

LETTER HEALTH CONSULTATION

REVIEW OF CANCER DATA FOR ZIP CODE 18901

DOYLESTOWN, PA

March 11, 2013

Prepared by:



Pennsylvania Department of Health
Division of Environmental Health Epidemiology

Health Consultation: A Disclaimer

The Pennsylvania Department of Health (PADOH) Health Assessment Program (HAP) collaborates with the Agency for Toxic Substances and Disease Registry (ATSDR), the lead federal public health agency, to prepare health consultation documents which determine if exposure to contaminants can harm people's health as well as prevent and reduce exposures and illnesses. A health consultation is a written response to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material, and considers the levels of hazardous substances at a site, whether people might be exposed to contaminants, by what pathways, and what potential harm the substances might cause to them. In order to prevent or mitigate exposures, a consultation may lead to specific actions and recommendations, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material. In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; conducting health studies; characterizing demographics; recommending changes/additions to related Commonwealth of Pennsylvania policies/regulations, improving quality of life; and/or providing health education for health care providers and community members.

ATSDR provides technical assistance and funding to PADOH to help identify and evaluate environmental health threats to communities using the best science, taking responsive public health actions, and providing trusted health information. While this health consultation was supported by funds from a cooperative agreement with the ATSDR, it has not been reviewed and cleared by ATSDR. More information about ATSDR is available online at www.atsdr.cdc.gov.

The conclusions and recommendations presented in this health consultation document are based on an analysis of the environmental sampling data and information made available to the PADOH within a limited time frame. The availability of additional sampling data, new information and/or changes in site conditions could affect the conclusions and recommendations presented in this document. PADOH will consider reviewing additional future data related to the site, if made available and deemed appropriate.



To: The Chem Fab Community Advisory Group (CAG) members

From: Farhad Ahmed, Epidemiologist/Program Director, Health Assessment Program,
Division of Environmental Health Epidemiology

Subject: Review of cancer data for residents of Doylestown area zip code 18901

Background and Statement of Issues:

A request was made to the Health Assessment Program of the Pennsylvania Department of Health (PADOH) by members of the Chem Fab CAG to address the cancer rates in Doylestown. This letter health consultation describes the cancer data review for the Chemfab superfund site. The PADOH Bureau of Epidemiology Division of Community Health Epidemiology, obtained data from the Pennsylvania Cancer Registry (PCR) ¹, which is a comprehensive database of all cancers diagnosed in Pennsylvania residents. The cancer review for the 18901 Doylestown Zip code area evaluated the incidence rates for the overall cancer rate and 16 specific types of cancer that were reported in the years 1990 – 2009. The overall cancer rate for Doylestown area zip code 18901 was 16% lower than expected when compared to Pennsylvania as a whole. The three types of cancer most closely linked to trichloroethylene (TCE), a chemical of concern at the site, are kidney, liver and non-Hodgkin's lymphoma, all of which were lower than expected when compared to the Commonwealth as a whole. Only malignant melanoma was significantly higher than expected when compared to the Commonwealth as a whole. Elevated malignant melanoma rates are associated with skin pigmentation and UV radiation, most frequently from recreational exposure to sunlight.

Cancer Data Review and Discussion:

Cancer is a common illness even in the absence of environmental exposures; every community will have a substantial number of cancer cases. Because cancer is not a single disease, it does not have a single cause. Many causes or risk factors can contribute to a person's chance of getting cancer. Risk factors are different with each type of cancer. Risk factors can include such things

as age, race, gender, genetic factors, diet, occupation, and exposure to chemicals, radiation, and tobacco. Genetics play a large role for many cancers, such as breast and colon cancer. This means that a family's health history can be a risk factor for some types of cancers. Environmental contaminants are only one of the many causes of cancers, but being exposed does not necessarily mean a person will develop cancer. The amount of a contaminant a person is exposed to, the length of exposure, and the route of exposure can also affect whether a person will experience negative health effects from an exposure ².

