

# **Arsenic Exposure Investigation Hebbronville, Jim Hogg County, Texas**

December 7, 2017



**TEXAS**  
Health and Human  
Services

**Texas Department of State  
Health Services**

# Table of Contents

<b>Purpose.....</b>	<b>1</b>
<b>Background .....</b>	<b>1</b>
<b>Exposure Investigation Design.....</b>	<b>2</b>
<b>Biological Sampling .....</b>	<b>2</b>
<b>Data Analysis.....</b>	<b>3</b>
<b>Biological Sampling Results.....</b>	<b>3</b>
<b>Discussion.....</b>	<b>5</b>
<b>Limitations.....</b>	<b>6</b>
<b>Conclusions.....</b>	<b>6</b>
<b>Recommendations.....</b>	<b>6</b>
<b>Actions Planned.....</b>	<b>7</b>
<b>Authors and Technical Advisors .....</b>	<b>8</b>
<b>Acknowledgements .....</b>	<b>8</b>
<b>References.....</b>	<b>9</b>
<b>Appendix A.....</b>	<b>10</b>
<b>Appendix B.....</b>	<b>12</b>
<b>Appendix C.....</b>	<b>14</b>
<b>Appendix D.....</b>	<b>17</b>
<b>Appendix E.....</b>	<b>22</b>

## Acronyms and Abbreviations

WCID	Water Control and Improvement District
CI	Confidence interval
DSHS	Texas Department of State Health Services
EPA	U.S. Environmental Protection Agency
ICP-MS	Inductively coupled plasma mass spectrometer
IRB	Institutional Review Board
L	Liter
MCL	maximum contaminant level
µg/L	micrograms per liter
µg/g-creatinine	micrograms per gram creatinine
mL	milliliter
NHANES	National Health and Nutrition Examination Survey
TCEQ	Texas Commission on Environmental Quality

## Purpose

The Texas Department of State Health Services (DSHS) conducted an exposure investigation on August 15, 2016 through August 18, 2016 in Hebbronville, Texas, to evaluate residents for possible exposure to arsenic in their drinking water. Total urinary arsenic and inorganic-related urinary arsenic species were measured in 112 residents, including 14 residents under 20 years of age.

The primary objectives of this investigation were to:

- Provide residents of Hebbronville with an assessment of their current exposure to arsenic through confidential and independent laboratory testing of their urine.
- If required, provide individuals with recommendations on how to reduce their exposure.
- Determine if participants' results were greater than arsenic levels found in the general population of the U.S.
- Provide aggregate summary results (not linked to any one individual) to help with the broader efforts in the community to reduce potential health risks.

## Background

Hebbronville is located in Jim Hogg County, Texas. Hebbronville has a population of 4,558 persons, with 93% describing themselves as being of Hispanic origin [1]. The main source of residential drinking water is supplied by the Jim Hogg County Water Control and Improvement District (WCID) #2, which provides water to 1,825 connections [2].

Residents of Hebbronville were concerned about arsenic exposure because their drinking water has had the second highest levels of arsenic in the state from 2011-2015 [2]. Arsenic levels in the WCID during this time period ranged from 28.7 micrograms per liter ( $\mu\text{g/L}$ ) to 78.0  $\mu\text{g/L}$  as noted in Table 1. These levels are consistently above the U.S. Environmental Protection Agency's (EPA) maximum contaminant level (MCL) for arsenic in drinking water of 10  $\mu\text{g/L}$  [2,3].

Year	2011	2012	2013	2014	2015
*All levels are shown in micrograms per liter ( $\mu\text{g/L}$ )					
Range of arsenic levels	30 - 78	48.2 - 65.1	60.1 - 64.4	60.8 - 67.6	28.7 - 65.2
Average yearly arsenic levels	55.5	56.6	61.9	63.7	50.1

## Exposure Investigation Design

Prior to conducting the investigation, DSHS took measures to ensure that the safety, confidentiality, rights, and welfare of the people involved were protected. The protocol was reviewed and approved by the DSHS Institutional Review Board (IRB).

Arsenic can be measured in blood, hair, fingernails, and urine. However, urine arsenic is considered to be the most reliable method for measuring exposure to arsenic because urine is the main route of excretion of most arsenic species. Most ingested arsenic leaves the body in the urine typically within three days following exposure [4]. Fluctuations in urine excretion rates make a 24-hour collection the optimal sample. However, the difficulties associated with collecting a 24-hour sample have resulted in the use of a first morning void, or a random spot sample, in most exposure investigations. In past studies, first morning void urine results have correlated well with 24-hour results [5].

Therefore, DSHS tested resident's first morning void urine samples as an indicator of recent exposure [4]. DSHS offered free urine testing to all adults and children who reside in Hebbronville. Participants were recruited through letters (Appendix A) sent to 1,709 households identified as having a Hebbronville, Texas mailing address. Participants were also recruited through door-to-door offerings and flyers (Appendix B). DSHS tested urine from 112 participants. Of the 112 participants, 65 (58%) were female, 14 (13%) were under 20 years of age, and 107 (96%) were Hispanic or Latino.

A brief questionnaire (Appendix C) was completed with each participant at the time he/she came in to pick up the urine-sampling supplies. Participants were asked questions pertaining to: 1) their source of tap water, 2) their primary water source for drinking, cooking, and making ice, and 3) other possible sources of exposure to arsenic, such as smoking, gardening, hobbies, and pesticides.

