TETRA TECH, INC.

January 3, 2013

Dustin Johnson, P.E.
City of Bozeman
P.O. Box 1230
Bozeman, MT 59715

SUBJECT: Progress Report on Sampling and Analysis of Soil Gas
From Perimeter Methane Monitoring Wells BLG-3, 4, 5, and 10
Bozeman Landfill, Bozeman, Montana

Dear Mr. Johnson,

The following progress report summarizes results of sampling and analysis of soil gas from four perimeter methane monitoring wells (BLG-3, 4, 5, and 10) along the south property boundary of the Bozeman Landfill in October 2012. The location of the site is shown in **Figure 1** and the location of the wells is shown in **Figure 2**. Work was conducted in accordance with Task 2 of Task Order/ Proposal: Landfill Gas Extraction System Optimization and Environmental Monitoring Activities dated May 23, 2011. City of Bozeman approved of this Task Order on June 6, 2011.

The purpose of sampling and analysis of soil gas at these locations was to 1) assess the potential for soil gas to contain volatile organic compounds near the south boundary of the landfill and 2) evaluate the need to conduct additional investigation(s) to determine the potential for 'vapor intrusion' into nearby residential subgrade (or above grade) spaces. The Department of Environmental Quality (DEQ) recently published the *Montana Vapor Intrusion Guide*[1]. As quoted in the guide, "Vapor intrusion refers to the process by which volatile chemicals migrate from subsurface contaminant sources such as contaminated soils or groundwater, to the soil vapor phase, and into the indoor air of existing or future nearby or overlying structures."

The collection of samples was conducted on October 30, 2012 by Tetra Tech environmental scientist, Mark Pearson. Each well was purged of a minimum of one casing volume of air (before sampling) using a battery-operated *Gillian BDX Abatement Air Sampler* operating at approximately 2 liters per minute airflow. When purging was complete, a series of Luer® valves connected with Nylaflow® and Tygon® tubing were opened and closed while pulling the soil gas from the well valve fitting using a 60 milliliter polyethylene syringe. Samples were collected in Tedlar® bags connected to the valve/tubing configuration by repeatedly filling and emptying the syringe. Valves, tubing, and syringes were new and in unused condition prior to the sampling and a set of this apparatus were dedicated to each well. Samples were shipped FEDEX next-morning delivery to the analytical laboratory, AtmAA, Inc., in Calabasas, California and arrived on October 31, 2012. The samples were analyzed for TO-15 components in Selective Ion Mode. There are 62 volatile organic compounds (VOCs) that comprise the TO-15 analysis. These are also referred to as components and are listed in the laboratory report contained in **Attachment A**.

Of the 62 VOCs analyzed, 25 VOCs were detected in the four wells. The concentration reported by the laboratory of parts per billion by volume (ppbv) was converted to micrograms per cubic meter ($\mu g/m^3$) assuming collection of the sample at standard ambient temperature (14 degrees C or 57 degrees F) and pressure conditions (SATP). **Table 1** details the conversion from ppbv to $\mu g/m^3$.

851 Bridger Drive, Suite 6 (59715)
P.O. Box 1413 (59771)
Bozeman, MT
Office 406.582.8780
Fax 406.582.8790

Next, a screening level was found for almost all of the detected VOCs in the United States Environmental Protection Agency (EPA) Regional Screening Levels (RSL) for 'Resident Air'[2]. These are presented in **Table 1**. The EPA RSLs for Residential Air are risk-based screening values intended to be protective of human health at a cancer risk level of 1 in 1-million and a non-cancer hazard index of 1

The RSLs for 'Resident Air' are for screening breathing air, rather than soil vapor. Because the concentrations of VOCs decrease (attenuate) from soil vapor to indoor air, an attenuation factor was applied to the RSL values to derive a more technically defensible screening value for soil vapor concentrations. The attenuation factor used (0.05) was taken from the California EPA Vapor Intrusion Guidance Manual and is for contaminant concentrations detected in soil gas immediately beneath a residential building with a slab-on-grade foundation. Because the BLG wells are screened at depths from 10 to 25 feet, this attenuation factor is conservative and provides a margin of error. The VOC concentrations, EPA RSL values, and attenuated RSL values are then compared in **Table 1**, to assess which VOC components are of concern. It should be noted that while application of attenuation factors to soil vapor concentrations is standard practice industry-wide, and is endorsed by the U.S. EPA and most state regulatory agencies, the Montana DEQ, as specified in their *Montana Vapor Intrusion Guide* does not permit the use of generic attenuation factors.

