Health Consultation

Evaluation of Private Residential Drinking Water Wells Near

CHAMBERLAIN SPRINGS

ALTON, BELKNAP COUNTY, NEW HAMPSHIRE

Prepared by the
New Hampshire Department of Environmental Services

SEPTEMBER 16, 2009

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

HEALTH CONSULTATION

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Summary & Purpose

The New Hampshire Department of Environmental Services (DES), Air Resources Division, Environmental Health Program (EHP) has completed this environmental data evaluation in response to a concern raised by the DES Drinking Water and Groundwater Bureau. Specifically, EHP evaluated residential drinking water well sample data for lead. These data were collected by DES and GZA GeoEnvironmental, Inc. (GZA) from January 19, 2006 until February 14, 2006 and summarized in an April 2006 GZA report entitled "*Lead Source Evaluation/Response to Preliminary Comments – Chamberlain Springs.*" Chamberlain Springs LLC. (Chamberlain) is located on 166 Old Wolfeboro Road in Alton, New Hampshire. Chamberlain initially submitted a Bottled Water and Major Groundwater Withdrawal Application with DES in September, 2006. GZA, on behalf of Chamberlain, completed the Lead Source Evaluation to address DES comments to the initial withdrawal application (1).

In 2006, EHP originally reviewed the DES and GZA drinking water quality sample data. Several samples detected lead at a concentration greater than the DES Ambient Groundwater Quality Standard for lead (15.0 μg/L) (1, 2). Accordingly, several residential well owners were notified by mail in March 2006 as to the possible adverse health effects resulting from exposure to lead in their drinking water wells. This health consultation further evaluates the potential for adverse health effects to occur from drinking water exposures to the naturally-occurring lead. This re-evaluation was requested by the DES Drinking Water & Groundwater Bureau.

Human Health Risk Assessment Methods

The EHP used a conservative, protective approach to determine whether lead levels constituted a potential health hazard. First, site-related drinking water data were gathered and compiled. Second, a health-based comparison value (CV) was used to identify whether lead levels in drinking water had a realistic possibility of causing adverse health effects. The CV used in this report (the DES Ambient Groundwater Quality Standard) represents a lead concentration that risk management decision makers concluded is protective of public health in the vast majority of exposure situations. If a contaminant level is lower than its CV, it is eliminated from further analysis. If a contaminant exceeds its CV, it is designated a "contaminant of concern" and examined in greater detail. This includes an analysis of the specific exposure scenario and a thorough scientific literature review to determine whether or not its level presents a public health hazard. Because CVs are based on conservative assumptions, the presence of concentrations greater than a CV does not necessarily indicate that adverse health effects will occur among exposed populations (3, 2).

Exposure Pathways

Environmental contamination cannot affect a person's health unless there is a "completed exposure pathway." A *completed* exposure pathway exists when all of the following five elements are present: 1) a source of contamination; 2) transport through an environmental medium; 3) a point of exposure; 4) a route of human exposure; and 5) an exposed population. These five elements do not define exposure; rather they contribute to determining the probability of exposure (3). The ingestion of drinking water is a *completed* exposure pathway in this Health Consultation.

Onsite Pathway Analysis

Source	Environmental Transport And Media	Exposure Point	Exposure Route	Exposed Population	Time Frame	Status
Naturally-occurring Lead in Geologic Media	Groundwater to **Private Drinking Water Wells**	Tap Water	Ingestion Dermal	Residents	Past	Completed
					Present	Completed
					Future	Completed

Drinking Water Quality Monitoring

The EHP evaluated sampling data collected between January 19, 2006 and February 14, 2006. Samples were collected by GZA and DES from twenty-five private residential drinking water wells in the proximity of the proposed Chamberlain Springs in Alton, NH. GZA summarized this data in an April 2006 Lead Source Evaluation report in order to address DES comments regarding the September, 2006 Chamberlain Bottled Water and Major Groundwater Withdrawal Application. The GZA report noted that lead levels in each well fluctuated with each sampling and ranged from less than 1.0 μg /L (lower limit of detection) to 110.0 μg /L. The highest level, 110.0 μg /L, was much higher than the next highest concentration of 59.0 μg /L. Sampling results, although variable, indicated maximum lead concentrations in nine wells that were higher than the CV (15.0 μg /L) (1). Accordingly, the EHP further evaluated these maximum contaminant concentrations detected in each drinking water well during the sampling period (Table 1). The Results & Public Health Implications Section of this report presents this more in-depth analysis of the risks associated with lead exposure to drinking water.

