

**Summary of Investigation into the Occurrence of Cancer
Zip Code 75939, Corrigan
Polk County, Texas
1998–2007
September 29, 2010**

Background: Concern about a possible excess of cancer prompted the Environmental Epidemiology and Disease Registries (EEDR) of the Texas Department of State Health Services (DSHS) to examine the occurrence of cancer in zip code 75939, Corrigan, Texas. Local citizens were concerned that disinfection by-products (exposure in the past) or other unknown toxic chemicals from their drinking water may be causing cancer. The scientific literature has shown an association between disinfection by-products and cancers of the bladder, colorectal, and liver. The EEDR evaluated 1998–2007 incidence data for cancers of the prostate, breast, lung, colon and rectum, bladder, corpus and uterus, kidney and renal pelvis (area at the center of the kidney), non-Hodgkin’s lymphoma, pancreas, esophagus, liver and intrahepatic bile duct (within the liver), and selected leukemia subtypes. Incidence data are the best indicator of the occurrence of cancer in an area because they more accurately show the number and types of cancer diagnosed each year than mortality data. Texas cancer incidence data currently meet national standards for timeliness and data quality. The rest of this report examines the investigative methods the EEDR used, the results of the investigation, recommendations, and general information on cancer risk factors.

Methodology: According to the National Cancer Institute, a cancer cluster is a greater than expected number of cancers among people who live or work in the same area and who develop or die from the same cancer within a short time of each other. The cancer cluster investigation is the primary tool used by the EEDR to investigate the possibility of excess cancer in a community. The cancer cluster investigation cannot determine that cancer was associated with or caused by environmental or other risk factors. Instead, the cancer cluster investigation is specifically intended to address the question “Is there an excess of cancer in the area or population of concern?”

The EEDR follows guidelines recommended by the Centers for Disease Control and Prevention for investigating cancer clusters¹ and often works with the DSHS Texas Cancer Registry, as well as other state and federal agencies. In order to determine if an excess of cancer is occurring and if further study is recommended, epidemiologic evidence is considered. Such evidence may include documented exposures; the toxicity of the exposures; plausible routes by which exposures can reach people (ingesting, touching, breathing); the actual amount of exposure to the people which can lead to absorption in the body; the time from exposure to development of cancer; the statistical significance of the findings; the magnitude of the effect observed; risk factors; and the consistency of the findings over time. The occurrence of rare cancers or unlikely cancers in certain age groups may also indicate a cluster needing further study. Because excesses of cancer may occur by chance alone, the role of chance is considered in the statistical analysis.

If further study is indicated, the EEDR will determine the feasibility of conducting an epidemiologic study. If the epidemiologic study is feasible, the final step is to recommend an

etiologic investigation to see if the cancer(s) can be related to the exposure of concern. Very few cancer cluster investigations in the United States proceed to this stage.

To determine whether a statistically significant excess of cancer existed in the geographic areas of concern, the number of observed cases was compared to what would be "expected" based on the state cancer rates. Calculating the expected number(s) of cancer cases takes into consideration the race, sex, and ages of people who are diagnosed with cancer. This is important because a person's race, sex, and age all impact cancer rates. If we are trying to determine if there is more or less cancer in a community compared to the rest of the state, we must make sure that the difference in cancer rates is not simply due to one of these factors.

The attached Table presents the number of observed cases for males and females, the number of "expected" cases, the standardized incidence ratio (SIR), and the corresponding 99% confidence interval. The standardized incidence ratio (SIR) is simply the number of observed cases compared to the number of "expected" cases. When the SIR of a selected cancer is equal to 1.0, then the number of observed cases is equal to the expected number of cases, based on the incidence in the rest of the state. When the SIR is less than 1.0, fewer people developed cancer than we would have expected. Conversely, an SIR greater than 1.0 indicates that more people developed cancer than we would have expected. To determine if an SIR greater than 1.0 or less than 1.0 is statistically significant or outside the variation likely to be due to chance, confidence intervals are also calculated.

A 99% confidence interval is used for statistical significance and takes into account the likelihood that the result occurred by chance. It also indicates the range in which we would expect the SIR to fall 99% of the time. If the confidence interval contains a range that includes 1.0, no statistically significant excess of cancer is indicated. The confidence intervals are particularly important when trying to interpret small numbers of cases. If only one or two cases are expected for a particular cancer, then the report of three or four observed cases will result in a very large SIR. As long as the 99% confidence interval contains 1.0, this indicates that the SIR is still within the range one might expect and, therefore, not statistically significant.