Each participant signed a consent form (Appendix D) outlining the purpose of the investigation, the procedures involved, the expected time commitment, any reasonable foreseeable risks or discomforts, potential benefits to the participant or to others, how their information will be kept confidential, and contact with any questions or concerns regarding the consent form or the specimen collection procedures.

## Biological Sampling

Biological samples were collected using approved procedures and materials. Sterile 120 milliliter urine specimen cups and collection instructions were supplied to participants. Participants were asked to collect the first morning void and place the sample in the freezer until it could be delivered to DSHS at the local community center. Upon receipt, DSHS froze any urine samples that were not frozen. DSHS staff delivered the frozen samples to the DSHS Chemical Threat

Laboratory in Austin, Texas for analysis. Confidentiality and chain-of-custody was maintained throughout sample collection and delivery.

## Data Analysis

The urine samples were analyzed using the DSHS Laboratory Service Section Chemical Threat high performance liquid chromatography-inductively coupled plasma-mass spectrometry (LC-ICP-MS) speciation method. This method separates and measures the different types of arsenic, including inorganic and organic compounds, and arsenic metabolites. Urine creatinine also was analyzed to control for differences in urine output and dilution. This is a standard practice in medicine to determine a creatinine-corrected urinary arsenic result. Inorganic-related arsenic species (hereafter referred to as inorganic arsenic) concentrations were calculated as the sum of arsenate, arsenite, monomethylarsonic acid, and dimethylarsenic acid. Test results were reported as micrograms of arsenic per liter ( $\mu\text{g/L}$ ) and as micrograms of arsenic per gram of creatinine ( $\mu\text{g/g}$  creatinine).

Results for creatinine-corrected total urinary arsenic and inorganic arsenic were compared to 2011-2012 National Health and Nutrition Examination Survey (NHANES) 95<sup>th</sup> percentile values [6]. Ninety-five percent of the general population of the U.S. is estimated to have urinary arsenic concentrations at or below the NHANES 95<sup>th</sup> percentile value. In addition, participants' total urine arsenic results were compared to a clinical reference interval [7]. The clinical reference interval is the range of values used by healthcare professionals to interpret test results for a particular patient. There is no clinical reference interval for inorganic arsenic.

Fisher's exact test was used to determine if those reporting consumption of tap water (with or without a filter) were more likely to have urinary arsenic concentrations greater than the NHANES 95<sup>th</sup> percentile value. Fisher's exact test is a statistical test used to determine if the proportion of people with an outcome in one group is the same as the proportion of people with that outcome in another group. Wilcoxon rank sum test was used to compare median arsenic values between those reporting tap water consumption and those reporting exclusive bottled water consumption. This test is used to compare the distribution of an outcome (in this case, urinary arsenic concentrations) between two groups.

## Biological Sampling Results

Individual test results and an explanation of their meaning were provided to each of the participants in writing (Appendix E). Recommendations for follow-up actions were made based on individual results. In accordance with state and federal confidentiality laws, individual test results were not made available to the general public.

Arsenic was detected in 100% of the 112 urine samples analyzed. Total arsenic levels for the 112 participants ranged from 1.4 to 184.1  $\mu\text{g/L}$ . The median total arsenic level was 13.7  $\mu\text{g/L}$ . Total

arsenic levels after creatinine correction ranged from 2.3 to 221.8  $\mu\text{g/g-creatinine}$ , with a median concentration of 13.0  $\mu\text{g/g-creatinine}$ .

Inorganic arsenic levels for the 112 participants ranged from 1.4 to 80.2  $\mu\text{g/L}$ . The median inorganic arsenic level was 11.0  $\mu\text{g/L}$ . Inorganic arsenic levels after creatinine correction ranged from 1.6 to 145.5  $\mu\text{g/g-creatinine}$ , with a median concentration of 11.3  $\mu\text{g/g-creatinine}$  (Table 2).

	<b>Unit</b>	<b>Min</b>	<b>Max</b>	<b>Median (95% Confidence Interval)</b>
<b>Total arsenic</b>	$\mu\text{g/L}^{\text{a}}$	1.4	184.1	13.7 (10.3, 19.1)
	$\mu\text{g/g-c}^{\text{b}}$	2.3	221.8	13.0 (11.5, 15.7)
<b>Inorganic-related arsenic<sup>c</sup></b>	$\mu\text{g/L}$	1.4	80.2	11.0 (8.5, 16.9)
	$\mu\text{g/g-c}$	1.6	145.5	11.3 (9.2, 12.7)

<sup>a</sup>  $\mu\text{g/L}$  = micrograms arsenic per liter urine

<sup>b</sup>  $\mu\text{g/g-c}$  = micrograms inorganic arsenic per gram creatinine

<sup>c</sup> Sum of arsenate, arsenite, monomethylarsonic acid, and dimethylarsenic acid

Thirteen (12%) participants' total creatinine-corrected urinary arsenic concentrations were greater than 35  $\mu\text{g/g-creatinine}$ , the clinical reference value, and 6 (5%) had total creatinine-corrected urinary arsenic concentrations greater than the 2011-2012 NHANES 95<sup>th</sup> percentile value of 50  $\mu\text{g/g-creatinine}$ . As stated previously, there is no clinical reference value for inorganic arsenic levels, and 26 (23%) had urinary inorganic arsenic concentrations greater than the 2011-2012 NHANES 95<sup>th</sup> percentile value of 20  $\mu\text{g/g-creatinine}$  (Table 3).

