Letter Health Consultation

ST. MARIES CREOSOTE

ST. MARIES, IDAHO

Prepared by
Idaho Department of Health and Welfare

JULY 18, 2013

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

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR 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 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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July 19, 2013

Ms. Helen Bottcher
U.S. Environmental Protection Agency
1200 Sixth Avenue, Suite 900 (ECL-113)
Seattle, WA 98101

Dear Ms. Bottcher:

In 2003, the Idaho Department of Health and Welfare's Bureau of Community and Environmental Health (BCEH) prepared a health consultation evaluating soil, surface water, groundwater, and sediment sampling data from the St. Maries Creosote site in Idaho. The site treated poles with creosote from 1939 – 1964. The U.S. Environmental Protection Agency's Superfund program will oversee cleanup of contaminated soils and river sediments; construction is scheduled to begin in 2014. In the 2003 health consultation, BCEH concluded that polycyclic aromatic hydrocarbons (PAHs) present at the site were not expected to harm people's health (ATSDR, 2003). The public health action plan section of the report indicated that BCEH will evaluate additional data when it becomes available. The purpose of this health consultation is to evaluate the latest sampling data and to determine if the PAHs in the soil and sediment at this site pose a health risk to people who may trespass onto the site.

RESULTS AND DISCUSSION

Exposure Pathway Analysis

BCEH determines exposure to environmental contamination by identifying exposure pathways. A completed exposure pathway consists of five elements: a source of contamination, an environmental medium (e.g., air, water and soil), a point of exposure (i.e., where people might be in contact with contaminated media), a route of exposure (e.g., breathing, eating or drinking), and a receptor population (e.g., community members, individual household members). A complete pathway exists when all five elements of a pathway are present. A potential pathway exists when one or more of the elements are not present, but the element(s) cannot be eliminated because of insufficient information. An eliminated pathway exists when one or more of the elements are not present. Once pathways (i.e., complete and potential) have been identified, they are evaluated further to determine possible health risks to the exposed population.

BCEH examined the potential exposure pathways to soil, sediment, and groundwater. Access to the St. Maries Creosote site for vehicles is restricted by a gate through the levee; however, there is no fence around the property and a park is located on the east side of the site. Thus, it is possible that people could trespass onto the site using the walkable grass levee. Trespassers could have limited exposure to PAHs by accidentally eating, breathing and touching contaminated soil and sediment. This health consultation focuses on eating and touching soil and sediment as the major pathways of exposure. It is important to note that breathing fugitive dust at this site is not likely to contribute much to the overall exposure to the contaminants at the site by trespassers as compared to eating and touching contaminated soil and sediment. The PAHs identified on-site have high molecular weight; thus, volatilization of PAHs on-site is not likely to occur and even if it occurs it will be above the ground level at breathing zone where it will be mixed with the air and be present at low levels. Furthermore, since there is a lack of evidence of significant mechanical disturbance to the soil on-site and absence of high sustained winds in the area, the inhalation pathway would not be a significant exposure route.

While the site is being remediated, it is likely that remediation workers will be exposed during the clean-up activities by accidentally eating, breathing or touching contaminated soil and sediment. However, it is anticipated that worker exposure would be brief, and that workers will be following a site-specific health and safety plan that minimizes exposures. Also, signage will be posted to keep community members away from the site. BCEH finds that there is no complete pathway for human exposure from groundwater exposure because there are no drinking water wells on the site. Public water systems supply water to the residents of the town. While there may be private wells in the area, no water quality data from these wells are available for review.[1]

Environmental Sampling

For this health consultation, BCEH evaluated PAH data from surface soil and sediment sampling provided by EPA and collected by ARCADIS and its subcontractors during the January and February 2011 and February 2012 sampling efforts (ARCADIS, 2012). Although groundwater sampling data were available, BCEH determined the groundwater pathway was not a complete pathway (See Exposure Pathway Analysis section for details). Soil samples were taken at different depths (e.g., 0–2, 2–4, 4–6, 6–8, 8–10, 10–12, 12–13.8 feet). Although BCEH only considered samples from the most upper layer (0–2 feet), this is considered a limitation of this letter health consultation because people are typically exposed to surface soil or the top few inches. Fifty-seven soil core samples were collected. Two of them (SC-34 and SC-47) did not

