

Letter Health Consultation

DEE FOUNDRIES

HOUSTON, HARRIS COUNTY, TEXAS

EPA FACILITY ID: TXN000607053

**Prepared by the
Texas Department of State Health Services**

JULY 7, 2010

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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June 30, 2010

Mr. Bret Kendrick, Site Assessment Manager
U.S. EPA - Region 6
1445 Ross Avenue Suite 1200
Dallas, Texas 75202

Subject: Evaluation of Soil Samples
Dee Foundries
2408 Everett
Houston, Harris County, Texas 77009

Dear Mr. Kendrick:

Background and Statement of Issues

Dee Foundries has been in operation since 1934 and produces non-ferrous sand casting products of all sizes made of aluminum and bronze alloys [1]. In 2009, the Texas Commission on Environmental Quality (TCEQ) received a complaint of a nuisance violation, which eventually led to the collection of soil samples both on Dee Foundries property and in off-site residential yards [2]. On March 1, 2010, the United States Environmental Protection Agency (EPA)-Region 6 asked the Texas Department of State Health Services (DSHS) to evaluate potential public health hazards associated with metals found in the soil samples collected by the City of Houston [3]. Results for this consult are based upon limited off-site sampling in nearby residential yards.

Discussion

In October 2009, five (5) on-site soil samples were collected at 0-3 inches below ground surface (bgs) on Dee Foundries' property, and 10 soil samples were collected at 0-3 inches bgs from nearby residential properties. The samples were found to contain the metals cadmium, chromium, copper, lead, manganese, mercury, nickel, silver, and zinc [4].

DSHS compared the concentrations of the metals measured in the soil samples with the Agency for Toxic Substances and Disease Registry's (ATSDR) health-based screening values (Table 1).

Metals found to exceed ATSDR's health-based screening values were cadmium, chromium, and copper (Table 1).

Cadmium was not detected in the on-site soil samples; therefore, in regards to cadmium in on-site samples, no further evaluation is required. Cadmium concentrations in the off-site soil samples ranged from non-detected (ND) to 1.09 mg/kg. One (1) of these off-site samples exceeded the health-based screening value for a pica¹ child and therefore warrants closer evaluation.

Chromium concentrations in the on-site soil samples ranged from 6.9 to 33.6 mg/kg. Of these on-site samples, two (2) were found to exceed the ATSDR health-based screening value for a pica child and thus warrant closer evaluation. Chromium concentrations in the off-site samples ranged from 7.8 to 32.1 mg/kg. Of these off-site samples, seven (7) were found to exceed health-based screening values for a pica child and thus warrant further evaluation.

Copper concentrations in the soil samples collected on Dee Foundries' property ranged from 4,680 to 9,110 mg/kg. Two (2) on-site copper concentrations exceed health-based screening values for adults while all on-site copper concentrations in the samples exceed health-based screening values for children and therefore warrant closer evaluation. Copper concentrations in the off-site soil samples collected from residential property surrounding Dee Foundries ranged from 156 to 4,690 mg/kg. Copper concentrations in seven (7) of the off-site samples exceeded health-based screening values for non-pica children and all off-site samples exceeded health-based screening values for children exhibiting pica behavior (Table 1). For adults, these off-site concentrations are below health-based screening values, thus adults are excluded from the off-site pathways analysis.

¹ Pica is a disorder characterized by the intentional ingestion of non-food items such as soil, sand, clay, and paint. Approximately 10-32% of children ranging in ages from 1-6 will show pica behavior [5].

