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An Open Letter to the Community of West Wichita

October 5, 2015

Dear Community Member,

This letter summarizes progress on the current disease cluster investigation by the Kansas Department of Health and Environment (KDHE). This investigation was undertaken in response to community concerns regarding environmental contamination in West Wichita and the number of persons associated with the affected area that have developed cancers and birth defects.

Executive Summary

KDHE found groundwater contamination in a West Wichita neighborhood, which impacted domestic water wells. Tetrachloroethylene, commonly referred to as PCE, was the primary chemical detected in the contamination. Based on current information, there is no indication that PCE groundwater contamination is linked to increased cancer rates or birth defect rates in the neighborhood.

Background

On April 10, 2014, the Kansas Department of Health and Environment held a public meeting to discuss an ongoing investigation into what is now known to be groundwater contamination near and downgradient from the locations of two separate dry cleaning facilities. One dry cleaning facility was established in 1962 and the other in 1968; therefore, it is possible that the contamination at the facilities began as early as 1962. The chemicals would likely take many years to work through the soil and into groundwater that would eventually impact residential properties to the south and southwest of the dry cleaners.

In response to these concerns, KDHE developed an investigation design that entailed: 1) gathering information on the contaminants of concern, possible routes of exposure to the contaminants, and potential health effects, 2) created a database of addresses in the area of interest and the current title owners and searched records from the Kansas Cancer Registry for both the addresses and names of the title owners, 3) used the database of addresses in the area of interest and searched the Kansas Birth Defects Information System for the addresses, and 4) drew conclusions from the available data.

Contaminants of concern, possible routes of exposure, and potential health effects

Volatile organic chemicals (VOCs) are liquid or solid chemicals that can easily evaporate into gases and are a significant source of pollution in the environment. These chemicals are sometimes found in groundwater beneath certain industrial businesses, such as dry cleaners. Tetrachloroethylene, also known as PCE, is a VOC commonly used at dry cleaning facilities. Trichloroethylene, also known as TCE, is a breakdown product of PCE. In the case of West Wichita, groundwater is contaminated with both PCE and TCE. Tetrachloroethylene (PCE) evaporates quickly from water into the air. Trichloroethylene (TCE), on the other hand, does not evaporate easily from water so it can remain in groundwater for long periods of time. PCE and TCE in groundwater may cause health concerns for people who depend on well water for domestic purposes such as drinking, cooking, showering, laundry, and other household uses inside the home. Furthermore, both PCE and TCE can move through groundwater or soil and into the air of homes and other buildings through a process called vapor intrusion.

Exposure to contaminants, PCE and TCE in this specific situation, can occur when a person breathes (inhalation), eats or drinks (ingestion), or touches (dermal) the chemicals. It is important to remember that, even if a person is exposed, they might not be harmed. Whether or not the contaminants cause harm will depend on a number of factors, including how much of the chemicals a person was exposed to (dose), how long they were exposed (duration), and how they were exposed (inhalation, ingestion or dermal). The health effects may also depend on other factors such as age, sex, diet, family traits, lifestyle, general health status, and exposures to other contaminants.

Most of the tetrachloroethylene (PCE) and trichloroethylene (TCE) that enters the body through breathing, eating or drinking will enter the bloodstream and enter into other organs. A much smaller amount can enter into the body through the skin. Once in the bloodstream, most of the contaminants will be breathed out very quickly and the breakdown products leave through the urine. If a person is exposed to PCE and TCE repeatedly, some may become stored in body fat and build up over time. Once the exposure stops, the body will slowly eliminate the contaminants stored in fat.[1-2]

Short-term exposure to air with high levels of PCE may cause dizziness, headaches, and may even cause unconsciousness or death. Long-term exposure to low levels of PCE may cause changes in mood, memory, and vision. Some health studies have suggested that exposure to PCE in humans may cause an increased risk of bladder cancer, multiple myeloma, and non-Hodgkin's lymphoma[1] and other studies of people exposed to high levels of tetrachloroethylene have found small increases in the risk of developing breast cancer[3] and lung cancer.[4] Some research in animals has shown an increased risk of cancer of the liver, kidney and blood.[1]

