NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

# Community Air Screen Program

**NYSDEC Region 9 – Applicant: Highland Community Revitalization Committee, Inc.**
**Niagara Falls, Niagara County**

## Ambient Air Quality Screening Report
## Highland Community

**April 23, 2013**

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Bureau of Air Quality Surveillance,
Division of Air Resources

# About the Community Air Screen Program

The Community Air Screen (CAS) program was launched by the New York State Department of Environmental Conservation (DEC) on April 25, 2012. The purpose of the CAS program is to better understand toxic air pollutants at the community level with the help of local community groups and interested citizens. DEC received 42 applications for the CAS program and accepted 23 for participation. Sampling by community groups and interested citizens began in August 2012 and is expected to continue through summer 2013.

DEC provides the CAS sampling equipment, field log and instructions. The participants collect a 1-hour air sample and return the equipment to the DEC laboratory where the sample is analyzed specifically for 43 toxic air pollutants.[1] DEC staff evaluate whether the sample results are of potential health concern and warrant further investigation.

First, the short-term monitoring results are evaluated to assess whether any measured air concentrations were of immediate public health concern in comparison to short-term health-based air concentration values derived by DEC. Second, DEC uses a number of factors to determine whether the results warrant further sampling on a case-by-case basis. One criterion when evaluating the need for follow-up sampling is to compare the measured air concentrations with long-term health-based air concentration values derived by DEC. Both the short-term and long-term comparison values are further discussed in the *DEC's Health-based Concentration Values* section. Next, the CAS sample results are compared with ambient air monitoring concentrations from DEC's air toxics monitoring network, since many of the toxic air pollutants assessed in the CAS program are frequently detected at other locations in the state. This comparison is done to evaluate whether the results from the program sampling are significantly different from air monitoring concentrations at other locations in the State. Lastly, staff may consider other information depending on the community and what is known about releases from sources in the area sampled.

# Background

DEC posted a notification for applicants to participate in the CAS program in April 2012. Forty-two applications were received. The application from the Highland Community Revitalization Committee (HCRC)[2] was among 23 accepted to the program and the only application received from a community group in the city of Niagara Falls. Five air samples were obtained in the Highland community in Niagara Falls starting in mid-October and ending in mid-December 2012. The samples were analyzed for toxic air pollutants and the results were evaluated for potential air quality concerns. This report provides details on that evaluation.

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[1] Toxic air pollutants are those pollutants which are known or suspected to cause cancer or other serious health effects, such as reproductive effects, birth defects, or harmful environmental effects.

[2] HCRC partnered with the following groups and agencies for this program: Niagara Falls Housing Authority, Center Court Tenant Association, Highland Block Club & Neighborhood Watch, Tennessee Avenue Block Club, and the New York State Department of Health.

## *Applicant's Concern*

The applicants expressed concern about the number of manufacturing companies releasing air pollutants in the Highland community. The applicant cited concerns about the high asthma rate for the Highland community[3] and the results of a recent community survey which indicated that residents are concern about air quality and air pollutants.

Additionally, the application expressed concern about the number of major highways and city streets, a rail line and heavily trafficked Niagara Falls tourist area and the potential exposures from these heavily traveled roadways.

## *The Highland Community[4]*

The Highland community resides in the city of Niagara Falls. The city's industry was built around hydroelectric power from the Niagara River. The Highland community, located approximately two miles north-west of the Niagara Falls State Park, is primarily made up of a mix of large industrial facilities, residential dwellings and vacant land. Niagara Falls State Park is a tourist destination, hosting over 8 million people in 2011.[5] Additionally the area is surrounded a number of heavily traveled primary highways like Robert Moses Parkway and I-190, as well as secondary state and county highways 31, 61, 104 and 182. Most of the facilities with air pollution control permits in the Highland community are located along College and Highland Avenues.

The population density for the Highland community is 2,646 people per square mile.[6] For the purpose of comparison to other air monitoring locations in the state, the Highland community will be characterized as an urban area.[7,8] Most people in the community (19.1%) are employed in the sectors of educational services, health care and social assistance. Other services (except public administration) employ 15.6% and retail trade, the third largest sector, employs 12.5%.[9]

The entire community is considered a potential environmental justice area following the DEC guidance for identification of these areas.[10]

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[3] According to NYS Department of Health information as cited in the application, the Highland community has the second highest rate of asthma related emergency department visits and hospital discharge occurrences as compared to other communities in Niagara County.
[4] The Highland community is not a formal census description but is generally thought of as the triangular-shaped census tract (36063020200) framed by Hyde Park Boulevard in the east, in proximity of Centre Avenue in the south and in proximity of Highland Avenue in the west.
[5] New York State Council of Parks, Recreation & Historic Preservation 2011 Annual Report.
[6] Based on 2010 census.
[7] Comparison to other locations in the State can be found in the *Results* section.
[8] The US Census has formal criteria for selecting urban and rural locations. In general, the Census classifies areas with more than 500 persons per square mile as an urban location. Federal Register, Vol. 76, No. 164, Department of Commerce, Urban Area Criteria for the 2010 Census. August 24, 2011
[9] U.S. Census Bureau – Selected Economic Characteristics, 2007 – 2011 American Community Survey 5-Year Estimates. Accessed online on 3/1/2013 for census tract 36063020200 at :
http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#
[10] DEC Environmental Justice Policy CP-29, March 19, 2003. The guidance can be found here:
http://www.dec.ny.gov/public/911.html

## *Site Selection*

Between the dates of October 16 and December 12, 2012, five sites were selected and samples collected throughout the community. The majority of samples were obtained in the southern most residential part of the city. Sample collection locations are shown in Figure 1.

## *Sampling and Analysis*

Five air samples were collected and the applicants completed a field log[11] that documented a chain of custody for the sampling canister, sampling location, pressure gauge readings, start and end times and weather conditions. Additional information about potential non-target sources was recorded on the field log, such as nearby lawn mowing and idling vehicles.

Table 1 lists the meteorological conditions during the five sampling events which were collected from October 16 to December 12, 2012. Although none of the weather conditions were optimal for any specific stationary source, the different sampling locations and weather conditions could be characterized overall as suitable for evaluating the area's air quality.

**Table 1 Highland Community Meteorological Conditions during Sampling**

| Date | Start Time | Temp. (°F) | Humidity (%) | Pressure (in) | Visibility (mi) | Wind Direction* | Wind Speed (mph) | Precip (in) | Conditions |
|---|---|---|---|---|---|---|---|---|---|
| 10/16/12 | 1:58 PM | 48.9 | 56 | 29.93 | 10.0 | West | 9.2 | N/A | Mostly Cloudy |
| 10/19/12 | 6:55 AM | 39.0 | 96 | 29.8 | 1.2 | East Southeast | 6.9 | N/A | Clear |
| 10/26/12 | 2:09 PM | 62.1 | 70 | 30.07 | 8.0 | North West | 19.6 | N/A | Mostly Cloudy |
| 11/16/12 | 3:20 AM | 27.0 | 89 | 30.40 | 10.0 | Calm | Calm | N/A | Clear |
| 12/12/12 | 3:12 PM | 37.9 | 76 | 30.37 | 10.0 | South West | 9.2 | N/A | Mostly Cloudy |

Source: Weather Underground[12]
Note: *This is the direction the wind is blowing from.

Ambient air samples were collected over a 1-hour period using an evacuated 6-liter SUMMA canister with a calibrated orifice. At completion of sampling, the canisters were returned to DEC's Bureau of Air Quality Surveillance laboratory to be analyzed using gas chromatography/mass spectrometry (GC/MS).

The canisters were analyzed for 43 target compounds[13] consistent with DEC's Toxics Air Monitoring Network. The canisters were analyzed using U.S. Environmental Protection Agency's (EPA's) method TO-15. The analytical process is described as follows: a portion of the air sample is taken from the canister at a controlled flow and temperature by an Entech Model 7100A preconcentrator, a device designed to take a dilute trace of a sample and concentrate it. This trace sample is subsequently injected into a Varian Saturn GC/MS.

[11] A copy of the Field Log is available online at: http://www.dec.ny.gov/docs/air_pdf/casfieldlog.pdf
[12] Historical data for Highland community obtained from Niagara Falls Airport online at: http://www.wunderground.com/
[13] Pollutants measured in the Community Air Screen program. http://www.dec.ny.gov/public/81654.html

# Interpretation of Samples

The five air sample results were compared to health-based concentration values derived by DEC. First, the measured air concentrations were compared to short-term health-based concentration values to assess whether the results were of immediate public health concerns. Second, the results were compared with long-term health-based concentrations values to evaluate the need for follow-up sampling, in concert with other factors. Both the short-term and long-term concentration values are further discussed below. Next, the CAS sample results were compared with ambient air monitoring concentrations from DEC's air toxics monitoring network, since many of the toxic air pollutants assessed in the CAS program are frequently detected at other locations in the state. This comparison evaluates whether the sampling results from the program are significantly different from air monitoring concentrations at other locations in the State. Finally, staff looked at both stationary sources (such as large industrial facilities and some specific small sources) and mobile sources (such as cars, trucks) in the area to qualitatively assess source contributions to the sample results.

What follows are explanations of DEC's health-based concentration values and a description of DEC's air toxics monitoring network.

## *DEC's Health-based Concentrations Values*

DEC derives both short-term and long-term air concentration values by adopting the most conservative health-based air concentration values developed by DEC, EPA, or the New York State Department of Health. DEC uses these values as part of its strategy to determine the degree of pollutant removal required for sources releasing air toxics. These air concentration values are being used in the CAS program.

First, the 1-hour CAS samples are compared with DEC's Short-term Guideline Concentrations (SGCs). SGCs are derived to protect the general public from adverse exposure to toxic air contaminants for short-term exposures of 1-hour. SGCs represent an exposure concentration which may cause short-term health outcomes for the general population including infants and children, and other individuals who may be susceptible. Examples of health outcomes from short-term exposures may include headaches, nausea, allergic reactions, asthma exacerbation, and irritation to the eyes, nose and throat. CAS samples were compared to SGCs to determine whether the results represent an immediate public health concern.

Next, for this program, the CAS 1-hour samples were compared with long-term health-based air concentration values which are called Annual Guideline Concentrations (AGCs). Comparison of the CAS samples to long-term values is a conservative approach and was conducted to determine the need for follow-up sampling. AGCs are ambient (for outdoor air) annual-based guideline concentrations that have been derived to protect the public's health from long-term (e.g., continuous lifetime) exposure to an air pollutant.

There are two health outcomes from long-term exposures, cancer and non-cancer endpoints such as reproductive, development, respiratory and cardiovascular effects. Greater detail about the derivation of AGCs from cancer and non-cancer endpoints can be found in Appendix A, *The*

*Development of the State Program* for addressing toxic air pollutants from stationary sources. A brief discussion follows.

Both the non-cancer and cancer AGCs are derived from an air concentration that is not expected to cause serious health effects during a lifetime of continuous exposure. The AGC air concentration is often modified – to be very conservative - from the experimental value to account for uncertainties for both non-cancer and cancer health endpoints. Follow-up sampling will be considered for any CAS sample result above a non-cancer AGC or above 10 times a cancer AGC.[14]

These guideline values are not bright lines between air concentrations that cause health effects and those that do not. They are values that are used by DEC to assess the acceptability of proposed new air pollution sources during the permitting process, and are also used to evaluate the results of ambient air monitoring studies that measure the impacts of numerous sources of air pollution in an area. The purpose of the guideline is to help guide decisions about reducing community exposure to air pollution. More information about controlling air pollution sources can be found in Appendix A.

## *DEC's Air Toxics Monitoring Network*

DEC has operated an air toxics monitoring network across the State since 1990. The purpose of the ambient air toxics monitoring network is to support DEC's efforts to reduce human exposure and health risks from air toxics. The network is intended to support four major objectives:

- Establish trends and evaluate the effectiveness of air toxics emissions reduction strategies.
- Characterize ambient concentrations (and deposition) in local areas. Air toxics often originate from local sources and can concentrate in relatively small geographical areas, producing the greatest risks to human health.
- Provide data to support, evaluate, and improve air quality models. Air quality models are used to develop emission control strategies, perform exposure assessments, and assess program effectiveness.
- Provide data to support scientific studies to better understand the relationship between ambient air toxics concentrations, human exposure, and health effects from these exposures.

DEC's air toxics monitoring network is designed to measure an average exposure over the course of a year. Samples are collected over a 24-hour period, on a one-in-six day schedule. In 2011, the network consisted of 10 monitors for toxic air pollutants located in urban, industrial, residential and rural areas of the State. Year 2011 air toxics monitoring data were compared to the CAS samples to provide a perspective on monitored concentrations obtained in these various locations in comparison to the 1-hour results obtained in the CAS program.

It is generally known, that areas with higher population densities have more sources of air toxics such as cars, trucks, gas stations and dry cleaners. Therefore, the monitors have been grouped by

[14] Readers are encouraged to read Appendix A for an explanation about the differences between non-cancer and cancer AGCs and the selection of AGC thresholds for considering follow-up sampling.

land-use classification into urban, suburban and rural locations. Additionally, monitors sited to capture releases from specific sources have been grouped together.

# Results

Table 2 shows the results for the five samples taken in the Highland community. Of the 43 pollutants measured, only 17 were reliably detected[15] at one or more sampling locations. Please see Appendix B for the full list of the toxic air pollutants measured in this program with information on uses and possible industries or other sources releasing these air pollutants.

The results in Table 2 are compared with DEC's short-term concentrations. As shown in Table 2, the results for the five samples collected in the Highland community are well below the short-term air concentration values. The measured results for the air toxics from this short-term assessment would not be considered an immediate public health concern.

Table 2 also shows that many of results in these samples are below the long-term air concentration values. None of the air toxics for which the health outcome is cancer were more than an order of magnitude above the long-term health-based comparison value. The long-term health-based comparison values for carcinogens are set at a 1-in-a-million cancer risk. The results from the Highland community sampling for 1,3-butadiene, benzene, carbon tetrachloride and chloroform are in the range of 1-in-a-million to 10-in-a-million cancer risk. As shown by the graphs in Appendix C, the concentrations of these four air toxics are similar to the monitoring concentrations found at other locations in DEC's toxics network. The land-use classification for the Highland community most closely represents an urban location.

The sample results for the Tennessee Avenue and 21st Street showed an unusual profile as compared to the other sampling locations. This sample was obtained at 3:20 am on November 16, 2012. During sampling the winds were calm and temperatures cool. These two conditions, common at night, can create surface-based temperature inversions. During an inversion, a shallow layer of cool air at the surface underlies warmer air aloft. This causes trapping of local emissions and can result in a rise in concentrations of pollutants released from localized, dispersed sources. Some of the air toxics found in the sample, are also components of gasoline and diesel emissions. Approximately 0.4 mile southeast of the sampling location is a passenger train station and a large CSX[16] rail yard. An Amtrak passenger train is scheduled to leave the station at 3:40 am during the week, according to the online schedule. Because of the large scale operations at the rail yard, round the clock activities both by train and truck transportation would not be uncommon.

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[15] Accurately detecting ambient levels of air toxics is dependent on the lowest reliable measured level (called the method detection limit) which varies by pollutant and by monitoring method. Although there is less reliability in those measurements reported below the lowest reliable measured level, USEPA's Science Advisory Board (Pilot City Air Toxics Measurements Summary, Office of Air Quality Planning and Standards, EPA454/R-01-003, February 2001) has stated that these values may be recognized as measurable results. For the Community Air Screen Program, results below the lowest reliable measured level will be noted but not used to determine follow-up activities.

[16] Chessie and Seaboard railroad Company.

The results from the Highland and Massachusetts Avenues sample show a slight elevation for toluene and trichloroethylene. Although elevated as compared to the other sites, the toluene concentration is well below the short-term and long-term health based concentration values. Approximately, one-quarter mile east of the sampling location is a facility that manufactures paints, varnish, lacquers, enamels and coating products. This facility reported releases of toluene to EPA's 2011 Toxic Release Inventory of approximately 400 lbs. Trichloroethylene is not frequently detected in the State's network and still well below the short-term and within an order of magnitude of the long-term health-based concentration values.

Five air toxics (e.g., carbon tetrachloride, chloromethane, dichlorodifluoromethane, trichlorofluoromethane, trichlorotrifluoroethane) commonly used as refrigerants were found in the same concentration range as detected in the state network. Since many of these are ozone-depleting chemicals with a long atmospheric half-life, their use is highly regulated.

**Table 2 Air Toxic Pollutant Concentrations from 1-Hour Air Sampling in Highland Community**

| Chemical | D'Amelio park 10/16/12 (ppb) | Highland & Mass Ave. 10/19/12 (ppb) | Highland & College 10/26/12 (ppb) | Tennessee & 21st St. 11/16/12 (ppb) | Highland & Fairfield 12/12/12 (ppb) | Short-Term (1-hour) Health-Based Concentration Values (ppb) | Long-Term Health-Based Concentration Values (ppb) ** | Carcinogen |
|---|---|---|---|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | nd | 0.073 | 0.028 | 0.26 | nd | -- | 1.2 | |
| 1,3,5-Trimethylbenzene | nd | nd | nd | 0.075 | nd | -- | 59 | |
| 1,3-Butadiene | nd | nd | nd | 0.033 | nd | -- | 0.015 | yes |
| Benzene | 0.071 | 0.14 | 0.12 | 0.33 | 0.17 | 400 | 0.04 | yes |
| Carbon Tetrachloride | 0.084 | 0.086 | 0.082 | 0.084 | 0.073 | 300 | 0.027 | yes |
| Chloroform | nd | nd | nd | 0.036 | nd | 31 | 0.009 | yes |
| Chloromethane | 0.50 | 0.55 | 0.46 | 0.43 | 0.47 | 11000 | 44 | |
| Dichlorodifluoromethane | 0.52 | 0.54 | 0.52 | 0.54 | 0.49 | -- | 2400 | |
| Dichloromethane | 0.048 | 0.066 | 0.084 | 0.082 | 0.14 | 4000 | 0.60 | yes |
| Ethylbenzene | 0.014 | 0.057 | 0.050 | 0.23 | 0.020 | 12000 | 230 | |
| m,p-Xylene | 0.041 | 0.19 | 0.13 | 0.93 | 0.067 | 990 | 23 | |
| o-Xylene | nd | 0.081 | 0.057 | 0.36 | 0.028 | 990 | 23 | |
| Tetrachloroethylene | 0.044 | 0.020 | 0.022 | 0.068 | 0.013 | 150 | 0.15 | yes |
| Toluene | 0.077 | 1.7 | 0.33 | 1.1 | 0.14 | 9800 | 1300 | |
| Trichloroethylene | nd | 0.081 | nd | nd | nd | 2600 | 0.093 | yes |
| Trichlorofluoromethane | 0.24 | 0.26 | 0.23 | 0.24 | 0.23 | 1600 | 900 | |
| Trichlorotrifluoroethane | 0.064 | 0.064 | 0.061 | 0.061 | 0.066 | 130000 | 23000 | |

Note: "--" indicates no Short-term Guideline Concentration value has been developed for this chemical
"nd" indicates results below analytical method detection limit
"**" The long-term values, in combination with other factors are used to assess whether additional sampling and evaluation is warranted on a case-by-case basis.

