



**Department
of Health**

Center for Environmental Health

PUBLIC HEALTH CONSULTATION

Former ITT Sealectro

Town of Mamaroneck, Westchester County, New York

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SUMMARY

INTRODUCTION

In 1999, a private citizen requested that the Agency for Toxic Substances and Disease Registry (ATSDR) review the results of air samples taken from the Mamaroneck Dialysis Clinic (also known as the International Health Specialist Dialysis Clinic) located at the former ITT Seaelectro site in Mamaroneck, Westchester County, and comment on the health implications associated with inhalation exposures to the detected contaminants. At that time, ATSDR evaluated the available data from two leased spaces within the on-site building and concluded that the concentrations of volatile organic compounds (VOCs) detected in indoor air did not pose a health threat to the general public or employees; however, ATSDR indicated that it was difficult to determine if prolonged exposure to indoor, low-level air VOCs at the facility would have posed a health hazard to the sensitive population (kidney dialysis patients). ATSDR recommended continued indoor air monitoring at the site [ATSDR 1999]. This recommendation and additional details regarding ATSDR's evaluation can be found in ATSDR's November 12, 1999 Health Consultation for the Mamaroneck Dialysis Clinic.

This public health consultation has been prepared to document activities completed at the on-site building to evaluate and abate human exposures related to soil vapor intrusion since ATSDR's 1999 Health Consultation. Improved analytical procedures, instrumentation capabilities, and available health effects information since 1999 allow for the evaluation of site-related chemicals at lower concentrations than previously detected. The New York State Department of Health (NYSDOH), under a cooperative agreement with ATSDR, has reviewed additional air data collected at the former ITT Seaelectro site between December 1998 and January 2007 and evaluated the public health implications of the exposures to contaminants detected in the indoor air of the on-site building. The results from this evaluation provide the basis for NYSDOH's conclusions and recommendations in this health consultation.

Between 2007 and 2013, the NYSDOH requested that actions be taken to mitigate human exposure to site-related contaminants in the indoor air of the on-site building. After lengthy negotiations with the property owner, a sub-slab depressurization system was installed in 2013.

The NYSDOH's top priority at this site is to ensure that past and current employees who worked/work in the former ITT Seaelectro building since 1999 have the best information possible about how contaminants in the indoor air might affect their health. The NYSDOH has reached the following conclusions for the ITT Seaelectro Site based on risk assessment methods. For more information on risk assessment, please refer to the section entitled "Risk Assessment Methods" in the Public Health Implications section of this document.

CONCLUSION 1

The NYSDOH concludes that past exposure (between December 1998 and 2013) to trichloroethene (TCE) in indoor air of the Mamaroneck Dialysis Clinic, the Davis Studio and the American Tile Company could have increased the risk for adverse health effects.

BASIS FOR CONCLUSION

TCE was found in the indoor air of all three establishments at concentrations that approached or exceeded exposure concentrations identified by the United States Environmental Protection Agency (USEPA) as associated with immune or developmental health effects.

CONCLUSION 2

The NYSDOH concludes that past exposure (between December 1998 and 2013) to VOCs, other than TCE, in the indoor air of the Mamaroneck Dialysis Clinic, the Davis Studio and the American Tile Company is not expected to harm people's health.

BASIS FOR CONCLUSION

Based on the available data, past exposure to the average levels of benzene, carbon tetrachloride, 1,1-dichloroethane, chloroform, and tetrachloroethene at the three establishments posed a very low¹ to low² increased lifetime risk for cancer, and a minimal³ risk for noncancer health effects.

CONCLUSION 3

The NYSDOH concludes that breathing VOCs at levels measured inside the former ITT Sealectro building after the 2013 installation of the sub-slab depressurization system is not expected to harm people's health.

BASIS FOR CONCLUSION

Installation and operation of a sub-slab depressurization system has mitigated exposures to VOCs associated with soil vapor intrusion at the former ITT Sealectro site. Post-mitigation air

¹ The estimated exposures pose a cancer risk of less than one in one million.

² The estimated exposures pose a cancer risk between one in one million and one in ten thousand.

³ The estimated exposures are less than the contaminant's reference concentration. The reference concentration is defined by the USEPA as an estimate (with uncertainty spanning perhaps an order of magnitude) of a chronic (up to a lifetime) contaminant exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious noncancer health effects.

data collected after the installation of a sub-slab depressurization system are consistent with levels commonly found in the indoor air of buildings.

NEXT STEPS

The NYSDOH recommends that the sub-slab depressurization system installed in the former ITT Sealectro building in 2013 remain in place and operational until it is no longer needed to address exposures related to soil vapor intrusion. The NYSDOH, in partnership with the New York State Department of Environmental Conservation (NYSDEC), will evaluate any proposal to turn off or modify the mitigation system.

The NYSDOH recommends that the responsible party (ITT Corporation) continue to monitor and maintain the sub-slab depressurization system installed in the former ITT Sealectro building, with NYSDOH and NYSDEC oversight in the state superfund program, to verify the system is effectively maintaining indoor air concentrations of site-related contaminants within background ranges.

For people exposed in the past to TCE in the indoor air of the Mamaroneck Dialysis Clinic, the Davis Studio, and the American Tile Company, general recommendations for maintaining good health are the same as general recommendations for others: maintain a healthy lifestyle and have regular medical check-ups.

FOR MORE INFORMATION

If you have questions about this health consultation or other health concerns about this site, please contact the NYSDOH at 518-402-7860.

A copy of this health consultation will be available on the NYSDOH public website at: <https://www.health.ny.gov/environmental/investigations/ITTSealectro.html>.

BACKGROUND

Statement of Issue

In 1999, a private citizen requested that the Agency for Toxic Substances and Disease Registry (ATSDR) review the results of air samples taken in 1998 from the Mamaroneck Dialysis Clinic (also known as the International Health Specialist Dialysis Clinic) located at the former ITT Seaelectro site (site) in Mamaroneck, Westchester County, and comment on the health implications associated with inhalation exposures to the detected contaminants. ATSDR evaluated the data using health effects information available at that time and concluded that the concentrations of volatile organic compounds (VOCs) detected in indoor air at the site did not pose a health threat to the general public or employees. However, ATSDR indicated that it was difficult to determine if prolonged exposure to indoor, low-level air VOCs at the facility would have posed a health hazard to the sensitive population (kidney dialysis patients). ATSDR recommended continued indoor air monitoring at the site [ATSDR 1999]. These conclusions and recommendations are found in ATSDR's Health Consultation for the Mamaroneck Dialysis Clinic, dated November 12, 1999.

This health consultation evaluates human exposures related to soil vapor intrusion at the site since 1999. This evaluation is consistent with the recommendation provided in the 1999 ATSDR Health Consultation for the Mamaroneck Dialysis Clinic, formerly located in the on-site building. Indoor air samples were collected between 1999 and 2007 to monitor the VOC levels in the on-site building. Improved analytical procedures and instrument capabilities since 1999 allow for the evaluation of site-related chemicals at lower concentrations than previously detected. An evaluation of the lower level sample results using available health effects information prompted the NYSDOH to recommend that actions be taken to reduce human exposures to indoor air contamination caused by soil vapor intrusion at the site.

Site Description and History

The site is located at 139 Hoyt Avenue in the Village of Mamaroneck in Westchester County, New York (Appendix A, Figure 1). The site is about one acre in size and contains one single-story building on a concrete slab. The building has a floor space of approximately 20,000 square feet and is zoned for commercial use. The remaining area of the site consists primarily of parking areas with a small grassy area and sidewalk on the front side of the building. Immediately bordering the site is the Sheldrake River to the north, Hoyt Avenue and railroad tracks to the south, and commercial/manufacturing buildings to the east and west.

