Letter Health Consultation

MACKENZIE CHEMICAL WORKS, INC.

CENTRAL ISLIP, SUFFOLK COUNTY, NEW YORK

EPA FACILITY ID: NYD980753420

Prepared by
The New York State Department of Health

DECEMBER 4, 2013

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, 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; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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NEW YORK
state department of
HEALTH

Nirav R. Shah, M.D., M.P.H.
Commissioner

Sue Kelly
Executive Deputy Commissioner

December 2, 2013

Mr. Mark Granger
Remedial Project Manager
Central New York Remediation Section
U.S. Environmental Protection Agency
290 Broadway, 20th Floor
New York, New York 10007-1866

Re: Letter Health Consultation
MacKenzie Chemical Works Site
EPA # NYD980753420
Suffolk County, New York

Dear Mr. Granger:

The New York State Department of Health (DOH) prepared this Letter Health Consultation (LHC) in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR) and with the help of the Suffolk County Department of Health Services (SCDHS) as a follow-up to the September 29, 2004 Public Health Assessment (PHA) written for the MacKenzie Chemical Works Site (site) in Central Islip, Suffolk County, New York (ATSDR 2004).

The 2004 PHA reviewed and evaluated data from water, soil, and soil vapor samples collected between the 1980s and 2004 by the SCDHS, the United States Environmental Protection Agency (EPA) and the New York State Department of Environmental Conservation (DEC). These samples were analyzed for several categories of compounds, including volatile organic compounds (VOCs), semi-volatile organic compounds, metals, polychlorinated biphenyls and pesticides. The analysis did not detect most of these compounds, or detected them at very low concentrations. The analysis frequently found two VOCs, tetrachloroethene (PCE) and 1,2,3-trichloropropane (TCP), in high concentrations in wastewater, soil, soil vapor, and groundwater samples collected at the site, and in the 2004 PHA, these two compounds are considered the primary contaminants of concern for the site.

The 2004 PHA concluded that the site did not pose a public health hazard because there were no known completed exposure pathways to PCE or TCP. However, since significant concentrations of these two compounds were still present in groundwater beneath and near the site, the PHA noted that future exposures were possible if contaminated groundwater migrated to public or private drinking water supply wells and/or if the indoor air of structures near the site was impacted by intrusion of contaminated soil vapor. This LHC re-evaluates some of the data (groundwater, public and private drinking water, soil vapor, and indoor air) that were used in the preparation of the PHA, evaluates other data generated prior to 2004 that were not evaluated in the 2004 PHA, and evaluates data generated after completion of the 2004 PHA to determine if a public health hazard now exists.

Site Description and History

The site is located in a residential/light commercial area of Central Islip, Suffolk County, New York. From 1948 to 1987, the 1.4 acre site was used for storing and manufacturing various chemical products. The SCDHS and the Suffolk County Fire Department documented poor housekeeping and improper operational procedures by the MacKenzie Chemical Works (MacKenzie) Company beginning around 1977. Site conditions led to the EPA recommending in 1983 that actions be taken to address contamination. In 1987, MacKenzie ceased operations at the site. The DEC included the site on the State's Registry of Inactive Hazardous Waste Sites in 1996, and then requested that EPA take over as lead agency for the site in 2000. In 2001, the EPA added the site to the National Priorities List. EPA issued a Record of Decision (ROD) in 2003 (EPA 2003) that identified TCP as the primary VOC of concern in groundwater beneath and down-gradient of the site. The ROD called for remediation of contaminated soil by vapor extraction and remediation of contaminated groundwater by in-situ chemical oxidation. By October 2006, these remediation technologies were operational. According to the EPA's First Five Year Review Report (EPA 2011a), the remedy is functioning as intended by the decision documents, is protecting human health and the environment, and has ongoing operation, maintenance, and monitoring activities as part of the remedy.

Groundwater

The DOH evaluated monitoring well, private well, and public water supply well data from EPA (EPA 2011b), the SCDHS (DOH site files) and the Suffolk County Water Authority (SCWA) (DOH site files) to determine if potable water supply wells are being impacted by site-related PCE and TCP at levels of health concern.

EPA Data

Monitoring Well Data

DOH reviewed data for samples collected between 1999 and 2010 from 32 site-related monitoring wells (see Figure 1), including 21 monitoring wells (six on-site and fifteen off-site wells) sampled by the EPA in 2010.

