BDE 100)	serum	Pool	•	•
2,2',4,4',5,5'-Hexabromobiphenyl (BB 153)	serum	Pool	•	•
2,2',4,4',5,6'-Hexabromodiphenyl ether (BDE 154)	serum	Pool	•	•
2,2',4,4',5,5'-Hexabromodiphenyl ether (BDE 153)	serum	Pool	•	•
2,2',3,4,4',5,6-Heptabromodiphenyl ether (BDE 183)	serum	Pool	•	•
2,2',3,3',4,4',5,5',6,6'-Decabromodiphenyl ether (BDE 209)	serum	Pool	•	•
Polychlorinated Naphthalenes				
1,2,3,4-Tetrachlorinated naphthalene (PCN 27)	serum	Pool	Pool	Pool
1,2,3,5,7- and 1,2,4,6,7-Pentachlorinated naphthalene (PNC 52 & 60)	serum	Pool	Pool	Pool
1,2,3,4,5,7- and 1,2,3,5,6,8-Hexachlorinated naphthalene (PNC 64 & 68)	serum	Pool	Pool	Pool
1,2,3,4,6,7- and 1,2,3,5,6,7-Hexachlorinated naphthalene (PNC 66 & 67)	serum	Pool	Pool	Pool
1,2,3,5,7,8-Hexachlorinated naphthalene (PCN 69)	serum	Pool	Pool	Pool
1,2,3,4,5,6,7-Heptachlorinated naphthalene (PCN 73)	serum	Pool	Pool	Pool
Volatile Organic Compounds (VOCs)				
1,1,1-Trichloroethane ⁴	whole blood	•	•	•
1,1,2,2-Tetrachloroethane ⁴	whole blood	•	•	
1,1,2-Trichloroethane ⁴	whole blood	•	•	
1,1-Dichloroethane ⁴	whole blood	•	•	
1,1-Dichloroethene ⁴	whole blood	•	•	
1,2-dibromo-3-chloropropane ⁴	whole blood	•	•	
1,2-Dichlorobenzene ⁴	whole blood	•	•	•

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
1,2-Dichloroethane ⁴	whole blood	•	•	•
1,2-Dichloropropane ⁴	whole blood	•	•	
1,3-Dichlorobenzene ⁴	whole blood	•	•	•
1,4-Dichlorobenzene ⁴	whole blood	•	•	•
2,5-Dimethylfuran ⁴	whole blood	•	•	•
Acrylonitrile ⁴	whole blood	•	•	•
Benzene ⁴	whole blood	•	•	•
Bromodichloromethane ⁴	whole blood	•	•	•
Bromoform ⁴	whole blood	•	•	•
Carbon Tetrachloride ⁴	whole blood	•	•	•
Chlorobenzene ⁴	whole blood	•	•	•
Chloroform ⁴	whole blood	•	•	•
Chloroform ⁴	water	•	•	•
cis-1,2-Dichloroethene ⁴	whole blood	•	•	
Dibromochloromethane ⁴	whole blood	•	•	•
Dibromomethane ⁴	whole blood	•	•	
Ethylbenzene ⁴	whole blood	•	•	•
Furan ⁴	whole blood	•	•	•
Hexachloroethane ⁴	whole blood	•	•	
m-/p-Xylene ⁴	whole blood	•	•	•
Methylene Chloride ⁴	whole blood	•	•	•
Methyl-tert-Butyl Ether (MTBE) ⁴	whole blood	•	•	•
Nitrobenzene ⁴	whole blood	•	•	•

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
o-Xylene ⁴	whole blood	•	•	•
Styrene ⁴	whole blood	•	•	•
Tetrachloroethene ⁴	whole blood	•	•	•
Toluene ⁴	whole blood	•	•	•
<i>trans</i> -1,2-Dichloroethene ⁴	whole blood	•	•	
Trichloroethene ⁴	whole blood	•	•	•
1,4-Dioxane ⁴	whole blood	•	•	•
1,2-Dibromoethane ⁴	whole blood	•	•	•
n-Hexane ⁴	whole blood	•	•	•
Nitromethane ⁴	whole blood	•	•	•
1,1,1,2-Tetrachloroethane ⁴	whole blood	•	•	•
Cumene/isopropylbenzene ⁴	whole blood	•	•	•
1,2,3-Trichloropropane ⁴	whole blood	•	•	•
Ethyl acetate ⁴	whole blood			•
1-Bromopropane/Propyl bromide ⁴	whole blood			•
Methylcyclopentane ⁴	whole blood			•
Cyclohexane ⁴	whole blood			•
Benzonitrile ⁴	whole blood			•
AAA-Trifluorotoluene/ α,α,α -Trifluorotoluene ⁴	whole blood			•
Chloroethane ⁴	whole blood			•
Methyl isobutyl ketone ⁴	whole blood			•
Tetrahydrofuran ⁴	whole blood			•
Vinyl bromide ⁴	whole blood			•