From 1960 to 1990, the site was used for various manufacturing/assembly operations, including screw machine operations (through 1975) and electroplating (through 1986), along with the assembling of electronic parts and jewelry. The on-site building was vacant from 1990 to 1994. Following the sale of the site in 1995, the site building was subdivided into two units and was used by several commercial businesses, including a showroom and warehouse for flooring

material (American Tile Company) that operated in the west side of the building from 1995 to 2012, and a kidney dialysis treatment center (Mamaroneck Dialysis Clinic) that operated in the east side of the building from December 1997 to March 1999. The Davis Studio, a photography studio, operated out of the east side of the building from 1999 to 2012 after the dialysis clinic moved out (Appendix A, Figure 2). In March 2012, all tenants vacated the premises when the building underwent a complete renovation. A beverage sales company, which is open to the public during normal business hours, has occupied the entire building since 2014.

In addition to the building being vacant during remodeling in 2012 and 2013, the building was not occupied between March and November 2005 and April 2007 to February 2008 due to flooding from storms.

During the site's manufacturing history (pre-1990), an outdoor drum storage area located on the west side of the building held various drums containing VOCs, including trichloroethene (TCE) and 1,1,1-trichloroethane (1,1,1-TCA). TCE and 1,1,1-TCA were used as contact cleaners. Samples collected during the site investigation indicated soils in the drum area were contaminated with solvents. In 1991, during the removal of underground storage tanks (USTs) from the front of the building, observations revealed that used solvents, electroplating wastes, and fuel oil had leaked from the USTs. Environmental sampling indicated that site soil and groundwater were contaminated with TCE and 1,1,1-TCA, along with other VOCs, including tetrachloroethene (PCE), 1,2-dichloroethene (1,2-DCE), 1,1-dichloroethene (1,1-DCE), 1,1-dichloroethane (1,1-DCA), and vinyl chloride (VC). See Appendix A, Figure 2 for the locations of the former drum and underground storage tanks.

The New York State Department of Environmental Conservation (NYSDEC) listed the property as a Class 2 site on its Registry of Inactive Hazardous Waste Disposal Sites in March of 1992 (also known as the State Superfund program). Although the work by the site owner was conducted before a signed Order on Consent, the NYSDEC acknowledged the remedial work and data. Once the Order on Consent was signed the site owner conducted additional remedial activities between September 1992 and August 1995, including the installation of two groundwater recovery and treatment systems, excavation and off-site disposal of contaminated soils, and a five-month soil vapor extraction (SVE) pilot study at the former drum storage area. The pilot study revealed that SVE successfully reduced site-related VOCs in the vadose zone (soil above the water table), but did not effectively reduce residual dense non-aqueous phase liquid contaminants remaining in the saturated zone of the site.

In March 1999, the NYSDEC, in consultation with the NYSDOH, signed a Record of Decision (ROD) indicating that the remedy for the site would include monitored natural attenuation of groundwater, along with the continued operation and maintenance of the groundwater extraction and treatment systems. Finally, the ROD included an indoor air monitoring requirement to assess if additional actions were necessary to reduce/mitigate exposures from inhalation of site-related contaminants in the indoor air due to soil vapor intrusion.

Environmental Investigation Results

Remedial Investigation/Feasibility Study (RI/FS, 1992-1995)

The RI/FS included collecting on-site soil and groundwater samples, surface water and sediment sampling of the Sheldrake River, and air samples from inside the site building. RI/FS analytical data were compared to environmental standards, criteria, and guidance values. VOCs were found to be the primary chemicals of concern at the site, confirming previous sampling results. The primary VOCs detected include: 1,1,1-TCA, PCE, TCE, 1,2-DCE, 1,1-DCE, 1,1-DCA and vinyl chloride.

The RI/FS defined the nature and extent of site-related contamination in the three previously identified areas of the site where remedial measures were implemented. These areas were 1) the solvent UST area, 2) the fuel oil UST area, and 3) the former drum storage area (Figure 2).

In October 1993, two indoor air samples were collected and analyzed for eight site-related VOCs to determine if actions were needed to address exposures. Although none of the VOCs tested for were detected, the method detection limits were 50 to 100 times higher than typical indoor air levels for the compounds. Consequently, the results of this sampling event did not provide useful information as to the need for actions to reduce to exposure.

Air sampling (1998)

At the request of the NYSDOH, a second round of indoor air sampling was conducted at the site in December 1998. An outdoor air sample was also collected for comparison with indoor air sample results. These air samples were analyzed using significantly lower method detection limits than the 1993 sampling event. The results indicated that some site-related chemicals (i.e., PCE, TCE, 1,1,1-TCA, and 1,1-DCA) were detected at or slightly higher than their respective typical indoor air background concentrations and outdoor air sample results. Based on this information, further air sampling of the building was necessary to determine whether actions were needed to reduce exposure. Because of this new information the dialysis treatment center decided to move their operation out of the building in March 1999 [ATSDR 1999].

Periodic Indoor Air Sampling (1999-2001)

In accordance with the 1999 ROD, the consultant for the site's owner conducted indoor air sampling of the site building on a quarterly basis through March 2000. Subsequently, the air sampling approach was modified and completed semi-annually during the rest of 2000 and 2001. At the time, the building was occupied by two businesses, and the indoor air samples were collected from each occupant's building space along with outdoor air background samples. Similar to prior sampling events, TCE and PCE were detected in indoor air above their respective indoor air background concentrations. The NYSDOH recommended that additional measures be taken to minimize the migration of contaminated soil vapors into the building.

On-Site Soil Vapor Intrusion Evaluation (2007)

In 2006, the NYSDOH requested that a comprehensive soil vapor intrusion evaluation be completed at the site based on a review of available data from the site's routine groundwater monitoring program and historic soil vapor monitoring data. Soil vapor intrusion can occur when VOCs in groundwater, soil, or other subsurface sources move into the soil vapor (air spaces within the soil), and then move into overlying buildings and affect the indoor air quality. This process is similar to the movement of radon gas from the subsurface into the indoor air of buildings. The soil vapor intrusion evaluation was completed at the site in January 2007. Paired sub-slab vapor and indoor air samples were collected at six locations throughout the site building (three each in the two spaces leased to American Tile Company, Inc. and Davis Studio). The goal of collecting sub-slab vapor samples in conjunction with indoor air samples was to guide recommendations to address potential or current exposures.

Levels of TCE in sub-slab vapor samples were as high as 24,000 micrograms per cubic meter (mcg/m^3). Levels of PCE and 1,1,1-TCA in sub-slab vapors were as high as 11,000 mcg/m^3 and 2,700 mcg/m^3 , respectively. TCE levels in indoor air samples ranged from 9.7 to 91 mcg/m^3 . PCE and 1,1,1-TCA were detected in all indoor air samples and levels ranged from 7.5 to 140 mcg/m^3 and 4.3 to 19 mcg/m^3 , respectively.

Following a review of the sub-slab vapor and indoor air results in May 2007, the NYSDEC, in consultation with NYSDOH, required that the property owner install a sub-slab depressurization system on the building to mitigate human exposures related to soil vapor intrusion. A sub-slab depressurization system uses a fan-powered vent and piping to draw vapors from the soil beneath the building's foundation (i.e. essentially creating a vacuum beneath the slab) and discharge them to the atmosphere. This results in lower sub-slab air pressure relative to indoor air pressure, which prevents the infiltration of sub-slab vapors into the building.

