

National Health and Nutrition Examination Survey 2003-2004

Documentation, Codebook, and Frequencies

Laboratory Component:
Polyfluorinated Compounds

Survey Years:
2003 to 2004

SAS Export File:
L24PFC_C.XPT



First Release: July 2007
Last Revised: N/A

NHANES 2003–2004 Data Documentation

Laboratory Assessment: Lab 24 Polyfluorinated Compounds

Years of Coverage: 2003–2004

First Published: July 2007

Last Revised: N/A

Component Description

Organic fluorochemicals are used in multiple commercial applications including surfactants, lubricants, paints, polishes, food packaging and fire-retarding foams. Several polyfluorinated surfactants, a group of these polyfluorochemicals (PFCs), are ubiquitous contaminants found both in humans and animals worldwide, and there is increased concern regarding the toxicity of these polyfluorinated compounds, including perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). PFOS has been used in a wide variety of industrial and consumer products including protective coatings for carpets and apparel, paper coatings, insecticide formulations, and surfactants. In May 2000, the 3M Company, the sole manufacturer of PFOS in the United States and the principal manufacturer worldwide, announced that it was discontinuing the production of perfluorooctanyl fluoride-based chemistries, including PFOS. PFOA is used primarily to produce its salts which are used in the production of fluoroelastomers and fluoropolymers, such as polytetrafluoroethylene (PTFE) and polyvinylidene fluoride (PVDF). PFOA is still being produced. PTFE has numerous uses in many industrial and consumer products, including coatings on textiles and carpet; uses in the automotive, mechanical, aerospace, chemical, electrical, medical, and building/construction industries; personal care products; and non-stick coatings on cookware. PVDF is used primarily in electrical/electronics, building/construction, and chemical processing industrial sectors.

Eligible Sample

Participants aged 12 years and older who met the subsample requirements.

Description of Laboratory Methodology

The test principle utilizes solid phase extraction-high performance liquid chromatography-turboionspray ionization-tandem mass spectrometry (SPE-HPLC-TCI-MS/MS) for the quantitative detection of PFCs: perfluorooctane sulfonamide (PFOSA), 2-(N-methyl-perfluorooctane sulfonamido) acetic acid (Me-PFOSA-AcOH), 2-(N-

ethyl-perfluorooctane sulfonamido) acetic acid (Et-PFOSA-AcOH), perfluorohexane sulfonate (PFHxS), PFOS, perfluoropentanoate (PFPeA), perfluorohexanoate (PFHxA), perfluoroheptanoate (PFHpA), PFOA, perfluorononanoate (PFNA), perfluorodecanoate (PFDeA), perfluoroundecanoate (PFUA), and perfluorododecanoate (PFDoA) (16). The PFCs are extracted from serum using an automated SPE procedure, separated from other extracted components in the SPE eluate by reversed phase HPLC, and detected by negative ion TIS-MS/MS using a multiple reaction monitoring experiment. This method allows for rapid detection of these fluorochemicals in human serum with limits of detection in the low parts per billion (ppb or ng/mL) range.

Laboratory Quality Control and Monitoring

Serum specimens are processed, stored, and shipped to the Division of Environmental Health Laboratory Sciences, National Center for Environmental Health, Centers for Disease Control and Prevention for analysis.

Detailed specimen collection and processing instructions are discussed in the NHANES Laboratory/Medical Technologists Procedures Manual (LPM). Vials are stored under appropriate frozen (-20°C) conditions until they are shipped to National Center for Environmental Health for testing.

Mobile Examination Centers (MECs)

Laboratory team performance is monitored using several techniques. NCHS and contract consultants use a structured quality assurance evaluation during unscheduled visits to evaluate both the quality of the laboratory work and the quality-control procedures. Each laboratory staff person is observed for equipment operation, specimen collection and preparation; testing procedures and constructive feedback are given to each staff. Formal retraining sessions are conducted annually to ensure that required skill levels were maintained.

The NHANES QA/QC protocols meet the 1988 Clinical Laboratory Improvement Act mandates. Detailed QA/QC instructions are discussed in the NHANES LPM.

Analytical Laboratories

NHANES uses several methods to monitor the quality of the analyses performed by the contract laboratories. In the MEC, these methods include performing blind split samples collected on “dry run” sessions.

In addition, contract laboratories randomly perform repeat testing on 2.0% of all specimens.

NCHS developed and distributed a quality control protocol for all the contract laboratories which outlined the Westgard rules used when running NHANES specimens. Progress reports containing any problems encountered during shipping or receipt of specimens, summary statistics for each control pool, QC graphs, instrument calibration, reagents, and any special considerations are submitted to NCHS and Westat quarterly. The reports are reviewed for trends or shifts in the data. The laboratories are required to explain any identified areas of concern.

