Bridgeton/West Lake Landfill

Radiological Sampling
November 4-5, 2015
Final Report

Missouri Department of Health and Senior Services

Bureau of Environmental Epidemiology

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Bridgeton/West Lake Landfills

Section 1: Site History

The site is located on a parcel of approximately 200 acres in Bridgeton, Missouri. The site consists of the Bridgeton Sanitary Landfill (BLF), which stopped receiving waste on Dec. 31, 2004, and several old inactive areas with municipal solid waste and demolition debris. The site is divided into two Operable Units, or OUs. OU-1 consists of radiological areas and OU-2 consists of the other landfill areas (including Bridgeton Sanitary Landfill), which did not receive any radiologically contaminated soil. In 1990, West Lake Landfill was listed on the National Priorities List making it a Superfund site.

On December 23, 2010, Bridgeton/Republic reported to the Missouri Department of Natural Resources (DNR) that the Bridgeton Sanitary Landfill was experiencing elevated temperatures on some gas extraction wells. The facility began testing landfill gas from the gas extraction system and found elevated hydrogen, carbon monoxide and reduced methane concentrations, which is indicative of a subsurface smoldering event.

By spring 2011, Bridgeton/Republic began implementing a series of corrective actions addressing the increased temperatures. In April 2012, DNR and Bridgeton/Republic began meeting to determine additional corrective actions necessary to address the subsurface smoldering event and associated odors.

On February 2, 2013, staff from the Missouri Department of Health and Senior Services (DHSS) collected air samples for particulate radioactive material at the Bridgeton / West Lake Landfills. Laboratory analysis of the DHSS samples by two different laboratories confirmed that no radioactivity was detected above normal background levels. Additional testing was conducted by DNR on May 16, 2013, and analysis of these samples showed no radioactivity distinguishable from natural background levels. The results of this additional testing are located on the DNR website http://www.dnr.mo.gov/env/hwp/fedfac/westlakelandfill-ffs.htm.

During the month of June 2013, additional air sampling was conducted by DHSS due to continued community concerns about radiation, specifically alpha/beta radiation. The results confirmed that alpha/beta activities around the Bridgeton and West Lake Landfills during this time were indistinguishable from natural background levels. The results of this additional testing are located on DHSS website http://www.health.mo.gov/living/environment/bridgeton/pdf/rasamplingreport.pdf.

Section 2: Alpha/Beta Radiation Air Sampling, Analysis and Results

Introduction: On November 4th and 5th, 2015, staff from DHSS visited the Bridgeton Sanitary Landfill and West Lake Landfill to collect particulate air samples to be analyzed for alpha/beta activity. These samples were collected daily at locations around the landfills including residential areas. Additional samples were collected in the St. Charles area for a background comparison.

A total of 31 particulate air samples were collected in predominant upwind and downwind directions around the landfill for comparison with 13 air samples that were collected in "background" areas west of the site but in relative proximity of the landfill with a total of 44 samples being collected. See enclosed figures 1 and 2 for location of samples.

Objective: The objective of the DHSS air sampling operation was to determine if the levels of alpha/beta activity around the landfill in upwind and downwind locations were distinguishable from levels in background locations. Additionally, like the sampling event completed in June 2013, this sampling event provided an opportunity for acquiring additional baseline data around the landfills.

Meteorological Conditions: Wind direction was relatively consistent during the two day event with winds mainly coming from a south to south-south east direction during sample collection. Wind direction was obtained prior to sample collection near the site from the DNR meteorological station.

Sample Locations: Locations of air samples were arranged prior to the sampling event and upwind/downwind designations were based on the wind direction obtained from the DNR meteorological station that day. See enclosed figure 1.

Background Sample Locations: Locations of background samples were arranged prior to the sampling event. The St. Charles area was chosen due to its close proximity to the landfill site. See enclosed figure 2.

Collection and Analysis of Airborne sample results: Airborne particulates were collected using standard operating procedures by drawing air through a glass fiber membrane with an air sampling pump placed approximately 3-5 feet above the ground. (See section 4, Equipment) A total volume of 10,000 liters was drawn through the filter. The filter was placed in a glassine envelope and then placed in a bag. The bag was surveyed for external exposure and contamination using a Ludlum 2241-3 with 44-38 and 44-9 probes. (See section 4, Equipment) Samples collected for the two day event were sent off to the laboratory and particulate material collected on the filter was analyzed for alpha/beta activity.

Analysis of Samples: Analysis of air samples collected around the Bridgeton and West Lake Landfills was completed by Eberline Analytical/ Oak Ridge Laboratory, Oak Ridge, TN following analytical method LANL MLR-100 Modified. The reports of the analysis were reported as radioactive concentrations in microcurie per milliliter (µCi/mL).

Air Sample Results: The gross alpha and beta results for each sample taken during the November 4-5, 2015 air sampling event are shown in Table 1 through 3.

Table 1. Upwind Samples.