The April 2006 GZA report indicated that lead detected in drinking water samples was from naturally-occurring geologic source and was not attributable to an anthropogenic source (e.g., leaded gasoline discharge). This lead is mobilized when groundwater flows though the subsurface. Residents who have wells drilled in to these geologic formations could be exposed to the lead-contaminated groundwater by ingesting the water or though dermal absorption during showering and/or washing. It is not possible, however, to determine the exact number of people exposed to lead in drinking water or the exact amount of lead they were exposed to because lead levels in tap water samples were variable (1).

Results & Public Health Implications

This section evaluates the public health implications of drinking water quality from wells near the proposed Chamberlain Springs in Alton, NH. Analysis of available data indicates that lead in drinking water was above its comparison value (CV) in at least one sample from each well identified in Table 1. Lead is thus a “contaminant of concern” warranting further review. To evaluate the likelihood of adverse health effects in people who drink lead contaminated water, EHP derived theoretical blood-lead levels from modeling, and reviewed relevant environmental health studies on health effects from lead exposure.

Table 1: Summary of Private Residential Drinking Water Wells Near Chamberlain Springs in Alton, NH that were higher than the Comparison Value (CV) (1, 4).

Private Well Location	Maximum Concentration of *Total Lead* in Drinking Water (ug/L)	Comparison Value- (ug/L)	Number of Samples Above the CV & Total Number Collected at Each Location
Map 8, Lot 40	22.0	15.0*	2 of 4
Map 9, Lot 60	59.0	15.0*	2 of 4
Map 9, Lot 60-2-1	19.0	15.0*	1 of 4
Map 9, Lot 60-4	28.2	15.0*	1 of 1
Map 12, Lot 47	26.4	15.0*	1 of 1
Map 12, Lot 53-27	20.0	15.0*	1 of 4
Map 12, Lot 55	42.0	15.0*	1 of 3
Map 12, Lot 54-1	23.0	15.0*	3 of 3
Map 12, Lot 57 - Joy Hill	110.0	15.0*	2 of 4

*** DES Ambient Groundwater Quality Standard (AGQS)**

Lead Exposure & Modeling

The amount of lead humans are exposed to is generally expressed in terms of an "absorbed dose." The most common metric of an "absorbed dose" for lead is its concentration in the blood (PbB). This is measured in micrograms per deciliter of blood (μg /dL). The concentration of lead in blood reflects a more recent exposure history; usually the past couple months. Other indices, such as lead in bone, hair, or teeth are also available and are discussed in later sections. Bone measurements, on the other hand, measure longer-term, cumulative exposures, because lead accumulates in bone over the lifetime. For this reason, bone lead may be a better predictor than blood lead of some health effects (4).

The Centers for Disease Control and Prevention (CDC) identified 10 μg/dL as the blood lead level of concern in children in their report "Preventing Lead Poisoning in Young Children." Because health effects were and continue to be identified below this level of concern, the CDC convened an Advisory Committee on Childhood Lead Poisoning Prevention to consider whether the level of concern should be changed. At this time, however, CDC has not changed the blood lead level of concern (5,6).