Results: The analysis of incidence data for zip code 75939, Corrigan, Texas, from January 1, 1998–December 31, 2007, found cancers of the breast, prostate, lung, colon and rectum, bladder, corpus and uterus, kidney and renal pelvis, non-Hodgkin's lymphoma, liver and intrahepatic bile duct, pancreas, esophagus, and selected leukemia subtypes to be within expected ranges in both males and females. Analysis summaries are presented in Table 1.

Additionally, the EEDR contacted the Drinking Water Quality Team at the Texas Commission on Environmental Quality and found there are no current violations for the Damascus Stryker water system. Past violations for trihalomethanes (a disinfection by-product) have been corrected.

Discussion: Like other studies, this cancer cluster investigation had limitations. The incidence data did not include data for the most recent years. Also, cancer incidence data are based on residence at the time of diagnosis. It is possible that some residents who developed cancer no longer lived in the area at the time of diagnosis, so were not included in the analyses. However, it is also possible that people may have moved into the area and then

developed cancer because of an exposure from a prior residential location or other factors. These cases are included in the investigation.

Recommendations: Based on the findings and the information discussed above, it is not recommended at this time to further examine the cancers in zip code 75939, Corrigan, Texas. As new data or additional information become available, consideration will be given to updating or re-evaluating this investigation.

Information on Cancer and Cancer Risk Factors: Overall, the occurrence of cancer is common, with approximately two out of every five persons alive today predicted to develop some type of cancer in their lifetime.² In Texas, as in the United States, cancer is the leading cause of death for people under the age of 85.³ Also, cancer is not one disease, but many different diseases. Different types of cancer are generally thought to have different causes. If a person develops cancer, it is probably not due to one factor but to a combination of factors such as heredity; diet, tobacco use, and other lifestyle factors; infectious agents; chemical exposures; and radiation exposures. Although cancer may impact individuals of all ages, it primarily is a disease of older persons with over one-half of cancer cases and two-thirds of cancer deaths occurring in persons 65 and older. Finally, it takes time for cancer to develop, between 10–40 years can go by between the exposure to a carcinogen and a diagnosis of cancer.⁴

The chances of a person developing cancer as a result of exposure to an environmental contaminant are slight. Most experts agree that exposure to pollution, occupational, and industrial hazards account for fewer than 10% of cancer cases.⁵ The Harvard Center for Cancer Prevention estimates 5% of cancer deaths are due to occupational factors, 2% to environmental pollution and 2% to ionizing/ultraviolet radiation.⁶ In contrast, the National Cancer Institute estimates that lifestyle factors such as tobacco use and diet cause 50 to 75 percent of cancer deaths.⁷ Eating a healthy diet and refraining from tobacco are the best ways to prevent many kinds of cancer. It is estimated that one-third of all cancer deaths in this country could be prevented by eliminating the use of tobacco products. Additionally, about 25 to 30 percent of the cases of several major cancers are thought to be associated with obesity and physical inactivity.⁸

Known Risk Factors for Cancers Examined in This Investigation: The following is a brief discussion summarized from the American Cancer Society and the National Cancer Institute about cancer risk factors for the specific cancers studied in this investigation.^{9,10}

The occurrence of cancer may vary by race/ethnicity, gender, type of cancer, geographic location, population group, and a variety of other factors. Scientific studies have identified a number of factors for various cancers that may increase an individual's risk of developing a specific type of cancer. These factors are known as risk factors. Some risk factors we can do nothing about, but many are a matter of choice.

Breast Cancer: Simply being a woman is the main risk factor for developing breast cancer. Breast cancer can affect men, but this disease is about 100 times more common among women than men. White women are slightly more likely to develop breast cancer than are African-American women, but African Americans are more likely to die of this cancer because they are often diagnosed at an advanced stage when breast cancer is harder to treat

and cure. Other risk factors for breast cancer include aging, presence of genetic markers such as the BRCA1 and BRCA2 genes, personal and family history of breast cancer, previous breast biopsies, previous breast irradiation, diethylstilbestrol therapy, oral contraceptive use, not having children, hormone replacement therapy, drinking alcohol, and obesity. Secondhand smoke may also be a risk factor. Currently, research does not show a link between breast cancer risk and environmental pollutants such as the pesticide DDE (chemically related to DDT) and PCBs (polychlorinated biphenyls).