Report of Analyis for Missouri Department of Health and Senior Services								
Client SampleID	Matrix	Date Sampled	Date Analyzed	Parameter	Result	Error	MDA	Units
KNOWN	Air	11/10/15	11/12/15	Gross Alpha	2.63E-04	1.13E-05	2.52E-07	uCi/ml
SPIKE	Air	11/10/15	11/12/15	Gross Alpha	2.95E-04	3.87E-06	2.52E-07	uCi/ml
BLANK	Air	11/10/15	11/12/15	Gross Alpha	0.00E+00	8.92E-15	2.23E-14	uCi/ml
15-0002 DUP	Air	11/04/15	11/12/15	Gross Alpha	1.96E-14	1.33E-14	2.21E-14	uCi/ml
15-0002	Air	11/04/15	11/12/15	Gross Alpha	7.99E-15	1.52E-14	3.24E-14	uCi/ml
15-0003	Air	11/04/15	11/12/15	Gross Alpha	-1.41E-15	1.33E-14	3.21E-14	uCi/ml
15-0004	Air	11/04/15	11/12/15	Gross Alpha	6.31E-15	1.50E-14	3.25E-14	uCi/ml
15-0010	Air	11/04/15	11/12/15	Gross Alpha	-9.05E-15	1.46E-14	3.68E-14	uCi/ml
15-0011	Air	11/04/15	11/12/15	Gross Alpha	1.70E-14	1.56E-14	2.97E-14	uCi/ml
15-0012	Air	11/04/15	11/12/15	Gross Alpha	-8.60E-15	1.43E-14	3.70E-14	uCi/ml
15-0021	Air	11/04/15	11/12/15	Gross Alpha	2.66E-15	1.61E-14	3.62E-14	uCi/ml
15-0022	Air	11/04/15	11/12/15	Gross Alpha	1.85E-14	1.68E-14	3.22E-14	uCi/ml
15-0026	Air	11/04/15	11/12/15	Gross Alpha	1.34E-15	1.31E-14	3.04E-14	uCi/ml
15-0027	Air	11/04/15	11/12/15	Gross Alpha	6.60E-15	1.39E-14	3.00E-14	uCi/ml
15-0032	Air	11/05/15	11/12/15	Gross Alpha	1.19E-14	1.29E-14	2.52E-14	uCi/ml
15-0033	Air	11/05/15	11/12/15	Gross Alpha	1.84E-14	1.31E-14	2.23E-14	uCi/ml
15-0034	Air	11/05/15	11/12/15	Gross Alpha	2.35E-14	1.40E-14	2.21E-14	uCi/ml
15-0035	Air	11/05/15	11/12/15	Gross Alpha	5.65E-15	1.47E-14	3.21E-14	uCi/ml
15-0040	Air	11/05/15	11/12/15	Gross Alpha	6.43E-15	1.16E-14	2.46E-14	uCi/ml
BLANK FILTER	Air	11/10/15	11/12/15	Gross Alpha	2.59E-15	1.30E-14	2.95E-14	uCi/ml
KNOWN	Air	11/10/15	11/12/15	Gross Beta	2.87E-04	8.60E-06	5.87E-07	uCi/ml
SPIKE	Air	11/10/15	11/12/15	Gross Beta	2.65E-04	3.07E-06	5.87E-07	uCi/ml
BLANK	Air	11/10/15	11/12/15	Gross Beta	-1.24E-14	2.65E-14	5.84E-14	uCi/ml
15-0002 DUP	Air	11/04/15	11/12/15	Gross Beta	3.99E-13	4.44E-14	5.97E-14	uCi/ml
15-0002	Air	11/04/15	11/12/15	Gross Beta	2.95E-13	4.17E-14	6.30E-14	uCi/ml
15-0003	Air	11/04/15	11/12/15	Gross Beta	1.98E-13	3.80E-14	6.19E-14	uCi/ml
15-0004	Air	11/04/15	11/12/15	Gross Beta	1.79E-13	3.77E-14	6.40E-14	uCi/ml
15-0010	Air	11/04/15	11/12/15	Gross Beta	2.46E-13	3.90E-14	6.00E-14	uCi/ml
15-0011	Air	11/04/15	11/12/15	Gross Beta	2.93E-13	4.21E-14	6.36E-14	uCi/ml
15-0012	Air	11/04/15	11/12/15	Gross Beta	2.05E-13	4.28E-14	7.28E-14	uCi/ml
15-0021	Air	11/04/15	11/12/15	Gross Beta	2.20E-13	3.95E-14	6.42E-14	uCi/ml
15-0022	Air	11/04/15	11/12/15	Gross Beta	3.41E-13	4.29E-14	6.18E-14	uCi/ml
15-0026	Air	11/04/15	11/12/15	Gross Beta	2.57E-13	4.06E-14	6.27E-14	uCi/ml
15-0027	Air	11/04/15	11/12/15	Gross Beta	2.16E-13	3.87E-14	6.23E-14	uCi/ml
15-0032	Air	11/05/15	11/12/15	Gross Beta	2.26E-13	3.79E-14	5.87E-14	uCi/ml
15-0033	Air	11/05/15	11/12/15	Gross Beta	2.74E-13	4.01E-14	5.84E-14	uCi/ml
15-0034	Air	11/05/15	11/12/15	Gross Beta	2.96E-13	4.08E-14	5.97E-14	uCi/ml
15-0035	Air	11/05/15	11/12/15	Gross Beta	2.30E-13	3.93E-14	6.19E-14	uCi/ml
15-0040	Air	11/05/15	11/12/15	Gross Beta	2.00E-13	3.62E-14	5.78E-14	uCi/ml
BLANK FILTER	Air	11/10/15	11/12/15	Gross Beta	1.76E-13	3.41E-14	5.44E-14	uCi/ml

Table 2. Downwind Samples.