All QC procedures recommended by the manufacturers were followed. Reported results for all assays meet the Division of Laboratory Science's quality control and quality assurance performance criteria for accuracy and precision (similar to specifications outlined by Westgard (1981)).

Analytic Notes

Subsample weights

Measures of serum polyfluorinated chemicals were measured in a one third subsample of persons 12 years and over. Special sample weights are required to analyze these data properly. Specific sample weights for this subsample are included in this data file and should be used when analyzing these data.

Variance estimation

The analysis of NHANES 2003-2004 laboratory data must be conducted with the key survey design and basic demographic variables. The NHANES 2003-2004 Demographic Data File contains demographic and sample design variables. The recommended procedure for variance estimation requires use of stratum and PSU variables (SDMVSTRA and SDMVPSU, respectively) in the demographic data file.

Links to NHANES Data Files

This laboratory data file can be linked to the other NHANES 2003-2004 data files using the unique survey participant identifier SEQN.

Detection Limits

The detection limits were constant for all of the analytes in the data set. Two variables are provided for each of these analytes. The variable named LBD___LC indicates whether the result was below the limit of detection. There are two values: “0” and “1”. “0” means that the result was at or above the limit of detection. “1” indicates that the result was below the limit of detection.

The other variable named LBX___ provides the analytic result for that analyte.

The constant lower limits of detection for each polyfluorochemical is:

Analyte	Item Id	LLOD
Perfluorooctanoic acid	LBXPFOA	0.1
Perfluorooctane sulfonic acid	LBXPFOS	0.4
Perfluorohexane sulfonic acid	LBXPFHS	0.3
2-(N-Ethyl-perfluorooctane sulfonamido) acetic acid	LBXEPAH	0.4
2-(N-Methyl-perfluorooctane sulfonamido) acetic acid	LBXMPAH	0.6
Pefluorodecanoic acid	LBXPFDE	0.3
Perfluorobutane sulfonic acid	LBXPFBS	0.4
Perfluoroheptanoic acid	LBXPFHP	0.3
Perfluorononanoic acid	LBXPFNA	0.1
Perfluorooctane sulfonamide	LBXPFSA	0.2
Perfluoroundecanoic acid	LBXPFUA	0.3
Perflurododecanoic acid	LBXPFDO	1

Please refer to the Analytic Guidelines for further details on the use of sample weights and other analytic issues.

References

1. J.P. Giesy, K. Kannan. Global distribution of perfluorooctane sulfonate in wildlife. *Environ. Sci. Technol.* 35: 1339-42 (2001).

Locator Fields

Title: Polyfluorinated compounds

Contact Number: 1-866-441-NCHS

Years of Content: 2003–2004

First Published: July 2007

Revised: N/A

Access Constraints: None

Use Constraints: None

Geographic Coverage: National

Subject: Polyfluorinated compounds

Record Source: NHANES 2003–2004

Survey Methodology: NHANES 2003–2004 is a stratified multistage probability sample of the civilian non-institutionalized population of the U.S.

Medium: NHANES Web site; SAS transport files

**National Health and Nutrition Examination Survey
Codebook for Data Production (2003-2004)**

**Polyfluorochemicals Compounds (L24PFC_C)
Person Level Data**

First Published: July 2007

Last Revised: N/A



SEQN	Target
	B(12 Yrs. to 150 Yrs.)
Hard Edits	SAS Label
	Respondent sequence number
English Text: Respondent sequence number.	
English Instructions:	

WTSA2YR	Target
	B(12 Yrs. to 150 Yrs.)
Hard Edits	SAS Label
	Two-year MEC weights of subsample A
English Text: Two-year MEC weights of subsample A	
English Instructions:	

Code or Value	Description	Count	Cumulative	Skip to Item
0 to 455771.88304	Range of Values	2368	2368	
.	Missing	0	2368	

LBXPFOA	Target
	B(12 Yrs. to 150 Yrs.)
Hard Edits	SAS Label
	Perfluorooctanoic acid
English Text: Perfluorooctanoic acid	
English Instructions:	

Code or Value	Description	Count	Cumulative	Skip to Item
0.1 to 77.2	Range of Values	2094	2094	
.	Missing	274	2368	

LBDPFOAL		Target		
		B(12 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Perfluorooctanoic acid comment		
English Text: Perfluorooctanoic acid comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	2085	2085	
1	Below lower detection limit	9	2094	
.	Missing	274	2368	

LBXPFOS		Target		
		B(12 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Perfluorooctane sulfonic acid		
English Text: Perfluorooctane sulfonic acid				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.3 to 435	Range of Values	2094	2094	
.	Missing	274	2368	

LBDPFOSL		Target		
		B(12 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Perfluorooctane sulfonic acid comment		
English Text: Perfluorooctane sulfonic acid comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	2091	2091	
1	Below lower detection limit	3	2094	
.	Missing	274	2368	

