Letter Health Consultation

ARSENIC IN SCHOOLS

ORLEANS PARISH

NEW ORLEANS, LOUISIANA

MARCH 6, 2008

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

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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 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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Prepared By:

State of Louisiana
Department of Health and Hospitals
under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Bobby P. Jindal
GOVERNOR

STATE OF LOUISIANA
DEPARTMENT OF HEALTH AND HOSPITALS

Alan Levine
SECRETARY

January 29, 2008

Tom Harris
Administrator, Environmental Technology Division
Louisiana Department of Environmental Quality
P.O. Box 4314
Baton Rouge, LA 70821-4314

Dear Mr. Harris:
The Louisiana Department of Health and Hospitals/Office of Public Health/Section of Environmental Epidemiology and Toxicology (DHH/OPH/SEET) has evaluated arsenic soil samples collected from four elementary schools in New Orleans, Louisiana. The following letter provides the results of SEET's assessment of the soil sampling conducted at each of the four locations.

Discussion:
On August 14, 2007, the Louisiana Department of Environmental Quality (LDEQ) collected soil samples at Joseph A. Craig Elementary, Dr. Charles R. Drew Elementary, John Dibert Elementary, and McDonough #42 Elementary in New Orleans, Louisiana. LDEQ collected eight surface soil samples and one duplicate sample from outdoor play areas at each of the four school yards [1]. All samples were analyzed for inorganic arsenic using U.S. Environmental Protection Agency (EPA) method 6010B. This sampling effort was in response to public concern over arsenic concentrations at the four schools [1].

Each of the soil sample concentrations from Joseph A. Craig Elementary, Dr. Charles R. Drew Elementary, and McDonough #42 Elementary were below the Agency for Toxic Substances and Disease Registry's (ATSDR) child Environmental Media Evaluation Guide (EMEG) for arsenic of 20 milligrams per kilogram (mg/kg). A detailed explanation of the ATSDR/SEET evaluation process can be accessed in Appendix A.

One of the eight soil samples collected at John Dibert Elementary (sample ID C-8) yielded an arsenic concentration of 40.1 mg/kg, exceeding the child EMEG of 20 mg/kg. As such, SEET evaluated this sample further, estimating both oral and dermal exposure doses for children who may be exposed to arsenic in the school play yard. Exposure doses were calculated assuming an exposure occurring five days per week, 40 weeks per year for 7 years, in order to capture the elementary school schedule. Further exposure assumptions are detailed in Appendix A. Child ingestion and dermal contact exposure doses estimated for arsenic in soil from the play yards did not exceed the EPA reference dose (RfD) for arsenic of 0.0003 milligrams per kilogram per day (mg/kg/day). Arsenic identified in sampled play yard soil from John Dibert Elementary is not expected to cause adverse health effects.

Due to the carcinogenic nature of arsenic, SEET evaluated the lifetime expected cancer risk (LECR) for children, using the maximum arsenic concentration (40.1 mg/kg) in soil collected from the play yard at John Dibert Elementary. The maximum detected concentration of arsenic was observed at a level below that expected to present an unacceptable cancer risk. Acceptable risk represents an estimated one excess cancer in 10,000 (1×10^{-4}) people exposed for a lifetime of 70 years in duration. If ingestion of or dermal contact with soil from the sampled play yard locations at John Dibert Elementary were to occur, such contact poses no apparent public health hazard to children. An explanation and exposure assumptions of the LECR are available in Appendix A.

Child Health Considerations:

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than adults; this means they breathe dust, soil, and vapors close to the ground. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus adults need as much information as possible to make informed decisions regarding their children's health.

Estimated oral and dermal child exposure doses did not exceed the EPA RfD for arsenic, and therefore are unlikely to cause adverse health effects. Furthermore, the LECR is not expected to pose an unacceptable carcinogenic risk to children.

Sample results indicate that the majority of arsenic concentrations were detected at naturally occurring levels, and are below the state background level of 12 mg/kg for arsenic. Additionally, it should be noted that six of the eight soil samples collected at John Dibert Elementary were non-detect (below 5 mg/kg of arsenic) in those play yard locations, and one sample was below the child EMEG for arsenic. One sample above the child EMEG is not representative of arsenic concentrations in the entire play yard. It can be concluded from the data evaluations and the environmental pathway analyses that no apparent health hazards specific to children are present related to the sampled arsenic locations.

Conclusions:

- Based on available data, there is no apparent public health hazard related to arsenic in soil from sampled play areas at Joseph A. Craig Elementary, Dr. Charles R. Drew Elementary, and McDonough #42 Elementary.
- One of the eight soil samples collected from John Dibert Elementary (sample ID C-8) was detected above the child EMEG for arsenic. SEET estimated child ingestion and dermal contact exposure doses and found no exceedance of the RfD for arsenic. In

addition, SEET estimated the LECR for arsenic, which is not expected to pose an unacceptable carcinogenic risk to children. Based on available data, there is no apparent public health hazard related to arsenic in soil from the sampled play areas at John Dibert Elementary.

