

# **AIR QUALITY SURVEY OF SYNTHETIC TURF FIELDS CONTAINING CRUMB RUBBER INFILL**

*Prepared for*

**New York City Department of  
Health and Mental Hygiene**

New York, NY

*Prepared by*

**TRC**  
Windsor, Connecticut

March 2009

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**TRC**  
Windsor, Connecticut

*Report Author:*  
Karen M. Vetrano, Ph.D.

*TRC Certified Industrial Hygienist:*  
Gary Ritter, CIH

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**TRC**  
21 Griffin Road North  
Windsor, Connecticut 06095  
Telephone 860-298-9692  
Facsimile 860-298-6399

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## EXECUTIVE SUMMARY

Synthetic turf fields have been installed in many athletic and playing fields throughout New York City (NYC), the United States and the world. Many of the synthetic turf fields contain crumb rubber infill. Crumb rubber consists of recycled, chipped/pulverized, used automobile tires primarily made from styrene butadiene rubber (SBR). Crumb rubber granules contain a variety of chemicals typical in rubber, including semi-volatile organic chemicals (SVOC) such as polycyclic aromatic hydrocarbons (PAH) and volatile organic chemicals (VOC). In addition, crumb rubber may contain some amounts of particulate matter and metals. Recent concern about the potential for exposure to chemicals found in crumb rubber prompted NYC Department of Parks (DPR) to request assistance from the NYC Department of Health and Mental Hygiene (DOHMH). In response to this request, and with a grant awarded by the New York Community Trust, the DOHMH contracted TRC to lead an intensive literature review focusing on the potential exposures and health effects related to synthetic turf fields and to identify gaps in what is known. The findings from the review were released in a report prepared by TRC titled “A Review of the Potential Health and Safety Risks from Synthetic Turf Fields Containing Crumb Rubber Infill” (DOHMH 2008). While potential health effects due to heat exposures were identified, an increased risk for human health effects as a result of ingestion, dermal or inhalation exposure to crumb rubber contaminants of potential concern (COPC) was not identified by the review. The review, however, did identify certain knowledge gaps associated with exposure to synthetic turf fields and specifically recommended that air quality related to crumb rubber fields be assessed in the breathing zones of children.

To address the recommendation in the report, with the grant awarded by the New York Community Trust, DOHMH contracted TRC to conduct an air quality survey (AQS). The purpose of the AQS was to investigate the potential release of contaminants from crumb rubber synthetic turf fields and the subsequent potential exposures in the breathing zones of young children to those airborne contaminants. Although there is potential for ingestion and dermal contact of the crumb rubber infill itself, inhalation exposure would be expected to be a primary route of exposure to any emissions from the synthetic turf.

The AQS consisted of air sampling for a suite of SVOCs (PAHs and benzothiazole), VOCs, metals and particulate matter (PM<sub>2.5</sub>) at two outdoor crumb rubber athletic fields in NYC; Thomas Jefferson Park (East Harlem, Manhattan) and Mullaly Park (Bronx). These

COPCs were selected based upon studies showing that SBR crumb rubber contains these classes of COPCs (DOHMH 2008). These studies were either direct analyses of the crumb rubber or air quality studies conducted in indoor soccer halls. In the AQS, stationary samplers placed on turf fields were used to take measurements in the breathing zone of young children (three feet above ground surface). Air samples were collected under simulated playing conditions such as a practice soccer game and walking/running around the samplers. Stationary background samples were collected upwind of the field at the same time as the corresponding active field samples. A grass field also located at Mullaly Park was sampled in a manner similar to the synthetic turf fields for comparison purposes. Air sampling was conducted under summer conditions (August 2009) in the late morning to afternoon hours to represent potentially the highest concentrations of VOCs released due to the heating of the fields by the sun.. The AQS results represent the conditions of the day and time when sampling was performed.

The results of the AQS air measurements indicate the following:

- Of 69 VOCs tested, eight VOCs were detected in the air measurements. Although VOCs were detected in the air, there was little evidence of harmful levels at the two sampled synthetic turf fields. Also, there was no consistent pattern to indicate that detected VOCs were associated with the synthetic turf. Similar concentrations were found in the background samples from the comparison grass field and upwind locations.
- For the SVOCs:
  - ◆ None of the 17 PAHs tested were detected in any of the ambient air samples.
  - ◆ Benzothiazole, which is considered a chemical “marker” for synthetic rubber (DOHMH 2008) was not detected in any of the air samples, including background samples.
- Of 10 metals tested, two were detected in the ambient air samples. Only one of these metals, however, was detected in the ambient air samples collected from the synthetic turf fields. Similar concentrations were found in both the grass field and upwind samples.
- Ranges of particulate matter (PM<sub>2.5</sub>) air concentrations from both turf fields were within the background levels found at the comparison grass field and upwind locations.

An analysis of the air in the breathing zones of children above synthetic turf fields did not show appreciable levels from COPCs contained in the crumb rubber. Therefore, a risk assessment related to actual exposure to children was not warranted from the inhalation route of

exposure. Results from one of the bulk crumb rubber samples collected as part of this project identified an elevated lead level in the synthetic turf field at Thomas Jefferson Park.\*

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\* DPR is currently replacing the field and continuing to investigate the source of the lead contamination. Using protocols developed by DOHMH, DPR has since tested the remaining synthetic turf installations throughout NYC for lead and has not found a lead hazard. Results will be posted on the DPR website at [www.nyc.gov/parks](http://www.nyc.gov/parks) when available.

## 1.0 INTRODUCTION

Synthetic turf fields have been installed in many athletic and playing fields throughout New York City (NYC), the United States and the world. The NYC Department of Parks and Recreation (DPR) provides more than 800 athletic fields around the City for New Yorkers to get exercise and enjoy the outdoors. Of these athletic fields, 94 are made of synthetic turf (89 crumb rubber infill fields and 5 carpet-style turf fields without crumb rubber infill). In addition to the athletic fields, there are 17 play areas (14 with crumb rubber infill and 3 carpet-style).

This project focused on synthetic turf fields with crumb rubber infill. The infill-type synthetic turf fields in NYC parks contain several layers, including:

- A bottom layer composed of geo-textile.
- Middle layers composed of broken stone with plastic perforated pipe for drainage and rubber padding for shock absorbance.
- A top layer composed of carpet with soft, flexible plastic grass.
- Crumb rubber infill made from recycled tires added to the 'grass' layer to provide extra padding, serve as a ballast to hold the carpet down, and keep the grass upright. Sand is sometimes mixed with the crumb rubber.

The crumb rubber infill consists of recycled, chipped/pulverized, used automobile tires primarily made from styrene butadiene rubber (SBR). The tire crumbs are roughly the size of grains of coarse sand and generally are spread two to three inches thick over the field surface and packed between ribbons of green polyethyelene fibers used to simulate grass. Crumb rubber granules contain a variety of chemicals typical in rubber, including semi-volatile organic chemicals (SVOC) such as polycyclic aromatic hydrocarbons (PAH) and volatile organic chemicals (VOC). These chemicals may be released into the breathing zones of users, especially on hot days when turf surface temperatures may be elevated. In addition, crumb rubber may contain some amounts of particulate matter and metals. These particles may become airborne during play and sports activities. Crumb rubber may also be further reduced in size and concentration by mechanical abrasion and wear that comes with use of the fields.

In May 2008, DOHMH released a report prepared by TRC, “A Review of the Potential Health and Safety Risks from Synthetic Turf Fields Containing Crumb Rubber Infill.” This report identified several gaps in the current knowledge about potential exposures to COPCs from the crumb rubber in synthetic turf fields. These include:

- Outdoor air concentrations of COPCs on both newly installed and older synthetic turf fields. Most of the data generated have been from indoor synthetic turf facilities.
- Background air concentrations of COPCs in NYC. Many of the COPCs found in crumb rubber are also present in the urban environment, but there is little available data on background levels of these COPCs.

The report made the following recommendations:

- Field operators should measure air concentrations of COPCs and particulate matter above outdoor fields to give more representative data related to use of playing fields in urban parks. Measurements taken on a hot, calm (no wind) day would represent a worst case scenario.
- When conducting air studies over fields with crumb rubber, air measurements should also be taken simultaneously at nearby off-field sites, as well as on natural grass and/or asphalt fields, to provide comparative data on exposures related to urban environments.

The AQS addresses the recommendation to investigate the potential airborne release of contaminants from crumb rubber synthetic turf fields and the subsequent potential exposures in the breathing zones of young children to those airborne contaminants. The AQS also addresses the recommendation to investigate natural air measurements on a grass field for comparison data. Although there is potential for ingestion and dermal contact of the crumb rubber infill itself, inhalation exposure would be expected to be a primary route of exposure to any emissions from the synthetic turf.



## 2.0 AIR QUALITY SURVEY

### 2.1 Specific Objectives:

This air quality survey (AQS) had the following objectives:

- 1) Characterize the concentrations of certain SVOCs (PAHs, Benzothiazole), VOCs, metals and particulate matter (PM<sub>2.5</sub>) at selected crumb rubber fields in NYC, including the Mullaly Park field, a "newer" (<1 year old) synthetic turf field and the Thomas Jefferson Park field, an "older" synthetic turf field (> 3 years old); as well as a grass field (also at Mullaly Park) for comparison purposes. The different ages of the turf fields would potentially provide information relating to the aging effect of the crumb rubber.
- 2) Evaluate the suitability of toxicology data to assess the health risks associated with concentrations measured during the AQS.
- 3) Evaluate the level of potential risk for cancer and non-cancer health effects for those analytes found to be above background levels or of toxicological concern.

### 2.2 Air Quality Survey Design

The AQS consisted of air sampling for a suite of 18 SVOCs (17 PAHs and benzothiazole), 69 VOCs, 10 metals and particulate matter (PM<sub>2.5</sub>) at two outdoor crumb rubber athletic fields in NYC, Thomas Jefferson Park (East Harlem, Manhattan) and Mullaly Park (Bronx), and at a comparison grass field in Mullaly Park. These COPCs were selected based on studies showing that SBR crumb rubber contains these classes of COPCs (DOHMH 2008). These studies were either direct analysis of the crumb rubber or air quality studies conducted in indoor soccer halls. In addition, a bulk sample of crumb rubber infill was also collected from each turf field and analyzed for 77 organic compounds (VOCs and some SVOCs) and eight metals for the purpose of matching substances identified in the air samples with the constituents found in the bulk crumb rubber.

AQS background and field air samples were collected using stationary samplers. Field air samples were collected from the crumb rubber fields (Refer to Appendix A for sample locations). Background samples, which consisted of air samples collected at upwind locations adjacent to the crumb rubber fields, were collected at the same time as the corresponding active field air samples. In addition, a grass field also located at Mullaly Park, away from the synthetic turf field, was sampled in a manner similar to the synthetic turf fields for comparison purposes. The stationary background and field samples were collected at 3 feet above ground level to

simulate the breathing zone of a young child (USEPA 2008). Samples were collected under simulated playing conditions during a practice soccer game and walking/running around the samplers. Sampling was conducted under summer conditions in the late morning to afternoon hours in order to capture potentially the highest concentrations of VOCs released due to the heating of the fields. Samples were collected over four separate days. Table 1 provides details about the sampling and analytical methods.

**Table 1. Air Sampling and Analytic Methods.**

Analytes	Sampling Method/Analytical Method	Sampling Equipment	# of Samples (per Turf field)	# of Upwind Samples (per Turf field)*
VOCs	EPA TO-15	1-liter SUMMA canister placed on field (and upwind of field) at 3 ft above ground	4	2
SVOCs/PAHs	NIOSH 5506	Sampling pump with sorptive media placed on field (and upwind of field) at 3 ft above ground	4	2
Metals	OSHA ID 125	Hi-vol sampler placed on field, (and upwind of field) at 3 ft above ground	4	2
SVOCs/ Benzothiazole	NIOSH 2550	Low flow pumps with Teflon filter and adsorbing media	4	2
PM <sub>2.5</sub>	Continuous Sampling	Dustrak Model 8520 (TSI Instruments)**	4	2

\* Upwind samples were not collected for the grass field.