Due to the likelihood of simultaneous exposure to various sources of lead (e.g., lead in water, soil, ambient air, and lead-based paint), the Environmental Protection Agency (EPA) recommends a case-by-case evaluation of the relative contributions of relevant lead exposures in a particular setting. EPA utilizes the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children. The IEUBK Model was developed by EPA to predict the risk of elevated blood-lead levels in children under the age of seven that are exposed to environmental lead from many sources. The IEUBK model combines estimates of lead intake from air, water, soil, dust, diet, and paint with an absorption module for the uptake of lead from the lungs and the gastrointestinal tract, and a biokinetic model of lead distribution and elimination from a child's body to predict plausible distributions of blood-lead levels in children. Children are most sensitive to low level lead exposure, therefore risk levels calculated for residential children are protective of adult exposures (5, 6, 7)

Lead Exposure & Adverse Health Effects

People are primarily exposed to lead by eating food or drinking water that contains lead. Plumbing from older houses can "leach" lead into the drinking water; especially if the water is acidic or "soft." Acidic and/or warm water makes it easier for the lead in older pipes, leaded solder, and brass faucets to be dissolved. You cannot see, taste, or smell lead in water, and boiling your water will not remove lead – in fact as water boils, the lead concentration actually increases in the remaining water. Dissolved lead in plumbing, however, can be reduced by flushing pipes of their water before drinking and using cold water for drinking, cooking, and preparing baby formula. Dermal exposure to lead is usually minimal unless the skin has been damaged (e.g., scrapes, scratches, and wounds); thus allowing more lead to pass through and enter your blood (4).

The amount of lead that actually enters your blood and subsequent "soft tissues" (e.g., liver, kidneys, lungs, brain, spleen, muscles, and heart) after ingestion, depends on the time since your last meal, age, and the extent to which stomach juices dissolve the swallowed lead particles. Experiments on adults who had recently eaten revealed that only 6% of total ingested lead entered the blood from the stomach. In adults with empty stomachs, however, 60–80% of ingested lead reached their blood. In general, a larger amount of ingested lead (about 50%) enters a child's blood than an adult. Your body does not change this lead into any other form (4).

Several weeks after an exposure, most "absorbed" lead moves into bones and teeth where it can remain for decades. Under certain circumstances (e.g., during pregnancy and periods of breast feeding, after a bone is broken, and during advancing age), lead contained in bones can reenter your blood and organs. Absorbed lead that does not become stored in bones leaves your body in your urine or your feces; adults remove a higher percentage (99% within approximately two weeks) than do children (32%) (4).

The toxic effects of lead are the same regardless of the route of entry into the body. The main target for lead toxicity is the nervous system. Long-term lead exposure in adult workers has shown decreases in some nervous system function tests. Lead exposure can also cause weakness in fingers, wrists, or ankles, small increases in blood pressure (particularly in middle-aged and older people), and anemia. At high levels of exposure, lead can severely damage the brain and kidneys in adults or children and ultimately cause death. High exposure levels may also cause miscarriage in pregnant women, and damage the organs responsible for sperm production. The human body accumulates lead over a lifetime, so even small doses can also result in higher "total body burdens." That is, relatively low blood-lead levels resulting from a myriad of different exposure sources can cause adverse health effects. These effects, such as mild behavioral disorders or decreased IQ, may not produce noticeable signs or symptoms (4). Blood-lead concentrations corresponding to specific adverse effects in children, adults and elderly adults are shown in Table 2.

There is no conclusive proof that lead causes cancer in humans however, the National Toxicology Program has recommended that lead and lead compounds be considered "reasonably anticipated to be human carcinogens" based on sufficient animal evidence (4).

Table 2. Blood-Lead Concentrations Corresponding to Adverse Health Effects (8).

Life Stage	Effect	Blood-Lead Concentration (µg/dL)
Children	Depressed ALAD* Activity	<5
	Neurodevelopmental Effects	<10
	Sexual Maturation	<10
	Depressed Vitamin D	>15
	Elevated Erythrocyte Porphyrin**	>15
	Depressed Nerve Conduction Velocity	>30
	Depressed Hemoglobin	>40
	Colic***	>60
Adults	Depressed GFR****	<10
	Elevated Blood Pressure	<10
	Elevated EP** (Females)	>20
	Enzymuria*****/Proteinuria******	>30
	Peripheral Neuropathy	>40
	Neurobehavioral Effects	>40
	Altered Thyroid Hormone	>40
	Reduced Fertility	>40
	Depressed Hemoglobin	>50
Elderly Adults	Depressed ALAD*	<5
	Neurobehavioral Effects	>4

