Letter Health Consultation

ANDRELEAU POINT SUBDIVISION
REPORTED ARSENIC CONTAMINATION

DARIEN, MCINTOSH COUNTY, GEORGIA

Prepared by the
Georgia Department of Human Resources

MAY 27, 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.

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LETTER HEALTH CONSULTATION

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REPORTED ARSENIC COMTAMINATION

DARIEN, MCINTOSH COUNTY, GEORGIA

Prepared By:

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Division of Public Health
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DHR

B. J. Walker, Commissioner

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December 17, 2008

Eric Rumer, County Manager
Environmental Health Section
McIntosh County Health Department, District 9-1
311 Highway 251, P.O. Box 576
Darien, GA 31305-9459

Re: Andreleau Point Subdivision Reported Arsenic Contamination

Dear Eric,

On October 22, 2008 a resident of the Andreleau Point subdivision called the McIntosh County Health Department and reported that a private drinking water well shared by three households was found to contain arsenic at a levels exceeding the U.S. Environmental Protection Agency's (EPA) Safe Drinking Water Act criterion (reported result = 25 parts per billion [ppb]; EPA Maximum Contaminant Level = 10 ppb). In response, staff from the District and County Health Departments conducted well water and soil sampling and analyses.

In October and November 2008, your Health Department staff collected 14 water samples from the water well from both first draw (no flush), and then again after purging (at least 300 gallon flush) the well. Samples were also collected from the tap at each house. After several days, two additional rounds of sampling were conducted at the wells and household taps. Analyses results for all water samples (< 1 ppb) were well below state and federal regulatory and health based values.

On November 18th, 2008, after consultation with the resident, I collected three soil samples from their home vegetable garden. The soil samples were used to screen an isolated area where household members were known to be active and in frequent contact with a potential pathway (soil) for arsenic exposure. This specific garden soil is irrigated with the same source water and contains imported soil amendments (e.g., manure). I collected a total of three samples from the garden: two soil composites from the soil and one grab sample from a small burn pit located inside the garden perimeter. One soil composite was collected from the furrows (garden base) and one from the windrows (worked/hilled soil). Each sample was comprised of nine sub-samples obtained at equidistant locations throughout the garden. The samples were collected from 0 - 3 inches below ground surface.

Results for all soil samples were well below state regulatory values for arsenic in soil (20 parts per million - ppm). Low levels of arsenic ranging from 0.7 to 1.0 ppm were found in the garden soil samples. The highest concentrations were associated with the small burn pit. All soil levels were below expected background (normal) levels for the Southeast United States (Appendix 1).

Arsenic levels in the garden soil did, however, exceed the Agency for Toxic Substances and Disease Registry (ATSDR) Cancer Risk Evaluation Guideline (CREG) concentration of 0.5 ppm. Using the highest level of arsenic found (1.0 ppm), we can calculate a cancer risk from exposure to soil using EPA's cancer slope factor for arsenic. Assuming an adult living in this subdivision consumes 100 milligrams of soil containing 1.0 ppm arsenic everyday for 15 years (the approximate age of the subdivision and, therefore, maximum length of residency possible), the risk for developing cancer from this exposure would be approximately 5 excess cancers in ten million people. Assuming that an average duration of residency is 30 years, and that for 30 years, the residents are exposed everyday to 1.0 ppm arsenic in soil, the risk for developing excess cancers from this exposure would be approximately 5 in ten million people. These risk factors constitute a very low cancer risk from exposure to garden soil. See Appendix B for more information on evaluating adverse health risks and cancer risks.

Resident(s) in the subdivision also reported that medical test results showed that some residents had elevated levels of arsenic in their urine. These test results were not provided to staff for review. McIntosh County Health Department staff recommended that all of the potentially exposed residents have additional medical testing to assess the levels and forms of arsenic in their urine.

Arsenic is found in two forms: inorganic and organic. The inorganic forms are more toxic than organic arsenic. Elevated organic arsenic levels in urine are common for people who consume fish and seafood. Urine is usually tested for total arsenic (inorganic and organic) coming from all sources—food, water, air, and soil. Total arsenic in urine is mostly the relatively nontoxic organic arsenic from food sources ((80%*). Testing for both organic and inorganic arsenic separately (speciated) is preferable to total arsenic testing because we can distinguish between exposure to the more toxic inorganic arsenic (found in water, air and soil) and its metabolites, and organic arsenic from food.

