Benzene: Effects of Refinery Air Pollution on Texas City Residents

Eleanor Hethcox

Texas Woman’s University

Spring 2014
Benzene: Effects of Refinery Air Pollution on Texas City Residents

Air pollution has been a major concern for many residents in highly industrialized cities. Exposure to such environmental hazards have serious ramifications for society, health and the economy (Friis, 2014). Environmental exposures are thought to be responsible for 19 percent of all cancers globally (2014) and the World Health Organization estimates that environmental factors are linked to 24 percent of the global burden of disease (2014).

Many refineries and oil companies such as Marathon, British Petroleum, Shell and Valero, line the major highways and farm roads of Texas and produce and release toxic chemicals in the air. Cities such as Pasadena, Texas City and Deer Park are a few that are home to such entities. Residents that live close to these refineries have legitimate concerns related to exposure to these harmful chemicals and the health hazards they pose.

In April of 2010, British Petroleum Refinery, released tens of thousands of pounds of toxic chemicals into the Texas City air. This release at BP Refinery began on April 6 and lasted approximately 40 days (Knutson, 2010). According to Neil Carman, a former Texas regulator, the release was giant over the 40 day period (2010). The release stemmed from their decision to continue producing and selling gasoline while attempting to repair equipment (2010). BP estimates that over 500,000 pounds of chemicals escaped from the refinery during the 40 day period which included 17,000 pounds of benzene, 37,000 pounds of nitrogen oxides, and 186,000 pounds of carbon monoxide (2010).

Over the years, many Texas City residents have unknowingly been exposed to unacceptable levels of benzene and other air pollutants. These pose serious risks to their health and well-being, but many continue to reside in this highly industrialized city. In this paper, I will describe one of the major pollutants that was released by a well-known refinery, discuss the
health risks and effects of this pollutant on the human body, personal action taken in the community to address this issue and discuss lessons learned from this experience.

**Benzene**

Benzene is one of the 20 most widely used chemicals in the United States. It is a clear flammable and volatile liquid with a sweet odor that evaporates readily into the air and occurs naturally in crude oil and is used to make glues, lubricants, and certain prescription medications (TCEQ, 2013). It is also used as a solvent for fats, waxes, resins, oils, inks, paints, plastics and rubber. Benzene is also used to manufacture detergents, explosives, and dyestuffs (EPA, 2014).

**Benzene in the Environment**

Benzene can be found in the ambient air and water. It is found in the air from emissions from burning coal and oil, gasoline service stations and exhaust from motor vehicles (EPA, 2014). Tobacco smoke also contains benzene and accounts for almost 50% of the national exposure to benzene (2014).

In 2005, a task force of physicians, researchers and community health specialists was created to answer which ambient air pollutants were most likely to cause significant health risks for current and future residents of Houston (Wolf, 2012). The findings from this task force were significant for benzene there was compelling and convincing evidence of significant risk to the general population or vulnerable subgroups at current ambient concentrations (2012).

The Occupational Safety and Health Administration (OSHA) limits workers' exposure to benzene to 1 part per million over an eight-hour shift or up to 5 parts per million over a 15-minute time period (TCEQ, 2013).

**Monitoring Benzene**
Agencies involved in the monitoring of benzene and other pollutants and chemicals released by refineries include the Environmental Protection Agency, the Texas Commission on Environmental Quality, and the Galveston City-County Health Department. The TCEQ has conducted mobile monitoring projects and has evaluated ambient benzene concentrations in Texas City (TCEQ, 2013). Other individual companies in Texas City sponsor four other monitoring sites pursuant to individual enforcement agreements with the TCEQ, the EPA and the U.S. Department of Justice. They are located in several areas throughout the refinery and just outside the refineries in residential areas. The TCEQ evaluates concentrations of air toxics through AMCVs which are screening values that are chemical-specific air concentrations that are designed to protect human health and welfare (2013). The short term, health-based AMCV for benzene is 180 ppbv and for long-term it is 1.4 ppbv.

Benzene was one pollutant of interest because of its increase in concentrations or AMCV. The annual average benzene concentration at one of the Texas City monitors had exceeded the long-term, health-based AMCV listed above. Until recently, before BP was sold to Marathon, another refinery, the concentration of benzene increased until just last year, March of 2013 (2013).

**Effects of Benzene on the Body**

Benzene has been designated as a human carcinogen by several agencies including the Texas Commission on Environmental Quality, the Environmental Protection Agency, the National Toxicology Program and the International Agency for Research on Cancer (TCEQ, 2013). Biologically, exposure to benzene produces genetic changes and toxic effects of exposure can occur at air levels of 1 part per million or less which suggests that even low levels of exposure can be harmful (Bulka, 2013). Environmental exposure can lead to deleterious effects
on many systems including bone marrow, liver and kidneys (Singh, 2013). Acute inhalation exposure of humans to benzene may cause drowsiness, dizziness, headaches and eye, skin and respiratory tract irritation. At high levels, benzene may also cause unconsciousness.

Chronic effects of benzene exposure include aplastic anemia which is a risk factor for acute nonlymphocytic leukemia, excessive bleeding, immune system damage due to decreases of antibodies in the blood and loss of white blood cells (EPA, 2014). It also causes structural and numerical chromosomal aberrations in humans.

In a study published in Environmental Health Perspectives, studies suggest a link between benzene exposure and spina bifida and childhood leukemia. Another study analyzed 977 cases of childhood leukemia in 866 census tracts surrounding Houston, TX and researchers found that these tracts with the highest ambient air levels of benzene had “elevated rates of leukemia compared with census tracts with the lowest estimated levels” (Wolf, 2012).

**Community Action**

In order to take community action, I personally interviewed all patients who were residents of Texas City and all those employed by the refineries and asked questions about symptoms or exacerbations of symptoms in the last four years since the BP release of chemicals. I also interviewed family members of patients who were currently residents of Texas City and were living there in April of 2010. Though most had some level of awareness of the potential dangers of hazardous air pollution, almost all of them had no idea what benzene was nor could they name any of the air or water pollutants. Approximately 80 percent of the persons interviewed could list cancer as a possible outcome of exposure, but could not definitely describe any signs or symptoms indicative of acute or chronic exposure.
Impact on Community Health

Interviewing patients and their family members about their knowledge of the release of chemicals into the air surrounding the plants increased resident awareness of the severity of the issue. From my personal assessment, I proposed to my clinical director an awareness program that includes a list of agencies that monitor air quality and emissions and an educational pamphlet that lists pollutants in the residential areas surrounding Texas City. In all, I believe I made a small but positive impact on the residents who are patients in my clinic.

Reason for choosing this topic and lessons learned

The topic chosen for this assignment was highly influenced by the history of accidents at the refineries of Texas City and especially by personal interactions with patients at my clinic located just a few blocks away from the refineries in Texas City. I reside in the same county just south of the plants and drive by them daily. Many of the patients seen in clinic are plant workers who at one time worked for BP who now work for Marathon. Among this patient population, I noticed many of them had similar symptoms including migraine headaches, high blood pressure, generalized aches and pains and CBC profiles that were not within normal limits.

This assignment allowed me the opportunity to interview residents and research environmental concerns that my patients have related to working and living near these refineries. I learned that many of those that I interviewed had moderate concerns related to toxic chemicals released in the air and that many generally felt safe. Their concerns included: possible explosions, air and water contamination and risk of developing cancer or other illness due to exposure.
Finally, this assignment raised my awareness of air pollution in the Texas City area and expanded my limited knowledge of the different agencies involved in monitoring and enforcing the laws and regulations related to refineries and their emissions.
References