Prostate Cancer: Prostate cancer is the most common type of malignant cancer (other than skin) diagnosed in men, affecting an estimated one in five American men. Risk factors for prostate cancer include aging, a high fat diet, physical inactivity, and a family history of prostate cancer. African American men are at higher risk of acquiring prostate cancer and dying from it. Prostate cancer is most common in North America and northwestern Europe. It is less common in Asia, Africa, Central America, and South America.

Colon and Rectum Cancer: Researchers have identified several risk factors that increase a person's chance of developing colorectal cancer: family and personal history of colorectal cancer, hereditary conditions such as familial adenomatous polyposis, personal history of intestinal polyps and chronic inflammatory bowel disease, aging, a diet mostly from animal sources, physical inactivity, obesity, smoking, and heavy use of alcohol. People with diabetes have a 30%-40% increased chance of developing colon cancer. Recent research has found a genetic mutation leading to colorectal cancer in Jews of Eastern European descent (Ashkenazi Jews).

Lung and Bronchus Cancer: The greatest single risk factor for lung cancer is smoking. The American Cancer Society estimates that 87% of lung cancer is due to smoking. Several studies have shown that the lung cells of women have a genetic predisposition to develop cancer when they are exposed to tobacco smoke. Other risk factors include secondhand smoke, asbestos exposure, radon exposure, other carcinogenic agents in the workplace such as arsenic or vinyl chloride, marijuana smoking, recurring inflammation of the lungs, people with silicosis and berylliosis, personal and family history of lung cancer, and arsenic in drinking water. In some cities, air pollution may slightly increase the risk of lung cancer. This risk is far less than that caused by smoking.

Bladder Cancer: The greatest risk factor for bladder cancer is smoking. Men get bladder cancer at a rate four times that of women. Smokers are more than twice as likely to get bladder cancer as nonsmokers. Whites are two times more likely to develop bladder cancer than are African Americans. Other risk factors for bladder cancer include occupational exposure to aromatic amines such as benzidine and beta-naphthylamine, aging, chronic bladder inflammation, personal history of urothelial carcinomas, birth defects involving the bladder and umbilicus, infection with a certain parasite, high doses of certain chemotherapy drugs, and arsenic in your drinking water.

Corpus and Uterus Cancer: Corpus and uterus cancer include cancer of the endometrium (lining of the uterus). Risk factors for endometrial cancer include menstrual periods before age 12, menopause after age 52, infertility or not having children, obesity, treatment with the drug Tamoxifen, estrogen replacement therapy, certain ovarian diseases, a diet high in animal fat, diabetes, aging, family history of endometrial cancer, and early pelvic radiation therapy. Women

who have had breast or ovarian cancer may have increased risk of getting endometrial cancer.

Kidney and Renal Pelvis Cancer: Kidney cancer risk factors include smoking, obesity, a sedentary lifestyle, occupational exposure to heavy metals or organic solvents, advanced kidney disease, family history, high blood pressure, certain medications, and aging. Men and African Americans have higher rates of kidney cancer.

Non-Hodgkin's Lymphoma: Risk factors for non-Hodgkin's lymphoma include infection with *Helicobacter pylori*, human immunodeficiency virus (HIV), human T-cell leukemia/lymphoma virus (HTLV-1), or the Epstein-Barr virus and malaria. Other possible risk factors include aging, certain genetic diseases, radiation exposure, immuno-suppressant drugs after organ transplantation, autoimmune diseases, benzene exposure, the drug Dilantin, exposure to certain pesticides, a diet high in meats or fat, or certain chemotherapy drugs.

Pancreatic Cancer: Risk factors for cancer of the pancreas include smoking, long-standing diabetes, chronic pancreatitis, cirrhosis of the liver, being African American, genetic syndromes, aging, obesity, family history, occupational exposure, and stomach problems. A diet high in meats and fat may increase pancreatic cancer risk.

Esophageal Cancer: Compared with women, men have a three-fold higher rate of esophageal cancer. African Americans are two times more likely to have esophageal cancer than whites. Other risk factors for esophageal cancer include aging, use of tobacco products, alcohol, obesity, gastric reflux, diets low in fruits and vegetables, lye ingestion, frequent drinking of very hot liquids, achalasia, tylosis, and esophageal webs.

Liver and Intrahepatic Bile Duct Cancer: In contrast to many other types of cancer, the number of people who develop liver cancer and die from it is increasing. Men and Asian Americans have higher rates of liver cancer. The risk factors for liver cancer include viral hepatitis, cirrhosis, long-term exposure to aflatoxin, exposure to vinyl chloride and thorium dioxide, diabetes, obesity, anabolic steroids, arsenic in drinking water, bile duct disease, ulcerative colitis, liver fluke infection, and aging. Chemicals that are associated with bile duct cancer include dioxin, nitrosamines, and polychlorinated biphenyls (PCBs).