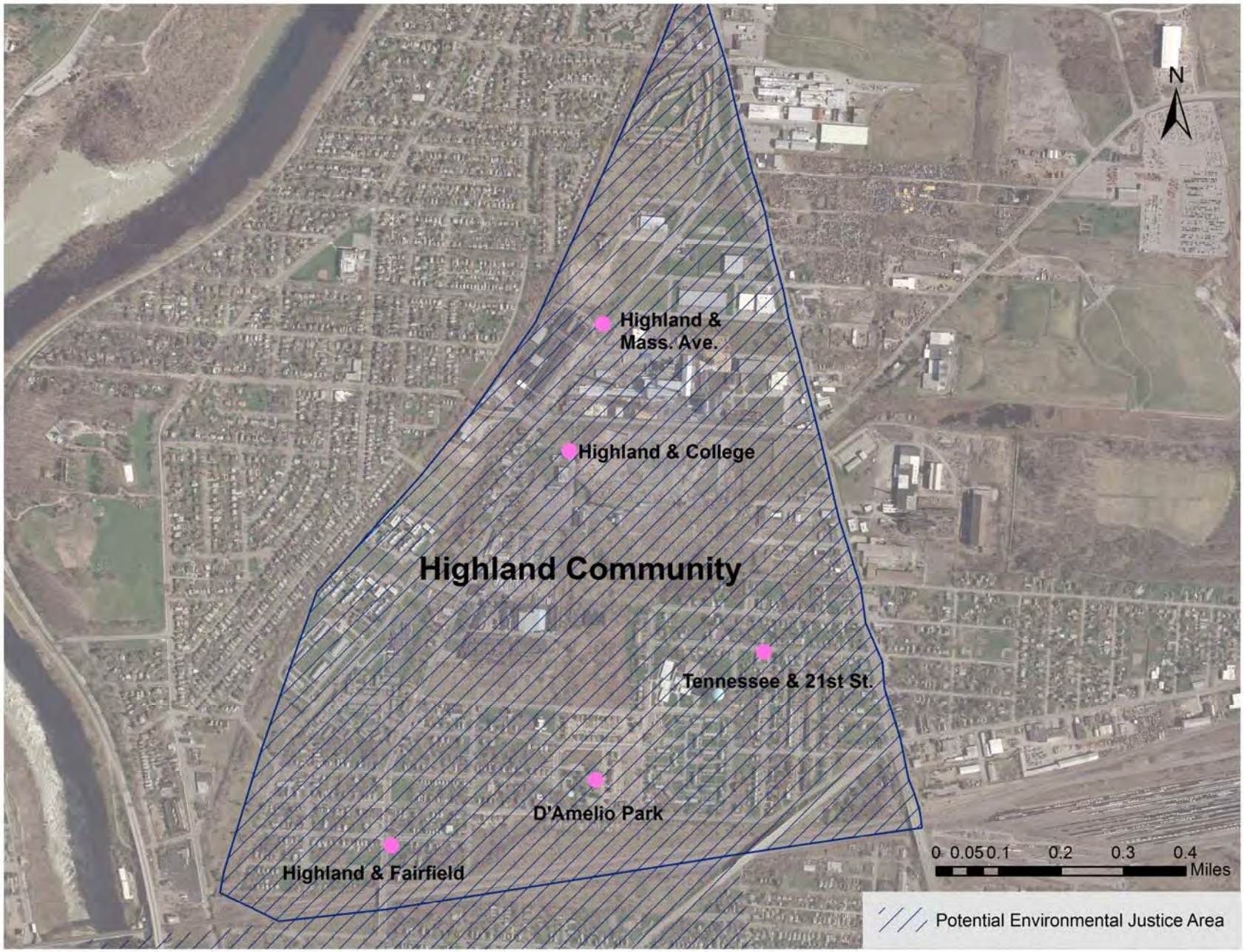


**Figure 1 Location for Five Ambient Air Samples Collected**

# Discussion

Five air samples were collected in the Highland community within the city of Niagara Falls. All samples were collected for 1-hour with a 6-liter sampling canister and analyzed using a laboratory method which evaluates the presence of 43 toxic air pollutants.

Only 17 toxic air pollutants were detected and all were well below the short-term health-based air concentration values. Therefore, the results would not be considered an immediate public health concern. The results also are below or within an order of magnitude of the long-term health-based air concentration values and similar to concentrations found in the DEC's ambient air monitoring network. Based on these comparisons, DEC staff concluded that follow-up sampling will not be considered at this time.

In conclusion, this short-term screening assessment did not identify concentrations of toxic air pollutants that would be considered a public health concern. Additionally, the results do not indicate the need for follow-up sampling at this time.

DEC's Division of Air Resources works to minimize the amount of toxic air pollution that is released to the atmosphere. Across the State, thousands of tons of toxic air pollutants are released from manmade sources such as cars, trucks, power plants, manufacturing factories and smaller sources such as drycleaners and gasoline stations.[17] In the Highland community, the sources of toxic air pollutants include emissions from cars, trucks, trains, residential space heating, manufacturer of refractory mixtures, dielectric and ceramic powders, manufacturer of high purity silicon metal, manufacturer of carbon and graphite products, manufacturer of abrasive products, manufacturer of paints, varnishes, lacquers,
enamels and coating products and numerous small sources.

## *Limitations/Uncertainties*

The assessment is limited to contaminants evaluated by EPA's TO-15 method. Some of the large facilities in the area release pollutants not captured by this method such as sulfur dioxide, particulate matter and oxides of nitrogen, but these pollutants are regulated as part of the Clean Air Act and must meet specific limitations to minimize their release.

The results from this air screen program cannot be compared with confidence to long-term health risks from exposure because of the different averaging period. The 1-hour sample represents a snap-shot of information and cannot be definitely representative of the entire year. The sampling method is a short-term monitoring assessment and many factors affect concentrations of pollutants in a neighborhood. Factors include, but are not limited to time of day, wind, and activities going on in the area. For example, facility releases may be cyclical depending on production schedules. Meteorological conditions also greatly influence local pollutant concentration. Because of the limits of a 1-hour sampling, a 1-hour sample at another time could be lower or higher in comparison to the results from this screening assessment. Participants in

[17] To learn more about sources of toxic pollutants in your community and health concerns visit the National Library of Medicine's interactive web site, *Tox Town.* http://toxtown.nlm.nih.gov/flash/town/flash.php

the CAS program have been asked to obtain the 1-hour samples during periods of concern (such as during times when odors or visible emissions are present) which suggests that the results evaluated in this program reflect single periods of potentially higher concentrations.

Finally, it should not be assumed that the results from the CAS sampling represent an individual's exposure. Monitoring results from any single location, whether short-term or long-term sampling do not account for the fact that people spend time in many locations during the day as well as spend time indoors and outdoors. Other factors (such as smoking, pumping gasoline, hobbies and occupations using solvents) can lead to increases in toxic air pollutant exposures and contribute to the overall uncertainty in characterizing risk from the short-term sampling obtained in this program.

# Appendix A
# Controlling Sources of Toxic Air Pollutants

This appendix provides a summary of Federal and State programs to limit releases of pollutants from stationary sources (large industrial facilities and some specific small sources) and from mobile sources (such as cars, trucks, airplanes and locomotives and lawn, farming and construction equipment). The summary focuses on strategies addressing the releases of toxic air pollutants since these pollutants are the focus of the Community Air Screen Program.

The summary is intended to provide the reader with a general understanding of the history and types of programs implemented to control these pollutants. This overview is not comprehensive. Readers are encouraged to review "Taking Toxics Out of the Air" at EPA's web page http://www.epa.gov/airquality/takingtoxics/.

In 1957, the New York State Legislature enacted one of the nation's first comprehensive air pollution control laws by passing the Air Pollution Control Act, Article 12-A of the Public Health Law. The Law recognized the need "to safeguard the air resources of the state from pollution" by controlling or abating air pollutant releases from existing sources and preventing new source releases for the public good. The State's policy was then and remains: "to maintain a reasonable degree of purity of the air resources of the state, which shall be consistent with public health and welfare and the public enjoyment thereof, the industrial development of the state…"

By 1962 this policy provided the foundation for an air pollution control program to control emissions from industrial processes and the combustion of fuels in NYS.

The state and federal programs to protect the public from adverse effects of air contamination are presented in the next sections.

## Addressing Stationary Source Pollution

### *The Development of the State Program*

In 1968, New York enacted regulations (Part 212, General Process Emission Sources) to address the control of toxic air pollutant emissions from industrial processes[1] and burning of waste fuels. A handbook was developed (Process Source Handbook) to assist DEC staff in determining the degree of air pollution control that would be required to reduce emissions for each process source.[2] Additionally, in the early 1970s, the State enacted a regulation setting air quality standards (Part 257) for nine toxic air pollutants.

The state program evolved over the decades as our knowledge about the adverse public health and environmental impacts of air pollution grew, coupled with advances to assess the ambient air concentrations of air pollution (through dispersion modeling) and technological advances in air pollution

[1] A process is any activity at a stationary source that results in an emission of a regulated air pollutant. Many large stationary sources (e.g., industrial facilities) have multiple processes.
[2] A process source is a term used to separate out the different areas at a stationary source that could lead to releases of air pollutants. For example, a facility which paints metal parts could have two process sources: (1) metal cleaning area with a degreasing process could release pollutants and (2) an area where the metal parts are painted would be considered a second process emission source.

control.[3,4] These advances have resulted in the implementation of stronger air pollution abatement strategies over the years to improve air quality and better ensure the protection of public health and the environment.

The current State air toxics program[5] applies to numerous stationary sources and requires these sources to undergo a screening risk assessment to determine the public health impacts from inhalation exposures. For the initial review of each source, DEC requires the use of a specific air dispersion model to estimate the maximum short-term (1-hour) and annual ambient air concentrations for each toxic air pollutant released. These modeled concentrations are compared to Short-term (SGC) and Annual Guideline Concentrations (AGC) developed by DEC. These guideline concentrations for toxic air pollutants, along with other factors, are used to determine the degree of air pollution control. The guideline concentrations are updated every three years.[6]

SGCs are derived to protect the general public from adverse exposure to toxic air contaminants for short-term exposures of 1-hour. Examples of health outcomes from short-term exposures may include headaches, nausea, allergic reactions, asthma exacerbation, and irritation to the eyes, nose and throat. SGCs are compared with samples obtained for short periods of time (1-hour) or dispersion modeling estimates for 1-hour impacts.

There are two health outcomes from long-term exposures, cancer and non-cancer endpoints such as reproductive, development, respiratory and cardiovascular effects. AGCs are developed for both types of health outcomes. AGCs are compared with samples obtained from a full year of monitoring or dispersion modeling estimates for annual averages.

The non-cancer AGC is derived from an air concentration that is not expected to cause serious health effects during a lifetime of continuous exposure. The AGC air concentration is often modified – to be very conservative - from the experimental value to account for uncertainties such as whether the effects in animals can be used to estimate the likelihood of effects in humans and whether the effects of high exposure concentrations in humans or animals can be used to estimate the effects of low exposure levels. The non-cancer health endpoints generally require higher exposures to elicit a response when compared to cancer health endpoints. Therefore, for the CAS program sample results above the non-cancer AGC will be considered for follow-up sampling.

The other health outcome possible from long-term exposure is cancer. Similar to the derivation for non-cancer AGCs, there is a lot of uncertainty in deriving AGCs based on cancer health outcomes. Cancer AGCs are defined as chemical concentrations in air that are associated with an estimated excess lifetime human cancer risk of 1-in-a-million ($1 \times 10^{-6}$). Under the 1990 Clean Air Act, the acceptable cancer risk used by the EPA to make regulatory decisions regarding the need for further air pollution reductions from sources or to identify significant concerns from ambient monitoring data is 100-in-a-million ($1 \times 10^{-4}$). The acceptable cancer risk used by the DEC's Division of Air Resources to make regulatory permitting decisions about the need to consider further air pollution controls for sources ranges from 1-in-a-million to 10-in-a-million ($1 \times 10^{-5}$). This is more conservative than EPA's acceptable level of concern. The

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[3] New York State Department of Environmental Conservation (NYSDEC) 1981. Air Guide-1: Application of 6NYCRR Part 212 – Toxic Air Contaminants.
[4] Cashman, T.J. 1982. Establishment of DEC's Toxic Air Contaminant Guideline Air Guide-1. New York State Department of Environmental Conservation. Division of Air Resources. New York State Public Health Association Annual Conference, Rochester NY. June 7, 1982.
[5] New York State Department of Environmental Conservation (NYSDEC) 1997. Guidelines for The Control of Toxic Ambient Air Contaminants. Division of Air Resources. Albany, NY. November 12, 1997.
[6] The most recent values developed in 2010 are available online at: http://www.dec.ny.gov/docs/air_pdf/agcsgc10.pdf

selection of an acceptable level of concern is a risk management decision. For the CAS program sample results above the 10-in-a-million risk level (which is 10 times the cancer AGC) will be considered for follow-up sampling.

Specific stationary sources are required to use a dispersion model to predict short-term (1-hour) and long-term (annual average) concentrations from facility emissions. These modeled short-term and annual maximum ambient concentrations are compared to DEC's SGCs and AGCs to evaluate whether the facility's emissions and associated air pollution control measures are acceptable. If the guideline concentrations are not met, a refined, site-specific analysis, using EPA recommended air dispersion models, is required. The New York air toxics program is referred to as a risk-based program. This means that the risks to public health and environmental are evaluated in order to determine the degree of air pollution control necessary for each toxic air pollutant from each process source at a stationary source.

The degree of air pollution control is documented through the permitting process. DEC has three distinct levels of permits for stationary sources based on the potential level of emissions that could be released by the facility. The first permit type is the Title V[7] facility permit which is required at "major" facilities that have the potential to release pollutants above specific thresholds for criteria pollutants or hazardous air pollutants (HAPs). All requirements for controlling toxic air pollutants are written into the Title V permit including emission limitations, monitoring requirements, recordkeeping and reporting requirements and requirements to periodically (at least semi-annually and annually) certify that the facility complies with all requirements. DEC is required by EPA to conduct evaluations of Title V facilities at least every two years, but the majority of these facilities in the State are evaluated every year. DEC receives an annual emission statement from all facilities with Title V permits. These statements list all criteria pollutants and HAPs and the annual amount released for each.

The second level of air permits are State Facility Permits.[8] Facilities that have emission releases below the specific threshold for criteria pollutants or HAPs are given this permit. This permit would include requirements such as emissions limits, recordkeeping and reporting requirements, and emissions monitoring and testing requirements. Sources with permit conditions that require emissions be kept below Title V thresholds are required to have an evaluation every five years to ensure compliance with the permit conditions.

The third level of air permits is called a minor facility registration and, generally, applies to smaller facilities such as dry cleaners or gas stations. The registrations for these facilities include a list of HAPs for which releases may be of concern. Facilities with registrations are still required to comply with all applicable state and federal requirements, including emissions limitations or enforceable operational conditions, but these requirements are not included in the registration itself. Lastly, some facilities are exempt from the permitting process because they are engaged in activities associated with very small releases of air pollutants. These facilities do not need to obtain a permit or registration, but are required to comply with all applicable state and federal requirements, including emissions limitations or enforceable operational conditions.

[7] Title V is a national air permitting program.
[8] Some facilities are considered small emission sources and are specifically exempt from a State Facility Permit as detailed in State regulation.

### *The Development of the Federal Programs*

In 1970, the Clean Air Act (CAA) distinguished between two categories of pollutants: criteria pollutants[9] and hazardous air pollutants (HAPs).[10] This early version of the Act listed only eight HAPs[11] and regulated only seven.

Major amendments to the CAA in 1990 (CAAA) established a number of milestones or regulatory deadlines to improve air quality. One was that the HAPs list was expanded to 187 with a greater effort to control HAP releases from mobile sources.

For large stationary sources the CAAA authorized the federal government to develop National Emission Standards for Hazardous Air Pollutants (NESHAPs) for 174 source categories which emitted HAPs and established a national air permitting program called Title V. The purpose was to ensure that the requirements to reduce HAPs were national, ensuring no Title V facility had a competitive edge by having to meet less stringent pollution control requirements.

The goal of the NESHAP program was to reduce toxic air pollutant emissions by over 75% from large stationary sources (i.e., industrial facilities) within 10 years by enacting a two-stage regulatory process. First, technology-based standards (NESHAPS) would be developed and implemented for 174 categories of large stationary sources. Second, risk to public health and the environment would be assessed within eight years after promulgation of the stationary source-specific NESHAP. This program is referred to as the Risk and Technology program and is currently being implemented.

Other goals established by EPA to measure progress in the reduction of air pollution under the CAAA are briefly discussed below.

## Addressing Mobile Source Pollution

The control of air pollution from motor vehicles is extremely important in order to improve air quality and protect public health. Unlike stationary sources, regulation of mobile sources has been primarily dominated by two programs: EPA's national program and California's state program. The 1970 Clean Air Act divides mobile sources into three categories: on-road motor vehicles, like cars, trucks, and buses; airplanes; and nonroad vehicles and engines (which includes the following: construction equipment, lawn and farm equipment, ships, locomotives, motorboats, tractors, mining trucks). The authority to set federal standards began with the 1965 Motor Vehicle Air Pollution Control Act and the first emission standards were promulgated in 1966. The 1965 Act also prohibited the sale of nonconforming vehicles and the rendering inoperable any pollution control devices. The 1970 CAA required further reductions and established a framework for motor vehicle emissions regulations that has been preserved in later amendments. These earlier emission reductions primarily focused on criteria pollutants (carbon monoxide and nitrogen oxides) and hydrocarbons.[12,13]

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[9] Criteria pollutants are: carbon monoxide, sulfur oxides, nitrogen oxides, ozone, lead and particulate matter.
[10] Most of the toxic air pollutants evaluated in the Community Air Screen are among the list of 187 hazardous air pollutants. Sometimes the terms toxic air pollutants and hazardous air pollutants are used interchangeably.
[11] The eight HAPs are: asbestos, beryllium, mercury, vinyl chloride, radionuclides, inorganic arsenic, benzene and coke oven emissions.
[12] The term hydrocarbon refers to organic compounds consisting entirely of hydrogen and carbon atoms. The majority of hydrocarbons found naturally occur in crude oil.
[13] Robert J. Martineau, Jr. and David P. Novello. The Clean Air Act Handbook, Second Edition. American Bar Association Publishing. 2004.

The 1990 CAAA empowered EPA to develop regulations that would require the development of fuels that would burn cleaner and would mandate new technology to reduce emissions of criteria air pollutants and HAPs from all motor vehicles (cars, trucks and buses). This two-fold approach has significantly reduced air pollution from motor vehicles, even as the number of vehicles and vehicle miles traveled has increased over the past twenty-two years. The Amendments also authorized the promulgation of emission standards for nonroad engines, included provisions to increase the regulatory life of vehicles, and required onboard emission monitoring equipment.

There are three general areas of regulatory focus in the national strategy to reduce air pollution from motor vehicles; clean cars and fuels, clean trucks and buses and diesel fuels, and the establishment of certification and compliance programs.[14] More stringent emission standards and cleaner fuel began with the Tier 2 vehicle standards and gasoline sulfur program which were phased in beginning in 2004 and fully implemented by 2009. Nationally, these two components have resulted in cleaner gasoline powered vehicles, as much as 77% to 95% cleaner compared to the 2003 model-year. Since the mid-1990s though, New York State has adopted the Low Emission Vehicle (LEV) program promulgated by the California Air Resources Board. The LEV emission standards achieve roughly the same reductions as Tier 2, but were phased in several years sooner.

The Department has also adopted regulations that require environmental performance labels be affixed to new vehicles delivered for sale in New York. The label contains quantitative information on emissions of criteria pollutants and greenhouse gases for new vehicles relative to the average new vehicle for the same year. This regulation furthers the goals of reducing air pollution from motor vehicles by providing consumers with clear information on the emissions of criteria pollutants and greenhouse gases for specific vehicles.[15]

The latest heavy-duty engine and vehicle standards and highway diesel fuel sulfur control requirements were phased in between 2007 and 2010. This program will result in each new truck and bus being more than 90% cleaner than pre-2007 models. By 2030, this regulation will provide annual emission reductions equivalent to removing the pollution from more than 90% of today's trucks and buses, or about 13 million trucks and buses. The motor vehicle certification and compliance programs will ensure that all vehicles are designed to meet new emission standards and will continue to meet those standards throughout their useful life.