Therefore, the following VOCs or component concentrations exceeded either the EPA RSL, as specified in Table 1: chloroform in wells BLG-3 and BLG-4; tetrahydrofuran in well BLG-10; benzene in all the BLG- wells; trichloroethene (TCE) in well BLG-5; tetrachloroethene (PCE) in all the BLG- wells; ethylbenzene in all the BLG- wells; and 1,2,4-trimethylbenzene in wells BLG-5 and BLG10. Note that only chloroform in BLG-4 exceeded the adjusted SL (with the attenuation factor applied).

The detection of VOCs in soil gas at the south boundary of the landfill may be due to landfill gas escaping from the closed waste cells. Alternatively, the VOCs in soil gas may be sourced from groundwater that is impacted with VOCs. It is, therefore of concern from a vapor intrusion perspective, that PCE, TCE, and other VOC components may occur in soil gas above the area of PCE/TCE impacted groundwater south of the landfill and underlying the adjacent residential area. Chloroform has not been detected in groundwater monitoring and yet, has been detected in wells BLG-3 and BLG-4. Of particular concern is the possibility that the source of detected VOC components is the impacted groundwater, rather than direct emission from the waste cells at the landfill, as this would imply there may be similar concentrations directly beneath the adjacent homes. In consideration of this, Tetra Tech recommends additional sampling of soil gas to verify that VOC concentrations detected in the BLG- wells are not a vapor intrusion concern. Specifically the following is recommended:

- The soil gas investigation should be expanded to include a series of temporary gas monitoring points along the pedestrian trail/walkway adjacent to the south property boundary of the landfill, St. Andrews Drive, Turnberry Court, and Caddie Court (in the residential area south of the Bozeman Landfill). A truck-mounted Geoprobe® "drill" would provide the most un-obtrusive and expedient method of installing temporary monitoring points and obtaining gas samples for laboratory analysis.

- The four BLG- wells should be resampled, at the same time, for direct comparison of component concentrations with the additional gas monitoring points.

- Gas samples would be submitted for laboratory analysis of a reduced TO-15 SIM component list.

- Laboratory results would be reviewed and interpreted as in this report, in terms of a potential exceedance to EPA RSLs for 'Resident Air'. This information could determine if any additional investigation would be warranted.

Please contact me with any questions or comments regarding this report. I can also provide a cost estimate pertaining to the above recommendations.