According to the American Cancer Society, cancer incidence data (2005-2007) shows that 44.29% of the U.S. population will develop some form of cancer in their lifetime ³. Generally, cancer rates in Pennsylvania tend to be slightly higher than those nationally. (Figure 1) Based on statistics from the Centers for Disease Control and Prevention (CDC), age-adjusted cancer incidence rates from 2003-2007 show rates of certain cancers, such as colon and rectum, lung, and thyroid, tend to be higher in Pennsylvania when compared with national trends. For example, cancer incidence rates for colon and rectum cancers, during this time frame, were 54.5 per 100,000 and 49 per 100,000 in Pennsylvania and the U.S. populations, respectively ⁴

General and Overall Public Health Recommendations for the Community

Many causes or risk factors can contribute to a person's chance of getting cancer. More than 30% of cancers could be prevented by modifying or avoiding these risk factors. You can reduce your risk of getting cancer in a variety of ways, including keeping a healthy weight and eating a healthy diet, avoiding tobacco use, limiting the amount of alcohol you drink, reducing excess exposure to the ultra violet (UV) light, and checking your home for radon ⁵. A summary of these risk factors is presented below:

- **Healthy diet/weight and physical activity.** Research has shown that being overweight or obese substantially raises a person's risk of getting uterine, breast, prostate, and colorectal cancers ⁶. Diets high in fruits and vegetables may have protective effects against many cancers. Conversely, excess consumption of red and preserved meat may be associated with an increased risk of colorectal cancer. In addition, healthy eating habits that prevent the development of diet-associated cancers will also lower the risk of cardiovascular disease. Regular physical activity (30 minutes of daily physical activity) and the maintenance of a healthy body weight, along with a healthy diet, can considerably reduce cancer risk. ⁷
- **Tobacco use.** Tobacco use is the single greatest avoidable risk factor for cancer. Lung cancer is the leading cause of cancer death, and cigarette smoking is the greatest risk factor. Compared to nonsmokers, men who smoke are about 23 times more likely to develop lung cancer and women who smoke are about 13 times more likely. Smoking causes about 90% of lung cancer deaths in men and almost 80% in women.
- **Alcohol consumption.** Studies have shown that drinking alcohol regularly in excess increases the risk of getting mouth, voice box, and throat cancers, liver cancer, breast

cancer and colorectal cancer. The risk from heavy drinking for several cancer types (e.g. cancer of the voice box, mouth, throat and esophagus) substantially increases if a person is also a heavy smoker.

- **UV radiation.** UV radiation, and in particular solar radiation, causes a variety of types of skin cancer, such as basal cell carcinoma, squamous cell carcinoma and melanoma. UV-emitting tanning devices are now also classified as carcinogenic to humans based on their association with skin and ocular melanoma cancers. Avoiding excessive UV exposure, the use of sunscreen and protective clothing, and avoiding tanning devices are effective preventive measures to reduce the risk of skin cancer ⁵

Results:

The 2000 U.S. census was the source of basic population data ⁸. Cancer cases were tabulated in accordance with ICD-10 (site coding definitions used by the PADOH Bureau of Health Statistics and Research to prepare the PCR annual reports). The data were further standardized to eliminate possible effects due to differences in race, gender, and age between the study area and the rest of the Commonwealth. Adjusted Statewide incidence rates were used to calculate the expected number of cases that would have occurred if the study area had incidence rates similar to the rest of the state. The statistical significance of the indirectly age-adjusted incidence rates was calculated in accordance with the methodology recommended by *Selven, et. al.* ⁹

To determine if the cancer rates are elevated, the “observed cases” are the number of cancers reported to the PCR for the Doylestown ZIP code. The “expected cases” represent the number of cases expected to occur if Doylestown experienced rates of cancer similar to the rest of Pennsylvania during the study period. The ratio of observed cases to expected cases is known as the standardized incidence ratio (SIR). A SIR of 1.0 means the observed number is exactly the same as the expected number. A SIR greater than 1.0 means there is a higher number than expected. Conversely, a SIR less than 1.0 means there is a lower number of cases than expected. The deviation from 1.0 represents the percentage above or below the expected (i.e. a SIR of 1.05 means there is a 5% percent excess). Statistical formulas (Z-test) are then applied to determine whether the difference is considered statistically significant. The difference is said to be statistically significant if it is greater than what would be expected to happen by chance alone. In common practice, a statistically significant finding means that the probability that the observed number of cases could have happened by chance alone is 5 percent or less.

