

# National Health and Nutrition Examination Survey 2003-2004

---

## Documentation, Codebook, and Frequencies

### Acrylamide and Glycidamide

Laboratory

Survey Years:  
2003 to 2004

SAS Transport File:  
L06AGE\_C.XPT



December 2008

## NHANES 2003–2004 Data Documentation

### Laboratory Assessment: Acrylamide and Glycidamide (I06AGE\_C)

First Published: December 2008

Last Revised: N/A

---

#### **Component Description**

Acrylamide, a toxic and potentially cancer-causing chemical, is formed in high amounts in many types of food prepared/cooked at high temperatures. Because acrylamide is formed during the cooking process, specifically when producing French fries, potato chips and other fried products, intake of acrylamide through consumption of these foods can be high, thus exposing a large portion of the population to this chemical and putting them at risk of adverse health effects. Though acrylamide is known to cause adverse health effects and biomarkers exist to assess exposure to this chemical, no data on the actual acrylamide exposure in the population exist. Filling this knowledge gap is especially important to properly assess the risks associated with the consumption of food containing high levels of acrylamide.

#### **Eligible Sample**

Participants aged 3 year and older who do not meet any of the exclusion criteria are eligible.

#### **Description of Laboratory Methodology**

This procedure describes a method to measure hemoglobin adducts of acrylamide and its primary metabolite glycidamide in human whole blood or erythrocytes. Specifically, the reaction products with the N-terminal valine of the hemoglobin protein chains (N-[2-carbamoyl-ethyl]valine and N-[2-hydroxycarbonyl-ethyl]valine for acrylamide and glycidamide adducts, respectively) are measured.

This method is based on modified Edman reaction, which uses the effect of N-alkylated amino acids being able to form Edman products in neutral or alkaline conditions without changing the pH to acidic conditions required in conventional Edman reaction procedures (1). It was first described for N-terminal hemoglobin adducts of ethylene oxide, propylene oxide and styrene oxide (2) and later optimized to increase yield of Edman products of these adducts (3). This optimized method was then successfully applied to adducts produced by other chemicals such as acrylamide, glycidamide and acrylonitrile (4,5,6,7). This optimized method was further refined and modified in-house to increase sensitivity and enable automation (8)

The procedure described here consists of 4 parts:

1)Preparation of the specimen for measurement of hemoglobin adducts of acrylamide and glycidamide; 2)Total hemoglobin measurement in the sample solution used for hemoglobin adduct measurements; 3)Modified Edman reaction in the sample solution and isolation of Edman products and 4)Analysis of Edman products by HPLC/MS/MS and results processing

Because results are reported in pmol adduct per g hemoglobin, the amount of hemoglobin used for the modified Edman reaction needs to be known. Therefore, this procedure includes a measurement procedure for total hemoglobin. It is a commercial assay kit based on a well-established procedure commonly used in clinical chemistry.

Quantitation of the acrylamide and glycidamide hemoglobin adduct is performed using octapeptides with the same amino acid sequence as the N-terminal of the beta-chain of hemoglobin and with acrylamide and glycidamide attached at the valine (AA-VHLTPEEK, GA-VHLTPEEK) and the corresponding stable isotope labeled AA-Val(13C5 15N)-HLTPEEK and GA-Val(13C5 15N)-HLTPEEK as internal standards. Total hemoglobin measurement is performed using calibrators provided with the manufacture's assay kit.

### **Laboratory Quality Control and Monitoring**

The NHANES quality control and quality assurance protocols (QA/QC) meet the 1988 Clinical Laboratory Improvement Act mandates. Detailed quality control and quality assurance instructions are discussed in the NHANES Laboratory/Medical Technologists Procedures Manual (LPM). Read the LABDOC file for detailed QA/QC protocols.

### **Data Processing and Editing**

Packed red cells 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 (–30°C) conditions until they are shipped to National Center for Environmental Health for testing.

### **Analytic Notes**

The analysis of NHANES 2003–2004 laboratory data must be conducted with the key survey design and basic demographic

variables.

The NHANES 2003–2004 Household Questionnaire Data Files contain demographic data, health indicators, and other related information collected during household interviews. The Household Questionnaire Data Files also contain all survey design variables and sample weights required to analyze these data. The Phlebotomy Examination file includes auxiliary information on duration of fasting, the time of day of the venipuncture, and the conditions precluding venipuncture. The Household Questionnaire and Phlebotomy Exam files may be linked to the laboratory data file using the unique survey participant identifier SEQN.