***** **Aminolevulinic acid dehydratase (ALAD) - an enzyme of which the concentration in erythrocytes is a widely used indicator of the level of lead poisoning in animals (9).**
****** **Free Erythrocyte Porphyrin (EP) is a pahtological condition caused by deficiency of iron**
******* **Colic- A condition in which an otherwise healthy baby cries or screams frequently and for extended periods without any discernible reason.**
******** **Glomerular Filtration Rate – a measure of the level of kidney function.**
***** **Enzymuria - the presence of enzymes in urine**
****** **Proteinuria is a condition characterized by the presence of greater than normal amounts of protein in the urine.**

Sensitive Receptors

Fetuses and children are more sensitive to the health effects of lead than adults. Lead exposure in infants and young children has been shown to decrease intelligence, slow growth, and cause hearing problems at blood lead levels at or below 10 µg/dL; a level previously thought to be safe (5). Lead affects children in different ways depending on the extent of exposure. At high levels of lead exposure, children may develop anemia, kidney damage, colic (severe “stomach ache”), muscle weakness, and brain damage. In some cases, drugs can be administered to help eliminate lead from a child’s body. At lower levels of exposure, much less severe but still important effects on blood, development, and behavior may occur. In such cases, recovery is likely once the child is removed from the source of lead exposure. There still, however, is no guarantee that the child will completely avoid all long-term consequences of lead exposure. At still lower levels of exposure, lead can affect a child’s mental and physical growth. Fetuses exposed to lead in the womb from their mother, may be born prematurely and have lower weights at birth. Exposure in the womb, in infancy, or in early childhood also may slow mental development and cause lower intelligence later in childhood. There is evidence that these effects may persist beyond childhood (4).

Lead Modeling Results

The maximum lead concentrations recorded in each residential drinking water well near Chamberlain Springs were higher than the CV of 15.0 μg/L. These lead levels, however, fluctuated between less than 1.0 μg/L (non-detect) to 110.0 μg/L (1). Potential blood-lead concentrations were modeled using the IEUBK model (win32 v1.0.264) (7). Standard default values were used for air, soil, dust and paint exposures based on national data supplied by the model. This analysis used the updated dietary lead intake estimates from the U.S. Food and Drug Administration Total Diet Study and food consumption data from NHANES III (7, 10, 11). These calculations assumed that a child's entire daily intake of water would be from one source and the concentration of lead in the water is constant.

To model potential blood lead levels, the four highest measured lead concentrations were used as water concentration inputs. In addition, the average lead concentrations were modeled for those wells where the maximum concentrations resulted in IEUBK modeled risk-based levels that exceded regulatory criteria.

A blood-lead level of 10 micrograms per deciliter (μg/dL) in greater than 5% of a hypothetically exposed population represents the threshold for unacceptable levels of potential adverse neurological effects in children (2). The results of the IEUBK modeling are summarized in Table 3, and presented in Appendices A and B.

Table 3A. IEUBK Modeling Results Using Maximum Residential Well Water Concentrations (1,7)

Private Well Location	Sample Dates	Maximum Water Concentration (μg/L)	Predicted Geometric Mean Blood Lead Concentration (μg/dL)	Percent of Exposed Population Greater than 10 μg/dL
Map 12, Lot 57 - Joy Hill	1/19/2006	110	9.6	46
Map 9, Lot 60	1/19/2006	59	6.6	19
Map 12, Lot 55	2/10/2006	42	5.5	10
Map 9, Lot 60	1/31/2006	30	4.7	5

Notes:
ug/L = micrograms/liter
ug/dL = micrograms/deciliter
Please see text for model input parameters.
Model outputs are presented in Appendix 1.