4,785 New Cancers were diagnosed among residents of zip code 18901 during the 20 year period, or 239 new cancers each year. During the 1990-2009 period 1,531,588 new cancers were diagnosed among all Pennsylvania residents. Because more people are being successfully

treated, both new cases and many previously diagnosed cases live in the community. This results in hundreds of residents living with cancer, and increases the public’s awareness of disease.

Table 1 shows that the **types of cancer are the same** in the Doylestown Area [Zip Code 18901], and in Pennsylvania. **Table 1** also shows the distribution by cancer types, expressed as percentages of the total number diagnosed between 1990 and 2009. When the percentages are compared, they are remarkably similar between area residents and Pennsylvania. **Differences are less than half a percent, with the exception of colon cancer (1.1%), lung cancer (2.0%), breast cancer (2.1%) and malignant melanoma (2.3%).** **Table 2** Compares the number of cancers diagnosed for residents to the numbers of cases expected if the population of zip code 18901 had experienced the same risk as the entire state, during the 1990 to 2009 period. **Table 2 shows that the risk (rates) of nearly all types of cancer were lower than the rates for the state.** This is based on the number of cancers diagnosed for residents to the numbers of cases expected, if the Population of Zip Code 18901 had experienced the same risk as the entire state during the 1990 to 2009 period. The only exception is the risk ratio for Melanoma of skin.

When compared to Pennsylvania the four leading types of cancer Colon-Rectum, Lung, Breast, and Prostate composed 2,486 cases or **52.0 percent of total cancers** in the Doylestown Area, zip code 18901, while in Pennsylvania they accounted for **838,683 cases and 54.8 percent** of total cases during the same period. The overall rate for the zip code area was **16 percent lower** than Pennsylvania; Risk Ratio = 0.84 [**4,785 obs. compared to 5,672 exp. = 0.84**]. This was statistically significant.

Seven types of cancer showed rates **significantly lower than Pennsylvania:**

| | <u>Ratio</u> | <u>Difference</u> |
|-----------------------|--------------|-------------------|
| Stomach | 0.57 | or 43 % lower; |
| Colon | 0.77 | or 23 % lower; |
| Pancreas | 0.80 | or 20 % lower; |
| Lung | 0.74 | or 26% lower; |
| Urinary Bladder | 0.81 | or 19 % lower; |
| Prostate | 0.77 | or 23 % lower; |
| Non-Hodgkn’s Lymphoma | 0.79 | or 21 % lower; |

Only one type of cancer showed a rate *significantly higher than Pennsylvania:*

Ratio Difference

Malig. Melanoma 1.37 or 37% higher;

The reason for a higher or lower cancer rate in a community frequently is not understood. Most often the cause(s) is not known or if there are multiple risk factors the contribution from each cannot be determined. Frequently, the causative factor(s) are distributed randomly throughout the population and the variation in the rates may be attributable to chance alone.

The following describes known risk factors for major cancers:

Malignant Melanoma of Skin:

Malignant melanoma was the only cancer in the population of Doylestown with a statistically significant elevated rate [SIR=1.37 or 37 percent higher than Pennsylvania]. Rates are associated with skin pigmentation where the risk is 10 times higher in whites compared to blacks and lower in Hispanics. Exposure to UV radiation is the major determinant of risk. The elevated rate in the Doylestown area and the rest of the county compared to Pennsylvania is likely due to more frequent exposures to UV radiation from recreational exposures outdoors.