The adoption of reformulated gasoline (RFG) in 1995 has resulted in significant decreases in ambient benzene concentrations for those areas where this program has been implemented. Section 211(k) of the CAA deemed that RFG must be sold in certain ozone non-attainment areas.[16] Federal rules limit the amount of benzene by volume in RFG gasoline. RFG is required in New York Metropolitan area (NYMA),[17] Orange County and Dutchess County. A reduction in the content of benzene in gasoline translates into reduced tailpipe and evaporative emissions of benzene. The use of reformulated gasoline in the NYMA has resulted in significant reductions of ambient air benzene concentrations.

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[14] United States Environmental Protection Agency (USEPA). 2005. Toward a Cleaner Future: Office of Transportation and Air Quality Progress Report 2005. Available On-Line: http://www.epa.gov/otaq/about/420r05011.pdf

[15] All passenger vehicle and light-duty trucks, model-year 2010 and newer.

[16] Ozone is a criteria pollutant. There are national ambient air quality standards (NAAQS) for each of the criteria pollutants. These standards apply to the concentration of a pollutant in outdoor air. If the air quality in a geographic area meets or does better than the national standard, it is called an attainment area; areas that don't meet the national standard are called nonattainment areas.

[17] NYMA consists of the following nine counties: Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Suffolk and Westchester.

In 2007, EPA issued a more stringent rule to address releases of toxic air pollutants from motor vehicles and nonroad sources. The final standard will significantly lower emissions of benzene and other toxic air pollutants in three ways: (1) by further lowering the benzene content in gasoline (lower than 1995 RFG levels); (2) by reducing exhaust emission from passenger vehicles operated at cold temperatures (under 75 degrees Fahrenheit); and (3) by reducing emissions that evaporate from, and permeate through, portable fuel containers.

The New York State Diesel Emissions Reduction Act (DERA) was passed by the legislature and signed by the Governor in 2006 with the goal of reducing emissions of fine particulate matter from diesel vehicles being operated by or on behalf of the State and to help New York meet its air quality and public health objectives. DEC adopted regulations that require these heavy duty vehicles to comply with specific emission standards for particulate matter and requires them to use ultra-low sulfur diesel.

Because EPA's new heavy-duty highway and non-road diesel engine standards apply to engines manufactured after the year 2007, EPA launched the National Clean Diesel Campaign to address diesel pollutant releases from older existing vehicles.[18] As part of this campaign the federal government instituted a grant program, also known as DERA, to address diesel pollutant releases from older existing vehicles. In October 2008, EPA and DEC announced funding of over $1 million for projects such as retrofitting school buses with new equipment to reduce pollutant releases. Additionally, EPA provided funds to DEC to purchase hybrid diesel electric marine engines for a new Hudson River patrol boat. The DERA grant program has been reauthorized for 2012 through 2016, with almost $30 million appropriated for 2012.

As required under Federal regulations, DEC jointly administers with the New York State Department of Motor Vehicles, a state-run Inspection/Maintenance (I/M) program for the control and abatement of motor vehicle emissions. I/M programs are required in both ozone and carbon monoxide (CO) nonattainment areas, depending upon population and other specific criteria. All light duty[19] vehicles (ages 2 to 25) operating in the State are required to pass both a safety inspection and emission test. Those from model year 1996 or newer must pass an onboard diagnostic emission test. Older vehicles are subject to a visual check of emission control devices. All heavy duty diesel vehicles (HDDV)[20] operating in New York State with a few exemptions are subject to random roadside emissions inspections including smoke opacity tests. HDDV registered in the nine-county NYMA are subject to emissions inspections on an annual basis.

Finally, in addition to regulating emissions and fuels, the State has many policies to address idling vehicles and school bus emissions. The current laws are listed below:

- **School Bus Idling:** NYS Department of Education (NYSED) promulgated a law to address idling of buses and other vehicles at schools. The NYS Education Law 3637, promulgated on July 1, 2008, requires school districts to minimize the idling of school buses and other vehicles owned or leased by the school district on or in front of school grounds. It is the policy of NYSED that this law applies to all school districts.[21]
- **State and City Idling Laws:** NYS and New York City (NYC) have laws addressing idling. The State law applies to all on-road heavy duty vehicles (gross vehicle weight exceeding 8,500 pounds) and prohibits idling for more than five consecutive minutes,

[18] USEPA's National Clean Diesel Campaign. Available: http://epa.gov/cleandiesel/index.htm#voluntary [accessed 10/14/08].
[19] Vehicles with a gross vehicle weight rating of 8,500 pounds and less.
[20] Vehicles with a gross vehicle weight rating exceeding 8,500 pounds.
[21] Reducing School Bus Idling - Requirements and Notice Materials for School Districts. Available: http://www.emsc.nysed.gov/schoolbus/anti-idling/ [accessed 10/14/08].

providing exceptions for safety and other considerations.[22] The City law prohibits idling for longer than three minutes while parking, standing or stopping, with specific exceptions for safety and operation of buses.[23]

- In February 2009, the NYC Council passed legislation to limit the idling in all **NYC public or private school zones** to one minute.[24] The school zone created by the law encompasses all streets that immediately border public and private schools. The law also requires city agencies to submit idling violation reports to the City Council. Additionally, the City Council voted to extend enforcement authority for NYC idling laws to the Department of Parks and Recreation and Department of Sanitation.

In summary, the goals of the federal and state air pollution control programs are consistent with each other and promote the economic and social well-being of the community in NYS.

## New York State Air Quality

The strategies discussed previously to reduce toxic air pollutants from stationary and mobile sources have resulted in significant improvements in air quality. An historical perspective that reflects the success of these efforts can be seen in DEC's Bureau of Air Quality Surveillance (BAQS) report titled: NYS Ambient Air Monitoring Program Network Assessment (May 2010).[25] The Network Assessment report shows historical trends for criteria pollutants and some toxic air pollutants. Historical trends for common toxic air pollutants frequently detected in DEC's monitoring network can be found in Trends for Specific VOC Compounds [26] or in Volatile Organics Data Summaries.[27]

[22] New York State Department of Environmental Conservation Regulations. Available: http://www.dec.ny.gov/regs/4256.html [accessed 10/14/08].
[23] Laws of New York State http://public.leginfo.state.ny.us/menugetf.cgi
[24] Local Law to amend the administrative code of the city of New York, in relation to engine idling. Available online at: http://webdocs.nyccouncil.info/textfiles/Int%200631-2007.htm?CFID=45987&CFTOKEN=43880504 [accessed 2/18/09].
[25] Available online at: http://www.dec.ny.gov/chemical/65574.html
[26] Available online at: http://www.dec.ny.gov/chemical/66472.html
[27] Available online at: http://www.dec.ny.gov/chemical/29680.html

# Appendix B

## Uses, Sources and Potential Exposure to Toxic Air Pollutants Evaluated in the Community Air Screen Program[1]

### 1,1,1-Trichloroethane[2] (71-55-6)[3]

#### *Uses*

1,1,1-trichloroethane is an ozone-depleting chemical and because of this, production of it has been highly regulated. 1,1,1-Trichloroethane is used as a solvent and degreasing agent in industry. 1,1,1-trichloroethane also is used in tire manufacturing[4] and for cleaning photographic films[5] (movie/slide/negatives).

#### *Sources and Potential Exposure*

1,1,1-Trichloroethane was used an ingredient in consumer products such as household cleaners and aerosol sprays and has been identified as a constituent in landfill gas.[6] In 2008, the largest source for ambient release of 1,1,1-trichloroethane (88%) in New York was from industrial uses (such as tire manufacture and photographic film cleaning).[7]

### 1,1,2,2-Tetrachloroethane[8] (79-34-5)

#### *Uses*

There is very little production of 1,1,2,2-tetrachloroethane in the U.S. Any remaining production would likely be for on-site uses as a chemical intermediate, as a trace constituent with other chemicals, or as part of a waste stream in releases to the environment. In the past, 1,1,2,2-tetrachloroethane was used in large amounts to produce trichloroethylene, tetrachloroethylene, and 1,2,-dichloroethylene. It was also used as a solvent, in cleaning and degreasing metals, in paint removers, varnishes and lacquers, in photographic films, as an extractant for oils and fats, and in pesticides.

#### *Sources and Potential Exposure*

Limited occupational exposure to 1,1,2,2-tetrachloroethane may occur. 1,1,2,2-tetrachloroethane has been identified as a constituent in landfill gas.[6] In 2008, the largest source for ambient release of 1,1,2,2-tetrachloroethane (90%) in New York was from municipal landfills and waste treatment and disposal facilities.[7]

### 1,1,2-Trichloroethane (79-00-5)

#### *Uses*

1,1,2-Trichloroethane is primarily used as a chemical intermediate in the production of 1,1-dichloroethene. It is also used as a solvent for chlorinated rubbers, fats, oils, waxes, and resins.

#### *Sources and Potential Exposure*

1,1,2-Trichloroethane has not been reported in food or soil, and exposure from contaminated drinking water appears to be rare. Exposure to 1,1,2-trichloroethane may occur in the workplace where it is used as a solvent. 1,1,2-trichloroethane has been identified as a constituent in landfill gas.[6]

### 1,1-Dichloroethane[9] (75-34-3)

#### *Uses*

1,1-Dichloroethane is used as an intermediate in the manufacture of other products such as vinyl chloride, l,l,l-trichloroethane, and to a lesser extent high vacuum rubber. It also has limited use as a solvent for plastics, oils, and fats, and is used as both a cleaning agent and a degreaser.

### *Sources and Potential Exposure*

Based on its industrial use, 1,1-dichloroethane is primarily released to the atmosphere, and people are potentially exposed to this chemical through the inhalation or ingestion of contaminated air or water. However, because data available on production, import, export, use, and disposal are limited, it is difficult to estimate the potential for human exposure. 1,1-Dichloroethane has been identified as a constituent in landfill gas.[6]

## 1,1-Dichloroethylene (75-35-4)

### *Uses*

1,1-Dichloroethylene (also called vinylidene chloride) is primarily used as a chemical intermediate for organic chemical synthesis. It is also used in the production of polyvinylidene chloride copolymers. The major application of these chloride copolymers is in the production of flexible films for food packaging (SARAN® and VELON® wraps).

### *Sources and Potential Exposure*

Air releases, primarily from emissions from polymer synthesis and fabrication industries, are the greatest source of ambient 1,1-dichloroethylene. Occupational exposure to 1,1-dichloroethylene may occur by inhalation or dermal contact. 1,1-Dichloroethylene has been detected at low levels in a number of drinking water supplies across the United States. 1,1-Dichloroethylene has been identified as a constituent in landfill gas.[6] In 2008, the largest source for ambient release of 1,1-dichloroethylene (99%) in New York was from municipal landfills and waste treatment and disposal facilities.[7]

## 1,2,4-Trichlorobenzene[10] (120-82-1)

### *Uses*

1,2,4-Trichlorobenzene is primarily used as a solvent to dissolve special materials as oils, waxes, resins, greases, and rubber. It is also frequently used to produce dyes and textiles.

### *Sources and Potential Exposure*

The general population is exposed to 1,2,4-trichlorobenzene from inhalation of ambient air and ingestion of food and drinking water. Exposures may be greater near heavily industrialized areas or at Superfund sites where this solvent is present. 1,2,4-Trichlorobenzene has been identified as a constituent in landfill gas.[6] In 2008, the largest source for ambient release of 1,2,4-trichlorobenzene (77%) in New York was from industrial uses (such as tire manufacture and pulp, paper and wood products production).[7]

## 1,2,4-Trimethylbenzene[11,12] (95-63-6)

### *Uses*

1,2,4-Trimethylbenzene is used as a solvent in manufacture of dyes, perfumes, resins and in the manufacture of pharmaceuticals. It is used as a solvent and paint thinner. Production of 1,2,4-trimethylbenzene occurs during petroleum refining as a major component of the C9 aromatic hydrocarbon fraction. It typically constitutes around 40% of the C9 fraction. Another primary use is as a gasoline additive.

### *Sources and Potential Exposure*

1,2,4-Trimethylbenzene is released directly to the environment as a component of gasoline and as an emission from gasoline-powered vehicles, municipal waste-treatment plants, and coal-fired power stations. Occupational exposure may also occur from industrial uses.

## 1,2-Dibromoethane (106-93-4)

### *Uses*

1,2-Dibromoethane was used in the past as an additive to leaded gasoline; however, since leaded gasoline is now banned, it is no longer used for this purpose. 1,2-Dibromoethane was used as a fumigant to protect against insects, pests, and nematodes in citrus, vegetable, and grain crops, and as a fumigant for turf, particularly on golf courses. In 1984, EPA banned its use as a soil and grain fumigant. 1,2-Dibromoethane is currently used in the treatment of felled logs for bark beetles and termites, and control of wax moths in beehives. 1,2-Dibromoethane is also used as an intermediate for dyes, resins, waxes, and gums.

#### *Sources and Potential Exposure*

Possible sources of 1,2-dibromoethane emissions to the ambient air are production and processing facilities. Exposure could occur from inhalation of ambient air near industries that use 1,2-dibromoethane or through the ingestion of contaminated drinking water. In 2008, the largest source for ambient release of 1,2-dibromoethane (83%) in New York was from industrial uses (such as internal combustion engines burning natural gas, natural gas compressor and storage stations and tire manufacture).[7]

### 1,2-Dichlorobenzene[11,13,14] (95-50-1)

#### *Uses*

The greatest use of 1,2-dichlorobenzene is as a chemical intermediate for making agricultural chemicals, primarily herbicides. Other present and past uses include: solvent for waxes, gums, resins, wood preservatives, paints; insecticide for termites and borers; in making dyes; as a coolant, deodorizer, and degreaser.

#### *Sources and Potential Exposure*

Occupational exposure to 1,2-dichlorobenzene may be through inhalation and dermal contact with this compound at workplaces where 1,2-dichlorobenzene is produced or used. 1,2-Dichlorobenzene is a by-product in the manufacture of 1,4-dichlorobenzene and may be a pathway by which 1,2-dichlorobenzene is released into the environment.

### 1,2-Dichloroethane[15] (107-06-2)

#### *Uses*

1,2-Dichloroethane (also known as ethylene dichloride) is currently used as a chemical intermediate and as a solvent in closed systems. In the U.S., about 98% of the 1,2-dichloroethane produced is used to manufacture vinyl chloride. Smaller amounts of 1,2-dichloroethane are used in the synthesis of 1,1-dichloroethene, 1,1,1-trichloroethane, trichloroethene, tetrachloroethene, aziridines, and ethylene diamines and in chlorinated solvents.

#### *Sources and Potential Exposure*

There are no known natural sources of 1,2-dichloroethane. Releases of this compound to the environment may result from the manufacture, use, storage, distribution, and disposal of 1,2-dichloroethane. 1,2-Dichloroethane is released from commercial cooking activities.[16] 1,2-Dichloroethane has been identified as a constituent in landfill gas.[6] In 2008, the largest source for ambient release of 1,2-dichloroethane (51%[33]) in New York was from commercial and institutional uses (such as charbroiling food at commercial facilities or institutions).[7]

### 1,2-Dichloropropane[11,17] (78-87-5)

#### *Uses*

1,2-Dichloropropane (also known as propylene dichloride) is used as a chemical intermediate in the production of chlorinated organic chemicals, as an industrial solvent, in ion exchange manufacture, in toluene diisocyanate production, in photographic film manufacture, for paper coating, and for petroleum catalyst regeneration. 1,2-Dichloropropane is used in furniture finish, dry cleaning fluid, and paint remover, gum processing, metal degreasing, oil processing, and as a rubber- and wax-making agent, and a

chemical intermediate in the production of tetrachloroethylene and carbon tetrachloride. Previously used as an agricultural soil fumigant.

### *Sources and Potential Exposure*

Occupational exposure to 1,2-dichloropropane may occur during its production, during its use in chemical reactions or as an industrial solvent, or from evaporation from wastewater that contains the chemical. General population exposures may occur if exposed to contaminated water sources.[18]
1,2-Dichloropropane has been identified as a constituent in landfill gas.[6] In 2008, the largest source for ambient release of 1,2-dichloropropane (60%) in New York was from industrial uses (such as from the photographic film manufacturing and other industrial processes).[7]

## 1,3,5-Trimethylbenzene[11] (108-67-8)

### *Uses*

Used as a paint thinner, solvent, and motor fuel component. It is also used as an intermediate in the synthesis of dyes and antioxidants.

### *Sources and Potential Exposure*

1,3,5-Trimethylbenzene is released directly to the environment as a component of gasoline and as an emission from gasoline-powered vehicles, municipal waste-treatment plants, and coal-fired power stations. Workers and the general population that operate gasoline-pumping stations and off-set printers may be exposed 1,3,5-trimethylbenzene.

## 1,3-Butadiene[19] (106-99-0)

### *Uses*

1,3-Butadiene is used in the production of rubber and plastics. It is also used in copolymers including acrylics.

### *Sources and Potential Exposure*

Sources of 1,3-butadiene released into the air include motor vehicle exhaust, manufacturing and processing facilities, forest fires or other combustion, and cigarette smoke. Higher levels of 1,3-butadiene may be found in highly industrialized cities or near oil refineries, chemical manufacturing plants, and plastic and rubber factories. 1,3-Butadiene has been found in drinking water and in plastic or rubber food containers, and very low levels in some food samples. Occupational exposure to 1,3-butadiene may occur in the rubber, plastics, and resins industries. In 2008, the largest source for ambient release of 1,3-butadiene (87%) in New York was from mobile sources (both transportation such as cars, trucks and buses and non-road vehicles and engines[20]).[7]

## 1,3-Dichlorobenzene[21] (541-73-1)

### *Uses*

1,3-Dichlorobenzene has been used in the production of herbicides and insecticides as well as in the production of pharmaceuticals and dyes.

### *Sources and Potential Exposure*

1,3-Dichlorobenzene is not found frequently in the air of homes and buildings because this chemicals is not used in household products. Whereas, 1,4-dichlorobenzene is used as a deodorant. Occupational exposures may occur where this chemical is used in production.

## 1,4-Dichlorobenzene[21] (106-46-7)

### *Uses*

For the past 20 years, 1,4-dichlorobenzene has been used principally (25–55% of all uses) as a space deodorant for toilets and refuse containers, and as a fumigant for control of moths, molds, and mildews. In recent years, the use of 1,4-dichlorobenzene in the production of polyphenylene sulfide resin has increased steadily (25– 50% of its total use). 1,4-Dichlorobenzene is also used as an intermediate in the production of other chemicals such as 1,2,4-trichlorobenzene (approximately 10%). Minor uses of 1,4-dichlorobenzene include its use in the control of certain tree-boring insects and ants, and in the control of blue mold in tobacco seed beds.

### *Sources and Potential Exposure*

People are exposed to 1,4-dichlorobenzene mainly by breathing vapors from 1,4-dichlorobenzene products used in the home, such as mothballs and toilet-deodorizer blocks. Reported air levels of 1,4-dichlorobenzene in some homes and public restrooms have ranged from 0.291 to 272 ppb. 1,4-Dichlorobenzene has been found in 13% of surface water samples collected during a national survey. These samples contained about 0.008–154 ppb of 1,4-dichlorobenzene. People who work or live in buildings where air fresheners, toilet block deodorants, or moth balls containing 1,4-dichlorobenzene are used also are expected to have a higher exposure to this compound, which could occur from skin contact as well as by breathing.

Individuals can be occupationally exposed to 1,4-dichlorobenzene in workplace air at much higher levels than the general public is exposed. Levels measured in the air of factories that make or process 1,4-dichlorobenzene products have ranged from 5.6 to 748 ppm of air. In addition, people who live or work near industrial facilities or hazardous waste sites that have high levels of 1,4-dichlorobenzene may have greater exposure to these compounds due to emissions from the facilities and waste sites. In 2008, the largest source for ambient release of 1,4-dichlorobenzene (67%) in New York was from municipal wastewater treatment operations.[7]

## *a*-Chlorotoluene (Benzylchloride) [11,17] (100-44-7)

### *Uses*

The primary use of *a*-chlorotoluene is in the manufacture of benzyl butyl phthalate and other flexible poly(vinyl chloride) uses such as food packaging. *a*-Chlorotoluene is used as a chemical intermediate in the manufacture of certain dyes and pharmaceutical, perfume and flavor products. *a*-Chlorotoluene can be used in the manufacture of synthetic tannins and as a gasoline gum inhibitor.