Sub-slab Depressurization System Installation and Confirmation Testing (2013 and 2015)

The NYSDEC and NYSDOH approved the design for the sub-slab depressurization system in 2008. Pressure field communication testing⁴ was conducted at the site in October 2008 and February 2009 to assess whether the soil conditions under the building were favorable for effective sub-slab depressurization. In addition, the building was evaluated for evidence of cracks in the slab/foundation, sumps, or any other openings that needed repair to improve the effectiveness of a sub-slab depressurization system. Overall, data collected from the communication test indicated that the slab and the materials (soil) beneath the slab were sufficient to allow for an effective system.

After years of negotiation with the property owner and upon completion of building renovations, the sub-slab depressurization system was installed and became fully operational in

⁴ A diagnostic test performed to measure the ability of a suction field and air flow to extend through the material beneath the foundation of a building.

December 2013. Similar to a pressure field communication test, pressure field extension testing was completed at six locations to demonstrate the effectiveness of the system at creating a vacuum beneath the building slab

Post-mitigation indoor air sampling was conducted in the on-site building in March 2015 to confirm that the sub-slab depressurization system was operating effectively as designed. A total of six indoor air samples and one outdoor air sample were collected as part of the sampling event. Post-mitigation sample results indicated a significant decrease in the concentrations of VOCs previously present in the indoor air due to soil vapor intrusion. VOCs were detected within range of typical indoor air background levels found in public and commercial office buildings. [USEPA 2001b]. See Table B2 of Appendix B for post mitigation indoor air sample results. The NYSDOH and NYSDEC concluded that the sub-slab depressurization system was effectively mitigating exposures related to soil vapor intrusion and the system should continue to operate and be maintained as part of site management.

DISCUSSION

The health consultation process assesses whether people have been exposed, are currently being exposed, or potentially may be exposed in the future to hazardous substances and, if so, whether that exposure is harmful or potentially harmful, and, if exposure continues should therefore be stopped or reduced. The process for assessing whether a health hazard to a community exists is to evaluate environmental data (contaminants), determine whether there is a completed exposure pathway from a contaminant source to a receptor population (exposure evaluation) and, if so, determine whether exposure to the contamination is at a level that poses a health concern (public health implications evaluation). This health consultation summarizes and evaluates the public health implications of indoor air data collected from rental units within the former ITT Sealectro site building and provides conclusions and recommendations.

Exposure Pathway Analysis

An exposure pathway refers to the way a person can come into contact with a hazardous substance that originates from some source of contamination. There are three basic exposure routes: inhalation, ingestion, or direct contact with skin. A completed exposure pathway occurs when all five of the following elements exist:

1. Source of contamination;
2. Environmental media and transport mechanism;
3. Point of exposure;
4. Route of exposure; and
5. Receptor population.

The source of contamination is the point of contaminant release to the environment (any waste disposal area or point of discharge). If the original source is unknown, the contaminant source

is considered to be the environmental media (soil, air, biota, or water) that are contaminated at the point of exposure. Environmental media and transport mechanisms carry contaminants from the source to points where people may be exposed. The point of exposure is a location where actual or potential human contact with a contaminated medium may occur. The route of exposure is the manner in which a contaminant actually enters or contacts the body (i.e., ingestion, inhalation, or absorption through the skin). The receptor population are those who are exposed or may be exposed to contaminants at a point of exposure. An eliminated exposure pathway is when one or more of the elements does not exist and therefore no further evaluation is required.

The most exposed population for the former ITT Sealectro site includes employees who worked at the on-site businesses. People were exposed in the past to site-related contamination through the soil vapor intrusion process. The evaluated exposure pathway for site-related contaminants is presented in Table 1 below.

Table 1. Evaluated Exposure Pathway at the Former ITT Sealectro Site.

Pathway	Environmental Medium	Exposure Point	Exposure Route	Exposed Population	Pathway Classification
Soil Vapor Intrusion	Indoor Air	Mamaroneck Dialysis Clinic	Inhalation	Employee	Past – Completed; Current and Future – Eliminated ¹
		Davis Studio	Inhalation	Employee	Past – Completed; Current and Future – Eliminated ¹
		American Tile	Inhalation	Employee	Past – Completed; Current and Future – Eliminated ¹

¹A mitigation system has been installed to prevent subsurface vapors from entering the building.

Public Health Implications

Risk Assessment Methods

The following section summarizes a risk assessment for air contaminants related to the ITT Sealectro Site. Risk assessment is a scientific process that is used to characterize the nature and magnitude of health risks to humans from environmental exposures. Risk assessment uses a standard approach that combines information about the frequency and magnitude of an environmental exposure with information about the toxicity of the chemical to draw conclusions about the risk for human health effects. Information on exposure and the toxicity of a chemical are usually limited, and risk assessors often must make estimates and use judgement when performing risk calculations, making all risk estimates uncertain to some degree. Risk assessment cannot be used to predict health effects, nor can it be used to determine if health effects occurred in the past. Information obtained from risk assessment is

one of several considerations in the development of risk management decisions about reducing exposures to environmental chemicals.

Selection of Contaminants for Further Evaluation

The NYSDOH selected contaminants for further evaluation from the chemicals detected at businesses that operated at the site by comparing the highest detected indoor air concentrations to ATSDR air comparison values [ATSDR 2017]. ATSDR air comparison values are chemical concentrations in air that are used to identify environmental contaminants at hazardous waste sites that require further evaluation. The comparison values are based on health guidelines, incorporate generic assumptions of daily exposure to the chemical, and are considered protective of public health. For PCE and TCE, the NYSDOH also compared the highest levels to the New York State air guidelines for these chemicals.

The highest contaminant levels for all detected chemicals in indoor air at the site and their corresponding comparison values are found in Table B1 of Appendix B. Table 2 (below) shows the chemicals at each business that were detected in indoor air at levels above their comparison values. The NYSDOH therefore further evaluated the risk for cancer and noncancer health effects for inhalation exposures to these chemicals at the site. A general summary of the health effects of the chemicals selected for further evaluation is presented in Appendix C.

Table 2. Chemicals Selected for Further Evaluation at the Former ITT Sealectro Site.

Business	Chemicals Selected for Further Evaluation
Mamaroneck Dialysis Clinic (1997 – 1999) ¹	benzene 1,1-DCA PCE TCE
Davis Studio ² (1999 – 2012)	benzene carbon tetrachloride chloroform 1,1-DCA PCE TCE
American Tile Company ² (1995 – 2012)	benzene 1,1-DCA PCE TCE

¹This business operated from December 1997 through March 1999 (16 months).

²These businesses operated until March of 2012, except when the building was flooded for 7 months in 2005 and 10 months from 2007 to 2008.

1,1-DCA = 1,1-dichloroethane; PCE = tetrachloroethene; TCE = trichloroethene.

General Methods

The NYSDOH evaluated the noncancer and cancer risks for people who may have been exposed to chemicals detected in the indoor air while working for businesses that operated at the site. To evaluate noncancer risks, the NYSDOH compared the time-weighted air concentrations (an estimate of long term contaminant exposure) to the reference concentration or chronic inhalation minimal risk level (MRL) for each chemical. The reference concentrations and MRLs are contaminant air concentrations that are unlikely to result in noncancer health effects assuming up to a lifetime of exposure. The cancer risk is estimated by multiplying the time-weighted contaminant air concentration (adjusted by the fraction of the lifetime exposed) by the chemical's inhalation unit risk (a numerical estimate of a chemical's cancer potency per unit air concentration).

To account for the fact that people were not continuously exposed, the average air concentrations from sampling events were time-weighted for occupational exposures assuming that employees inhaled 10 cubic meters (m³) of air per day while working (compared to 20 m³, the default human volume of air inhaled in a 24-hour day [USEPA 1994]), 5 days per week, and 50 weeks per year. When evaluating cancer risks, the NYSDOH assumed employees were exposed for the total amount of time each business was open, and then time-weighted this exposure duration over a 78-year lifetime [USEPA 2011a].

