

HEALTH CONSULTATION
TEXAS VOLUNTARY CLEANUP PROGRAM No. 538
TRICHLOROETHYLENE GROUNDWATER PLUME
EL CAMPO, WHARTON COUNTY, TEXAS

Prepared By:

Texas Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

SUMMARY

Recently, elevated levels of trichloroethylene (TCE) have been found in residential drinking water wells in the West Hills subdivision of El Campo, Texas. The source of the TCE is suspected to be a 48-acre former aluminum extrusion plant. Ownership of the plant has changed several times since it was built in 1963. Alcoa currently owns the facility.

On April 26, 2002, Alcoa asked the Texas Department of Health (TDH) to provide information on liver and kidney cancer rates for the area as there have been some reports in the literature of associations between exposure to TCE and these types of cancer. The TDH Cancer Registry Division (CRD) evaluated cancer incidence and mortality data for the zip code 77437, which encompasses the area of concern. CRD examined cancer incidence data for the years 1995-1998 and cancer mortality data for the years 1995-2000.

Both the incidence and mortality rates for kidney cancer in females living in this zip code were significantly higher than expected. The standardized incidence ratio (SIR) for kidney cancer was almost four times higher than the state rate while the standardized mortality ratio (SMR) for kidney cancer was over three times the state rate.

A plot of the individual cases shows no evidence of a spatial clustering of cases in the area of the groundwater contamination. While these data suggest that the kidney cancer cases do not appear to share a common exposure to TCE through contaminated residential drinking water wells, the addresses used only represent residence at the time of diagnosis; residential history is unknown.

TDH will explore the feasibility of obtaining a residential history for each of the cases and will continue to monitor kidney cancer rates for this area as more data become available.

Regardless of the cancer findings, TDH and ATSDR have concluded that the TCE in the residential well water poses a public health hazard.

BACKGROUND AND STATEMENT OF THE ISSUES

Recently, elevated levels of trichloroethylene (TCE) were found in residential drinking water wells in the West Hills subdivision in El Campo, Wharton County, Texas (Figure 1). One possible source of the TCE is thought to be a 48-acre aluminum extrusion plant initially built in 1963 by May Aluminum. The facility has changed ownership on several occasions. It was sold to Whittaker Metals in 1968 and in 1972 it was purchased by Reynolds Metals who entered the site into the Texas Voluntary Cleanup Program (VCP) in 1997. In 2000, Alcoa purchased Reynolds Metals.

A total of 209 drinking water wells (59 business and 150 residential wells) have been sampled. As of this writing, 68 residential wells (32%) were found to be impacted with TCE and other solvents above the detection limits. TCE concentrations in the residential wells ranged from non-detect to 111 micrograms per liter (Fg/L) or 111 parts per billion (ppb). Thirty-three of the impacted wells had levels above the drinking water standard of 5 parts per billion (ppb). Figure 2 shows the distribution of TCE found in the residential wells. Concentrations as high as 1,700 ppb were found in business wells.

On April 26, 2002, Alcoa asked the Texas Department of Health (TDH) to provide information on liver and kidney cancer rates for the area. Given the nature of the contaminant, TDH concluded that a review of the cancer statistics for these two types of cancer was warranted. According to the U.S. Department of Health and Human Services National Toxicology Programs 9th Report on Carcinogens, TCE is reasonably anticipated to be a human carcinogen. This classification is based on limited evidence of carcinogenicity from studies in humans, sufficient evidence of malignant tumor formation in experimental animals, and convincing relevant information that TCE acts through mechanisms indicating that it may cause cancer in humans. Although the epidemiologic data for evaluating the carcinogenicity of TCE in humans is limited, studies have suggested that occupational exposure to TCE may cause liver and kidney cancer. The target organs for TCE-induced tumors appears to be consistent between humans and rodents. In mice, TCE increases tumors of the liver. In rats, TCE induces cancer of the kidneys [1]. In general, the associations between exposure to TCE and cancer are suggestive, but inconclusive.