Studies have shown that women who worked as dry cleaner and laundry workers and were exposed to tetrachloroethylene during the first trimester of pregnancy experienced an increased risk of miscarriages.[5] There is no strong evidence to support an increase in heart, oral cleft or neural tube defects among babies born to women exposed to tetrachloroethylene.[1] A study of births during 1968-1985 at Camp Lejeune, a site where drinking water was contaminated for many years with tetrachloroethylene, trichloroethylene and benzene, found a small increased risk of preterm births for women exposed to the highest level of PCE during their entire pregnancy.[6]

Short-term exposure to air with moderate levels of TCE may cause dizziness, headaches, and sleepiness. Exposure to large amounts may cause damage to the nerves in the face, changes in heartbeat, liver and kidney damage, coma or death. Health studies have shown that exposure to TCE in humans may cause cancers of the kidney and liver, as well as malignant lymphoma. Research in animals has also shown an increased risk of liver and testicular cancer.[2]

A study of maternal exposure to trichloroethylene through soil vapor intrusion found an increased risk for low birth weight, small for gestational age, term low birth weight, cardiac defects, and conotruncal defects associated with trichloroethylene contamination.[7] The study of Camp Lejeune birth during 1968-1985 also found that women exposed to the highest TCE category during the entire pregnancy experienced an increased risk for small for gestational age babies.[6]

Cancer Incidence Analysis

The first step in the cancer incidence analysis was to create a database of the 600 addresses in the area of interest and the current title owners. Based on the history of environmental contamination, the cancers included in this investigation were: bladder (including in situ), liver and biliary tree, kidney and renal pelvis, female breast, lung and bronchus, multiple myeloma, and non-Hodgkin's lymphoma. Information on Sedgwick County residents diagnosed with any of these cancers between 2002 and 2011 were requested from the Kansas Cancer Registry. This timeframe represents cancer diagnoses verified by the Kansas Cancer Registry and is the most recent database of certified data. The data from the cancer registry was then searched for any patients listing the addresses in the area of interest as their residential address at the time of diagnosis and for the names of the current title owners. In counting the number of cancer cases, only the first diagnosis of cancer was counted. If a person was diagnosed with one type of cancer, which later became another type of cancer, only the first diagnosis was counted.

An incidence rate is the rate of occurrence of new cases diagnosed within a specific time period. Age adjustment is a statistical process applied to rates of disease, death, injuries or other health outcomes that allows communities with different age structures to be compared. Age-adjusted incidence rates are presented here for the area of interest, Sedgwick County, Region 5 (which includes Harvey, Reno, McPherson, and Sedgwick counties) and Kansas. In addition to the age-adjusted incidence rates, 95% confidence intervals are provided for the rates. A confidence interval is the range around a measurement that conveys how precise the measurement is. If the confidence intervals for the rates do not overlap, the rates are said to be statistically significantly different. Incidence rates are not calculated for specific types of cancers that have fewer than 16 cases because the calculated rate would be statistically unstable.

Searching the Kansas Cancer Registry data for patients listing the addresses in the area of interest as their residential address at the time of diagnosis yielded 58 cases for all of the target cancers combined (Table 1). Searching the registry for title owner names yielded an additional 27 cases for all of the target cancers combined. Based on the number of cases, incidence rates were calculated for female breast (Table 2), lung and bronchus (Table 3), and all target cancers combined (Table 4).

Between 2002 and 2011, for the area of interest, the age-adjusted incidence rate of female breast cancer was 59.20 cases per 100,000 population (95% CI: 36.13-82.28) (Table 2). The rate for the area of interest was statistically significantly lower than the rates for Sedgwick County, Region 5, and Kansas during the same time period.

For the area of interest, the age-adjusted incidence rate of lung and bronchus cancer (29.52 cases per 100,000 population, 95% CI: 16.98-42.07) was statistically significantly lower than the rates for Sedgwick County, Region 5, and Kansas during the same time period (Table 3).