Using the assumptions described above, the predicted geometric mean blood-lead level for residential children (ages 0.5 to 7 years of age) exposed to the highest measured level of lead in drinking water (110 μg/L) is 9.6 μg/dL. At this water concentration, approximately 50% of children would be at risk for a blood-lead level greater than 10 μg/dL. Using the maximum concentrations for IEUBK input, wells identified as (Map 12, Lot 57 -Joy Hill), (Map 9, Lot 60), and (Map 12, Lot 55) would all result in an unacceptable percentage of the hypothetically exposed population at risk for a blood-lead concentration of 10 μg/dL or greater. Also seen in

Table 3A above, using a drinking water concentration of 30 μg/L (Map 9, Lot 60 – 1/31/06), approximately 5% of a theoretically exposed population would have a blood-lead level greater than 10 μg/dL, therefore, under these circumstances, a 30 μg/dL lead level in water would not trigger any action for the protection of public health. Using the averages for IEUBK model input (Table 3B below), only the (Map 12, Lot 57 -Joy Hill) well presented an unacceptable risk to the theoretically exposed population.

Table 3B. IEUBK Modeling Results Using Arithmetic Mean Residential Well Water Concentrations (1,7)

Well	Sample Dates (all from 2006)	Arithmetic Mean Water Concentration (ug/L)	Predicted Geometric Mean Blood Lead Concentration (ug/dL)	Percent of Exposed Population Greater than 10 ug/dL
Map 12, Lot 57 (Joy Hill)	1/19, 1/3, 2/3, 2/10	34	4.9	6.6
Map 9, Lot 60	1/19, 1/3, 2/3, 2/10	23	4.16	3.1
Map 12, Lot 55	1/19, 2/3, 2/10	14	3.5	1.3

Notes:
ug/L = micrograms/liter
ug/dL = micrograms/deciliter
Arithmetic Means were calculated using 1/2 detection limit for non-detects.
Please see text for model input parameters.
Model outputs are presented in Appendix 1.

Environmental Data Limitations

Available environmental data for this evaluation are subject to limitations. Specifically, total lead concentrations detected in each residential well varied during the sampling period. As stated in previous sections, maximum lead values were utilized for IEUBK model input and recommendations. The use of maximum values does not account for fluctuating lead levels, and thus may not accurately represent a chronic exposure scenario. The use of maximum lead values does, however, account for the “known” worst-case scenario, and is the most conservative, protective, approach to safeguarding public health.

Conclusions

EHP’s review of the available environmental data concludes that drinking water from the wells (Map 12, Lot 57 -Joy Hill), (Map 9, Lot 60), and (Map 12, Lot 55) near Chamberlain Springs for the foreseeable future could harm people’s health. This is a public health hazard.

Using the maximum detected concentrations from these wells, the IEUBK blood lead predictions exceeded the established threshold of 10 μg/dL in >5% of a hypothetically exposed population. All other sources of lead exposure (past and current) to these residents (child or adult) are, however, unknown at this time.

Because of the varied and numerous factors that affect an individual's exposure to lead, it can not be determined from drinking water data alone as to the significance of lead's impact on any past or future health effects. This "public health hazard" statement indicates that the potential exists for some residents to experience adverse health effects from drinking water containing higher concentrations of lead from wells (Map 12, Lot 57 -Joy Hill), (Map 9, Lot 60), and (Map 12, Lot 55). It does not, however, necessarily indicate that every individual would have the same adverse health effects. The potential risks are dependent upon multiple factors including: 1) the amount of water ingested; 2) the concentration of lead in the water; 3) the individual's current health status, 4) genetic predisposition; 5) environmental stressors placed on the individual; and/or 6) a compromised immune system of an individual.

Please contact Eric K. Abrams at (603) 271-1371 if you have any questions regarding this review.

Recommendations

Residents should reduce the potential harm from excess lead in private water wells (Map 12, Lot 57 -Joy Hill), (Map 9, Lot 60), and (Map 12, Lot 55) near Chamberlain Springs by:

1. Using an alternate water source, such as bottled water and/or a public water system (if available);

2. Using a filter (or filtration system) for well water and/or tap water;

3. Regular testing of private well water to monitor lead levels;

4. A medical test to detect blood lead levels of any children living in the residence known to have elevated lead levels and drinking the well water as their primary drinking source.

NOTE: The residential owners of all nine wells were notified by DES on March 13, 2006 that lead levels in their drinking water exceeded the Ambient Groundwater Quality Standard (AGQS).