For each business that operated in the on-site building, the NYSDOH evaluated the risk from exposure to air contaminants for employees. The exposure frequency and duration of the employees (e.g., 8 to 12 hours per day, 5 days per week and 50 weeks per year) exceed those of people who obtained goods and/or services from the businesses, including dialysis patients, who typically need treatments lasting up to four hours, three times per week [NKF 2015]. Thus, employees at the businesses represent people who most likely had the greatest degree of exposure to indoor air contaminants associated with the site.

Mamaroneck Dialysis Clinic

Noncancer Risk Evaluation

Air contaminants selected for further evaluation at the Mamaroneck Dialysis Clinic include benzene, 1,1-DCA, PCE and TCE. Past exposure of Mamaroneck Dialysis Clinic employees to benzene and PCE posed a minimal risk for noncancer health effects, because the time-weighted air concentrations were below the reference concentrations or MRLs for these chemicals⁵

⁵A reference concentration or chronic inhalation minimal risk level for 1,1-dichloroethane is not available. The National Center for Environmental Assessment (NCEA 2006) noted that Hofmann et al. (1971) identified renal effects in cats exposed 6 hours/day, 5 days/week for 13 weeks as the most sensitive effect for 1,1-dichloroethane, but that the data in this study are inadequate to identify the lowest exposure level (500 ppm, or 2024 mg/m³) as either a lowest observed effect level (LOEL) or a no observed effect level (NOEL). Assuming the lowest exposure level could be a LOEL, the time-weighted air concentration at the LOEL would be 506 mg/m³. The highest 1,1-dichloroethane level found in the indoor air of the Mamaroneck Dialysis Clinic (26.9 mcg/m³) is about 19,000 times lower than this air concentration.

(Table 3). The time-weighted air concentration for TCE in the indoor air (12 mcg/m³) was six times higher than the reference concentration. The reference concentration for TCE is based on studies reporting immune toxicity in mice [Keil et al. 2009; Peden-Adams et al. 2006] and developmental toxicity (fetal heart defects) in rats [Johnson et al. 2003]. Since the reference concentration was exceeded, the NYSDOH further evaluated TCE by comparing the air levels to estimated effect levels derived by the USEPA for immune and developmental toxicity.

Table 3. Noncancer Risk Evaluation: Mamaroneck Dialysis Clinic.

Chemical	Average Air Concentration (mcg/m ³)	Time-Weighted Air Concentration ¹ (mcg/m ³)	Reference Concentration or Chronic MRL ² (mcg/m ³)	Hazard Quotient ³
benzene	3.1	1.1	10	0.10
1,1-DCA	26.7	9.2	na	na
PCE	68.9	23.7	40	0.59
TCE	34.6	12.0	2 ⁽⁴⁾	6.0

¹Time weighted air concentrations calculated for occupational exposures: (average air concentration) x (10 m³/20 m³) x (5 days/7days) x (50 weeks/52 weeks).

²The MRL for benzene was derived by ATSDR [ATSDR 2007]; the reference concentrations for PCE and TCE were derived by USEPA [USEPA 2012;2011b].

³The hazard quotient is the ratio of the time-weighted air concentration at the site to the reference concentration or the MRL. Air concentrations resulting in hazard quotients less than or equal to 1 pose a minimal risk for adverse health effects.

⁴For TCE, ATSDR has adopted the US EPA reference concentration as its chronic inhalation minimal risk level [ATSDR 2014]. US EPA = United States Environmental Protection Agency; MRL = minimal risk level; 1,1-DCA = 1,1-dichloroethane; PCE = tetrachloroethene; TCE = trichloroethene; na = not available.

The NYSDOH concludes that past TCE exposures of Mamaroneck Dialysis Clinic employees posed a risk for immune system effects based on a comparison of these exposures to estimated effect levels for immune toxicity. The time-weighted air concentration (12.0 mcg/m³) calculated from the average TCE air level exceeds the reference concentration by about six-fold, and is only 16-times lower than the USEPA’s estimate of the air concentration for humans that corresponds to a dose that causes immune toxicity in mice (190 mcg/m³) [USEPA 2011b]. The NYSDOH considers this margin of exposure too small to adequately protect public health. Stated another way, the estimated past TCE exposure for Mamaroneck Dialysis Clinic employees approaches exposures that might cause immune system effects in humans.

The NYSDOH also concludes that past TCE exposures of Mamaroneck Dialysis Clinic employees posed a risk for developmental toxicity based on a comparison of these exposures to estimated air concentrations associated with fetal heart malformations. Since developmental effects such as fetal heart defects could result from a relatively short period of exposure, we used the highest measured TCE level in air (35.2 mcg/m³) at the clinic and time-weighted the exposure assuming a pregnant worker inhales 10 m³ of air per day (compared to 20 m³, the default human volume of air inhaled in a 24-hour day [USEPA 1994]), while working 5 days per week. This time-weighted air concentration (12.6 mcg/m³) is only 1.7 times lower than the US EPA’s

estimated human TCE air concentration that corresponds to a dose associated with fetal heart malformations in rats (21 mcg/m³) [USEPA 2011b]. The NYSDOH considers this margin of exposure too small to be adequately protective of public health. Stated another way, the estimated TCE exposure for Mamaroneck Dialysis Clinic employees approaches exposures that might cause developmental toxicity in humans.

Cancer Risk Evaluation

The Mamaroneck Dialysis Clinic provided dialysis treatment in the on-site building from December 1997 to March 1999. The NYS DOH therefore estimated the increased cancer risk for employees assuming an exposure duration of 1.3 years. Based on the available sampling information, past exposure to the average levels of benzene, 1,1-DCA, PCE and TCE is estimated to pose increased cancer risks of less than 1 in one million (range of 1 to 8 in ten million [Table 4]), which the NYSDOH considers very low.

Table 4. Cancer Risk Evaluation: Mamaroneck Dialysis Clinic.

Chemical	Average Air Concentration (mcg/m ³)	Time-Weighted Air Concentration ¹ (mcg/m ³)	Inhalation Unit Risk ² (mcg/m ³) ⁻¹	Cancer Risk ³
benzene	3.1	0.02	7.8E-06	1 in 10,000,000
1,1-DCA	26.7	0.15	1.6E-06	2 in 10,000,000
PCE	68.9	0.39	2.6E-07	1 in 10,000,000
TCE	34.6	0.20	4.1E-06	8 in 10,000,000

¹Concentrations time weighted for occupational exposures (10 m³/20 m³), 5 days per week, 50 weeks per year for 1.3 years.

²Inhalation unit risk for 1,1-DCA was derived by the CA EPA [CA EPA 2009] and unit risks for benzene, PCE, and TCE are from the USEPA's Integrated Risk Information System [US EPA 2000;2012; 2011b].

³Cancer risks were calculated as follows: Lifetime cancer risk = (average air concentration) x (10 m³/20 m³) x (5 days/7 days) x (50 weeks/52 weeks) x (1.3 years/78 years) x (unit risk).

CA EPA = California Environmental Protection Agency; USEPA = United States Environmental Protection Agency; 1,1-DCA = 1,1-dichloroethane; PCE = tetrachloroethene; TCE = trichloroethene.