Similarly, for the area of interest, the age-adjusted incidence rate for all target cancers (79.13 cases per 100,000 population, 95% CI: 59.30-98.97) was statistically significantly lower than the rates for Sedgwick County, Region 5 and Kansas during the same time period (Table 4).

The previous analysis presented the age-adjusted incidence rates, which are useful for comparing different geographical areas. However, it should be noted that the rates for the area of interest may be statistically unstable because of the small number of cases and the small number of people living in the area. The wide 95% confidence intervals associated with each rate show the unstable nature of the rates.

An additional statistic, known as the Standardized Incidence Ratio (SIR), was calculated to determine if the observed number of a specific type of cancer was higher or lower than expected. This statistic is useful for assessing specific types of cancer with small numbers of cases. This additional analysis also showed the expected number of cases by specific age groups, which is important for assessing whether there was an excess of cancer in younger residents. A 95% confidence interval was calculated around the ratios to determine how likely it is that the number of observed cases is high or low by chance. If the confidence interval includes 1.0, then the difference between the observed and expected number of cases is likely to have occurred by chance. The SIR was calculated for bladder (including in situ), liver and intrahepatic bile duct, kidney and renal pelvis, female breast, lung and bronchus, multiple myeloma, and non-Hodgkin's lymphoma. For this analysis, incidence rates from the Surveillance, Epidemiology and End Results (SEER) Program were used to determine the expected number of cases by age group.

The observed number of bladder cancer cases in the area of interest was 61% lower than the expected number of cases (11 observed cases versus 28.15 expected cases) (Table 5). The observed number of kidney and renal pelvis cancers was 89% lower than the expected number of cases (2 observed cases versus 18.43 expected cases). The observed number of female breast cancer cases was 61% lower than the expected number of cases (31 observed versus 80.02 expected). The observed number of lung and bronchus cancer cases was 58% lower than the expected number of cases (34 observed versus 80.75 expected). The observed number of multiple myeloma cases was 50% lower than the expected number of cases (4 observed versus 7.99 expected). Finally, the observed number of non-Hodgkin's lymphoma cases in the area of interest was 88% lower than the expected number of cases (3 observed versus 24.68 expected). For all of the Standardized Incidence Ratios, because the 95% confidence intervals did not contain 1.0, the low number of observed cases is not likely to have occurred by chance.

Birth Outcomes Analysis

The Kansas Birth Defects Information System includes information on birth defects reported on birth certificates and by Kansas physicians caring for children with birth defects. The Birth Defects Information System records between 1985 and August 4, 2015 were searched for any matches between the mother's residential address and the list of addresses in the area of interest. Based on the history of environmental contamination, the investigation focused on the number and type of birth defects and the number of stillbirths.

Between 1985 and August 4, 2015, there were 35,803 records in the Kansas Birth Defects Information System. Based on a search of mother's residential address, 13 mothers listed addresses in the area of interest as their residential address. Of the 13 address matches, 12 infants were born with different birth defects and one was stillborn. None of the birth defects that were found were associated in the scientific literature with exposure to either tetrachloroethylene (PCE) or trichloroethylene (TCE).

Between 1985 and 2015, there were 898 births to women listing any of the 600 addresses in the area of interest as their residential address on the infant's birth certificate; therefore, birth defects affected approximately 1.4% of births in the area of interest. The overall prevalence of birth defects in the United States is approximately 3% of births.[8]

Conclusions

Based on the cancer incidence analysis, the rates of new female breast and lung and bronchus cancers in the area of interest were all statistically significantly lower than the rates for Sedgwick County, Region 5 (which includes Harvey, Reno, McPherson, and Sedgwick counties) and Kansas. Additionally, the number of observed cases of bladder (including in situ), liver and intrahepatic bile duct, kidney and renal pelvis, female breast, lung and bronchus, multiple myeloma, and non-Hodgkin's lymphoma cancers were all statistically significantly lower than the expected number. Based on the birth outcomes analysis, the evidence does not indicate an unusual number or types of birth defects.