\*\* The Dustrak uses laser photometry to measure particles from 0.1 to 10 um in diameter. A 2.5 size selective inlet nozzle with an omni-directional probe to reduce wind impact was used. Instrument was zeroed before sampling.

The VOC sampling time was pre-set for 1-hour using SUMMA canisters with a flow controlled inlet. Sampling times for all other substances were 120 minutes in duration. The sampling times were chosen based on the anticipated amount of time a child would spend on the field in any given day. NYC Department of Parks and Recreation schedules field use for 1 to 2 hours per permit. Fields permits are in high demand and permit times are limited accordingly.

Field parameters such as the site name, type and age of field, field description, sampling start and end times, date, sampling location on and off the field, ambient and surface temperatures, relative humidity, wind direction/speed and weather conditions were documented. Variables that could provide insight during data interpretation, such as high traffic conditions in adjacent roads were also documented. Field worksheets with the above data can be found in Appendix C.

## 2.3 Data Analysis and Interpretation

Data were logged into Excel spreadsheets by uniquely coded sample numbers so that all measurements for a single sample appear on the same line. The raw sample data and summary statistics tables can be found in Appendix B. Summary statistics were prepared for each parameter (number of detects, minimum and maximum detected concentration, minimum and maximum detection limit and arithmetic average).

### 2.3.1 Data Analysis

In order to organize the data into a form manageable and appropriate for risk assessment, data usability was evaluated following USEPA's protocol given in *Guidance for Data Usability in Risk Assessment* (USEPA 1992). The following steps were followed during the data evaluation process as described by USEPA (1989):

- 1) Gather and Sort All Data by Medium (*i.e.*, air and bulk sample).
- 2) Evaluate Methods of Analysis - Analytical methods were evaluated to determine which ones are appropriate for use in the quantitative risk assessment. In doing so, the specificity of the results, the sensitivity of the analytical methods, and the use of adequate quality assurance/quality control (QA/QC) procedures are considered.
- 3) Evaluate the Sample Quantitation Limits (SQL) - For the purpose of the evaluation, all non-detects were evaluated, not simply omitted.
- 4) Evaluate the Data Qualifiers and Codes - Data validation qualifiers were also assessed during the data evaluation process. As indicated in USEPA guidance (USEPA 1989), unqualified data and data qualified with a "J" qualifier are treated as detected concentrations. Data qualified with "UJ" or "U" qualifiers are treated as non-detectable concentrations. As described above, non-detects will be assigned a value equal to the SQL. Data for constituents not detected in any medium or rejected data (qualified with an "R") were not included in the quantitative Human Health Risk Assessment.
- 5) Evaluate Blank Data - Field, trip and laboratory blanks were used to segregate actual site contamination from cross contamination associated with field or laboratory procedures. As indicated in USEPA guidance (1989), sample results are considered positive only if concentrations exceeded ten times the concentration of a common laboratory contaminant in a blank, or five times the concentration of a chemical that is not considered a common laboratory contaminant. Definitions of common laboratory contaminants are provided in USEPA guidance (1989). If less than five or ten times the blank concentration, the constituent will be treated as non-detected in that sample.

- 6) Evaluate Background Data – Site-specific upwind (background) locations were sampled. These site background samples were used as a screening method to evaluate whether constituents detected from within the study area are non-site related.
- 7) Develop Data Sets by Medium - Tables were designed to provide summary statistics (*i.e.*, frequency and range of detects) for constituents detected in air. Full summary statistic tables are provided in Appendix B.

### 2.3.2 Sampling Results

Summary tables in Appendix B present the findings from the air sampling and bulk crumb rubber analysis. Air sampling was conducted at Mullaly Park’s “newer” (<1 yr) synthetic turf field and at Thomas Jefferson Park’s “older” (>3 yr) synthetic turf field. Background air samples were collected from upwind locations at Mullaly and Thomas Jefferson Parks and a grass baseball field at Mullaly Park. A bulk sample of crumb rubber infill was collected from each of the turf fields. The data presented represent those compounds that were detected at these fields and at their corresponding background locations given the conditions on the day when sampling was performed. These samples were collected on hot summer days with ambient temperatures ranging from approximately 79°F to 94°F (Appendix B). The surface temperatures on these days ranged from approximately 80°F to 129°F. Of the 18 SVOCs (17 PAHs and benzothiazole), 69 VOCs and 10 metals tested, a total of eight VOCs and two metals were detected in the air measurements as discussed in detail below. Ranges of PM<sub>2.5</sub> air concentrations from both turf fields were within background levels. Results from one of the bulk crumb rubber samples collected as part of this project identified an elevated lead level in the synthetic turf field at Thomas Jefferson Park.

### 2.4 Selection of Constituents of Potential Concern (COPCs)

A selection process was used to identify and target site-related COPCs that were likely to contribute significantly to the estimates of risk. Constituents were omitted from the list of COPCs if the:

- Constituent was not detected in any sample;
- Detected air concentrations were present at levels less than the NYS DEC’s DAR-1 annual guideline levels (NYSDEC 2007). These screening values are considered conservative screening measures as they assume long-term exposure;

- Detected air concentrations fell within the range measured in the background locations or appear to be from a source unrelated to the synthetic turf.

## 2.5 Discussion

### 2.5.1 Sampling Results

#### *Air*

##### *Volatile Organic Compounds (VOCs)*

Of 69 VOCs tested, eight were detected in the air measurements (Appendix B). Of these eight, three of the VOCs (2-butanone, chloroform and n-hexane) were unique to the synthetic turf samples (*i.e.* not detected in the upwind background locations or at the Mullaly Park grass field). Detected concentrations of 2-butanone and n-hexane were well below the respective guideline values of 5,000  $\mu\text{g}/\text{m}^3$  and 700  $\mu\text{g}/\text{m}^3$ , respectively. The detected concentration of chloroform (1 out of 4 samples from Thomas Jefferson Park), however, exceeded its guideline (2.9  $\mu\text{g}/\text{m}^3$  vs. 0.043  $\mu\text{g}/\text{m}^3$ ). Chloroform has been associated with crumb rubber through direct analysis of the rubber (see DOHMH 2008); however, it was not detected in the analysis of crumb rubber from the Thomas Jefferson Park synthetic turf field. In addition, it has not been detected in air emissions from indoor synthetic turf fields (see DOHMH 2008) suggesting a source other than the crumb rubber for the chloroform. Small amounts of chloroform are formed when chlorine is added to water. A chlorinated swimming pool is located adjacent to the field in which the chloroform was detected, and is a likely source of the compound. Although this reading exceeds the NYS DEC annual guideline concentration, it is far below the short-term guideline concentration for chloroform, 150  $\mu\text{g}/\text{m}^3$ .

Five of the 69 VOCs (acetone, chloromethane, ethanol, toluene and methylene chloride) were detected both in the synthetic turf field samples as well as in the upwind background samples and/or the Mullaly Park grass field. Detected concentrations of acetone, chloromethane, ethanol, and toluene did not exceed the respective guideline values of 28,000  $\mu\text{g}/\text{m}^3$ , 90  $\mu\text{g}/\text{m}^3$ , 45,000  $\mu\text{g}/\text{m}^3$  and 5,000  $\mu\text{g}/\text{m}^3$ , respectively. Detected concentrations of methylene chloride from both Mullaly Park (synthetic turf field) and Thomas Jefferson Park, as well as one upwind background sample, exceeded the guideline of 2.1  $\mu\text{g}/\text{m}^3$ . The maximum detected concentration was at Thomas Jefferson Park at a concentration of 9  $\mu\text{g}/\text{m}^3$ . Methylene chloride is a common laboratory contaminant. It was detected in a majority of the samples including background locations at consistent concentrations. Although the SUMMA canister methodology used for the sample collection does not allow for a blank comparison, the consistency of the methylene

chloride concentrations suggests the presence of laboratory contamination. Methylene chloride has been associated with crumb rubber through direct analysis of the rubber (see DOHMH 2008), however, it was not detected in the analysis of the crumb rubber sample from the Mullaly Park synthetic turf field or the Thomas Jefferson Park synthetic turf field. In addition, it has not been detected in air emissions from indoor synthetic turf fields (see DOHMH 2008).

In addition to the 69 VOCs that were detected as a result of using a standardized analytical method, seven VOC TICs (Tentatively Identified Compounds) were detected in the air measurements. TICs are analytes that the laboratory instrument can detect, but unlike the panel of 69 VOCs the TIC results cannot be verified by the analytic method. Consequently, the TIC findings are merely estimated levels that were detected as part of the analysis. Of the seven VOC TICs detected, four VOC TICs (isobutane, pentane, 2-methyl-1,3-butadiene, and 2-methylbutane) were unique to the synthetic turf fields (*i.e.* not detected in the upwind background locations or at the Mullaly Park grass field). Detected concentrations of 2-methylbutane, isobutane and pentane were well below the respective guideline values of 42,000  $\mu\text{g}/\text{m}^3$ , 57,000  $\mu\text{g}/\text{m}^3$  and 4,200  $\mu\text{g}/\text{m}^3$ , respectively. 2-Methyl-1,3-butadiene does not have a screening criterion. 2-Methyl-1,3-butadiene also known as isoprene is a common hydrocarbon in animals and plants. It is also found in naturally occurring rubbers. Since 2-methyl-1,3-butadiene was only identified in one sample as a tentatively identified compound and it was not detected in the bulk rubber sample it is not considered a constituent of potential concern. Acetaldehyde was detected in one of the synthetic turf field air measurements as well as in a sample collected from the grass field. Though the measured concentration from the turf field (1.8  $\mu\text{g}/\text{m}^3$ ) exceeded the respective guideline value of 0.45  $\mu\text{g}/\text{m}^3$ , the level was close to the background measured concentration collected from the grass field (1.1  $\mu\text{g}/\text{m}^3$ ). Acetaldehyde, being that it is a product of combustion including automobile exhaust, is ubiquitous in an urban environment. Although this reading exceeds the NYS DEC annual guideline concentration, it is far below the short-term guideline concentration for acetaldehyde, 4,500  $\mu\text{g}/\text{m}^3$ .

#### Semi-Volatile Organic Compounds (SVOCs)

None of the 18 SVOCs (17 PAHs and benzothiazole) tested were detected in any of the ambient air samples.

### Metals

Of 10 metals tested, two (chromium, zinc) were detected in the ambient air samples. However, only one of these metals (chromium) was detected in the ambient air samples obtained from the synthetic turf fields. Similar concentrations were found in the background samples.

Detected concentrations of chromium from the Mullaly Park and Thomas Jefferson Park synthetic turf fields, the Mullaly Park grass field and the two upwind samples all exceeded the guideline value of  $1.2 \mu\text{g}/\text{m}^3$ . The concentrations of chromium, however, were consistent among all five sample locations. In addition, chromium was detected in a blank sample at  $0.65 \mu\text{g}/\text{m}^3$ . As indicated in USEPA guidance (1989), sample results are considered positive only if concentrations exceeded ten times the concentration of a common laboratory contaminant in a blank, or five times the concentration of a chemical that is not considered a common laboratory contaminant. Since the detected concentrations of chromium are less than five times the concentration in the blank, the detections are not considered to be positive for chromium. Zinc was detected in a single ambient air sample from the Mullaly Park Grass field at a concentration of  $83 \mu\text{g}/\text{m}^3$ . This concentration was above the screening criteria of  $45 \mu\text{g}/\text{m}^3$ . However, it was not detected in any of the samples from the synthetic turf fields or the upwind background samples. The screening levels are 'protective' of long-term, generally continuous exposures. Exposure during the limited time (2 hours per day) spent at any of the playing fields is not expected to be a concern for health effects.