Table 1. Soil Sample Results (mg/kg)				
Metal	Range (Average)	#Detected Samples/Total Samples	HAC² Values	# Exceeding HAC
Cadmium on-site	ND	0/5	400 (Intermediate EMEG ³ Adult) 30 (Intermediate EMEG Child) 1 (Intermediate EMEG Pica Child)	0
Cadmium off-site	ND - 1.09 (NA ⁴)	1/10	400 (Intermediate EMEG Adult) 30 (Intermediate EMEG Child) 1 (Intermediate EMEG Pica Child)	1 (Pica Child)
Chromium on-site	6.9 - 33.6 (15.8)	2/5	4,000 (Intermediate EMEG Adult) 300 (Intermediate EMEG Child) 10 (Intermediate EMEG Pica Child)	2 (Pica Child)
Chromium off-site	7.8 - 32.1 (15.4)	7/10	4,000 (Intermediate EMEG Adult) 300 (Intermediate EMEG Child) 10 (Intermediate EMEG Pica Child)	7 (Pica Child)
Copper on-site	4,680 - 9,110 (6,408)	5/5	7,000 (Intermediate EMEG Adult) 500 (Intermediate EMEG Child) 20 (Intermediate EMEG Pica Child)	2 (Adult) 5 (Child) 5 (Pica Child)
Copper off-site	156 - 4,690 (1,537)	10/10	7,000 (Intermediate EMEG Adult) 500 (Intermediate EMEG Child) 20 (Intermediate EMEG Pica Child)	7 (Child) 10 (Pica Child)
Lead	26.4 - 166 (82.7)	15/15	400 (EPA ⁵ Screening Level)	0
Manganese	82.2 - 273 (141.8)	15/15	40,000 (RMEG ⁶ Adult) 3,000 (RMEG Child)	0
Mercury	ND	0/15	5.6 (EPA-Region 6 Media Specific Screening Level)	0
Nickel	11 - 448 (145)	15/15	10,000 (RMEG Adult) 1,000 (RMEG Child)	0
Silver	ND	0/15	4,000 (RMEG Adult) 300 (RMEG Child)	0
Zinc	51.3 - 1,250 (430.2)	15/15	200,000 (Intermediate EMEG Adult) 20,000 (Intermediate EMEG Child) 600 (Intermediate EMEG Pica Child)	0

Upon further evaluation, DSHS calculated estimated exposure doses (ED) for each of the three (3) metals (cadmium, chromium, and copper) and then compared the estimated EDs to ATSDR's intermediate oral minimal risk level (MRL) for each of the three (3) metals. Of these EDs, copper was the only metal to exceed the intermediate oral MRL and will therefore be further evaluated in this consultation.

² Health Assessment Comparison Values - Media-specific concentrations that are used to select environmental contaminants for further evaluation.

³ Environmental Media Evaluation Guide - Estimates a contaminant concentration at which non-carcinogenic health effects are unlikely. EMEGs are chemical specific without consideration for carcinogenic effects, chemical interactions, multiple route exposures, or other media-specific exposures.

⁴ The average concentration was not computed for off-site cadmium samples as it was only detected in one sample.

⁵ Currently ATSDR-specific HAC values are not available for lead and mercury.

⁶ Reference Dose Media Guide - A concentration in air, soil, or water (or other environmental media), which is derived from EPA's RfD, and below which adverse non-cancer health effects are not expected to occur. RMEGs account only for chronic exposure.

Pathways Analysis

The presence of hazardous chemical contaminants in the environment does not always mean that people who spend time in the area are likely to experience adverse health effects. Such effects are possible only when people in the area engage in activities that make it possible for a sufficient quantity of the hazardous chemicals to be transported into the body. Once the exposure occurs, the potential for adverse health effects depends on: 1) the toxicological properties of the chemical; 2) the manner in which the person contacts the chemical; 3) the concentration of the chemical; 4) how often the exposure occurs (exposure frequency); 5) how long the exposure occurs; and 6) how much of the chemical is absorbed into the body during each exposure event.

The exposure pathways considered for on-site and off-site exposure evaluation in adults and children are skin contact with soil and incidental or intentional ingestion of soil. Skin contact will most likely occur in the workplace and when an individual comes into contact with soil through activities such as walking or playing in unvegetated areas, digging in the soil, or gardening. Copper is poorly absorbed through intact skin, thus exposure via skin contact will not be considered further for this consultation [6].

It is normal for an individual to unintentionally ingest soil throughout daily activities. Adults will ingest an average of 100 milligrams of soil per day (mg/day) while children will ingest an average of 200 mg/day. A child exhibiting pica behavior will ingest an average of 5,000 mg/day. Incidental ingestion of soil can occur through hand-to-mouth activities. In the case of a child exhibiting pica behavior, the child directly consumes the soil [7]. In this consult we also considered adolescents as being more like an adult than a child; therefore, an adult soil ingestion rate of 100 mg/day was used to calculate scenarios involving adolescents.