Davis Studio

Noncancer Risk Evaluation

Chemicals selected for further evaluation in the air of the Davis Studio include benzene, carbon tetrachloride, chloroform, 1,1-DCA, PCE and TCE. Past exposure of Davis Studio employees to benzene, carbon tetrachloride, chloroform and PCE posed a minimal risk for noncancer health effects, because the time-weighted air concentrations were below the reference concentrations or MRLs for these chemicals⁶ (Table 5). The time-weighted TCE air concentration

⁶A reference concentration or chronic inhalation minimal risk level for 1,1-dichloroethane is not available (see footnote 4). The highest 1,1-dichloroethane concentration in the Davis Studio (3.1 mcg/m³) is about 160,000 times lower than the air concentration that may be associated with kidney toxicity in cats (506 mg/m³).

(2.3 mcg/m³) slightly exceeded its reference concentration, and therefore the NYS DOH further evaluated the risks for immune and developmental toxicity.

Table 5. Noncancer Risk Evaluation: Davis Studio.

Chemical	Average Air Concentration (mcg/m ³)	Time-Weighted Air Concentration ¹ (mcg/m ³)	Reference Concentration or Chronic MRL ² (mcg/m ³)	Hazard Quotient ³
benzene	2.1	0.7	10	0.07
carbon tetrachloride	0.9	0.3	100	0.003
chloroform	0.6	0.2	100	0.002
1,1-DCA	1.4	0.5	na	na
PCE	6.3	2.2	40	0.06
TCE	6.7	2.3	2	1.2

¹Time weighted air concentrations calculated for occupational exposures: (average air concentration) x (10 m³/20 m³) x (5 days/7days) x (50 weeks/52 weeks).

²The MRLs for benzene and chloroform were derived by ATSDR [ATSDR 2007; 1997]; the reference concentrations for carbon tetrachloride, PCE, and TCE were derived by USEPA [USEPA 2010b; 2012; 2011b]

³The hazard quotient is the ratio of the time-weighted air concentration at the site to the reference concentration or the MRL. Air concentrations resulting in hazard quotients less than or equal to 1 pose a minimal risk for adverse health effects.

ATSDR = Agency for Toxic Substances and Disease Registry; CA EPA = California Environmental Protection Agency; US EPA = United States Environmental Protection Agency; MRL = minimal risk level; 1,1-DCA = 1,1-dichloroethane; PCE = tetrachloroethene; TCE = trichloroethene; na = not available.

The time-weighted air concentration calculated from the average TCE air level at the Davis studio (2.3 mcg/m³) is 83 times lower than the USEPA's estimate of the air concentration for humans that corresponds to a dose or exposure that causes immune toxicity in mice (190 mcg/m³) [USEPA 2011b]. Based on this margin of exposure, the NYSDOH concludes that exposure of employees to TCE at the Davis Studio posed a low risk for immune toxicity.

The NYSDOH concludes that past exposure to TCE at the Davis Studio posed a risk for developmental toxicity. Using the same methods for evaluating developmental risks for employees of the Mamaroneck Dialysis Clinic, the time-weighted air concentration (5.4 mcg/m³) based on the highest detected TCE air concentration is only 4 times lower than the USEPA's estimated human TCE air concentration that corresponds to a dose associated with fetal heart malformations in rats (21 mcg/m³) [US EPA 2011b]. Thus, the margin of exposure is too small to be adequately protective of public health, and the estimated TCE exposure for employees of the Davis Studio approaches exposures that might cause developmental toxicity in humans.

Cancer Risk Evaluation

The Davis Studio operated its business in the on-site building from 1999 to March 2012, except for two periods totaling 17 months when the building was closed due to flooding. The NYSDOH

therefore estimated the increased cancer risk for employees assuming an exposure duration of 12 years. Based on the available sampling information, past exposures to the average level of TCE pose an increased lifetime cancer risk of 1 in one million, which the NYSDOH characterizes as low (Table 6). Past exposures to average levels of benzene, carbon tetrachloride, chloroform, 1,1-DCA, and PCE are estimated to pose increased cancer risks of less than 1 in one million (range of 9 in one hundred million to 9 in ten million [Table 6]), which the NYSDOH considers very low.

Table 6. Cancer Risk Evaluation: Davis Studio.

Chemical	Average Air Concentration (mcg/m ³)	Time-Weighted Air Concentration ¹ (mcg/m ³)	Inhalation Unit Risk ² (mcg/m ³) ⁻¹	Cancer Risk ³
benzene	2.1	0.1	7.8E-06	9 in 10,000,000
carbon tetrachloride	0.9	0.05	6.0E-06	3 in 10,000,000
chloroform	0.6	0.03	2.3E-05	7 in 10,000,000
1,1-DCA	1.4	0.07	1.6E-06	1 in 10,000,000
PCE	6.3	0.33	2.6E-07	9 in 100,000,000
TCE	6.7	0.35	4.1E-06	1 in 1,000,000

¹Concentrations time weighted for occupational exposures (10 m³/20 m³), 5 days a week, 50 weeks for 12 years.

²Inhalation unit risk for 1,1-dichloroethane was derived by the CA EPA [CA EPA 2009] and unit risks for benzene, PCE, TCE, chloroform and carbon tetrachloride are from the USEPA's Integrated Risk Information System [USEPA 2000; 2012; 2011b; 2001a; 2010b].

³Cancer risks were calculated as follows: Lifetime cancer risk = (average detected air level) x (10 m³/20 m³) x (5 days/7 days) x (50 weeks/52 weeks) x (12 years/78 years) x (unit risk)

CA EPA = California Environmental Protection Agency; USEPA = United States Environmental Protection Agency; 1,1-DCA = 1,1-dichloroethane; PCE = tetrachloroethene; TCE = trichloroethene.

American Tile Company

Noncancer Risk Evaluation

Chemicals selected for further evaluation for employees at the American Tile Company include benzene, 1,1-DCA, PCE, and TCE. Past exposure of the American Tile Company employees to benzene and PCE posed a minimal risk for noncancer health effects, because the time-weighted air concentrations were below the reference concentrations or MRLs for these chemicals⁷ (Table 7). The time-weighted TCE air concentration (9.3 mcg/m³) is more than 4 times higher than the TCE reference concentration. Since the TCE reference concentration is exceeded, the NYSDOH further evaluated the risks for immune and developmental toxicity.

⁷A reference concentration or chronic inhalation minimal risk level for 1,1-dichloroethane is not available (see footnote 1). The highest 1,1-dichloroethane concentration in the American Tile Company (4.5 mcg/m³) is about 112,000 times lower than the air concentration that may be associated with kidney toxicity in cats (506 mg/m³).

Table 7. Noncancer Risk Evaluation: American Tile Company.

Chemical	Average Air Concentration (mcg/m ³)	Time-Weighted Air Concentration ¹ (mcg/m ³)	Reference Concentration or Chronic MRL ² (mcg/m ³)	Hazard Quotient ³
benzene	2.4	0.8	10	0.08
1,1-DCA	4.5	1.5	na	na
PCE	34.7	11.9	40	0.30
TCE	27.2	9.3	2	4.7

¹Time weighted air concentrations calculated for occupational exposures: (average air concentration) x (10 m³/20 m³) x (5 days/7days) x (50 weeks/52 weeks).

²The MRL for benzene was derived by ATSDR [ATSDR 2007]; the reference concentrations for PCE and TCE were derived by USEPA [USEPA 2012; 2011b].

³The hazard quotient is the ratio of the time-weighted air concentration at the site to the reference concentration or the MRL. Air concentrations resulting in hazard quotients less than or equal to 1 pose a minimal risk for adverse health effects. USEPA = United States Environmental Protection Agency; MRL = minimal risk level; 1,1-DCA = 1,1-dichloroethane; PCE = tetrachloroethene; TCE = trichloroethene; na = not available.