	<b>Clinical reference interval</b>	<b>95<sup>th</sup> Percentile</b>	<b>Number of samples above the reference values</b>	
			<b>Clinical reference interval</b>	<b>95<sup>th</sup> Percentile</b>
<b>Total arsenic</b>	<35 $\mu\text{g/g-c}^{\text{a}}$	50 $\mu\text{g/g-c}$	13 (12%)	6 (5%)
<b>Inorganic-related arsenic<sup>b</sup></b>	Not available	19 $\mu\text{g/g-c}$	N/A	26 (23%)

<sup>a</sup>  $\mu\text{g/g-c}$  = micrograms inorganic arsenic per gram creatinine

<sup>b</sup> Sum of arsenate, arsenite, monomethylarsonic acid, and dimethylarsenic acid

Of the 112 people who were tested, more than 95% reported that the Jim Hogg County WCID #2 water was the source of their tap water, and the remaining residents reported a private well as their source of tap water. Eighty-three participants (74%) reported that they consume the tap water (Table 4). Thirty-five participants (31%) use tap water to make ice, 74 (66%) eat food cooked with tap water, and 11 (10%) drink tap water (tap water uses are not mutually exclusive). With respect to other possible routes of exposure to arsenic, 17 people (15%) reported that they currently use tobacco products, 12 people (11%) reported that they have contact with chemicals, including pesticides, and 20 (25%) reported eating seafood in the 3 days prior to the urine test.

The median creatinine-corrected total and inorganic-related arsenic concentrations among those that consume tap water were 15.4 µg/g-creatinine and 12.6 µg/g-creatinine, respectively (Table 4). Among those that said they never consume tap water, median creatinine-corrected total and inorganic-related arsenic concentrations were 9.6 µg/g-creatinine and 7.2 µg/g-creatinine, respectively.

Participants that reported consumption of tap water had significantly higher median concentrations of creatinine-corrected total arsenic (p=0.01) and inorganic-related arsenic (p<0.0001) than those who said they never used tap water for consumption (Table 4). They were also more likely to have inorganic-related urinary arsenic concentrations above NHANES 95<sup>th</sup> percentile values (p=0.02; results not shown to protect participant confidentiality). There was no difference between adults and children or males and females.

**Table 4: Comparison of median urinary arsenic concentrations by tap water use**

	Does not consume tap water (n=29)		Consumes tap water (n=83)		p-value <sup>b</sup>
	Median (95% CI) <sup>a</sup>	Min-Max	Median (95% CI)	Min-Max	
<b>Total arsenic (µg/g-creatinine)</b>	9.6 (7.2-13.5)	2.3-221.8	15.4 (10.5-38.5)	2.3-145.5	0.01
<b>Inorganic-related arsenic<sup>c</sup> (µg/g-creatinine)</b>	7.2 (4.4-8.9)	1.6-38.5	12.6 (11.4-16.0)	2.1-145.5	<0.0001

<sup>a</sup> CI = confidence interval

<sup>b</sup> Calculated using Wilcoxon Rank Sum test

<sup>c</sup> Sum of arsenate, arsenite, monomethylarsonic acid, and dimethylarsenic acid

## Discussion

Arsenic is a naturally-occurring element in the earth’s crust that is usually found in combination with other elements. Arsenic compounds can be classified into three main groups: 1) inorganic arsenic compounds, 2) organic compounds, and 3) arsine gas. In the environment, arsenic is most often found as inorganic arsenic, which is formed when arsenic combines with other elements such as oxygen, sulfur, and chlorine. Organic forms of arsenic, which result when arsenic combines with carbon and hydrogen, generally are considered less toxic than the inorganic forms [4].

The presence of chemical contaminants in the environment does not always result in people being exposed. People may be exposed to chemicals by breathing, eating, drinking, or by getting a substance on their skin. The degree to which arsenic compounds can be detected in urine depends on the concentration of the contaminant in the environment, the amount of contaminant that a person ingests, and how often ingestion occurs. The presence of contaminants in the public water supply is what drove this investigation.

All of the participants tested in this investigation had detectable levels of total arsenic in their urine. Having detectable levels of arsenic in the body is common since arsenic is found naturally in the environment, including the air, water, and food [4]. Foods such as fish, shellfish, beans, and rice are common sources of the organic forms of arsenic and can cause higher than normal urinary total arsenic levels.

Clinical reference levels for interpreting urinary inorganic arsenic levels do not exist; however, 6 (5%) and 26 (23%) of the participants had total and inorganic creatinine-corrected urinary arsenic levels greater than 95% of the U.S. population<sup>\*</sup>, respectively. This investigation also shows that participants who indicated that they drink tap water were statistically significantly more likely to have urinary inorganic arsenic levels greater than those who said they never used tap water for consumption. Collectively, these results suggest that the drinking water in Hebbronville is a source of arsenic exposure.

## Limitations

Limitations of this investigation include:

- Individual health effects associated with arsenic exposure cannot be determined.
- Arsenic has a short half-life in the body (hours); therefore, the levels found in the body only represent recent exposures.
- Participants were a self-selected sample of Hebbronville residents, so results may not be generalizable to the entire Hebbronville population.
- The results are based on a one-time sampling event.