Acute Lymphocytic Leukemia (ALL): Possible risk factors for ALL include the following: being male, being white, being older than 70 years of age, past treatment with chemotherapy or radiation therapy, exposure to atomic bomb radiation, or having a certain genetic disorder such as Down syndrome.

Chronic Lymphocytic Leukemia (CLL): Possible risk factors for CLL include the following: being middle-aged or older, male, or white; a family history of CLL or cancer of the lymph system; having relatives who are Russian Jews or Eastern European Jews; or having exposure to herbicides or insecticides including Agent Orange, an herbicide used during the Vietnam War.

Acute Myeloid Leukemia (AML): Possible risk factors for AML include the following: being male; smoking, especially after age 60; having had treatment with chemotherapy or radiation therapy in the past; having had treatment for childhood ALL in the past; being

exposed to atomic bomb radiation or the chemical benzene; or having a history of a blood disorder such as myelodysplastic syndrome.

Chronic Myeloid Leukemia (CML): Most people with CML have a gene mutation (change) called the Philadelphia chromosome. The Philadelphia chromosome is not passed from parent to child.

For additional information about cancer, visit the “Resources” link on our web site at <http://www.dshs.state.tx.us/tcr/>.

Questions or comments regarding this investigation may be directed to Ms. Brenda Mokry, Epidemiology Studies & Initiatives at 800-252-8059 or brenda.mokry@dshs.state.tx.us.

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Table 1
Number of Observed and Expected Cancer Cases and Race Adjusted Standardized
Incidence Ratios, Selected Cancers, Zip Code 75939, Corrigan, TX, 1998–2007

Males				
Site	Observed	Expected	SIR	99% CI
Prostate	43	27.5	1.6	1.0 – 2.3
Lung	24	16.9	1.4	0.8 – 2.4
Colon and Rectum	11	10.2	1.1	0.4 – 2.2
Bladder	1	5.3	0.2	0.0 – 1.4
Kidney and Renal Pelvis	2	3.6	0.6	0.0 – 2.5
Non-Hodgkin's Lymphoma	3	3.8	0.8	0.1 – 2.9
Breast	0	0.3	0.0	0.0 – 19.0
Pancreas	2	2.2	0.9	0.1 – 4.2
Esophagus	4	1.4	2.9	0.5 – 9.0
Liver and Intrahepatic Bile Duct	2	1.7	1.2	0.1 – 5.5
Acute Lymphocytic Leukemia	0	0.4	0.0	0.0 – 14.1
Chronic Lymphocytic Leukemia	1	1.1	0.9	0.0 – 6.8
Acute Myeloid Leukemia	2	0.8	2.6	0.1 – 12.2
Chronic Myeloid Leukemia	1	0.4	2.7	0.0 – 19.8
Aleukemic, Subleukemic, & NOS	0	0.1	0.0	0.0 – 40.7
Females				
Site	Observed	Expected	SIR	99% CI
Breast	25	26.9	0.9	0.5 – 1.5
Lung	17	13.8	1.2	0.6 – 2.2
Colon and Rectum	8	10.7	0.8	0.2 – 1.7
Bladder	1	2.0	0.5	0.0 – 3.7
Kidney and Renal Pelvis	4	2.6	1.6	0.3 – 4.9
Non-Hodgkin's Lymphoma	2	3.8	0.5	0.0 – 2.5
Corpus and Uterus	7	4.3	1.6	0.5 – 4.0
Pancreas	2	2.5	0.8	0.0 – 3.7
Esophagus	0	0.5	0.0	0.0 – 11.7
Liver and Intrahepatic Bile Duct	1	0.8	1.3	0.1 – 9.4
Acute Lymphocytic Leukemia	0	0.3	0.0	0.0 – 19.0
Chronic Lymphocytic Leukemia	0	0.9	0.0	0.0 – 5.9
Acute Myeloid Leukemia	3	0.7	4.3	0.5 – 15.8
Chronic Myeloid Leukemia	0	0.3	0.0	0.0 – 16.3
Aleukemic, Subleukemic, & NOS	0	0.2	0.0	0.0 – 35.2

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 the period 1998–2007. The SIR has been rounded to the first decimal place.

*Significantly higher than expected at the $p < 0.01$ level.

**Significantly lower than expected at the $p < 0.01$ level.