Report of Analysis for Missouri Department of Health and Senior Services								
Client SampleID	Matrix	Date Sampled	Date Analyzed	Parameter	Result	Error	MDA	Units
KNOWN	Air	11/10/15	11/12/15	Gross Alpha	2.70E-04	1.16E-05	2.21E-07	uCi/ml
SPIKE	Air	11/10/15	11/12/15	Gross Alpha	3.01E-04	3.88E-06	2.21E-07	uCi/ml
BLANK	Air	11/10/15	11/12/15	Gross Alpha	1.26E-15	7.44E-15	1.82E-14	uCi/ml
15-0001 DUP	Air	11/04/15	11/12/15	Gross Alpha	0.00E+00	1.29E-14	3.04E-14	uCi/ml
15-0001	Air	11/04/15	11/13/15	Gross Alpha	-5.28E-15	1.64E-14	3.92E-14	uCi/ml
15-0007	Air	11/04/15	11/12/15	Gross Alpha	2.66E-15	1.69E-14	3.78E-14	uCi/ml
15-0008	Air	11/04/15	11/12/15	Gross Alpha	0.00E+00	1.40E-14	3.25E-14	uCi/ml
15-0009	Air	11/04/15	11/12/15	Gross Alpha	-1.29E-15	1.58E-14	3.68E-14	uCi/ml
15-0014	Air	11/04/15	11/12/15	Gross Alpha	2.61E-15	1.31E-14	2.97E-14	uCi/ml
15-0015	Air	11/04/15	11/12/15	Gross Alpha	4.30E-15	1.66E-14	3.70E-14	uCi/ml
15-0017	Air	11/04/15	11/12/15	Gross Alpha	2.66E-15	1.61E-14	3.62E-14	uCi/ml
15-0018	Air	11/04/15	11/12/15	Gross Alpha	2.65E-15	1.42E-14	3.22E-14	uCi/ml
15-0019	Air	11/04/15	11/12/15	Gross Alpha	2.68E-15	1.34E-14	3.04E-14	uCi/ml
15-0023	Air	11/04/15	11/12/15	Gross Alpha	-5.28E-15	1.16E-14	3.00E-14	uCi/ml
15-0028	Air	11/05/15	11/12/15	Gross Alpha	1.19E-14	1.29E-14	2.52E-14	uCi/ml
15-0029	Air	11/05/15	11/12/15	Gross Alpha	1.05E-14	1.15E-14	2.23E-14	uCi/ml
15-0030	Air	11/05/15	11/12/15	Gross Alpha	2.22E-14	1.38E-14	2.21E-14	uCi/ml
15-0031	Air	11/05/15	11/12/15	Gross Alpha	1.84E-14	1.68E-14	3.21E-14	uCi/ml
15-0044	Air	11/05/15	11/13/15	Gross Alpha	1.97E-14	1.24E-14	1.89E-14	uCi/ml
15-0045	Air	11/05/15	11/13/15	Gross Alpha	0.00E+00	1.35E-14	3.17E-14	uCi/ml
BLANK FILTER	Air	11/10/15	11/13/15	Gross Alpha	0.00E+00	1.47E-14	3.44E-14	uCi/ml
KNOWN	Air	11/10/15	11/12/15	Gross Beta	2.93E-04	8.80E-06	5.83E-07	uCi/ml
SPIKE	Air	11/10/15	11/12/15	Gross Beta	2.79E-04	3.15E-06	5.83E-07	uCi/ml
BLANK	Air	11/10/15	11/12/15	Gross Beta	3.24E-14	1.92E-14	3.63E-14	uCi/ml
15-0001 DUP	Air	11/04/15	11/12/15	Gross Beta	2.18E-13	3.25E-14	4.66E-14	uCi/ml
15-0001	Air	11/04/15	11/13/15	Gross Beta	2.47E-13	3.92E-14	6.01E-14	uCi/ml
15-0007	Air	11/04/15	11/12/15	Gross Beta	2.52E-13	3.39E-14	4.63E-14	uCi/ml
15-0008	Air	11/04/15	11/12/15	Gross Beta	1.94E-13	3.82E-14	6.40E-14	uCi/ml
15-0009	Air	11/04/15	11/12/15	Gross Beta	2.34E-13	3.85E-14	6.00E-14	uCi/ml
15-0014	Air	11/04/15	11/12/15	Gross Beta	2.31E-13	3.98E-14	6.36E-14	uCi/ml
15-0015	Air	11/04/15	11/12/15	Gross Beta	1.92E-13	4.23E-14	7.28E-14	uCi/ml
15-0017	Air	11/04/15	11/12/15	Gross Beta	2.88E-13	4.20E-14	6.42E-14	uCi/ml
15-0018	Air	11/04/15	11/12/15	Gross Beta	2.19E-13	3.85E-14	6.18E-14	uCi/ml
15-0019	Air	11/04/15	11/12/15	Gross Beta	2.39E-13	3.99E-14	6.27E-14	uCi/ml
15-0023	Air	11/04/15	11/12/15	Gross Beta	2.36E-13	3.94E-14	6.23E-14	uCi/ml
15-0028	Air	11/05/15	11/12/15	Gross Beta	2.52E-13	3.89E-14	5.87E-14	uCi/ml
15-0029	Air	11/05/15	11/12/15	Gross Beta	2.60E-13	3.96E-14	5.84E-14	uCi/ml
15-0030	Air	11/05/15	11/12/15	Gross Beta	2.69E-13	3.98E-14	5.97E-14	uCi/ml
15-0031	Air	11/05/15	11/12/15	Gross Beta	2.30E-13	3.93E-14	6.19E-14	uCi/ml
15-0044	Air	11/05/15	11/13/15	Gross Beta	2.68E-13	3.88E-14	5.52E-14	uCi/ml
15-0045	Air	11/05/15	11/13/15	Gross Beta	2.85E-13	4.27E-14	6.62E-14	uCi/ml
BLANK FILTER	Air	11/10/15	11/13/15	Gross Beta	2.45E-13	3.89E-14	5.91E-14	uCi/ml

Table 3. Background Samples.