Public Health Implications

Copper is a naturally occurring element found in rocks, soil, water, and air. According to the 2004 ATSDR Toxicological Profile for copper, soil naturally contains between two (2) and 250 mg/kg of copper [6]. It is an essential element in plants, humans, and animals and is used to make several products including wire, plumbing pipes, and sheet metal. Combined with other metals, it can be used to make brass and bronze pipes and faucets.

If high levels of copper are breathed in, it can cause irritation of the nose and throat. Ingesting copper can result in nausea, vomiting, and diarrhea. Ingestion of high levels could cause liver and kidney damage and can even cause death. It is not known if these effects would occur at the same doses for children as they would for adults; however, animal studies suggest that young children may have more severe effects than adults. It has also not been determined if copper can cause birth defects or developmental defects in humans. It is not known if copper has the potential to cause cancer in humans and the EPA has determined that copper is not classifiable as a human carcinogen [6].

An estimated ED was calculated using standard parameters (Table 2), and then compared to ATSDR's MRL for copper of 0.01 milligrams per kilogram per day (mg/kg/day). DSHS first assumed the most conservative scenario: an exposure frequency of one (1) which indicates the

individual will come into contact with the contaminant 7 days out of every week. DSHS also calculated a more realistic ED using an exposure frequency of 5 days per week: similar to a work or school schedule. For preschool-aged pica children, DSHS used an exposure frequency of 3 days per week for 1 year to better represent exposure to copper-contaminated soil via pica behavior.

Table 2. Parameters Used for Calculations		
	Average Ingestion Rate (mg/day)	Body Weight (kg)
Adult	100 ⁷	70
Adolescent (12-17 years old)	100 ⁸	50
Elementary-Aged Child (7-11 years old)	200	30
Preschool-Aged Child (1-6 years old)	200	16
Preschool-Aged Pica Child (1-6 years old)	5,000	16

Table 3. Soil Copper Concentrations Used for ED Calculations (mg/kg)		
On-Site	Highest	9,110
	Average	6,408
Off-Site	Highest	4,690
	Average	1,537

Adult Exposures

Dee Foundries is an actively operating business and as such we would expect adult workers but not children to routinely frequent the property. An ED for adults was estimated using the highest (Table 3) on-site copper concentration and assuming the adult unintentionally ingests copper-contaminated soil 7 days out of the week for 1 year. The estimated adult ED was 0.01 mg/kg/day, which is equivalent to the intermediate⁹ MRL of 0.01 mg/kg/day and below the intermediate no observable adverse effect level (NOAEL) (0.04 mg/kg/day) and the intermediate lowest observable adverse effect level (LOAEL) (0.09 mg/kg/day). Studies have observed gastrointestinal effects at doses ranging from 0.011-0.03 mg/kg/day [6]. In this exposure scenario, the potential for health effects in adults is possible but unlikely because the calculated ED is below both the intermediate NOAEL and LOAEL.

An adult working at Dee Foundries is more likely to have exposures at different locations throughout the foundry property, thus their exposure is likely closer to the average on-site copper concentration (6,408 mg/kg). If they work 5 days per week or less, their estimated ED, 0.006 mg/kg/day, would be below the MRL and would not be expected to cause health effects.

⁷ Ingestion rates and body weights used in this health consult were acquired from ATSDR's Public Health Assessment Guidance Manual [7].

⁸ DSHS conservatively assumes that the ingestion rate for a teenager would be comparable to an adult's ingestion rate because their body size is similar to an adult.

⁹ Because ATSDR has not derived a chronic MRL for copper, we considered an intermediate exposure representing an exposure greater than 2 weeks but less than 1 year.

Child Exposures

DSHS assumes that children would not be exposed to copper-contaminated soil found on-site because this is an operating facility and children would not have access to the property. There is a possibility that children could come into contact with on-site copper concentrations through contaminated clothing worn home by a parent who works at the foundry. At this time, DSHS lacks complete information in order to evaluate this as a potential exposure pathway because we do not know what operating procedures Dee Foundries has in place for its employees. We also do not know if any employees have small children at home. As a precaution, we recommend that anyone who might have contact with on-site soil wash their hands and change out of potentially contaminated clothing before playing with children. We also recommend washing potentially contaminated clothing separate from children's clothing.

There are schools in the neighborhood surrounding Dee Foundries; however, no information about soil-copper levels on school property exists at this time. DSHS lacks complete information in order to evaluate child exposure to soil on school property in the area surrounding Dee Foundries.