### Particulate Matter (PM 2.5)

Air concentrations of  $\text{PM}_{2.5}$  at the synthetic turf fields ranged from  $0.003 \text{ mg}/\text{m}^3$  to  $0.048 \text{ mg}/\text{m}^3$ . Background air concentrations of  $\text{PM}_{2.5}$ , which include the sampling at Mullaly Park's grass field and the specific background samples taken at Mullaly Park and Thomas Jefferson Park, ranged from  $0.003$  to  $0.05 \text{ mg}/\text{m}^3$ . The range of  $\text{PM}_{2.5}$  measurements taken at the synthetic turf fields are within those measured for the grass playing field and the upwind background locations. The primary source of  $\text{PM}_{2.5}$  is fossil fuel combustion from stationary sources, such as oil-fired power plants, and mobile sources, such as diesel vehicles. Certain industrial sources, *e.g.* smelting, and large wildfires, also emit fine particulate matter. Since ranges of  $\text{PM}_{2.5}$  air concentrations from both parks' turf fields are within background levels, and due to the urbanized location of the parks, it is concluded the  $\text{PM}_{2.5}$  levels from the synthetic turf fields were not distinguishable from background. The consistent measurement of  $\text{PM}_{2.5}$  at Thomas

Jefferson Park, which is located adjacent to a highway, on a day when the wind was blowing steadily from the direction of the roadway, supports this conclusion.

#### *Bulk Crumb Rubber*

A bulk crumb rubber sample was collected from each of the two synthetic turf fields for the purpose of matching substances identified in the air samples with the constituents found in the bulk crumb rubber. The crumb rubber samples were analyzed for 77 organic compounds (VOCs and some SVOCs) and eight metals. Of the organic compounds tested, only one (naphthalene) was detected in the crumb rubber sample collected from the Thomas Jefferson Park synthetic turf field. Detected concentration of the naphthalene was well below the soil cleanup objective level of 100 mg/kg (Appendix B). Concentrations of metals, other than lead and zinc, were well below the respective guideline values. The lead and zinc level for the crumb rubber sample collected from the Thomas Jefferson Park exceeded the respective guideline values of 400 mg/kg and 10,000 mg/kg, respectively. NYS DEC caps the soil cleanup objective values for metals at 10,000 mg/kg. This is not based on health concerns. As zinc is a known component of tires and crumb rubber, a level of 13,100 mg/kg zinc is not at all unexpected. The elevated level of lead detected in the bulk crumb rubber sample from the Thomas Jefferson Park synthetic turf field requires further investigation.

#### 2.5.2 Human Health Risk Assessment

The data does not support the need to conduct a human health risk assessment from the inhalation route of exposure.



### 3.0 CONCLUSION

The purpose of this AQS was to investigate the potential release of contaminants from crumb rubber synthetic turf fields and the subsequent potential exposures in the breathing zones of young children to those airborne contaminants. Very few constituents were detected in the air samples taken above the fields, and fewer still exceeded the screening levels. Of the 18 SVOCs (17 PAHs and benzothiazole), 69 VOCs and 10 metals tested, a total of eight VOCs and two metals were detected in the air measurements. Of these, only three VOCs were found unique to the synthetic turf fields (*i.e.* not detected in the upwind background locations or at the Mullaly Park grass field); only one of which (chloroform) exceeded the screening level. There was no consistent pattern to indicate that the constituents were associated with the synthetic turf. Regardless, the screening levels are highly conservative and “protective” of long-term, generally continuous exposures, and such continuous and long-term exposures are unlikely to occur at synthetic turf fields. Ranges of PM<sub>2.5</sub> air concentrations from both synthetic turf fields were within background levels. Overall, none of the detected air measurements were found to be at a level that is likely to cause adverse health effects from typical exposures that occur at synthetic turf fields.

In summary, an analysis of the air in the breathing zones of children above synthetic turf fields do not show appreciable impacts from COPCs contained in the crumb rubber. Therefore, a risk assessment was not warranted from the inhalation route of exposure. The bulk crumb rubber samples collected as part of this project, however, resulted in the detection of an elevated lead level.<sup>†</sup>

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<sup>†</sup> DPR is currently replacing the field and continuing to investigate the source of the lead contamination. Using protocols developed by DOHMH, DPR has since tested the remaining synthetic turf installations throughout NYC for lead and has not found a lead hazard. Results will be posted on the DPR website at [www.nyc.gov/parks](http://www.nyc.gov/parks) when available.

#### 4.0 REFERENCES

**New York City Department of Health and Mental Hygiene (DOHMH). 2008.** A Review of the Potential Health and Safety Risks From Synthetic Turf Fields Containing Crumb Rubber Infill. Prepared by TRC for DOHMH. May.

**New York State Department of Environmental Conservation (NYS DEC). 2007.** Guidelines for the Control of Toxic Ambient Air Contaminants. DAR-1. Division of Air Resources. September 10.

**New York State Department of Environmental Conservation (NYS DEC) and New York State Department of Health (NYS DOH). 2006.** New York State Brownfield Cleanup Program Development of Soil Cleanup Objectives Technical Support Document, New York State Department of Environmental Conservation and New York State Department of Health. September.

**USEPA. 1989.** Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part A) Interim Final. Washington, DC: US Environmental Protection Agency Office of Emergency and Remedial Response. EPA/540/1-89/002. December.

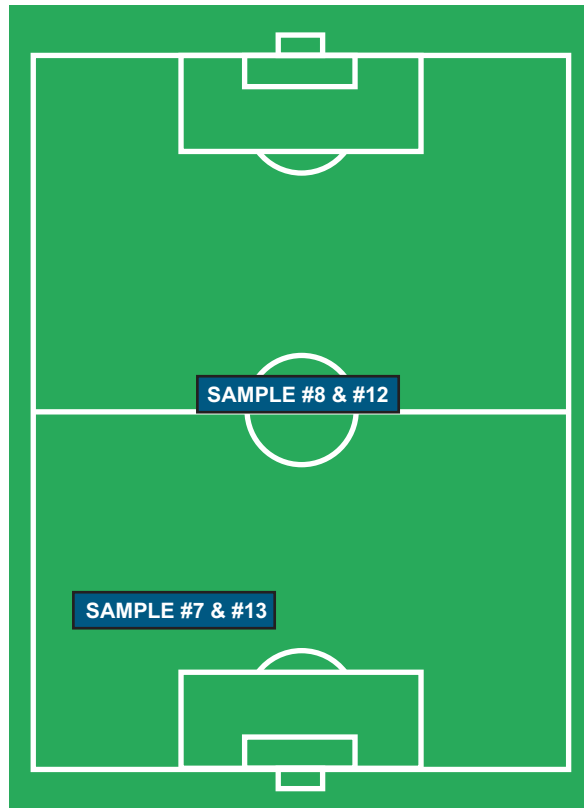
**USEPA. 1992.** Guidance for Data Usability in Risk Assessment, Final. US Environmental Protection Agency Office of Emergency and Remedial Response. Washington DC. Publication 9285.7-09A. April.

**USEPA. 2008.** Child-Specific Exposures Factor Handbook. EPA/600/R-06/096F.

**APPENDIX A**  
**SAMPLING LOCATIONS**



BACKGROUND  
SAMPLE #6 & 11



# MULLALY PARK

*NOT TO SCALE*



21 Griffin Rd. North  
Windsor, CT 06095  
(860) 298-9692

**MULLARY PARK**  
NEW YORK, NEW YORK

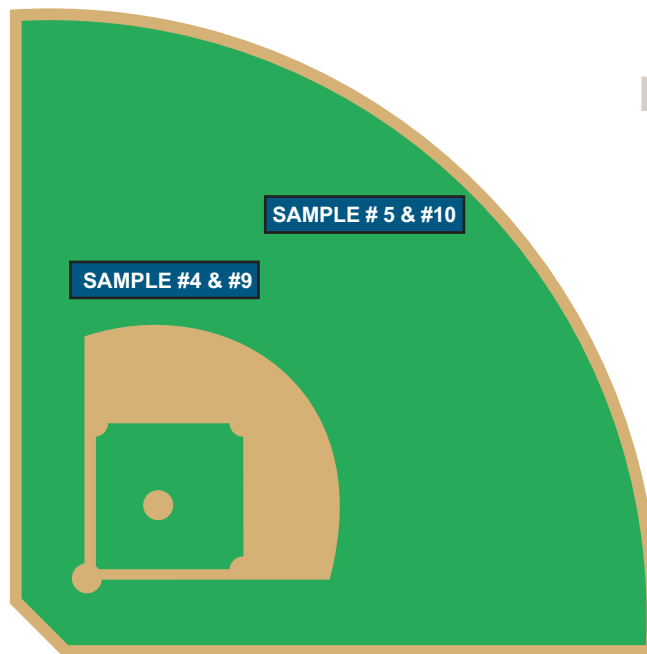
## **APPENDIX A-1** **SAMPLING LOCATIONS -** **TURF FIELD**

Date: 09/08

Project No. 153896.0010.0000



# MULLALY PARK



*NOT TO SCALE*



21 Griffin Rd. North  
Windsor, CT 06095  
(860) 298-9692

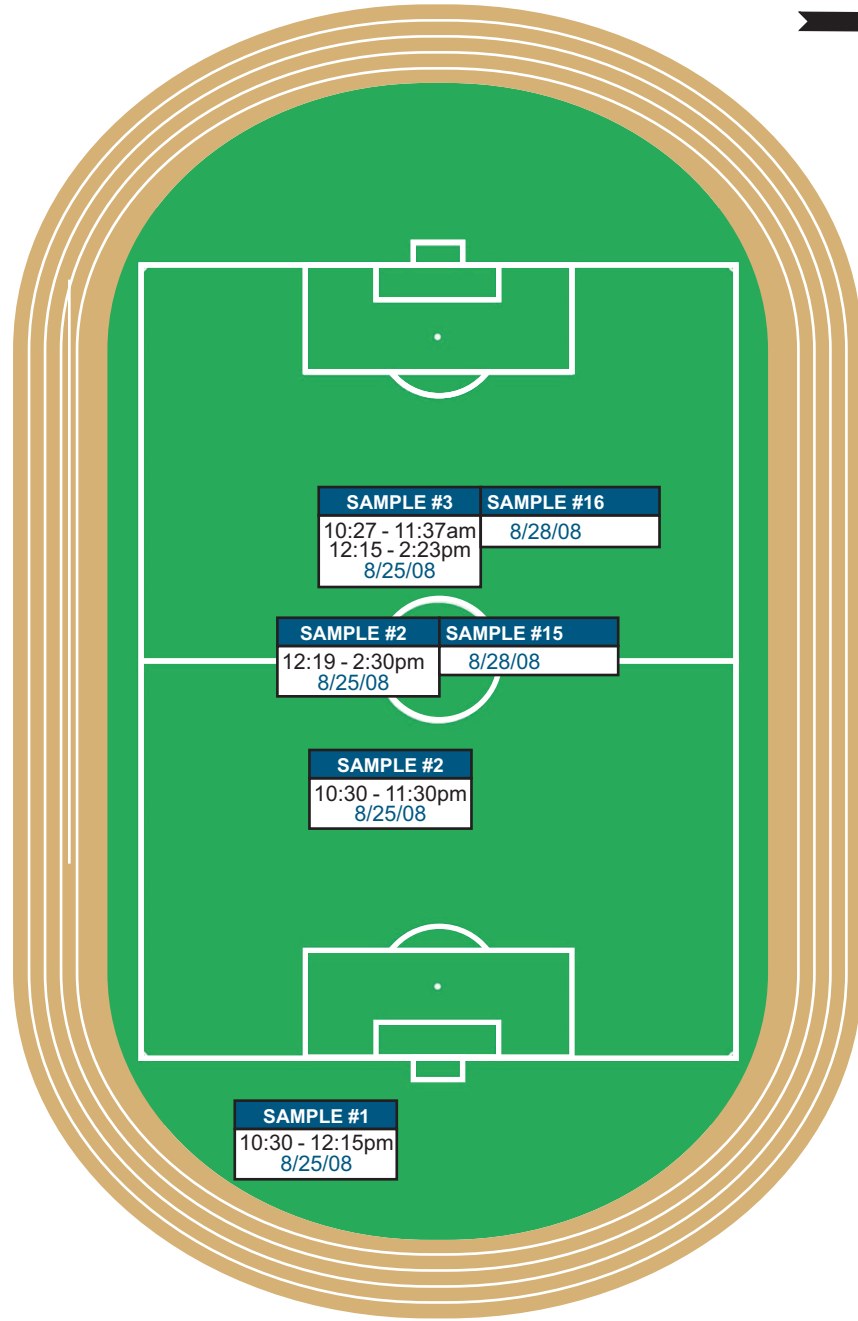
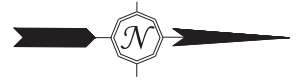
**MULLARY PARK**  
NEW YORK, NEW YORK