Report of Analysis for Missouri Department of Health and Senior Services								
Client SampleID	Matrix	Date Sampled	Date Analyzed	Parameter	Result	Error	MDA	Units
KNOWN	Air	11/10/15	11/12/15	Gross Alpha	2.70E-04	1.16E-05	2.21E-07	uCi/ml
SPIKE	Air	11/10/15	11/12/15	Gross Alpha	3.04E-04	3.90E-06	2.21E-07	uCi/ml
BLANK	Air	11/10/15	11/12/15	Gross Alpha	3.79E-15	8.22E-15	1.82E-14	uCi/ml
15-0005 DUP	Air	11/04/15	11/12/15	Gross Alpha	6.24E-15	1.41E-14	3.04E-14	uCi/ml
15-0005	Air	11/04/15	11/12/15	Gross Alpha	2.66E-15	1.43E-14	3.24E-14	uCi/ml
15-0006	Air	11/04/15	11/12/15	Gross Alpha	-9.30E-15	1.50E-14	3.78E-14	uCi/ml
15-0013	Air	11/04/15	11/12/15	Gross Alpha	5.05E-15	1.48E-14	3.25E-14	uCi/ml
15-0016	Air	11/04/15	11/12/15	Gross Alpha	-5.17E-15	1.52E-14	3.68E-14	uCi/ml
15-0020	Air	11/04/15	11/12/15	Gross Alpha	2.35E-14	1.66E-14	2.97E-14	uCi/ml
15-0024	Air	11/04/15	11/12/15	Gross Alpha	1.43E-15	1.61E-14	3.70E-14	uCi/ml
15-0025	Air	11/04/15	11/12/15	Gross Alpha	7.98E-15	1.69E-14	3.62E-14	uCi/ml
15-0036	Air	11/05/15	11/12/15	Gross Alpha	5.30E-15	1.47E-14	3.22E-14	uCi/ml
15-0037	Air	11/05/15	11/12/15	Gross Alpha	8.03E-15	1.44E-14	3.04E-14	uCi/ml
15-0038	Air	11/05/15	11/12/15	Gross Alpha	0.00E+00	1.27E-14	3.00E-14	uCi/ml
15-0039	Air	11/05/15	11/12/15	Gross Alpha	7.92E-15	1.21E-14	2.52E-14	uCi/ml
15-0042	Air	11/05/15	11/12/15	Gross Alpha	1.45E-14	1.24E-14	2.23E-14	uCi/ml
15-0043	Air	11/05/15	11/12/15	Gross Alpha	2.61E-15	9.57E-15	2.21E-14	uCi/ml
BLANK FILTER	Air	11/10/15	11/12/15	Gross Alpha	1.84E-14	1.68E-14	3.21E-14	uCi/ml
KNOWN	Air	11/10/15	11/12/15	Gross Beta	2.94E-04	8.81E-06	5.83E-07	uCi/ml
SPIKE	Air	11/10/15	11/12/15	Gross Beta	2.76E-04	3.14E-06	5.83E-07	uCi/ml
BLANK	Air	11/10/15	11/12/15	Gross Beta	4.32E-14	2.00E-14	3.63E-14	uCi/ml
15-0005 DUP	Air	11/04/15	11/12/15	Gross Beta	2.03E-13	3.19E-14	4.66E-14	uCi/ml
15-0005	Air	11/04/15	11/12/15	Gross Beta	1.70E-13	3.70E-14	6.30E-14	uCi/ml
15-0006	Air	11/04/15	11/12/15	Gross Beta	2.54E-13	3.40E-14	4.63E-14	uCi/ml
15-0013	Air	11/04/15	11/12/15	Gross Beta	1.78E-13	3.76E-14	6.40E-14	uCi/ml
15-0016	Air	11/04/15	11/12/15	Gross Beta	2.51E-13	3.92E-14	6.00E-14	uCi/ml
15-0020	Air	11/04/15	11/12/15	Gross Beta	2.87E-13	4.19E-14	6.36E-14	uCi/ml
15-0024	Air	11/04/15	11/12/15	Gross Beta	1.90E-13	4.22E-14	7.28E-14	uCi/ml
15-0025	Air	11/04/15	11/12/15	Gross Beta	2.16E-13	3.94E-14	6.42E-14	uCi/ml
15-0036	Air	11/05/15	11/12/15	Gross Beta	2.44E-13	3.94E-14	6.18E-14	uCi/ml
15-0037	Air	11/05/15	11/12/15	Gross Beta	2.34E-13	3.97E-14	6.27E-14	uCi/ml
15-0038	Air	11/05/15	11/12/15	Gross Beta	2.25E-13	3.90E-14	6.23E-14	uCi/ml
15-0039	Air	11/05/15	11/12/15	Gross Beta	2.39E-13	3.84E-14	5.87E-14	uCi/ml
15-0042	Air	11/05/15	11/12/15	Gross Beta	2.48E-13	3.91E-14	5.84E-14	uCi/ml
15-0043	Air	11/05/15	11/12/15	Gross Beta	2.65E-13	3.97E-14	5.97E-14	uCi/ml
BLANK FILTER	Air	11/10/15	11/12/15	Gross Beta	2.25E-13	3.91E-14	6.19E-14	uCi/ml

Air Sample Data Summary: Box plots were generated to visually summarize the collected sample values of gross alpha and gross beta concentrations among the three different location classifications. See Figures 1 and 2 below. The box plots for alpha and beta concentrations suggest similar means and medians between the locations around the landfills designated as either upwind or downwind and the locations in St. Charles designated as background.