DSHS is considering four (4) child exposure scenarios in this consult using the off-site, residential soil samples collected.

- *Adolescent and elementary-aged:*

exposed 5 days per week for 1 year to off-site copper-contaminated soil while walking to school through residential property surrounding Dee Foundries.

- *Adolescent and elementary-aged:*

living at a residential property surrounding Dee Foundries; exposed to copper-contaminated soil on a daily basis.

- *Preschool-aged child:*

living at one of the residential properties surrounding Dee Foundries; exposed to copper-contaminated soil on a daily basis.

- *Preschool-aged pica child:*

living at residential properties surrounding Dee Foundries; exposed to copper-contaminated soil 3 days per week for 1 year.

Pica in children is only common from 1-6 years of age; therefore, scenarios involving adolescent and elementary-aged children will not include exposure doses for pica behavior.

Adolescent and elementary-aged children who do not live near Dee Foundries but who walk to school through residential property surrounding the foundry

An adolescent who does not live near the foundry but who walks through residential property surrounding Dee Foundries 5 days per week for 1 year will have an ED of 0.002 mg/kg/day when exposed to the average off-site copper-contaminated soil concentration. This dose is below the intermediate MRL, thus health effects are unlikely.

An elementary-aged child who does not live near the foundry but who walks to school through residential property surrounding Dee Foundries 5 days per week for 1 year will have an ED of 0.007 mg/kg/day when exposed to the average copper-contaminated soil concentration found in off-site samples. This dose is below the intermediate MRL, thus health effects are unlikely.

Adolescent and elementary-aged children living at residential property surrounding Dee Foundries

An adolescent who lives at residential property surrounding the foundry and who is potentially exposed 7 days per week for 1 year will have an ED of 0.003 mg/kg/day when exposed to the average copper-contaminated soil concentration. If the same adolescent is exposed to the highest soil-copper concentration 7 days per week for a year, the ED is calculated as 0.009 mg/kg/day. Both of these doses do not exceed the intermediate MRL, thus health effects are unlikely.

An elementary-aged child who lives at residential property surrounding the foundry and potentially has exposure 7 days per week for 1 year will have an ED of 0.01 mg/kg/day when exposed to the average copper-contaminated soil concentration. This dose is equivalent to the intermediate MRL, thus health effects are not likely to occur; although some studies suggest gastrointestinal effects may occur at doses ranging from 0.011-0.03 mg/kg/day [6]. If the same elementary-aged child is exposed to the highest copper-contaminated soil concentration, then the ED is calculated as 0.03 mg/kg/day. This dose exceeds the intermediate MRL, but does not exceed the intermediate NOAEL and LOAEL. As previously stated, doses in the range of 0.011-0.03 mg/kg/day have been shown to result in gastrointestinal effects. At this ED of 0.03 mg/kg/day these effects could be possible but are unlikely to occur because the ED is lower than both the intermediate NOAEL and LOAEL.

Preschool-aged children living at residential property surrounding Dee Foundries

The ED for a preschool-aged child (0.02 mg/kg/day) exposed to the average off-site copper-contaminated soil concentration, 7 days per week for 1 year, is above the intermediate MRL, but below the intermediate NOAEL and LOAEL, thus the potential for adverse health effects is unlikely; however, studies have observed gastrointestinal effects at doses ranging from 0.011-0.03 mg/kg/day [6].

The EDs calculated for a preschool-aged child exposed 7 days a week for 1 year using the highest off-site copper-contaminated soil concentration is calculated as 0.06 mg/kg/day. This ED exceeds the intermediate MRL and NOAEL, and is not too far below the intermediate LOAEL, thus the potential for health effects in a preschool-aged child are possible. This dose also exceeds the range in which gastrointestinal effects have been observed.

Preschool-aged pica children living at residential property surrounding Dee Foundries

A preschool-aged pica child exposed to the average off-site copper-contaminated soil concentration 3 days per week for 1 year would have an ED of 0.20 mg/kg/day. The ED for a preschool-aged pica child exposed to the highest off-site copper-contaminated soil concentration 3 days per week for 1 year would have an ED of 0.62 mg/kg/day. Both of these estimated EDs exceed the intermediate MRL, the intermediate NOAEL, and the intermediate LOAEL. Health effects such as gastrointestinal disturbances have been reported at the LOAEL of 0.09 mg/kg/day and in a two week exposure study by Pizzaro et al. (1999), significant increases in the incidence of gastrointestinal symptoms were observed in subjects exposed to between 0.0731 and 0.124 mg/kg/day [6].