Based on available information, the Agency for Toxic Substances and Disease Registry (ATSDR) has concluded that cancer should be a concern for people exposed to TCE in the environment and at hazardous waste sites [2]. Qualitatively, based on the cancer potency factor currently under review by the U.S. Environmental Protection Agency (EPA), the excess lifetime cancer risk associated with the concentrations of TCE found in the residential wells could range from insignificant to high.

In response to Alcoa's request, the TDH Cancer Registry Division (CRD) evaluated cancer incidence data for the years 1995-1998 and cancer mortality data for 1995-2000 for the zip code 77437, which encompasses the area of concern. CRD only provided incidence data for the most current years that have undergone CRD's numerous data quality procedures and were deemed to be complete (at least 95% complete). The mortality data analysis was limited to encompass similar years while providing enough years for a stable comparison.

METHODS

To determine whether the number of cancer patients found in a community is unusual, CRD compares the number of observed cases (for incidence) and deaths (for mortality) to what would be expected based on the race-, sex-, and age-specific cancer incidence and mortality experience for the state of Texas for the same periods of time. Tables 1 and 2 list the number of observed cases and deaths for males and females, the number of expected cases and deaths, the standardized incidence ratio or standardized mortality ratio, and the corresponding 95% confidence interval.

The SIR or SMR is the number of observed cases or deaths divided by the number of expected cases or deaths. When the SIR or SMR of a selected cancer is equal to 1.00, then the number of observed cases or deaths is equal to the expected number of cases or deaths, based on the incidence or mortality experience of the rest of the state. When the SIR or SMR is less than 1.00, fewer people developed or died from the cancer than would have been expected. Conversely, an SIR or SMR greater than 1.00 indicates that more people developed cancer than we would have expected.

To determine if an SIR or SMR greater or less than 1 is due to chance, we calculate 95% confidence intervals. The 95% confidence interval indicates the range in which we would expect the SIR or SMR to fall 95% of the time. A confidence interval containing 1 indicates no statistically significant excess of cancer. The confidence intervals are important when trying to interpret small numbers of cases. If only one or two (or even less than one) cases are expected for a particular cancer, then the report of three or four observed cases will result in a large SIR or SMR. As long as the 95% confidence interval contains 1.00, the SIR or SMR is still within the range one might expect based on the experience of the rest of the state.

RESULTS

The analysis of incidence data for 1995&1998 shows that zip code 77437 had a statistically significant excess of kidney cancer in females (SIR=3.4; 95%CI=1.7&6.2). The analysis of mortality data for 1995&2000 also shows a statistically significant excess of kidney cancer in females (SMR=3.2; 95% CI=1.2&6.9). The incidence and mortality of liver cancer was not elevated for either gender (Appendix 1: Tables 1 & 2).

DISCUSSION

When evaluating whether an observed excess could be related to an environmental exposure we often expect to see excesses in both sexes; however, there may be patterns of exposure that could account for the differences. For instance, females who stay at home may have a greater exposure to contaminants in the home than males who work outside the home for much of the day. Residential exposure to TCE in the groundwater could result in exposure through ingestion, inhalation, and dermal absorption. We determined that further investigation of these findings was warranted based on the fact that kidney cancer usually is about twice as common in men as in women (Appendix 2), and that the investigation was initiated as a result of an environmental investigation into possible exposures to an agent reported to be associated with the disease.

To evaluate whether the people identified as having kidney cancer could have been exposed to the contaminated groundwater CRD provided addresses for all of the observed cases of kidney cancer (male and female) for 1995–1998. The TDH Spatial Approaches to Health Outcomes Program then geocoded and mapped the addresses to provide a picture illustrating the location of the cases with respect to the suspected groundwater plume. However, TDH was unable to geocode three of the 15 cases (11 female and 4 male). Addresses for these cases either were listed as a Route # or as a P.O. Box #. Of the twelve cases that were geocoded there was no evidence of a spatial clustering of cases within the area of concern.¹

For the initial spatial analysis, we only used data from the years for which the incidence data were considered complete (1995–1998). Thus, cases diagnosed prior to 1995 or after 1998 were not included. While using complete incidence data is necessary for statistical analysis and interpretation, we decided to try to use all available incidence data to better approximate the geographic distribution of known cases in an area. CRD provided addresses for all known kidney cancer cases in the zip code 77437 (male and female) for 1990 to the present. A total of 29 cases were identified. Of the 23 cases that we were able to geocode, there still was no evidence of a spatial clustering of cases within the area of concern. These data suggest that the kidney cancer cases do not share a common exposure to TCE through contaminated residential drinking water wells; however, it is important to acknowledge that the addresses used in the spatial analysis only represent residence at the time of diagnosis; residential history is not known.