Figure 1. Box Plots of Gross Alpha Sample Results

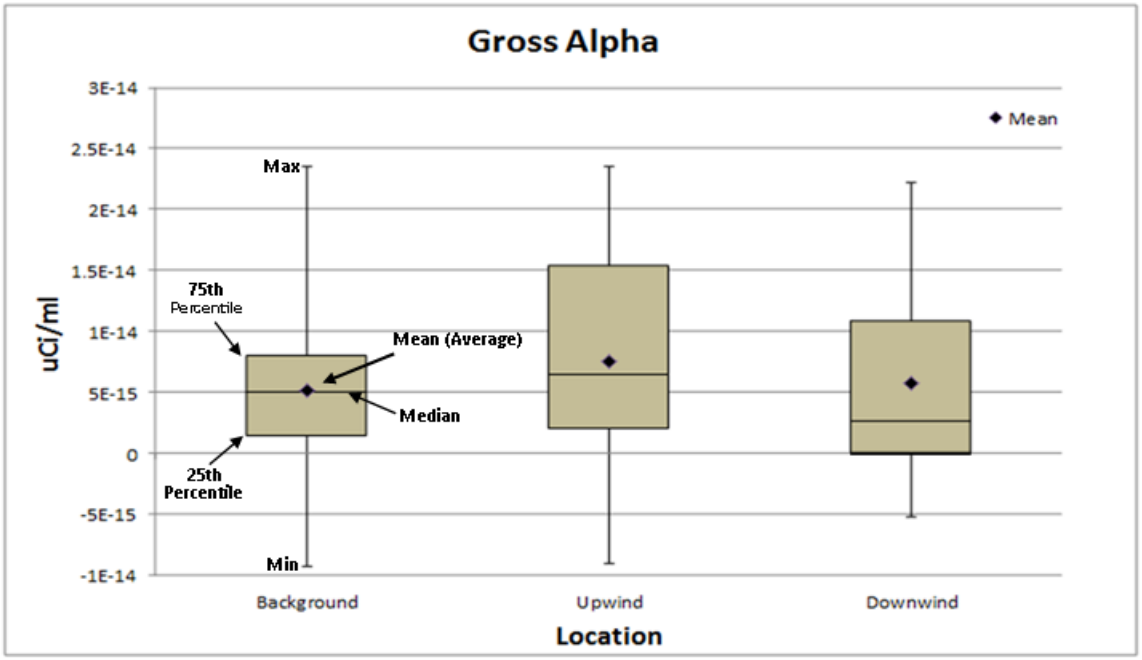
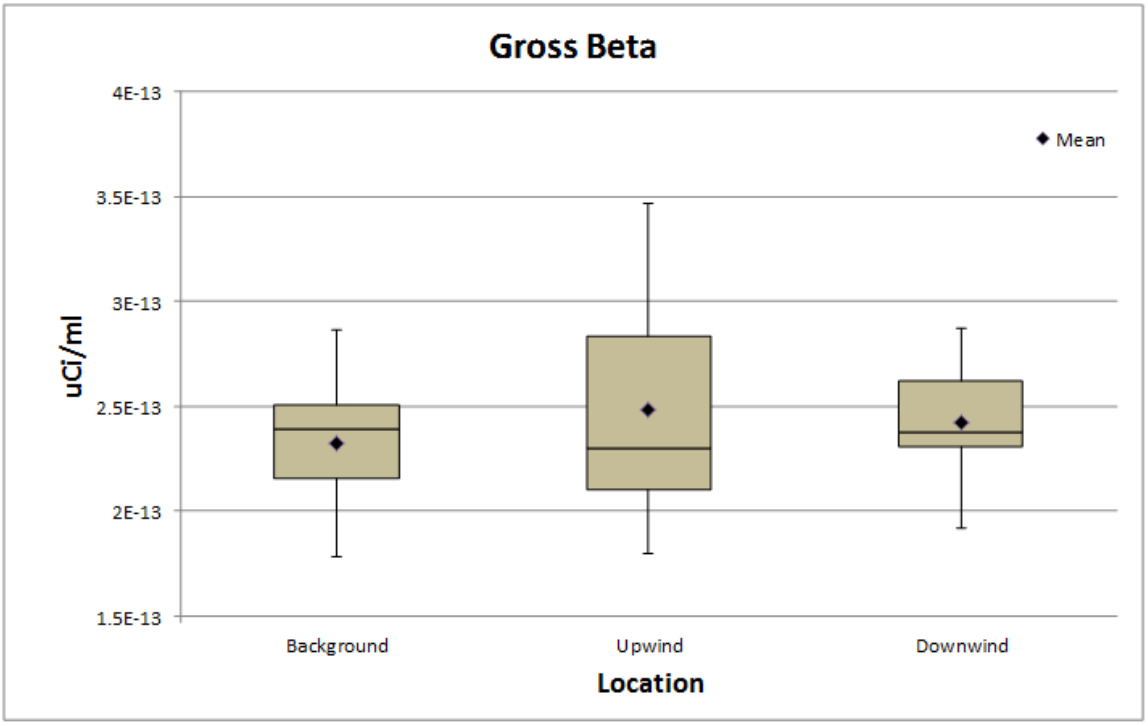