## Conclusions

Arsenic above the MCL has been documented consistently in the Jim Hogg County WCID #2. Approximately 23% of people who participated in this investigation had urinary inorganic arsenic levels that were higher than those found in the general U.S. population. Individuals reporting tap water consumption had significantly higher median concentrations of total arsenic and inorganic-related arsenic than those who said they never used tap water for consumption, suggesting that consumption of water is a source of arsenic.

## Recommendations

Based upon the results of this investigation DSHS recommends that:

1. Individuals with inorganic arsenic levels greater than 19.6 µg/g-creatinine consult with their personal physician to determine if further testing is warranted.
2. Households connected Jim Hogg County WCID #2 use bottled water or properly filtered water for consumption as long as arsenic levels above the MCL persist.

---

<sup>\*</sup> According to 2011-2012 NHANES 95th percentile value of 50.4 µg/g-creatinine for total, and 19.6 µg/g-creatinine for inorganic arsenic

3. All individuals discuss their urine arsenic level results with a personal health care provider. Participants of this investigation and/or their health care providers may discuss their results with DSHS by sending an email to [epitox@dshs.texas.gov](mailto:epitox@dshs.texas.gov) with Hebbronville EI in the subject line, and their specific request in the body of the message.
4. The Jim Hogg County WCID #2 continue its efforts to reduce the arsenic levels in the public water supply system.

## **Actions Planned**

1. This report will be available to participants, citizens, the Jim Hogg County WCID #2, the Texas Commission on Environmental Quality (TCEQ), the Texas A&M Argilife Extension, the Jim Hogg County Commissioners Court and other interested parties through hard copies and the DSHS website.
2. DSHS will work with TCEQ to address the issue of arsenic in the public drinking water supply.
3. DSHS will continue to answer community questions regarding this investigation. Questions regarding this document should be sent to [epitox@dshs.texas.gov](mailto:epitox@dshs.texas.gov) with Hebbronville EI in the subject line.

---

## Authors and Technical Advisors

Heidi Bojes, PhD  
Section Director, Toxicologist  
Environmental & Injury Epidemiology and Toxicology  
Texas Department of State Health Services

Tina Walker  
Health Educator  
Environmental & Injury Epidemiology and Toxicology  
Texas Department of State Health Services

Emily Hall  
Epidemiologist  
Environmental & Injury Epidemiology and Toxicology  
Texas Department of State Health Services

Jessica Kessinger  
Health Assessor  
Environmental & Injury Epidemiology and Toxicology  
Texas Department of State Health Services

## Acknowledgements

Technical assistance provided by:

Leticia Nogueira, PhD,  
Unit Director  
Environmental & Injury Epidemiology and Toxicology  
Texas Department of State Health Services

Jocelyn Hover-Jeansonne, Chemist  
Chemical Threat Team Lead  
Chemical Threat Laboratory  
Texas Department of State Health Services

DSHS staff and interns that assisted in sample collection include Tom Ellerbee, Josh Duty, Diana Rangel, Sandra Hernandez, and Chandi Jaggi.

## References

1. US Census Bureau. American Factfinder 2010, Community Facts Hebbronville CDP, Texas. <https://factfinder.census.gov/> Accessed:12/01/2017
2. Texas Commission on Environmental Quality. Texas Drinking Water Watch, Jim Hogg County WCID. [http://dww2.tceq.texas.gov/DWW/JSP/WaterSystemDetail.jsp?tinwsys\\_is\\_number=3876&tinwsys\\_st\\_code=TX&wsnumber=TX1240001%20&DWWState=TX.%20Accessed%2012/5/2017](http://dww2.tceq.texas.gov/DWW/JSP/WaterSystemDetail.jsp?tinwsys_is_number=3876&tinwsys_st_code=TX&wsnumber=TX1240001%20&DWWState=TX.%20Accessed%2012/5/2017). Accessed 12/5/2017.
3. Federal Register. Part VIII Environmental Protection Agency, 40 CFR Parts 9, 141, and 142 National Primary Drinking Water Regulations; Arsenic Clarifications to Compliance and New Source Contaminants Monitoring; Final Rule. Vol. 66, No. 14/Monday, January 22, 2001 / Rules and Regulations.
4. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological profile for Arsenic. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service; August 2007.
5. Kalman DA, Huges J, van Belle G, Burbacher T, Bogiano D, Colbe K, Mottet N, Polissar L. The effect of variable environmental arsenic contamination on urinary concentrations of arsenic species. Environmental Health Perspective 1990; 89:145-51.
6. Center for Disease Control and Prevention (CDC). National Center for Health Statistics (NCHS). National Health and Nutrition Examination Survey Data. Hyattsville, MD: U.S. Department of Health and Humans Services, Centers for Disease Control and Prevention; 2017.
7. Wu AHB. Tietz Clinical Guide to Laboratory Tests. 4th ed. St. Louis: WB Saunders; 2006.

**Appendix A**

**Investigation Recruitment Letter**



Staff from the Texas Department of State Health Services (DSHS) are in your neighborhood, **August 15-18, 2016**, to speak with residents about their drinking water.