### *Sources and Potential Exposure*

Sources of *a*-chlorotoluene emissions into the air include emissions or venting with other gases in industrial settings. Emissions of *a*-chlorotoluene from floor tile plasticized by butyl benzyl phthalate have been reported. *a*-Chlorotoluene has also been detected in emissions from the burning of polyvinyl chloride, neoprene and rigid urethane foam compounds. Individuals may be exposed to *a*-chlorotoluene through breathing contaminated air or from exposure to water or soil that has been contaminated with *a*-chlorotoluene. Individuals may be exposed to *a*-chlorotoluene if exposed to gasoline where this chemical has been used. In 2008, the largest source for ambient release of *a*-chlorotoluene (98%) in New York was from the burning of coal in electric generation facilities. Current releases are expected to be much lower since more facilities are using natural gas which is cheaper than coal.[7]

## Benzene[22] (71-43-2)

### *Uses*

Benzene is used as a constituent in motor fuels; as a solvent for fats, waxes, resins, oils, inks, paints, plastics, and rubber; in the extraction of oils from seeds and nuts; and in photogravure printing. It is also used as a chemical intermediate. Benzene is also used in the manufacture of detergents, explosives, pharmaceuticals, and dyestuffs.

### *Sources and Potential Exposure*

Everyone is exposed to a small amount of benzene every day, primarily through breathing air that contains benzene. The major sources of benzene exposure are tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions. Air releases from products that contain benzene, such as glues, paints, furniture wax, and detergents, can also be a source of exposure. In 2008, the largest source for ambient release of benzene (68%) in New York was from mobile sources (both transportation such as cars, trucks and buses and non-road vehicles and engines[20]).[7]

Individuals employed in industries that manufacture or use benzene may be exposed to the highest levels of benzene. These industries include benzene production (petrochemicals, petroleum refining, and coke and coal chemical manufacturing), rubber tire manufacturing, and storage or transport of benzene and petroleum products containing benzene. Other workers who may be exposed to benzene include workers in the steel industry, printers, rubber workers, shoe makers, laboratory technicians, firefighters, and gas station employees. Individuals may also be exposed to benzene by consuming contaminated water. Non-anthropogenic sources of benzene include volcanoes and forest fires.

## Bromodichloromethane[11,23] (75-27-4)

### *Uses*

The principal use of bromodichloromethane is as a chemical intermediate for organic synthesis and as a laboratory reagent.

### *Sources and Potential Exposure*

Bromodichloromethane's production and use as a chemical intermediate and solvent may result in its release to the environment through various waste streams. The general population is exposed to bromodichloromethane through consumption of contaminated drinking water, beverages, and food products. The contamination is a result of inadvertent formation during chlorination treatment of the drinking water and subsequent use of chlorinated tap water to produce food products. Exposure can also occur through inhalation of background levels in ambient air and through dermal exposure in chlorinated swimming pool water. The predominant anthropogenic source of bromodichloromethane release to the environment is its inadvertent formation during chlorination treatment processes of water.

## Bromomethane (Methyl bromide) (74-83-9)

### *Uses*

The primary use of methyl bromide is as a fumigant in soil to control fungi, nematodes, and weeds; in space fumigation of food commodities (e.g., grains); and in storage facilities (such as mills, warehouses, vaults, ships, and freight cars) to control insects and rodents.

### *Sources and Potential Exposure*

Workers who fumigate homes and fields may be exposed to high levels of methyl bromide if proper safety precautions are not followed. Some methyl bromide is formed naturally by algae or kelp in the ocean. Methyl bromide is released from the burning of bituminous and sub-bituminous coal.[24] In 2008, the largest source for ambient release of methyl bromide in New York (96%) was from the burning of coal in electric generation facilities.[7] Current releases are expected to be much lower since more facilities are using natural gas which is cheaper than coal.

## Carbon disulfide (75-15-0)

### *Uses*

Carbon disulfide is used predominantly in the manufacture of rayon, cellophane, and carbon tetrachloride. Carbon disulfide is also used to produce rubber chemicals and pesticides.

### *Sources and Potential Exposure*

Carbon disulfide was one of the seven sulfur-gas released from problem drywall installed in U.S. homes.[25] The main route of exposure to this compound is in the workplace. Workers in plants that use carbon disulfide in their manufacturing processes have a high degree of exposure potential. Releases of carbon disulfide from industrial processes are almost exclusively to the air; individuals in proximity to these sites may be exposed. Carbon disulfide has been detected in some samples of drinking water. Low amounts of carbon disulfide may be emitted naturally from volcanoes and marshes.

## Carbon tetrachloride[26] (56-23-5)

### *Uses*

The major use of carbon tetrachloride has historically been for the production of chlorofluorocarbons, such as dichlorodifluoromethane (F-12) and trichlorofluoromethane (F-11), which are used primarily as refrigerants. Historically, it was widely used as a cleaning fluid in the home and as a degreaser in industry. Carbon tetrachloride was phased out in January 1996 by the Montreal Protocol. It is only available for those uses for which no effective substitute has been found. The atmospheric half-life for carbon tetrachloride is 50 years or more and therefore, it will remain a ubiquitously distributed airborne contaminant for many years to come.

### *Sources and Potential Exposure*

The general public is exposed to a small amount carbon tetrachloride everyday because of global circulating concentrations because this chemical has a long atmospheric half-life. Individuals may be exposed to carbon tetrachloride in the air from accidental releases from production and uses, and from its disposal in landfills where it may evaporate into the air or leach into groundwater. Carbon tetrachloride is also a common contaminant of indoor air; the sources of exposure appear to be building materials or products, such as cleaning agents, used in the home. Workers directly involved in the manufacture or use of carbon tetrachloride are most likely to have significant exposures to carbon tetrachloride. Individuals may also be exposed to carbon tetrachloride by drinking contaminated water.

## Chlorobenzene (108-90-7)

### *Uses*

The primary uses of chlorobenzene are as a solvent for pesticide formulations, diisocyanate manufacture, and degreasing automobile parts and for the production of nitrochlorobenzene. In the past, chlorobenzene was used as an intermediate in phenol and DDT production.

### *Sources and Potential Exposure*

Exposure to chlorobenzene appears to be primarily occupational. In urban areas, chlorobenzene may be released to the ambient air during its manufacture and use and from wastewater treatment facilities. In 2008, the largest source for ambient release of chlorobenzene (87%) in New York was from municipal wastewater treatment operations.[7]

## Chloroethane (75-00-3)

### *Uses*

Chloroethane is used in the production of ethyl cellulose, use as a solvent, refrigerant, in the manufacture of dyes, chemicals, and pharmaceuticals, and as a medication to alleviate pain associated with insect burns and stings. In the past, chloroethane was used in the production of tetraethyl lead, an anti-knock additive to leaded gasoline. Government-mandated reduction in the amount of lead additives used in gasoline in the United States and a shift to the use of unleaded gasoline has caused a drastic reduction in the amount of chloroethane required for the production of tetraethyl lead.

### *Sources and Potential Exposure*

Sources of possible chloroethane exposure include the inhalation of contaminated air and ingestion of contaminated drinking water at very low levels. The general population can be exposed to chloroethane by skin contact with consumer products that contain chloroethane such as solvents and refrigerants. Occupational exposure by inhalation or dermal contact with chloroethane can occur in industries such as medical and health services; automotive dealers and service stations; wholesale trade, electric, gas, and sanitary services; machinery (except electrical) and special trade contractors; fabricated metal productions; printing and publishing; painting; rubber and plastic products; and food. Chloroethane is released from the burning of bituminous and sub-bituminous coal.[24] In 2008, the largest source for ambient release of chloroethane in New York (90%) was from the burning of coal in electric generation facilities.[7] Current releases are expected to be much lower since more facilities are using natural gas which is cheaper than coal.

## Chloroform (67-66-3)

### *Uses*

The vast majority of the chloroform produced in the United States is used to make HCFC-22. The rest is produced for export and for miscellaneous uses. Chloroform was used in the past as an extraction solvent for fats, oils, greases, and other products; as a dry cleaning spot remover; in fire extinguishers; as a fumigant; and as an anesthetic. However, chloroform is no longer used in these products.

### *Sources and Potential Exposure*

Chloroform may be released to the air from a large number of sources related to its manufacture and use, as well as its formation in the chlorination of drinking water, wastewater, and swimming pools. Pulp and paper mills, hazardous waste sites, and sanitary landfills are also sources of air emissions. Human exposure to chloroform may occur through drinking water, where chloroform is formed as a result of the chlorination of naturally occurring organic materials found in raw water supplies. Chloroform may also be found in some foods and beverages, largely from the use of tap water during production processes. In 2008, the largest source for ambient release of chloroform (85%) in New York was from municipal wastewater treatment operations.[7]

## Chloromethane (74-87-3)

### *Uses*

Chloromethane is used mainly in the production of silicones where it is used to make methylate silicon. It is also used in the production of agricultural chemicals, methyl cellulose, quaternary amines, and butyl rubber and for miscellaneous uses including tetramethyl lead. Chloromethane was used widely in refrigerators in the past, but generally this use has been taken over by newer chemicals such as Freon.

### *Sources and Potential Exposure*

Chloromethane is formed in the oceans by natural processes (e.g., marine phytoplankton) and from biomass burning in grasslands and forested areas (e.g., forest fires); it has been detected at low levels in air all over the world. Other sources of exposure to chloromethane include cigarette smoke, polystyrene insulation, and aerosol propellants; home burning of wood, coal, or certain plastics; and chlorinated swimming pools. Chloromethane is also present in some lakes and streams and has been found in drinking water at very low levels. Occupations that present a higher risk of exposure include building contracting, metal industries, transportation, car dealers, and service-station attendants. In 2008, the largest source for ambient release of chloromethane (85%) in New York was from industrial uses (such as plastics production, chemical manufacturing, and pulp, paper and wood products production).[7]

## cis1,3-Dichloropropene (542-75-6)

### *Uses*

*Cis*-1,3-Dichloropropene is the predominant component of several formulations used in agriculture as soil fumigants for parasitic nematodes.

### *Sources and Potential Exposure*

Workers may be occupationally exposed to 1,3-dichloropropene, dermally or by inhalation, during its manufacture, formulation, or application as a soil fumigant. The general public may be exposed via inhalation near source areas or from the consumption of contaminated drinking water from wells near some hazardous waste sites.

## cis1,2-Dichloroethylene[11] (156-59-2)

### *Uses*

*Cis*-1,2-Dichloroethylene has been used as a solvent for fats, phenols, camphor, and also to retard fermentation. It has been used in the rubber manufacturing, as a refrigerant, an additive to dye and lacquer solutions, a low-temperature solvent for heat-sensitive substances (eg, caffeine), constituent of perfumes and thermoplastics and used in organic synthesis and medicine.

### *Sources and Potential Exposure*

Occupational exposures may occur where this chemical is used in manufacturing. Monitoring data indicate that the general population may be exposed to cis-1,2-dichloroethylene via drinking water containing this compound.

## Dichlorodifluoromethane[11] (75-71-8)

### *Uses*

Historical use has been as a refrigerant. Fully halogenated chlorofluorocarbons (CFCs) such as dichlorodifluoromethane were scheduled for production phase-out in 1987 by the Montreal Protocol.

### *Sources and Potential Exposure*

Due to its long atmospheric residence time, the general population may be exposed to dichlorodifluoromethane via inhalation of ambient air.

## Dichlorotetrafluoroethane (76-14-2)

### *Uses*

Historical use has been as a refrigerant, blowing agent for cellular polymers, and foaming agent in fire extinguishing. Fully halogenated chlorofluorocarbons (CFCs) such as dichlorodifluoromethane were scheduled for production phase-out in 1987 by the Montreal Protocol.

### *Sources and Potential Exposure*

Due to its long atmospheric residence time, the general population may be exposed to dichlorotetrafluoroethane via inhalation of ambient air.

## Ethylbenzene[27] (100-41-4)

### *Uses*

Ethylbenzene is used primarily in the production of styrene. It is also used as a solvent, as a constituent of asphalt and naphtha, and in fuels.

### *Sources and Potential Exposure*

Exposure to ethylbenzene occurs from the use of consumer products, gasoline, pesticides, solvents, carpet glues, varnishes, paints, and tobacco smoke. Occupational exposure to ethylbenzene occurs in factories that use ethylbenzene to produce other chemicals; for gas and oil workers; and for varnish workers, spray painters, and persons involved in gluing operations. In 2008, the largest source for ambient release of

benzene (50%) in New York was from mobile sources (both transportation such as cars, trucks and buses and non-road vehicles and engines[20]).[7]

### Hexachloro-1,3-butadiene (87-68-3)

#### *Uses*

Hexachloro-1,3-butadiene is used mainly as an intermediate in the manufacture of rubber compounds. It is also used in the production of lubricants, as a fluid for gyroscopes, as a heat transfer liquid, and in hydraulic fluids.

#### *Sources and Potential Exposure*

Persons working in industries where hexachloro-1,3-butadiene is formed or used may be exposed to the chemical. Individuals who consume large amounts of fish from contaminated waters may also be exposed to hexachloro-1,3-butadiene. In 2008 for New York, the ambient release of hexachloro-1,3-butadiene was split between waste water treatment operations and industrial uses (such as chemical manufacturing and tire retreading).[7]

### m,p-Xylene[28] (1330-20-7)

#### *Uses*

Xylenes are primarily used in the production of ethylbenzene and as solvents in products such as paints and coatings, and are blended into gasoline.

#### *Sources and Potential Exposure*

Mixed xylenes are distributed throughout the environment; they have been detected in air, rainwater, soils, surface water, sediments, drinking water, and aquatic organisms. Xylenes are released into the atmosphere as fugitive emissions from industrial sources, from auto exhaust, and through volatilization from their use as solvents and from paints and surface coatings. Xylenes are commonly found in indoor air of homes and buildings. Occupational exposure to mixed xylenes may occur at workplaces where mixed xylenes are produced and used as industrial solvents. In 2008, the largest source for ambient release of *m,p*-xylene (74%) in New York was from mobile sources (both transportation such as cars, trucks and buses and non-road vehicles and engines[20]).[7]

### Methyl tert butyl ether[29] (1634-04-4)

#### *Uses*

Nearly all methyl tert-butyl ether (MTBE) produced in the United States is used as an additive in unleaded gasoline to increase octane levels and reduce carbon monoxide emissions. MTBE was used in New York, until its statewide ban on January 1, 2004. The expanding use of MTBE in gasoline from 1979 to 2004, in conjunction with its physical and chemical properties resulted in significant MTBE impacts to the groundwater resources in the State.[30] MTBE is used in small quantities as a laboratory reagent to extract semi-volatile organic compounds from such sample types as leachates or solid wastes. MTBE is also a pharmaceutical agent, which can be used as an alternative to surgery in dissolving gallstones when injected intraductally.

#### *Sources and Potential Exposure*

In New York, the general public may be exposed to MTBE if contamination is present in surface water, groundwater and soil. Because it is no longer used as an additive in automotive fuel in New York, the general population is unlikely to be exposed through auto exhaust or gasoline fumes. In 2008, the largest source for ambient release of MTBE (55%) in New York was from industrial uses (such as pharmaceutical production and tire manufacturing).[7]

## Methylene chloride[31] (dichloromethane) (75-09-2)

### *Uses*

Methylene chloride is predominantly used as a solvent in paint strippers and removers; as a process solvent in the manufacture of drugs, pharmaceuticals, and film coatings; as a metal cleaning and finishing solvent in electronics manufacturing; and as an agent in urethane foam blowing. Methylene chloride is also used as a propellant in aerosols for products such as paints, automotive products, and insect sprays. Methylene chloride is also approved for use as a postharvest fumigant for grains and strawberries and as a degreening agent for citrus fruit.

### *Sources and Potential Exposure*

The principal route of human exposure to methylene chloride is inhalation of ambient air. Occupational and consumer exposure to methylene chloride in indoor air may be much higher, especially from spray painting or other aerosol uses. People who work in these places can breathe in the chemical or it may come in contact with the skin. Methylene chloride has been detected in both surface water and groundwater samples taken at hazardous waste sites and in drinking water at very low concentrations. In 2008, the largest source for ambient release of methylene chloride in New York (57%) was from solvent use and cleaning operations.[7]

## o-Xylene[28] (95-47-6)

### *Uses*

Xylenes are primarily used in the production of ethylbenzene and as solvents in products such as paints and coatings, and are blended into gasoline.

### *Sources and Potential Exposure*

Mixed xylenes are distributed throughout the environment; they have been detected in air, rainwater, soils, surface water, sediments, drinking water, and aquatic organisms. Xylenes are released into the atmosphere as fugitive emissions from industrial sources, from auto exhaust, and through volatilization from their use as solvents and from paints and surface coatings. Xylenes are commonly found in indoor air of homes and buildings. Occupational exposure to mixed xylenes may occur at workplaces where mixed xylenes are produced and used as industrial solvents. In 2008, the largest source for ambient release of o-xylene (79%) in New York was from burning of wood for residential heat.[7]

## Styrene[32] (100-42-5)

### *Uses*

Styrene is used predominately in the production of polystyrene plastics and resins. In addition, fiberglass products used for boats are also made from polyester resins dissolved in styrene. Styrene is also used as an intermediate in the synthesis of materials used for ion exchange resins and to produce copolymers such as styrene-acrylonitrile (SAN) and acrylonitrilebutadiene-styrene (ABS), both representing approximately 9% of styrene use, and styrene-butadiene rubber (SBR), representing approximately 6% of styrene use. SBR is used for such products as car tires, hoses used for industrial applications, and shoes. Styrene-butadiene latex is used in making carpet, coatings for paper, and as part of latex paints. SAN and ABS are used for materials such as piping, automotive components, refrigerator liners, plastic drinking glasses, and car battery enclosures. Styrene is used in resins to make boat hulls, and is used to make thermoplastics, glues and adhesives. Styrene copolymers are frequently used in liquid toner for photocopiers and printers. The Food and Drug Administration permits styrene to be used as a direct additive for synthetic flavoring and an indirect additive in polyester resins, ion-exchange membranes, and in food packaging material.

### *Sources and Potential Exposure*

Occupational exposure to styrene occurs in the reinforced plastics industry and polystyrene factories. The general public is mostly likely exposed to styrene in indoor air attributable to releases from building materials, consumer products, and tobacco smoke. In 2008, the largest source for ambient release of styrene (41%) in New York was from residential burning of garbage containing plastics and Styrofoam.[7] Current releases of styrene should be much lower since the burning of household waste was prohibited by DEC regulation in 2009.

### Tetrachloroethylene (perchloroethylene) (127-18-4)

#### *Uses*

Tetrachloroethylene is used for dry cleaning and textile processing, as a chemical intermediate, and for vapor degreasing in metal-cleaning operations.

#### *Sources and Potential Exposure*

Occupational exposure to tetrachloroethylene may occur, primarily in dry cleaning establishments and at industries manufacturing or using the chemical. The general public may be exposed in residential dwellings which are attached to dry cleaning establishments using tetrachloroethylene. The general public may be exposed if near clothes that have been dry cleaned using tetrachloroethylene. Exposures may occur if showering or bathing in water contaminated with tetrachloroethylene. In 2008, the largest source for ambient release of tetrachloroethylene in New York (56%) was from waste water treatment operations.[7]

### Toluene (108-88-3)

#### *Uses*

The major use of toluene is as a mixture added to gasoline to improve octane ratings. Toluene is also used to produce benzene and as a solvent in paints, coatings, synthetic fragrances, adhesives, inks, and cleaning agents. Toluene is also used in the production of polymers used to make nylon, plastic soda bottles, and polyurethanes and for pharmaceuticals, dyes, cosmetic nail products, and the synthesis of organic chemicals. Toluene is also used as a starting material in the synthesis of trinitrotoluene (TNT).