Public Health Action Plan

The purpose of the Public Health Action Plan is to ensure that the current document not only identifies exposure potentials and possible health risks, but also provides a plan of action to mitigate and prevent adverse human health effects resulting from exposures to drinking water contaminants. The first section of the Public Health Action Plan contains a description of completed and ongoing actions taken to mitigate air pollution. The second section presents a list of public health actions planned for the future.

Actions Completed

1. DES and GZA GeoEnvironmental, Inc. collected private drinking water well samples from January 19, 2006 until February 14, 2006.

2. EHP evaluated the drinking water results and issued agency letters notifying applicable well owners of the lead health risk.

3. EHP disseminated fact sheets to well owners detailing health-related information regarding drinking lead-contaminated water.

Actions Planned

1. DES will evaluate new private drinking water well data as it becomes available.

2. EHP will re-notify private drinking water well owners of the sampling results.

EHP will reevaluate and expand the Public Health Action Plan as needed. New environmental, health outcome data, or the results of implementing the above actions may warrant additional actions at this site.

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The Health Consultation evaluating the Private Drinking Water Wells near Chamberlain Springs located in Alton, New Hampshire was prepared by the New Hampshire Department of Environmental Services, Environmental Health Program, under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodologies and procedures existing at the time this health consultation was initiated. Editorial review was completed by the cooperative agreement partner.

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Technical Project Officer, CAT, CAPEB, DHAC, ATSDR

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

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Team Lead CAT, CAPEB, DHAC, ATSDR

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Appendices

Appendix A. Example Output of IEUBK model with site specific parameters.

LEAD MODEL FOR WINDOWS Version 1.0

Model Version: 1.0 Build 264
User Name:
Date:
Site Name:
Operable Unit:
Run Mode: Research

The time step used in this model run: 1 - Every 4 Hours (6 times a day).

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (ug Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

****** Diet ******

Age	Diet Intake(ug/day)
.5-1	2.260
1-2	1.960
2-3	2.130
3-4	2.040
4-5	1.950
5-6	2.050
6-7	2.220

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Alternate Water Values Used
Values:
Percent of Total Consumed as First Draw: 0.000%
Concentration of Lead in First Draw: 110.000 ug/L
Concentration of Lead in Flushed: 110.000 ug/L
Percentage of Total Consumed from Fountains: 0.000 %
Concentration of Lead in Fountain Water: 10.000 ug/L
****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 150.000 ug/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
.5-1	200.000	150.000
1-2	200.000	150.000
2-3	200.000	150.000
3-4	200.000	150.000
4-5	200.000	150.000
5-6	200.000	150.000
6-7	200.000	150.000

****** Alternate Intake ******

Age	Alternate (ug Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

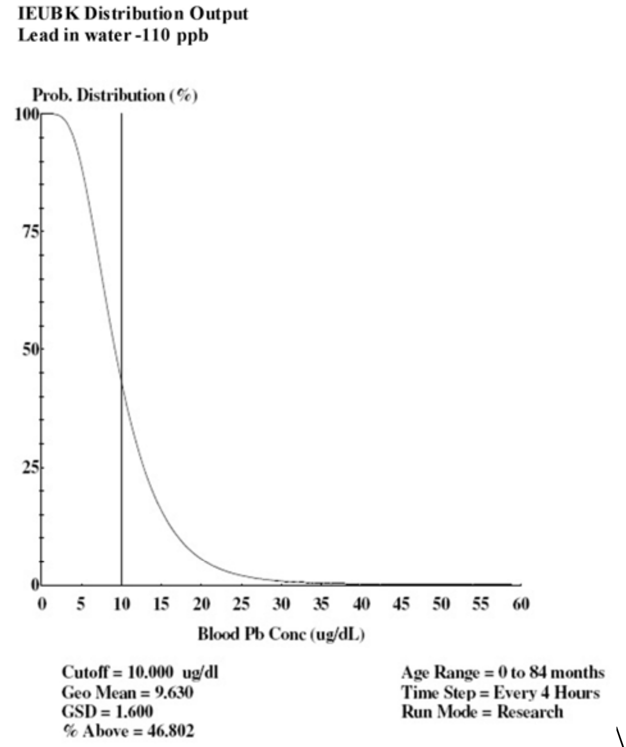
****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 2.500 ug Pb/dL