## References

1. Tornqvist M, Fred C, Haglund J, Helleberg H, Paulsson B, Rydberg P. *J. Chromatogr. B* 2002; 778: 279.
2. Mowrer J, Tornqvist M, Jensen S, Ehrenberg L. *Toxicol. Environ. Chem.* 1986; 11: 215.
3. Tornqvist M, Mowrer J, Jensen S, Ehrenberg L. *Anal. Biochem.* 1986; 154: 255.
4. Fennell TR, Sumner SC, Snyder RW, Burgess J, Spicer R, Bridson WE, Friedman MA. *Toxicol. Sci.* 2005; 85: 447.
5. Baum M, Fauth E, Fritzen S, Herrmann A, Mertes P, Merz K, Rudolphi M, Zankl H, Eisenbrandt G. *Mutat. Res.* 2005; 580: 61.
6. Ospina M, Vesper HW, Licea-Perez H, Meyers T, Mi L, Myers GL. *Adv. Med. Appl. Biol.* 2005; 561: 97.
7. Paulsson B, Athanassiadis I, Rydberg P, Tornqvist M. *Rapid Commun. Mass Spectrom.* 2003; 17: 1859.
8. Vesper HW, Ospina M, Meyers T, Ingham L, Smith A, Gray JG, Myers GL. *Rapid Commun. Mass Spectrom.* 2006; 20: 959.

## Locator Fields

**Title:** Acrylamide and Glycidamide

**Contact Number:** 1-866-441-NCHS

**Years of Content:** 2003–2004

**First Published:** December 2008

**Last Revised:** N/A

**Access Constraints:** None

**Use Constraints:** None

**Geographic Coverage:** National

**Subject:** Acrylamide and Glycidamide

**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)**

**Acrylamide and Glycidamide (L06AGE\_C)  
Person Level Data**

December 2008



<b>SEQN</b>	<b>Target</b>
	B(3 Yrs. to 150 Yrs.)
<b>Hard Edits</b>	<b>SAS Label</b>
	Respondent sequence number
<b>English Text:</b> Respondent sequence number.	
<b>English Instructions:</b>	

<b>LBXACR</b>	<b>Target</b>
	B(3 Yrs. to 150 Yrs.)
<b>Hard Edits</b>	<b>SAS Label</b>
	Acrylamide (pmoL/G Hb)
<b>English Text:</b> Acrylamide (pmoL/G Hb)	
<b>English Instructions:</b>	

Code or Value	Description	Count	Cumulative	Skip to Item
2 to 910	Range of Values	7101	7101	
.	Missing	1455	8556	

<b>LBDACRLC</b>	<b>Target</b>
	B(3 Yrs. to 150 Yrs.)
<b>Hard Edits</b>	<b>SAS Label</b>
	Acrylamide comment code
<b>English Text:</b> Acrylamide comment code	
<b>English Instructions:</b>	

Code or Value	Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	7096	7096	
1	Below lower detection limit	5	7101	
.	Missing	1455	8556	

<b>LBXGLY</b>		<b>Target</b>		
		B(3 Yrs. to 150 Yrs.)		
<b>Hard Edits</b>		<b>SAS Label</b>		
		Glycidamide (pmol/G Hb)		
<b>English Text:</b> Glycidamide (pmol/G Hb)				
<b>English Instructions:</b>				
<b>Code or Value</b>	<b>Description</b>	<b>Count</b>	<b>Cumulative</b>	<b>Skip to Item</b>
3 to 756	Range of Values	7278	7278	
.	Missing	1278	8556	

<b>LBDGLYLC</b>		<b>Target</b>		
		B(3 Yrs. to 150 Yrs.)		
<b>Hard Edits</b>		<b>SAS Label</b>		
		Glycidamide comment code		
<b>English Text:</b> Glycidamide comment code				
<b>English Instructions:</b>				
<b>Code or Value</b>	<b>Description</b>	<b>Count</b>	<b>Cumulative</b>	<b>Skip to Item</b>
0	At or above the detection limit	7117	7117	
1	Below lower detection limit	161	7278	
.	Missing	1278	8556	