## **APPENDIX A-2** **SAMPLING LOCATIONS -** **GRASS FIELD**

Date: 09/08

Project No. 153896.0010.0000

# THOMAS JEFFERSON



BACKGROUND
SAMPLE #1
12:29 - 2:34pm
8/25/08
BACKGROUND
SAMPLE #14
8/28/08

Playground

NOT TO SCALE



21 Griffin Rd. North  
Windsor, CT 06095  
(860) 298-9692

THOMAS JEFFERSON  
NEW YORK, NEW YORK

## APPENDIX A-3 SAMPLING LOCATIONS - TURF FIELD

WIND DIRECTION  
AT 10:30 A.M. NE



Date: 09/08

Project No. 153896.0010.0000

**APPENDIX B**  
**SAMPLING RESULTS**

**Table B-1**  
**Summary Air Sampling Results for Detected Analytes**

Analytes	Synthetic Turf Fields (Concentration Range)	Background - Grass/Upwind (Concentration Range)	Annual Air Guideline <sup>†</sup>	Short-Term Air Guideline <sup>†</sup>
	( $\mu\text{g}/\text{m}^3$ )	( $\mu\text{g}/\text{m}^3$ )	( $\mu\text{g}/\text{m}^3$ )	( $\mu\text{g}/\text{m}^3$ )
<b>Volatile Organic Compounds or VOCs</b> (Of 69 VOCs tested, eight were detected)				
2-Butanone (MEK)	ND – 3	ND	5,000	13,000
Acetone	9.3 – 51	ND - 11	28,000	180,000
Chloroform	ND - 2.9*	ND	0.043	150
Chloromethane	ND - 1.1	ND - 1.1	90	22,000
Ethanol	6.2 – 22	5.1 - 8.9	45,000	NA
n-Hexane	ND - 2.1	ND	700	NA
Methylene Chloride	ND - 9*	ND - 6.9*	2.1	14,000
Toluene	ND - 2.7	ND - 2	5,000	37,000
<b>Metals</b> (Of 10 metals tested, two were detected)				
Chromium	0.87 - 1.4*	ND - 1.8*	1.2	NA
Zinc	ND	ND - 83	45	NA
<b>Particulate Matter or PM</b>				
PM 2.5	0.003 - 0.048	0.003 - 0.05	15	NA
<b>Semi-Volatile Organic Compounds or SVOCs</b> (Of 18 SVOCs tested which included 17 PAHs and benzothiazole, none were detected in any of the ambient air samples)				
*Measurement exceeded guideline value.				
ND = Not detected above the laboratory reporting limit.				
NA = Not available.				
<sup>†</sup> NYS DEC 2007. DAR 1 Tables – Short-term and annual air guideline levels.				





* Sample ID :	MPT7	MPT8	MPT12	MPT13	MPT12a	MPT12b	Lab Blank
Sample Name:	Mullaly Park Turf	Mullaly Park Turf	Mullaly Park Turf Dup. Comb.	Mullaly Park Turf	Mullaly Park Turf	Mullaly Park Turf	
Sample Date :	08/26/08	08/26/08	08/27/08	08/27/08	08/27/08	08/27/08	
* Sample Type :	Air	Air	Air	Air	Air	Air	Air
Lab ID :	280801650-14	280801650-13	280801650-7 280801650-3	280801650-6	280801650-7	280801650-3	
Duplicate :			Yes				
<b>VOC TICS</b>							
Butane, 2-methyl		2.95 J					
Isobutane		2.38 J					
Pentane		11.80 J					
<b>SVOCs</b>							
Acenaphthene	0.83 U	0.84 U	0.78 U	0.79 U			0.2 U
Acenaphthylene	0.83 U	0.84 U	0.78 U	0.79 U			0.2 U
Anthracene	0.83 U	0.84 U	0.78 U	0.79 U			0.2 U
Benzo(a)anthracene	0.41 U	0.42 U	0.39 U	0.39 U			0.1 U
Benzo(a)pyrene	0.41 U	0.42 U	0.39 U	0.39 U			0.1 U
Benzo(b)fluoranthene	0.41 U	0.42 U	0.39 U	0.39 U			0.1 U
Benzo(e)pyrene	0.41 U	0.42 U	0.39 U	0.39 U			0.1 U
Benzo(g,h,i)perylene	0.41 U	0.42 U	0.39 U	0.39 U			0.1 U
Benzo(k)fluoranthene	0.41 U	0.42 U	0.39 U	0.39 U			0.1 U
Chrysene	0.41 U	0.42 U	0.39 U	0.39 U			0.1 U
Dibenzo(a,h)anthracene	0.41 U	0.42 U	0.39 U	0.39 U			0.1 U
Fluoranthene	0.41 U	0.42 U	0.39 U	0.39 U			0.1 U
Fluorene	0.83 U	0.84 U	0.78 U	0.79 U			0.2 U
Indeno(1,2,3-c,d)pyrene	0.41 U	0.42 U	0.39 U	0.39 U			0.1 U
Naphthalene	0.83 U	0.84 U	0.78 U	0.79 U			0.2 U
Phenanthrene	0.41 U	0.42 U	0.39 U	0.39 U			0.1 U
Pyrene	0.41 U	0.42 U	0.39 U	0.39 U			0.1 U
<b>Benzothiazole</b>	0.41 U	0.42 U	0.32 U	0.4 U			
<b>Metals</b>							
Cadmium	0.41 U	0.41 U	0.39 U	0.39 U			0.2 U
Chromium	1.2	1.3	1.3	0.97 U			0.65
Copper	2.1 U	2.1 U	2 U	1.9 U			1 U
Iron	10 U	10 U	9.9 U	9.7 U			5 U
Lead	1 U	1 U	0.99 U	0.97 U			0.5 U
Manganese	1.5 U	1.5 U	1.5 U	1.5 U			0.75 U
Nickel	2.1 U	2.1 U	2 U	1.9 U			1 U
Silver	1 U	1 U	0.99 U	0.97 U			0.5 U
Tin	10 U	10 U	9.9 U	9.7 U			5 U
Zinc	2.1 U	2.1 U	2 U	1.9 U			1 U

Appendix B-1b  
 Thomas Jefferson Park - Synthetic Turf Field  
 New York, NY

* Sample ID :	TJ2	TJ3	TJ15	TJ16
Sample Name:	Thomas Jefferson Turf	Thomas Jefferson Turf	Thomas Jefferson Turf	Thomas Jefferson Turf
Sample Date :	08/25/08	08/25/08	08/28/08	08/28/08
* Sample Type :	Air	Air	Air	Air
Lab ID :	280801650-20	280801650-17	280801650-8	280801650-2
Duplicate :				
<b>CONSTITUENTS</b>				
<b>VOCs</b>				
4,Methyl-2-pentanone	2 U	2 U	2 U	2 U
Acetone	11	20	11	51
Acetonitrile	0.84 U	0.84 U	0.84 U	0.84 U
Acrylonitrile	1.1 U	1.1 U	1.1 U	1.1 U
Benzene	1.6 U	1.6 U	1.6 U	1.6 U
Benzyl Chloride	3.7 U	3.7 U	3.7 U	3.7 U
Bromodichloromethane	3.3 U	3.3 U	3.3 U	3.3 U
Bromoethane	2.2 U	2.2 U	2.2 U	2.2 U
Bromoethene	2.2 U	2.2 U	2.2 U	2.2 U
Bromoform	5.2 U	5.2 U	5.2 U	5.2 U
Bromomethane	1.9 U	1.9 U	1.9 U	1.9 U
Butadiene, 1,3-	1.1 U	1.1 U	1.1 U	1.1 U
Butanone, 2- (MEK)	2.4	3	1.6	1.5
Carbon disulfide	1.6 U	1.6 U	1.6 U	1.6 U
Carbon Tetrachloride	3.1 U	3.1 U	3.1 U	3.1 U
Chlorobenzene	2.3 U	2.3 U	2.3 U	2.3 U
Chloroethane	1.3 U	1.3 U	1.3 U	1.3 U
Chloroform	2.4 U	2.4 U	2.4 U	2.9
Chloromethane	1.1	1 U	1 U	1 U
Chloropropene, 3-	1.6 U	1.6 U	1.6 U	1.6 U
Chlorotoluene, 2-	2.6 U	2.6 U	2.6 U	2.6 U
Cyclohexane	1.7 U	1.7 U	1.7 U	1.7 U
Dibromochloromethane	4.3 U	4.3 U	4.3 U	4.3 U
Dibromoethane, 1,2-	3.8 U	3.8 U	3.8 U	3.8 U
Dichlorobenzene, 1,2-	3 U	3 U	3 U	3 U
Dichlorobenzene, 1,3-	3 U	3 U	3 U	3 U
Dichlorobenzene, 1,4-	3 U	3 U	3 U	3 U
Dichloroethane, 1,1-	2 U	2 U	2 U	2 U
Dichloroethane, 1,2-	2 U	2 U	2 U	2 U
Dichloroethene, 1,1-	2 U	2 U	2 U	2 U
Dichloroethene, cis- 1,2-	2 U	2 U	2 U	2 U
Dichloroethene, trans-1,2-	2 U	2 U	2 U	2 U
Dichloropropane, 1,2-	2.3 U	2.3 U	2.3 U	2.3 U
Dichloropropene, cis-1,3-	2.3 U	2.3 U	2.3 U	2.3 U
Dichloropropene, trans-1,3-	2.3 U	2.3 U	2.3 U	2.3 U
Dioxane, 1,4-	1.8 U	1.8 U	1.8 U	1.8 U
Ethanol	6.8	12	7.6	22
Ethyl acetate	1.8 U	1.8 U	1.8 U	1.8 U
Ethylbenzene	2.2 U	2.2 U	2.2 U	2.2 U
Ethyltoluene, 4-	2.5 U	2.5 U	2.5 U	2.5 U
Freon 11 (Trichlorofluoromethane)	2.8 U	2.8 U	2.8 U	2.8 U
Freon 113 (1,1,2 Trichlorotrifluoroethane)	3.8 U	3.8 U	3.8 U	3.8 U
Freon 114 (1,2 Dichlorotetrafluoroethane)	3.5 U	3.5 U	3.5 U	3.5 U
Freon 12 (Dichlorodifluoromethane)	2.5 U	2.5 U	2.5 U	2.5 U
Heptane, n-	2 U	2 U	2 U	2 U
Hexachloro-1,3-butadiene	5.3 U	5.3 U	5.3 U	5.3 U
Hexane, n-	1.8 U	1.8 U	2.1	1.8 U
Hexanone, 2-	2 U	2 U	2 U	2 U
Isopropyl alcohol	3.7 U	3.7 U	3.7 U	3.7 U
Methylene chloride	5.2 U	5.2 U	5.2 U	9
Methyl-tert-butyl ether	1.8 U	1.8 U	1.8 U	1.8 U
Propylene	1.7 U	1.7 U	1.7 U	1.7 U
Styrene	2.1 U	2.1 U	2.1 U	2.1 U
Tertiary butyl alcohol	1.5 U	1.5 U	1.5 U	1.5 U
Tetrachloroethane, 1,1,2,2-	3.4 U	3.4 U	3.4 U	3.4 U
Tetrachloroethene	3.4 U	3.4 U	3.4 U	3.4 U
Tetrahydrofuran	1.5 U	1.5 U	1.5 U	1.5 U
Toluene	1.9 U	1.9	1.9 U	2.7
Trichlorobenzene, 1,2,4-	3.7 U	3.7 U	3.7 U	3.7 U
Trichloroethane, 1,1,1-	2.7 U	2.7 U	2.7 U	2.7 U
Trichloroethane, 1,1,2-	2.7 U	2.7 U	2.7 U	2.7 U
Trichloroethene	2.7 U	2.7 U	2.7 U	2.7 U
Trimethylbenzene, 1,2,4-	2.5 U	2.5 U	2.5 U	2.5 U
Trimethylbenzene, 1,3,5-	2.5 U	2.5 U	2.5 U	2.5 U
Trimethylpentane, 2,2,4-	2.3 U	2.3 U	2.3 U	2.3 U
Vinyl acetate	1.8 U	1.8 U	1.8 U	1.8 U
Vinyl chloride	1.3 U	1.3 U	1.3 U	1.3 U
Xylene (ortho)	2.2 U	2.2 U	2.2 U	2.2 U
Xylene (para & meta)	2.2 U	2.2 U	2.2 U	2.2 U