Figure 2. Box Plots of Gross Beta Sample Results



Statistical Analysis: The results were statistically compared against each other to identify any differences in gross alpha and gross beta concentrations detected in the upwind, downwind and background samples around the Bridgeton / West Lake Landfills. Three statistical tests were chosen based on the type of data and the strengths of each type of test to most effectively identify any statistical differences between the sample values. The following tables 4 and 5 summarize the results.

Table 4. Gross Alpha Statistical Results

Statistical Test[1]	**Result of Statistical Tests for Gross Alpha Data**			
	Background Compared to Downwind.	Background Compared to Upwind.	Upwind Compared to Downwind.	Total Sample Comparison.
Kruskal-Wallis	No difference. (*p = 0.792*)	No difference. (*p = 0.447*)	No difference. (*p = 0.384*)	No difference. (*p = 0.623*)
Friedman	No difference. (*p = 0.792*)	No difference. (*p = 0.447*)	No difference. (*p = 0.384*)	No difference. (*p = 0.623*)
Wilcoxon-Mann-Whitney	No difference. (*p = 0.809*)	No difference. (*p = 0.461*)	No difference. (*p = 0.395*)	N/A[2]

[1] Statistical analyses performed using SAS 9.4 Statistical Software Package. A p-value equal to or less than 0.05 suggests that a statistically significant difference between each value is present. A p-value greater than 0.05 suggests that no statistical difference between the values is present and that the values are comparable.

[2] The Wilcoxon-Mann-Whitney test does not permit the comparison of more than two groups to each another. Thus, a calculation for a total comparison between background, downwind, and upwind air sample results is not available.

Table 5. Gross Beta Statistical Results

Statistical Test[1]	**Result of Statistical Tests for Gross Beta Data**			
	Background Compared to Downwind.	Background Compared to Upwind.	Upwind Compared to Downwind.	Total Sample Comparison.
Kruskal-Wallis	No difference. (*p = 0.405*)	No difference. (*p = 0.534*)	No difference. (*p = 0.859*)	No difference. (*p = 0.693*)
Friedman	No difference. (*p = 0.405*)	No difference. (*p = 0.534*)	No difference. (*p = 0.859*)	No difference. (*p = 0.693*)
Wilcoxon-Mann-Whitney	No difference. (*p = 0.417*)	No difference. (*p = 0.549*)	No difference. (*p = 0.874*)	N/A[2]

[1] Statistical analyses performed using SAS 9.4 Statistical Software Package. A p-value equal to or less than 0.05 suggests that a statistically significant difference between each value is present. A p-value greater than 0.05 suggests that no statistical difference between the values is present and that the values are comparable.

[2] The Wilcoxon-Mann-Whitney test does not permit the comparison of more than two groups to each another. Thus, a calculation for a total comparison between background, downwind, and upwind air sample results is not available.

Statistical Results: None of the statistical analyses performed identified any statistically significant difference between the three different sets of air samples collected from background, upwind, and downwind locations.

Section 3: Ambient Gamma Radiation Monitoring:

Introduction: Collection of gamma radiation data was performed by DHSS staff with equipment suitable for radiation exposure monitoring (see Section 4: Equipment Description). Typical exposure rate readings in outdoor environments fluctuate around 10 µR/hr as a result of cosmic and terrestrial sources of radiation (National Council on Radiation Protection and Measurements 1987). Construction materials can also have an effect on background radiological readings due to naturally occurring radioactive materials found in them.

Objective: Ambient gamma readings were taken by DHSS staff approximately every 15 minutes at sample locations around the landfills and in background locations. Individual instrument readings over the two day period were evaluated to ensure constancy from location to location.

Results: Over the two day sampling period, staff collected 168 gamma exposure rate readings at locations where air sampling was conducted, summarized in Table 1 below. From this data, the following conclusions were made:

- The average of the individual readings by detector is consistent from site to site, and
- The average results show a normal range for "natural background" radiation levels (i.e. 0.5 to 11.2) for all detectors.

The highest individual reading recorded over the two day period was at location A06 (upwind location) with a measurement of 14.4. This is slightly over the 10 µR/hr that is typically found in outdoor environments and can be accounted for through normal fluctuations of naturally occurring radioactive material and cosmic radiation.