If you would be willing to visit with us, either in person or by telephone, please contact us at **512-981-8397** or **512-981-8415** during **August 15-18, 2016**. Please leave a message letting us know the best time to contact you as well as a phone number where you can be reached. We will check messages throughout the day and will return your call as soon as possible.

**After August 18th you can contact us at 1-800-588-1248 extension 6572.**

---

Personal del Departamento Estatal de Servicios de Salud de Texas (DSHS, por sus siglas en inglés) están en su vecindario, el **15 al 18 de Agosto del 2016**, para hablar con los residentes sobre su agua potable.

Si usted estaría dispuesto/a a hablar con nosotros, o en persona o por teléfono, por favor llámenos al **512-981-8397** o al **512-981-8415** durante el **15 al 18 de Agosto del 2016**. Favor de dejarnos un mensaje que incluya su número de teléfono y la mejor hora para ponernos en contacto con usted. Estaremos escuchando mensajes durante el día y devolveremos su llamada lo más pronto posible.

**Después del 18 de Agosto puede comunicarse con nosotros al 1-800-588-1248 extensión 6572.**

Texas Department of State Health Services  
Health Assessment and Consultation Program, MC 1964  
PO Box 149347, Austin, Texas 78714-9347

Diana Rangel, Community Involvement Liaison  
Public Health Assessment and Consultation Program

1-800-588-1248 ext. 6572  
epitox@dshs.texas.gov

**Appendix B**

**Investigation Recruitment Flyer**



## Free Urine Testing for Hebbronville, Texas Residents

In response to public concerns about naturally occurring arsenic in the Hebbronville public drinking water, staff from the Texas Department of State Health Services (DSHS) will be offering **free urine testing** to the **first 400 Hebbronville residents** that contact us.

The DSHS laboratory will test the samples for arsenic only. Information from the testing will help DSHS identify whether further public health recommendations are needed to help residents reduce their risk of exposure.

If you would like to participate please contact Tina Walker or Diana Rangel with the Health Assessment and Consultation Program between **August 15<sup>th</sup>- 18<sup>th</sup>, 2016** to set up an appointment.

Tina Walker	Diana Rangel
Health Educator	Community Liaison
<b>1-800-588-1248, ext. 2932</b>	<b>1-800-588-1248, ext. 6572</b>

**Appendix C**

**Investigation Questionnaire**

ID Number: \_\_\_\_\_

DSHS Staff: \_\_\_\_\_

**Arsenic Investigation Questionnaire**

1. First Name: \_\_\_\_\_ Last Name: \_\_\_\_\_ MI: \_\_\_\_\_

2. What is your current address? \_\_\_\_\_

3. Date of Birth: \_\_\_\_\_ Sex: \_\_\_\_\_ Male \_\_\_\_\_ Female

4. Do you consider yourself Hispanic or Latino?  Yes  No

5. Race: (circle) White / Black or African-American / Asian / Pacific Islander / Other \_\_\_\_\_

6. How many years have you lived in Hebbronville?  less than 1  1-5  5-10  more than 10

a. If less than one year, where did you live before (city and state)? \_\_\_\_\_

7. Best Phone #: \_\_\_\_\_

8. What is your current occupation? \_\_\_\_\_

9. How long have you done this type of work? \_\_\_\_\_

10. Do you have contact with chemicals (including pesticides) at your current job?  Yes  No

If so, what chemicals? \_\_\_\_\_

11. What are your hobbies? (e.g. gardening, stained glass, gunsmith, auto repair, etc.) \_\_\_\_\_

\_\_\_\_\_

12. Please provide the following information on all individuals currently living in your household.

Full Name	Age	Occupation	Hobbies

**Please include any notes on the reverse side of page**

13. Do you use any of the following tobacco products?

Date:

- Cigarettes
- Cigars
- Snuff
- Chewing tobacco
- Other \_\_\_\_\_

14. Please list any medications you are currently taking (including: over the counter, prescription, vitamins or supplements).

Medication/ Product name and brand	What is it taken for?

15. Do you use any herbal or natural remedies?  Yes  No If yes, please describe \_\_\_\_\_

16. What is the source of tap water in your home?  Private well  Municipal water  Unknown  Other  
(specify) \_\_\_\_\_

17. What kind of water do you drink?  Tap water, unfiltered  Tap water, filtered (specify type of filter) \_\_\_\_\_  
 Bottled water, store bought  Bottled water, reusable bottle  Other (specify)

18. How many glasses of water do you drink per day? \_\_\_\_\_

19. How many glasses of other types of drinks made with drinking water do you drink per day?  
(e.g. coffee, tea)? \_\_\_\_\_

What kind of water do you use to make ice?  Bottled water, store bought  Bottled water, reusable  
bottle

- Tap water, unfiltered
- Tap water, filtered (specify type of filter) \_\_\_\_\_
- Other (specify) \_\_\_\_\_

21. What kind of water do you use to prepare food?

- Tap water, unfiltered
- Tap water, filtered (specify type of filter) \_\_\_\_\_
- Bottled water, store bought
- Bottled water, reusable bottle
- Other (specify) \_\_\_\_\_

22. Have you eaten any of the following foods in the last three days?

- Fish (specify type) \_\_\_\_\_
- Rice
- Beans

**Please include any notes on the reverse side of page**

ID # \_\_\_\_\_

**Appendix D**

**Participant Consent for Urine Specimen Testing**



## **Participant Consent for Urine Specimen Testing Exposure Investigation for Arsenic in Water**

The Texas Department of State Health Services (DSHS) is investigating arsenic exposure for people who drink water from the Hebronville area.

