

**National Health and Nutrition
Examination Survey 2005–2006**

**Documentation, Codebook,
and Frequencies**

Urinary Heavy Metal

Laboratory

**Survey Years:
2005 to 2006**

**SAS Transport File:
UHM_D.XPT**



October 2008

NHANES 2005–2006 Data Documentation

Laboratory Assessment: - Heavy Metals (UHM_D)

First Published: October 2008

Last Revised: N/A

Component Description

Trace metals have been associated with adverse health effects in occupational studies or laboratory studies, but have not been monitored in general population groups.

This method is used to achieve rapid and accurate quantifications of multiple elements of toxicological and nutritional interest. The method is sensitive and rapid enough to screen urine specimens from subjects suspected to be exposed to a number of important toxic elements or to evaluate environmental or other nonoccupational exposure to these same elements.

Eligible Sample

Participants aged 6 years and older who met the subsample requirements.

Description of Laboratory Methodology

Inductively coupled plasma-mass spectrometry (ICP-MS) is a multi-element analytical technique (1). Liquid samples are introduced into the ICP through a nebulizer and spray chamber carried by a flowing argon stream. By coupling radio-frequency power into flowing argon, plasma is created in which the predominant species are positive argon ions and electrons. The sample passes through a region of the plasma that has a temperature of 6000–8000 °K. The thermal energy atomizes the sample and then ionizes the atoms. The ions, along with the argon, enter the mass spectrometer through an interface that separates the ICP from the mass spectrometer, which is operating at an atmospheric pressure of 10–5 torr. The mass spectrometer permits ions at each mass to be detected in rapid sequence, allowing individual isotopes of an element to be determined. Electrical signals resulting from the detection of the ions are processed into digital information that is used to indicate first the intensity of the ions and then the concentration of the element. The ICP-MS method is used to measure the following 12 elements in urine: beryllium (Be), cobalt (Co), molybdenum (Mo), cadmium (Cd), antimony (Sb), cesium (Cs), barium (Ba), tungsten (W), platinum (Pt), thallium (Tl), lead (Pb), and uranium (U). This method is

based on the method by Mulligan et al. (2) Urine samples are diluted 1+9 with 2% (v/v), double-distilled, concentrated nitric acid containing both iridium (Ir) and rhodium (Rh) for multi-internal standardization. This procedure can be used for all 12 elements or subsets of the 12 elements.

Laboratory Quality Control and Monitoring

Urine 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 urinary heavy metals were measured in a one third subsample of persons 6 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 2005-2006 laboratory data must be conducted with the key survey design and basic demographic variables. The NHANES 2005-2006 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 2005-2006 data files using the unique survey participant identifier SEQN.

Detection Limits

The detection limit was 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. In cases, where the result was below

the limit of detection, the value for that variable is the detection limit divided by the square root of two.

URXUCD and URDUCD:

When comparing urine cadmium across two-year cycles please note that even though these two variables have different names the data is comparable. Variable URXUCD is used in 1999-2000, 2003-2004, and 2005-2006 and variable URDUCD was used in 2001-2002. Variable URDUCD was derived to correct for molybdenum interference (Reference to 2001-2002 lab 6 heavy metal documentation). Beginning in 2003-2004 the urinary cadmium data is corrected at the testing laboratory for molybdenum interference.

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

References

1. Date AR, Gray AL. Applications of Inductively Coupled Plasma Mass Spectrometry. NY: Chapman and Hall; 1989.
2. Franke AA, Custer LJ. High-performance liquid chromatographic assay of isoflavonoids and coumestrol from human urine. J Chromatogr B Biomed Appl. 1994;662:47–60.
3. Gamache PH, Acworth IN. Analysis of phytoestrogens and polyphenols in plasma, tissue, and urine using HPLC with coulometric array detection. Proc Soc Exp Biol Med. 1998;217:274–280.
4. Joannou GE, Kelly GE, Reeder AY, Waring M, Nelson C. A urinary profile study of dietary phytoestrogens. J Steroid Biochem Mol Biol. 1995;54:167–184.
5. Messina M, Barnes S, Setchell KD. Phyto-oestrogens and breast cancer. Lancet. 1997;350:971–972.
6. Barnes S, Coward L, Kirk M, Sfakianos J. HPLC-mass spectrometry analysis of isoflavones. Proc Soc Exp Biol Med. 1998;217:254–262.

