Letter Health Consultation

MARATHON REFINERY CATALYST RELEASE

BAYOU VISTA, GALVESTON COUNTY, TEXAS

Prepared by
Texas Department of State Health Services
Epidemiology and Disease Surveillance

December 28, 2015

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
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Division of Community Health Investigations
Atlanta, Georgia 30333

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TEXAS DEPARTMENT OF STATE HEALTH SERVICES

P.O. Box 149347
Austin, Texas 78714-9347
1-888-963-7111
TTY: 1-800-735-2989
www.dshs.state.tx.us

KIRK COLE
INTERIM COMMISSIONER

December 28, 2015

Randy Valcin, Manager of Disease & Disasters
Galveston County Health District
9850-A Emmett F. Lowry Expy, Suite A108
Texas City, Texas 77591

RE: Review of Environmental Sampling Data and Community Health Concerns
FCC Catalyst Release from the Marathon Refinery – January 2015
Texas City, Galveston County, Texas

Mr. Valcin:

In response to your agency's request, the Texas Department of State Health Services (DSHS) examined environmental sampling results collected in January 2015 following a fluidic catalytic cracking (FCC) catalyst release from the Marathon Refinery in Texas City, Texas. DSHS evaluated the data to determine if exposure to the catalyst could have resulted in adverse health effects to residents living in the Bayou Vista, Omega Bay, and Highlands Bayou communities.

Based on the January 2015 sampling results, DSHS concluded that exposure to the released material is not likely to result in adverse health effects for children and adults.

Limitations of this letter health consultation include: (1) conclusions are based on daily exposures to metals in surface soil, surface water, wipe samples, and air samples, so data represent a point in time that may not be representative of past exposures; (2) conclusions are based on exposure assumptions considered to be health-protective, but may over- or underestimate actual risk; (3) health information received from residents was based on personal accounts, no medical records were reviewed or examined to support health claims; and, (4) DSHS is unable to determine whether individual health concerns were a result of exposure to the catalyst dust.

Background and Statement of Issues

On January 13-14, 2015, an air release occurred at the Marathon Refinery (a.k.a. Blanchard Refining Galveston Bay Refinery) in Texas City, Galveston County, Texas. The release continued for approximately 23 hours causing a discharge of FCC Catalyst [1]. Catalyst dust

from the release reportedly coated homes and automobiles in the Bayou Vista, Omega Bay, and Highlands Bayou communities. A heavy rain event occurred two days after the catalyst release, which should have washed away a significant amount of material.

Discussion

Data Used

On January 15, 2015, prior to rainfall, the Center for Toxicology and Environmental Health (CTEH), L.L.C. on behalf of the Marathon Refinery collected bulk catalyst samples to identify the composition of the dust and determined that it contained amorphous silica, aluminum oxide, and trace amounts of heavy metals [1]. CTEH also collected 32 residential surface soil samples, 3 surface water samples from residential swimming pools, 7 outdoor air samples, and 55 outdoor wipe samples in the Bayou Vista community. The samples were evaluated for heavy metals likely found in the catalyst material, including aluminum, arsenic, barium, copper, magnesium, nickel, and vanadium [2]. DSHS assumed adequate quality assurance/quality control procedures were followed with regard to data collection, chain of custody, laboratory procedures, and data reporting.

In addition to the data collected by CTEH, DSHS received a water sampling result and photomicrographs collected by a local chemist. This information was not reviewed because DSHS does not have the resources to evaluate the photomicrographs and the water sample was collected from a puddle located outside the impacted area.

Screening Analysis

DSHS evaluated sampling data by comparing reported concentrations to contaminant-specific health based comparison values (CVs) for non-cancer and cancer health effects. The CVs used to analyze the surface soil, surface water, and outdoor air samples are published by the Agency for Toxic Substances and Disease Registry (ATSDR). For outdoor surface wipe samples DSHS compared the wipe sample results to settled dust screening CVs developed by the World Trade Center Indoor Air Task Force [3].

Using CVs for screening is considered a conservative approach and protective of individuals that might come into contact with contaminants. Contaminant concentrations below CVs are considered safe and are not evaluated further. If the concentration of a given contaminant were higher than the CV, the contaminant was considered a Contaminant of Potential Concern (COPC). It is important to note that exceeding a CV does not indicate that a COPC poses a human health hazard, only that additional evaluation of that contaminant is needed.

Surface Soil

Surface soil samples were collected from residential yards and analyzed for aluminum, arsenic, barium, copper, magnesium, nickel, and vanadium. Arsenic was present in all surface soil samples at concentrations ranging from 1.4 to 25.3 mg/kg [Table 1]. Three surface soil samples collected exceeded the child environmental media evaluation guide (EMEG) of 15 mg/kg. No samples exceeded the adult chronic EMEG (210 mg/kg) (Table 1). Children’s exposure to arsenic in soil was evaluated further.

Table 1. Arsenic levels in surface soil samples collected on January 15, 2015, by the Center for Toxicology and Environmental Health, L.L.C.

Metal	Concentration Range (mg/kg)	Screening Value[a] (mg/kg)	Number of Samples Exceeding Screening Value/Total Number of Samples
Arsenic[b]	1.4-25.3	**15 – child Chronic EMEG[c]** 210 – adult Chronic EMEG	**3/32** 0/32

mg/kg – milligrams per kilogram are equivalent to parts per million (ppm)

[a] Screening levels utilized were chronic environmental media evaluation guides (EMEGs) published by ATSDR. Chronic EMEGs are based on an exposure period of 365 days or more and are media specific (e.g. soil, air, and water). They are estimated contaminant concentrations that are not expected to result in adverse non-carcinogenic health effects based on ATSDR evaluation.

[b] To be protective of human health, DSHS assumed that the arsenic was in the more toxic inorganic form

[c] Bolded values indicate the concentrations of arsenic exceed the screening value(s)

Pica Behavior

Pica behavior is the recurrent ingestion of unusually high amounts of soil and other non-food items and typically occurs in children less than 6 years old. While experts agree pica behavior exists, there is extensive debate as to the degree to which it occurs, making it difficult to assess potential exposures [4].

DSHS compared the concentrations of arsenic detected in soil to the CVs calculated for children exhibiting pica behavior. Seven of 32 surface soil samples exceeded the pica child acute EMEG; 10 mg/kg) for arsenic. However, the number of children exhibiting pica-behavior is generally low and infrequent, and parents should discourage children from ingesting large amounts of soil and/or sediment. Based on these assumptions, pica-behavior was not evaluated further in this health assessment.

Surface Water

Surface water samples were collected from residential swimming pools and analyzed for aluminum, arsenic, barium, copper, magnesium, nickel, and vanadium. Although the pool water is not a drinking water source, DSHS evaluated the surface water sample results by comparing the maximum result for each chemical to CVs for drinking water. Although all six metals were detected in the surface water samples, concentrations were below CVs. Therefore, no further evaluation was conducted.

Outdoor Air

Air sampling data was collected in the Bayou Vista and Omega Bay neighborhoods and analyzed for aluminum, arsenic, barium, copper, magnesium, nickel, and vanadium. DSHS evaluated the air samples by comparing the maximum result for each contaminant to CVs for air. Three of the seven samples evaluated had detectable levels of barium ranging from 0.000041 to 0.000067 milligrams per cubic meter (mg/m^3). However, barium levels were below the health-based screening level (0.00049 mg/m^3) [3]. Therefore, barium is not considered a contaminant of concern and no further evaluation is needed. All other contaminants analyzed were below the detection limit and no further evaluation was conducted.

Outdoor Surface Wipe Samples
Wipe samples were collected from various locations outside of residential homes in the Bayou Vista and Omega Bay neighborhoods, and were analyzed for aluminum, arsenic, barium, copper, magnesium, nickel, vanadium, and lead. Wipe sampling can be a valuable technique for estimating contaminant deposition in buildings, homes, or outdoor surfaces. However, there is limited comparison value information available for outdoor surface wipe samples to determine human health risk. DSHS compared the wipe sample results to settled dust screening CVs developed by the World Trade Center Indoor Air Task Force [3]. None of the wipe samples had contaminants that exceeded CVs and, therefore, no further evaluation was conducted.

Public Health Implications
Exposure Pathways
In order for a contaminant to be harmful to human health, people must physically come in to contact with it through what is known as an "exposure pathway". Residents, especially small children, may be exposed to contaminants in surface soil in residential areas. While there are some children that purposefully ingest large quantities of soil (a behavior known as soil pica), most people are exposed to contaminants in soil through incidental ingestion. Incidental ingestion may occur by inadvertently swallowing soil stuck on hands or food items or through the mouthing of objects. Children in particular mouth or ingest non-food items [5]. As vegetation acts as a barrier for contact with soil, those areas with little vegetation are of most concern. Inhalation of wind-blown dust and dermal contact with contaminated soil are also possible. While dermal exposure to soil can occur, this exposure pathway is considered a minor contributor to the overall exposure to contaminants compared to oral ingestion and was not evaluated [5]. DSHS health assessors assumed all exposure was from ingestion and inhalation of contaminated soil.

Exposure Dose Estimates
Exposure doses, in milligrams per kilograms per day (mg/kg/day), were calculated for arsenic. Soil concentrations for arsenic were averaged for all 32 samples and a 95 percent upper confidence limit (95% UCL) of the mean value was calculated [6]. Standard body weight, ingestion rate, and bioavailability assumptions[1] were also used in these calculations. The following formula was used to calculate an estimated exposure dose for arsenic [7]:

$$\text{Dose (mg/kg/day)} = \frac{\text{Concentration (mg/kg) x intake rate (mg) x exposure frequency x } 10^{-6}\text{ (kg/mg)}}{\text{body weight (kg)}}$$

Hazard quotients (HQs) were calculated[2] to compare estimated exposure doses to ATSDR minimal risk levels (MRLs). MRLs are considered to be safe doses at which no harmful health effects are expected. If an HQ is less than 1, the estimated exposure dose is below the health guideline and adverse non-cancer health effects are not expected. If an estimated exposure dose exceeds a health guideline, the dose is then compared to known carcinogenic and non-

[1] Standard exposure dose assumptions include children (age 0–21 years) weighing 9.2 to 71.6 kilograms (kg) ingesting 60 to 100 milligrams (mg) of surface soil per day and an 80 kg adult (older than 21 years) ingesting 50 mg of surface soil per day. The exposure frequency was 1, indicating a daily exposure. Bioavailability was 100%.
[2] The hazard quotient is calculated by dividing the estimated exposure dose by the minimal risk level (MRL).

carcinogenic health effect levels found in the scientific literature. These comparisons are used to determine if adverse health effects are possible and if the exposure poses a health hazard.

An estimated lifetime cancer risk was calculated for arsenic, which is a known carcinogen. Estimated cancer risk for arsenic was calculated using the following formula:

$$\text{Risk} = \frac{\text{Dose (mg/kg/day) x cancer slope factor (mg/kg/day)}^{-1} \text{ x exposure (years)}}{\text{Lifetime (years)}}$$

The cancer risk was estimated for children exposed from birth to 21 years as these are the most sensitive ages for exposure. These exposures were averaged over a lifetime of 78 years.

Estimated exposure doses for children were calculated assuming daily exposures to arsenic in soil. Based on the calculated exposure point concentration (EPC) of arsenic in surface soil (8.4 mg/kg), the daily estimated exposure doses for children range from 0.00001 – 0.00007 mg/kg/day [Table 2]. The highest estimated exposure dose (0.00007 mg/kg/day) is for children between 1 to less than 2 years of age.

Table 2. Estimated exposure doses and hazard quotients (HQs) for children (age 0–21 years) exposed daily to arsenic in surface soil

Metals	Exposure Point Concentration (mg/kg)[a]	Estimated Exposure Dose (mg/kg/day)	Health Guideline (mg/kg/day)	Hazard Quotient	Non-Cancer Risk Conclusion
Children (age 0–21 years)					
Arsenic[b]	8.4	0.00001 – 0.00007	0.0003 – MRL	0.04 – 0.2	No further evaluation

mg/kg – milligrams per kilogram are equivalent to parts per million (ppm)
mg/kg/day – milligrams per kilogram per day
MRL – minimal risk level
[a] The percent upper confidence level (UCL) is used as the exposure point concentration in order to assess a site-specific exposure scenario.
[b] To be protective of human health, DSHS assumed that the arsenic was in the more toxic inorganic form.

Estimated exposure doses for children were below the chronic oral MRL for arsenic (0.0003 mg/kg/day). The MRL was derived from a study where no observable adverse effects were noted in humans exposed to 0.0008 mg/kg/day arsenic in drinking water [8]. Because the estimated exposure doses were below levels at which non-cancer health effects have been observed, exposure to arsenic in soil is not likely to pose non-cancer human health risks.

Arsenic is considered a human carcinogen by both oral and inhalation exposure routes [8]. The estimated cancer risk for children (exposed to arsenic in surface soils for 21 years – birth to 21 years) per site-specific information was calculated to be 1.1×10^{-5} [Table 3]. This result means that there is a potential excess of lifetime cancer of 1.1 cases per 100,000 children following an exposure period of 21 years. This result represents a no apparent health hazard, thus exposure to arsenic in soil is not likely to result in adverse health effects.

Table 3. Cancer risk estimates for children (age 0-21 years) exposed daily to arsenic in surface soil					
Metals	**Exposure Point Concentration (mg/kg)[a]**	**Estimated Exposure Dose (mg/kg/day)**	**Cancer Slope Factor $(mg/kg/day)^{-1}$**	**Estimated Cancer Risk**	**Cancer Risk Conclusion**
Children (age 0-21 years)					
Arsenic[b]	8.4	0.00001 – 0.00007	1.5	1.1×10^{-5}	Low increased risk for cancer

mg/kg – milligrams per kilogram are equivalent to parts per million (ppm)
mg/kg/day – milligrams per kilogram per day
[a] The 95 percent upper confidence level (UCL) is used as the exposure point concentration in order to assess a site-specific exposure scenario.
[b] To be protective of human health, DSHS assumed that the arsenic was in the more toxic inorganic form.

Community Outreach

In response to continued community concerns, DSHS and Galveston County Health District (GCHD) staff conducted a site visit and an educational outreach campaign with residents and gathered health concerns in the neighborhoods that were potentially impacted by the January release. Staff went door-to-door and distributed approximately 1,500 informational flyers (Appendix A) and spoke with 206 residents, which is approximately 14% of the defined communities.

Based on the information collected, approximately 20% of the participants were not aware that the release had occurred and approximately 25% reported they had health concerns possibly related to the January air release. These are discussed below.

Health concerns

Residents stated they had experienced one or more of the following: respiratory irritation, throat irritation, cough, congestion, bronchitis/wheezing, an increased occurrence of asthma, skin irritation including unknown rashes, eye irritation, running nose, and/or, a metallic taste in their mouth.

DSHS concluded that people with compromised immune systems or respiratory sensitivities (e.g. asthma, chronic obstructive pulmonary disease [COPD]), especially when breathing at higher rates (e.g. exercising) may have had an increased chance of irritation from catalyst dust during the time of the event. However, the duration of exposure would have been minimal due to a heavy rain event that occurred two days after the release. Therefore, DSHS does not suspect that individuals would have lasting health effects from exposures related to the dust that settled outside of homes.

Non-health related concerns

Many residents believe that there should be some type of warning system in place for early notification when an event has occurred.

Texas City currently has an emergency notification system in place. Residents can sign up to receive timely notifications by phone, email, and/or text messages through the Texas City Emergency Management office. The alert system sends out important alerts, warnings and

instructions related to chemical spills, accidental chemical releases, or weather related situations [9]. Residents that would like to sign up for the alert system can go to the following webpage: https://texascitytx.bbcportal.com/.

Many residents were concerned whether or not it was safe to eat fruits and vegetables from their gardens.
DSHS concluded that exposure through eating fruits and vegetables is negligible based on the concentrations found in the soil. As a general precaution DSHS recommends that people wash their fruits and vegetables before eating.

Some residents were concerned that the catalyst released during the January 2015 event triggered health issues in their pets.
DSHS recommends that if residents are concerned about their pets that they speak with their veterinarians. Veterinarians interested in reviewing the contaminant levels recorded in the CTEH samples may contact DSHS at 1-800-588-1248 or epitox@dshs.state.tx.us.

DSHS and GCHD staff was asked whether or not it was safe to eat fish caught from the Galveston Bay in the Bayou Vista area. According to some residents, the catalyst blew across and settled into the bay and the runoff from homes being power washed flowed in the bay.
There were no data collected from the bay to test for catalyst residue. Although it is not related to the Marathon release, residents should be aware that there is a current fish consumption advisory (Advisory 50), issued on June 26, 2013, for Galveston Bay and adjoining waters that includes Chocolate, East, Trinity, and West Bays. Consuming blue crab, all catfish species, and spotted seatrout from the Galveston Bay Estuary may pose a human health risk. For more information please visit: http://www.dshs.state.tx.us/seafood/

Some residents wanted to know if the catalyst dust could be in their air condition units and if so, what they should do about it.
It is possible that some of the catalyst dust settled into air-conditioning units outside the homes. However, the heavy rains that occurred two days after the release would have washed most of the dust out of the units. In addition, it is not likely that dust from the outdoor unit would have gotten into the home. Therefore, this is an unlikely source of exposure.

Conclusions
Based on the January 15, 2015, sampling results collected by the Center for Toxicology and Environmental Health, L.L.C., the Texas Department of State Health Services concluded that exposure to contaminants in the surface soil, surface water, wipe samples, and air samples, is not likely to result in adverse health effects for adults or children.

Recommendations
Based on the review of the available data, DSHS has no recommendations at this time. However, if residents are concerned about their health, they should consult with their personal health care provider.

If you have additional questions regarding this letter, please contact me at 512.776.2932.

Sincerely,

Tina Walker
Information Specialist
Public Health Assessment and Consultation Program
Texas Department of State Health Services

References

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8. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Arsenic. United States Department of Health and Human Services, Public Health Service. August 2007.
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ACRONYMS

ATSDR	Agency for Toxic Substances and Disease Registry
COPC	contaminant of potential concern
COPD	chronic obstructive pulmonary disease
CSF	Cancer slope factor
CTEH	Center for Toxicology and Environmental Health, L.L.C.
CV	comparison value
DSHS	Texas Department of State Health Services
EMEG	environmental media evaluation guide
EPA	Environmental Protection Agency
EPC	Exposure point concentration
FCC	fluidic catalytic cracking
GCHD	Galveston County Health District
HQ	hazard quotient
kg	kilogram
kg/mg	kilograms per milligram
mg	milligram
mg/day	milligrams per day
mg/kg	milligrams per kilogram
mg/kg/day	milligrams per kilogram per day
mg/m^3	milligrams per cubic meter
MRL	minimal risk level
ppm	parts per million
UCL	upper confidence level

APPENDIX A – DSHS Informational Flyer

TEXAS Department of State Health Services

On January 13, 2015, an air release occurred at the Blanchard (Marathon) Galveston Bay Refinery in Texas City and drifted over the Bayou Vista, Omega Bay, and the Highlands Bayou neighborhoods.

Residents had questions about the potential health effects related to the release. In response, the Texas Department of State Health Services (DSHS) has been asked to conduct a door-to-door survey to gather and address community concerns.

Staff from DSHS and the Galveston County Health District will be in your neighborhood to speak with residents on the following dates:

On June 1-4, 2015, staff will be available to speak with you:

- in person (at your residence);
- by telephone at 512-981-8397 or 512-981-8415; or
- at the Bayou Vista Community Center from 5:30 p.m. – 7:30 p.m. 783-C Marlin Street (corner of Marlin Street & Neptune Drive)

Texas Department of State Health Services
PO Box 149347 MC 1964
Austin, Texas 78714-9347

Tom Ellerbee, Manager
Public Health Assessment and Consultation Program

1-800-588-1248 ext. 6039
tom.ellerbee@dshs.state.tx.us