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[1]According to the Idaho Department of Environmental Quality (IDEQ) records of public drinking systems, three public drinking water wells exists near the St. Maries Creosote site: Cherry Creek Trailer Park, located approximately 1.9 miles from the site; Cottonwood Park Water Association, located 1.8 miles from the site; and St. Maries wells, located 1.3 miles from the site. All of these wells exclusively provide groundwater to their systems with the exception of the St. Maries wells (north east wells). St. Maries uses their wells as a back-up supply to their slow sand filter which treats surface water from Rochat Creek, located approximately one mile from the site. IDEQ estimates that the city of St. Maries uses these wells less than 14 days per year (Scheidt; Suzanne. Idaho Department of Environmental Quality, December 3, 2012, personal communication).

have results for the upper layer (0–2 feet). Duplicates for samples SC-17, SC-25, and SC-53 were included in the analysis. Thirty sediment grab samples (0-0.3 feet) were collected to determine the extent of sediment exceeding cleanup levels. BCEH analyzed the results of these thirty samples including duplicates of samples SG-02 and SG-27. The sediment samples are representative of the top surface (i.e., 0.3 feet or 3.6 inches) where people are most likely to be exposed.

Identification of Contaminants of Concern

BCEH compares the concentrations of contaminants found in samples to ATSDR's health comparison values. In the absence of ATSDR values, EPA's health comparison values are used. If a contaminant concentration exceeds the comparison value (CV) it is selected for further evaluation. Contaminant concentrations below CVs are considered safe and are not evaluated further. Concentrations above CVs are not necessarily a health concern, but further investigation is needed to ensure people who are exposed will not be harmed. Site specific exposure scenarios are part of the evaluation, and they are incorporated into any health risk estimation. CVs used to screen contaminants in soil and sediment at this site include: ATSDR Environmental Media Evaluation Guides (EMEGs), ATSDR Cancer Risk Evaluation Guides (CREGs), Reference Dose Media Evaluation Guides (RMEGs), ATSDR's Minimal Risk Level (MRL) (ATSDR, 2005), and EPA's Reference Dose (RfD) (EPA, 2013).

Polycyclic aromatic hydrocarbons (PAHs) were found in soil and sediment samples from the site. It is important to emphasize that the concentration of these contaminants were found at a depth of 0–2 feet (soil samples) and 0–0.3 feet (sediment samples). People are more likely to be exposed to contaminants on the surface and in the first few inches of soil. Thus, the soil concentrations may not be as representative of possible exposure concentrations as the sediment concentrations which were taken at or near the surface.

Non-carcinogenic effects were evaluated first by comparing the maximum detected concentration to the CV for each individual PAH for which a CV was available. PAHs above the CV were further analyzed by deriving estimated doses using an adult trespasser scenario; a standard soil ingestion rate; approximate exposure time (a 70 kg adult ingesting 100 mg of soil/ day, exposed four hours per week for nine months out of the year); and a child trespasser scenario (a 20 kg child ingesting 200 mg of soil/day, exposed four hours per week for nine months out of the year). BCEH used nine months (36 weeks) instead of 52 weeks because it is assumed that exposure would be limited in the winter months due to frozen ground and snow cover; however, the total exposure period used for averaging exposures in the calculations is 12 months.

Non-cancer Exposure Analysis

Of the 16 PAHs analyzed in soil and sediment samples, only six had non-cancer CVs available. The remaining 10 PAHs were included in the Cancer Exposure Analysis section. In soil samples, a total of five PAHs exceeded at least one of the child or adult CVs (Appendix A). Three out of these five PAHs (fluorene, naphthalene, and pyrene) had maximum concentrations above both child and adult CVs. The other two PAHs (2-methylnaphthalene and fluoranthene) had maximum concentrations that only exceeded the child CV. BCEH estimated doses using the child and adult trespasser exposure scenarios and the maximum concentration for all the PAHs above the CVs. These estimated doses were then compared to health guidelines (MRLs and RfDs). EPA's RfDs were used where MRLs were not available (Appendix B). All the estimated doses for the five PAHs were below the ATSDR's MRL and EPA's available RfDs (Appendix B). In the sediment samples all the PAHs maximum concentrations were below their CVs. Thus, BCEH does not expect harmful non-carcinogen health effects in trespassers breathing and touching soil and sediment on-site.