- We are offering **free, voluntary urine arsenic testing** for residents from the Hebronville area.
- Along with the free testing, **exposure information will be collected** with a questionnaire.

This investigation will let you know your own levels of arsenic and will help DSHS identify if public health actions are needed to reduce exposure

### **Participation**

I understand that I will benefit from participating by learning if I (or my child/ward) have recently had elevated exposure to arsenic. If arsenic is detected outside acceptable levels, I will receive information about arsenic exposure and how to reduce current and future exposures.

I understand that my **participation is voluntary**. Furnishing any information is voluntary and even if I agree to participate and sign this form, I can stop my participation or my child's/ward's participation at any time. I understand and agree that there is no provision for compensation or medical treatment offered by DSHS based upon the test results or in the event of injury from participation. I understand that I must sign this form to participate.

### **Procedure/Tests:**

I understand that:

- I am providing a **urine sample to test for arsenic only**.
- A representative of the Texas Department of State Health Services will provide urine specimen cups and instructions to me.
- I understand that I will collect the first urine of the morning in the specimen container.
- I understand that I should deliver the sample to the DSHS staff at the exposure investigation site.

### **Results**

I understand that every effort will be made to provide the results of my tests in writing to me within approximately 2 months. I will receive an actual test result in addition to laboratory reference values with an explanation of their significance. Results that are of immediate health concern will be reported to me as soon as they are known. If my results reveal an elevated value of arsenic, I understand that I should notify my personal physician.

### **Confidentiality**

I understand that confidentiality will be protected to the fullest extent possible according to state and federal laws. Forms containing my name or address will be kept in locked cabinets at the Texas Department of State Health Services. Any reports produced from this investigation will give only group information and not identify specific individuals.

**Contact**

If I have any additional questions about this investigation or the test, I may contact DSHS at (512) 776-7269.

**Consent**

The risks and benefits of this exposure investigation have been explained to me. All of my questions have been satisfactorily answered. I hereby freely and voluntarily give my signed consent for participating in the testing described above.

I, (please print) \_\_\_\_\_, the undersigned, agree to urine sampling and completing questionnaires for:

( ) Myself.

( ) My child/ward, \_\_\_\_\_, age - \_\_\_\_\_, ID#

( ) My child/ward, \_\_\_\_\_, age - \_\_\_\_\_, ID#

( ) My child/ward, \_\_\_\_\_, age - \_\_\_\_\_, ID#

( ) My child/ward, \_\_\_\_\_, age - \_\_\_\_\_, ID#

( ) My child/ward, \_\_\_\_\_, age - \_\_\_\_\_, ID#

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Address: \_\_\_\_\_

Phone # \_\_\_\_\_

Witness: \_\_\_\_\_ Signature \_\_\_\_\_



## Consentimiento del participante para análisis de muestras de sangre

El Departamento Estatal de Servicios de Salud de Texas (DSHS, por sus siglas en inglés) está investigando una posible exposición a arsénico en el agua potable.

- DSHS ofrecerá **un análisis de orina gratuito** a cualquier individual que sea residente de Hebronville, o que reciba servicio de agua del Jim Hogg County Water Control and Improvement District #2
- A los participantes se le pedirá que completen un cuestionario breve que contiene preguntas sobre otras posibles fuentes de investigación.

Dicha investigación puede identificar si usted tiene arsénico urinario a un nivel de lo que se encuentra en la población general de los Estados Unidos. La información nos ayudará a identificar si acciones mayores son necesarias para reducir la exposición para las personas en esta área.

### Participación

Entiendo que participando yo, o mi hijo, sabremos si hemos estado expuestos al arsénico. Vamos a recibir información sobre la exposición al arsénico y cómo reducir las exposiciones actuales y futuras.

Entiendo que mi **participación es voluntaria**. Si doy información es de forma voluntaria y aun cuando acepte participar y firmar este formulario, puedo suspender mi participación o la participación de mi hijo/tutelado en cualquier momento. Entiendo que este procedimiento podría tomar hasta 1 hora. Entiendo y acepto que el DSHS no provee compensación ni ofrece tratamiento médico en base a los resultados de los análisis o en caso de lesión por participar. Entiendo que debo firmar este formulario para participar.

Entiendo que DSHS recolectarán hasta 500 muestras de orina y analizarlos para el arsénico.

### Procedimiento/análisis:

Entiendo que:

- yo, o mi hijo proveemos **un análisis de orina**.
- entiendo que un técnico calificado, que representa al DSHS, obtendrá la muestra de sangre.
- entiendo que los riesgos no son mayores que los esperados con procedimientos clínicos normales.

### Resultados

Entiendo que harán todo lo posible por darme los resultados de mis análisis por escrito dentro de un periodo de aproximadamente 2 meses. Recibiré el resultado del análisis junto con una explicación de su importancia. Se me informará de los resultados que sean motivo de preocupación de salud inmediata tan pronto se sepan.

**Confidencialidad**

Entiendo que se protegerá mi confidencialidad en la medida de lo posible de acuerdo con las leyes estatales y federales. Los formularios que contengan mi nombre o domicilio se mantendrán en armarios bajo llave en el DSHS. Cualquier informe producido a partir de esta investigación sólo dará información de grupo y no identificará a individuos específicos.