Sincerely,

Mark F. Pearson

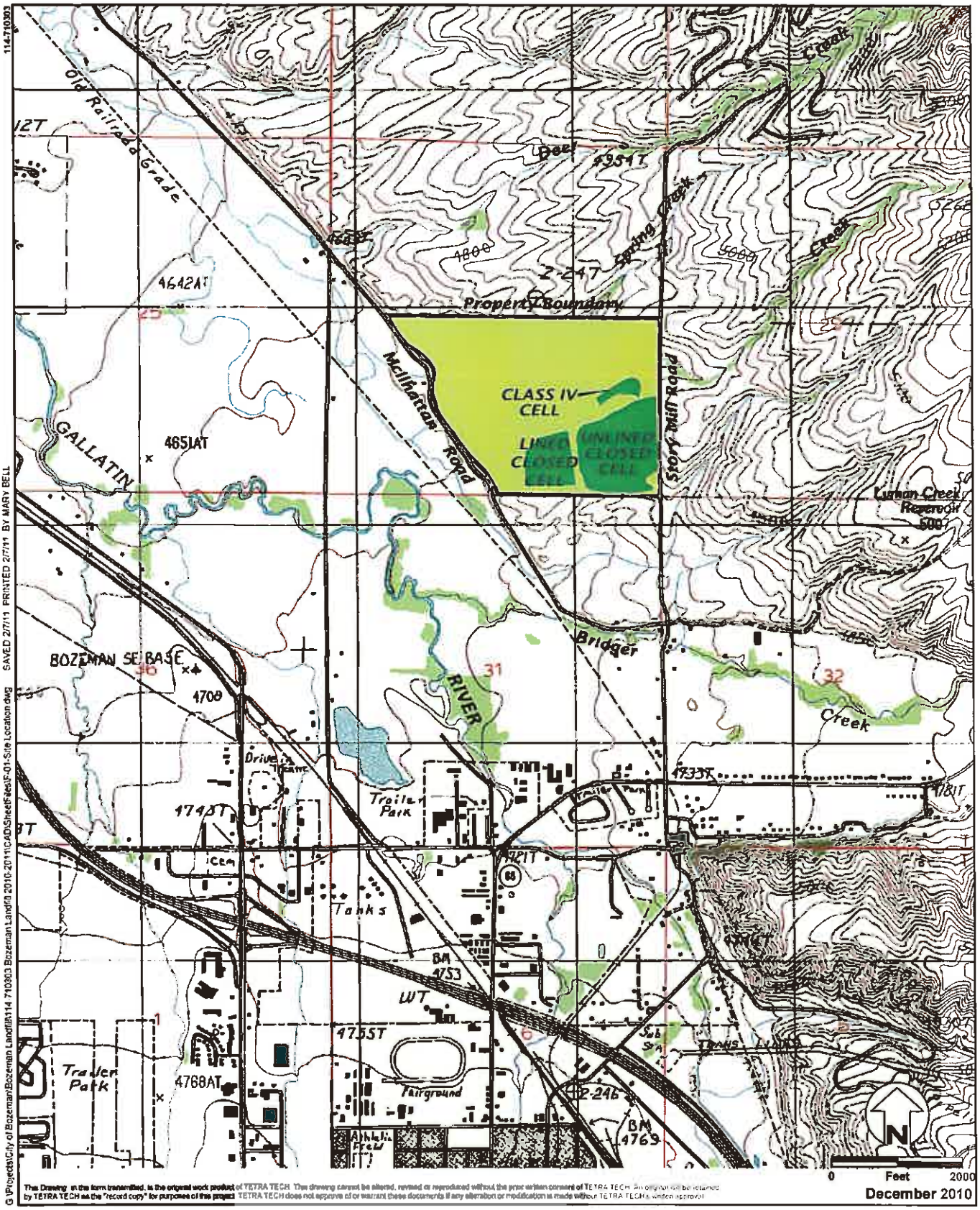
Mark Pearson
Environmental Scientist/Project Manager

Mfp

References:

1 Department of Environmental Quality, 2011. *Montana Vapor Intrusion Guide.* http://deq.mt.gov/statesuperfund/viguide.mcpx

2 United States Environmental Protection Agency, November 2012. Regional Screening Levels (formerly PRGs), Screening Levels for Chemical Contaminants. Pacific Southwest, Region 9. http://www.epa.gov/region9/superfund/prg



From USGS 7.5' Bozeman Quad (1987)

114-710303.400

Site Location Map
Bozeman Sanitary Landfill
Bozeman, Montana
FIGURE 1


BOZEMAN LANDFILL
BLG-1
BLG-2
BLG-3
BLG-4
BLG-5
BLG-6
BLG-10
Well MW-12
Well MW-8A
Well LF-2
Well LF-3
Red line is landfill property boundary
Constructed Residence
Methane Monitoring Probe (BLG-)
Monitoring Well (not all wells shown)
Site Map
Bozeman Sanitary Landfill
Bozeman, Montana
Figure 2

TABLE 1
PROGRESS REPORT ON SAMPLING AND ANALYSIS OF SOIL GAS
FROM PERIMETER METHANE MONITORING WELLS BLG-3, 4, 5, and 10
OCTOBER 30, 2012
BOZEMAN LANDFILL, BOZEMAN, MONTANA

Calculation and Results prepared by Mark Pearson, Tetra Tech Bozeman Office, December 21, 2012

$$\text{ppbv} = \mu\text{g/m3} * \frac{0.08205 * \text{T in Kelvin}}{\text{MW}}$$

OR

$$\mu\text{g/m3} = \text{ppbv} * \frac{\text{MW}}{0.08205 * \text{T in Kelvin}}$$

where:

ppbv	=	parts per billion by volume — Contaminant concentration
µg/m3	=	micrograms per cubic meter — Contaminant concentration
0.08205	=	Universal Gas Law Constant
T in Kelvin	=	Atmospheric temperature in Kelvin (273.15 + Deg C)
MW	=	Molecular weight of contaminant
SATP	=	Standard Ambient Temperature and Pressure where sampling temperature was 57 degrees F or 287.15 degrees Kelvin
	=	Exceedance of USEPA screening level for Resident Air (1)
	=	Exceedance of adjusted screening level for Resident Air (1) based on attenuation factor (2) of 0.05
U	=	Below analytical detection limit
		Assume sample collection and analysis at SATP