Breast Cancer:

Breast cancer rates were the same as the state. Rates are largely affected by hormonal factors or the levels and length of exposure to estrogens. Risk Factors include

Age at menarche < 12 versus >14

Age at first birth >30 versus < 20

Age of menopause >54 versus <45

High body mass index after menopause versus before menopause

Height – increases risk

Benign breast disease

Dense breasts

Socioeconomic level where higher education results in delayed child bearing.

Socioeconomic level affects screening, where women with more education are screened more, resulting in a greater detection of disease increasing the rates.

Leukemia;

The causes of leukemia are largely unknown. Ionizing radiation at large doses has been established to be a cause of leukemia.

Stomach Cancer;

The stomach cancer rates were significantly lower than the state rate. This likely is because the population represents a higher socio economic status (SES) group compared to the entire state. Variations in risk by SES levels probably reflect similar associations with environmental and occupational exposures. Risk Factors include

Lower socioeconomic levels

Coal mining

Dietary factors - salted and smoked foods

Benign stomach conditions - atrophic gastritis

Bacterial infections – *H. pylori*

Lung and Larynx Cancers: Risk Factors include:

Cigarettes

Alcohol (larynx)

Occupation – nickel refining, chromium workers, arsenic, asbestos

Poor socioeconomic status

The lower rate most likely reflects lower cigarette consumption in the area, as the prevalence of cigarette use is associated with income/educational level of the population.

Trichloroethylene (TCE) exposure in some studies with mice have suggested that high levels of TCE may cause liver, kidney or lung cancer

Liver Cancer: Risk Factors include:

Hepatitis B and C infections

Alcohol/Cirrhosis

Aflatoxins (fungi products)

Thorotrast - medical imaging contrast dye containing thorium

Vinyl Chloride

Pancreas: Risk Factors include:

Smoking

Alcohol

Certain occupational groups working with petroleum products and solvents

Brain and Central Nervous Sys.; Risk Factors include:

N-Nitroso- compounds
Head trauma
Genetic factors
Radiation
Pesticides
Diet
Viral infections

Prostate Gland; Risk Factors include:

Unknown
Black race

Conclusions

The overall cancer rate was 16% lower than expected when compared to Pennsylvania as a whole. The three types of cancer most closely linked to TCE, a chemical of concern at the site, are kidney, liver and non-Hodgkin's lymphoma, all of which were lower than expected when compared to the commonwealth as a whole. Only malignant melanoma was significantly higher than expected when compared to the commonwealth as a whole. Elevated malignant melanoma rates are associated with skin pigmentation and UV radiation, most frequently from recreational exposure to sunlight.

The PCR has validated data up to year 2009. When new data become available and/or if the situation changes around the Chem Fab site, PADOH would certainly be willing to review the new data and report the findings to the Chem Fab Community Advisory Group members.

Sincerely,

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References

1. PA Cancer Registry. 2013
http://www.portal.state.pa.us/portal/server.pt/community/pa_cancer_registry/14280
2. ATSDR. Cancer Fact Sheet. 2002 <http://www.atsdr.cdc.gov/com/cancer-fs.html>
3. American Cancer Society. Lifetime Risk of Developing or Dying from Cancer. 2010
<http://www.cancer.org/cancer/cancerbasics/lifetime-probability-of-developing-or-dying-from-cancer>
4. CDC. United States Cancer Statistics. 2003-2007. <http://apps.nccd.cdc.gov/uscs/>
5. World Health Organization. Cancer Prevention Guidelines.
<http://www.who.int/cancer/prevention/en/>
6. ATSDR. Cancer Factsheet. 2002 <http://www.atsdr.cdc.gov/COM/cancer-fs.html>.
7. CDC. Cancer Prevention and Control. 2011.
<http://www.cdc.gov/cancer/dcpc/prevention/other.htm>
8. US Bureau of Census. US Census 2000 Data Engine. June 2003.
<http://www.census.gov/support/SF1Data.html>
9. Selven S, Sacks ST, Merrill DW. Standardization of Age Adjusted Mortality Rates, Lawrence Berkeley Laboratory, University of California. February 1980.