**Contacto**

Si tengo preguntas adicionales sobre la investigación o el análisis, me puedo comunicar con el DSHS Health Assessment and Toxicology Group a 512-776-7269.

Me han explicado los riesgos y los beneficios de esta investigación de exposición. Han contestado todas mis preguntas satisfactoriamente. Por este conducto, libre y voluntariamente, doy mi consentimiento firmado para participar en los análisis antes descritos.

Yo, (escriba en letra de molde) \_\_\_\_\_, el suscrito, acepto el muestreo de sangre y rellenar un cuestionario para: \_\_\_\_\_.

Firma: \_\_\_\_\_ Fecha: \_\_\_\_\_

Dirección: \_\_\_\_\_

Teléfono: \_\_\_\_\_

Witness: \_\_\_\_\_ (print name) \_\_\_\_\_ (signature)

**Appendix E**

**Investigation Results Letter**



## TEXAS DEPARTMENT OF STATE HEALTH SERVICES

JOHN HELLERSTEDT, M.D.  
COMMISSIONER

P.O. Box 149347  
Austin, Texas 78714-9347  
1-888-963-7111  
TTY: 1-800-735-2989  
www.dshs.state.tx.us

January 27, 2017

«parents\_first\_name» «parent\_last\_name»  
«parent\_address»  
«city», Texas «ZIPPostal»

Dear «parent\_prefix» «parent\_last\_name»,

You are receiving this letter because your child, «First\_Name» «Last\_Name», participated in the Hebronville Arsenic Exposure Investigation conducted by the Texas Department of State Health Services (DSHS) from August 15, 2016 through August 18, 2016. DSHS recently determined that the urine arsenic results previously reported to you were not correct. The revised results from your child's sample are attached to this letter.

DSHS compared the total and inorganic arsenic results from your child's sample to results found in people throughout the United States (US). Specifically, we looked to see if each result was greater than arsenic levels found in 95% of the US population (the 95<sup>th</sup> percentile)<sup>†</sup> as well as a reference value used by physicians (clinical reference value)<sup>‡</sup>. Having a value greater than one or both of the reference values does not mean your child will get sick. It does, however, suggest their exposure to arsenic may be higher than most individuals across the US.

If your child's results are greater than the 95<sup>th</sup> percentile or the clinical reference value, DSHS recommends you share their results and any health concerns that you have with your child's physician. You can provide your child's physician with our contact information prior to their appointment if they have any questions about the test results.

A summary report of our findings is currently being prepared and will be available later this year.

If you have any questions, please contact the Health Assessment and Consultation Program at 1-800-588-1248 or by email at [epitox@dshs.texas.gov](mailto:epitox@dshs.texas.gov). Si tiene preguntas o prefiere la información en español, llame a Emily Hall al 1-800-588-1248 extensión 2652.

Sincerely,

Tina Walker  
Health Educator  
Health Assessment and Toxicology Program  
Texas Department of State Health Service

---

<sup>†</sup> Based on the 2011-2012 National Health and Nutrition Examination Survey (NHANES) conducted by the Centers for Disease Control and Prevention.

<sup>‡</sup> From the *Tietz Clinical Guide to Laboratory Tests*, 2006.

Arsenic is a chemical element that exists in several different organic and inorganic forms. Inorganic arsenic compounds are found in soils, groundwater, and some foods, and are considered more toxic than organic arsenic compounds.

For this investigation DSHS looked at total and inorganic arsenic levels in your urine sample. **Total arsenic** includes all inorganic and organic arsenic compounds found in your sample.

**Inorganic arsenic** includes inorganic arsenic compounds and their related metabolites.

The table below gives the total arsenic and inorganic arsenic levels detected in your urine sample.

**Urine Sample Results<sup>a</sup>**

Contaminant	Your Result	Clinical Reference Value <sup>b</sup>	95 <sup>th</sup> Percentile <sup>c</sup>	Range of Arsenic Levels in the 81 Hebbbronville Participants
Total Arsenic	«Total_as_labcalc_cc»	35.0 µg/g-creatinine	50.4 µg/g-creatinine	<1.0 – 105.7 µg/g-creatinine
Inorganic Arsenic <sup>d</sup>	«Total_inorganic_labcalc_cc»	Not available	19.6 µg/g-creatinine	<LOD <sup>e</sup> – 105.7 µg/g-creatinine

- <sup>a</sup>. Results are expressed as micrograms of arsenic per gram creatinine (µg/g-creatinine). Standardizing the results per gram creatinine is a standard practice in medicine when presenting urine test results.
- <sup>b</sup>. The clinical reference value is from the *Tietz Clinical Guide to Laboratory Tests*, 2006, and is typically used in clinical settings. There is no clinical reference interval for inorganic arsenic.
- <sup>c</sup>. 95<sup>th</sup> percentiles are from the 2011-2012 National Health and Nutrition Examination Survey (NHANES) conducted by the Centers for Disease Control and Prevention.
- <sup>d</sup>. Inorganic arsenic results include laboratory results for inorganic arsenic compounds (arsenous acid and arsenic acid), and their related metabolites (dimethylarsinic acid [DMA] and monomethylarsonic acid [MMA]).
- <sup>e</sup>. <LOD = less than limit of detection

Having a value greater than one or both of the reference values does not mean you will get sick. It does, however, suggest your exposure to arsenic may be higher than most individuals across the US.