Selected components from TO-15 SIM Analysis of October 30, 2012 gas monitoring in four permeter methane monitoring wells

(1) USEPA Regional Screening Level (SL) Table November 2012 (http://www.epa.gov/region9/superfund/prg/)

(2) California EPA Vapor Intrusion Guidance Manual, Table 2, Page 64; Residential Subslab Attenuation Factor

Station	Component:	USEPA Screening Levels Resident Air (1) (µg/m3)	Adjusted Screening Levels for Resident Air (1) based on attenuation factor (2) of 0.05	MW	Analytical Result (ppbv)	Analytical Result Flag	Conversion to µg/m3	Above Adjusted Screening Level with attenuation factor?	Comments
BLG-3	Freon 12	100.00	2,000.00	120.91	3.2		16.42	-	
BLG-4	(Dichlorodifluoromethane)			120.91	0.3	U	1.54	-	
BLG-5				120.91	0.61		3.13	-	
BLG-10				120.91	0.3	U	1.54	-	
BLG-3	Chloromethane	94.00	1,880.00	50.49	0.4	U	0.86	-	
BLG-4				50.49	8.49		18.19	-	
BLG-5				50.49	0.4	U	0.86	-	
BLG-10				50.49	0.4	U	0.86	-	
BLG-3	Freon 114	No SL	-	170.92	0.3	U	2.18	-	
BLG-4				170.92	30.5		221.26	-	Could not find a screening level for this component
BLG-5				170.92	0.3	U	2.18	-	
BLG-10				170.92	0.36		2.61	-	
BLG-3	Vinyl Chloride	0.16	3.20	62.5	0.3	U	0.80	-	
BLG-4				62.5	0.3	U	0.80	-	Analytical detection limit exceeds USEPA SL
BLG-5				62.5	0.3	U	0.80	-	
BLG-10				62.5	0.3	U	0.80	-	

Station	Component:	Screening Levels Resident Air (1) (µg/m3)	Adjusted Screening Levels for Resident Air (1) based on attenuation factor (2) of 0.05	MW	Analytical Result (ppbv)	Analytical Result Flag	Conversion to µg/m3	Above Adjusted Screening Level with attenuation factor?	Comments
BLG-3	Acetone	32,000.00	640,000.00	58.08	11.8		29.09	-	
BLG-4				58.08	8.66		21.35	-	
BLG-5				58.08	7.36		18.14	-	
BLG-10				58.08	13.6		33.53	-	
BLG-3	Freon 11	730.00	14,600.00	137.37	0.3	U	1.75	-	
BLG-4	(Trichlorofluoromethane)			137.37	1.57		9.15	-	
BLG-5				137.37	0.3	U	1.75	-	
BLG-10				137.37	0.36		2.10	-	
BLG-3	Carbon Disulfide	730.00	14,600.00	76.14	3.42		11.05	-	
BLG-4				76.14	6.97		22.52	-	
BLG-5				76.14	2.28		7.37	-	
BLG-10				76.14	6.84		22.10	-	
BLG-3	2-Butanone	5,200.00	104,000.00	72.11	4.46		13.65	-	
BLG-4	(Methyl Ethyl Ketone or MEK)			72.11	2.54		7.77	-	
BLG-5				72.11	3.89		11.91	-	
BLG-10				72.11	6.04		18.49	-	
BLG-3	Chloroform	0.11	2.20	119.38	0.3		1.52	-	
BLG-4				119.38	0.86		4.36	yes	
BLG-5				119.38	0.3	U	1.52	-	Analytical detection limit exceeds USEPA SL
BLG-10				119.38	0.3	U	1.52	-	
BLG-3	Ethyl Acetate	No SL	-	88.11	3.63		13.58	-	
BLG-4				88.11	0.8		2.99	-	
BLG-5				88.11	0.4	U	1.50	-	
BLG-10				88.11	0.4	U	1.50	-	
BLG-3	Tetrahydrofuran	21.00	420.00	72.11	1.11		3.40	-	
BLG-4	(1,4-Epoxybutane)			72.11	0.62		1.90	-	
BLG-5	(1,2-Epoxybutane used)			72.11	2.15		6.58	-	
BLG-10				72.11	7.28		22.28	-	
BLG-3	Benzene	0.31	6.20	78.11	0.85		2.82	-	
BLG-4				78.11	1.1		3.65	-	
BLG-5				78.11	0.75		2.49	-	
BLG-10				78.11	1.31		4.34	-	
BLG-3	Cyclohexane	6,300.00	126,000.00	84.16	0.4	U	1.43	-	
BLG-4				84.16	3.69		13.18	-	
BLG-5				84.16	3.35		11.97	-	
BLG-10				84.16	5.68		20.29	-	
BLG-3	Trichloroethene	0.43	8.60	131.39	0.3	U	1.67	-	Analytical detection limit exceeds USEPA SL
BLG-4	(Trichloroethylene or TCE)			131.39	0.3	U	1.67	-	
BLG-5				131.39	0.37		2.06	-	
BLG-10				131.39	0.3	U	1.67	-	
BLG-3	n-Heptane	No SL	-	100.21	0.4	U	1.70	-	
BLG-4				100.21	0.4	U	1.70	-	
BLG-5				100.21	0.4	U	1.70	-	
BLG-10				100.21	0.47		2.00	-	