Table 1

Distribution of Cancer Cases by Type for Residents of Doylestown, Zip Code 18901 and Pennsylvania, Diagnosed Between 1990 and 2009

| | <u>Zip Code 18901</u> | | | <u>Pennsylvania</u> | | |
|-----------------|------------------------------|-------|--------|----------------------------|-----------|--------|
| | Percent | Cases | Ave/Yr | Percent | Cases | Ave/Yr |
| All Cancers | 100.0 | 4,785 | 239 | 100.0 | 1,531,588 | 76,576 |
| Esophagus | 1.1 | 52 | 2.6 | 1.0 | 15,486 | 774 |
| Stomach | 1.1 | 51 | 2.6 | 1.5 | 23,020 | 1,151 |
| Colon-Rectum | 11.3 | 543 | 27.2 | 12.4 | 189,623 | 9,481 |
| Liver | 0.9 | 44 | 2.2 | 0.9 | 13,668 | 683 |
| Pancreas | 2.1 | 99 | 5 | 2.1 | 32,815 | 1,641 |
| Lung | 11.2 | 537 | 26.9 | 13.2 | 202,395 | 10,120 |
| Breast | 17.5 | 836 | 41.8 | 15.4 | 235,418 | 11,771 |
| M. Melanoma | 5.8 | 277 | 13.9 | 3.5 | 53,061 | 2,653 |
| Kidney | 2.9 | 139 | 7 | 2.6 | 39,482 | 1,974 |
| Urinary Bladder | 4.6 | 222 | 11.1 | 4.7 | 72,688 | 3,634 |
| Brain/CNS | 2.0 | 98 | 4.9 | 1.9 | 28,503 | 1,425 |
| Prostate | 11.9 | 570 | 28.5 | 13.8 | 211,247 | 10,562 |
| H. Lymphoma | 0.5 | 22 | 1.1 | 0.5 | 8,342 | 417 |
| N H Lymphoma | 4.2 | 201 | 10 | 4.4 | 68,123 | 3,406 |
| M. Myeloma | 0.9 | 45 | 2.3 | 1.1 | 16,339 | 817 |
| Leukemia | 1.7 | 83 | 4.2 | 1.5 | 23,690 | 1,185 |

Table 2

**Observed and Expected⁺, Cancer Cases and Risk Ratios for 1990-2009 Incidence,
Doylestown, Zip Code 18901, Pennsylvania**

| | Cases Observed | Cases Expected | Ratio of Observed/Expected |
|-------------------------|-----------------------|-----------------------|-----------------------------------|
| | A | B | A/B |
| ALL CANCERS | 4,785 | 5,672 | 0.84 |
| ESOPHAGUS | 52 | 57 | 0.91 |
| STOMACH | 51 | 89 | 0.57* |
| COLON-RECTUM | 543 | 709 | 0.77* |
| LIVER | 44 | 51 | 0.86 |
| PANCREAS | 99 | 123 | 0.80* |
| LUNG | 537 | 731 | 0.74* |
| BREAST | 836 | 893 | 0.94 |
| SKIN MELANOMA | 277 | 202 | 1.37** |
| KIDNEY | 139 | 146 | 0.95 |
| URINARY BLADDER | 222 | 273 | 0.81* |
| BRAIN | 98 | 109 | 0.90 |
| PROSTATE | 570 | 741 | 0.77* |
| HODG. LYMPHOMA | 22 | 31 | 0.71 |
| NH LYMPHOMA | 201 | 255 | 0.79* |
| MULTIPLE MYELOMA | 45 | 61 | 0.74 |
| LEUKEMIA | 83 | 90 | 0.92 |

+ Based on US Age-specific Rates for 1990-2009 Period

** Rate higher than PA and statistically significant

*Rate lower than PA and statistically significant

