



**Cancer Incidence Report
Merrimack, NH**

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Key Findings

- In February 2016 low levels of PFOA were detected in the Merrimack Valley District public water supply.
- Some studies have found associations between PFOA and certain types of cancer.
- More research is needed to determine whether PFOA *causes* cancer and what types of cancers it may cause.
- Cancers associated with PFOA were not found to be higher in Merrimack.
- The DHHS will continue to monitor rates of cancer in Merrimack.

The purpose of this report is to inform the Merrimack, NH community about different types of cancer in their community. As a result of the perfluorooctanoic acid (PFOA) drinking water contamination surrounding the Saint-Gobain Performance Plastics facility located in Merrimack, NH, the New Hampshire Department of Health and Human Services (NH DHHS) has received requests from multiple individuals to look at cancer rates in the area. The information in this report is not the result of a “cancer cluster” investigation, rather this information is being provided to help inform community concerns about potential health impact from PFOA exposure and to further discussions about cancer, the known causes of cancer, and how residents can stay healthy.

Because exposure to PFOA has been a primary concern in the communities impacted in Southern NH, we have reviewed the published science about what is known (both positive and negative scientific findings) about the cancer causing potential of PFOA. It is important to note that while some studies have found “associations” between PFOA exposure and the development of certain types of cancer, a statistical “association” does not mean that PFOA caused the cancer findings in the various studies. More research is needed before scientists can conclude that PFOA causes cancer. To that end, the NH DHHS is working with other states, congressional leadership, and the Centers for Disease Control and Prevention’s Agency for Toxic Substances and Disease Registry (CDC/ATSDR) for a national U.S. study to be conducted to help further the science. Because of the current limitations of the science, any findings of a difference in cancer in a particular community cannot be directly attributed to PFOA exposure. Differences in the numbers of cancer from one community to another are common and often do not have any identifiable cause. Nevertheless, concern exists that PFOA may contribute to development of certain types of cancer. We hope that the information in this report is helpful.

Background

In February 2016 low levels of PFOA, approximately 30 parts per trillion (ppt), were found in tap water supplied by the Merrimack Village District (MVD) public water system. A subsequent investigation into environmental contamination surrounding the Saint-Gobain plant led to findings of drinking water contamination in private and public water supply wells in the surrounding communities. The current U.S. Environmental Protection Agency’s (US EPA) lifetime Health Advisory for PFOA levels in drinking water is for PFOA and perfluorooctane sulfonic acid (PFOS) levels combined to not exceed 70 ppt in drinking water (U.S. EPA 2016a). To date, levels of PFOA and PFOS combined in

the MVD public water supply have not exceeded these Health Advisory limits.

Due to residents' concern about exposure to PFOA, the NH DHHS implemented the "MVD Community Exposure Assessment". Approximately 200 individuals consuming drinking water from the MVD public water system were randomly selected to test their blood for levels of various PFCs. The purpose of the MVD Community Exposure Assessment is to inform all residents about approximate levels of PFOA exposure that may have been associated with public drinking water consumption. Recruitment and blood testing for PFCs (called "biomonitoring") was conducted from October 2016 through August 2017, when the final blood tests were returned.

Additional information about PFOA and other perfluorochemicals (PFCs) along with the response by NH DHHS and the New Hampshire Department of Environmental Services (NHDES) has been made available:

- <https://www.dhhs.nh.gov/dphs/pfcs/index.htm>
- <https://www4.des.state.nh.us/nh-pfas-investigation/>

Exposure Information

The Saint-Gobain plant has been operational since the 1980's. It is not possible to know when contamination of the public drinking water supply began, or the past levels of contamination. Preliminary results of the NH DHHS MVD Community Exposure Assessment have shown that out of the 217 randomly selected residents on the MVD public water system who had their blood tested for various PFCs, only PFOA was found at higher levels than typically seen in the general U.S. population. This is consistent with the existence of a known source of PFOA exposure through drinking water ingestion.