Station	Component:	Screening Levels Resident Air (1) (µg/m3)	Adjusted Screening Levels for Resident Air (1) based on attenuation factor (2) of 0.05	MW	Analytical Result (ppbv)	Analytical Result Flag	Conversion to µg/m3	Above Adjusted Screening Level with attenuation factor?	Comments
BLG-3	Toluene	5,200.00	104,000.00	92.14	8.77		34.30	-	
BLG-4				92.14	6.55		25.62	-	
BLG-5				92.14	9.32		36.45	-	
BLG-10				92.14	14		54.75	-	
BLG-3	2-Hexanone	31.00	620.00	100.16	0.4	U	1.70	-	
BLG-4				100.16	0.4	U	1.70	-	
BLG-5				100.16	0.4	U	1.70	-	
BLG-10				100.16	0.74		3.15	-	
BLG-3	Tetrachloroethene	9.40	188.00	165.83	10.8		74.61	-	
BLG-4	(PCE)			165.83	1.52		10.70	-	
BLG-5				165.83	3.5		24.63	-	
BLG-10				165.83	16.3		114.73	-	
BLG-3	Ethylbenzene	0.97	19.40	106.17	1.74		7.84	-	
BLG-4				106.17	1.17		5.27	-	
BLG-5				106.17	1.64		7.39	-	
BLG-10				106.17	3.2		14.42	-	
BLG-3	m,p-Xylene	100.00	2,000.00	106.17	4.06		18.30	-	
BLG-4				106.17	2.64		11.90	-	
BLG-5				106.17	5.76		25.96	-	
BLG-10				106.17	12.2		54.98	-	
BLG-3	Styrene	1,000.00	20,000.00	104.15	3.06		13.53	-	
BLG-4				104.15	1.64		7.25	-	
BLG-5				104.15	1.65		7.29	-	
BLG-10				104.15	1.72		7.60	-	
BLG-3	o-Xylene	100.00	2,000.00	106.17	1.43		6.44	-	
BLG-4				106.17	0.89		4.01	-	
BLG-5				106.17	1.89		8.52	-	
BLG-10				106.17	5.37		24.20	-	
BLG-3	4-Ethyltoluene	5,200.00	104,000.00	120.2	0.4	U	2.04	-	Could not find a screening level specifically for 4-Ethyltoluene
BLG-4	(Consider similar to Toluene)			120.2	0.63		3.21	-	
BLG-5				120.2	1.36		6.94	-	
BLG-10				120.2	6.56		33.47	-	
BLG-3	1,3,5-Trimethyl	No SL	-	120.2	0.4	U	2.04	-	
BLG-4	Benzene			120.2	0.4	U	2.04	-	
BLG-5				120.2	0.42		2.14	-	
BLG-10				120 2	2.08		10.61	-	
BLG-3	1,2,4-Trimethyl	7.30	146.00	120.2	1.08		5.51	-	
BLG-4	Benzene			120.2	0.66		3.37	-	
BLG-5				120.2	1.47		7.50	-	
BLG-10				120.2	3.74		19.08	-	