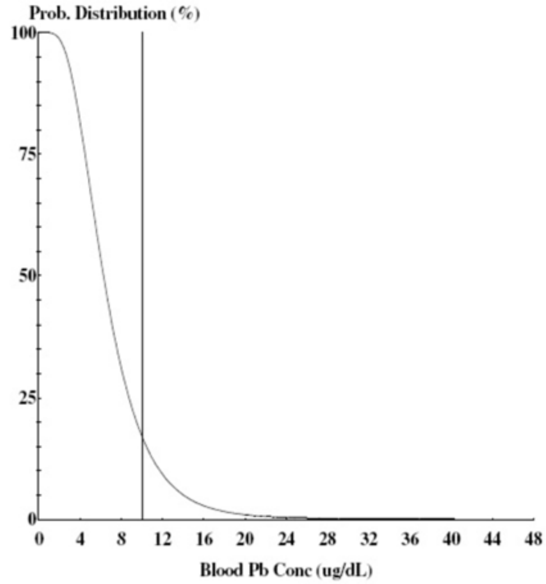
****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (ug/day)	Diet (ug/day)	Alternate (ug/day)	Water (ug/day)
.5-1	0.021	0.960	0.000	9.345
1-2	0.034	0.763	0.000	21.413
2-3	0.062	0.851	0.000	22.844
3-4	0.067	0.836	0.000	23.890
4-5	0.067	0.821	0.000	25.465
5-6	0.093	0.874	0.000	27.198

Appendix B. Distribution profiles for potential blood lead levels estimated by the IEUBK model using point estimated lead concentrations in Alton groundwater wells, as described in the text.



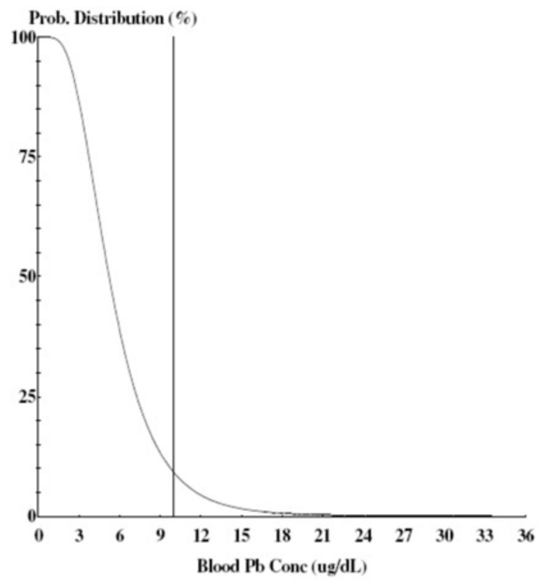
IEUBK Distribution Output
Lead in water -59 ppb



Cutoff = 10.000 ug/dl
Geo Mean = 6.590
GSD = 1.600
% Above = 18.747

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research

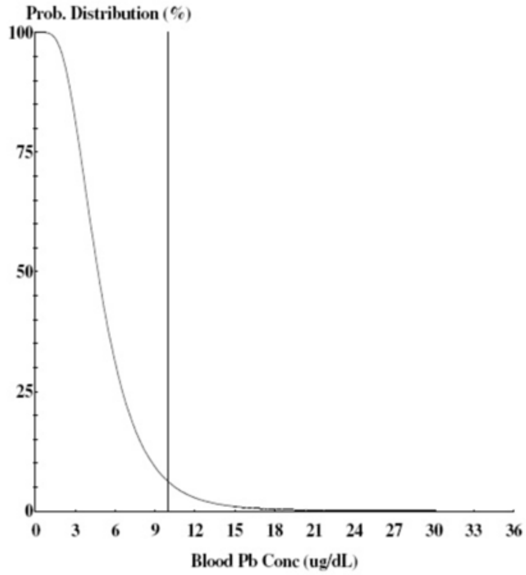
IEUBK Distribution Output
Lead in water -42 ppb