The results of this preliminary investigation should be interpreted with an understanding of its limitations. The first step in this investigation was to create a database of the 600 addresses in the area of interest and the current title owners. For the cancer incidence analysis, patient's current residential address in the Kansas Cancer Registry was matched to the list of homes in the area of interest. This search only indicates that the patient lived in the area of interest at the time of diagnosis, and does not indicate how long they lived at the address. For cancer in general, there is typically a long period of time between when a person is exposed to a cancer-causing agent and when the cancer develops. In this preliminary investigation, a person who lived in the area of interest for one month would look the same as a person who lived in the area for 40 years, when in actuality their exposures would be quite different. The cancer incidence analysis also matched patient name in the Kansas Cancer Registry to the current title owners. The limitation of this process is that it assumes that the current title owners are also residents in the area of interest, when in actuality they might own a home in the area of interest without ever living in the area. And, in the situation where the title owner did live in the area of interest, this process does not allow for a clear indication that they lived in the area before they were diagnosed. A further limitation of the current analysis is that information on other factors that contribute to the occurrence of cancer, including diet, family traits, lifestyle, general health status, smoking status, and exposures to other contaminants, is not available through the Kansas Cancer Registry.

For the birth outcomes analysis, mother's residential address in the Kansas Birth Defects Information System was matched to the list of homes in the area of interest. Information on the mother's residential address is reported by mother's themselves on the birth certificate, and may not reflect the home that they actually lived in. Furthermore, this may not reflect where the mother lived during the first few weeks of her pregnancy, when the fetus would have been more susceptible to exposure to tetrachloroethylene (PCE) and trichloroethylene (TCE).

Plans for Future Study

The Kansas Department of Health and Environment is currently planning a more in-depth investigation into the health concerns arising from the West Wichita contamination. This in-depth investigation will help address questions that the current investigation was not able to answer due to the limitations previously discussed.

The next step in the investigation is to establish a more thorough database of people who were potentially exposed to tetrachloroethylene (PCE) and trichloroethylene (TCE) while living in the area of interest. This step involves using public records to establish the history of residency for each of the 600 homes in the area of interest between 1992 and 2014. Although the contamination of the area may have begun as early as 1962, the database will be limited to residents living in the area from 1992 onward because reliable Kansas Cancer Registry records begin in 2002 and investigators are assuming at least a ten-year latency period between the time of exposure and the development of cancer.

Once the database is established, the next step will be to develop a questionnaire that will be sent out to everyone who lived in the area of interest from 1992 to 2014. The questionnaire will focus on gathering information on all occupants of each home, including the length of time they lived in the home. The questions will also focus on characterizing the level

of each person's exposure. For example, questions about whether well water was used for drinking, cooking, showering, laundry, and other household uses inside the home help to distinguish between people who had low exposure versus people with high exposure. The questionnaire will also gather information on a number of health outcomes that are not captured by the Kansas Cancer Registry or the Kansas Birth Defects Information System.

Once the questionnaire is developed and approvals have been granted to conduct the survey, the questionnaire will be sent to everyone who lived in the area of interest from 1992 to 2014. This step in the investigation will likely take several months because non-responders will be approached numerous times and asked to participate. Also, if current addresses and phone numbers are incorrect or unavailable using public records, it may take a substantial amount of time to track people down. The goal is to have as close to 100% response as possible so that the results of the survey are not skewed by certain groups who decide to participate or not to participate.

Once the data from the questionnaire are analyzed, a report discussing the findings will be made publicly available. The report will include information on health outcomes that were not included in the preliminary investigation, and will also update the cancer incidence and birth defect prevalence analysis.

Depending on the results of the in-depth investigation, input from the community, and input from other stakeholders, a decision will be made to either end the investigation at this point or to continue monitoring the population. Continued monitoring of the population would involve creating an exposure registry from the information already gathered, and systematically updating the information over a prolonged period of time, usually years.[9] For a registry to be justified, the exposure must present a clear element of risk. After the second phase of the investigation, investigators will have a clearer assessment of individual's actual exposure to tetrachloroethylene (PCE) and trichloroethylene (TCE) and a clearer understanding of any increased risk of disease in the community.