** Source: Agency for Toxic Substances and Disease Registry, Department of Health and Human Services, Atlanta, Georgia, U.S.A. ToxFAQs™: Arsenic*, January, 2006.
www.atsdr.cdc.gov/cabs/arsenic

Conclusions

Based on the limited information obtained during this investigation, there appears to be no apparent public health hazard to residents from exposure to arsenic in drinking water and soil. There is no evidence to suggest that chronic exposure to arsenic at levels of health concern is occurring or will occur in the future.

Recommendation

If residents are concerned about arsenic exposure, they can consult with a health care professional for medical testing to determine if exposure to arsenic is presently occurring. If elevated levels of inorganic arsenic are found in urine, contact the McIntosh County Health Department.

Toxicological evaluation for arsenic**

Arsenic is found naturally in the environment. People may be exposed to arsenic by eating food, drinking water, breathing air, or by skin contact with soil or water that contains arsenic. In the U.S., the diet (primarily fish and seafood) is a predominant source of exposure for the general population with smaller amounts coming from drinking water and air. Children may also be exposed to arsenic because of frequent hand to mouth contact or eating dirt. In addition to the normal levels of arsenic in air, water, soil, and food, people could by exposed to higher levels in several ways such as in areas containing unusually high natural levels of arsenic in rocks ,which can lead to unusually high levels of arsenic in soil or water. People living in an area like this could take in elevated amounts of arsenic in drinking water.

In industry, arsenic is a by-product of the smelting process for many metal ores and has many commercial uses:

- cattle and sheep dips
- pesticides (fungicides, herbicides, insecticides)
- paints and pigments
- wood preservatives
- preserving animal hides
- bronze plating
- clarifying glass and ceramics
- electronics manufacturing
- microwave devices
- lasers
- light-emitting diodes
- photoelectric cells
- semiconductor devices
- antiparasitic drugs
- some cultural, folk and naturopathic remedies
- kelp-containing health foods

Workers in an occupation that involves arsenic production or use (for example, smelting, wood treatment, pesticide application) could be exposed to arsenic at work, and they may get arsenic contaminated dust on their clothing, which may cause others to be exposed. When pressure-treated wood is burned, high levels of arsenic could be released in the smoke. In agricultural areas where arsenic-based pesticides were used on crops the soil could contain high levels of arsenic. Arsenic has been found in at least 1,014 current or former Superfund National Priorities List sites. At the hazardous waste sites evaluated by ATSDR, exposure to arsenic in soil predominated over exposure to water, and no exposure to air had been recorded. Exposure assessment, community and tribal involvement, and evaluation and surveillance of health effects are among the ATSDR future Superfund research program priority focus areas for arsenic.

*** Source: Selene C.-H.; Chou J.; De Rosa C.T. International Journal of Hygiene and Environmental Health, Volume 206, Numbers 4-5, August 2003, pp. 381-386.*

For more information about arsenic, please consult ATSDR's, *Toxicological Profile for Arsenic*, www.atsdr.cdc.gov/toxprofiles/tp2.html. Please contact me at 912 242-2090 any time if you have questions.

Sincerely,

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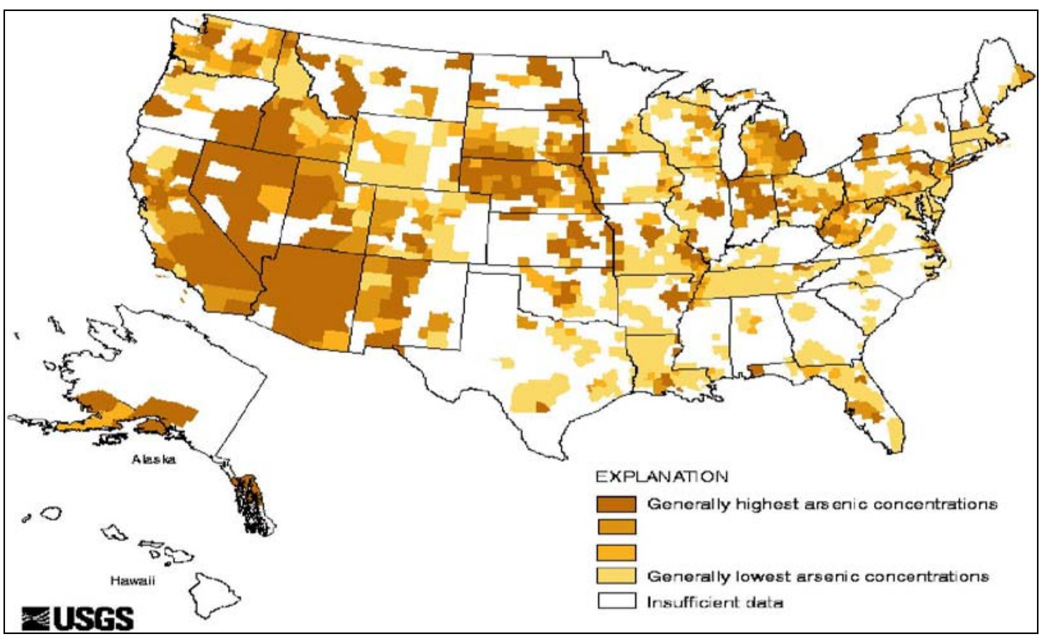
Gary A. Hummel, District Risk Communicator
Hazardous Waste Program
Coastal Health District