Table 6. Ambient Gamma Exposure Rate Data (micro-roentgen per hour)

Detector 25009985					
Station 2	LPHA	Station 5			
7.7	6.8	7.3			
Detector 25009986					
A01	A03	A05	A06	A09	
9.6	10.3	10.2	11.2	10.7	
Dectector 25003413					
A01	A02	A03	A06	A08	A09
0.9	1.3	0.5	3.0	2.9	1.2
Detector 25007091					
A02	A04	A05	A07	A09	
1.7	3.9	2.1	2.3	0.7	

Section 4: Equipment

- **Air Sampling**:
  - Radeco Model H810 AC High Volume air samplers with holder to accommodate a two-inch particulate filter.
  - Model 0750-37 particulate filters 99% efficient
  - Ludlum Model 2241-3 with 44-38 Energy Compensate GM probe and 44-9 pancake probe.
- **Ambient Gamma Monitoring**
  - Ludlum Model 9DP Ion Chamber

Section 5: Radon

Radon is a naturally occurring radioactive gas that can be an indoor air hazard anywhere in Missouri. It comes from the natural decay of uranium that is found in nearly all soils. Radon is a noble gas, which means it does not burn or react readily with other chemicals. It typically moves up through the ground to the air above, where it dissipates to low levels. The Environmental Protection Agency (EPA) estimates that naturally occurring background levels for radon are around 0.4 pCi/L. However, a home or other building can trap radon inside where it can build up. Any home may have a radon problem. This means new and old homes, well-sealed and drafty homes, and homes with or without basements.

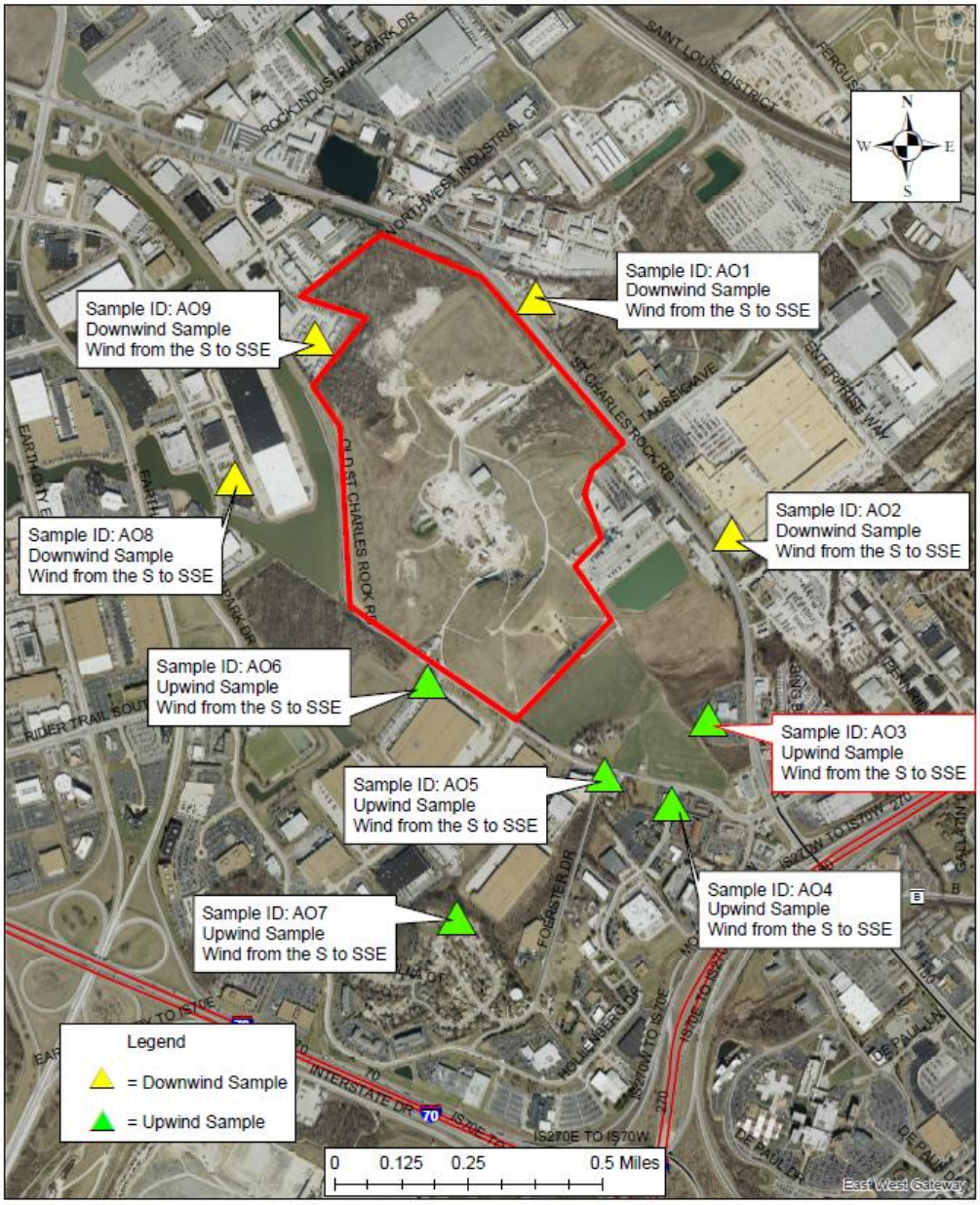
Although isotopes at the nearby West Lake Landfill do generate radon, ambient air concentrations are expected to dissipate quickly to background levels. Perimeter air monitoring for radon required by EPA at the West Lake Landfill should continue to verify this.

Section 6: Conclusion

This final report provides an update on airborne radiological survey activities around the Bridgeton/Westlake Landfill by DHSS on November 4 through November 5, 2015. As part of this effort, DHSS and DNR performed radiological surveys and sampling at numerous locations in the vicinity of the Bridgeton/West Lake Landfill. This final report discusses laboratory analysis and statistical comparison of air samples collected around the landfill site.