If your **total arsenic** and/or **inorganic arsenic** results are above the respective reference value, DSHS recommends that you share your results and any health concerns that you have with your physician.

If you have any questions, please contact the Health Assessment and Consultation Program at 1-800-588-1248 or by email at [epitox@dshs.texas.gov](mailto:epitox@dshs.texas.gov)



## TEXAS DEPARTMENT OF STATE HEALTH SERVICES

JOHN HELLERSTEDT, M.D.  
COMMISSIONER

P.O. Box 149347  
Austin, Texas 78714-9347  
1-888-963-7111  
TTY: 1-800-735-2989  
www.dshs.state.tx.us

January 27, 2017

«parents\_first\_name» «parent\_last\_name»  
«parent\_address»  
«city», Texas «ZIPPostal»

Dear «parent\_prefix» «parent\_last\_name»,

You are receiving this letter because your child, «First\_Name» Last\_Name», participated in the Hebronville Arsenic Exposure Investigation conducted by the Texas Department of State Health Services (DSHS) from August 15, 2016 through August 18, 2016. DSHS recently determined that the urine arsenic results previously reported to you were not correct. The revised results from your child's sample are attached to this letter.

DSHS compared the total and inorganic arsenic results from your child's sample to results found in people throughout the United States (US). Specifically, we looked to see if each result was greater than arsenic levels found in 95% of the US population (the 95<sup>th</sup> percentile)<sup>§</sup> as well as a reference value used by physicians (clinical reference value)<sup>\*\*</sup>. Having a value greater than one or both of the reference values does not mean your child will get sick. It does, however, suggest their exposure to arsenic may be higher than most individuals across the US.

If your child's results are greater than the 95<sup>th</sup> percentile or the clinical reference value, DSHS recommends you share their results and any health concerns that you have with your child's physician. You can provide your child's physician with our contact information prior to their appointment if they have any questions about the test results.

A summary report of our findings is currently being prepared and will be available later this year.

If you have any questions, please contact the Health Assessment and Consultation Program at 1-800-588-1248 or by email at [epitox@dshs.texas.gov](mailto:epitox@dshs.texas.gov). Si tiene preguntas o prefiere la información en español, llame a Emily Hall al 1-800-588-1248 extensión 2652.

Sincerely,

Tina Walker  
Health Educator  
Health Assessment and Toxicology Program  
Texas Department of State Health Services

---

<sup>§</sup> Based on the 2011-2012 National Health and Nutrition Examination Survey (NHANES) conducted by the Centers for Disease Control and Prevention.

<sup>\*\*</sup> From the *Tietz Clinical Guide to Laboratory Tests*, 2006.

Arsenic is a chemical element that exists in several different organic and inorganic forms. Inorganic arsenic compounds are found in soils, groundwater, and some foods, and are considered more toxic than organic arsenic compounds.

For this investigation DSHS looked at total and inorganic arsenic levels in your urine sample.

**Total arsenic** includes all inorganic and organic arsenic compounds found in your sample.

**Inorganic arsenic** includes inorganic arsenic compounds and their related metabolites.

The table below gives the total arsenic and inorganic arsenic levels detected in your urine sample.

**Urine Sample Results<sup>a</sup>**

Contaminant	Your Result	Clinical Reference Value <sup>b</sup>	95 <sup>th</sup> Percentile <sup>c</sup>	Range of Arsenic Levels in the 81 Hebbbronville Participants
Total Arsenic	«Total_as_1 abcalc_cc»	35.0 µg/g-creatinine	50.4 µg/g-creatinine	<1.0 – 105.7 µg/g-creatinine
Inorganic Arsenic <sup>d</sup>	«Total_inor ganic_labca lc_cc»	Not available	19.6 µg/g-creatinine	<LOD <sup>e</sup> – 105.7 µg/g-creatinine

- <sup>a.</sup> Results are expressed as micrograms of arsenic per gram creatinine (µg/g-creatinine). Standardizing the results per gram creatinine is a standard practice in medicine when presenting urine test results.
- <sup>b.</sup> The clinical reference value is from the *Tietz Clinical Guide to Laboratory Tests*, 2006, and is typically used in clinical settings. There is no clinical reference interval for inorganic arsenic.
- <sup>c.</sup> 95<sup>th</sup> percentiles are from the 2011-2012 National Health and Nutrition Examination Survey (NHANES) conducted by the Centers for Disease Control and Prevention.
- <sup>d.</sup> Inorganic arsenic results include laboratory results for inorganic arsenic compounds (arsenous acid and arsenic acid), and their related metabolites (dimethylarsinic acid [DMA] and monomethylarsonic acid [MMA]).
- <sup>e.</sup> <LOD = less than limit of detection

Having a value greater than one or both of the reference values does not mean you will get sick. It does, however, suggest your exposure to arsenic may be higher than most individuals across the US.

If your **total arsenic** and/or **inorganic arsenic** results are above the respective reference value, DSHS recommends that you share your results and any health concerns that you have with your physician.

If you have any questions, please contact the Health Assessment and Consultation Program at 1-800-588-1248 or by email at [epitox@dshs.texas.gov](mailto:epitox@dshs.texas.gov).