APPENDIX 1

Arsenic Background Concentrations in Florida Soils

Lena Q. Ma, Ming Chen, Willie Harris, and Arthur Hornsby, Soil and Water Science Department, University of Florida

Arsenic contamination in soils is of great environmental concern due to its toxic effects as a carcinogen. There are thousands of arsenic contaminated soils in Florida due to widespread use of arsenic pesticides. The current risk-based arsenic cleanup goal for residential soils in Florida is 0.8 ppm arsenic or their natural background concentrations. However, there is neither a scientific protocol available for determining background arsenic concentrations nor a good database to be used as a reference for such a purpose in Florida. Thus, a comprehensive study was conducted to determine arsenic background concentrations in Florida surface soils using 450, geographically and pedogenically representative, and chemically and physically characterized, soil samples. Great care was taken during soil sampling to select sites without known sources of anthropogenic contamination. Arsenic concentrations were determined using the microwave-based EPA Method 3051a and a graphite furnace AA. Arsenic concentrations in Florida soils were extremely low compared to those in US and world soils and varied greatly with soil types, ranging from 0.01 to 61.1 ppm with its geometric mean (GM) being 0.27 ppm and 95th percentile (P95) being 3.54 ppm. Among the 450 samples tested, only 73% had arsenic concentrations lower than the FDEP soil cleanup goal of 0.8 ppm. Arsenic concentrations in wet soils (P95=18.8 ppm; MG=1.28 ppm) were much greater than those of upland soils (P95=1.70 ppm; GM=0.18 ppm). Among the wet soils, arsenic concentrations in the Histosols (organic soils, P95=10.7 ppm; MG=2.86 ppm) and marl soils (dominated by calcium carbonate; P95=34.1 ppm; MG=4.01 ppm), were much greater than those in the mineral soils (excluding these two types of soils, P95=2.24 ppm; MG=0.21 ppm). It is important to use valid background arsenic concentrations for cost-effectively cleaning up arsenic contaminated soils.



Appendix B: Explanation of Evaluation Process

Step 1--The Screening Process

In order to evaluate the available data, GDPH used comparison values (CVs) to determine which chemicals to examine more closely. CVs are contaminant concentrations found in a specific environmental media (for example; air, soil, water) and are used to select contaminants for further evaluation. CVs incorporate assumptions of daily exposure to the chemical and a standard amount of air, soil, or water that someone may inhale or ingest each day. CVs are generated to be conservative and non-site specific. The CV is used as a screening level during the public health assessment process where substances found in amounts greater than their CVs might be selected for further evaluation. CVs are not intended to be environmental clean-up levels or to indicate that health effects occur at concentrations that exceed these values.

CVs can be based on either carcinogenic (cancer-causing) or non-carcinogenic effects. Cancer-based CVs are calculated from the U.S. Environmental Protection Agency's (EPA) oral cancer slope factors for ingestion exposure, or inhalation risk units for inhalation exposure. Non-cancer CVs are calculated from the Agency for Toxic Substances and Disease Registry's (ATSDR) minimal risk levels, EPA's reference doses, or EPA's reference concentrations for ingestion and inhalation exposure. When a cancer and non-cancer CV exist for the same chemical, the lower of these values is used as a conservative measure. The chemical and media-specific CVs used in the preparation of this public health assessment are listed below:

Step 2--Evaluation of Public Health Implications

The next step in the evaluation process is to take those contaminants that are above their respective CVs and further identify which chemicals and exposure situations are likely to be a health hazard. Separate child and adult exposure doses (or the amount of a contaminant that gets into a person's body) are calculated for site-specific scenarios, using assumptions regarding an individual's likelihood of accessing the site and contacting contamination.