Cancer Exposure Analysis

The level of toxicity to humans in PAHs is directly correlated to a PAH's molecular weight. For example, high molecular weight PAHs may cause cancer in humans, while low molecular weight PAHs are not carcinogenic. Benzo(a)pyrene (BaP) has been well characterized as the most carcinogenic of the group (Nisbet & LaGoy, 1992). In this report, BaP was used as a surrogate to assess potential cancer risks associated with PAHs in soil. To address the total effect of PAHs, individual PAH concentrations were converted to a BaP toxic equivalent (TEQ) value using established toxic equivalency factors (TEFs) (Appendix C).

Benzo(a)pyrene and some other PAHs have been classified as a "probable human carcinogen" (US EPA, 2012). This classification is largely based on animal studies. Evidence of carcinogenic effects of BaP or other PAHs in humans is lacking. To determine if exposure to BaP in the soil or sediment could cause additional cancers, BCEH compared the analytical results to the cancer CV of 0.1 mg/kg. The estimated additional lifetime cancer risk for BaP found to be above its cancer CV is shown in Appendix D, and the cancer risk calculations are in Appendix E. The cancer CVs from ATSDR and EPA are based on the possibility of an individual getting cancer over a lifetime from chronic (long-term) exposure. The BaP TEQ values for soil concentrations were higher than the cancer CV value of 0.1 mg/kg. Using both trespasser scenarios (i.e., adult and child) and BaP TEQ concentrations of 1,062 mg/kg for soils, the estimated additional lifetime cancer risk was calculated (Appendix E).

The increased theoretical cancer risk for trespassers from accidentally eating PAH contaminated soil is 3 additional cancers in 1 million adult trespassers exposed to contaminated soil and 2 additional cancers in 100,000 children trespassers exposed to contaminated soil on-site over a lifetime (Appendix E). It is important to consider that the American Cancer Society estimates that one in two men and one in three women living the United States will develop cancer in his or her life time (American Cancer Society, 2012). The exposures from the site are not likely to increase the risk of getting cancer above the normal risk one has of developing cancer in his or her lifetime.

CONCLUSIONS

BCEH concludes that based on the review of soil and sediment sampling data provided by EPA, it is unlikely that a future adult or child trespasser would be harmed through accidentally eating or touching contaminated soil or sediment from the site. It is unlikely that eating or touching soil and sediment on this site would increase a person's chances of developing cancer in his or her lifetime.

RECOMMENDATIONS

BCEH recommends:

- EPA should continue to post signage around the site to discourage people from accessing the site and to prevent accidental exposures.

- EPA should continue plans for a permanent remedy for the site that will reduce any future public health hazards.

- Workers on site should follow the safety plan for the site to limit exposure to contaminants.

- Community members, particularly children who live close to the site can further prevent exposures by washing their hands when coming in from playing outside and before eating. Family members should remove their shoes by the door, and frequently bathe pets to reduce tracking contaminated soil into the home.

- Private well owners in St. Maries and throughout Idaho should have their water tested as a prudent public health practice. Additional information on private water wells and testing can be found at: http://www.healthandwelfare.idaho.gov/Health/EnvironmentalHealth/WellWater/tabid/1128/Default.aspx.

PUBLIC HEALTH ACTION PLAN

BCEH will:

- Communicate the findings of this letter health consultation to EPA and IDEQ.

- Coordinate with EPA and other agencies during the remedial activities planned for 2014 to conduct community outreach education for St. Maries Creosote site.

- Review new environmental data as it becomes available.

If you have any questions, please do not hesitate to contact me at 208-334-5682 or at padenn@dhw.idaho.gov.

