



Tacoma - Pierce County
Health Department
Healthy People in Healthy Communities

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**Fall 2015 Summary Report
Residential Drinking Water Well Sampling
LRI Landfill**

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Summary

Background

This report is a summary of the water quality sampling event conducted in the Fall of 2015

All drinking water wells within one-half (1/2) mile of the boundary of the LRI Landfill are eligible for free water quality sampling once each year. The Fall 2015 water sampling is a continuation of a *Residential Drinking Water Well Program (Program)* developed and implemented in 2006, by the Tacoma-Pierce County Health Department, in response to concerns raised during the LRI Landfill's solid waste permit re-issuance process. The Program is a requirement of the LRI Landfill Solid Waste Handling Permit, issued by the Health Department. Substances chosen for testing by the Health Department were selected in order to assess groundwater quality. These tests can provide information about possible groundwater impacts from the landfill.

The Program allows property owners to have their well water sampled in either the Spring ("Spring Participants") or Fall ("Fall Participants") of each year, and may decline participation in the Program or drop out of the Program at any time.

The water samples are tested annually for twenty characteristics and substances, including conductivity, pH, ammonia, nitrate, chloride, iron, manganese, magnesium, and Coliform bacteria. In addition to the annual water quality test, participants will have their water tested once every five years for 'Volatile Organic Compounds' (VOCs). Approximately one fifth of the participating property owners will be selected to have their well water tested for VOCs each year, thereby ensuring all participants will have their water analyzed for VOCs once every five year cycle. However, effective with the spring 2015 sampling event, members of the Woodbrook Homeowners Association are now eligible for annual VOC testing. This change is the result of a legal settlement between the Woodbrook Homeowners Association and LRI over the relocation of Woodbrook Road (317th Street East). Woodbrook Road currently bisects the southern portion of the landfill property and is the sole access point for residents of the Woodbrook community. The legal settlement will facilitate the relocation of Woodbrook Road around the perimeter of the landfill.

Although landfills are not regarded as a source of Coliform bacteria in groundwater, the Health Department elected to include Coliform bacteria testing as part of the sampling program. These tests are taken due to the known health effects of bacterial contamination, and because many homeowners in rural areas are unaware of possible bacterial contamination of their well water.

In addition to this Program, the landfill operator is required by the Health Department to maintain an on-site groundwater monitoring program. This on-site monitoring program has been in effect since 1999. For the on-site groundwater monitoring program, nine wells around the perimeter of the landfill property are sampled quarterly (four times a year). All groundwater monitoring data from these wells are available from the Health Department.

Fall 2015 Sampling Event

The Fall 2015 water samples were collected at 32 properties from September 28 through October 1, 2015. Samples collected by the Health Department were analyzed by independent Washington State certified analytical laboratories. Water Management Laboratories performed bacteriological analyses, and OnSite Environmental Inc. performed organic and inorganic chemical analyses. 2015 Fall Participants were sent detailed water quality test results in December 2015. No landfill-related impacts to groundwater quality were identified from the water quality test results.

A complete list of water quality test results may be found on **Table 1** of this summary report.

For the Fall 2015 sampling event, water samples from 20 residential wells were tested for VOCs.

The analytical results indicated that VOCs were detected in water samples from 4 of the 20 wells tested. Of the 68 different VOCs that the testing process identifies, chloroform was detected in one well; CFC-12 was detected in one well; toluene in one well and styrene in two wells. Follow-up water samples were obtained from two of the four wells on October 29th.

The detection of chloroform (0.58 ppb) was from a well where the owner has a history of using chlorine as a water treatment process (disinfectant). Chloroform is a known by-product of the chlorine disinfection process. Re-sampling of this well was therefore not deemed necessary.

The CFC-12 detection was at 0.3 ppb. CFC-12 is also known as Freon-12, R-12 or Dichlorodifluoromethane. CFC-12 is a colorless gas that is utilized as a refrigerant and an aerosol propellant. This particular well was re-sampled on October 29. The resample once again detected CFC-12 in the water, this time at 0.38 ppb. CFC-12 at these levels pose no health threat.

Styrene was detected in one well water sample at 1.8 ppb with a resample result of 1.2 ppb. Styrene was also detected at 1.4 ppb along with Toluene at 4.8 ppb in another well. The compound *Styrene* is not naturally occurring in ground waters of Pierce County. It was noted that one of these well locations had a plastic rope going down their well that was attached to the submersible pump. Plastic rope is often made of *Polystyrene* and Polypropylene plastics. Due to the very low level of *Styrene* found in this well water, it is possible that the rope is the source of the *Styrene*. *Styrene* at the levels detected in these water samples poses no health threat.