Only two of the 21 monitoring wells sampled in 2010 had concentrations of TCP greater than the NYS drinking water standard (known as the maximum contaminant level [MCL]) of 5 micrograms per liter (mcg/L). On-site well (EPA-7) had a TCP concentration of 140 mcg/L (down from a maximum concentration of 14,000 mcg/L in 2005). Off-site well OS-2D had a TCP concentration of 110 mcg/L (concentrations in this well have fluctuated between not detected and 170 mcg/L). One on-site well (EPA-2) and one off-site (OS-3DR) well had detections of TCP at levels less than the 5 mcg/L MCL, but greater than the detection limit (0.5 mcg/L).

Two on-site monitoring wells had detections of PCE: EPA-7 at 6.6 mcg/L, which is slightly above the MCL of 5 mcg/L, and EPA-2 at 0.95 mcg/L.

Overall, the data demonstrate that the remedial technologies used at the site (vapor extraction and in-situ chemical oxidation) have been successful in reducing the concentration of PCE and TCP in groundwater at and near the source areas. Table 1 shows PCE and TCP concentration reductions for selected monitoring wells.

Table 1: Selected EPA Groundwater Monitoring Well Data for Tetrachloroethene (PCE) and 1,2,3-Trichloropropane (1,2,3-TCP).

Well Number	Depth (feet)	PCE (mcg/L)	Year Sampled	TCP (mcg/L)	Year Sampled
OS-3S	62	33	2005	14,000	2004
		ND	2010	ND	2010
OS-3D	160	0.59	2005	840	2005
		ND	2010	0.85	2010
OS-4D	157	ND	1999	490	1999
		ND	2006	ND	2006
EPA MW-1	49 to 59	5.7	2004	91,000	2004
		ND	2010	ND	2010
EPA MW-2	47 to 57	16	2004	57,000	2005
		ND	2010	2.9	2010

PCE=tetrachloroethene, TCP=1,2,3-trichloropropane, mcg/L= micrograms per liter, ND=not detected

Suffolk County Data

Public Water Supply Wells

The SCDHS provided DOH with modeling data that estimates where the source water originates for two SCWA public water supply well-fields down-gradient (in the direction of known groundwater flow) of the site, and results from a private well survey (a survey intended to identify private wells being used to supply potable water) and private well sampling conducted in the area down-gradient of the site. The source water modeling was completed subsequent to the 2004 PHA.

DOH identified in the 2004 PHA a SCWA well-field on Carlton Avenue (Figure 2) as a public water supply well-field that could be affected by site contaminants. However, the source water area modeling indicates the site is not within the source water area for the Carlton Avenue well field, and that this well field would not be expected to be impacted by groundwater contamination originating at the MacKenzie site. This well-field has no history of TCP contamination.

The source water area modeling estimates (Figure 2) did show that the site was in SCWAs Bellmore Avenue Wellfield source water area, indicating that it is possible that Bellmore Avenue well-field wells could be impacted by site-related contamination. SCWA data show that TCP was first included as a raw water analyte in 1983 at which time the minimum level that could be detected by the laboratory (detection level) was 2 mcg/L, and that by 1988 the detection level

was 0.5 mcg/L. Review of SCWA data for these Bellmore Avenue wells show that TCP was detected in 1991, and that between 1991 and 1994, TCP was detected in five out of eight bi-yearly raw well head water samples, with the highest concentration of TCP detected at 3 mcg/L in 1993. TCP was not detected after 1994.

Water from several SCWA public water supply wells, including the Bellmore Avenue wells, is blended together before or within what is known as SCWA Distribution Zone 1A. Data from more than 1,200 distribution water samples collected by SCDHS between 1998 and 2010 from over 40 locations within SCWA Distribution Zone 1A showed no detectable levels of TCP. No Zone 1A distribution water samples were available for the years that TCP was detected in the Bellmore Avenue wells, however, it would not be expected that TCP would have been detected in distribution water samples when it was found in the Bellmore Avenue wells due to the low concentrations found, the relative sporadic nature of the detections, and the fact that water from wells not impacted by TCP is blended with the water that is distributed to customers.

Private Wells

In 2007, as recommended in the PHA, SCDHS identified and sampled eight private wells used for drinking water in the area down-gradient of the site. Two of the sampled wells on two adjacent properties located approximately four miles from the site were found to have detections of TCP. One well (Private Well # 1) had a TCP concentration of 5.3 mcg/L, slightly above the drinking water standard for TCP of 5 mcg/L. This property connected to the SCWA public water supply shortly after receiving the sample results. In 2007, the concentration of TCP in the other private well (Private Well # 2) was 0.9 mcg/L, and the property owner chose not to connect to the public water supply at that time. Samples collected in 2011 and 2012 from this home showed that TCP was not detected. The EPA was informed by the owner of Private Well #2 in July of 2013 that the property had been connected to the SCWA public water supply after the last sampling event.