ATTACHMENT A

Laboratory Report

AtmAA Inc.
23917 Craftsman Rd., Calabasas, CA 91302 • (818) 223-3277 • FAX (818) 223-8250

environmental consultants
laboratory services

LABORATORY ANALYSIS REPORT

TO-15 Component Analysis in Tedlar Bag Samples, by GC/MS

Report Date: November 23, 2012
Client: Tetra Tech, Inc.
Project Location: Bozeman Landfill
Client Project No.: 114-710303 Task 710
Date Received: October 31, 2012
Date Analyzed: November 2, 2012

AtmAA Lab No.:	13052-1	13052-2	13052-3	13052-4
Sample ID:	BLG-3	BLG-4 New	BLG-5	BLG-10
Components		(Concentations in ppbv)		
Freon 12	3.20	<0.3	0.61	<0.3
Chloromethane	<0.4	8.49	<0.4	<0.4
Freon 114	<0.3	30.5	<0.3	0.36
Vinyl Chloride	<0.3	<0.3	<0.3	<0.3
1,3-Butadiene	<0.4	<0.4	<0.4	<0.4
Bromomethane	<0.4	<0.4	<0.4	<0.4
Chloroethane	<0.4	<0.4	<0.4	<0.4
Bromoethene	<0.4	<0.4	<0.4	<0.4
Acetone	11.8	8.66	7.36	13.6
Freon 11	<0.3	1.57	<0.3	0.36
Isopropyl Alcohol	<0.6	<0.6	<0.6	<0.6
1,1-Dichloroethene	<0.4	<0.4	<0.4	<0.4
Methylene Chloride	<0.4	<0.4	<0.4	<0.4
3-Chloro-1-Propene	<0.4	<0.4	<0.4	<0.4
Carbon Disulfide	3.42	6.97	2.28	6.84
Freon 113	<0.3	<0.3	<0.3	<0.3
trans-1,2-Dichloroethene	<0.4	<0.4	<0.4	<0.4
1,1-Dichloroethane	<0.4	<0.4	<0.4	<0.4
MTBE	<0.4	<0.4	<0.4	<0.4
Vinyl Acetate	<0.4	<0.4	<0.4	<0.4
2-Butanone	4.46	2.54	3.89	6.04
cis-1,2-Dichloroethene	<0.4	<0.4	<0.4	<0.4
n-Hexane	<0.4	<0.4	<0.4	1.28
Chloroform	0.30	0.86	<0.3	<0.3
Ethyl Acetate	3.63	0.80	<0.4	<0.4
Tetrahydrofuran	1.11	0.62	2.15	7.28
1,2-Dichloroethane	<0.4	<0.4	<0.4	<0.4
1,1,1-Trichloroethane	<0.3	<0.3	<0.3	<0.3
Benzene	0.85	1.10	0.75	1.31
Carbon Tetrachloride	<0.3	<0.3	<0.3	<0.3
Cyclohexane	<0.4	3.69	3.35	5.68
1,2-Dichloropropane	<0.4	<0.4	<0.4	<0.4
Bromodichloromethane	<0.4	<0.4	<0.4	<0.4
Trichloroethene	<0.3	<0.3	0.37	<0.3
1,4-Dioxane	<0.4	<0.4	<0.4	<0.4
2,2,4-Trimethylpentane	<0.4	<0.4	<0.4	<0.4
n-Heptane	<0.4	<0.4	<0.4	0.47
cis-1,3-Dichloropropene	<0.4	<0.4	<0.4	<0.4
4-Methyl-2-pentanone	<0.4	<0.4	<0.4	<0.4
trans-1,3-Dichloropropene	<0.4	<0.4	<0.4	<0.4
1,1,2-Trichloroethane	<0.4	<0.4	<0.4	<0.4
Toluene	8.77	6.55	9.32	14.0
2-Hexanone	<0.4	<0.4	<0.4	0.74
Dibromochloromethane	<0.4	<0.4	<0.4	<0.4
1,2-Dibromomethane	<0.4	<0.4	<0.4	<0.4
Tetrachloroethene	10.6	1.52	3.50	16.3
Chlorobenzene	<0.4	<0.4	<0.4	<0.4
Ethylbenzene	1.74	1.17	1.64	3.20
m,p-Xylene	4.06	2.64	5.76	12.2
Bromoform	<0.3	<0.3	<0.3	<0.3
Styrene	3.06	1.64	1.65	1.72
1,1,2,2-Tetrachloroethane	<0.4	<0.4	<0.4	<0.4
o-Xylene	1.43	0.89	1.89	5.37
Benzyl Chloride	<0.4	<0.4	<0.4	<0.4
4-Ethyltoluene	<0.4	0.63	1.36	6.56
1,3,5-Trimethylbenzene	<0.4	<0.4	0.42	2.08
1,2,4-Trimethylbenzene	1.08	0.66	1.47	3.74
1,3-Dichlorobenzene	<0.3	<0.3	<0.3	<0.3
1,4-Dichlorobenzene	<0.3	<0.3	<0.3	<0.3
1,2-Dichlorobenzene	<0.3	<0.3	<0.3	<0.3
1,2,4-Trichlorobenzene	<0.6	<0.6	<0.6	<0.6
Hexachlorobutadiene	<0.6	<0.6	<0.6	<0.6

