Review For the Necessity of Granular Activated Carbon Units on the Influent Air Stream

Mr. C's Dry Cleaners Site
NYSDEC Site #9-15-157
East Aurora, New York

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Prepared for:
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1.1 Purpose

The purpose of this study is to determine the necessity of the granular activated carbon units on the treatment of the discharged air after the air stripping unit treatment system and prior to the granular activated carbon (GACs) at the Mr. C's Dry Cleaners Site.

The evaluation of data and elimination of the GAC units is to provide additional relief, if acceptable for safety concerns and to provide increased access in the performance of operations and maintenance inside the treatment building.

1.2 Site Location and Description

The Mr. C's Dry Cleaners site is located at 586 Main Street in the Village of East Aurora in Erie County, New York (Figure 1-1). The site is located on an approximately ½-acre parcel in a mixed-use area of residential, municipal and light commercial properties. The building that houses the Mr. C's Dry Cleaners is a one story building on a concrete slab foundation with an adjacent paved parking lot. Mr. C's Dry Cleaners occupies the front portion of the building along Main Street and the remainder of the building is occupied by various other commercial businesses. Refer to Figure 1-2 for a site location map.

1.3 General Background

Ecology and Environment Engineering, P.C. (EEEPC) has monthly operations and maintenance reporting since the system began treatment operations in October 2002. For the basis of this evaluation analytical data is being evaluated for the past eleven months (October 2003 to August 2004). The data was analyzed for volatile organic compounds (VOCs) from samples collected every month during normal operating conditions from the air stripping unit inside the treatment building.

The treatment system was constructed in 2001 to 2002 to treat contaminated groundwater from prior leaks and spills resulting from handling operations at the Mr. C's Dry Cleaners. The system is comprised of eight groundwater pumping wells located west and downgradient of the treatment building. The average pumping rate from the groundwater pumping system is approximately 80 to 110 gallons per minute. The pumped groundwater is stored in an equalization holding tank and pumped to the stripping tower to release or strip the VOCs from the contaminated groundwater. The VOCs in the air stream flow by fans or blowers and then processed through two-6200 lb. GAC canisters filled with granular vapor phase carbon connected in series. The vapor phase carbon is used to strip VOCs from the air stream for discharge of the effluent air into the atmosphere. The effluent from the GAC units is then exhausted through a single point source located on the roof of the treatment building.

The analytical data used for this evaluation was collected and reported in the monthly O&M Reports for Mr. C's Dry Cleaners Site, Contract #D004180, Site #9-15-157, by EEEPC.

The VOC's that were consistently detected in the influent and effluent air samples were Benzene, cis-1, 2-Dichloroethene, Bromomethane, Tetrachlororoethene, Trichloroethene, and Trichlorofluoromethane. The detected limits are summarized in Table 1 and then were compared to New York State Air Guide-1 Guidelines For the Control of Toxic Ambient Air Contaminants, provided by the New York State Department of Environmental Conservation (NYSDEC), Division of Air Resources. These guidelines provide guidance for the control of toxic ambient air contaminants in New York State and outlines the procedures for evaluating sources of air pollution for those chemical contaminants directly addressed by New York State or federal regulations and those for which no State or federal ambient air quality standards exist (Air Guide-1). Air Guide-1 are not standards, but are to provide guidelines to make decisions based on the protection of public health and the environment.

2.1 Analytical Data

The monthly analytical data of contaminants found in the pre GAC air stream are recorded in Table 1 at the end of this report. The data was recorded from October 2003 to August 2004 from the monthly compliance sampling. The pre-GAC results refer to the analytical results taken in the influent air stream after the air stripper exhaust but before the GAC vessels. Pre-GAC analytical data has been provided as Attachment A. Since only 11 months of data were recorded the available data was factored for 12 months. The measurements are recorded in parts per billion of volume, or ppbv. Non-detect contaminants below the detection level have been assumed to be equal to zero.

Table 2 is the calculation of potential peak contaminant discharge on a short term basis as a result of the monthly compliance sampling. All air sampling was taken using Summa canisters for a 1-hour duration. Furthermore, the sampling assumes that all contaminants in the air stripper discharge or pre-GAC would discharge to stack located at the roof of the treatment building. Table 3 calculates potential annual air discharges using factored 12 months total volumes of contaminants. As mentioned above, the 11 months of analytical data were summarized and then factored for 12 months.

The annual averages were then compared to the Air Guide-1 Guidelines for those contaminants available. The Air Guide-1 Guidelines are provided in two concentrations: annual guideline concentrations (AGC) and short-term guideline concentrations (SGC). AGC refers to concentrations that are developed to protect the environment and public from long-term exposure to the chemical. The SGC refers to concentrations that are developed to evaluate short-term impacts that are safe to the environment and public based on the most restrictive occupational exposure limits. No SGC guidelines were provided for cis-1,2-Dichloroethene and no AGC guidelines were provided for Trichlorofluoromethane, therefore no comparison is applicable. Table 4 provides the comparisons for the short term and annual term results against the guidelines.