The NYSDOH concludes that past TCE exposures of American Tile Company employees posed a risk for effects on the immune system based on a comparison of the exposures to estimated effect levels for immune toxicity. The time-weighted average air concentration (9.3 mcg/m³) is only 20-times lower than the USEPA’s estimate of the air concentration for humans that corresponds to a dose that causes immune toxicity in mice (190 mcg/m³) [US EPA 2011b]. This margin of exposure is considered too small by the NYSDOH to be adequately protective of public health. In other words, the estimated past TCE exposure for employees of the American Tile Company approaches exposures that might cause immune system effects in humans.

The NYSDOH also concludes that past TCE exposures of American Tile Company employees posed a risk for developmental toxicity based on a comparison of the exposures to estimated air concentrations associated with fetal heart malformations. Using the same methods for evaluating risks for the Mamaroneck Dialysis Company, the time-weighted air concentration (32.5 mcg/m³) based on the highest detected TCE air concentration exceeds the USEPA’s estimated human TCE air concentration that corresponds to a dose associated with fetal heart malformations in rats (21 mcg/m³) [USEPA 2011b]. Therefore, past exposures occurred at levels that could cause developmental toxicity in humans.

Cancer Risk Evaluation

The American Tile Company operated its business in the on-site building from 1995 to March 2012, except for two periods totaling 17 months when the building was closed due to flooding. The NYSDOH therefore estimated the increased cancer risk for employees assuming an exposure duration of 16 years. Based on the available sampling information, past exposure to the average level of benzene and TCE posed increased lifetime cancer risks of 1 in one million and 8 in one million respectively, which the NYS DOH characterizes as low (text Table 8). Past

exposure to average levels of 1,1-DCA and PCE is estimated to pose increased cancer risks of less than 1 in one million (5 and 6 in ten million respectively [text Table 8]), which the NYS DOH considers very low.

Table 8. Cancer Risk Evaluation: American Tile Company.

Chemical	Average Air Concentration (mcg/m³)	Time-Weighted Air Concentration¹ (mcg/m³)	Inhalation Unit Risk² (mcg/m³)⁻¹	Cancer Risk³
benzene	2.4	0.2	7.8E-06	1 in 1,000,000
1,1-DCA	4.5	0.3	1.6E-06	5 in 10,000,000
PCE	34.7	2.4	2.6E-07	6 in 10,000,000
TCE	27.2	1.9	4.1E-06	8 in 1,000,000

¹Concentrations time weighted for occupational exposures (10 m³/20 m³), 5 days a week, 50 weeks a year for 16 years.

²Inhalation unit risk for 1,1-dichloroethane was derived by the CA EPA [CA EPA 2009] and unit risks for benzene, PCE and TCE from the USEPA's Integrated Risk Information System [USEPA 2000; 2012; 2011b].

³Cancer risks were calculated as follows: Lifetime cancer risk = (average detected air level) x (10 m³/20 m³) x (5 days/7 days) x (50 weeks/52 weeks) x (16 years/78 years) x (Unit Risk).

CA EPA = California Environmental Protection Agency; US EPA = United States Environmental Protection Agency; 1,1-DCA = 1,1-dichloroethane; PCE = tetrachloroethene; TCE = trichloroethene.

LIMITATIONS

This evaluation is based on available data. Sampling data for indoor air does not provide information on contaminant levels during times sampling is not taking place. Thus, there is some uncertainty in using the sampling results to estimate exposures. Further, there is limited knowledge about potential effects of TCE in humans. Studies have shown that TCE exposure causes immune system effects and developmental effects (congenital heart defects) in laboratory animals. However, it is not known whether these effects will occur (or at what exposure levels) in humans exposed to TCE. Finally, the finding of an increased risk using risk assessment methods cannot be used to predict health effects, nor can it be used to determine if health effects occurred in the past.

CONCLUSIONS

Following the review and assessment of environmental data associated with the soil vapor intrusion investigation, the NYSDOH has reached the following conclusions regarding exposures to employees who worked and currently work at businesses located in the former ITT Sealectro on-site building:

1. The NYSDOH concludes that past exposure (between December 1998 and 2013) to TCE in indoor air of the Mamaroneck Dialysis Clinic, the Davis Studio and the American Tile Company could have increased the risk for adverse health effects because TCE was found in the indoor air of all three establishments at concentrations that approached or

exceeded exposure concentrations identified by the USEPA as associated with immune or developmental health effects.

2. The NYSDOH concludes that past exposure (between December 1998 and 2013) to VOCs, other than TCE, in the indoor air of the Mamaroneck Dialysis Clinic, the Davis Studio and the American Tile Company is not expected to harm people's health. Based on the available data, past exposure to the average levels of benzene, carbon tetrachloride, 1,1-DCA, chloroform, and PCE at the three establishments posed a very low to low increased lifetime risk for cancer, and a minimal risk for noncancer health effects.
3. The NYSDOH concludes that, breathing VOCs at levels measured inside the former ITT Sealectro building after the 2013 installation of the sub-slab depressurization is not expected to harm people's health. Installation and operation of a sub-slab depressurization system has mitigated exposures to VOCs associated with soil vapor intrusion at the former ITT Sealectro site. Post-mitigation air data collected after the installation of a sub-slab depressurization system are consistent with levels commonly found in the indoor air of buildings and do not pose a health concern.

RECOMMENDATIONS

The NYSDOH recommends that the sub-slab depressurization system installed in the former ITT Sealectro building in 2013 remain in place and operational until it is no longer needed to address exposures related to soil vapor intrusion. The NYSDOH, in partnership with NYSDEC, will evaluate any proposal to turn off or modify the mitigation system.

The NYSDOH recommends that the responsible party (ITT Corporation) continue to monitor and maintain the sub-slab depressurization system installed in the former ITT Sealectro building, with NYSDOH and NYSDEC oversight in the state superfund program, to verify the system is effectively maintaining indoor air concentrations of site-related contaminants within background ranges.

For people exposed in the past to TCE in the indoor air of the Mamaroneck Dialysis Clinic, the Davis Studio, and the American Tile Company, general recommendations for maintaining good health are the same as general recommendations for others: maintain a healthy lifestyle and have regular medical check-ups.