PFOA and Cancer Science Review

The United States Environmental Protection Agency (US EPA) and the International Agency for Research on Cancer (IARC) regularly evaluate the science and cumulative evidence in order to assess the likelihood of different chemical exposures contributing to the development of cancer. Table 1 shows the different classifications used by both the U.S. EPA and the IARC for classifying the cancer causing potential of chemicals. The rows with gray shading highlight the classification level used by the U.S. EPA and IARC to classify the current understanding of the cancer causing potential of PFOA. The IARC in 2014 classified PFOA as "possibly carcinogenic to humans" due to some limited evidence in humans of carcinogenic (i.e. cancer causing) potential (Benbrahim-Tallaa 2014). Similarly, the US EPA has determined that there is "suggestive evidence for carcinogenic potential" for PFOA in humans due to the concern raised by some scientific studies, but the evidence is not sufficient to support a stronger conclusion (U.S. EPA 2005 and 2016a). These determinations are based largely on the finding of associations between PFOA and testicular and kidney cancer in the C8 Health Project study of environmentally exposed communities in the Ohio River Valley area (U.S. EPA 2016b; IARC 2016; Barry et al. 2013; Vieira et al. 2013). The evidence for PFOA contributing to other types of cancer is even more limited and inadequate to assess cancer-causing potential (IARC 2016).

Table 1. Current Classification Categories Used by US EPA and IARC to Describe the Strength of the Evidence for Cancer-Causing Potential of Chemicals

US EPA	IARC
Carcinogenic to humans	Carcinogenic to humans
Likely to be carcinogenic to humans	Probably carcinogenic to humans
Suggestive evidence of carcinogenic potential*	Possibly carcinogenic to humans*

Inadequate information to assess carcinogenic potential	Not classifiable as to its carcinogenicity to humans
Not likely to be carcinogenic to humans	Probably not carcinogenic to humans

US EPA: United States Environmental Protection Agency, IARC: International Agency for Research of Cancer

* Shading shows categories assigned to PFOA by the US EPA and the IARC

While the C8 Health Project studies along with a single study of PFOA chemical plant workers have reported associations between PFOA and testicular and kidney cancers (Barry et al. 2013; Vieira et al. 2013; Steenland and Woskie 2012), multiple other studies of occupational workers exposed to very high levels of PFOA have not shown a connection between PFOA and kidney cancer (Leonard et al. 2008; Lundin et al. 2009; Raleigh et al. 2014), or testicular cancer (Gilliand and Mandel 1993; Leonard et al. 2008; Lundin et al. 2009; Steenland and Woskie 2012; Raleigh et al. 2014). These occupational studies, however, had more limited numbers and often relied on cancer death as the health outcome that was studied instead of occurrence of cancer (i.e. cancer incidence).

A couple of these occupational worker studies have shown an association between PFOA exposure and prostate cancer (Gillian and Mandel 1993; Lundin et al. 2009). Other studies of workers, environmentally exposed community members, and the general population, have not shown a connection between PFOA exposure and prostate cancer (Leonard et al. 2008; Eriksen et al. 2009; Steenland and Woskie 2012; Barry et al. 2013; Vieira et al. 2013; Hardell et al. 2014; Raleigh et al. 2014; Ducatman et al. 2015).

There has been concern in affected communities about the impact of PFOA on the thyroid; however, there is no substantial evidence supporting PFOA as a cause of thyroid cancer. Only a single study of PFOA chemical plant workers in Parkersburg, WV found a statistically significant association between thyroid cancer and PFOA exposure. This finding, was based on only three deaths from “thyroid and other endocrine” cancers out of more than 6,000 workers (Leonard et al. 2008). Follow-up studies on the same group of workers failed to show significant associations between PFOA exposure and thyroid cancer development or death (Lundin et al. 2009; Raleigh et al. 2014). Additionally, the C8 Health Project studies have found no link between PFOA and thyroid cancer (Barry et al. 2013; Vieira et al. 2013).