The well which had the detection of toluene and styrene was not re-sampled as the owner did not respond to inquiries from the Department seeking authorization to resample. Toluene is a common solvent used for paints, paint thinners, chemical reactants, adhesives, lacquers and disinfectants. Toluene also occurs naturally at low levels in crude oil and is by-product of petroleum refining.

Of these VOCs, only Toluene has a health based risk level established for drinking water at 1 ppm (one part per million). The level of Toluene found during this sampling event is nearly 1,000 times lower than the established health risk level. For the other VOCs encountered we referred to data from the State of California, which has established health-risk based levels in water for *Freon-11* (150 ppb) and for *Styrene* (100 ppb). *Freon-11* is a parent compound to *Freon 12* (CFC-12).

CFC-12 and *Styrene* have been intermittently detected at low concentrations in the LRI Landfill leachate yet neither compound has ever been detected in the network of perimeter groundwater monitoring wells that comprise the facility's groundwater monitoring network. Toluene, on the other hand, is a very common constituent in landfill leachate yet has only been detected in ground water monitoring wells on four occasions since the landfill began operations in 1999. Considering that three of the four residential well locations where the VOC's were detected are located up-gradient from the landfill and the fact that these compounds have not been detected by the onsite ground water monitoring network (toluene excluded), the detection of these compounds is not believed to be related to the LRI Landfill.

The remaining water quality results for these wells were typical for the region.

With the exception noted above, the Fall 2015 water quality test results are consistent with water quality test results from previous sampling events, and show groundwater in the vicinity of the

landfill remains typical of groundwater chemistry in Pierce County. Iron and manganese levels were consistently above the secondary standards set by the Washington State Department of Health. Elevated iron and manganese levels are typical of groundwater conditions throughout much of Pierce County due to the underlying geology.

Iron and manganese are considered “secondary contaminants” by the Washington State Department of Health. Secondary contaminants pose aesthetic problems rather than health concerns. High levels of iron and manganese can give water a metallic taste, cause odors, and can cause brown or black staining of porcelain fixtures exposed to the water. They are not a health hazard and are not a result of the LRI Landfill.

The water quality sample results are shown on **Tables 1 and 2** of this report. Results that exceed the state water quality standards are shown in bold. For quality control purposes duplicate samples were taken at four locations. Results of the quality control samples are shown on **Tables 3 and 4**.

Bacteria

During this sampling event, nine of the thirty-two wells tested had bacteria present in their well water (bacteria in the water is shown as an “unsatisfactory” test result, and indicated as a “u” on Table 1, or indicated as an “E” if e-coli bacteria are present).

CONTACTS

For questions regarding this report or the sample results please contact representatives of the Health Department’s Drinking Water Program.

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TABLE 1: LRI Landfill Residential Well Sampling Program – Fall 2015 Water Quality Results
Chemical or Analytes*----->