LBXPFHS		Target		
		B(12 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Perfluorohexane sulfonic acid		
English Text: Perfluorohexane sulfonic acid				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.2 to 82	Range of Values	2094	2094	
.	Missing	274	2368	

LBDPFHSL	Target			
	B(12 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Perfluorohexane sulfonic acid comment			
English Text: Perfluorohexane sulfonic acid comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	2046	2046	
1	Below lower detection limit	48	2094	
.	Missing	274	2368	

LBXEPAH	Target			
	B(12 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	2-(N-ethyl-PFOA) acetate			
English Text: 2-(N-Ethyl-perfluorooctane sulfonamido) acetic acid				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.1 to 4.1	Range of Values	2094	2094	
.	Missing	274	2368	

LBDEPAHL	Target			
	B(12 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	2-(N-ethyl-PFOSA) acetate comment			
English Text: 2-(N-Ethyl-perfluorooctane sulfonamido) acetic acid comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	79	79	
1	Below lower detection limit	2015	2094	
.	Missing	274	2368	

LBXMPAH	Target			
	B(12 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	2-(N-methyl-PFOSA) acetate			
English Text: 2-(N-Methyl-perfluorooctane sulfonamido) acetic acid				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.4 to 62.3	Range of Values	2094	2094	
.	Missing	274	2368	

LBDMPAHL	Target			
	B(12 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	2-(N-methyl-PFOSA) acetate comment			
English Text: 2-(N-Methyl-perfluorooctane sulfonamido) acetic acid comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	562	562	
1	Below lower detection limit	1532	2094	
.	Missing	274	2368	

LBXPFDE	Target			
	B(12 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Perfluorodecanoic acid			
English Text: Pefluorodecanoic acid				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.1 to 3.7	Range of Values	2094	2094	
.	Missing	274	2368	

LBDPFDEL		Target		
		B(12 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Perfluorodecanoic acid comment		
English Text: Pefluorodecanoic acid comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	579	579	
1	Below lower detection limit	1515	2094	
.	Missing	274	2368	

LBXPFBS		Target		
		B(12 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Perfluorobutane sulfonic acid		
English Text: Perfluorobutane sulfonic acid				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.1 to 1.2	Range of Values	2094	2094	
.	Missing	274	2368	

LBDPFBSL	Target			
	B(12 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Perfluorobutane sulfonic acid comment			
English Text: Perfluorobutane sulfonic acid comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	6	6	
1	Below lower detection limit	2088	2094	
.	Missing	274	2368	

LBXPFHP	Target			
	B(12 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Perfluoroheptanoic acid			
English Text: Perfluoroheptanoic acid				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.2 to 3.8	Range of Values	2094	2094	
.	Missing	274	2368	

LBDPFHPL	Target			
	B(12 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Perfluoroheptanoic acid comment			
English Text: Perfluoroheptanoic acid comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	160	160	
1	Below lower detection limit	1934	2094	
.	Missing	274	2368	

LBXPFNA	Target			
	B(12 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Perfluorononanoic acid			
English Text: Perfluorononanoic acid				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.1 to 11.5	Range of Values	2094	2094	
.	Missing	274	2368	

LBDPFNAL		Target		
		B(12 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Perfluorononanoic acid comment		
English Text: Perfluorononanoic acid comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	2058	2058	
1	Below lower detection limit	36	2094	
.	Missing	274	2368	

LBXPFSA		Target		
		B(12 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Perfluorooctane sulfonamide		
English Text: Perfluorooctane sulfonamide				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.1 to 3.1	Range of Values	2094	2094	
.	Missing	274	2368	

LBDPFSAL	Target			
	B(12 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Perfluorooctane sulfonamide comment			
English Text: Perfluorooctane sulfonamide comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	443	443	
1	Below lower detection limit	1651	2094	
.	Missing	274	2368	

LBXPFUA	Target			
	B(12 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Perfluoroundecanoic acid			
English Text: Perfluoroundecanoic acid				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.1 to 6.9	Range of Values	2094	2094	
.	Missing	274	2368	

LBDPFUAL	Target			
	B(12 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Perfluoroundecanoic acid comment			
English Text: Perfluoroundecanoic acid comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	174	174	
1	Below lower detection limit	1920	2094	
.	Missing	274	2368	

LBXPFDO	Target			
	B(12 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Perfluorododecanoic acid			
English Text: Perfluorododecanoic acid				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.1 to 1	Range of Values	2094	2094	
.	Missing	274	2368	

LBDPFDOL		Target		
		B(12 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Perfluorododecanoic acid comment		
English Text: Perfluorododecanoic acid comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	1	1	
1	Below lower detection limit	2093	2094	
.	Missing	274	2368	