Recommendations:

- There are no actions recommended at this time.

If additional data becomes available at a later date, SEET will be glad to consider a separate request for an evaluation. If there are any questions regarding this health consultation, please contact Darcie Olexia (504) 219-4579 or Kathleen Aubin (504) 219-4575.

Sincerely,

Darcie Olexia, MSPH
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Louisiana Office of Public Health
Section of Environmental Epidemiology & Toxicology

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Certification

This health consultation evaluating arsenic in four schools in New Orleans was prepared by Louisiana Department of Health and Hospitals under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodology and procedure existing at the time the health consultation was initiated.

Jeff Kellam
Technical Project Officer
Division of Health Assessment and Consultation (DHAC)
ATSDR

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

Alan W. Yarbrough
Cooperative Agreement Team Leader, DHAC, ATSDR

Appendix A: Evaluation Process

Screening Process

Health based comparison values (CVs) were used to determine which samples needed further evaluation. CVs are not used to predict health effects or to set clean-up levels. Contaminants with media concentrations above a health based comparison value do not necessarily represent a health threat, but are selected for further evaluation. Contaminants with media concentrations below a health based comparison value are unlikely to be associated with illness and are not evaluated further.

ATSDR's child Environmental Media Evaluation Guide (EMEG) for arsenic (20 mg/kg), EPA's reference dose (RfD) for arsenic (.0003 mg/kg/day) and EPA's cancer slope factor (CSF) for arsenic (1.5 $(mg/kg\text{-}day)^{-1}$) were used as CVs in the evaluation of arsenic detected in the school play yards. EMEGs are estimated contaminant concentrations that are unlikely to cause adverse non-carcinogenic health effects. EMEGs are calculated by using ATSDR's Minimal Risk Level (MRL) for arsenic (.0003 mg/kg/day), which is also an estimate of daily exposure to contaminants that are unlikely to cause adverse non-cancer health effects.

An RfD is an estimated daily lifetime exposure to a hazardous substance that is not likely to cause adverse non-cancer health effects to human populations. RfDs are developed by the EPA and based on valid toxicological studies. RfDs may be found at http://www.epa.gov/iris. In this evaluation the arsenic RfD was compared to the calculated exposure dose for arsenic in soil at the play yard at John Dibert Elementary.

A CSF is an estimate of possible increases in cancer cases in a population. CSFs are developed by the EPA and are based on a qualitative weight-of-evidence approach and a quantitative evaluation of human and animal toxicity studies of a substance. CSFs represent an estimated lifetime risk of one excess cancer in 10,000 (1×10^{-4}) people exposed for a lifetime of 70 years in duration. Because arsenic is a known human carcinogen, SEET calculated a lifetime expected cancer risk (LECR) for children related to exposure to arsenic in soil at the play yard at John Dibert Elementary. This LECR is based on a 7 year exposure duration during a 70 year lifetime. The LECR indicates that a maximum detected arsenic soil concentration of 40.1 mg/kg presents a cancer risk of 2.5 E-05, or 2.5 excess cancers per 100,000 people. This is below EPA's predicted cancer rate of 1 excess cancer per 10,000 people (1×10^{-4}).

A-1: Arsenic detected in soil collected from four New Orleans elementary schools [2]

Sample ID	Elementary School Name	Soil Arsenic Concentration (mg/kg)[1]
A-1 / AK22714	Joseph A. Craig	6.0
A-1D / AK22715	Joseph A. Craig	6.2
A-2 / AK22716	Joseph A. Craig	ND[2]
A-3 / AK22717	Joseph A. Craig	ND
A-4 / AK22718	Joseph A. Craig	ND
A-5 / AK22719	Joseph A. Craig	ND
A-6 / AK22720	Joseph A. Craig	ND
A-7 / AK22721	Joseph A. Craig	ND
A-8 / AK22722	Joseph A. Craig	ND

Sample ID	Elementary School Name	Soil Arsenic Concentration (mg/kg)[1]
B-1 / AK22736	Dr. Charles R. Drew	ND
B-2 / AK22737	Dr. Charles R. Drew	6.9
B-2D / AK22738	Dr. Charles R. Drew	6.1
B-3 / AK22739	Dr. Charles R. Drew	8.1
B-4 / AK22740	Dr. Charles R. Drew	6.3
B-5 / AK22741	Dr. Charles R. Drew	15.5
B-6 / AK22742	Dr. Charles R. Drew	ND
B-7 / AK22743	Dr. Charles R. Drew	ND
B-8 / AK22744	Dr. Charles R. Drew	5.9
C-1 / AK22680	John Dibert	ND
C-2 / AK22681	John Dibert	ND
C-3 / AK22682	John Dibert	ND
C-4 / AK22683	John Dibert	ND
C-5 / AK22684	John Dibert	ND
C-6 / AK22685	John Dibert	ND
C-7 / AK22686	John Dibert	16.6
C-7D / AK22687	John Dibert	11.9
C-8 / AK22688	John Dibert	40.1
D-1 / AK22690	McDonough #42	ND
D-2 / AK22691	McDonough #42	ND
D-2D / AK22692	McDonough #42	ND
D-3 / AK22693	McDonough #42	13.9
D-4 / AK22694	McDonough #42	8.0
D-5 / AK22695	McDonough #42	ND
D-6 / AK22696	McDonough #42	ND
D-7 / AK22697	McDonough #42	ND
D-8 / AK22698	McDonough #42	ND