We share your concern for the health of the West Wichita community. We recognize that every case of cancer and every adverse health outcome is significant for the person affected and his or her family. Within the limits of available resources, KDHE is extensively involved in efforts to reduce the occurrence of cancer in Kansas and improve the care for those in whom it does occur. Staff from our Bureau of Health Promotion can provide resources for members in your community who want information on how they can reduce the risk of cancer. We at KDHE are committed to monitoring, and helping improve, the health of our communities. If you have any questions about this report, please contact the Bureau of Epidemiology and Public Health Informatics at 785-296-1415. For more information about cancer prevention, please contact the Bureau of Health Promotion at 785-296-1207.

Sincerely,

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Table 1: Number of new cancer cases diagnosed in the area of interest, 2002-2011		
Sites	Number of cases identified by address search*	Number of cases identified by owner search*
Bladder (including in situ)	5	6
Liver and biliary tree	0	0
Kidney and renal pelvis	2	0
Female breast	22	9
Lung and bronchus	24	10
Multiple myeloma	3	1
Non-Hodgkin's lymphoma	2	1
All target cancers	58	27

* Data source: Kansas Cancer Registry

Table 2: Incidence rates for female breast cancer, 2002-2011			
Geographical Area	Total number of cases*	Age-adjusted rate† (per 100,000 population)	95% Confidence Interval (per 100,000 population)
Area of interest	31	59.20	36.13-82.28
Sedgwick County	3,842	166.62	161.81-171.44
Region 5	5,059	166.33	161.93-170.73
Kansas	23,281	164.37	162.29-166.45

* Data source: Kansas Cancer Registry

† Rates are age-adjusted to the 2010 US standard population with 18 age groups

Table 3: Incidence rates for lung and bronchus cancer, 2002-2011			
Geographical Area	Total number of cases*	Age-adjusted rate† (per 100,000 population)	95% Confidence Interval (per 100,000 population)
Area of interest	34	29.52	16.98-42.07
Sedgwick County	2,931	65.32	63.19-67.44
Region 5	3,860	63.73	61.79-65.67
Kansas	18,342	64.49	63.56-65.42

* Data source: Kansas Cancer Registry

† Rates are age-adjusted to the 2010 US standard population with 18 age groups

Table 4: Incidence rates for all target cancers, 2002-2011			
Geographical Area	Total number of cases*	Age-adjusted rate† (per 100,000 population)	95% Confidence Interval (per 100,000 population)
Area of interest	85	79.13	59.30-98.97
Sedgwick County	9,880	217.59	213.68-221.50
Region 5	13,220	217.92	214.32-221.52
Kansas	61,687	217.31	215.60-219.01

* Data source: Kansas Cancer Registry

† Rates are age-adjusted to the 2010 US standard population with 18 age groups

Table 5: Standardized Incidence Ratios for area of interest, 2002-2011				
Sites	Observed number of cases*	Expected number of cases†	Standardized Incidence Ratio	95% Confidence Interval
Bladder (including in situ)	11	28.15	0.39	0.16-0.62
Liver and intrahepatic bile duct‡	0	9.69	0.00	-
Kidney and renal pelvis	2	18.43	0.11	-0.04-0.26
Female breast	31	80.02	0.39	0.25-0.53
Lung and bronchus	34	80.75	0.42	0.28-0.56
Multiple myeloma	4	7.99	0.50	0.01-0.99
Non-Hodgkin's lymphoma	3	24.68	0.12	-0.02-0.26

* Observed number of cases in a 10-year period. Data source: Kansas Cancer Registry

† Expected number of cases in a 10-year period. Calculated based on age-specific cancer incidence rates from the Surveillance, Epidemiology, and End Results (SEER) Program (2003-2012)

‡ This category was recoded to match SEER (21071 and 21072 combined)

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