Best regards,

Norka E. Paden, PhD.
Toxicologist/Public Health Assessor
Bureau of Community and Environmental Health

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Appendix A: Polyaromatic hydrocarbons (PAHs) that exceeded the comparison value in soil samples (0–2 feet)

Contaminant	Percentage of detected values	Average Concentration (detected values) (mg/kg)	Maximum Concentration (mg/kg)	Non-cancer CV for Adult (mg/kg)	Non-cancer CV for Child (mg/kg)
2-Methylnaphthalene	57.9	1,338.8	26,262	28,000[a]	2,000[a]
Fluoranthene	70.2	2,237.7	37,373	28,000[b]	2,000[b]
Fluorene	61.4	1,464.3	24,242	28,000[b]	2,000[b]
Naphthalene	70.2	4,553.8	55,555	14,000[b]	1,000[b]
Pyrene	68.4	1,844.9	30,303	21,000[b]	1,500[b]

a = ATSDR Environmental Media Guides (EMEGs)
b = ATSDR Reference Dose Media Evaluation Guides (RMEGs)
mg/kg = milligram per kilogram

Appendix B: Dose Calculations for Accidental Ingestion and Dermal contact

Dose Calculation Formula

$$D = \frac{C \ x \ EF \ x \ CF \ x \ [(IR \ x \ BF) + (A \ x \ AF)]}{BW}$$

D = Dose in milligram per kilogram of body weight per day (mg/kg-day)
C = Contaminant concentration in milligrams per kilogram (mg/kg)
EF[1] = Exposure factor in days per year exposed/365
CF = Conversion factor $1x10^{-6}$
IR[2] = Ingestion rate in mg/day
BF = Bioavailability factor (default of 1 used)
A[2] = Total soil adherence = Exposed skin times soil adherence concentration
AF = Bioavailability factor (default of 0.1 used)
BW[3] = Body weight

Sources:
1 = Exposure factor for likely scenario at site
Adult and child trespasser scenario (4 hours/week x 36 weeks over 1 year)
2 = ATSDR default values
3 = Default for adult = 70 kg, default for child = 20 kg

Soil

A. 2-Methylnaphthalene (26,262 mg/kg)

Child trespasser scenario

$$\text{Dose (mg/kg per day)} = \frac{\text{C (mg/kg soil) x EF x CF } (10^{-6}) \text{ x [IR (mg/kg) x (BF) + (A x AF)]}}{\text{BW (kg)}}$$

$$= \frac{26{,}262 \text{ x } 0.016 \text{ x } 10^{-6} \text{ x } [200 \text{ x } 1 + (525 \text{ x } 0.1)]}{20}$$

$= 5 \text{ x } 10^{-3} = 0.005$ mg/kg body weight per day (Exposure Dose)

Reference Dose (Chronic Oral MRL)*:* 0.04 mg/kg/day

B. Fluoranthene (37,373 mg/kg)

Adult trespasser scenario

$$\text{Dose (mg/kg per day)} = \frac{\text{C (mg/kg soil) x EF x CF } (10^{-6}) \text{ x [IR (mg/day) x (BF) + (A x AF)]}}{\text{BW (kg)}}$$

$$= \frac{37{,}373 \text{ x } 0.016 \text{ x } 10^{-6} \text{ x } [100 \text{ x } 1 + (326 \text{ x } 0.1)]}{70}$$

$= 1 \text{ x } 10^{-3}$ = 0.001 mg/kg body weight per day (Exposure Dose)

Child trespasser scenario

$$\text{Dose (mg/kg per day)} = \frac{\text{C (mg/kg soil) x EF x CF } (10^{-6}) \text{ x [IR (mg/day) x (BF) + (A x AF)]}}{\text{BW (kg)}}$$

$$= \frac{37{,}373 \text{ x } 0.016 \text{ x } 10^{-6} \text{ x } [200 \text{ x } 1 + (525 \text{ x } 0.1)]}{20}$$

$= 8 \text{ x } 10^{-3}$ = 0.008 mg/kg body weight per day (Exposure Dose)