		General Chemistry						Dissolved Metals										Total Metals					
Site	Sample Date	Ammonia	Chloride	Nitrogen, Nitrate	Nitrogen, Nitrite	Sulfate	Total Dissolved Solids	Arsenic	Barium	Calcium	Copper	Iron	Magnesium	Manganese	Potassium	Sodium	Vanadium	Zinc	Iron	Manganese	Conductivity	Bacteria	pH
MCL**			250	10.0	1.0	250	500	0.01	2.0		1.3							5.0	0.3	0.05	750		
SR0117337	9/30/2015	0.07	5.6	ND	ND	ND	160	0.0032	ND	22	ND	ND	11	0.17	3.2	11	ND	ND	0.62	0.18	256	S	7.9
SR0117339	10/1/2015	0.084	3.3	ND	ND	ND	130	0.0046	ND	23	ND	ND	7.3	0.12	3.3	12	ND	ND	0.4	0.14	234	U	8
SR0117447	10/1/2015	0.01	3.2	1.6	ND	ND	150	ND	ND	11	0.055	ND	8.1	ND	2.3	7.9	ND	ND	ND	ND	164.9	S	7
SR0117449	9/30/2015	0.006	ND	0.052	ND	ND	170	ND	ND	ND	ND	ND	ND	ND	ND	49	ND	ND	ND	ND	198.3	S	8
SR0117450	10/1/2015	0.015	11	ND	ND	ND	79	ND	ND	20	ND	ND	7.2	0.086	3	18	ND	0.06	1.3	0.097	245	S	7.7
SR0117451	10/1/2015	0.009	16	0.15	ND	ND	330	ND	ND	ND	ND	0.12	ND	ND	ND	93	ND	ND	0.2	ND	391	S	6.9
SR0117456	9/29/2015	0.01	120	ND	ND	13	380	0.0039	ND	2.4	ND	ND	1.7	0.042	ND	140	ND	ND	ND	0.046	659	S	7.8
SR0117459	9/28/2015	0.016	2.6	ND	ND	ND	110	ND	ND	13	ND	0.2	6.8	0.16	1.4	11	ND	ND	0.52	0.18	185.5	U	7.9
SR0117478	10/1/2015	0.036	2.9	ND	ND	ND	150	ND	ND	16	ND	0.08	7.4	0.19	1.8	12	ND	ND	0.88	0.21	185.5	S	7.8
SR0117479	9/30/2015	0.021	2.5	ND	ND	ND	130	ND	ND	14	ND	0.34	7.1	0.16	1.4	10	ND	ND	0.53	0.17	167	S	7.9
SR0117480	9/28/2015	0.022	3.5	ND	ND	ND	53	ND	ND	17	ND	0.36	10	0.51	1.7	19	ND	ND	0.92	0.57	237	U	7.4
SR0120517	9/30/2015	0.008	6.4	0.11	ND	9.4	180	0.004	ND	23	ND	ND	12	ND	4.2	9.1	ND	ND	ND	ND	255	S	7.4
SR0120518	9/29/2015	0.038	2.9	ND	ND	ND	110	0.0032	ND	15	ND	0.15	7.7	0.32	2	15	ND	ND	0.23	0.36	297	U	7.9
SR0120627	9/30/2015	0.006	ND	0.47	ND	ND	140	ND	ND	11	ND	ND	6.4	ND	1.9	7.6	ND	ND	0.18	ND	139.7	S	7.4
SR0120639	9/30/2015	0.274	6	ND	ND	7.2	200	0.005	ND	21	ND	ND	15	0.28	3.8	9.5	ND	ND	0.31	0.29	262	S	8.1
SR0120645	9/28/2015	0.053	3	ND	ND	ND	140	ND	ND	17	ND	ND	7	0.22	1.6	14	ND	ND	0.12	0.22	191.8	S	8.2
SR0120928	9/29/2015	0.007	2.9	ND	ND	ND	160	ND	ND	ND	ND	ND	ND	ND	ND	58	ND	ND	ND	ND	234	S	7.8
SR0126801	9/30/2015	0.028	7.9	ND	ND	13	230	0.0057	ND	27	ND	ND	19	0.024	3.8	8.9	ND	ND	ND	0.028	318	U	7.9
SR0126807	9/29/2015	0.011	5.6	0.51	ND	8.5	120	0.0033	ND	12	ND	ND	8	ND	1.9	8.3	ND	ND	ND	ND	168.7	U	7.2
SR0126808	9/28/2015	0.005	7.2	4	ND	ND	120	ND	ND	10	0.015	ND	11	ND	1.9	7.9	0.011	ND	ND	ND	187.8	U	7.1
SR0126809	9/30/2015	0.04	2.3	ND	ND	ND	110	0.0036	ND	17	ND	ND	6.3	0.11	1.3	10	ND	ND	0.23	0.11	174.4	S	8.1
SR0133428	10/1/2015	0.027	3.1	0.072	ND	ND	130	ND	ND	16	ND	ND	6.6	0.15	ND	12	ND	ND	0.86	0.17	178.4	U	7.8
SR0133429	9/30/2015	0.017	3	0.22	ND	ND	140	ND	ND	14	ND	0.38	7	0.15	1.3	11	ND	ND	1.1	0.15	167.7	S	8.1
SR0133431	10/1/2015	0.008	2.9	ND	ND	ND	96	ND	ND	ND	ND	0.07	ND	ND	ND	48	ND	ND	0.07	ND	201.3	E	7.7
SR0138417	9/30/2015	0.029	ND	ND	ND	ND	140	ND	ND	16	ND	0.06	6.8	0.14	1.4	13	ND	ND	0.24	0.15	187	S	8
SR0145751	10/1/2015	0.023	3.3	0.12	ND	ND	120	ND	ND	15	ND	0.14	6.6	0.13	1.3	11	ND	0.04	2	0.15	175.4	S	7.9
SR0154487	10/1/2015	0.019	4.1	ND	ND	ND	96	ND	ND	ND	ND	ND	ND	ND	2	40	ND	ND	ND	ND	170.8	S	8.2
SR0173998	10/1/2015	0.011	3.3	1	ND	ND	110	ND	ND	10	0.024	ND	9.4	ND	1.8	7.9	0.015	ND	ND	ND	162.7	S	7
SR0179187	9/28/2015	0.076	5.1	ND	ND	ND	160	0.004	ND	ND	ND	ND	ND	ND	ND	57	ND	ND	ND	ND	227	S	7.8
SR0192658	9/29/2015	0.052	3.7	ND	ND	ND	140	0.0043	ND	18	ND	ND	7.8	0.21	2.5	9.1	ND	ND	0.55	0.24	194.3	S	7.7
SR0192724	9/29/2015	0.02	3	ND	ND	ND	130	ND	ND	14	ND	0.63	7.6	0.41	1.4	15	ND	ND	1.6	0.49	216.3	S	7.5
SR0192747	9/29/2015	0.03	6.8	ND	ND	ND	150	ND	ND	21	ND	ND	8.7	0.51	1.6	8.1	ND	ND	0.08	0.58	239	S	7.6