Michael L. Porter
Laboratory Director

QUALITY ASSURANCE SUMMARY
(Repeat Analyses)

Project Location: Bozeman Landfill
Date Received: October 31, 2012
Date Analyzed: November 2, 2012

Components	Sample ID	Repeat Analysis Run #1	Repeat Analysis Run #2	Mean Conc.	% Diff. From Mean
		(Concentration in ppbv)			
Freon 12	BLG-10	<0.3	<0.3	—	—
Chloromethane	BLG-10	<0.4	<0.4	—	—
Freon 114	BLG-10	0.34	0.37	0.36	4.2
Vinyl Chloride	BLG-10	<0.3	<0.3	—	—
1,3-Butadiene	BLG-10	<0.4	<0.4	—	—
Bromomethane	BLG-10	<0.4	<0.4	—	—
Chloroethane	BLG-10	<0.4	<0.4	—	—
Bromoethene	BLG-10	<0.4	<0.4	—	—
Acetone	BLG-10	14.3	13.0	13.6	4.8
Freon 11	BLG-10	0.39	0.34	0.36	6.8
Isopropyl Alcohol	BLG-10	<0.6	<0.6	—	—
1,1-Dichloroethene	BLG-10	<0.4	<0.4	—	—
Methylene Chloride	BLG-10	<0.4	<0.4	—	—
3-Chloro-1-Propene	BLG-10	<0.4	<0.4	—	—
Carbon Disulfide	BLG-10	7.37	6.32	6.84	7.7
Freon 113	BLG-10	<0.3	<0.3	—	—
trans-1,2-Dichloroethene	BLG-10	<0.4	<0.4	—	—
1,1-Dichloroethane	BLG-10	<0.4	<0.4	—	—
MTBE	BLG-10	<0.4	<0.4	—	—
Vinyl Acetate	BLG-10	<0.4	<0.4	—	—
2-Butanone	BLG-10	6.57	5.52	6.04	8.7

QUALITY ASSURANCE SUMMARY
(Repeat Analyses)
(continued)

Components	Sample ID	Repeat Analysis Run #1	Repeat Analysis Run #2	Mean Conc.	% Diff. From Mean
		(Concentration in ppbv)			
cis-1,2-Dichloroethene	BLG-10	<0.4	<0.4	---	---
n-Hexane	BLG-10	1.41	1.14	1.28	10
Chloroform	BLG-10	<0.3	<0.3	---	---
Ethyl Acetate	BLG-10	<0.4	<0.4	---	---
Tetrahydrofuran	BLG-10	7.39	7.18	7.28	1.4
1,2-Dichloroethane	BLG-10	<0.4	<0.4	---	---
1,1,1-Trichloroethane	BLG-10	<0.3	<0.3	---	---
Benzene	BLG-10	1.42	1.20	1.31	8.4
Carbon Tetrachloride	BLG-10	<0.3	<0.3	---	---
Cyclohexane	BLG-10	6.00	5.37	5.68	5.5
1,2-Dichloropropane	BLG-10	<0.4	<0.4	---	---
Bromodichloromethane	BLG-10	<0.4	<0.4	---	---
Trichloroethene	BLG-10	<0.3	<0.3	---	---
1,4-Dioxane	BLG-10	<0.4	<0.4	---	---
2,2,4-Trimethylpentane	BLG-10	<0.4	<0.4	---	---
n-Heptane	BLG-10	0.45	0.49	0.47	4.2
cis-1,3-Dichloropropene	BLG-10	<0.4	<0.4	---	---
4-Methyl-2-pentanone	BLG-10	<0.4	<0.4	---	---
trans-1,3-Dichloropropene	BLG-10	<0.4	<0.4	---	---
1,1-2-Trichloroethane	BLG-10	<0.4	<0.4	---	---
Toluene	BLG-10	14.6	13.3	14.0	4.6
2-Hexanone	BLG-10	0.76	0.73	0.74	2.0