3.1 Summary

In comparing the short term guidelines against the 1 hour direct analytical results, Tetrachloroethene is the only contaminant that exceeds the NYSDEC DAR-1 concentration guidelines.

In comparing the AGC guidelines against the annual converted analytical results, Benzene, Bromomethane, Tetrachloroethene, and Trichloroethene exceed the NYSDEC DAR-1 concentration guidelines.

Table 1

Mr. C's Dry Cleaners Site Remediation

Site #9-15-157

Detected VOC's in Air Prior to Granular Actrivated Carbon (GAC) Treatment

GAC Influent Air Contaminants Detected Results [1]

Month-Year	Benzene (ppbv)	cis-1,2-Dichloroethene (ppbv)	Bromomethane (ppbv)	Tetrachloroethene (ppbv)	Trichlororethene (ppbv)	Trichlorofluoromethane (ppbv)
9/2003[2]	-	-	-	-	-	-
10/2003[3,5]	ND	ND	ND	144	5.34 J	ND
11/2003[3,5]	ND	1.46 J	ND	192	5.52	ND
12/2003[3,5]	ND	ND	ND	1400	127	ND
1/2004[3,5]	ND	ND	ND	713	ND	ND
2/2004[3,5]	ND	ND	ND	1100	68.8	ND
3/2004[3,5]	ND	2.66 J	ND	727	25.8 J	1.71 JB
4/2004[3,5]	ND	ND	ND	695	ND	ND
5/2004[3,5]	ND	ND	ND	681	20 J	3.42 JB
6/2004[3]	ND	ND	4.77 JB	726	20.9 J	2.56 JB
7/2004[3,5]	4.80 J	13.2 J	ND	1810	67.5 J	5.42 JB
8/2004[3]	ND	7.13 J	ND	1080	46.7	1.14 J
Annual Totals	**4.80**	**24.45**	**4.77**	**9,268.00**	**387.56**	**14.25**
Factored Annual Totals [4]	**5.24**	**26.67**	**5.20**	**10,110.55**	**422.79**	**15.55**

Footnotes:

1. Based on 11 months of operation
2. System shut down for month of September 2003 for transfer of operation and maintence to new contractor.
3. Operation and Maintenance performed by O&M Enterprises, Inc. Sampling and analysis performed by EEEPC.
4. Factoring the volume to 12 months of operation
5. Additional analytical dilution required by EEEPC ASC to quantify contaminant analytical results.

General Notes:

Assume analysis is equal to zero if results are noted as non-detect (ND) if below detection limits.
Analytical results based on 1-hour sampling taken with Summa canisters of the in-line air stream after the air stripper exhaust and prior to the GAC units.
J - Analyte detected below reporting limits
B - Analyte detected in the associated method blank

Table 2
Mr. C's Dry Cleaners Site
NYSDEC Site #9-15-158

Potential Short Term Contaminant Discharge
Pre-Granular Activated Carbon Unit Air Stream Evaluation

Compound	Molecular Weight (g/mol)	Estimated short-term Peak Intake[1] Concentration (ppbv)	Estimated short-term Peak Intake Concentration (ppmv)	Estimated short-term Peak Intake Concentration (ug/m^3)
Benzene	78.11	4.80	0.00480	15.59
Bromomethane	94.95	4.77	0.00477	18.83
cis-1,2-Dichloroethene	96.94	13.20	0.01320	53.21
Tetrachloroethene	165.83	1,810.00	1.81000	12,481.69
Trichloroethene	131.40	127.00	0.12700	693.95
Trichlorofluoromethane	137.38	5.42	0.00542	30.96

Ave. Monthly hours of operation = **336** Hours

Pressure, P = 1 atm = **1013** millibars

Assumed stack temp, T = 68 F = **293** K

Gas Constant, R = **0.08314** $mb*m^3/K*mol$

Notes
1. Peak intake values of each contaminant as noted from analytical reports from October 2003 to August 2004.
2. Peak intake values from taken from the Pre-GAC compliance sampling taken monthly.
3. Basis of sampling is taken from a 1-hour Summa canister sample taken monthly and analyzed using USEPA method TO-14A.
4. Assume the pre GAC discarge air concentration would equal the discharge stack concentration if GAC units removed.
5. average hours of monthly operation are based on batch operation with the air stripper.

$$\frac{\mu g}{m^3} = \frac{pM}{RT} * \quad \textit{concentration in ppm}$$

Where,
T is temperature in degrees Kelvin
p is pressure in millibars
R is the gas constant
M is the molecular weight