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
Heptane ⁴	whole blood			•
Octane ⁴	whole blood			•
Volatile Organic Compound Metabolites (VOC metabolites) (28)				
N-Acetyl-S-(2-carbamoylethyl)-L-cysteine	urine		•	•
N-Acetyl-S-(N-methylcarbamoyl)-L-cysteine	urine		•	•
2-Aminothiazoline-4-carboxylic acid	urine		•	•
N-Acetyl-S-(benzyl)-L-cysteine	urine		•	•
N-Acetyl-S-(n-propyl)-L-cysteine	urine		•	•
N-Acetyl-S- (2-carboxyethyl)-L-Cysteine	urine		•	•
N-acetyl-S-(2-cyanoethyl)-L-cysteine	urine		•	•
N-acetyl-S-(1,2-dichlorovinyl)-L-cysteine	urine		•	•
N-acetyl-S-(2,2-dichlorovinyl)-L-cysteine	urine		•	•
N-Acetyl-S- (3,4-dihydroxybutyl)-L-Cysteine	urine		•	•
N-Acetyl-S-(dimethylphenyl)-L-Cysteine	urine		•	•
N-Acetyl-S-(2-carbamoyl-2-hydroxyethyl)-L-cysteine	urine		•	•
N-Acetyl-S- (2-hydroxyethyl)-L-cysteine	urine		•	•
N-Acetyl-S- (3-hydroxypropyl)-L-Cysteine	urine		•	•
N-Acetyl-S- (2-hydroxypropyl)-L-Cysteine	urine		•	•
N-Acetyl-S-(3-hydroxypropyl-1-methyl)-L-cysteine	urine		•	•
Mandelic acid	urine		•	•
2-Methylhippuric acid	urine		•	•
3-Methylhippuric acid & 4-methylhippuric acid	urine		•	•
N-Acetyl-S- (1-hydroxyMethyl-2-Propenyl)-L-Cysteine	urine		•	•

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
N-Acetyl-S- (2-hydroxy-3-butenyl)-L-Cysteine	urine		•	•
N-Acetyl-S- (4-hydroxy-2-butenyl)-L-Cysteine	urine		•	•
t,t-Muconic acid	urine		•	•
N-Acetyl-S-(phenyl-2-hydroxyethyl)-L-cysteine	urine		•	•
Phenylglyoxylic acid	urine		•	•
N-Acetyl-S-(phenyl)-L-cysteine	urine		•	•
N-Acetyl-S-(trichlorovinyl)-L-cysteine	urine		•	•
N-Acetyl-S(2hydroxy3methyl3butenyl)-Lcys	urine			•
N-Acetyl-S(2hydroxy2methyl3butenyl)-Lcys	urine			•
2-Thioxothiazolidine-4-carboxylic acid	urine		•	•
Heterocyclic Amine (HCA) Hemoglobin Adducts				
2-Amino-3-methylimidazo[4,5-f]quinoline (Hb-IQ)	packed cells			•
2-Amino-1-methyl-6-phenylimidazo[4,5-b]pyridine (Hb-PhIP)	packed cells			•
2-Amino-9H-pyrido[2,3-b]indole (Hb-A-α-C)	packed cells			•
(2-Amino-3-methyl)-9H-pyrido[2,3-b]indole (Hb-MeA-α-C)	packed cells			•
3-Amino-1,4-dimethyl-5H-pyrido[4,3-b]indole (Hb-Trp-P-1)	packed cells			•
1-Methyl-3-amino-5H-pyrido[4,3-b]indole (Hb-Trp-P-2)	packed cells			•
2-Amino-6-methyldipyrido[1,2-a:3',2'-d]imidazole (Hb-Glu-P1)	packed cells			•
2-Aminodipyrido[1,2-a:3',2'-d]imidazole (Hb-Glu-P-2)	packed cells			•
Other				
Perchlorate	urine	•	•	•
Thiocyanate	urine	•	•	•
Nitrate	urine	•	•	•

Chemical / Metabolite Name	Matrix	09-10	11-12	13-14
Ethylene Oxide	packed cells			•
Acrylamide	packed cells	•		•
Formaldehyde	packed cells			•
Glycidamide	packed cells	•		•

⁰All participants ages 3 and older

¹All participants ages 6 and older

²Participants ages 1 -11 years and all participants 12+ years

³Participants ages 6+ years, one-third sample

⁴Participants-ages 12+ years, one-half sample