#### *Sources and Potential Exposure*

The highest concentrations of toluene usually occur in indoor air from the use of common household products (paints, paint thinners, adhesives, synthetic fragrances and nail polish) and cigarette smoke. Toluene exposure may also occur in the workplace, especially in occupations such as printing or painting, where toluene is frequently used as a solvent. Automobile emissions are the principal source of toluene to the ambient air. Toluene may also be released to the ambient air during the production, use, and disposal of industrial and consumer products that contain toluene. In 2008, the largest source for ambient release of toluene (76%) in New York was from mobile sources (both transportation such as cars, trucks and buses and non-road vehicles and engines[20]).[7]

### trans1,3-Dichloropropene (542-75-6)

#### *Uses*

1,3-Dichloropropene is the predominant component of several formulations used in agriculture as soil fumigants for parasitic nematodes.

#### *Sources and Potential Exposure*

Workers may be occupationally exposed to 1,3-dichloropropene, dermally or by inhalation, during its manufacture, formulation, or application as a soil fumigant. The general public may be exposed via inhalation near source areas or from the consumption of contaminated drinking water from wells near some hazardous waste sites.

## Trichloroethylene (79-01-6)

### *Uses*

The main use of trichloroethylene is in the vapor degreasing of metal parts. Trichloroethylene is also used as an extraction solvent for greases, oils, fats, waxes, and tars, a chemical intermediate in the production of other chemicals, and as a refrigerant. Trichloroethylene is used in consumer products such as typewriter correction fluids, paint removers/strippers, adhesives, spot removers, and rug-cleaning fluids.

### *Sources and Potential Exposure*

Because of its moderate water solubility, trichloroethylene in soil has the potential to migrate into groundwater. The relatively frequent detection of trichloroethylene in groundwater confirms its mobility in soils. Drinking water supplies relying on contaminated groundwater sources may contain trichloroethylene. The Agency for Toxic Substance and Disease Registry reports that trichloroethylene is the most frequently reported organic contaminant in groundwater. Workers may be exposed to trichloroethylene where it is manufactured or used. In addition, the general public may be exposed to trichloroethylene if released from facilities where it is manufactured or used. Persons may also be exposed to trichloroethylene through the use of products containing the chemical and from evaporation and leaching from waste disposal sites. In 2008, the largest source for ambient release of trichloroethylene (90%) in New York was from degreasing operations.[7]

## Trichlorofluoromethane[11] (75-69-4)

### *Uses*

Historical use has been as a refrigerant, polyurethane foam, and degreasing agent. Fully halogenated chlorofluorocarbons (CFCs) such as trichlorofluoromethane were scheduled for production phase-out in 1987 by the Montreal Protocol.

### *Sources and Potential Exposure*

Due to its long atmospheric residence time, the general population may be exposed to trichlorofluoromethane via inhalation of ambient air, ingestion of drinking water, and dermal contact with this chemical and other consumer products containing trichlorofluoromethane. Trichlorofluoromethane has been identified in emissions from volcanoes.

## Trichlorotrifluoroethane[11] (76-13-1)

### *Uses*

Historical use has been as a dry-cleaning solvent, fire extinguishers, to make chlorotrifluoroethylene, blowing agent, polymer intermediate, solvent drying, drying electronic parts and precision equipment. Fully halogenated chlorofluorocarbons (CFCs) such as trichlorotrifluoroethane were scheduled for production phase-out in 1987 by the Montreal Protocol.

### *Sources and Potential Exposure*

Due to its long atmospheric residence time, the general population may be exposed to trichlorotrifluoroethane via inhalation of ambient air, ingestion of drinking water, and dermal contact with this chemical and other consumer products containing trichlorotrifluoroethane.

## Vinyl chloride (75-01-4)

### *Uses*

Most of the vinyl chloride produced in the United States is used to make polyvinyl chloride (PVC), a material used to manufacture a variety of plastic and vinyl products including pipes, wire and cable coatings, and packaging materials. Smaller amounts of vinyl chloride are used in furniture and automobile upholstery, wall coverings, house wares, and automotive parts.

### *Sources and Potential Exposure*

Air inside new cars may contain vinyl chloride at higher levels than detected in ambient air because vinyl chloride may be released into the air from the new plastic parts. Drinking water may contain low levels of vinyl chloride released from contact with polyvinyl pipes. Vinyl chloride is a microbial degradation product of trichloroethylene in groundwater, and thus can be found in groundwater affected by trichloroethylene contamination. Occupational exposure to vinyl chloride may occur in those workers concerned with the production, use, transport, storage, and disposal of the chemical. Vinyl chloride has been identified as a constituent in landfill gas.[6] In 2008, the largest source for ambient release of vinyl chloride (81%) in New York was from municipal landfills and waste treatment and disposal facilities.[7]

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[1] Unless otherwise noted, the primary source for information on uses, sources and potential exposure was the USEPA's Health Effects Notebook for Hazardous Air Pollutants available online at: http://www.epa.gov/ttnatw01/hlthef/hapindex.html

[2] ATSDR Toxicological Profile for 1,1,1-trichloroethane at: http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=432&tid=76

[3] Number in parenthesis is called the CAS number. It is a unique identifier assigned to each chemical by the Chemical Abstract Service (CAS) which is a function of the American Chemical Society. CAS numbers are assigned because the same chemical can be identified by many different names. For example, 1,1,1-trichloroethane is also called methyl chloroform, Solvent 111, Genklene and R-140a.

[4] USEPA Emission Factors & AP 42, Compilation of Air Pollutant Emission Factors. http://www.epa.gov/ttnchie1/ap42/

[5] National Institutes of Health Haz-Map® occupational health database. http://hazmap.nlm.nih.gov/about-us

[6] USEPA Background Information Document for Updating AP 42 Section 2.4 for Estimating Emissions from Municipal Solid Waste Landfills. EPA/600/R-08-116 September 2008. http://www.epa.gov/ttnchie1/ap42/ch02/draft/db02s04.pdf

[7] The most recent National Emissions Inventory was used for all analysis in this appendix. Data from US Environmental Protection Agency's National Emissions Inventory for 2008 available online at http://www.epa.gov/ttn/chief/net/2008inventory.html.

[8] Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for 1,1,2,2-Tetrachloroethane (Update). U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 2008.

[9] Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for 1,1-Dichloroethane. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 1990.

[10] Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Trichlorobenzenes. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 2010.

[11] U.S. Department of Health and Human Services. Hazardous Substances Data Bank (HSDB, online database). National Toxicology Information Program, National Library of Medicine, Bethesda, MD.

[12] http://www.epa.gov/chemfact/s_trimet.txt

[13] http://www.epa.gov/ogwdw/pdfs/factsheets/voc/tech/o-dichlo.pdf

[14] Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Dichlorobenzenes. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 2006.

[15] Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for 1,2-Dichloroethane. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 2001.
[16] Roy Huntley, et. al. (USEPA). National Emissions Inventory for Commercial Cooking. presented at 13th International Emission Inventory Conference "Working for Clean Air in Clearwater". Clearwater, FL June 8-10, 2004
[17] USEPA's Health Effects Notebook for Hazardous Air Pollutants
[18] Environmental Working Group – Drinking Water Quality Report. http://www.ewg.org/tap-water/whatsinyourwater/2983/NY/NewYork/12-Dichloropropane/
[19] Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for 1,3-Butadiene. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 2009.
[20] Which includes the following: construction equipment, lawn and farm equipment, ships, locomotives, motorboats, tractors, mining trucks.
[21] Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Dichlorobenzenes. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 2006.
[22] Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Benzene. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 2007
[23] Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Bromodichloromethane. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 1989
[24] USEPA AP 42, Fifth Edition, Volume I: Chapter 1: External Combustion Sources Bituminous and Subbituminous Coal Combustion, September 1998.
[25] Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Carbon disulfide. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. Addendum to the Profile August 2012.
[26] Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Carbon tetrachloride. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 2005.
[27] Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Ethylbenzene. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 2010.
[28] Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Xylenes. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 2007.
[29] Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Methyl tert butyl ether. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 1996.
[30] http://www.dec.ny.gov/chemical/8428.html
[31] Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Methylene chloride. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 2000.
[32] Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Styrene. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 2010.
[33] NYSDEC staff are currently evaluating the emissions factors used to estimate releases of this air toxic from commercial charbroiling cooking. Because of staff's low confidence in the emission factor, the predominant source attribution for this air toxic should not be attributed to research conducted by the NYSDEC.

# Appendix C – Comparison to DEC's Ambient Monitoring Network for 2011

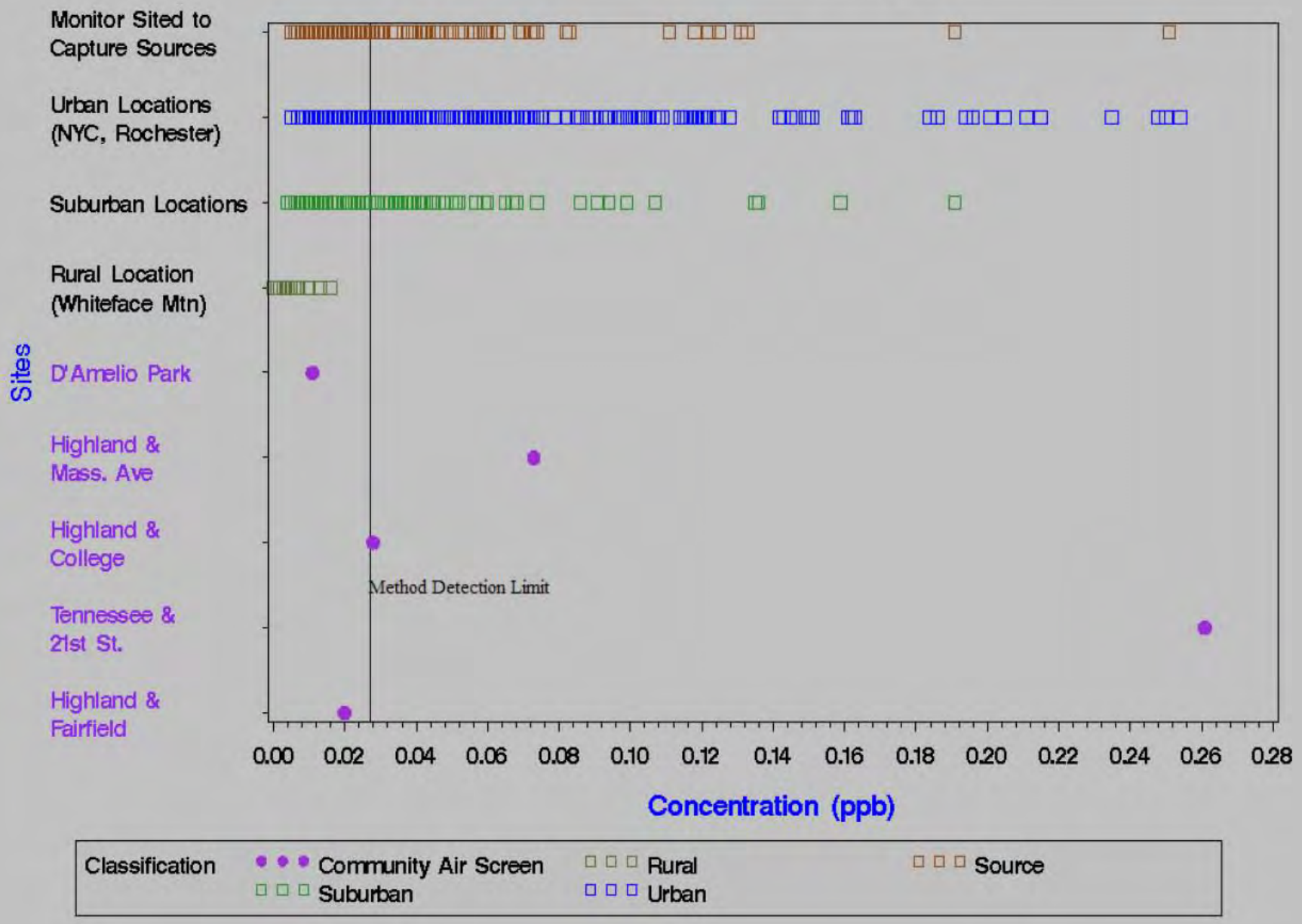
The graphs in this appendix display comparisons between different sampling periods of time, 1-hour samples in the CAS program and 24-hour monitoring concentrations from DEC's network. Comparisons with different sampling periods are not routinely conducted. We offer this comparison only to show that many of the air toxics found in this program are frequently detected at other locations in the state. Additionally, these comparisons provide a qualitative perspective for the CAS results in reference to the results in the monitoring network.

## Method Detection Limit

Results below the "lowest reliable measured level" (called the method detection limit), which varies by pollutant and by monitoring method, have been displayed for comparison purposes only. Although there is less reliability in those measurements reported below the "lowest reliable measured level," USEPA's Science Advisory Board (Pilot City Air Toxics Measurements Summary, Office of Air Quality Planning and Standards, EPA454/R-01-003, February 2001) has stated that these values may be recognized as measurable results. For the Community Air Screen Program, results below the lowest reliable measured level will be noted but not be used to determine follow-up activities.

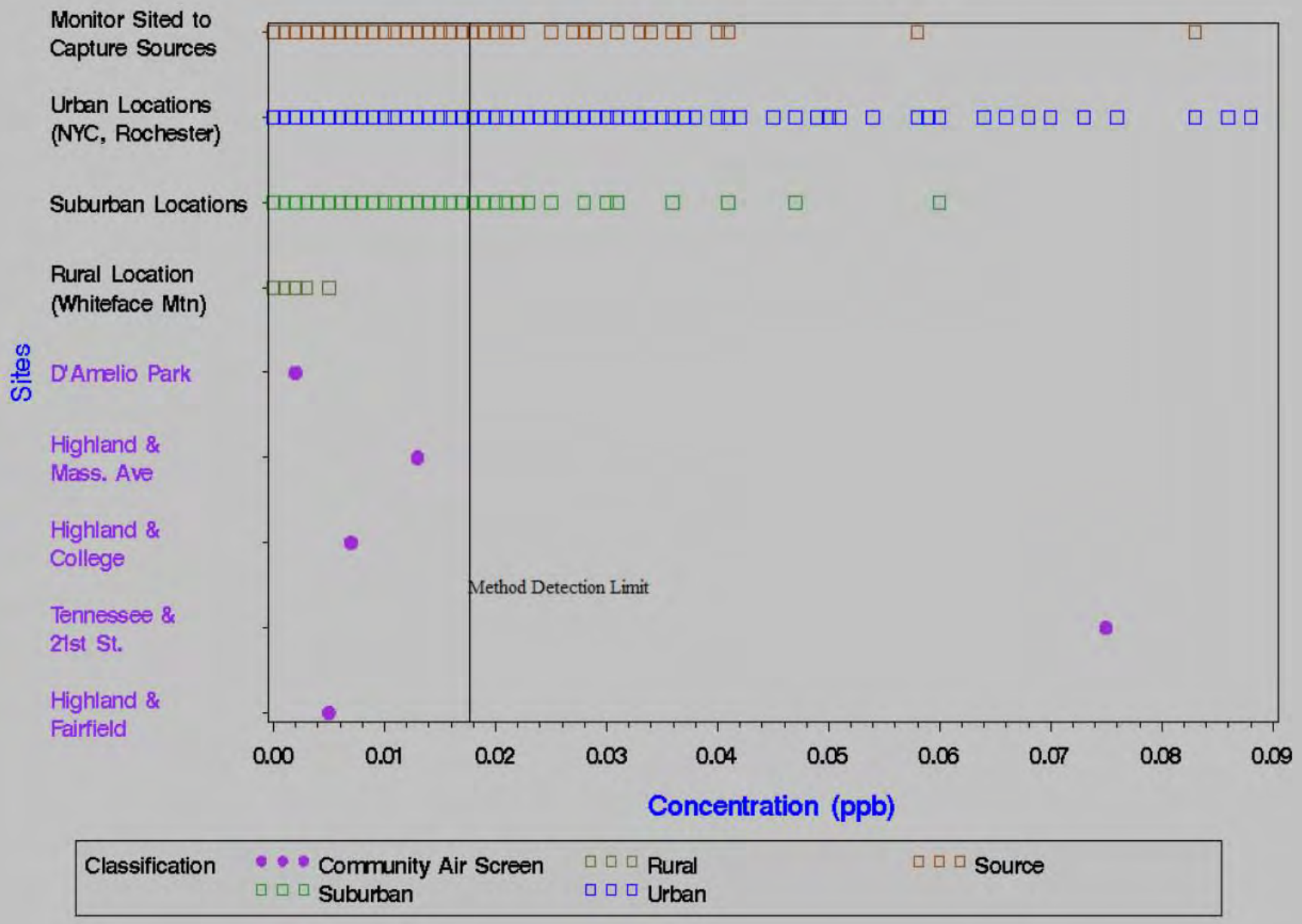
## 1,2,4—Trimethylbenzene

**Comparison — Highland Community Revitalization Committee CAS 1—hour Sampling with DEC 2011 Toxics Network 24—hour Sampling**