Table 3
Mr. C's Dry Cleaners Site
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Potential Annual Contaminant Discharge
Pre-Granular Activated Carbon Unit Air Stream Evaluation

Compound	Molecular Weight (g/mol)	Factored Annual Discharge Concentrations (ppbv)	Estimated Annual Discharge Concentrations (ppmv)	Estimated Annual Discharge Concentrations (ug/m^3)	Estimated Annual Discharge Concentrations (ug)	Estimated Annual Discharge Concentrations (mg)	Estimated Annual Total Discharge Point Source (Pre GAC) (lbs)
Benzene	78.11	5.24	0.0052	17.01	3.97E+06	3.97E+03	0.01
Bromomethane	94.95	5.20	0.0052	20.55	4.80E+06	4.80E+03	0.01
cis-1,2-Dichloroethene	96.94	26.67	0.0267	107.52	2.51E+07	2.51E+04	0.06
Tetrachloroethene	165.83	10,110.55	10.1105	69,721.94	1.63E+10	1.63E+07	35.88
Trichloroethene	131.40	422.79	0.4228	2,310.23	5.39E+08	5.39E+05	1.19
Trichlorofluoromethane	137.38	15.55	0.0155	88.81	2.07E+07	2.07E+04	0.05

Flowrate =	**408.79** scfm =	**11.58** m^3/min =	**694.62** m^3/hour
Ave. Monthly hours of operation =	**336** Hours		
Pressure, P =	1 atm =	**1013** millibars	
Assumed stack temp, T =	68 F =	**293** K	
Gas Constant, R =	**0.08314** mb*m^3/K*mol		

Notes
1. "J" values are included in above calculations.
2. "J" values are an estimated value indicating that the compound was detected by the laboratory below the practical quantitation limit, but above the method detection limit. The inital detection limits in the influent air ranged from 5 to 100. If samples were re-extracted based on estimated values, the detection limits ramged from 25 to 400. Analytical results were selected based the lowest detection limits or results which were not estimated.
3. Above calculations assume that non-detect (ND) values (<) = 0 ppbv
4. Flowrate calculated based on weekly readings from 6/04 - 8/04
5. Conversion from ppbv to ug/m3 based on the following equation below.
6. Assuming that blowers are only operating 50% of the total monthly reporting period time.

$$\frac{\mu g}{m^3} = \frac{pM}{RT} * \quad \textit{concentration in ppm}$$

Where,
T is temperature in degrees Kelvin
p is pressure in millibars
R is the gas constant
M is the molecular weight

Table 4
Mr. C's Dry Cleaners Site Remediation
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Comparison of Short-Term and Annual Air Results to Air Guide 1 Guidelines
VOCs Detected in Exhaust Pre-GAC

Compound	CAS Number	Peak Pre-GAC Intake Concentration (ug/m^3)	Air Guide 1 Guideline Concentrations - SGC (ug/m^3)	Estimated Annual Discharge Concentrations (ug/m^3)	Air Guide 1 Guideline Concentrations - AGC (ug/m^3)
Benzene	00071-43-2	15.59	1,300	17.01	0.13[6,8]
Bromomethane*	00074-83-9	18.83	3,900	20.55	1,900[7,2]
cis-1,2-Dichloroethene**	00156-59-2	53.21	-	107.52	5[6]
Tetrachloroethene***	00127-18-4	12,481.69	1,000[1,2,3]	69,721.94	1.0[1,2,3]
Trichloroethene****	000790-01-6	693.95	54,000[1,2]	2,310.23	0.50[1,2]
Trichlorofluoromethane	00075-69-4	30.96	560,000[5]	88.81	See notes 4 & 5 below

* Methyl Bromide
** cis – Dichloroethylene
*** Tetrachloroethylene
****Tricloroethylene

1- DAR-1 12/22/03 AGC/SGC Table Notes indicates NYSDOH derived AGC/SGC
2- DAR-1 12/22/03 AGC/SGC Table Notes indicates Moderate Toxicity Contaminant
3- DAR-1 12/22/03 AGC/SGC Table Notes indicates AGC equivalent to "one and million risk"
4- DAR-1 12/22/03 AGC/SGC Table Notes indicates there is no SGC/AGC value for this contaminant
5- DAR-1 12/22/03 AGC/SGC Table Notes indicates Low Toxicity Contaminant
6- DAR-112/22/03 AGC/SGC Table Notes indicates AGC based on EPS IRIS data
7- DAR-112/22/03 AGC/SGC Table Notes indicates AGC based on ACGIH TLV
8- DAR-1 12/22/03 AGC/SGC Table Notes indicates High Toxicity Contaminant

Attachment A

Mr. C's Dry Cleaners Site
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Pre GAC Analytical Results
October 2003 to August 2004