Appendix B-1b  
 Thomas Jefferson Park - Synthetic Turf Field  
 New York, NY

* Sample ID :	TJ2	TJ3	TJ15	TJ16
Sample Name:	Thomas Jefferson Turf	Thomas Jefferson Turf	Thomas Jefferson Turf	Thomas Jefferson Turf
Sample Date :	08/25/08	08/25/08	08/28/08	08/28/08
* Sample Type :	Air	Air	Air	Air
Lab ID :	280801650-20	280801650-17	280801650-8	280801650-2
Duplicate :				
<b>VOC TICs</b>				
Acetaldehyde		1.80 J		J
Butane, 2-methyl				2.95 J
Isobutane				2.38 J
Methyl-1,3-Butadiene, 2-			2.79 J	
Pentane				8.85
<b>SVOCs</b>				
Acenaphthene	0.51 U	0.49 U	0.75 U	0.77 U
Acenaphthylene	0.51 U	0.49 U	0.75 U	0.77 U
Anthracene	0.51 U	0.49 U	0.75 U	0.77 U
Benzo(a)anthracene	0.25 U	0.25 U	0.38 U	0.39 U
Benzo(a)pyrene	0.25 U	0.25 U	0.38 U	0.39 U
Benzo(b)fluoranthene	0.25 U	0.25 U	0.38 U	0.39 U
Benzo(e)pyrene	0.25 U	0.25 U	0.38 U	0.39 U
Benzo(g,h,i)perylene	0.25 U	0.25 U	0.38 U	0.39 U
Benzo(k)fluoranthene	0.25 U	0.25 U	0.38 U	0.39 U
Chrysene	0.25 U	0.25 U	0.38 U	0.39 U
Dibenzo(a,h)anthracene	0.25 U	0.25 U	0.38 U	0.39 U
Fluoranthene	0.25 U	0.25 U	0.38 U	0.39 U
Fluorene	0.51 U	0.49 U	0.75 U	0.77 U
Indeno(1,2,3-c,d)pyrene	0.25 U	0.25 U	0.38 U	0.39 U
Naphthalene	0.51 U	0.49 U	0.75 U	0.77 U
Phenanthrene	0.25 U	0.25 U	0.38 U	0.39 U
Pyrene	0.25 U	0.25 U	0.38 U	0.39 U
<b>Benzothiazole</b>	0.25 U	0.25 U	0.37 U	0.38 U
<b>Metals</b>				
Cadmium	0.25 U	0.25 U	0.37 U	0.39 U
Chromium	1.1	0.87	1.4	1.1
Copper	1.2 U	1.3 U	1.8 U	1.9 U
Iron	6.2 U	6.3 U	9.1 U	9.7 U
Lead	0.62 U	0.63 U	0.91 U	0.97 U
Manganese	0.93 U	0.94 U	1.4 U	1.5 U
Nickel	1.2 U	1.3 U	1.8 U	1.9 U
Silver	0.62 U	0.63 U	0.91 U	0.97 U
Tin	6.2 U	6.3 U	9.1 U	9.7 U
Zinc	1.2 U	1.3 U	1.8 U	1.9 U

Appendix B-1c  
Mullaly Park - Grass Field  
New York, NY

* Sample ID :	MPF4	MPF5	MPF9	MPF10
Sample Name:	Mullaly Park Grass Field	Mullaly Park Grass Field	Mullaly Park Grass Field	Mullaly Park Grass Field
Sample Date :	08/26/08	08/26/08	08/27/08	08/27/08
* Sample Type :	Air	Air	Air	Air
Lab ID :	280801650-21	280801650-15	280801650-4	280801650-19
Duplicate :				
<b>CONSTITUENTS</b>				
<b>VOCs</b>				
4,Methyl-2-pentanone	2 U	2 U	2 U	2 U
Acetone	9.5	7.1 U	9.2	7.3
Acetonitrile	0.84 U	0.84 U	0.84 U	0.84 U
Acrylonitrile	1.1 U	1.1 U	1.1 U	1.1 U
Benzene	1.6 U	1.6 U	1.6 U	1.6 U
Benzyl Chloride	3.7 U	3.7 U	3.7 U	3.7 U
Bromodichloromethane	3.3 U	3.3 U	3.3 U	3.3 U
Bromoethane	2.2 U	2.2 U	2.2 U	2.2 U
Bromoethene	2.2 U	2.2 U	2.2 U	2.2 U
Bromoform	5.2 U	5.2 U	5.2 U	5.2 U
Bromomethane	1.9 U	1.9 U	1.9 U	1.9 U
Butadiene, 1,3-	1.1 U	1.1 U	1.1 U	1.1 U
Butanone, 2- (MEK)	1.5 U	1.5 U	1.5 U	1.5 U
Carbon disulfide	1.6 U	1.6 U	1.6 U	1.6 U
Carbon Tetrachloride	3.1 U	3.1 U	3.1 U	3.1 U
Chlorobenzene	2.3 U	2.3 U	2.3 U	2.3 U
Chloroethane	1.3 U	1.3 U	1.3 U	1.3 U
Chloroform	2.4 U	2.4 U	2.4 U	2.4 U
Chloromethane	1 U	1.1	1 U	1 U
Chloropropene, 3-	1.6 U	1.6 U	1.6 U	1.6 U
Chlorotoluene, 2-	2.6 U	2.6 U	2.6 U	2.6 U
Cyclohexane	1.7 U	1.7 U	1.7 U	1.7 U
Dibromochloromethane	4.3 U	4.3 U	4.3 U	4.3 U
Dibromoethane, 1,2-	3.8 U	3.8 U	3.8 U	3.8 U
Dichlorobenzene, 1,2-	3 U	3 U	3 U	3 U
Dichlorobenzene, 1,3-	3 U	3 U	3 U	3 U
Dichlorobenzene, 1,4-	3 U	3 U	3 U	3 U
Dichloroethane, 1,1-	2 U	2 U	2 U	2 U
Dichloroethane, 1,2-	2 U	2 U	2 U	2 U
Dichloroethene, 1,1-	2 U	2 U	2 U	2 U
Dichloroethene, cis- 1,2-	2 U	2 U	2 U	2 U
Dichloroethene, trans-1,2-	2 U	2 U	2 U	2 U
Dichloropropane, 1,2-	2.3 U	2.3 U	2.3 U	2.3 U
Dichloropropene, cis-1,3-	2.3 U	2.3 U	2.3 U	2.3 U
Dichloropropene, trans-1,3-	2.3 U	2.3 U	2.3 U	2.3 U
Dioxane, 1,4-	1.8 U	1.8 U	1.8 U	1.8 U
Ethanol	5.8	5.1	7.6	6.4
Ethyl acetate	1.8 U	1.8 U	1.8 U	1.8 U
Ethylbenzene	2.2 U	2.2 U	2.2 U	2.2 U
Ethyltoluene, 4-	2.5 U	2.5 U	2.5 U	2.5 U
Freon 11 (Trichlorofluoromethane)	2.8 U	2.8 U	2.8 U	2.8 U
Freon 113 (1,1,2 Trichlorotrifluoroethane)	3.8 U	3.8 U	3.8 U	3.8 U
Freon 114 (1,2 Dichlorotetrafluoroethane)	3.5 U	3.5 U	3.5 U	3.5 U
Freon 12 (Dichlorodifluoromethane)	2.5 U	2.5 U	2.5 U	2.5 U
Heptane, n-	2 U	2 U	2 U	2 U
Hexachloro-1,3-butadiene	5.3 U	5.3 U	5.3 U	5.3 U
Hexane, n-	1.8 U	1.8 U	1.8 U	1.8 U
Hexanone, 2-	2 U	2 U	2 U	2 U
Isopropyl alcohol	3.7 U	3.7 U	3.7 U	3.7 U
Methylene chloride	5.2 U	5.2 U	5.2 U	5.2 U
Methyl-tert-butyl ether	1.8 U	1.8 U	1.8 U	1.8 U
Propylene	1.7 U	1.7 U	1.7 U	1.7 U
Styrene	2.1 U	2.1 U	2.1 U	2.1 U
Tertiary butyl alcohol	1.5 U	1.5 U	1.5 U	1.5 U
Tetrachloroethane, 1,1,2,2-	3.4 U	3.4 U	3.4 U	3.4 U
Tetrachloroethene	3.4 U	3.4 U	3.4 U	3.4 U
Tetrahydrofuran	1.5 U	1.5 U	1.5 U	1.5 U
Toluene	1.9 U	1.9 U	1.9 U	1.9 U
Trichlorobenzene, 1,2,4-	3.7 U	3.7 U	3.7 U	3.7 U
Trichloroethane, 1,1,1-	2.7 U	2.7 U	2.7 U	2.7 U
Trichloroethane, 1,1,2-	2.7 U	2.7 U	2.7 U	2.7 U
Trichloroethene	2.7 U	2.7 U	2.7 U	2.7 U
Trimethylbenzene, 1,2,4-	2.5 U	2.5 U	2.5 U	2.5 U
Trimethylbenzene, 1,3,5-	2.5 U	2.5 U	2.5 U	2.5 U
Trimethylpentane, 2,2,4-	2.3 U	2.3 U	2.3 U	2.3 U
Vinyl acetate	1.8 U	1.8 U	1.8 U	1.8 U
Vinyl chloride	1.3 U	1.3 U	1.3 U	1.3 U
Xylene (ortho)	2.2 U	2.2 U	2.2 U	2.2 U
Xylene (para & meta)	2.2 U	2.2 U	2.2 U	2.2 U