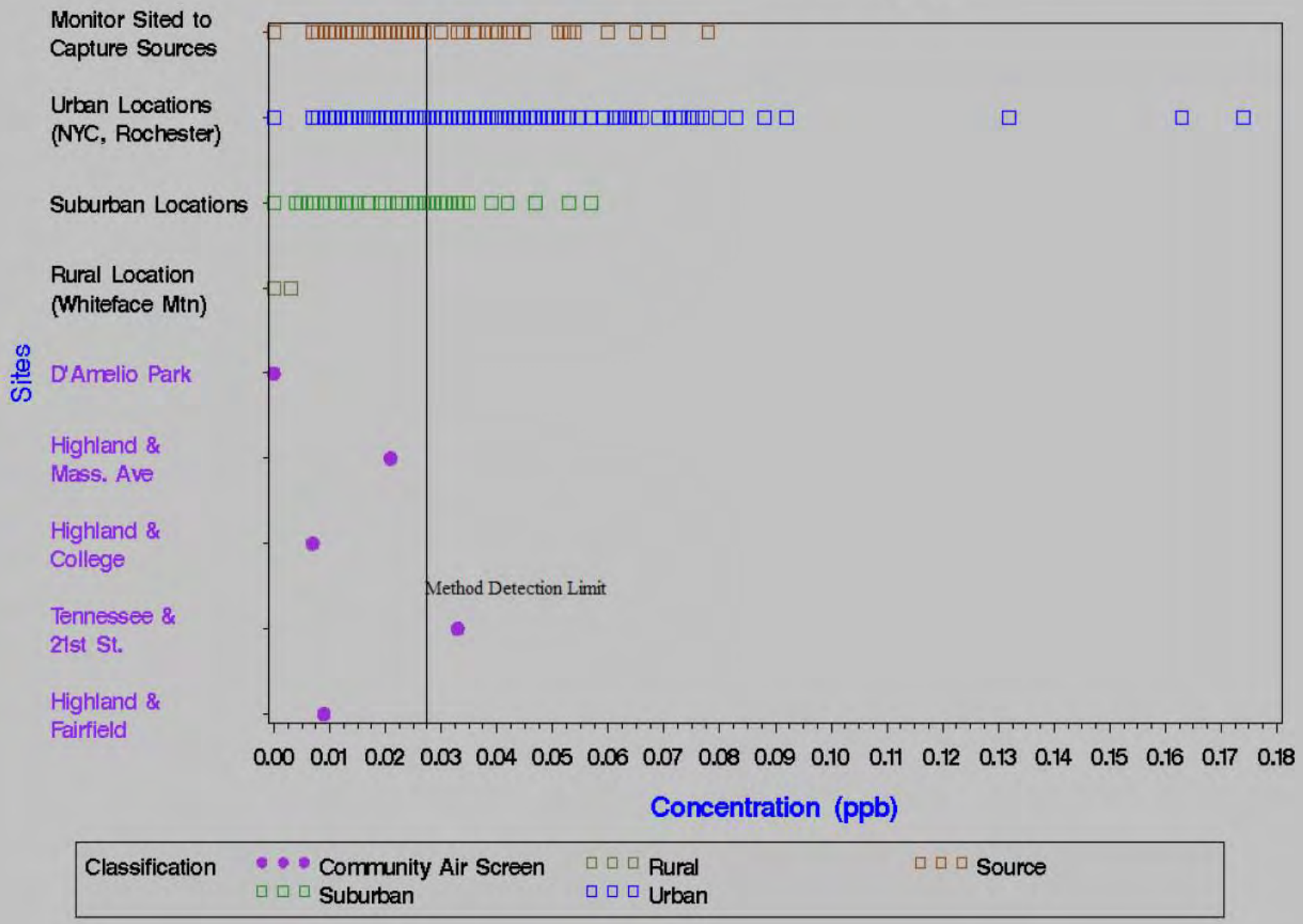
## 1,3,5—Trimethylbenzene

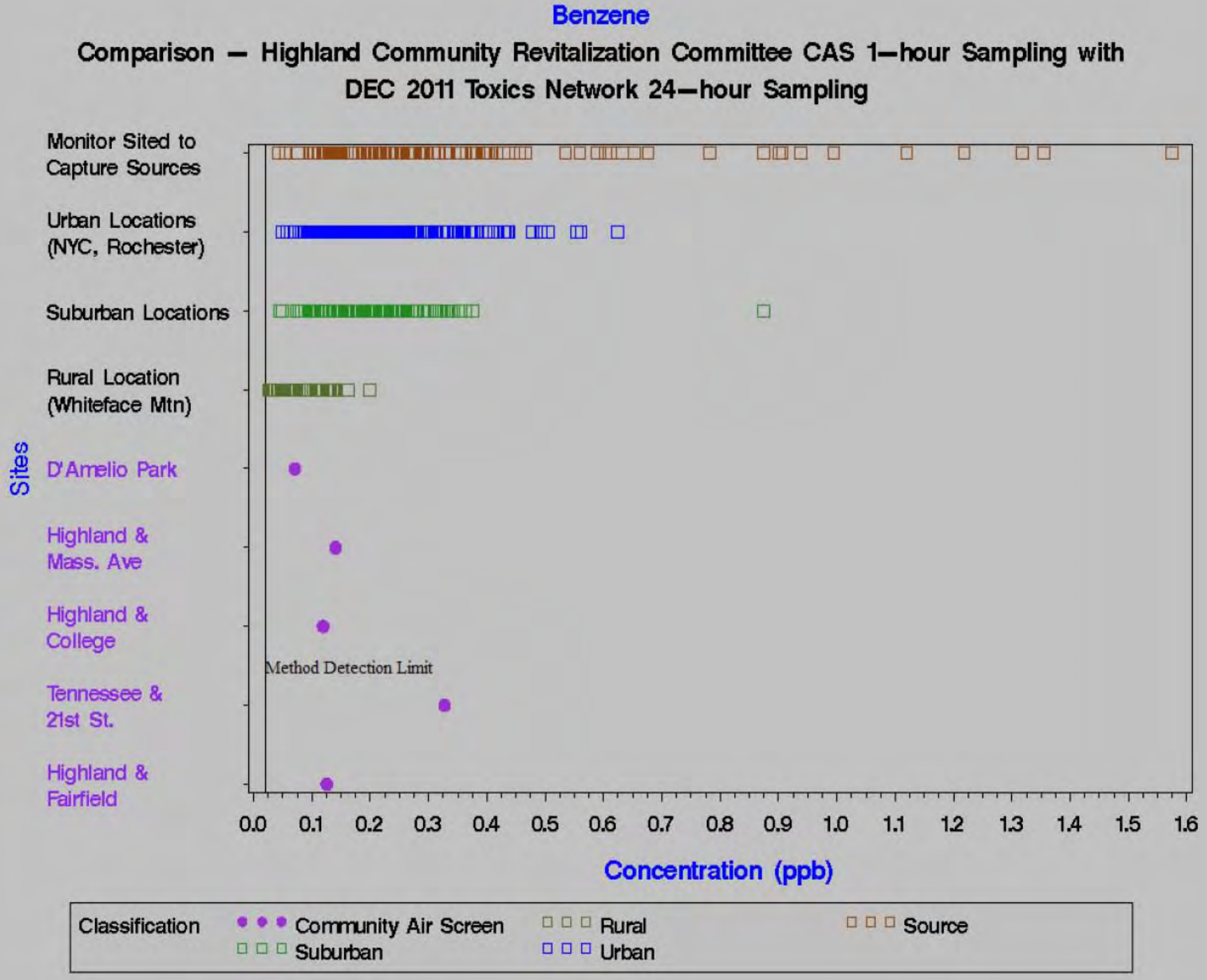
**Comparison — Highland Community Revitalization Committee CAS 1—hour Sampling with DEC 2011 Toxics Network 24—hour Sampling**



## 1,3—Butadiene

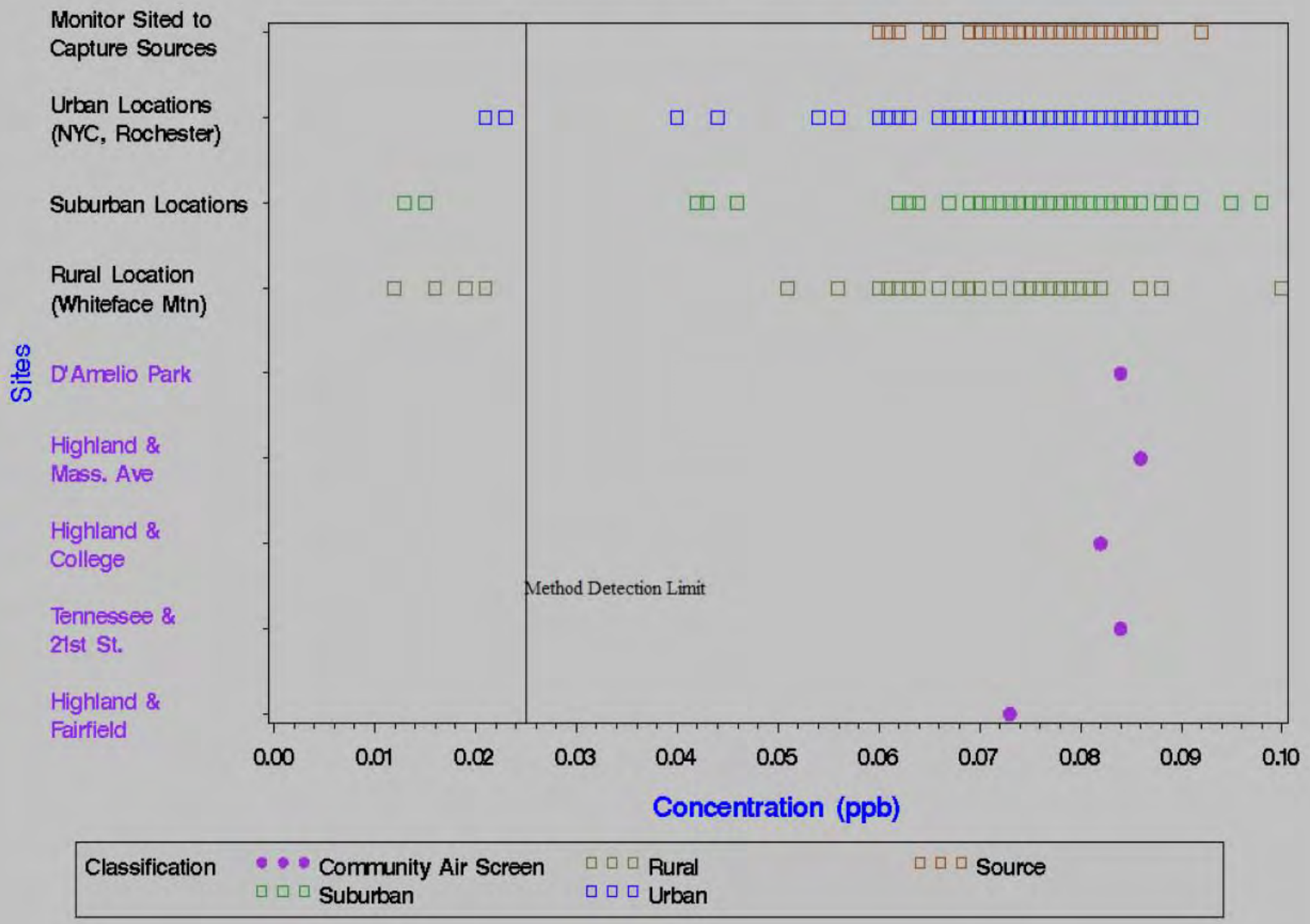
**Comparison — Highland Community Revitalization Committee CAS 1—hour Sampling with DEC 2011 Toxics Network 24—hour Sampling**

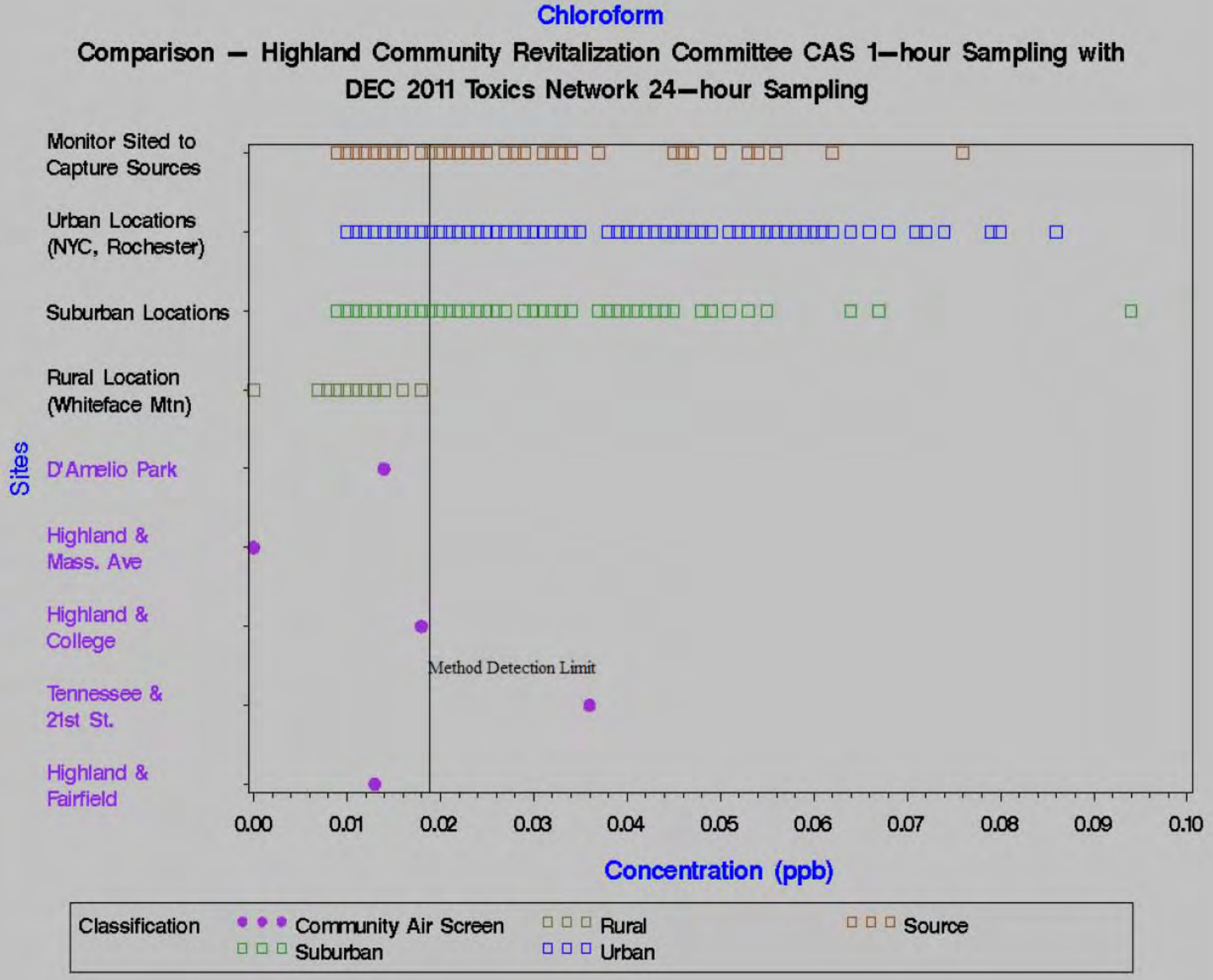



Benzene
Comparison — Highland Community Revitalization Committee CAS 1—hour Sampling with DEC 2011 Toxics Network 24—hour Sampling
Monitor Sited to Capture Sources
Urban Locations (NYC, Rochester)
Suburban Locations
Rural Location (Whiteface Mtn)
D'Amelio Park
Highland & Mass. Ave
Highland & College
Tennessee & 21st St.
Highland & Fairfield
Sites
Method Detection Limit
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6
Concentration (ppb)
Classification
Community Air Screen
Suburban
Rural
Urban
Source

## Carbon Tetrachloride

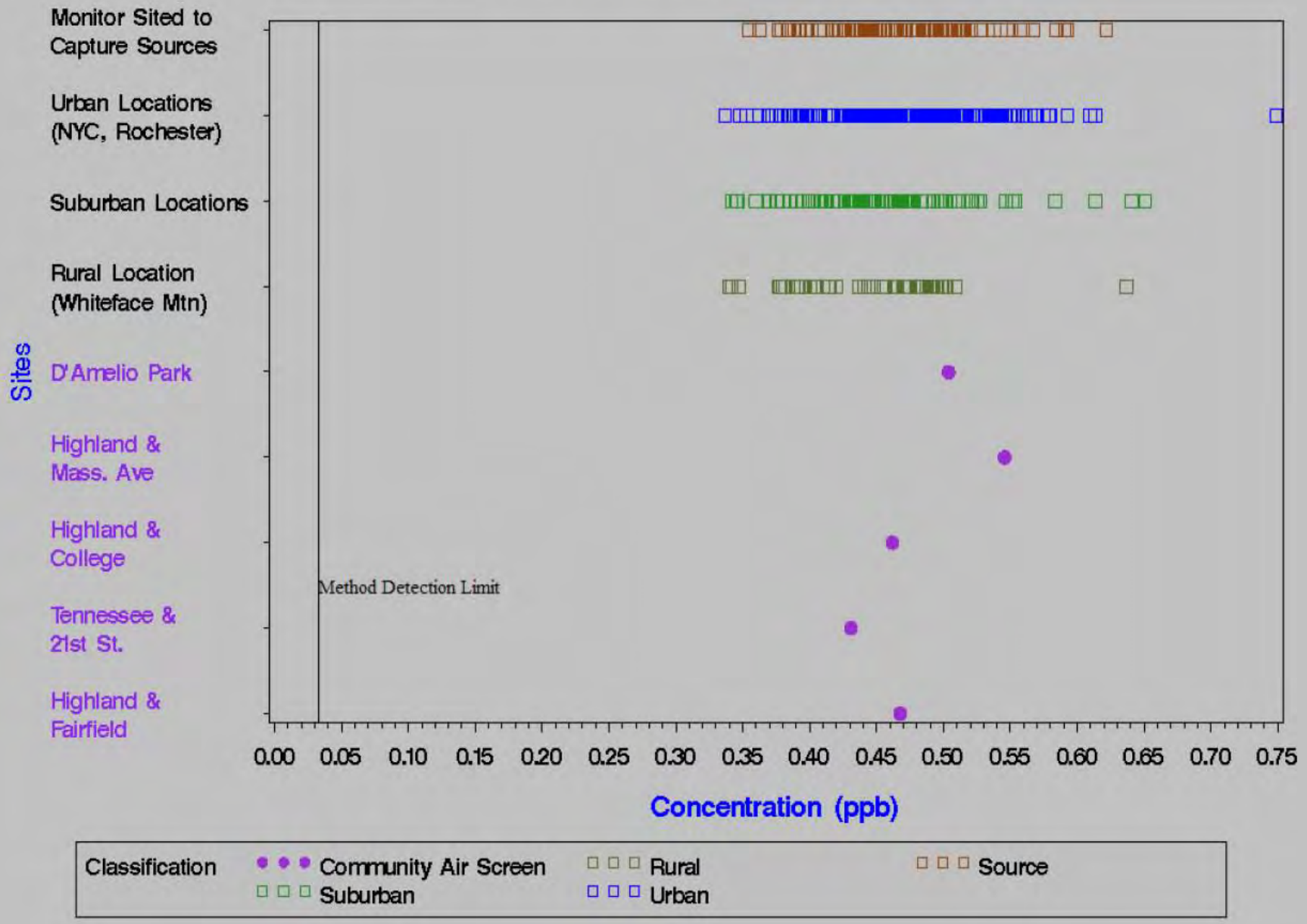
**Comparison — Highland Community Revitalization Committee CAS 1—hour Sampling with DEC 2011 Toxics Network 24—hour Sampling**




Chloroform
Comparison — Highland Community Revitalization Committee CAS 1—hour Sampling with DEC 2011 Toxics Network 24—hour Sampling
Monitor Sited to Capture Sources
Urban Locations (NYC, Rochester)
Suburban Locations
Rural Location (Whiteface Mtn)
D'Amelio Park
Highland & Mass. Ave
Highland & College
Tennessee & 21st St.
Highland & Fairfield
Sites
Method Detection Limit
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
Concentration (ppb)
Classification
Community Air Screen
Suburban
Rural
Urban
Source