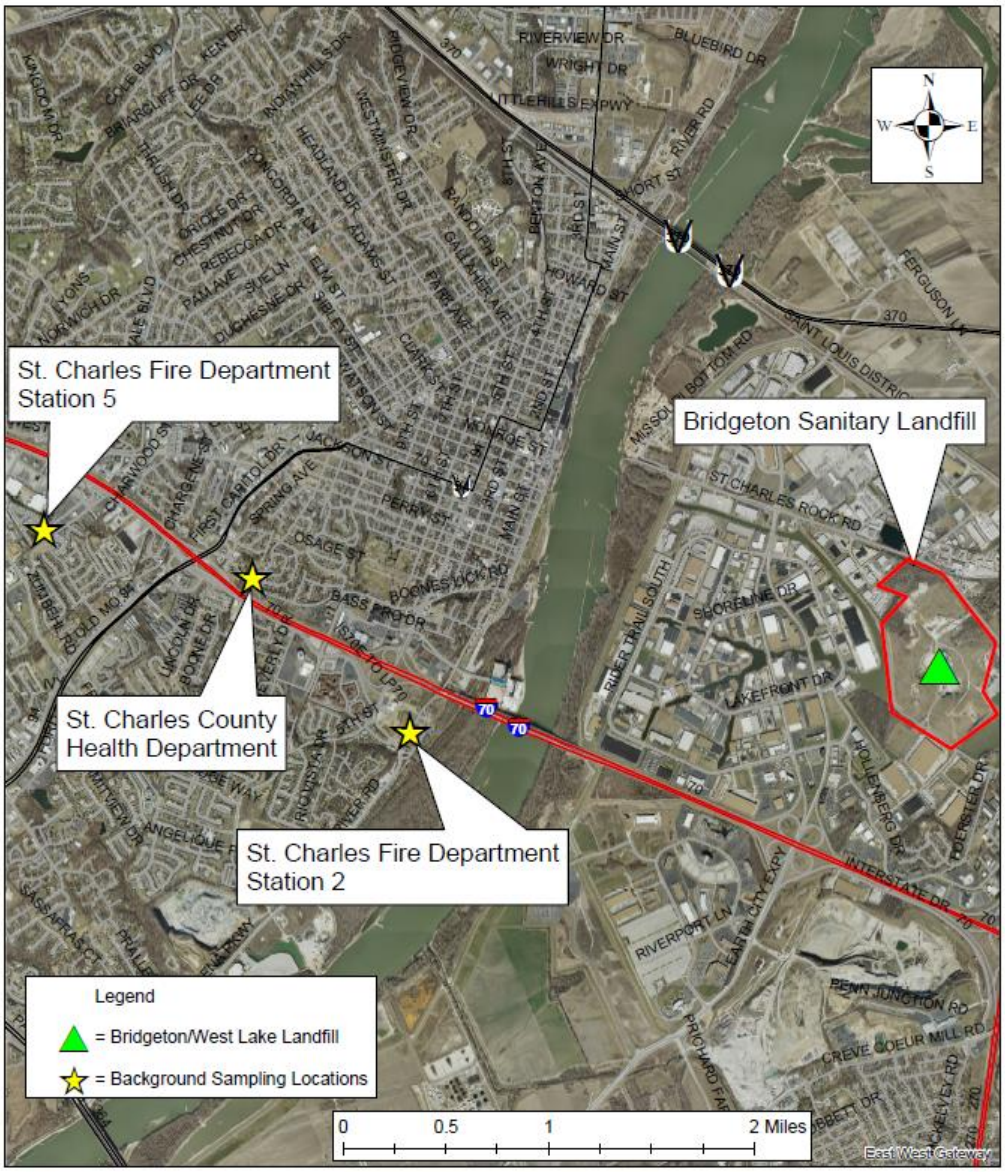
DHSS has communicated all information to the EPA and has shared all laboratory data as it was received and evaluated for quality assurance. No significant difference was observed between the background, upwind, and downwind ambient air samples for alpha, beta, or gamma radiation.

Figure 3
Bridgeton/West Lake Landfill
Air Sample Collection Points November 4-5, 2015



AIR_SAMPLING_LOCATION_ID	DESCRIPTION
A01	Lot across road from OU2, 13751 St Charles Rock Rd, typ downwind of OU1 Area 2
A02	Hussmann Lot with DNR trailer.
A03	Former Gas Station by Terrisan mobile home park
A04	Boenker Ln Location Alt A, Boenker Road & Hollenberg Rd SW Corner, Doctors Office
A05	Boenker Ln Location Alt B, Boenker Road & Foerster Dr SE Corner, D&E Automotive Products
A06	Old St Charles Rock Rd, MSD Lift Station & CLM Pallet Recycling
A07	Spanish Village park
A08	13374 Lakefront Dr. This is a vacant property
A09	AAA Trailer Service Lot adjoining OU1 Area 2

Figure 4
Bridgeton/West Lake Landfill
Background Sampling Locations
November 4-5, 2015



AIR_SAMPLING_LOCATION_ID	DESCRIPTION
Station 2	1550 S. Main St., St. Charles Mo
St. Charles County Health Dept	1650 Boone's Lick Rd, St Charles, Mo
Station 5	1650 Hawks Nest, St. Charles, Mo

Photographic Log

Photo 1: Location A05 looking north toward the landfill.

Photo 2: Location A02 looking west toward the landfill.

Photo 3: Location A08 looking east toward the landfill.

Photo 4: Location A09 looking south toward the landfill.