Appendix B-1c  
Mullaly Park - Grass Field  
New York, NY

* Sample ID :	MPF4	MPF5	MPF9	MPF10
Sample Name:	Mullaly Park Grass Field	Mullaly Park Grass Field	Mullaly Park Grass Field	Mullaly Park Grass Field
Sample Date :	08/26/08	08/26/08	08/27/08	08/27/08
* Sample Type :	Air	Air	Air	Air
Lab ID :	280801650-21	280801650-15	280801650-4	280801650-19
Duplicate :				
<b>VOC TICS</b>				
Acetaldehyde		1.80 J		
Hexanal	4.09 J			
Nonanal	5.81 J			
<b>SVOCs</b>				
Acenaphthene	0.8 U	0.81 U	0.82 U	0.8 U
Acenaphthylene	0.8 U	0.81 U	0.82 U	0.8 U
Anthracene	0.8 U	0.81 U	0.82 U	0.8 U
Benzo(a)anthracene	0.4 U	0.4 U	0.41 U	0.4 U
Benzo(a)pyrene	0.4 U	0.4 U	0.41 U	0.4 U
Benzo(b)fluoranthene	0.4 U	0.4 U	0.41 U	0.4 U
Benzo(e)pyrene	0.4 U	0.4 U	0.41 U	0.4 U
Benzo(g,h,i)perylene	0.4 U	0.4 U	0.41 U	0.4 U
Benzo(k)fluoranthene	0.4 U	0.4 U	0.41 U	0.4 U
Chrysene	0.4 U	0.4 U	0.41 U	0.4 U
Dibenzo(a,h)anthracene	0.4 U	0.4 U	0.41 U	0.4 U
Fluoranthene	0.4 U	0.4 U	0.41 U	0.4 U
Fluorene	0.8 U	0.81 U	0.82 U	0.8 U
Indeno(1,2,3-c,d)pyrene	0.4 U	0.4 U	0.41 U	0.4 U
Naphthalene	0.8 U	0.81 U	0.82 U	0.8 U
Phenanthrene	0.4 U	0.4 U	0.41 U	0.4 U
Pyrene	0.4 U	0.4 U	0.41 U	0.4 U
<b>Benzothiazole</b>	0.42 U	0.41 U	0.42 U	0.39 U
<b>Metals</b>				
Cadmium	0.41 U	0.43 U	0.41 U	0.41 U
Chromium	1.1	1.7	1 U	1 U
Copper	2.1 U	2.1 U	2.1 U	2 U
Iron	10 U	11 U	10 U	10 U
Lead	1 U	1.1 U	1 U	1 U
Manganese	1.6 U	1.6 U	1.5 U	1.5 U
Nickel	2.1 U	2.1 U	2.1 U	2 U
Silver	1 U	1.1 U	1 U	1 U
Tin	10 U	11 U	10 U	10 U
Zinc	2.1 U	2.1 U	83	2 U

Appendix B-1d  
Mullaly Park - Background  
New York, NY

* Sample ID :	MPT6	MPT11
Sample Name:	Mullaly Park Turf Background	Mullaly Park Turf Field Background
Sample Date :	08/26/08	08/27/08
* Sample Type :	Air	Air
Lab ID :	280801650-16	280801650-5
Duplicate :		
<b>CONSTITUENTS</b>		
<b>VOCs</b>		
4,Methyl-2-pentanone	2 U	2 U
Acetone	11	10
Acetonitrile	0.84 U	0.84 U
Acrylonitrile	1.1 U	1.1 U
Benzene	1.6 U	1.6 U
Benzyl Chloride	3.7 U	3.7 U
Bromodichloromethane	3.3 U	3.3 U
Bromoethane	2.2 U	2.2 U
Bromoethene	2.2 U	2.2 U
Bromoform	5.2 U	5.2 U
Bromomethane	1.9 U	1.9 U
Butadiene, 1,3-	1.1 U	1.1 U
Butanone, 2- (MEK)	1.5 U	1.5 U
Carbon disulfide	1.6 U	1.6 U
Carbon Tetrachloride	3.1 U	3.1 U
Chlorobenzene	2.3 U	2.3 U
Chloroethane	1.3 U	1.3 U
Chloroform	2.4 U	2.4 U
Chloromethane	1 U	1 U
Chloropropene, 3-	1.6 U	1.6 U
Chlorotoluene, 2-	2.6 U	2.6 U
Cyclohexane	1.7 U	1.7 U
Dibromochloromethane	4.3 U	4.3 U
Dibromoethane, 1,2-	3.8 U	3.8 U
Dichlorobenzene, 1,2-	3 U	3 U
Dichlorobenzene, 1,3-	3 U	3 U
Dichlorobenzene, 1,4-	3 U	3 U
Dichloroethane, 1,1-	2 U	2 U
Dichloroethane, 1,2-	2 U	2 U
Dichloroethene, 1,1-	2 U	2 U
Dichloroethene, cis- 1,2-	2 U	2 U
Dichloroethene, trans-1,2-	2 U	2 U
Dichloropropane, 1,2-	2.3 U	2.3 U
Dichloropropene, cis-1,3-	2.3 U	2.3 U
Dichloropropene, trans-1,3-	2.3 U	2.3 U
Dioxane, 1,4-	1.8 U	1.8 U
Ethanol	8.9	6.7
Ethyl acetate	1.8 U	1.8 U
Ethylbenzene	2.2 U	2.2 U
Ethyltoluene, 4-	2.5 U	2.5 U
Freon 11 (Trichlorofluoromethane)	2.8 U	2.8 U
Freon 113 (1,1,2 Trichlorotrifluoroethane)	3.8 U	3.8 U
Freon 114 (1,2 Dichlorotetrafluoroethane)	3.5 U	3.5 U
Freon 12 (Dichlorodifluoromethane)	2.5 U	2.5 U
Heptane, n-	2 U	2 U
Hexachloro-1,3-butadiene	5.3 U	5.3 U
Hexane, n-	1.8 U	1.8 U
Hexanone, 2-	2 U	2 U
Isopropyl alcohol	3.7 U	3.7 U
Methylene chloride	5.2 U	6.9
Methyl-tert-butyl ether	1.8 U	1.8 U
Propylene	1.7 U	1.7 U
Styrene	2.1 U	2.1 U
Tertiary butyl alcohol	1.5 U	1.5 U
Tetrachloroethane, 1,1,2,2-	3.4 U	3.4 U
Tetrachloroethene	3.4 U	3.4 U
Tetrahydrofuran	1.5 U	1.5 U
Toluene	2	1.9 U
Trichlorobenzene, 1,2,4-	3.7 U	3.7 U
Trichloroethane, 1,1,1-	2.7 U	2.7 U
Trichloroethane, 1,1,2-	2.7 U	2.7 U
Trichloroethene	2.7 U	2.7 U
Trimethylbenzene, 1,2,4-	2.5 U	2.5 U
Trimethylbenzene, 1,3,5-	2.5 U	2.5 U
Trimethylpentane, 2,2,4-	2.3 U	2.3 U
Vinyl acetate	1.8 U	1.8 U
Vinyl chloride	1.3 U	1.3 U
Xylene (ortho)	2.2 U	2.2 U
Xylene (para & meta)	2.2 U	2.2 U

Appendix B-1d  
Mullaly Park - Background  
New York, NY

* Sample ID :	MPT6	MPT11
Sample Name:	Mullaly Park Turf Background	Mullaly Park Turf Field Background
Sample Date :	08/26/08	08/27/08
* Sample Type :	Air	Air
Lab ID :	280801650-16	280801650-5
Duplicate :		
<b>SVOCs</b>		
Acenaphthene	0.81 U	0.8 U
Acenaphthylene	0.81 U	0.8 U
Anthracene	0.81 U	0.8 U
Benzo(a)anthracene	0.4 U	0.4 U
Benzo(a)pyrene	0.4 U	0.4 U
Benzo(b)fluoranthene	0.4 U	0.4 U
Benzo(e)pyrene	0.4 U	0.4 U
Benzo(g,h,i)perylene	0.4 U	0.4 U
Benzo(k)fluoranthene	0.4 U	0.4 U
Chrysene	0.4 U	0.4 U
Dibenzo(a,h)anthracene	0.4 U	0.4 U
Fluoranthene	0.4 U	0.4 U
Fluorene	0.81 U	0.8 U
Indeno(1,2,3-c,d)pyrene	0.4 U	0.4 U
Naphthalene	0.81 U	0.8 U
Phenanthrene	0.4 U	0.4 U
Pyrene	0.4 U	0.4 U
<b>Benzothiazole</b>	0.4 U	0.39 U
<b>Metals</b>		
Cadmium	0.39 U	0.39 U
Chromium	1.8	1.2
Copper	1.9 U	1.9 U
Iron	9.7 U	9.7 U
Lead	0.97 U	0.97 U
Manganese	1.4 U	1.4 U
Nickel	1.9 U	1.9 U
Silver	0.97 U	0.97 U
Tin	9.7 U	9.7 U
Zinc	1.9 U	1.9 U



Appendix B-1e  
 Thomas Jefferson Park - Background  
 New York, NY

* Sample ID :	TJ1	TJ14
Sample Name:	Thomas Jefferson Turf Background	Thomas Jefferson Turf Background
Sample Date :	08/25/08	08/28/08
* Sample Type :	Air	Air
Lab ID :	280801650-18	280801650-1
Duplicate :		
<b>CONSTITUENTS</b>		
<b>VOCs</b>		
4,Methyl-2-pentanone	2 U	2 U
Acetone	8.9	9
Acetonitrile	0.84 U	0.84 U
Acrylonitrile	1.1 U	1.1 U
Benzene	1.6 U	1.6 U
Benzyl Chloride	3.7 U	3.7 U
Bromodichloromethane	3.3 U	3.3 U
Bromoethane	2.2 U	2.2 U
Bromoethene	2.2 U	2.2 U
Bromoform	5.2 U	5.2 U
Bromomethane	1.9 U	1.9 U
Butadiene, 1,3-	1.1 U	1.1 U
Butanone, 2- (MEK)	1.5 U	1.5 U
Carbon disulfide	1.6 U	1.6 U
Carbon Tetrachloride	3.1 U	3.1 U
Chlorobenzene	2.3 U	2.3 U
Chloroethane	1.3 U	1.3 U
Chloroform	2.4 U	2.4 U
Chloromethane	1 U	1
Chloropropene, 3-	1.6 U	1.6 U
Chlorotoluene, 2-	2.6 U	2.6 U
Cyclohexane	1.7 U	1.7 U
Dibromochloromethane	4.3 U	4.3 U
Dibromoethane, 1,2-	3.8 U	3.8 U
Dichlorobenzene, 1,2-	3 U	3 U
Dichlorobenzene, 1,3-	3 U	3 U
Dichlorobenzene, 1,4-	3 U	3 U
Dichloroethane, 1,1-	2 U	2 U
Dichloroethane, 1,2-	2 U	2 U
Dichloroethene, 1,1-	2 U	2 U
Dichloroethene, cis- 1,2-	2 U	2 U
Dichloroethene, trans-1,2-	2 U	2 U
Dichloropropane, 1,2-	2.3 U	2.3 U
Dichloropropene, cis-1,3-	2.3 U	2.3 U
Dichloropropene, trans-1,3-	2.3 U	2.3 U
Dioxane, 1,4-	1.8 U	1.8 U
Ethanol	6.2	8
Ethyl acetate	1.8 U	1.8 U
Ethylbenzene	2.2 U	2.2 U
Ethyltoluene, 4-	2.5 U	2.5 U
Freon 11 (Trichlorofluoromethane)	2.8 U	2.8 U
Freon 113 (1,1,2 Trichlorotrifluoroethane)	3.8 U	3.8 U
Freon 114 (1,2 Dichlorotetrafluoroethane)	3.5 U	3.5 U
Freon 12 (Dichlorodifluoromethane)	2.5 U	2.5 U
Heptane, n-	2 U	2 U
Hexachloro-1,3-butadiene	5.3 U	5.3 U
Hexane, n-	1.8 U	1.8 U
Hexanone, 2-	2 U	2 U
Isopropyl alcohol	3.7 U	3.7 U
Methylene chloride	5.2 U	5.2 U
Methyl-tert-butyl ether	1.8 U	1.8 U
Propylene	1.7 U	1.7 U
Styrene	2.1 U	2.1 U
Tertiary butyl alcohol	1.5 U	1.5 U
Tetrachloroethane, 1,1,2,2-	3.4 U	3.4 U
Tetrachloroethene	3.4 U	3.4 U
Tetrahydrofuran	1.5 U	1.5 U
Toluene	1.9 U	1.9 U
Trichlorobenzene, 1,2,4-	3.7 U	3.7 U
Trichloroethane, 1,1,1-	2.7 U	2.7 U
Trichloroethane, 1,1,2-	2.7 U	2.7 U
Trichloroethene	2.7 U	2.7 U
Trimethylbenzene, 1,2,4-	2.5 U	2.5 U
Trimethylbenzene, 1,3,5-	2.5 U	2.5 U
Trimethylpentane, 2,2,4-	2.3 U	2.3 U
Vinyl acetate	1.8 U	1.8 U
Vinyl chloride	1.3 U	1.3 U
Xylene (ortho)	2.2 U	2.2 U
Xylene (para & meta)	2.2 U	2.2 U