After finding TCP in these two private wells, the SCDHS collected three “GeoProbe” samples (i.e. samples collected from temporary monitoring wells) at a location (Figure 2), north (i.e., up-gradient) of the two homes with the impacted wells. The results from this sampling showed detections of TCP at depths between 45 and 80 feet below ground surface, at concentrations ranging from 0.7 mcg/L to 2.7 mcg/L. SCDHS concluded that this “GeoProbe” data, combined with detections of TCP in the Bellmore Avenue public water supply wells, suggests the site is a potential source for the TCP found in the two private wells.

The EPA and DEC evaluated these data and concluded that the distance (more than four miles) of the two private wells from the site, and a lack of similar detections at the other private wells sampled (all located between the site and the two impacted wells) suggests that the site is not the source of TCP contamination in the two private wells. The EPA noted historic uses of TCP in the area for various industrial processes and in pesticide formulations as supporting information to suggest that other sources may be responsible for the detections. Additionally, the DEC has documented that fumigants containing TCP were widely applied at high application rates to potato acreage on Long Island between the 1950’s and the 1980’s (DEC 1997). SCWA data collected since 1997 shows there have been numerous TCP detections in public and private

water supply wells throughout Long Island (DOH site files), which may also support the conclusion that there could be other sources for the private well TCP detections rather than the MacKenzie Chemical site. Overall, the available information does not enable the DOH to conclusively determine whether the Site is the source of contamination in the private wells.

Soil Vapor Intrusion

Volatile organic compounds in the groundwater may move into the soil vapor (air spaces within the soil, typically located in the unsaturated zone between groundwater and ground surface), which in turn may move into overlying buildings and affect indoor air quality. This process, which is similar to the movement of radon gas from the subsurface into the indoor air of buildings, is referred to as soil vapor intrusion (SVI).

Soil vapor samples collected on the site prior to implementation of the remedial activities called for in the 2003 ROD (EPA 2003) showed PCE concentrations as high as 600 micrograms per cubic meter of air (mcg/m^3) and TCP concentrations as high as 2,000 mcg/m^3. The highest soil vapor sample result off-site for PCE was 300 mcg/m^3, and TCP was not detected in any off-site soil vapor samples.

The EPA conducted SVI evaluations of 16 down-gradient residential properties in 2005 and 2006. During the course of this investigation, the EPA collected air samples from beneath (known as sub-slab soil vapor samples) and within (indoor air samples) nearby buildings. No TCP was detected in the sub-slab soil vapor or indoor air of any of the properties sampled. PCE was detected at low levels in sub-slab soil vapor of several homes (not detected (ND) to 160 mcg/m^3). Only one property was found to have PCE in sub-slab and indoor air (160 mcg/m^3 and 30 mcg/m^3, respectively) at concentrations that, when compared to *Soil Vapor/Indoor Air Matrix 2* from the October 2006 DOH *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (DOH 2006), indicate soil vapor intrusion could be occurring. The EPA determined that even though the indoor air concentration of PCE was greater than concentrations typically found in indoor air (usually less than 10 mcg/m^3), the indoor concentration of 30 mcg/m^3 was well below the DOH air guideline value at the time for PCE of 100 mcg/m^3, and, therefore, no further action was called for. Other structures closer to the site did not show evidence of SVI. Therefore, EPA concluded that the PCE detected in sub-slab soil vapor and indoor air was probably not site related.

Public Health Implications

In 2007, the SCDHS sampled eight private wells located down-gradient of the MacKenzie Site. Well water from two private wells contained TCP, one at 5.3 mcg/L, and the other at 0.9 mcg/L. The source of the contamination is not known. The MacKenzie Chemical site, other industrial sources, and pesticide use are three possible sources of the TCP contamination. Currently, both of the residences that had TCP detections in their private wells have connected to the SCWA public water supply system. The following section summarizes information on the health effects of TCP and characterizes the risk for adverse health effects for past exposure to TCP in these wells.

Health Effects of TCP

TCP is a volatile organic chemical that has been used as a solvent, a degreasing agent, and in the synthesis of other chemicals. TCP is also produced as a byproduct in the production of other chemicals, including certain pesticides such as the active ingredient 1,3-dichloropropene (Telone II). TCP can get into drinking water through improper disposal and the use of pesticides containing TCP.