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AGENCY INFORMATION

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APPENDIX A: Figures



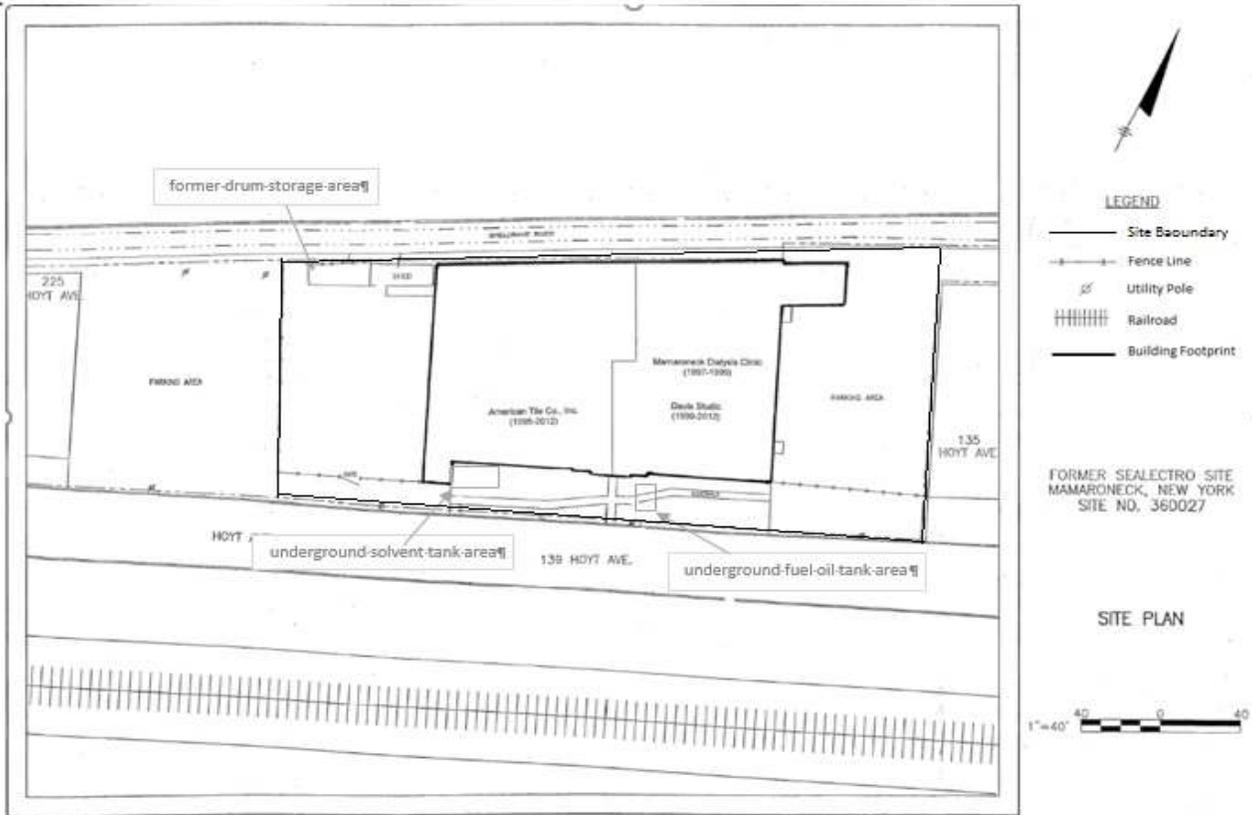
Figure 1 – Site Location

Former ITT Sealectro
139 Hoyt Avenue
Village of Mamaroneck, Westchester County, NY



Map Not To Scale

Figure 2. Site Plan



APPENDIX B: Tables

Table B1. Comparison of Air Contaminant Levels to Background Concentrations, Guidelines and Comparison Values at the Former ITT Sealectro Site

(All values in mcg/m³)

Chemical	Highest Detected Indoor Air Concentration	Indoor Air Background Concentrations ^a		New York State Air Guideline	ATSDR Air Comparison Values ^d	Other Comparison Values ^e	Contaminant Selected for Further Evaluation
		50 th Percentile ^b	95 th Percentile ^c				
Mamaroneck Dialysis Clinic^f							
benzene	3.1	3.6	9.1		0.13		Yes
1,1-dichloroethane	26.9	≤ LOQ	≤ LOQ			0.62 ^g	Yes
tetrachloroethene	69.6	1.5	18	30	3.8		Yes
toluene	9.5	8.7	39		3800		No
1,1,1-trichloroethane	31.0	3.1	21		3800		No
trichloroethene	35.2	0.29	2.6	2	0.22		Yes
<i>m-, p</i> -xylene	5.2	5.1	24		220		No
Davis Studio							
benzene	4.2	3.6	9.1		0.13		Yes
carbon tetrachloride	1.0	≤ LOQ	0.74		0.17		Yes
chloroform	0.63	≤ LOQ	1.3		0.043		Yes
cyclohexane	1.1	ND	ND		6000		No
dichlorodifluoromethane	4.9	6.8	36			100 ^h	No
1,1-dichloroethane	3.1	≤ LOQ	≤ LOQ			0.62 ^g	Yes
1,1-dichloroethene	0.67	≤ LOQ	≤ LOQ		79		No
<i>cis</i> -1,2-dichloroethene	2.5	ND	ND			60 ⁱ	No
ethyl benzene	3.2	1.5	6.2		260		No
4-ethyl toluene	1.2	0.77	4.1			60 ^j	No
<i>n</i> -heptane	2.9	ND	ND		2100 ^k		No
<i>n</i> -hexane	2.4	2.5	12		2100		No
tetrachloroethene	17	1.5	18	30	3.8		Yes
toluene	12	8.7	39		3800		No
1,1,1-trichloroethane	8.2	3.1	21		3800		No
trichloroethene	15	0.29	2.6	2	0.22		Yes
trichlorofluoromethane	3.0	3.9	51			1000 ^l	No
1,3,5-trimethylbenzene	0.4	0.54	3.9			60 ⁿ	No
<i>m-, p</i> -xylene	13	5.1	24		220		No
<i>o</i> -xylene	4.3	2.1	8.2		220		No
American Tile Company							
benzene	8.8	3.6	9.1		0.13		Yes
cyclohexane	1.4	ND	ND		6000		No
dichlorodifluoromethane	4.4	6.8	36			100 ^h	No
1,1-dichloroethane	12	≤ LOQ	≤ LOQ			0.62 ^g	Yes
<i>cis</i> -1,2-dichloroethene	21	ND	ND			60 ⁱ	No
ethyl benzene	12	1.5	6.2		260		No
4-ethyl toluene	2.2	0.77	4.1			7 ^j	No
<i>n</i> -heptane	7.0	ND	ND		2100 ^k		No
<i>n</i> -hexane	2.7	2.5	12		2100		No
tetrachloroethene	140	1.5	18	30	3.8		Yes

Chemical	Highest Detected Indoor Air Concentration	Indoor Air Background Concentrations ^a		New York State Air Guideline	ATSDR Air Comparison Values ^d	Other Comparison Values ^e	Contaminant Selected for Further Evaluation
		50 th Percentile ^b	95 th Percentile ^c				
toluene	110	8.7	39		3800		No
1,1,1-trichloroethane	19	3.1	21		3800		No
trichloroethene	91	0.29	2.6	2	0.22		Yes
trichlorofluoromethane	2.6	3.9	51			1000 ^l	No
2,2,4-trimethylpentane	2.0	ND	ND			20 ^m	No
<i>m</i> -, <i>p</i> -xylene	36	5.1	24		220		No
<i>o</i> -xylene	9.9	2.1	8.2		220		No

^aIndoor air background concentrations from US EPA Building Assessment Survey and Evaluation Study (US EPA 2015).

^bOne half of the values are above and one half of the values are below the 50th percentile.

^cFive percent of the values are above and 95 percent of the values are below the 95th percentile.

^dATSDR (2017).

^eComparison values from other health agencies were used for contaminants having no ATSDR comparison value.

^fOnly one sample was taken during the time the dialysis center was operational.

^gCA EPA (2009).

^hUS EPA (2010a).

ⁱRIVM (2009).

^jThe US EPA reference concentration for 1,2,4-trimethylbenzene (US EPA 2016a) was used as a surrogate comparison value for 4-ethyl toluene.

^kThe ATSDR comparison value for *n*-hexane was used as a surrogate comparison value for *n*-heptane.

^lUS EPA provisional subchronic reference concentration (US EPA 2009a). A chronic reference concentration was not available.

^mThe US EPA provisional reference concentration for *n*-nonane (US EPA 2009b) was used as a surrogate comparison value for 2,2,4-trimethylpentane.

ⁿ US EPA (2016b)

mcg/m³ = micrograms per cubic meter; LOQ = level of quantitation; ATSDR = Agency for Toxic Substances and Disease Registry.