Appendix B-1e  
 Thomas Jefferson Park - Background  
 New York, NY

* Sample ID :	TJ1	TJ14
Sample Name:	Thomas Jefferson Turf Background	Thomas Jefferson Turf Background
Sample Date :	08/25/08	08/28/08
* Sample Type :	Air	Air
Lab ID :	280801650-18	280801650-1
Duplicate :		
<b>VOC TICs</b>		
Nonanal	5.81 J	
<b>SVOCs</b>		
Acenaphthene	0.51 U	0.77 U
Acenaphthylene	0.51 U	0.77 U
Anthracene	0.51 U	0.77 U
Benzo(a)anthracene	0.26 U	0.39 U
Benzo(a)pyrene	0.26 U	0.39 U
Benzo(b)fluoranthene	0.26 U	0.39 U
Benzo(e)pyrene	0.26 U	0.39 U
Benzo(g,h,i)perylene	0.26 U	0.39 U
Benzo(k)fluoranthene	0.26 U	0.39 U
Chrysene	0.26 U	0.39 U
Dibenzo(a,h)anthracene	0.26 U	0.39 U
Fluoranthene	0.26 U	0.39 U
Fluorene	0.51 U	0.77 U
Indeno(1,2,3-c,d)pyrene	0.26 U	0.39 U
Naphthalene	0.51 U	0.77 U
Phenanthrene	0.26 U	0.39 U
Pyrene	0.26 U	0.39 U
<b>Benzothiazole</b>	0.26 U	0.38 U
<b>Metals</b>		
Cadmium	0.33 U	0.38 U
Chromium	0.96	1.1
Copper	1.6 U	1.9 U
Iron	8.1 U	9.5 U
Lead	0.81 U	0.95 U
Manganese	1.2 U	1.4 U
Nickel	1.6 U	1.9 U
Silver	0.81 U	0.95 U
Tin	8.1 U	9.5 U
Zinc	1.6 U	1.9 U

**Table B-2**  
**Summary Crumb Rubber Results for Detected Analytes**

Analytes	Synthetic Turf Fields (Concentration Range)	Soil Cleanup Objective†
	(mg/kg)	(mg/kg)
<b>Volatile and Semi-Volatile Organic Compounds (VOCs and SVOCs)</b> (Of 77 organic compounds tested, one was detected)		
Naphthalene	0.216	100
<b>Metals</b> (Of eight metals tested, six were detected)		
Arsenic	0.768	16
Barium	0.96 - 4.87	400
Cadmium	0.23 - 1.3	4.3
Chromium	0.888	110
Lead	5.9 - 409*	400
Zinc	1,810 - 13,100*	10,000
<p>*Measurement exceeded NYS DEC soil cleanup objective.</p> <p>†NYS DEC, 2006. 6NYCRR Part 375-6-8. Soil Cleanup Objective Tables for restricted residential land uses.  <a href="http://www.dec.ny.gov/regs/15507.html#15517">http://www.dec.ny.gov/regs/15507.html#15517</a>.</p>		

Appendix B-2a  
Mullaly Park - Bulk Crumb Rubber  
New York, NY

	<b>Mullaly Park</b>	<b>Blank</b>
* Sample ID :		
* Sample Depth :		
Sample Date :	08/26/08	
* Sample Type :	Crumb Rubber	
Lab ID :	SA-83958-2	8090301-BLK1
<b>CONSTITUENTS</b>		
<b>VOCs and SVOCs (ug/kg)</b>		
Acetone	1340 U	10 U
Acrylonitrile	67.1 U	1 U
Benzene	134 U	1 U
Bromobenzene	134 U	1 U
Bromochloromethane	134 U	1 U
Bromodichloromethane	67.1 U	1 U
Bromoform	134 U	1 U
Bromomethane	268 U	2 U
Butanone, 2- (MEK)	1340 U	10 U
Butylbenzene, sec-	134 U	1 U
Butylbenzene, tert-	134 U	1 U
Butylbenzene, n-	134 U	1 U
Carbon disulfide	671 U	5 U
Carbon tetrachloride	134 U	1 U
Chlorobenzene	134 U	1 U
Chloroethane	268 U	2 U
Chloroform	134 U	1 U
Chloromethane	268 U	2 U
Chlorotoluene, 2-	134 U	1 U
Chlorotoluene, 4-	134 U	1 U
Dibromo-3-chloropropane, 1,2-	268 U	2 U
Dibromochloromethane	67.1 U	1 U
Dibromoethane, 1,2-	67.1 U	1 U
Dibromomethane	134 U	1 U
Dichlorobenzene, 1,2-	134 U	1 U
Dichlorobenzene, 1,3-	134 U	1 U
Dichlorobenzene, 1,4-	134 U	1 U
Dichlorodifluoromethane (Freon 12)	268 U	2 U
Dichloroethane, 1,2-	134 U	1 U
Dichloroethane, 1,1-	134 U	1 U
Dichloroethene, 1,1-	134 U	1 U
Dichloroethene, cis-1,2-	134 U	1 U
Dichloroethene, trans-1,2-	134 U	1 U
Dichloropropane, 1,2-	134 U	1 U
Dichloropropane, 1,3-	134 U	1 U
Dichloropropane, 2,2-	134 U	1 U
Dichloropropene, 1,1-	134 U	1 U
Dichloropropene, cis-1,3-	67.1 U	1 U
Dichloropropene, trans-1,3-	67.1 U	1 U
Di-isopropyl ether	134 U	1 U
Dioxane, 1,4-	2680 U	20 U
Ethanol	53700 U	400 U
Ethyl ether	134 U	1 U
Ethyl tert-butyl ether	134 U	1 U
Ethylbenzene	134 U	1 U
Hexachlorobutadiene	67.1 U	1 U
Hexanone, 2- (MBK)	1340 U	10 U
Isopropylbenzene	134 U	1 U
Isopropyltoluene, 4-	134 U	1 U
Methyl tert-butyl ether	134 U	1 U
Methyl-2-pentanone, 4- (MIBK)	1340 U	10 U
Methylene Chloride	671 U	10 U
Naphthalene	134 U	1 U
Propylbenzene, n-	134 U	1 U
Styrene	134 U	1 U
Tert-amyl methyl ether	134 U	1 U
Tert-Butanol/butyl alcohol	1340 U	10 U
Tetrachloroethane, 1,1,1,2-	134 U	1 U
Tetrachloroethane, 1,1,2,2-	67.1 U	1 U
Tetrachloroethene	134 U	1 U
Tetrahydrofuran	1340 U	10 U
Toluene	134 U	1 U
trans-1,4-Dichloro-2-butene	671 U	5 U
Trichlorobenzene, 1,2,3-	134 U	1 U
Trichlorobenzene, 1,2,4-	134 U	1 U
Trichlorobenzene, 1,2,5-	134 U	1 U
Trichloroethane, 1,1,1-	134 U	1 U
Trichloroethane, 1,1,2-	134 U	1 U
Trichloroethene	134 U	1 U
Trichlorofluoromethane	134 U	1 U
Trichloropropane, 1,2,3-	134 U	1 U
Trichlorotrifluoroethane, 1,1,2-	134 U	1 U
Trimethylbenzene, 1,2,4-	134 U	1 U
Trimethylbenzene, 1,3,5-	134 U	1 U
Vinyl chloride	134 U	1 U
Xylene, m,p-	268 U	2 U
Xylene, o-	134 U	1 U

Appendix B-2a  
Mullaly Park - Bulk Crumb Rubber  
New York, NY

	<b>Mullaly Park</b>	<b>Blank</b>
* Sample ID :		
* Sample Depth :		
Sample Date :	08/26/08	
* Sample Type :	Crumb Rubber	
Lab ID :	SA-83958-2	8090301-BLK1
<b>Total Metals (mg/kg)</b>		
Arsenic	0.225 U	
Barium	0.956	
Cadmium	0.231	
Chromium	0.15 U	
Lead	5.95	
Selenium	0.225 U	
Silver	0.225 U	
Zinc	1810	

Appendix B-2b  
 Thomas Jefferson Park - Bulk Crumb Rubber  
 New York, NY

	Thomas Jefferson	Blank
* Sample ID :		
* Sample Depth :	0-2'	
Sample Date :	08/25/08	
* Sample Type :	Crumb Rubber	
Lab ID :	SA-83958-2	8090301-BLK1
<b>CONSTITUENTS</b>		
<b>VOCs and SVOCs (ug/kg)</b>		
Acetone	2060 U	10 U
Acrylonitrile	206 U	1 U
Benzene	206 U	1 U
Bromobenzene	206 U	1 U
Bromochloromethane	206 U	1 U
Bromodichloromethane	206 U	1 U
Bromoform	206 U	1 U
Bromomethane	412 U	2 U
Butanone, 2- (MEK)	2060 U	10 U
Butylbenzene, sec-	206 U	1 U
Butylbenzene, tert-	206 U	1 U
Butylbenzene, n-	206 U	1 U
Carbon disulfide	1030 U	5 U
Carbon tetrachloride	206 U	1 U
Chlorobenzene	206 U	1 U
Chloroethane	412 U	2 U
Chloroform	206 U	1 U
Chloromethane	412 U	2 U
Chlorotoluene, 2-	206 U	1 U
Chlorotoluene, 4-	206 U	1 U
Dibromo-3-chloropropane, 1,2-	412 U	2 U
Dibromochloromethane	206 U	1 U
Dibromoethane, 1,2-	206 U	1 U
Dibromomethane	206 U	1 U
Dichlorobenzene, 1,2-	206 U	1 U
Dichlorobenzene, 1,3-	206 U	1 U
Dichlorobenzene, 1,4-	206 U	1 U
Dichlorodifluoromethane (Freon 12)	412 U	2 U
Dichloroethane, 1,2-	206 U	1 U
Dichloroethane, 1,1-	206 U	1 U
Dichloroethene, 1,1-	206 U	1 U
Dichloroethene, cis-1,2-	206 U	1 U
Dichloroethene, trans-1,2-	206 U	1 U
Dichloropropane, 1,2-	206 U	1 U
Dichloropropane, 1,3-	206 U	1 U
Dichloropropane, 2,2-	206 U	1 U
Dichloropropene, 1,1-	206 U	1 U
Dichloropropene, cis-1,3-	206 U	1 U
Dichloropropene, trans-1,3-	206 U	1 U
Di-isopropyl ether	206 U	1 U
Dioxane, 1,4-	4120 U	20 U
Ethanol	82500 U	400 U
Ethyl ether	206 U	1 U
Ethyl tert-butyl ether	206 U	1 U
Ethylbenzene	206 U	1 U
Hexachlorobutadiene	206 U	1 U
Hexanone, 2- (MBK)	2060 U	10 U
Isopropylbenzene	206 U	1 U
Isopropyltoluene, 4-	206 U	1 U
Methyl tert-butyl ether	206 U	1 U
Methyl-2-pentanone, 4- (MIBK)	2060 U	10 U
Methylene Chloride	2060 U	10 U
Naphthalene	216	1 U
Propylbenzene, n-	206 U	1 U
Styrene	206 U	1 U
Tert-amyl methyl ether	206 U	1 U
Tert-Butanol/butyl alcohol	2060 U	10 U
Tetrachloroethane, 1,1,1,2-	206 U	1 U
Tetrachloroethane, 1,1,2,2-	206 U	1 U
Tetrachloroethene	206 U	1 U
Tetrahydrofuran	2060 U	10 U
Toluene	206 U	1 U
trans-1,4-Dichloro-2-butene	1030 U	5 U
Trichlorobenzene, 1,2,3-	206 U	1 U
Trichlorobenzene, 1,2,4-	206 U	1 U
Trichlorobenzene, 1,2,5-	206 U	1 U
Trichloroethane, 1,1,1-	206 U	1 U
Trichloroethane, 1,1,2-	206 U	1 U
Trichloroethene	206 U	1 U
Trichlorofluoromethane	206 U	1 U
Trichloropropane, 1,2,3-	206 U	1 U
Trichlorotrifluoroethane, 1,1,2-	206 U	1 U
Trimethylbenzene, 1,2,4-	206 U	1 U
Trimethylbenzene, 1,3,5-	206 U	1 U
Vinyl chloride	206 U	1 U
Xylene, m,p-	412 U	2 U
Xylene, o-	206 U	1 U