Reference Dose (Intermediate oral MRL)*:* 0.4 mg/kg/day

C. Fluorene (24,242 mg/kg)

Child trespasser scenario

$$\text{Dose (mg/kg per day)} = \frac{\text{C (mg/kg soil) x EF x CF } (10^{-6}) \text{ x [IR (mg/day) x (BF) + (A x AF)]}}{\text{BW (kg)}}$$

$$= \frac{24{,}242 \text{ x } 0.016 \text{ x } 10^{-6} \text{ x } [200 \text{ x } 1 + (525 \text{ x } 0.1)]}{20}$$

$= 5 \text{ x } 10^{-5}$ = 0.005 mg/kg body weight per day (Exposure Dose)

Reference Dose (Intermediate oral MRL)*:* 0.4 mg/kg/day

D. Naphthalene (55,555 mg/kg)

Adult trespasser scenario

$$\text{Dose (mg/kg per day)} = \frac{\text{C (mg/kg soil) x EF x CF } (10^{-6}) \text{ x [IR (mg/day) x (BF) + (A x AF)]}}{\text{BW (kg)}}$$

$$= \frac{55{,}555 \text{ x } 0.016 \text{ x } 10^{-6} \text{ x } [100 \text{ x } 1 + (326 \text{ x } 0.1)]}{70}$$

$= 2 \text{ x } 10^{-3}$ = 0.002 mg/kg body weight per day (Exposure Dose)

Child trespasser scenario

$$\text{Dose (mg/kg per day)} = \frac{\text{C (mg/kg soil) x EF x CF } (10^{-6}) \text{ x [IR (mg/day) x (BF) + (A x AF)]}}{\text{BW (kg)}}$$

$$= \frac{55{,}555 \text{ x } 0.016 \text{ x } 10^{-6} \text{ x } [200 \text{ x } 1 + (525 \text{ x } 0.1)]}{20}$$

$= 1 \text{ x } 10^{-2}$ = 0.01 mg/kg body weight per day (Exposure Dose)

Reference Dose (Intermediate oral MRL): 0.6 mg/kg/day

E. Pyrene (30,303 mg/kg)

Adult trespasser scenario

$$\text{Dose (mg/kg per day)} = \frac{\text{C (mg/kg soil) x EF x CF } (10^{-6}) \text{ x [IR (mg/day) x (BF) + (A x AF)]}}{\text{BW (kg)}}$$

$$= \frac{30{,}303 \text{ x } 0.016 \text{ x } 10^{-6} \text{ x } [100 \text{ x } 1 + (326 \text{ x } 0.1)]}{70}$$

$= 9 \text{ x } 10^{-4}$ = 0.0009 mg/kg body weight per day (Exposure Dose)

Child trespasser scenario

$$\text{Dose (mg/kg per day)} = \frac{\text{C (mg/kg soil) x EF x CF } (10^{-6}) \text{ x [IR (mg/day) x (BF) + (A x AF)]}}{\text{BW (kg)}}$$

$$= \frac{30{,}303 \text{ x } 0.016 \text{ x } 10^{-6} \text{ x } [200 \text{ x } 1 + (525 \text{ x } 0.1)]}{20}$$

$= 6 \text{ x } 10^{-3} = 0.006$ mg/kg body weight per day (Exposure Dose)

Reference Dose (EPA's RfD)*:* 0.03 mg/kg/day

Appendix C: Toxic Equivalency Factors (TEFs)[1] for Polycyclic aromatic hydrocarbons (PAHs)

Polyaromatic Hydrocarbons (PAHs)	Toxicity Equivalency Factors (TEFs)
Dibenzo(a,h)anthracene	5
Benzo(a)pyrene	1
Benzo(a)anthracene	0.1
Benzo(b)fluoranthene	0.1
Benzo(k)fluoranthene	0.1
Indeno(1,2,3-cd)pyrene	0.1
Benzo(g,h,i)perylene	0.01
Anthracene	0.01
Chrysene	0.01
Acenaphthene	0.001
Acenaphthylene	0.001
Fluoranthene	0.001
Fluorene	0.001
2-Methylnaphthalene	0.001
Naphthalene	0.001
Phenanthrene	0.001
Pyrene	0.001

Source: (Nisbet & LaGoy, 1992)[1] = Toxic Equivalency Factors (TEFs); It is a way to express the toxicity of a mixture of toxic compounds (e.g., polycyclic aromatic hydrocarbons) in a single number, which indicates the degree of toxicity compared to the surrogate compounds [e.g., Benzo(a)pyrene (BaP)].