Long-term studies on the health effects of TCP in humans are not available. TCP causes several types of adverse health effects in laboratory animals. Studies conducted by the National Toxicology Program (NTP 1993) that exposed both sexes of rats and mice to large amounts of TCP by gavage (oral stomach tube) for their lifetimes showed that TCP caused cancer in multiple body organs. The sites having an increased incidence of tumors included the digestive system, pancreas, liver, Harderian gland (a type of eye gland), and uterus. Based on the results of these animal studies, the EPA classifies TCP as likely to be carcinogenic to humans (EPA 2009). TCP also causes several types of noncancer toxicity. In laboratory animals given large oral doses by gavage, TCP caused damage to the liver, kidney, heart, digestive and respiratory systems, and reduced the animals' fertility and ability to reproduce (Merrick et al. 1991; NTP 1990, 1993). Rats exposed to high levels of TCP in air had damage to their lungs, liver and spleen (Johannsen et al. 1988).

Toxicity and Exposure Considerations for TCP

We made assumptions about the toxicity of TCP and the extent to which people may have been exposed to TCP in drinking water to calculate the TCP cancer risk estimates for children and adults. These assumptions involve 1) the type of tumor used to estimate the TCP cancer potency factor (a numerical value that expresses the ability [strength/potency] of TCP to cause cancer), 2) the mathematical methods used to derive the TCP cancer potency factor, and 3) how much contaminated water people drank and for how long. The increased risk for getting cancer is obtained by multiplying our estimate of exposure by the TCP cancer potency factor. The cancer risk calculations can be made using assumptions about toxicity and exposure that likely overestimate the increased risk, but equally valid and reasonable assumptions can also be used that can provide cancer risk estimates that are more representative of specific environmental exposure situations. We therefore used several site-specific exposure assumptions to estimate the cancer risks for TCP in drinking water from the private wells that had TCP contamination. These are summarized in the following table.

Table 2. Assumptions used to Estimate Cancer Risks for TCP in Drinking Water from Private Wells near the MacKenzie Chemical Site.

Parameter	Assumptions
Cancer Potency Factor	We calculated the cancer risks using cancer potency factors based on 1) all tumors and 2) all tumors except forestomach tumors. The cancer potency factors were the median value (calculated by DOH) of the maximum likelihood potency factors for male rats, female rats, male mice and female mice (EPA 2009). Humans do not have forestomachs, but forestomach tumors in rodents may be relevant to the cancer risks in humans.
Drinking Water Ingestion Rate	We estimated the exposure to TCP in drinking water using average "consumers only" ingestion rates for adults and children from the EPA Exposure Factors Handbook (EPA 2011c; Table ES-1).
Exposure Duration	We estimated the exposure to TCP using exposure durations of 11 and 8 years based on how long people could have lived in each house according to when the properties changed ownership.

We also considered exposure pathways for TCP in water other than by drinking. Exposure to VOCs such as TCP in water is possible not only by ingestion, but also by contact with the skin (dermal exposure) and inhalation from uses such as showering, bathing and cooking. Although the actual duration and frequency of exposure varies depending on an individual's lifestyle, each of these exposure routes can contribute to the overall daily intake of contaminants and therefore may increase the risk for adverse health effects. Several studies (e.g., Xu and Weisel 2003, 2005; Maxwell et. al. 1991; Weisel and Jo 1996) indicate that for VOCs in drinking water, exposures by the inhalation or dermal routes may approach the same level as exposure by ingestion. Therefore, we assumed that exposure to TCP in water through the inhalation and dermal routes was the same as exposure through the ingestion route.

A detailed example of our calculation of the increased theoretical risk for getting cancer from exposure to TCP in drinking water is found in Appendix A. The risks for noncancer health effects from exposure to TCP in drinking water were minimal.

Risk Characterization

Private Well 1 (no longer used)

For Private Well #1, we estimated the theoretical increased risk for getting cancer for adults and children for past exposure to 5.3 mcg/L TCP in drinking water for 8 years based on the maximum amount of time the occupants may have been exposed. We evaluated children for three different 8-year periods (birth to 8 years, age 1 to 9 years, and age 2 to 10 years) to account for life stages of increased vulnerability to the cancer effects of TCP (see Child Health Considerations section). The estimated risks are summarized in the table below.

Table 3: Estimated Theoretical Increased Cancer Risk for Exposure to 5.3 mcg/L TCP for 8 years.

Life Stage	Estimated Cancer Risk	Qualitative Descriptor
Risk Estimated Using CPF for All Tumors Except Forestomach		
Child (0 to < 8 yrs)	1 in 10,000	moderate
Child (1 to < 9 yrs)	7 in 100,000	low
Child (2 to < 10 yrs)	5 in 100,000	low
Adult (> 21 yrs)	1 in 100,000	low
Risk Estimated Using CPF for All Tumors		
Child (0 to < 8 yrs)	9 in 10,000	moderate
Child (1 to < 9 yrs)	4 in 10,000	moderate
Child (2 to < 10 yrs)	3 in 10,000	moderate
Adult (> 21 yrs)	8 in 100,000	low

CPF = cancer potency factor

Overall, our best professional judgment is that the estimated increased risk for getting cancer from exposure to 5.3 mcg/L TCP for 8 years for a person two years of age or younger is moderate, which is the descriptor we give to cancer risks in the range between one in ten thousand and one in one thousand. Our best professional judgment is that the increased cancer risk for adults is low (the increased risk is between one in one million and one in ten thousand). The risk for noncancer health effects is minimal.

Private Well 2 (no longer used)

For Private Well #2, we estimated the theoretical increased risk for getting cancer for adults and children for past exposure to 0.9 mcg/L TCP in drinking water for 11 years, based on the maximum amount of time the occupants may have been exposed. For children, we considered three different 11-year periods (birth to 11 years, age 1 to 12 years, and age 2 to 13 years) during which children may be especially vulnerable to the effects of TCP (see Child Health Considerations section). The estimated risks are summarized in the table below.

Table 4: Estimated Theoretical Increased Cancer Risk for Exposure to 0.9 mcg/L TCP for 11 years.

Life Stage	Estimated Cancer Risk	Qualitative Descriptor
Risk Estimated Using CPF for All Tumors Except Forestomach		
Child (0 to < 11 yrs)	3 in 100,000	low
Child (1 to < 12 yrs)	1 in 100,000	low
Child (2 to < 13 yrs)	1 in 100,000	low
Adult (> 21 yrs)	3 in 1,000,000	low
Risk Estimated Using CPF for All Tumors		
Child (0 to < 11 yrs)	2 in 10,000	moderate
Child (1 to < 12 yrs)	9 in 100,000	low
Child (2 to < 13 yrs)	6 in 100,000	low
Adult (> 21 yrs)	2 in 100,000	low

CPF = cancer potency factor

Overall, our best professional judgment is that the estimated increased risk for getting cancer from past exposure to 0.9 mcg/L TCP for 11 years is low for both children and adults. This is the descriptor we give to cancer risks in the range between one in one million and one in ten thousand. However, the risk for getting cancer will increase if people continue to drink the water. The risk for noncancer health effects is minimal.

Child Health Considerations

ATSDR and DOH consider children when evaluating exposure pathways and potential health effects for environmental contaminants. Children are of special concern because their behavior patterns and play activities can result in more exposure than adults. Children sometimes differ from adults in their sensitivity to the effects of chemicals, but this depends on the chemical, and whether or not there is a difference can also change as the child gets older.

We considered the possibility that children may be more sensitive to the health effects of TCP when we evaluated the health risks associated with exposure to TCP in two contaminated private wells. TCP is identified by the EPA as a chemical that causes cancer by permanently changing DNA (EPA 2005, 2006, 2009). Such chemicals are considered to pose a higher risk for cancer if exposure occurs early in life compared to the risk from exposure during adulthood (EPA 2005). Therefore, children may be more sensitive than adults to the carcinogenic effects of TCP. To account for this possible greater sensitivity, we followed the EPA guidance and increased our theoretical cancer risk calculations for TCP by a factor of 10 for ages 0 to < 2 years, and a factor of 3 for ages 2 to <16 years (EPA 2005, 2006). We also used age-specific drinking water ingestion rates from the EPA Exposure Factors Handbook when estimating child exposure to TCP in drinking water. See Appendix A for a detailed calculation of cancer risk estimates using these child-specific parameters.

Conclusions

DOH and ATSDR conclude that drinking water from private wells contaminated with TCP in the past could harm people's health (see Appendix B). This is because the risks for people using private wells that were contaminated with TCP in the past is estimated to pose a low to moderate increased risk for cancer and a minimal risk for noncancer health effects. Both residences that had a well contaminated with TCP have connected to public water.

DOH and ATSDR conclude that drinking water from public water supply wells is not expected to harm people's health (see Appendix B). This is because TCP is no longer detected in samples collected from the public water supply wells, and was never detected in water sampling results from locations where people drank the water (distribution samples).

Even though one residential structure near the site was found to have sub-slab and indoor air impacts by PCE, a site related contaminant, it appears that the PCE source that impacted this structure originated from somewhere other than the site. Therefore, DOH and ATSDR conclude that the indoor air of buildings in the area is not being impacted by soil vapor contaminants that originated at the site. Remedial activities at the site appear to have restricted the movement of site-related sub-surface contaminants so that soil vapor intrusion into nearby homes has not occurred.

Recommendations

The home with documented PCE impacts to sub-slab soil vapor and indoor air should be evaluated again to determine if soil vapor intrusion is occurring from another source and whether PCE in indoor air is at concentrations typically found in indoor air.

Public Health Action Plan

DOH and the SCDHS will make sure that the affected public water supply wells continue to be monitored, as required by the State Sanitary code for VOCs, including TCP and PCE.

DOH will work with EPA to determine whether actions should be taken to address exposures related to soil vapor intrusion at the one home.

If you have any questions, please call me at 518-402-7860.

Sincerely,

Steve Karpinski
Public Health Specialist
Bureau of Environmental Exposure Investigation

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Figure 1. Location of MacKenzie Chemical Works site and selected monitoring wells.

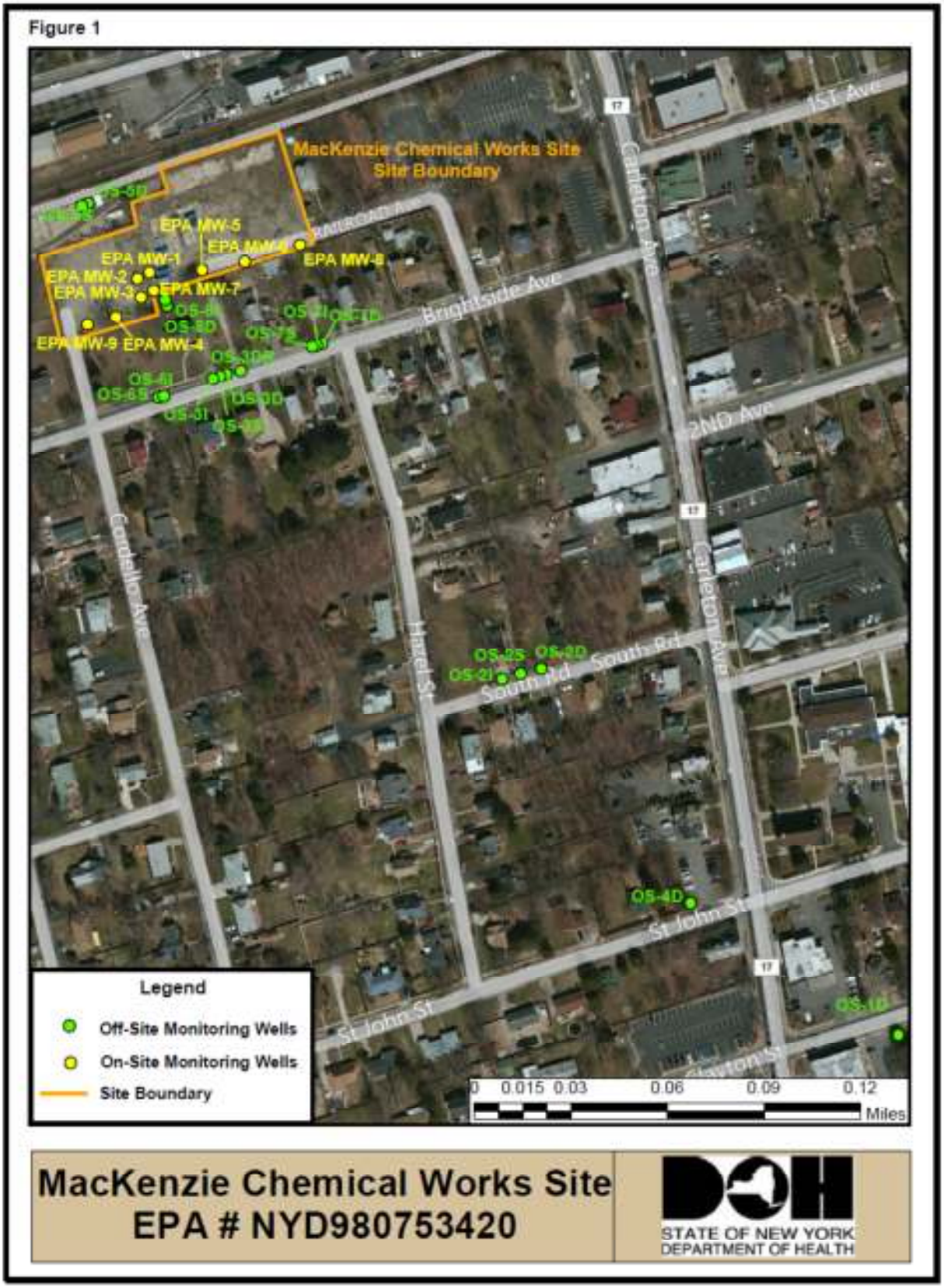
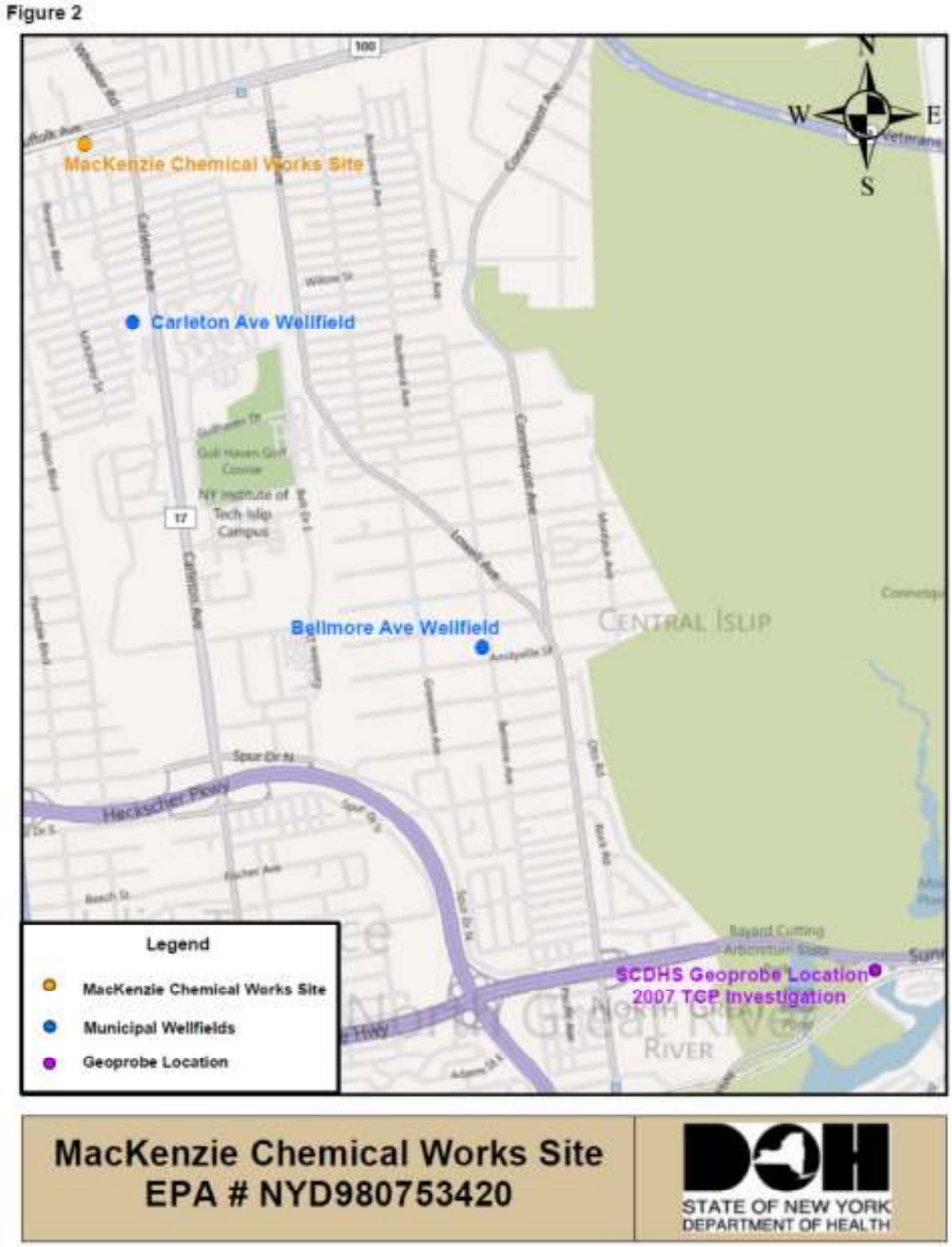


Figure 2. Locations of MacKenzie Chemical site, public wellfields and Geoprobe sampling.



Appendix A

Table 1

Sample Cancer Risk Calculation TCP in Drinking Water. Example used here is for 0.9 micrograms per liter (mcg/L).

Age	Contaminant Level (mcg/L)	Water Ingestion Rate[1] (L/kg-day)	Exposure Duration (years)	Age Specific Daily Dose[2] (mg/kg/day)	Cancer Potency Factor[3] ((mg/kg/day)$^{-1}$)	Averaging Time (years)	Unadjusted Age-Specific Cancer Risk	Age Dependent Adjustment Factor[4]	Adjusted Age Specific Cancer Risk
0 to <1	0.9	0.078	1	1.40E-04	4.2	70	8.42E-06	10	8.42E-05
1 to <2	0.9	0.027	1	4.86E-05	4.2	70	2.92E-06	10	2.92E-05
2 to <3	0.9	0.026	1	4.68E-05	4.2	70	2.81E-06	3	8.42E-06
3 to <4	0.9	0.021	1	3.78E-05	4.2	70	2.27E-06	3	6.80E-06
4 to <5	0.9	0.021	1	3.78E-05	4.2	70	2.27E-06	3	6.80E-06
5 to <6	0.9	0.021	1	3.78E-05	4.2	70	2.27E-06	3	6.80E-06
6 to <7	0.9	0.017	1	3.06E-05	4.2	70	1.84E-06	3	5.51E-06
7 to <8	0.9	0.017	1	3.06E-05	4.2	70	1.84E-06	3	5.51E-06
8 to <9	0.9	0.017	1	3.06E-05	4.2	70	1.84E-06	3	5.51E-06
9 to <10	0.9	0.017	1	3.06E-05	4.2	70	1.84E-06	3	5.51E-06
10 to <11	0.9	0.017	1	3.06E-05	4.2	70	1.84E-06	3	5.51E-06
							11 year (0-11 yrs) total risk:		**1.70E-04**

[1] The water ingestion rates are the average consumers only rates from Table ES-1 of the US EPA Exposure Factors Handbook (EPA, 2011).

[2] The drinking water concentration for TCP was doubled to account for inhalation and dermal exposures of a volatile organic chemical.

[3] The cancer potency factor is the median of four maximum likelihood estimate values based on total tumors in male rats (3.3 [mg/kg/day]$^{-1}$), female rats (1.1 [mg/kg/day]$^{-1}$), male mice (5.1 [mg/kg/day]$^{-1}$), and female mice (11.3 [mg/kg/day]$^{-1}$) from EPA (2009).

[4] Age-dependent adjustment factors are 10 for 0 to <2 years, 3 for ages 2 to <16 years (EPA, 2005; 2006).

References to Appendix A.

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Appendix B

Conclusion Categories and Hazard Statements

ATSDR has five distinct descriptive conclusion categories that convey the overall public health conclusion about a site or release, or some specific pathway by which the public may encounter site-related contamination. These defined categories help ensure a consistent approach in drawing conclusions across sites and assist the public health agencies in determining the type of follow-up actions that might be warranted. The conclusions are based on the information available to the author(s) at the time they are written.

1. Short-term Exposure, Acute Hazard "ATSDR concludes that...could harm people's health."

This category is used for sites where short-term exposures (e.g. < 1 yr) to hazardous substances or conditions could result in adverse health effects that require rapid public health intervention.

2. Long-term Exposure, Chronic Hazard "ATSDR concludes that...could harm people's health."

This category is used for sites that pose a public health hazard due to the existence of long-term exposures (e.g. > 1 yr) to hazardous substance or conditions that could result in adverse health effects.

3. Lack of Data or Information "ATSDR cannot currently conclude whether...could harm people's health."

This category is used for sites in which data are insufficient with regard to extent of exposure and/or toxicologic properties at estimated exposure levels to support a public health decision.

4. Exposure, No Harm Expected "ATSDR concludes that ... is not expected to harm people's health."

This category is used for sites where human exposure to contaminated media may be occurring, may have occurred in the past and/or may occur in the future, but the exposure is not expected to cause any adverse health effects.

5. No Exposure, No Harm Expected "ATSDR concludes that ...will not harm people's health."

This category is used for sites that, because of the absence of exposure, are not expected to cause any adverse health effects.

REPORT PREPARATION

This Health Consultation for the MacKenzie Chemical Works, Inc. site was prepared by the New York State Department of Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approved agency methods, policies, procedures existing at the date of publication. Editorial review was completed by the cooperative agreement partner. ATSDR has reviewed this document and concurs with its findings based on the information presented. ATSDR's approval of this document has been captured in an electronic database.

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