QUALITY ASSURANCE SUMMARY
(Repeat Analyses)
(continued)

Components	Sample ID	Repeat Analysis Run #1	Repeat Analysis Run #2	Mean Conc.	% Diff. From Mean
		(Concentration in ppbv)			
Dibromochloromethane	BLG-10	<0.4	<0.4	---	---
1,2-Dibromomethane	BLG-10	<0.4	<0.4	---	---
Tetrachloroethene	BLG-10	17.1	15.5	16.3	4.9
Chlorobenzene	BLG-10	<0.4	<0.4	---	---
Ethylbenzene	BLG-10	3.50	2.91	3.20	9.2
m,p-Xylene	BLG-10	13.4	11.1	12.2	9.4
Bromoform	BLG-10	<0.3	<0.3	---	---
Styrene	BLG-10	1.92	1.53	1.72	11
1,1,2,2-Tetrachloroethane	BLG-10	<0.4	<0.4	---	---
o-Xylene	BLG-10	5.88	4.86	5.37	9.5
Benzyl Chloride	BLG-10	<0.4	<0.4	---	---
4-Ethyltoluene	BLG-10	7.28	5.85	6.56	11
1,3,5-Trimethylbenzene	BLG-10	2.35	1.82	2.08	13
1,2,4-Trimethylbenzene	BLG-10	4.13	3.35	3.74	10
1,3-Dichlorobenzene	BLG-10	<0.3	<0.3	---	---
1,4-Dichlorobenzene	BLG-10	<0.3	<0.3	---	---
1,2-Dichlorobenzene	BLG-10	<0.3	<0.3	---	---
1,2,4-Trichlorobenzene	BLG-10	<0.6	<0.6	---	---
Hexachlorobutadiene	BLG-10	<0.6	<0.6	---	---

Four Tedlar bag samples, laboratory numbers 13052-(1-4), were analyzed for TO-15 components by GC/MS. Agreement between repeat analyses is a measure of precision and is shown above in the column "% Difference from Mean". The average % difference from mean for 20 repeat measurements from four Tedlar bag samples is 7.3%.

Bozeman Landfill
Project or Site Name

114-710303 Task 710
Project Number

Mark Pearson cell (406) 459-4169
Sampler Name (Printed)

Same
Project Manager, Report to

CHAIN OF CUSTODY RECORD

TETRA TECH, INC.
851 Bridger Drive, Suite 6, Bozeman, MT 59715
PO Box 1413, Bozeman, MT 59771
Tel 406.582.8780 Fax 406.582.8790
www.tetratech.com

Tetra Tech
Report to (Firm or Agency)

As shown
Address

City State Zip

Phone Fax

DATE COLLECTED	TIME COLLECTED	SAMPLE LOCATION OR DESCRIPTION	COMP OR GRAB	SAMPLE MATRIX	NO. OF CONTAINERS	ANALYSIS REQUIRED: TO-15 SIM	NOTES	LAB NUMBER
10/30/12		BLG-3	Grab	Gas	2 Tedlar bags	✓	Analyze each location for TO-15 Selective Ion Mode (SIM). There were two Tedlar bags collected at each sample location.	~~3052~~-1
		BLG-4 new	↓	↓	↓	✓		-2
		BLG 5				✓		-3
		BLG-10	↓	↓	↓	✓		-4

	Date	Time	Received by:
Relinquished by: Mark J. Pearson	10/30/12	1430	FedEx for next AM delivery to Ottawa
Relinquished by:	Date	Time	Received by:
Relinquished by:	Date 10-31-12	Time 10:15	Received by: