

Health Consultation

Ambient Air Assessment of Dundee Neighborhood Omaha, Douglas County, Nebraska

August 19, 2004

**U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333**

Background

The Douglas County Health Department (DCHD) requested the Agency for Toxic Substances and Disease Registry (ATSDR) to evaluate available ambient air data collected in a mixed-use community (Dundee Neighborhood) and to determine if these measured air concentrations of semi-volatile organic compounds (SVOCs) were present at levels likely to pose a public health hazard. This request was presented to members of ATSDR's Strike Team on July 20, 2004, through ATSDR's Division of Regional Operations (Sue A. Casteel, Division of Regional Operations, ATSDR, Region 7) to ATSDR Strike Team, Division of Health Assessment and Consultation, ATSDR. Strike Team Request, 2004.

The Question to ATSDR is: Do airborne semi-volatile organic compounds (SVOCs) present a health hazard for the community?

The Dundee Neighborhood is located about three miles west of downtown Omaha, Nebraska, and comprises industrial, commercial, and residential areas. Residents living near the industries located in the Dundee Neighborhood have complained about odors emanating from these industries. These complaints of foul odors have generated health concerns among the residents that include respiratory problems (e.g., asthma), burning eyes and throat, and other general health-related complaints.

ATSDR previously assessed ambient air concentrations of metals, SVOCs, and volatile organic compounds (VOCs) measured in the Dundee Neighborhood during April 2003 (ATSDR 2003a). ATSDR concluded that the levels of SVOCs, VOCs, and metals measured in the ambient air during April 2003 did not present a public health hazard for the residents of the Dundee Neighborhood. ATSDR noted that the ambient air data for April 2003 did not entirely exclude the possibility that higher concentrations of some air substances could occur during the work hours of the facility. The DCHD decided to conduct follow-up air sampling events during October 2003 and April 2004, mainly focusing on SVOCs (i.e., probable sources of odors based on an assessment of air releases from the industries located in the Dundee Neighborhood).

Discussion

As a follow-up measure and part of an ongoing 2-year ambient air study to address health concerns of the residents in the Dundee Neighborhood, DCHD collected additional ambient air samples from the Dundee Neighborhood during October 2003 and April 2004 on three separate and distinct days (October 29th, April 14th, and April 28th). DCHD placed three ambient air samplers in the Dundee Neighborhood and another sampler approximately 15 miles away in an Omaha suburban neighborhood to provide background measurements. The samplers were placed in the following locations: 210 South 49th Street (station 1), 46th and Farnum Streets (station 2), 708 Saddlecreek Street (station 3), and 132nd and Q streets (station 4, background air monitor).

On each distinct day of sampling, DCHD operated the ambient air samplers for a 12-hour period to entrap or capture a representative air vapor sample. All ambient air samples were later sent to a laboratory operated by Eastern Research Group, Inc., (ERG) for chemical analysis. ERG analyzed the ambient air samples for SVOCs only. Upon completion of the analyses, ERG provided DCHD with a complete list of the detected constituents and their measured concentrations in air. (Note, the measured concentrations of the detected constituents in air represent a 12-hour time-weighted average.) ERG stipulated that all data met the daily quality objectives as outlined in their Quality Assurance Project Plan for the analyses performed and that the company considered the data to be acceptable for reporting (Julie L. Swift, Eastern Research Group, Inc., to Tom Baker, Douglas County Department of Health, Letter, July 20, 2004).

October 2003 Ambient Air Data

Chemical analyses of the air samples collected during October 2003 showed the presence of 22 SVOCs (see attached spreadsheet), which were further categorized into three subclasses: phenols, phthalates, and polycyclic aromatic hydrocarbons. ATSDR compared the detected levels with air comparison values (CVs), which are used for screening purposes only to identify substances that warrant further evaluation. Of the substances detected in the air samples, none were selected for further public health evaluation because none of the detected levels exceeded air CVs.

April 2004 Ambient Air Data

Chemical analyses of the air samples collected during April 2004 also showed the presence of 22 SVOCs that fell into three subclasses: phenols, phthalates, and polycyclic aromatic hydrocarbons. Of the substances detected in the air samples, only two (bis(2-ethylhexyl)phthalate and naphthalene) were selected for further public health evaluation because their maximum detected levels exceeded air CVs.

Public Health Implications

Below is a discussion of the public health implications that could plausibly result from exposures to two airborne substances, bis(2-ethylhexyl)phthalate and naphthalene. Both were selected for further public health evaluation because their maximum detected concentrations exceeded air comparison values during April 2004 (see attached spreadsheet of results). Although the relative toxicity of a chemical is important, the response of the human body to a chemical exposure is actually determined by several additional factors, including the magnitude of the exposure (how much), the duration of the exposure (how long), and the route of the exposure (breathing, eating, drinking, or skin contact). Lifestyle factors (e.g., occupation and personal habits) have a major impact on these three elements of exposure. After exposure has occurred, individual characteristics such as age, sex, nutritional status, overall health, and genetic constitution will affect how a chemical is absorbed, distributed, metabolized, and eliminated from the body.

Together, all these factors help determine a person's physiological response to chemical exposures and the adverse health effects, if any, that the person may suffer as a result of the chemical exposures.

The comparison value for bis(2-ethylhexyl)phthalate is based on long-term exposures rather than on short-term exposures. Therefore, the comparison value for bis(2-ethylhexyl)phthalate is an average, not a maximum. Because the maximum concentration of bis(2-ethylhexyl)phthalate was not sustained and because the average is much lower than the comparison value, long-term exposures are also expected to be much lower than the comparison value.

Furthermore, no available scientific studies exist on cancer in humans following inhalation exposure to bis(2-ethylhexyl)phthalate; however, lifetime exposure of hamsters to $15 \mu\text{g}/\text{m}^3$ of bis(2-ethylhexyl)phthalate did not result in any significant increases in the incidence of tumors (Schmezer et al. 1988, ATSDR 2002). This non-significant level of exposure for cancerous effects is 18 times higher than the maximum detected concentration of bis(2-ethylhexyl)phthalate ($0.81 \mu\text{g}/\text{m}^3$).

ATSDR's chronic EMEG (Environmental Media Evaluation Guide) for naphthalene in air is $3.7 \mu\text{g}/\text{m}^3$. The maximum detected concentration of naphthalene in air in the Dundee Neighborhood was approximately twice as much ($7.48 \mu\text{g}/\text{m}^3$). Again, chronic comparison values are based on average exposure and not on peak exposure. The average levels of naphthalene were much lower than the comparison value.

Additionally, ATSDR's EMEG for naphthalene contains a built-in uncertainty (safety) factor of 300. In other words, the EMEG is 300 times lower than the LOAEL (Lowest Observed Adverse Effect Level). EPA's comparison value (RfC) is slightly more conservative; it is $3 \mu\text{g}/\text{m}^3$ and includes an uncertainty (safety) factor of 3000 (IRIS 2004).

In essence, the air concentrations of both bis(2-ethylhexyl)phthalate and naphthalene detected in the Dundee Neighborhood were all well below levels known to cause any adverse health effects, and the average exposures are expected to be below the comparison values.

Limitations

No air CVs were available for two polycyclic aromatic hydrocarbons (PAHs), acenaphthylene and phenanthrene, which were also detected in air samples collected during October 2003. Because the detected levels of acenaphthylene and phenanthrene were below the air CVs for the five PAHs of similar toxicity (true both for air samples collected during October 2003 and April 2004), ATSDR did not select these airborne substances for further public health evaluation.

This Health Consultation addresses chronic and acute exposures. Acute exposures were calculated using the maximum concentrations in the 12-hour samples. The shortest animal (no human data available) exposure study for naphthalene (the most odorous PAH detected) was 4 hours. If the maximum concentration of $7.48 \mu\text{g}/\text{m}^3$ all occurred in 4 hours instead of 12, the worst case concentration would be $22.4 \mu\text{g}/\text{m}^3$ which is 3800 times less than the lowest level shown to create acute effects in rats and mice.

The consultation cannot address quality of life issues associated with odors. Although, the recent SVOCs samples are more representative of the facility operations, they may not be representative of the short term peaks associated with nuisance odors (less than 4 hours).

Nuisance odors are sometimes associated with transient acute effects, such as burning eyes and throat and hypersensitivity reactions in asthmatics. ATSDR's comparison values are developed to protect sensitive individuals and the general population from all known dose-dependent adverse effects. However, some individuals develop hypersensitivity to substances and therefore their response is strongly affected by factors other than dose. Those hypersensitive individuals may react adversely to even trace levels of odorous compounds, levels of which would not effect the general population.

Conclusions

- 1) The SVOCs measured in the air in the Dundee Neighborhood do not present a potential health hazard for residents.
- 2) Extrapolating from the available 12-hr sampling data, plausible peak exposures of such substances as naphthalene, bis(2-ethylhexyl)phthalate, and other potential irritants may account for residents' complaints of odors, burning eyes, runny nose, etc. However, even these peak exposures would not be expected to produce any lasting adverse health effects.

Recommendations

None

References

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3. Agency for Toxic Substances and Disease Registry. 2003a. Omaha Steel Castings. Public Health Consultation (final). Atlanta: US Department of Health and Human Services.
4. Agency for Toxic Substances and Disease Registry. 2003b. Toxicological profile for naphthalene (public comment). Atlanta: US Department of Health and Human Services.
5. Schmezer P, Pool BL, Komitowski D, et al. 1988. Various short-term assays and two long-term studies with the plasticizer di(2-ethylhexyl)phthalate in the Syrian golden hamster. *Carcinogenesis* 9(1):37-43.
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