Appendix B-2b  
Thomas Jefferson Park - Bulk Crumb Rubber  
New York, NY

	<b>Thomas Jefferson</b>	<b>Blank</b>
* Sample ID :		
* Sample Depth :	0-2'	
Sample Date :	08/25/08	
* Sample Type :	Crumb Rubber	
Lab ID :	SA-83958-2	8090301-BLK1
<b>Total Metals (mg/kg)</b>		
Arsenic	0.768 J	
Barium	4.87	
Cadmium	1.3	
Chromium	0.888 J	
Lead	409	
Selenium	1.5 U	
Silver	1.5 U	
Zinc	13,100	

**Table B-3**  
**Summary of Temperature Measurements**

	Ambient Air Temp Range (°F)	Surface Temp Range (°F)
<b>Synthetic Turf Fields</b>		
Mullaly Park Synthetic Turf Field	83 - 87.4	96.7 - 120.8
Thomas Jefferson Park Synthetic Turf Field	79.1 - 84.5	91.9 - 129.1
<b>Background Grass/Upwind</b>		
Mullaly Park Background Grass Field	79.1 - 93.8	87.5 - 110.7
Mullaly Park Upwind Background (Grass)	79.1 - 93.8	91.2 - 110.2
Thomas Jefferson Park Upwind Background (Grass)	79.1 - 84.5	80.5 - 106.6

Temperature readings were obtained with a Kestral 4500 Pocket Weather Tracker every 10 minutes over an approximate 90 minute period.



Table B-3a  
 Surface Temperatures  
 Mullaly Park - 08/26/08  
 New York, NY

Station 4 - Grass Field		Station 5 - Grass Field		Station 6 - Background		Station 7 - Turf Field		Station 8 - Turf - Field	
Time	Temperature °F	Time	Temperature °F	Time	Temperature °F	Time	Temperature °F	Time	Temperature °F
12:40	94.4	12:35	87.5	3:13	104.6	3:10	113.2	3:06	120.3
12:50	107.5	12:52	102.7	3:26	108.5	3:21	120.8	3:24	114.5
1:00	98.6	1:04	97.5	3:37	110.2	3:32	119.9	3:35	115.8
1:10	98.4	1:13	99.8	3:47	98.8	3:43	105.7	3:45	105.5
1:22	96.7	1:25	97.7	3:56	96.8	4:02	107.7	4:04	120.4
1:33	105.2	1:37	102.3	4:14	102.7	4:13	96.7	4:11	113.1
1:42	104.6	1:45	99.8	4:30	106.1	4:27	103.1	4:28	108.1
1:54	101.3	2:01	104.7			4:40	105.3		
2:15	110.7	2:16	100.5						
	101.9		99.2		104.0		109.1		114.0

Table B-3b  
 Surface Temperatures  
 Mullaly Park - 08/27/08  
 New York, NY

Station 9 - Grass Field		Station 10 - Grass Field		Station 11 - Background		Station 12 - Turf Field		Station 13 - Turf - Field	
Time	Temperature °F	Time	Temperature °F	Time	Temperature °F	Time	Temperature °F	Time	Temperature °F
12:15	102.3	12:15	98.3	2:40	105.7	2:35	110.2	2:33	104.2
12:33	103.8	12:35	98.5	3:05	107.2	3:03	112.5	3:01	108.7
12:43	100.2	12:45	98.1	3:25	104.4	3:22	111.8	3:20	109.7
1:00	107.1	1:03	102.9	3:49	101.9	3:46	103.6	3:43	107.4
1:17	108.4	1:19	99.1	4:14	99.7	4:11	101.5	4:08	107.2
1:45	98.9	1:48	92.5	4:22	91.2	4:21	99.8	4:19	100.1
Average	103.5		98.2		101.7		106.6		106.2

Table B-3c  
 Surface Temperatures  
 Thomas Jefferson Park - 08/25/08  
 New York, NY

Station 1 - Background		Station 2 - Turf Field		Station 3 - Turf - Field	
Time	Temperature °F	Time	Temperature °F	Time	Temperature °F
11:20	88.3	11:00	92.9	11:15	104.2
11:34	86.5	11:18	100.8	11:30	97.5
12:47	92.7	11:35	94.6	12:35	114.8
1:07	88.2	12:45	112.3	12:43	112.5
1:20	92.2	1:02	107.5	12:59	110
1:39	91.7	1:17	108.1	1:15	102.3
1:55	88.9	1:35	107.8	1:33	113.4
2:01	106.6	1:52	96.4	1:49	97
2:20	92.2	2:04	106.8	2:07	91.9
		2:20	111.7	2:15	102.8
Average	91.9		103.0		104.8

Table B-3d  
 Surface Temperatures  
 Thomas Jefferson Park - 08/28/08  
 New York, NY

Station 14 - Background		Station 15 - Turf Field		Station 16 - Turf - Field	
Time	Temperature °F	Time	Temperature °F	Time	Temperature °F
12:22	104.3	12:18	122.5	12:16	129.1
12:41	95.6	12:37	100.6	12:39	122
1:10	80.5	1:03	121.8	1:00	121.7
1:25	94.2	1:21	120.9	1:19	112.4
1:50	104.6	1:46	125.6	1:44	124.6
Average	95.8		118.3		122.0

## **APPENDIX C**

# **SAMPLING WORKSHEETS**

Site Name Mullary Park Date 8-26-08

Type of Field Turf Age of Field < 1 yr

Field Description \_\_\_\_\_  
 \_\_\_\_\_

Ambient Temperature at start 87.4 ending 83.0

RH start 23.4 ending 26.3

Winds speed start 2.2 wind speed ending 2.0

Wind direction start SW wind direction ending SW

Weather conditions Sunny, clear sky

Data Interpretation \_\_\_\_\_

Sample 7 DT R638 14:39 / Sample 8 - R5751

Sample Location ID	Pump #	Start Time	Start Calibration	End Time	End Calibration
MPT6B1	4	2:50	2.017	4:52	2.050
MPT6C	6	2:50	2.051	4:52	2.026
MPT6D	15	2:50	4.068	4:52	4.422
MPT7B1	2	2:45	2.020	4:43	2.081
MPT7C1	1	2:45	2.054	4:43	2.087
MPT7D	7	2:45	4.015	4:43	4.188
MPT8C1	5	2:48	2.078	4:47	1.958
MPT8B1	3	2:48	2.047	4:47	1.969
MPT8D	10	2:48	4.078	4:47	4.110

SW corner of field

center field

Site Name Mullary ~~Field~~ Park Date 8-27-08

Type of Field Turf Field Age of Field 41

Field Description

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Ambient Temperature at start 84.6 ending 83.7

RH start 26.8 ending ~~27~~ 30.6

Winds speed start 2.2 wind speed ending 2.1

Wind direction start SE wind direction ending S

Weather conditions Sunny, clear sky

Data Interpretation

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Sample Location ID	Pump #	Start Time	Start Calibration	End Time	End Calibration
MPT11B1	5	2:26	2.020	4:33	1.915
MPT11C1	6	2:26	2.032	4:33	2.047
MPT11D	99	2:26	4.035	4:33	4.118
MPT12D	10	2:25	4.073	4:30	<del>4.033</del> 4.033
MPT12B1	2	2:25	2.055	4:30	2.064
MPT12C1	1	2:25	2.034	4:30	2.901
MPT13D	8	2:22	4.066	4:28	4.089
MPT13C1	3	2:22	2.039	4:28	1.923
MPT13B1	4	2:22	2.029	4:28	2.006

DT  
R6392

R6038

5751







Site Name Thomas Jefferson Date 8-25-08

Type of Field Turf Age of Field 73

Field Description :

~10 people played on the field during monitoring, green turf field  
no observable odors during testing hours, background sample in the park bt FDR+ Field

Ambient Temperature at start 79.1 ending 84.5

RH start 64.7% ending \_\_\_\_\_

Winds speed start 0.0 - 1.0 wind speed ending 2.6

Wind direction start NE wind direction ending \_\_\_\_\_

Weather conditions overcast, cloudy → rain → sunny → overcast

Data Interpretation traffic on the (W), playground on the (E)

Sample Location ID	Pump #	<del>Start Time</del> Start Cali	<del>Start Calibration</del> Stop time Cali	<del>End Time</del> 2nd start cali	<del>End Calibration</del> End time - Cali
TJ1C	2	10:34 2.010	11:43 2.002	12:29 2.014	2:34 1.965
TJ1B	3	10:34 2.005	11:43 2.001	12:28 2.021	2:34 1.999
TJ1D	9	10:34 4.013	11:43 3.926	—	2:35 3.926
TJ2C	4	10:29 2.043	11:37 2.038	12:20 2.050	2:29 - 1.992
TJ2B	5	10:29 2.000	11:37 1.987	12:19 2.005	2:30 - 1.941
TJ2D	8	10:29 4.048	11:37 4.029	12:22 4.066	2:28 - 4.015
TJ3B	1	10:27 2.108	11:37 2.005	12:15 2.061	2:23 - 1.975
TJ3C	6	10:27 2.053	11:37 2.082	12:17 1.945	2:25 - 1.962
TJ3D	7	10:27 4.072	11:37 4.038	12:18 4.034	2:26 - 3.957
TJ1D	99	12:27 4.020	1:49 3.915	—	2:30 - 3.915

Site Name Thomas Jefferson field Date 8-28-08

Type of Field Turf field Age of Field 73

Field Description

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Ambient Temperature at start 81.1 ending 81.9

RH start 42.5 ending 20.7

Winds speed start 1.8 wind speed ending 2.7

Wind direction start E wind direction ending E

Weather conditions Sunny, clear sky

Data Interpretation Kids play on w side of field

Sample Location ID	Pump #	Start Time	Start Calibration	End Time	End Calibration
TJ14B1	5	11:40	4.029	1:54	1.848
TJ14C1	6	11:40	2.009	1:54	1.964
TJ14D	10	11:40	2.025	1:54	3.839
TJ15C1	1	11:48	2.070	2:00	2.016
TJ15B1	2	11:48	2.052	2:00	1.977
TJ15D	7	11:48	4.061	2:00	4.232
TJ16B1	3	11:55	2.053	2:05	1.941
TJ16C1	4	11:55	2.053	2:05	1.954
TJ16D	8	11:55	4.065	2:05	3.872

Temp 79°

DT  
6392

T123  
DT  
6038

5751