[1]mg/kg- milligram per kilogram
[2]ND- non-detect at less than 5.0 mg/kg

A-2: Equation variables for calculation of a soil ingestion non-carcinogenic exposure dose

Variable	Value Used
C = contaminant concentration for arsenic	40.1 mg/kg
IR = intake rate	200 mg/day
CF = conversion factor	10^{-6} kg/mg
EF = Exposure Factor (unitless)	0.54
BW = Bodyweight	30 kg

The soil ingestion non-carcinogenic dose can be estimated as follows:

$$ID_s = [(C)\ (IR)\ (CF)\ (EF)\ /\ (BW)]$$

Where:

ID_s = Soil ingestion non-carcinogenic dose
C = Contaminant concentration (mg/kg)
IR = Soil intake rate (mg/day)
EF = Exposure factor (unitless) = (exposure frequency) (exposure duration) / (exposure time) = [(5 days/week) (40 days/year) (7 years)] / [(7years) (365 days/year)] = .54
BW = Bodyweight (kg)
CF = Conversion factor (10^{-6} kg/mg)

A-3: Equation variables for calculation of a soil dermal non-carcinogenic exposure dose

Variable	Value Used
C = contaminant concentration for arsenic	40.1 mg/kg
CF = conversion factor	10^{-6} kg/mg
SA= skin area exposed	8750 cm^2
A = sediment adherance concentration	0.02 mg/cm^2
AF = absorption factor (unitless)	0.03
EF = exposure factor (unitless)	0.54
BW= bodyweight	30 kg

The soil dermal non-carcinogenic dose can be estimated as follows:

$$DD_s = [(C) (CF) (SA) (A) (AF) (EF) / [(BW)]$$

Where:
DD_s= Soil dermal non-carcinogenic dose
C = Contaminant concentration (mg/kg)
CF= Conversion factor (10^{-6} kg/mg
SA= Skin area exposed (cm^2)
A = Soil adherence concentration (mg/cm^2)
AF = Absorption factor (unitless)
EF= Exposure factor (unitless) = (exposure frequency) (exposure duration) / (exposure time)= [(5 days/week) (40 days/year) (7 years)] / [(7years) (365 days/year)] = .54
BW = Body weight (kg)

A-4: Equation variables for calculation of a total soil oral and dermal non-carcinogenic exposure dose

Variable	Value Used
ID_s = Soil ingestion non-carcinogenic dose	1.4×10^{-4} mg/kg/day
DD_s= Soil dermal non-carcinogenic dose	3.8×10^{-5} mg/kg/day

The total soil oral and dermal non-carcinogenic dose can be estimated as follows:

$$TD_s = (ID_s) + (DD_s)$$

Where:

TD_s = total soil oral and dermal non-carcinogenic dose
ID_s = Soil ingestion non-carcinogenic dose (mg/kg/day)
DD_s= Soil dermal non-carcinogenic dose (mg/kg/day)

A-5: Equation variables for calculation of a total soil oral and dermal Lifetime Expected Cancer Risk (LECR)

Variable	Value Used
TD_s = Total soil oral and dermal non-carcinogenic dose	1.7×10^{-4} mg/kg/day
CSF = Cancer slope factor	1.5 $(mg/kg\text{-}day)^{-1}$
EF = Exposure factor (unitless)	0.1

The LECR can be estimated as follows:

$$LECR = (TD_s)\,(CSF)\,(EF)$$

Where:

LECR = lifetime expected cancer risk
TD_s = total soil oral and dermal non-carcinogenic dose (mg/kg/day)
CSF = cancer slope factor ($(mg/kg\text{-}day)^{-1}$)
EF = Exposure factor (unitless) = exposure duration / lifetime = (7 years) / (70 years) = 0.1

References

1. Louisiana Department of Environmental Quality. Correspondence from LDEQ Secretary Mike McDaniel to Ms. Karen Burke, Deputy Superintendent of Operations New Orleans Recovery School District. Arsenic soil sampling results. September 4, 2007.

2. Louisiana Department of Environmental Quality, Laboratory Services Division. Analytical Report ID: 070814008. Arsenic soil sampling results. Reported August 22, 2007.