Appendix D: Benzo(a)pyrene toxicity equivalent values in soil samples that exceeded the Cancer Risk Evaluation Guide (CREG)

Receptor	BaP[1] Concentration mg/kg	Cancer CV[2] in mg/kg	Dose mg/kg/day	Cancer slope[3] mg/kg/day	Exceeds CV (Yes or No)	Estimated Additional lifetime cancer risk
Adult trespasser	1,062	0.1	3×10^{-5}	7.3	Yes	3×10^{-6}
Child trespasser	1,062	0.1	2×10^{-4}	7.3	Yes	2×10^{-5}

1 = EPA's Provisional Guidance for Quantitative Risk Assessment of PAHs (1993), as reported in ATSDR Toxicological profile for PAHs (ATSDR, 1995) (For calculation details, see Appendix E.)
2 = ATSDR Cancer Risk Evaluation Guide (CREG)
3 = EPA's Integrated Risk Information System (IRIS)

Appendix E: Cancer Risk Calculations

Excess Cancer Risk Calculation

$$Cancer\ Risk = Dose\ x\ Cancer\ Slope\ Factor$$

Dose[2] = mg/kg-day
Cancer Slope Factor = EPA cancer slope factors from IRIS

Benzo(a)pyrene (Using the toxic equivalent factor approach)

Soil (1,062 mg/kg)

Adult Trespasser Scenario

$$\text{Dose (mg/kg per day)} = \frac{\text{C (mg/kg soil) x EF x CF } (10^{-6}) \text{ x [IR (mg/day) x (BF) + (A x AF)]}}{\text{BW (kg)}}$$

$$= \frac{1{,}062 \times 0.016 \times 10^{-6} \times [100 \times 1 + (326 \times 0.1)]}{70}$$

$= 3.2 \times 10^{-5}$ mg/kg body weight per day (Exposure Dose)

Cancer Slope Factor (CSF) = 7.3 $(\text{mg/kg-day})^{-1}$

Risk = Dose (mg/kg-day) x CSF ($[\text{mg/kg-day}]^{-1}$) x (Exposure years/70)

$3.2 \times 10^{-5} \times 7.3 \times (1/70) = 3 \times 10^{-6}$ (Approximately 3 in 1 million)

Cancer Risk Comparison Levels = 1×10^{-6}

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[2] Dose assumptions are in Appendix B

Soil (1,062 mg/kg)

Child Trespasser Scenario

$$\text{Dose (mg/kg per day)} = \frac{\text{C (mg/kg soil) x EF x CF } (10^{-6}) \text{ x [IR (mg/day) x (BF) + (A x AF)]}}{\text{BW (kg)}}$$

$$= \frac{1{,}062 \times 0.016 \times 10^{-6} \times [200 \times 1 + (525 \times 0.1)]}{20}$$

$= 2.1 \times 10^{-4}$ mg/kg body weight per day (Exposure Dose)

Cancer Slope Factor = 7.3 $(\text{mg/kg-day})^{-1}$

Risk = Dose (mg/kg-day) x CSF ($[\text{mg/kg-day}]^{-1}$) x (Exposure years/70)

$2.1 \times 10^{-4} \times 7.3 \times (1/70) = 2 \times 10^{-5}$ (Approximately 2 in 100,000)

Cancer Risk Comparison Levels = 1×10^{-6}

REPORT PREPARATION

This Letter Health Consultation for the St. Maries Creosote site was prepared by the Idaho Department of Health and Welfare under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approved agency methods, policies, procedures existing at the date of publication. Editorial review was completed by the cooperative agreement partner. ATSDR has reviewed this document and concurs with its findings based on the information presented.

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