**Table B2. Post Mitigation Indoor Air Sample Results:
Contaminants of Concern for ITT Sealectro Site
Samples Collected March 18, 2015**

All results reported in micrograms per cubic meter (mcg/m³)

Chemical	Number of Samples	Indoor Air Concentration Range	Indoor Air Background Concentrations ^a	
			90 th Percentile	95 th Percentile
benzene	6	ND < 0.64	9.4	12.5
1,1-dichloroethane	6	ND < 0.81	<0.7	<0.8
tetrachloroethene	6	0.27-0.53	15.9	25.4
trichloroethene	6	0.15-0.0.26	4.2	6.5
carbon tetrachloride	6	0.42-0.43	<1.3	0.7
chloroform	6	ND <0.98	1.1	1.4

^a Indoor air background concentrations from US EPA Building Assessment Survey and Evaluation BASE database, summa canister method; as reported in Appendix C2 of the NYSDOH Soil Vapor Intrusion Guidance (October 2006).

ND< Chemical not detected at or above the laboratory detection limit presented.

APPENDIX C: Summary of Health Effects of Select Chemicals

Health Effects of Chemicals Selected for Further Evaluation

All chemicals can cause health effects. The risk for adverse health effects from any chemical depends on the chemical's toxicity, the amount of the chemical to which a person is exposed, and how long and how often the exposure occurs. Below is some general information about the kinds of health effects that are associated with exposure to the chemicals selected for further evaluation at the former ITT Sealectro site. Most of the health effects described below occur at exposure levels much higher than those resulting from site contamination.

1,1-Dichloroethane

1,1-Dichloroethane (1,1-DCA) is a colorless, oily liquid with a sweet odor. It evaporates easily at room temperature and burns easily. It does not occur naturally in the environment and is used to make other chemicals, adhesives, synthetic fiber, and as a solvent for degreasing.

1,1-DCA was once used as a surgical anesthetic, but was discontinued when it was found that exposure to high levels can cause irregular heartbeats [ATSDR 2013]. Very little information is available regarding the health effects of 1,1-DCA following inhalation exposure in humans and animals. In laboratory studies, cats exposed to high levels of 1,1-DCA for long periods experienced kidney effects, but these effects have not been observed in other species [ATSDR 2013]. There is no evidence that 1,1-DCA causes cancer in humans, but based on results from limited animal studies in rats and mice that showed increased incidence of mammary gland and liver tumors, the US EPA concluded that 1,1-DCA is a possible human carcinogen [US EPA 1990].

Carbon Tetrachloride

Carbon tetrachloride is a clear liquid with a sweet odor that evaporates very easily. It does not occur naturally in the environment, and in the past, was produced in large quantities to make refrigeration fluid and propellants for aerosol cans, as a pesticide, and as a cleaning agent.

Exposure to high levels of carbon tetrachloride over long periods of time causes adverse liver and kidney effects, including a decrease in liver function and kidney failure [ATSDR 2003]. Carbon tetrachloride also affects the nervous system, including the brain, resulting in symptoms such as headache, dizziness, and sleepiness, which may be accompanied by nausea and vomiting [ATSDR 2003]. Chronic exposure to carbon tetrachloride induced liver and adrenal gland tumors in rats and mice [ATSDR 2003]. It is not known if breathing carbon tetrachloride causes cancer in humans, but based on sufficient evidence in animals and inadequate evidence in humans, the US EPA characterized carbon tetrachloride as likely to be carcinogenic to humans [US EPA 2010], and the US Department of Health and Human Services has determined that carbon tetrachloride is reasonably anticipated to be a human carcinogen [ATSDR 2003].

Tetrachloroethene

Tetrachloroethene (PCE) is a nonflammable colorless liquid that does not occur naturally in the environment. It is used as a dry-cleaning agent and a metal degreasing solvent, and is also used to make other chemicals. It is found in some consumer products such as paint and spot removers, water repellents, adhesives and wood cleaners.

Short-term exposures to high levels of PCE causes central nervous system effects, including dizziness, headache, and loss of consciousness [ASTDR 2014a]. In humans, PCE exposure causes liver and kidney effects, such as changes in serum levels of liver enzymes and renal dysfunction. Some studies show a slightly increased risk for some types of reproductive effects among dry cleaning workers exposed to PCE, however in many of these studies the role of other factors in causing these effects is unknown [ATSDR 2014a]. Studies show that exposure to PCE may be associated with an increased risk of certain types of cancer in humans, including bladder cancer, multiple myeloma, and non-Hodgkin's lymphoma [ATSDR 2014a]. PCE exposure to animals has been shown to cause cancers of the liver, kidney, and blood system. Based on these effects, the US EPA characterized PCE as likely to be carcinogenic to humans and the US Department of Health and Human Services has determined that PCE is reasonably anticipated to be a human carcinogen [US EPA 2012; ATSDR 2014a].

Benzene

Benzene is a widely used chemical that is a colorless liquid and evaporates easily. It is formed from both natural processes and human activity. Benzene is used to make other chemicals, and in the manufacturing of rubbers, lubricants, dyes, detergents, drugs, and pesticides. It is also found in petroleum products such as gasoline.

Exposure to high levels of benzene causes drowsiness, dizziness, rapid heart rate, headaches, and unconsciousness [ATSDR 2007]. Benzene exposure causes blood problems, including causing effects on the bone marrow and causing a decrease in red blood cells, leading to anemia. Benzene has been shown to cause leukemia in industrial workers who breathed elevated levels of the chemical over long periods of time in workplace air and has also caused cancer in laboratory animals exposed at high levels over their lifetimes [ATSDR 2007]. The US Department of Health and Human services has determined that benzene is known to be a human carcinogen, and the US EPA has determined that benzene is a known human carcinogen for all routes of exposure [NTP 2014, US EPA 2000]. Effects on the blood-cell-forming tissues, the immune and nervous system, and development have also been observed in studies of laboratory animals exposed to high levels of benzene [ATSDR 2007].

Chloroform

Chloroform is a colorless liquid that evaporates easily. It was once used as one of the first inhaled anesthetics during surgeries, but is no longer used for this today. The majority of

chloroform found in the environment comes from industry, and is mainly used to make other chemicals.

Exposure to high levels of chloroform causes adverse effects on the nervous system in humans, resulting in symptoms including fatigue, dizziness, and headache [ATSDR 1997]. Breathing air, eating food, or drinking water containing high levels of chloroform for long periods of time can damage the liver and kidney in humans. In studies using laboratory animals, exposure to high levels of chloroform also caused liver and kidney toxicity [ATSDR 1997]. Based on sufficient evidence of carcinogenicity in animals but limited evidence in humans, the US Department of Health and Human Services has determined that chloroform is reasonably anticipated to be a human carcinogen [NTP 2016]. High levels of chloroform exposure cause adverse effects on reproduction and development in laboratory animals, but it is not known if chloroform causes reproductive or developmental toxicity in people [ATSDR 1997].

Trichloroethene

Trichloroethene (TCE) is a colorless liquid that evaporates easily. It is used as a solvent to remove grease from metal parts and as a chemical that is used to make other chemicals. TCE has also been used in dry cleaning operations and as a component of adhesives, lubricants, paints, and pesticides.

The US EPA classifies TCE as carcinogenic to humans by all routes of exposure [US EPA 2011b] and the US Department of Health and Human Services has determined that TCE is a known human carcinogen [NTP 2016]. The types of cancer most strongly associated with human TCE exposure are non-Hodgkin's lymphoma and cancer of the liver and kidney. The US EPA identifies TCE as a chemical that causes kidney cancer by a mutagenic mode of action, and recommends the use of age-dependent adjustment factors to account for the greater vulnerability of cancer in early life stages when evaluating cancer risks from TCE exposure [US EPA 2005, 2011b]. Exposure to TCE affects the immune system of laboratory animals and can cause fetal heart malformations in their offspring [US EPA 2011a]. Some studies also report an increased risk for adverse effects on human fetal heart development in the offspring of women who lived in areas with elevated levels of TCE in air or drinking water [Goldberg et al. 1990; Forand et al. 2012], but it is not known if the effects are due to TCE or some other factor.

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