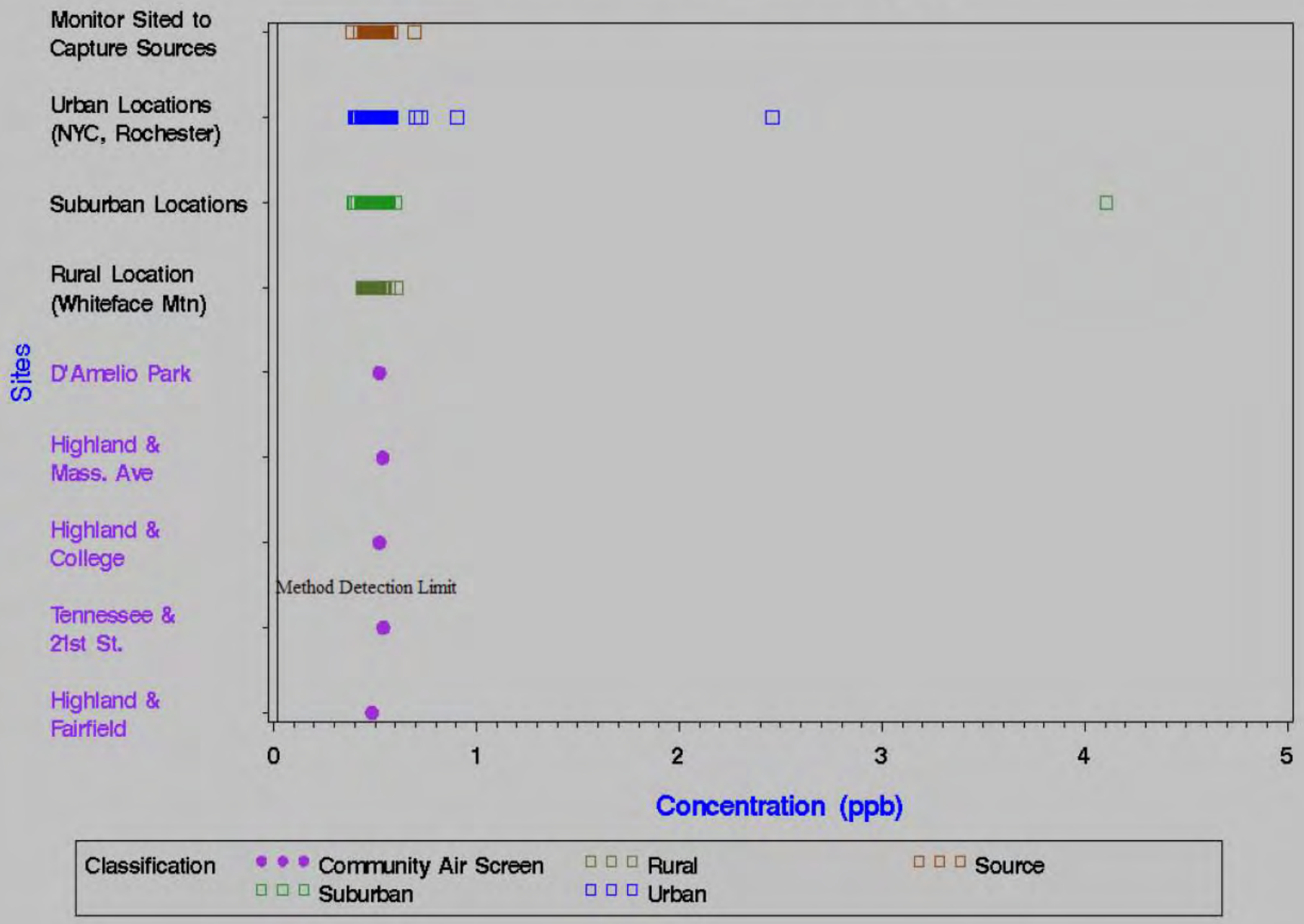
## Chloromethane

**Comparison — Highland Community Revitalization Committee CAS 1—hour Sampling with DEC 2011 Toxics Network 24—hour Sampling**



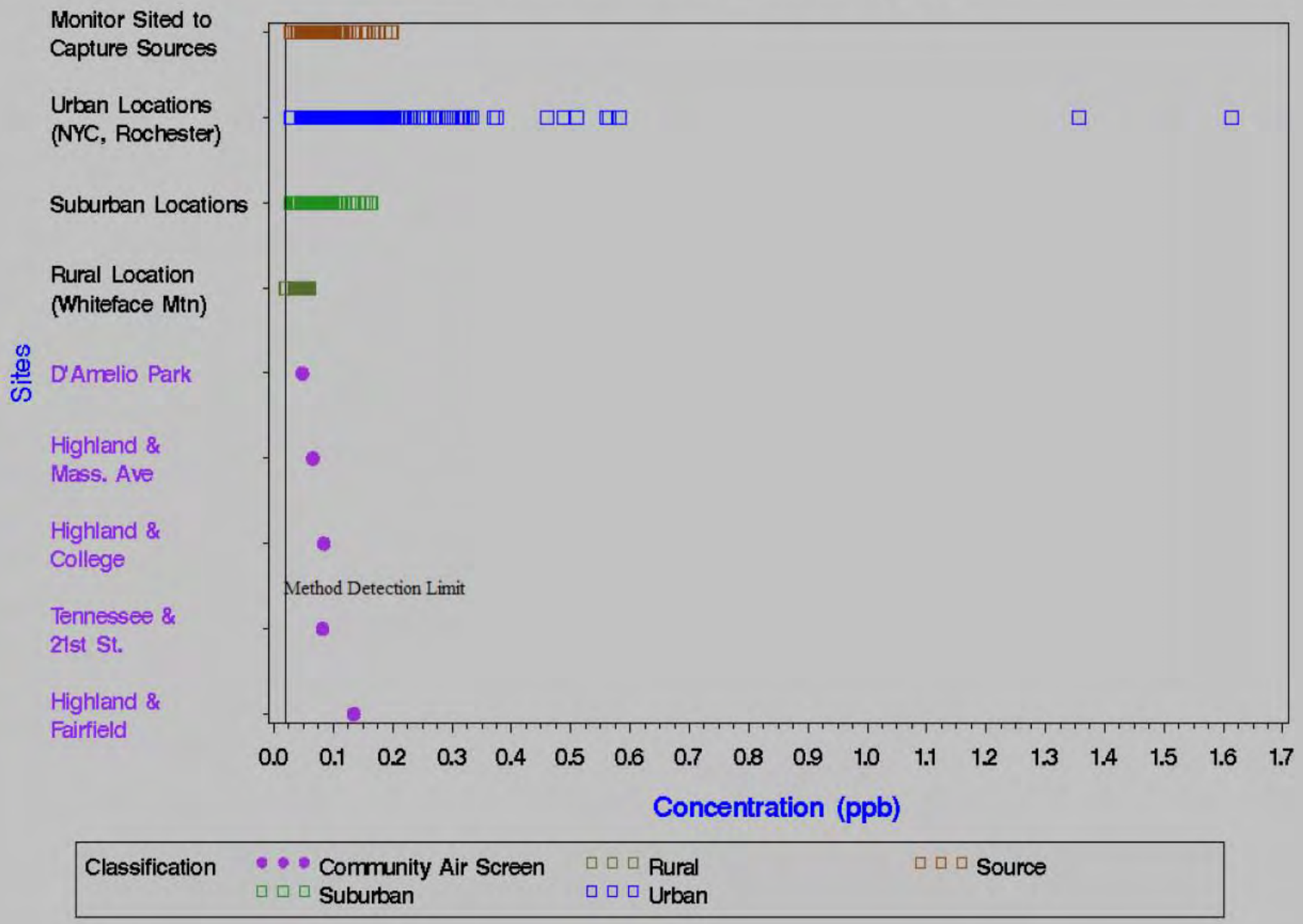
## Dichlorodifluoromethane

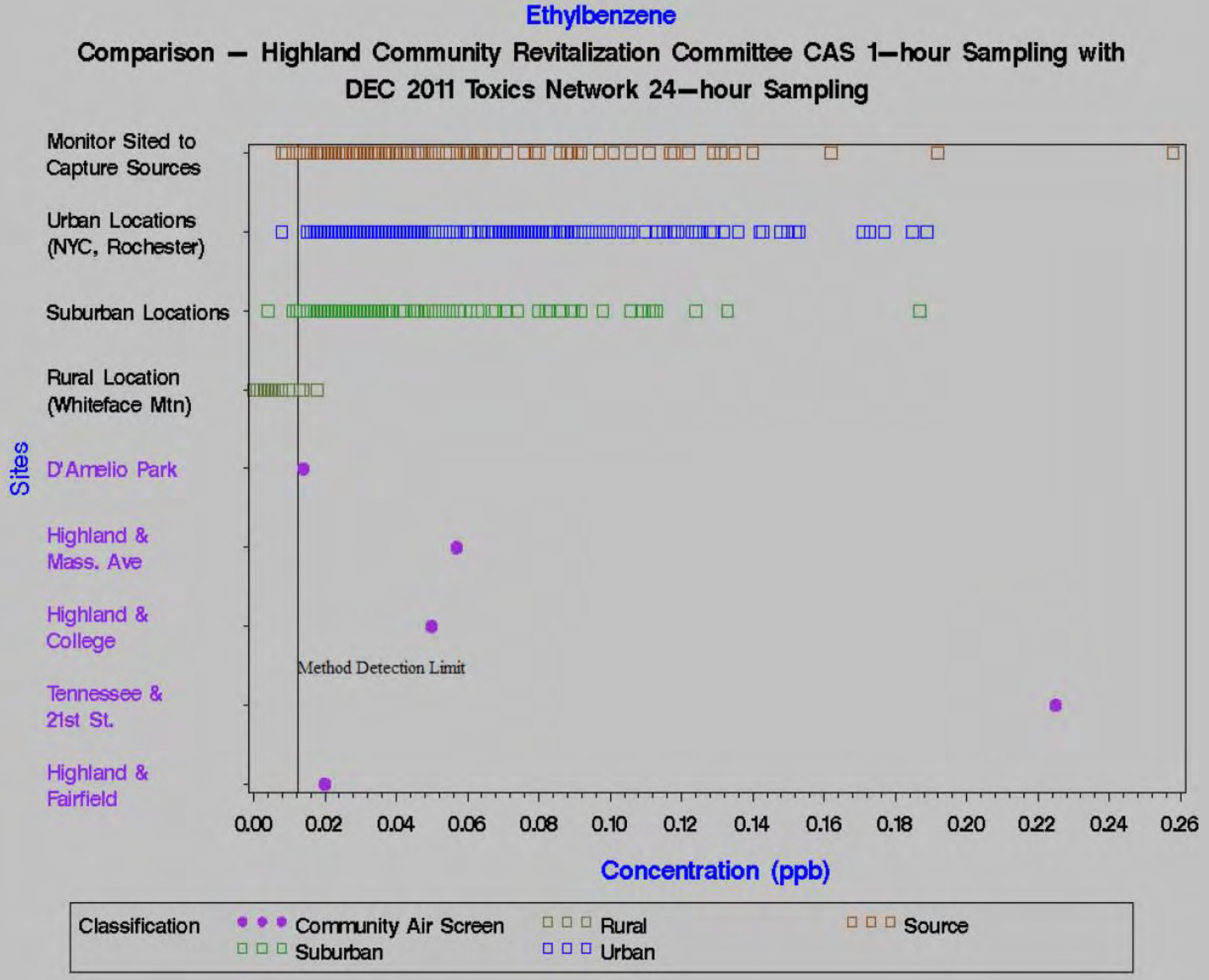
**Comparison — Highland Community Revitalization Committee CAS 1—hour Sampling with DEC 2011 Toxics Network 24—hour Sampling**

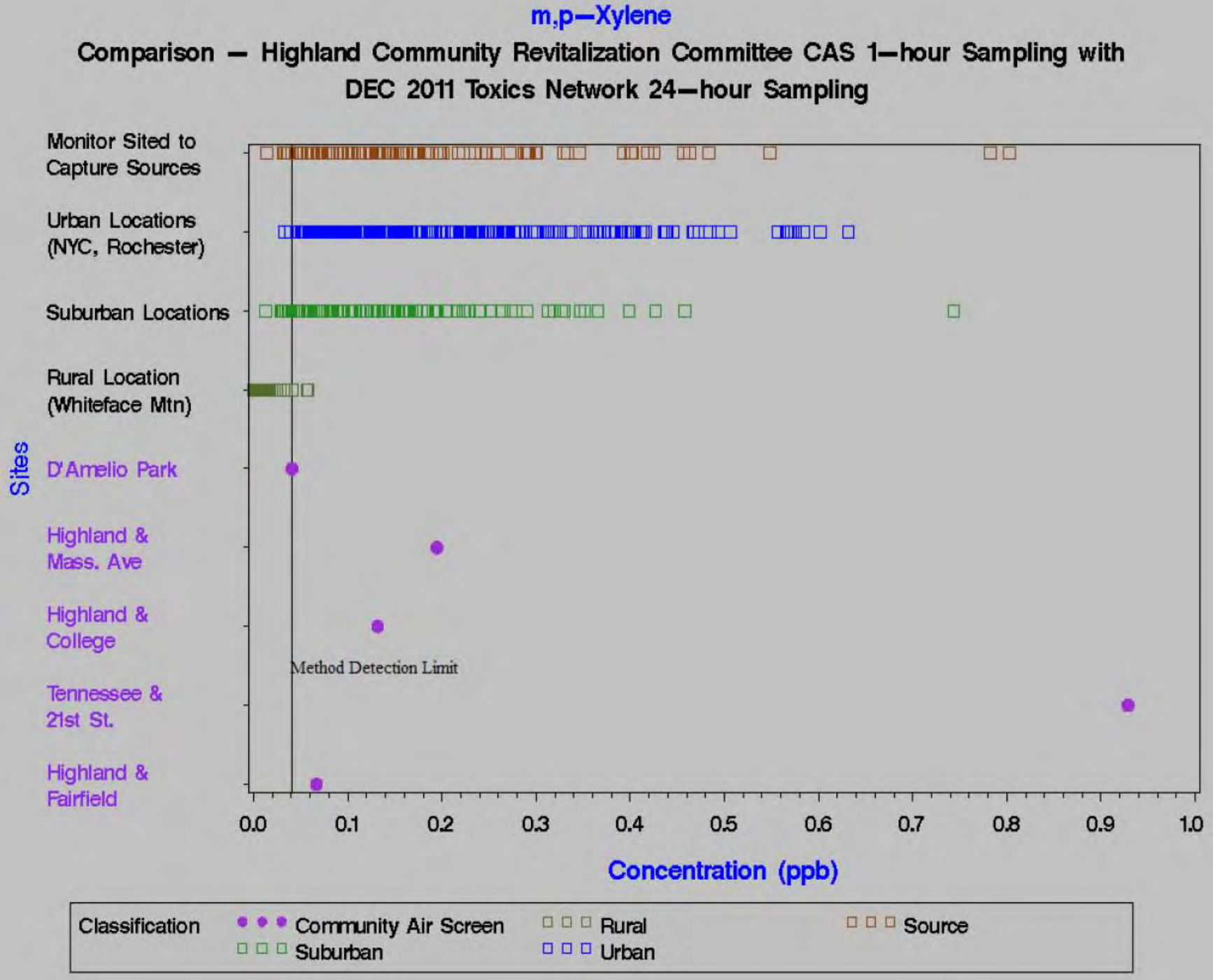


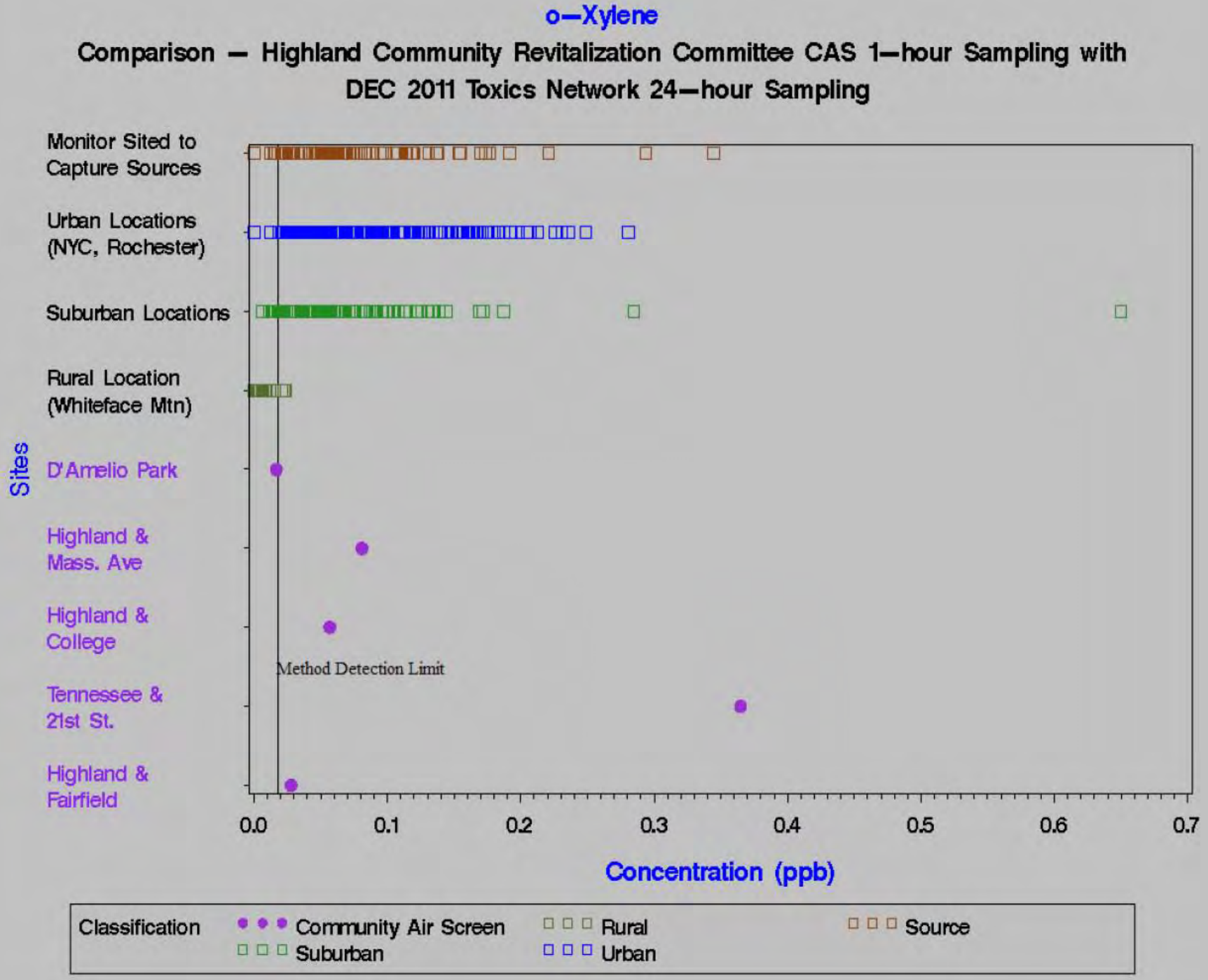
## Dichloromethane

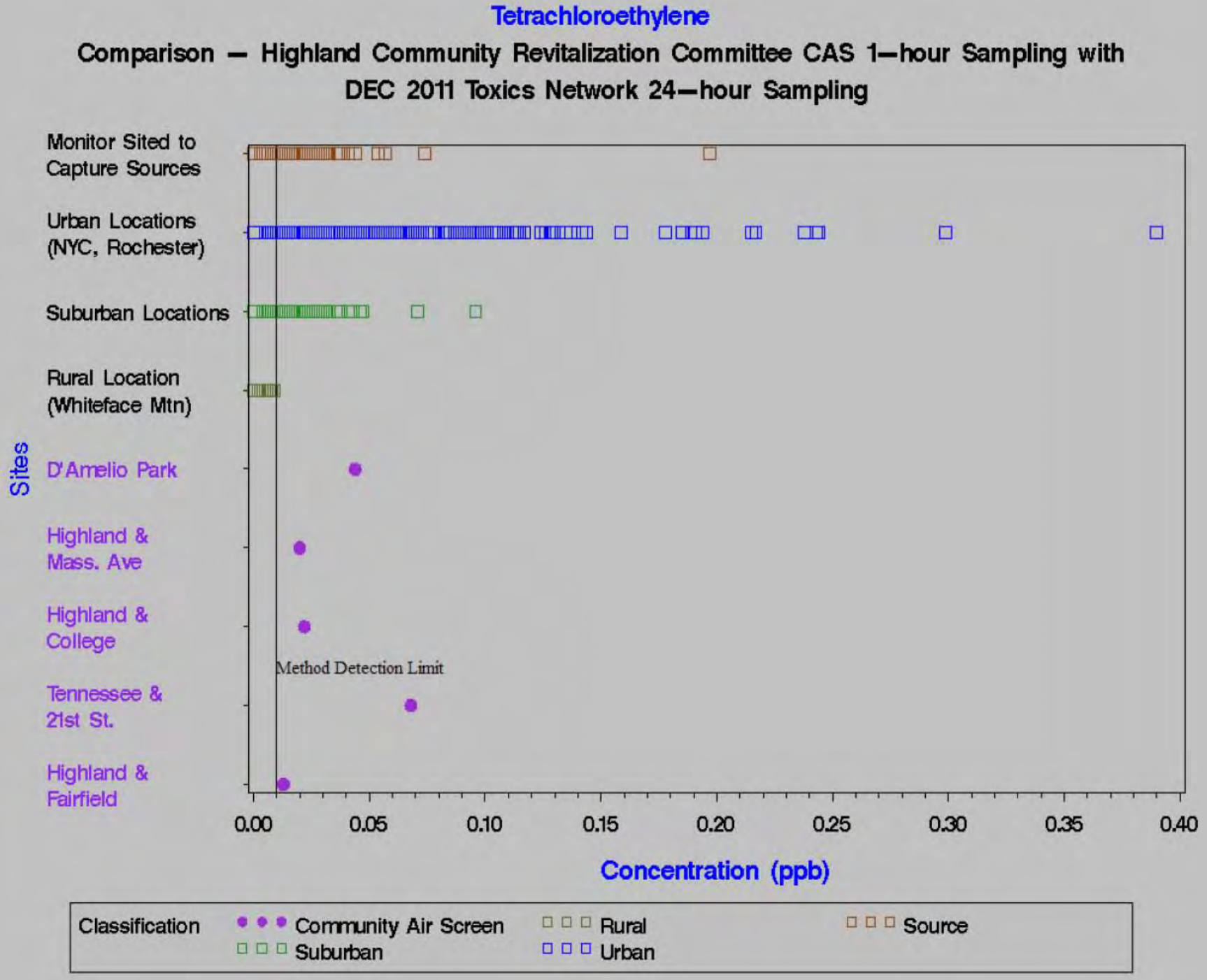
**Comparison — Highland Community Revitalization Committee CAS 1—hour Sampling with DEC 2011 Toxics Network 24—hour Sampling**