There has also been concern about PFOA and bladder cancer. Multiple studies have failed to show any significant associations between PFOA and bladder cancer in either exposed PFOA workers (Gilliand and Mandel 1993; Leonard et al. 2008; Lundin et al. 2009; Steenland and Woskie 2012; Raleigh et al. 2014) or in the general or exposed community members, including the C8 Health Project communities (Eriksen et al. 2009; Vieira et al. 2013; Barry et al. 2013).

Finally, there have been two studies on the same Greenland Inuit population which found some associations between PFOA and breast cancer. The first study of Greenlandic Inuit women found that women with breast cancer had a higher PFOA level than women without breast cancer, but this difference was not statistically significant when other exposures that could potentially cause cancer were taken into account (Bonefeld-Jorgensen et al. 2011). A follow-up study on the same population of Greenlandic Inuit women found some associations between breast cancer and higher blood levels of some PFCs, including PFOA (Wielsøe et al. 2017). Despite these two studies, multiple other studies of PFOA workers exposed to high levels of PFOA (Gilliand and Mandel 1993; Leonard et al. 2008; Lundin et al. 2009; Steenland and Woskie 2012; Raleigh et al. 2014) and communities exposed to lower levels have

found no connection between PFOA and breast cancer (Vieira et al. 2013; Barry et al. 2013; Bonefeld-Jorgensen et al. 2014).

There is very limited or no evidence for PFOA being connected with any other cancer. As we learn more about PFOA and the impact on human health, the science may change. The Centers for Disease Control and Prevention's Agency for Toxic Substances and Disease Registry (CDC/ATSDR) has also reviewed the science and noted that "there is no conclusive evidence that perfluoroalkyls cause cancer in humans. Some increases in prostate, kidney, and testicular cancers have been seen in individuals exposed to high levels. These results should be interpreted cautiously because the effects were not consistently found and most studies did not control for other potential factors such as smoking" (ATSDR 2015).

Calculating and Comparing Cancer Incidence Methodology

To assess whether the incidence of cancer was higher than expected in Merrimack, the NH DHHS used the New Hampshire State Cancer Registry (NHSCR) to review cancer diagnoses in the town of Merrimack, NH from January 2005 through December 2014. 2014 is the most recent year for which cancer data are at least 95% completely reported to the NHSCR. The NHSCR is a population-based registry of cases of cancer diagnosed in New Hampshire residents. NHSCR receives reports from medical facilities within the State including hospitals, laboratories, physicians, and other health care facilities. NH residents diagnosed in other states are also reported to the NHSCR, and the NHSCR receives data from the Veterans Administration (VA) in Washington DC for New Hampshire residents who may be cared for at VA facilities. VA cancer reports, however, are only current through 2013. We know from past analysis that reporting of VA data significantly impacts the numbers of certain types of cancer in men, including lung and bronchus cancer, and prostate cancer (Riddle 2012). Therefore, we report on the number of cancer cases for different types of cancer occurring in NH residents from 2005-2014, but report on occurrence of lung and bronchus cancer, and prostate cancer from 2005-2013. The reported (or "observed") number of cancer cases in Merrimack residents are then compared to a calculated "expected" number of cancer cases (by cancer type) for Merrimack assuming the town's rate of cancer was similar to the NH State rate. Statistical methods are then used to determine whether the difference between the observed number of cancer cases in Merrimack are similar or different (either higher or lower) than the calculated expected number of cancer cases.

Results

All Cancer Types - Overview of Findings

We compared the observed to the expected numbers of cancer cases for 24 types of cancer for males and 26 types of cancer for females. For cancers affecting both sexes, the observed and expected number of cancer cases were compared for both males and females combined. Table 2 summarizes the results of the cancer analysis, showing that none of the cancers in Merrimack, NH occurred in significantly higher numbers than would be expected.