OTHER PERTINENT INFORMATION

According to the American Cancer Society the risk factors for kidney cancer (renal cell carcinoma) include lifestyle-related risk factors, occupational related risk factors, genetic and hereditary related risk factors, certain medications, a history of kidney disease, age, and gender. A brief review of these risk factors is included in Appendix 2.

CONCLUSIONS

1. Both the incidence and mortality rates for kidney cancer in females living in the zip code area 77437 located within El Campo were significantly elevated. Both the SIR and the SMR for kidney cancer were over three times the respective state rate.
2. Although a spatial analysis of the individual cases suggests no evidence of a spatial clustering of cases in the area of known or suspected groundwater contamination, the addresses available for the analysis only represent residence at the time of diagnosis.
3. Although the reported associations between exposure to TCE and cancer are inconclusive, ATSDR has determined that cancer should be a concern for people exposed to TCE. Qualitatively, we estimate the excess lifetime cancer risk associated with the TCE found in the residential wells to range from insignificant to high. Based on

¹A copy of the map showing the location of the cases is not included in this report. TDH operates under strict rules of patient confidentiality and with the small number of cases such a map could result in the identification of individual cases which would be a violation of the State's confidentiality laws.

available information we have concluded that the TCE in the residential wells poses a public health hazard.

RECOMMENDATIONS

1. Determine the feasibility of obtaining a residential history for each of the cases (1990–present) to further delineate whether they may be exposed to TCE in contaminated well water.
2. Continue to monitor kidney cancer rates for this area.
3. Provide clean potable water for residences in the affected area.

PUBLIC HEALTH ACTION PLAN

1. TDH will explore the feasibility of obtaining a residential history for each of the cases.
2. TDH will continue to monitor kidney cancer rates for this area as more data become available.
3. Alcoa has provided bottled water for each of the residences in the affected area and is installing activated charcoal filtering systems on the wells to ensure clean potable water for each household.

REFERENCES

1. National Toxicology Program (NTP). Trichloroethylene- 9th Report on Carcinogens. US Department of Health and Human Services; Revised January 2001.
2. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological profile for trichloroethylene. Atlanta: US Department of Health and Human Services; September 1997.

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CERTIFICATION

This health consultation was prepared by the Texas Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was initiated.

Technical Project Officer, SPS, SSAB, DHAC, ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this health consultation and concurs with its findings.

Chief, State Programs Section, SSAB, DHAC, ATSDR

Appendix 1

Table 1

Number of Observed and Expected Cancer Cases and Race Adjusted Standardized Incidence Ratios, Selected Sites, El Campo, TX, Zip Code 77437, 1995–1998

Males				
Site	Observed	Expected	SIR	95% CI
Kidney and Renal Pelvis	4	4.9	0.8	0.2 – 2.1
Liver and Intrahepatic Bile Duct	0	2.3	0.0	0.0 – 1.6
Females				
Site	Observed	Expected	SIR	95% CI
Kidney and Renal Pelvis	11	3.2	3.4*	1.7 – 6.2
Liver and Intrahepatic Bile Duct	0	1.2	0.0	0.0 – 3.1

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas during 1995–1998. The SIR has been rounded to the first decimal place.

*Significantly higher than expected at the $p < 0.05$ level.