Because this ED exceeds 0.09 mg/kg/day, health effects such as nausea, vomiting and diarrhea would likely be observed. As previously mentioned, health effects could be observed at lower levels [6].

Conclusions

Conclusions in this letter health consult are based upon soil samples collected from residential yards surrounding Dee Foundries and soil samples collected from Dee Foundries' property by the City of Houston in October 2009. This sample data was very limited as only 15 soil samples were collected. Upon request, DSHS will re-evaluate these conclusions once more data becomes available in the future.

1. Both the on-site and off-site soil samples were found to contain cadmium, chromium, copper, lead, manganese, mercury, nickel, silver, and zinc. Except for copper, these metals are not at concentrations high enough to harm people's health.

2. Adults

DSHS and ATSDR conclude that ingesting the average concentration of copper-contaminated soil found on Dee Foundries' property will not harm an adult's health.

3. Adolescents (12-17 years)

DSHS and ATSDR conclude that ingesting the average concentration of copper-contaminated soil found in off-site residential yards 5 days per week for 1 year will not harm an adolescent child's health.

DSHS and ATSDR conclude that ingesting the highest concentration of copper-contaminated soil found in off-site residential yards 7 days per week for 1 year will not harm an adolescent child's health.

4. Elementary-Aged (7-11 years)

DSHS and ATSDR conclude that ingesting the average concentration of copper-contaminated soil found in off-site residential yards 5 days per week for 1 year will not harm an elementary-aged child's health.

DSHS and ATSDR conclude that ingesting the highest concentration of copper-contaminated soil found in off-site residential yards 7 days per week for 1 year will not harm an elementary-aged child's health.

5. Preschool-Aged (1-6 years)

DSHS and ATSDR conclude that ingesting the average concentration of copper-contaminated soil found in off-site residential yards 7 days per week for 1 year will not harm a preschool-aged child's health.

DSHS and ATSDR conclude that ingesting the highest concentration of copper-contaminated soil found in off-site residential yards 7 days per week for 1 year could harm a preschool-aged child's health. This is a public health hazard.

6. Preschool-Aged Pica (1-6 years)

DSHS and ATSDR conclude that ingesting the average concentration of copper-contaminated soil found in off-site residential yards 5 days per week for 1 year could harm a preschool-aged pica child's health. This is a public health hazard.

DSHS and ATSDR conclude that ingesting the highest concentration of copper-contaminated soil found in off-site residential yards 7 days per week for 1 year could harm a preschool-aged pica child's health. This is a public health hazard.

Recommendations

1. Parents of children living where copper-contaminated soil has been identified should take precautionary measures to lessen children's exposure by:
 - ensuring all household members and guests wash their hands before eating.
 - monitoring their children's behavior while playing outdoors to prevent their children from eating soil.
 - showering and/or washing their hands if they have contact with on-site soil before playing with children.
 - ensuring that any clothing worn home from Dee Foundries does not come into contact with children and is washed separately from children's clothing.
2. Responsible environmental agencies should collect soil samples from nearby playgrounds (public or school) to identify whether there is an exposure pathway for children.

Public Health Action Plan

DSHS will work with the responsible environmental agencies and local health authorities for exposure prevention education in the community.

DSHS prepared a copper fact sheet in English for exposure prevention education at this site. The fact sheet can be accessed online at <http://www.dshs.state.tx.us/epitox/education.shtm>

DSHS is having the copper fact sheet translated into Spanish for future prevention education.

Upon request, DSHS will review additional environmental sampling results as they become available.

If you have any questions, please contact me at 1(888)-963-7111 x 3961.

Sincerely,

Amanda Kindt, MPH
Environmental Specialist
Health Assessment and Consultation Program

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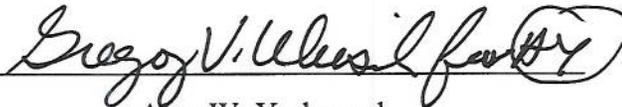
Certification

The Texas Department of State Health Services prepared this letter health consultation for Dee Foundries, Houston, TX 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. Editorial review was completed by the cooperative agreement partner.



Jeff Kellam, M.S.
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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