Cancer Types Possibly Associated with PFOA Exposure

Testicular cancer: There were eight cases observed compared to nine expected cases (Table 2). These numbers were not significantly different.

Kidney cancer: There were 51 cases observed compared to 41 expected cases (Table 2). These numbers were not significantly different, meaning the difference of 10 cases is within the range expected due to chance or random variation.

Prostate cancer: There were 198 observed cases compared to 173 expected cases (Table 2). These numbers were not significantly different, meaning the difference is within the range expected due to chance or random variation. Prostate cancer is also one of the cancers that can be routinely screened for by healthcare providers, and medical screening recommendations for prostate cancer have changed over the years. Therefore, differences in numbers could be due to differences in screening practices by providers in the community.

Table 2. Observed and Expected Numbers of Cancer Cases, Merrimack, NH, 2005-2014*

Cancer Type/Site	Observed	Expected	Significant Difference
Oral Cavity and Pharynx	28	33	Not significantly different
Esophagus	20	18	Not significantly different
Stomach	13	14	Not significantly different
Colorectal	115	101	Not significantly different
Liver and Intrahepatic	12	15	Not significantly different
Pancreas	30	30	Not significantly different
Gall Bladder	<5	<5	Not significantly different
Larynx	9	10	Not significantly different
Lung and Bronchus*	138	152	Not significantly different
Mesothelioma	6	<5	Not significantly different
Females Only:			
Breast	197	203	Not significantly different
Cervical	5	8	Not significantly different
Uterus	55	49	Not significantly different
Ovary	17	18	Not significantly different
Males Only:			
Prostate*	198	173	Not significantly different
Testis	8	9	Not significantly different
Bladder	79	68	Not significantly different
Kidney and Renal Pelvis	51	41	Not significantly different
Brain and Other CNS	22	20	Not significantly different
Thyroid	52	41	Not significantly different
Hodgkin Lymphoma	5	8	Not significantly different
Non-Hodgkin Lymphoma	48	54	Not significantly different
Kaposi Sarcoma	<5	<5	Not significantly different
Multiple Myeloma	14	15	Not significantly different
Leukemia	43	36	Not significantly different
Melanoma of Skin	61	75	Not significantly different
Other Cancers	95	95	Not significantly different

Table 2 Notes: Cancer types are listed in Table 2 in the order of their assigned diagnostic codes in the International Classification of Diseases for Oncology, 3rd Edition. Expected numbers are based on standard cancer incidence rates for New Hampshire. Breast cancer also occurs among males, but at a much lower rate than for females, so male cases are not included here. Unless otherwise noted, the difference between the number of cases observed and the number expected is not statistically significant. The probability that this difference is due to chance is greater than 95%.

* Due to limitations in the availability of data from the Veteran Affairs Administration, analyses for lung/bronchus and prostate cancers are limited to the years 2005-2013. All other cancer analyses are for 2005-2014.

Next Steps

NH DHHS is continuing to work with local, state, and national partners to address concerns around PFC exposure and to advance the science so we can better understand how exposure to PFCs impacts the health of New Hampshire residents. We are committed to continuing to be involved with and support the Merrimack community around ongoing concerns related to the PFOA contamination.

- We will update and review the cancer incidence data for Merrimack when the Veteran's Administration (VA) data for 2014 becomes available and will review the data in the next 1-2 years to check for any changes in the comparative cancer numbers for Merrimack residents.
- We will continue to review the science and update healthcare providers and Merrimack residents as new information on the health effects of PFOA becomes available.
- We will continue to work with the Agency for Toxic Substances and Disease Registry (ATSDR), local and federal officials, and local communities to try and get a national health study conducted to provide affected residents and communities more information about the potential health impact of PFOA and other PFC exposure.
- At the request of NH DHHS, ATSDR is currently conducting a Health Consultation for the affected southern NH communities around the Saint-Gobain plant.
- For questions about the cancer information in this report, please call the cancer program at: 603-271-4959.
- For questions about the Department's PFC response, please call: 603-271-4499.

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