Table 2**Number of Observed and Expected Cancer Deaths and Race Adjusted Standardized Mortality Ratios, Selected Sites, El Campo, TX, Zip Code 77437, 1995–2000**

Males				
Site	Observed	Expected	SMR	95% CI
Kidney and Renal Pelvis	2	2.9	0.7	0.1 – 2.5
Liver and Intrahepatic Bile Duct	1	3.6	0.3	0.0 – 1.6
Females				
Site	Observed	Expected	SMR	95% CI
Kidney and Renal Pelvis	6	1.9	3.2*	1.2 – 6.9
Liver and Intrahepatic Bile Duct	0	2.3	0.0	0.0 – 1.6

Note: The SMR (standardized mortality ratio) is defined as the number of observed deaths divided by the number of expected deaths. The latter is based on race-, sex-, and age-specific cancer mortality rates for Texas during the period 1995–2000. The SMR has been rounded to the first decimal place.

*Significantly higher than expected at the $p < 0.05$ level.

Appendix 2

What Are the Risk Factors for Kidney Cancer (Renal Cell Carcinoma)?

(Adapted from the American Cancer Society)

A risk factor is anything that increases a person's chance of getting a disease such as cancer. Different cancers have different risk factors. For example, unprotected exposure to strong sunlight is a risk factor for skin cancer. Scientists have found several risk factors that make you more likely to develop renal cell carcinoma.

Lifestyle-Related and Job-Related Risk Factors

Smoking

Cigarette smoking increases the risk of developing renal cell carcinoma by about 40%.

Obesity

If you are overweight, you have a much higher risk of developing renal cell cancer. Some doctors think obesity is a factor in 20% of people who get this cancer. Obesity may cause changes in certain hormones that can lead to renal cell carcinoma.

Diet

Well-cooked meat has been linked to renal cell carcinoma.

Occupational Exposures

Some studies suggest that workplace exposure to asbestos, cadmium (a type of metal), and organic solvents, particularly trichloroethylene, increases your risk of renal cell carcinoma.

Genetic and Hereditary Risk Factors

Some people inherit a tendency to develop certain types of cancer. The DNA that you inherit from your parents may have certain changes that account for this tendency. Sometimes, these DNA alterations also occur during fetal development inside the mother's womb. At least three different known inherited conditions can cause hereditary renal cell carcinoma:

von Hippel-Lindau Disease

People with this condition often develop several kinds of tumors. Between 25% and 45% of these people develop renal cell carcinoma, usually the clear cell type. They may also have benign blood vessel tumors called hemangioblastomas in their eyes, brain, and spinal cord; cystic (fluid filled) growths in their pancreas and other organs; and a type of adrenal gland tumor called pheochromocytoma.

Hereditary Papillary Renal Cell Carcinoma

People with this condition have an inherited tendency to develop one or more papillary renal cell carcinomas, but do not have the other medical problems that affect people with von Hippel-Lindau disease.

Hereditary Renal Oncocytoma

There are some people who inherit the tendency to develop a kidney tumor with very low potential for being malignant, which is called an oncocytoma.

Other Risk Factors

Medications

Phenacetin, once a popular non-prescription pain-reliever, has been linked to renal cell cancer in the past. Because this medication has not been available in the United States for over 20 years, this no longer appears to be a major risk factor. Diuretics (medications for treating high blood pressure and congestive heart failure that stimulate the kidneys to remove salt and fluid from the body) have also been linked to renal cell carcinoma, as has high blood pressure (which is often treated with diuretics). It is not clear whether the cause is the drugs or the disease. If you need diuretics, you should take them. You shouldn't avoid them in an attempt to reduce the risk of renal cell carcinoma.

Kidney disease

If you have advanced kidney disease and need to be on dialysis, you may have a higher risk of renal cell carcinoma. Dialysis is a treatment used to remove toxins from your body if your kidneys are not working properly.

Age

Most renal cell carcinomas occur in adults between the ages of 50-70 years. They rarely develop in children and young adults.

Gender

Renal cell carcinoma is about twice as common in men as in women. Men are more likely to be smokers and are more likely to be exposed to cancer-causing chemicals at work, which may account for the difference.

Figure 2
Distribution of TCE in Residential Wells in El Campo, Texas
(Preliminary Results as of April 30, 2002)