Locator Fields

Title: Heavy Metals(HM_d)

Contact Number: 1-866-441-NCHS

Years of Content: 2005–2006

First Published: October 2008

Revised: N/A

Access Constraints: None

Use Constraints: None

Geographic Coverage: National

Subject: Heavy Metals

Record Source: NHANES 2005–2006

Survey Methodology: NHANES 2005–2006 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 (2005-2006)**

**Urinary Heavy Metals (UHM_D)
Person Level Data**

October 2008



SEQN	Target
	B(6 Yrs. to 150 Yrs.)
Hard Edits	SAS Label
	Respondent sequence number
English Text: Respondent sequence number.	
English Instructions:	

WTSA2YR	Target
	B(6 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 412940.77909	Range of Values	2692	2692	
.	Missing	0	2692	

URXUCR	Target
	B(6 Yrs. to 150 Yrs.)
Hard Edits	SAS Label
	Creatinine, urine (mg/dL)
English Text: Creatinine, urine (mg/dL)	
English Instructions:	

Code or Value	Description	Count	Cumulative	Skip to Item
7 to 534	Range of Values	2608	2608	
.	Missing	84	2692	

URXUBA		Target		
		B(6 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Barium, urine (ug/L)		
English Text: Barium, urine (ug/L)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.08 to 85.7	Range of Values	2576	2576	
.	Missing	116	2692	

URDUBALC		Target		
		B(6 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Urinary Barium comment code		
English Text: Urinary Barium comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	2547	2547	
1	Below lower detection limit	29	2576	
.	Missing	116	2692	

URXUBE	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Beryllium, urine (ug/L)			
English Text: Beryllium, urine (ug/L)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.051 to 0.08	Range of Values	2576	2576	
.	Missing	116	2692	

URDUBELC	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Urinary Beryllium comment code			
English Text: Urinary Beryllium comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	5	5	
1	Below lower detection limit	2571	2576	
.	Missing	116	2692	

URXUCD	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Cadmium, urine (ug/L)			
English Text: Cadmium, urine (ug/L)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.03 to 5.35	Range of Values	2576	2576	
.	Missing	116	2692	

URDUCDLC	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Urinary Cadmium comment code			
English Text: Urinary Cadmium comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	2316	2316	
1	Below lower detection limit	260	2576	
.	Missing	116	2692	

URXUCO		Target		
		B(6 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Cobalt, urine (ug/L)		
English Text: Cobalt, urine (ug/L)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.029 to 39.8	Range of Values	2576	2576	
.	Missing	116	2692	

URDUCOLC		Target		
		B(6 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Urinary Cobalt comment code		
English Text: Urinary Cobalt comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	2566	2566	
1	Below lower detection limit	10	2576	
.	Missing	116	2692	

URXUCS		Target		
		B(6 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Cesium, urine (ug/L)		
English Text: Cesium, urine (ug/L)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.191 to 63.7	Range of Values	2576	2576	
.	Missing	116	2692	

URDUCSLC		Target		
		B(6 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Urinary Cesium comment code		
English Text: Urinary Cesium comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	2576	2576	
1	Below lower detection limit	0	2576	
.	Missing	116	2692	

URXUMO	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Molybdenum, urine (ug/L)			
English Text: Molybdenum, urine (ug/L)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
1.61 to 1230	Range of Values	2576	2576	
.	Missing	116	2692	

URDUMOLC	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Urinary Molybden comment code			
English Text: Urinary Molybden comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	2576	2576	
1	Below lower detection limit	0	2576	
.	Missing	116	2692	

URXUPB	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Lead, urine (ug/L)			
English Text: Lead, urine (ug/L)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.07 to 71.7	Range of Values	2576	2576	
.	Missing	116	2692	

URDUPBLC	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Urinary Lead comment code			
English Text: Urinary Lead comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	2515	2515	
1	Below lower detection limit	61	2576	
.	Missing	116	2692	

URXUPT	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Platinum, urine (ug/L)			
English Text: Platinum, urine (ug/L)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.006 to 697	Range of Values	2576	2576	
.	Missing	116	2692	

URDUPTLC	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Urinary Platinum comment code			
English Text: Urinary Platinum comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	310	310	
1	Below lower detection limit	2266	2576	
.	Missing	116	2692	

URXUSB	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Antimony, urine (ug/L)			
English Text: Antimony, urine (ug/L)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.023 to 47	Range of Values	2576	2576	
.	Missing	116	2692	

URDUSBLC	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Urinary Antimony comment code			
English Text: Urinary Antimony comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	2233	2233	
1	Below lower detection limit	343	2576	
.	Missing	116	2692	

URXUTL	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Thallium, urine (ug/L)			
English Text: Thallium, urine (ug/L)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.011 to 1.68	Range of Values	2576	2576	
.	Missing	116	2692	

URDUTLLC	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Urinary Thallium comment code			
English Text: Urinary Thallium comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	2573	2573	
1	Below lower detection limit	3	2576	
.	Missing	116	2692	

URXUTU	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Tungsten, urine (ug/L)			
English Text: Tungsten, urine (ug/L)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.015 to 20.11	Range of Values	2576	2576	
.	Missing	116	2692	

URDUTULC	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Urinary Tungsten comment code			
English Text: Urinary Tungsten comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	2382	2382	
1	Below lower detection limit	194	2576	
.	Missing	116	2692	

URXUUR	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Uranium, urinary (ug/L)			
English Text: Uranium, urinary (ug/L)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.0012 to 0.633	Range of Values	2576	2576	
.	Missing	116	2692	

URDUURLC	Target			
	B(6 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
	Urinary Uranium comment code			
English Text: Urinary Uranium comment code				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	2392	2392	
1	Below lower detection limit	184	2576	
.	Missing	116	2692	