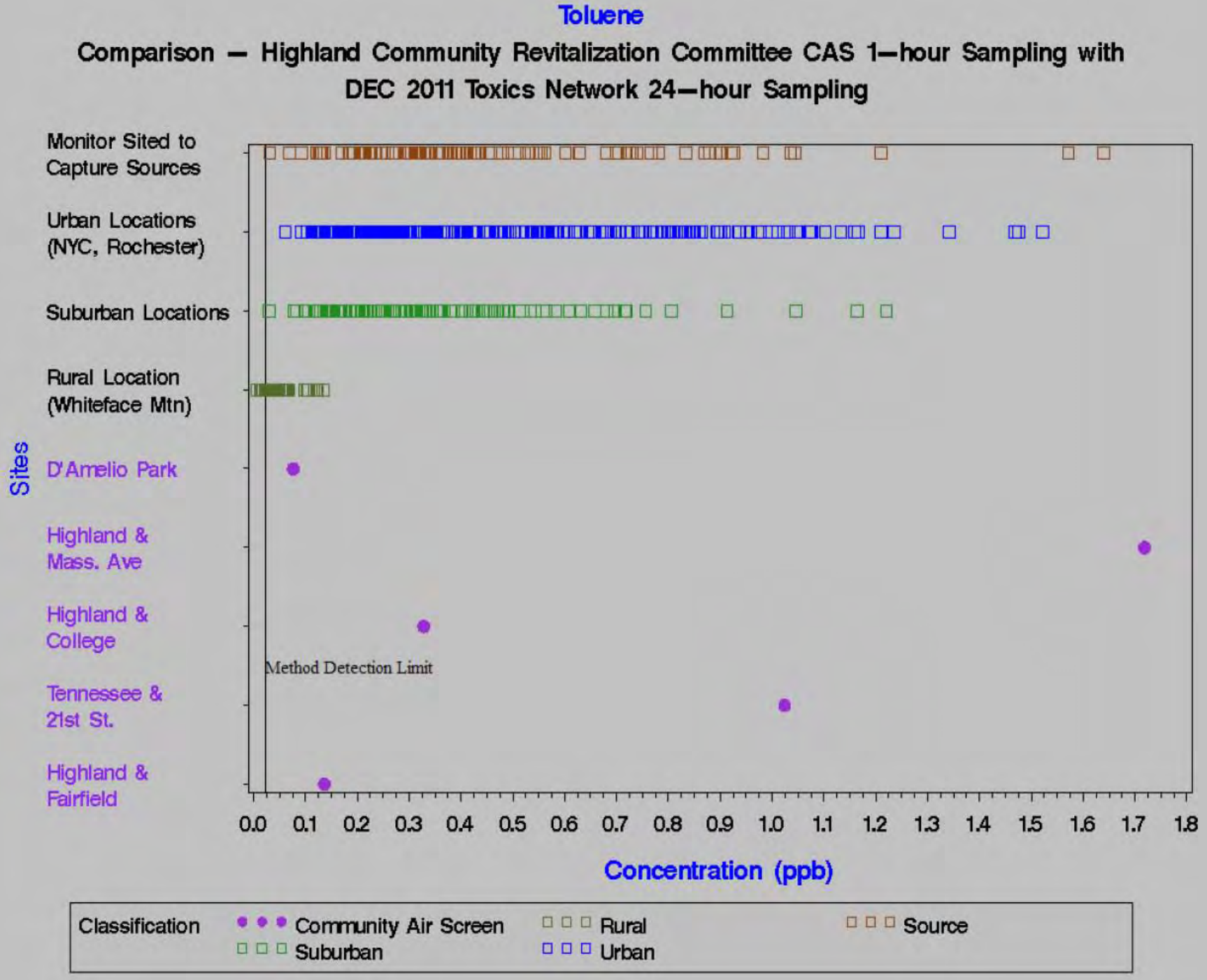



Ethylbenzene
Comparison — Highland Community Revitalization Committee CAS 1—hour Sampling with DEC 2011 Toxics Network 24—hour Sampling
Monitor Sited to Capture Sources
Urban Locations (NYC, Rochester)
Suburban Locations
Rural Location (Whiteface Mtn)
D'Amelio Park
Highland & Mass. Ave
Highland & College
Tennessee & 21st St.
Highland & Fairfield
Sites
Method Detection Limit
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0.18
0.20
0.22
0.24
0.26
Concentration (ppb)
Classification
Community Air Screen
Suburban
Rural
Urban
Source


m,p–Xylene
Comparison – Highland Community Revitalization Committee CAS 1–hour Sampling with DEC 2011 Toxics Network 24–hour Sampling
Monitor Sited to Capture Sources
Urban Locations (NYC, Rochester)
Suburban Locations
Rural Location (Whiteface Mtn)
D'Amelio Park
Highland & Mass. Ave
Highland & College
Tennessee & 21st St.
Highland & Fairfield
Sites
Method Detection Limit
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Concentration (ppb)
Classification
Community Air Screen
Suburban
Rural
Urban
Source

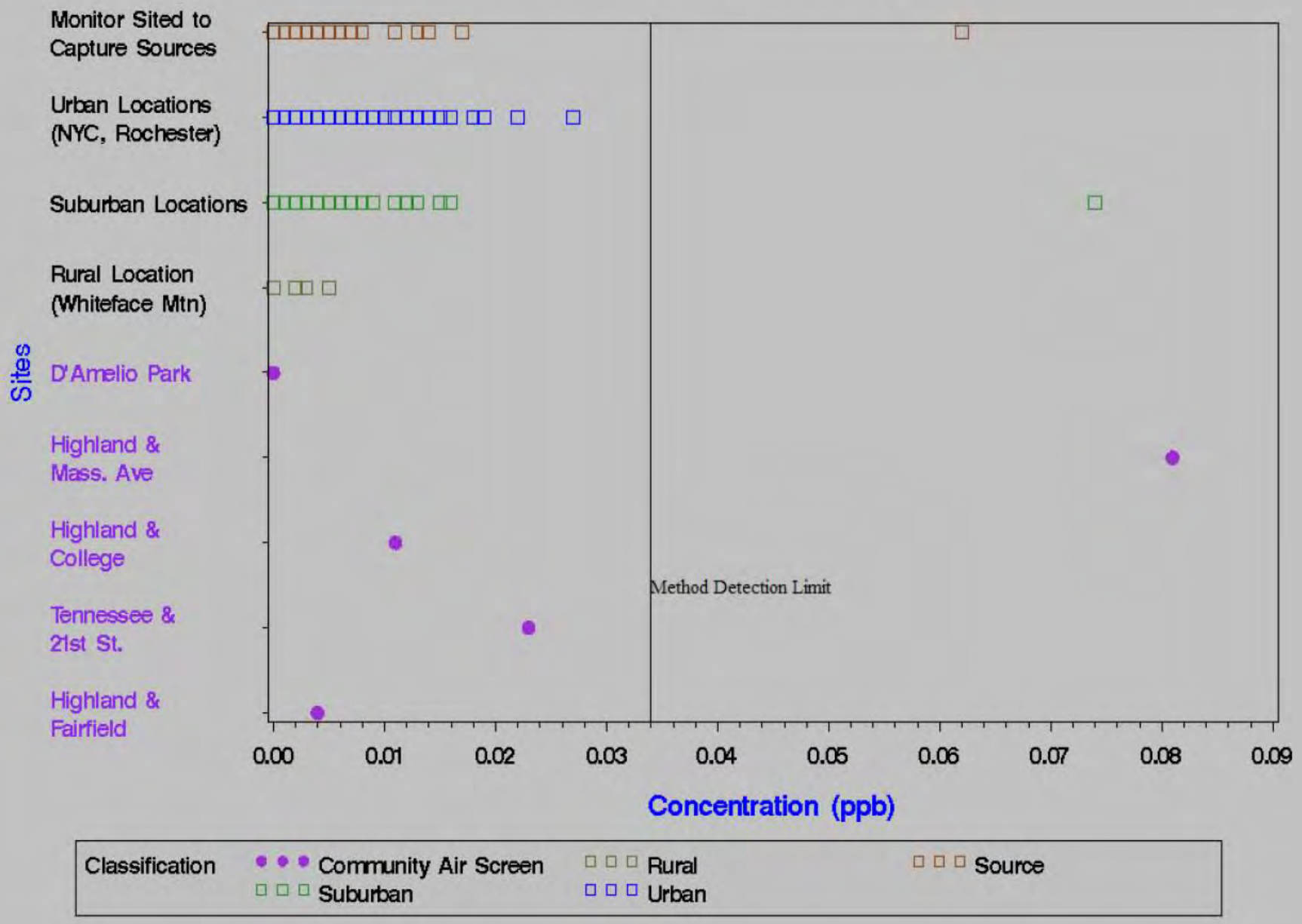

o—Xylene
Comparison — Highland Community Revitalization Committee CAS 1—hour Sampling with DEC 2011 Toxics Network 24—hour Sampling
Monitor Sited to Capture Sources
Urban Locations (NYC, Rochester)
Suburban Locations
Rural Location (Whiteface Mtn)
D'Amelio Park
Highland & Mass. Ave
Highland & College
Tennessee & 21st St.
Highland & Fairfield
Sites
Method Detection Limit
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Concentration (ppb)
Classification
Community Air Screen
Suburban
Rural
Urban
Source


Tetrachloroethylene
Comparison — Highland Community Revitalization Committee CAS 1—hour Sampling with DEC 2011 Toxics Network 24—hour Sampling
Monitor Sited to Capture Sources
Urban Locations (NYC, Rochester)
Suburban Locations
Rural Location (Whiteface Mtn)
D'Amelio Park
Highland & Mass. Ave
Highland & College
Tennessee & 21st St.
Highland & Fairfield
Sites
Method Detection Limit
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
Concentration (ppb)
Classification
Community Air Screen
Suburban
Rural
Urban
Source


Toluene
Comparison — Highland Community Revitalization Committee CAS 1—hour Sampling with DEC 2011 Toxics Network 24—hour Sampling
Monitor Sited to Capture Sources
Urban Locations (NYC, Rochester)
Suburban Locations
Rural Location (Whiteface Mtn)
D'Amelio Park
Highland & Mass. Ave
Highland & College
Tennessee & 21st St.
Highland & Fairfield
Sites
Method Detection Limit
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8
Concentration (ppb)
Classification
Community Air Screen
Rural
Source
Suburban
Urban

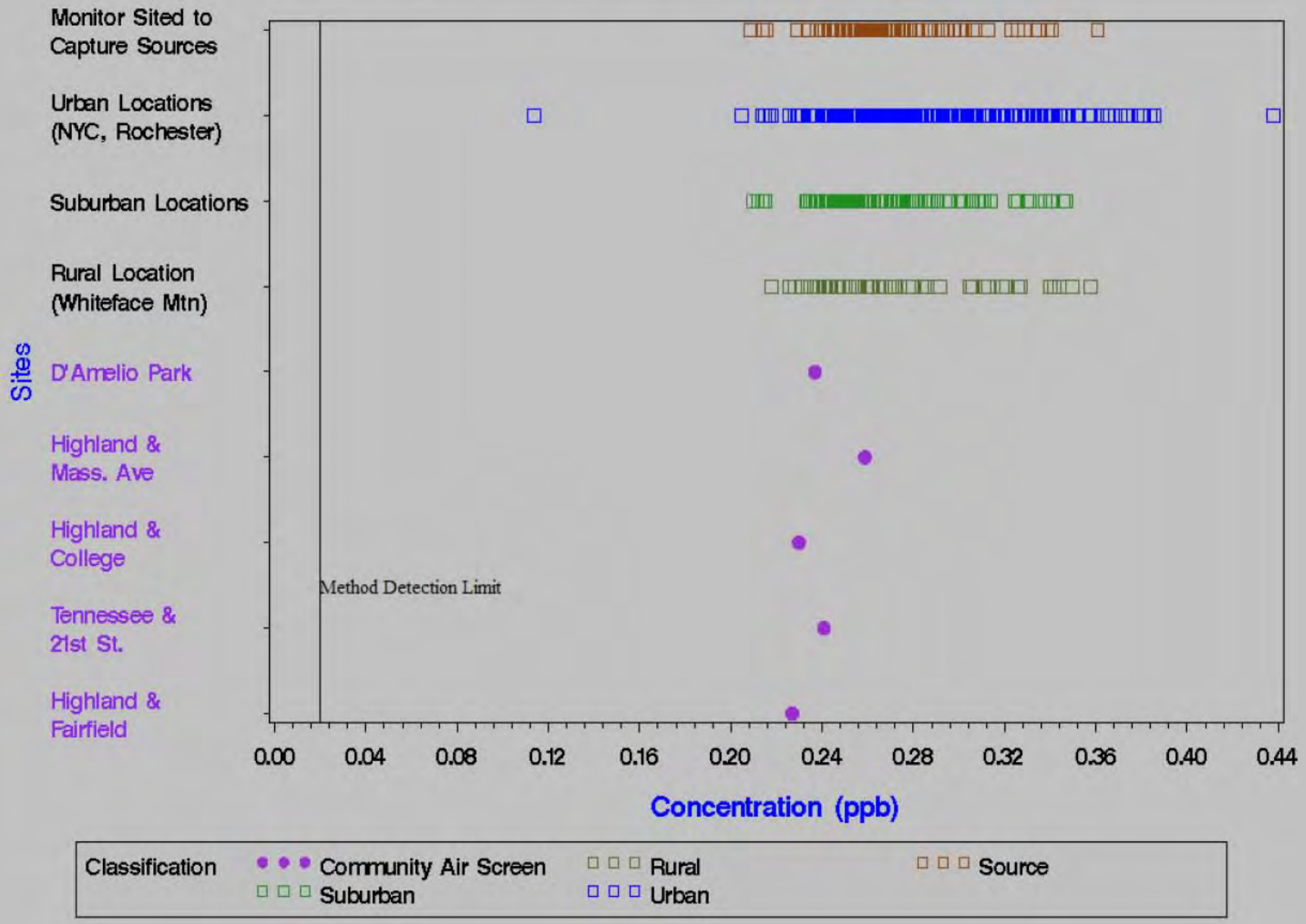
## Trichloroethylene

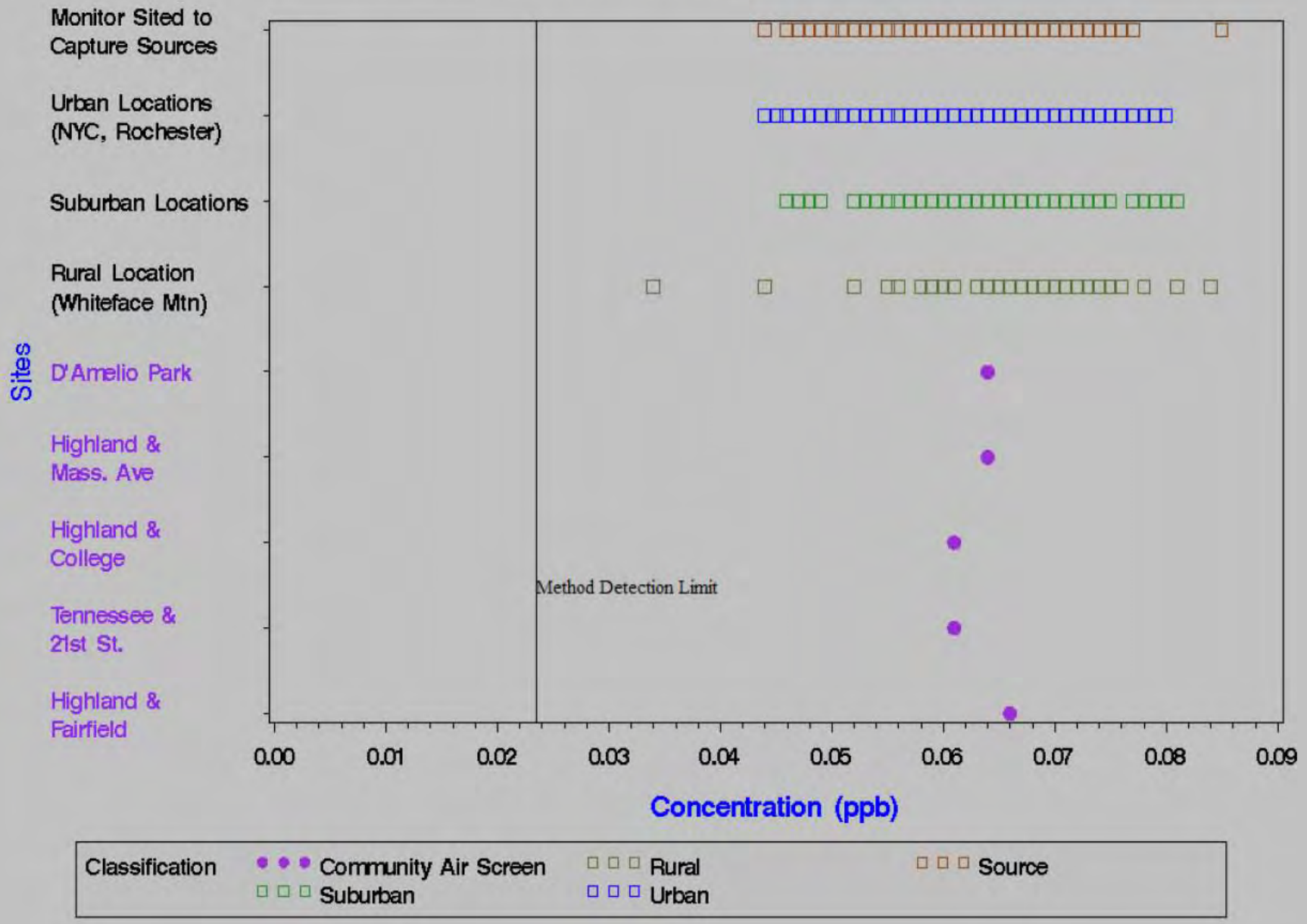
**Comparison — Highland Community Revitalization Committee CAS 1—hour Sampling with DEC 2011 Toxics Network 24—hour Sampling**



## Trichlorofluoromethane

**Comparison — Highland Community Revitalization Committee CAS 1—hour Sampling with DEC 2011 Toxics Network 24—hour Sampling**



## Trichlorotrifluoroethane

**Comparison — Highland Community Revitalization Committee CAS 1—hour Sampling with DEC 2011 Toxics Network 24—hour Sampling**