Non-cancer Health Risks

The doses calculated for exposure to individual chemicals are then compared to an established health guideline, such as an ATSDR minimal risk level (MRL) or an EPA reference dose (RfD), in order to assess whether adverse health impacts from exposure are expected. Health guidelines are chemical-specific values that are based on available scientific literature and are considered protective of human health. Non-carcinogenic effects, unlike carcinogenic effects, are believed to have a threshold, that is, a dose below which adverse health effects will not occur. As a result, the current practice to derive health guidelines is to identify, usually from animal toxicology experiments, a no observed adverse effect level (NOAEL), which indicates that no effects are observed at a particular exposure level. This is the experimental exposure level in animals (and sometimes humans) at which no adverse toxic effect is observed. The known toxicological values are doses derived from human and animal studies that are summarized in ATSDR's *Toxicological Profiles (www.atsdr.cdc.gov/toxpro2.html).* The NOAEL is modified with an uncertainty (or safety) factor, which reflects the degree of uncertainty that exists when experimental animal data are extrapolated to the human population. The magnitude of the uncertainty factor considers various factors such as sensitive subpopulations (e.g., children, pregnant women, the elderly), extrapolation from animals to humans, and the completeness of the available data. Thus, exposure doses at or below the established health guideline are not expected to cause adverse health effects because these values are much lower (and more human health protective) than doses, which do not cause adverse health effects in laboratory animal studies.

Minimal Risk Levels (MRLs) are developed by ATSDR for contaminants commonly found at hazardous waste sites. The MRL is developed for ingestion and inhalation exposure, and for lengths of exposures: acute (less than 14 days); intermediate (between 15-364 days), and chronic (365 days or greater). ATSDR has not developed MRLs for dermal exposure (absorption through skin).

Reference Doses (RfDs) EPA developed chronic RfDs for ingestion and RfCs for inhalation as estimates of daily exposures to a substance that are likely to be without a discernable risk of deleterious effects to the general human population (including sensitive subgroups) during a lifetime of exposure.

If the estimated exposure dose to an individual is less than the health guideline value, the exposure is unlikely to result in non-cancer health effects. If the calculated exposure dose is greater than the health guideline, the exposure dose is compared to known toxicological values for the particular chemical and is discussed in more detail in the text of the public health assessment. A direct comparison of site-specific exposures and doses to study-derived exposures and doses found to cause adverse health effects is the basis for deciding whether health effects are likely to occur.

It is important to consider that the methodology used to develop health guidelines does not provide any information on the presence, absence, or level of cancer risk. Therefore, a separate cancer risk evaluation is necessary for potentially cancer-causing contaminants detected at this site.

Cancer Risks

Exposure to a cancer-causing chemical, even at low concentrations, is assumed to be associated with some increased risk for evaluation purposes. The estimated risk for developing cancer from exposure to contaminants associated with the site was calculated by multiplying the site-specific doses by EPA's chemical-specific cancer slope factors (CSFs) available at *www.epa.gov/iris*. This calculation estimates a theoretical excess cancer risk expressed as a proportion of the population that may be affected by a carcinogen during a lifetime of exposure. For example, an estimated risk of 1×10^{-6} predicts the probability of one additional cancer over background in a population of 1 million. An increased lifetime cancer risk is not a specified estimate of expected cancers. Rather, it is an estimate of the increase in the probability that a person may develop cancer sometime in his or her lifetime following exposure to a particular contaminant under specific exposure scenarios. For children, the theoretical excess cancer risk is not calculated for a lifetime of exposure, but from a fraction of lifetime; based on known or suspected length of exposure, or years of childhood.

Because of conservative models used to derive CSFs, using this approach provides a theoretical estimate of risk; the true or actual risk is unknown and could be as low as zero. Numerical risk estimates are generated using mathematical models applied to epidemiologic or experimental data for carcinogenic effects. The mathematical models extrapolate from higher experimental doses to lower experimental doses. Often, the experimental data represent exposures to chemicals at concentrations orders of magnitude higher than concentrations found in the environment. In addition, these models often assume that there are no thresholds to carcinogenic effects--a single molecule of a carcinogen is assumed to be able to cause cancer. The doses associated with these estimated hypothetical risks might be orders of magnitude lower that doses reported in toxicology literature to cause carcinogenic effects. As such, a low cancer risk estimate of 1×10^{-6} and below may indicate that the toxicology literature supports a finding that no excess cancer risk is likely. A cancer risk estimate greater than 1×10^{-6}, however, indicates that a careful review of toxicology literature before making conclusions about cancer risks is in order.

CERTIFICATION

This letter health consultation was prepared by the Georgia Division of Public Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodologies and procedures existing at the time the health consultation was initiated. Editorial Review was completed by the Georgia Division of Public Health.

Technical Project Officer, CAT, CAPEB, DHAC

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

Team Lead, CAT, CAPEB, DHAC, ATSDR