Cutoff = 10.000 ug/dl
Geo Mean = 5.476
GSD = 1.600
% Above = 10.006

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research

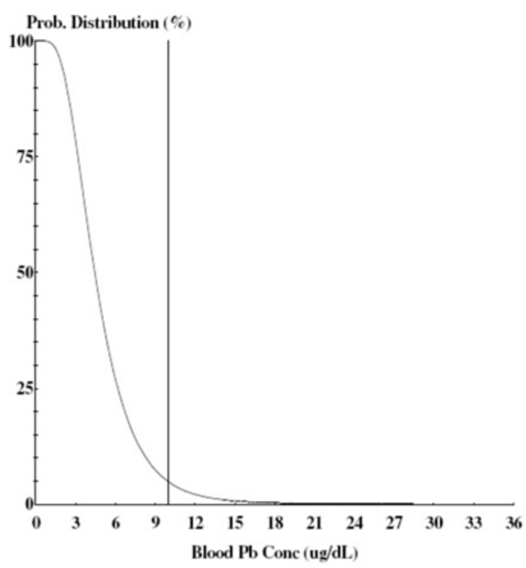
IEUBK Distribution Output
Lead in water -34 ppb



Cutoff = 10.000 ug/dl
Geo Mean = 4.932
GSD = 1.600
% Above = 6.631

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research

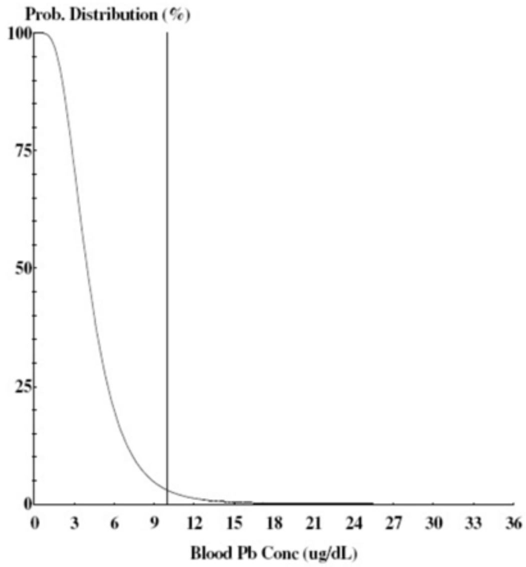
IEUBK Distribution Output
Lead in water -30 ppb



Cutoff = 10.000 ug/dl
Geo Mean = 4.655
GSD = 1.600
% Above = 5.188

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research

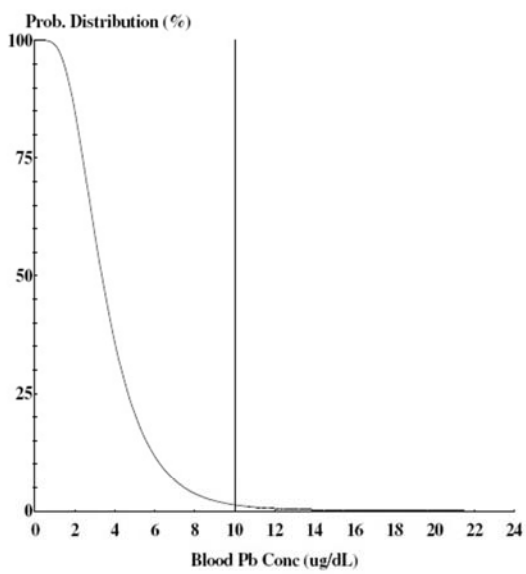
IEUBK Distribution Output
Lead in water - 23 ppb



Cutoff = 10.000 ug/dl
Geo Mean = 4.161
GSD = 1.600
% Above = 3.106

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research

IEUBK Distribution Output
Lead in water -14 ppb



Cutoff = 10.000 ug/dl
Geo Mean = 3.510
GSD = 1.600
% Above = 1.296

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research