Units of measurement = Parts Per Million (mg/L), except for bacteria, conductivity, and pH
ND = Not detected at the specified laboratory detection limit
U = Unsatisfactory (bacteria are present in the sample)
S = Satisfactory
U = Unsatisfactory
E = e-coli present
**MCL = Maximum Contamination Level

*Please refer to the “Water Quality and Abbreviation and Notes” page for information about the terms used on this table.

TABLE 3: LRI Landfill Residential Well Sampling Program – Fall 2015 Water Quality Duplicate Results

Chemical or Analytes*----->																							
		General Chemistry						Dissolved Metals										Total Metals					
Site	Sample Date	Ammonia	Chloride	Nitrogen, Nitrate	Nitrogen, Nitrite	Sulfate	Total Dissolved Solids	Arsenic	Barium	Calcium	Copper	Iron	Magnesium	Manganese	Potassium	Sodium	Vanadium	Zinc	Iron	Manganese	Conductivity	Bacteria	pH
MCL**			250	10.0	1.0	250	500	0.01	2.0		1.3							5.0	0.3	0.05	750		
SR0117339	10/1/2015	0.084	3.3	ND	ND	ND	130	0.0046	ND	23	ND	ND	7.3	0.12	3.3	12	ND	ND	0.4	0.14	234	U	8
SR0117339 D	10/1/2015	0.083	3.3	ND	ND	ND	160	0.0049	ND	23	ND	ND	7.5	0.13	3.4	12	ND	ND	0.43	0.14	236	U	7.9
SR0120517	9/30/2015	0.008	6.4	0.11	ND	9.4	180	0.004	ND	23	ND	ND	12	ND	4.2	9.1	ND	ND	ND	ND	255	S	7.4
SR0120517 D	9/30/2015	0.005	6.9	0.17	ND	11	150	0.0036	ND	23	ND	ND	13	ND	4.5	9	ND	ND	ND	ND		S	
SR0120928	9/29/2015	0.007	2.9	ND	ND	ND	160	ND	ND	ND	ND	ND	ND	ND	ND	58	ND	ND	ND	ND	234	S	7.8
SR0120928 D	9/29/2015	0.006	3	ND	ND	ND	160	ND	ND	ND	ND	ND	ND	ND	ND	58	ND	ND	ND	ND	226	S	7.7
SR0126808	9/28/2015	0.005	7.2	4	ND	ND	120	ND	ND	10	0.015	ND	11	ND	1.9	7.9	0.011	ND	ND	ND	187.8	U	7.1
SR0126808 D	9/28/2015	0.006	7	3.9	ND	ND	110	ND	ND	10	0.013	ND	11	ND	2	8.2	ND	ND	ND	ND		S	

Units of measurement = Parts Per Million (mg/L)

ND = Not detected at the specified laboratory detection limit
**MCL = Maximum Contamination Level

MCL exceedances for Iron and Manganese do not pose a health risk.

*Please refer to the “Water Quality and Abbreviation and Notes” page for information about the terms used on this table.

TABLE 4: LRI Landfill Residential Well Sampling Program – Fall 2015 Water Quality VOC Duplicate Results

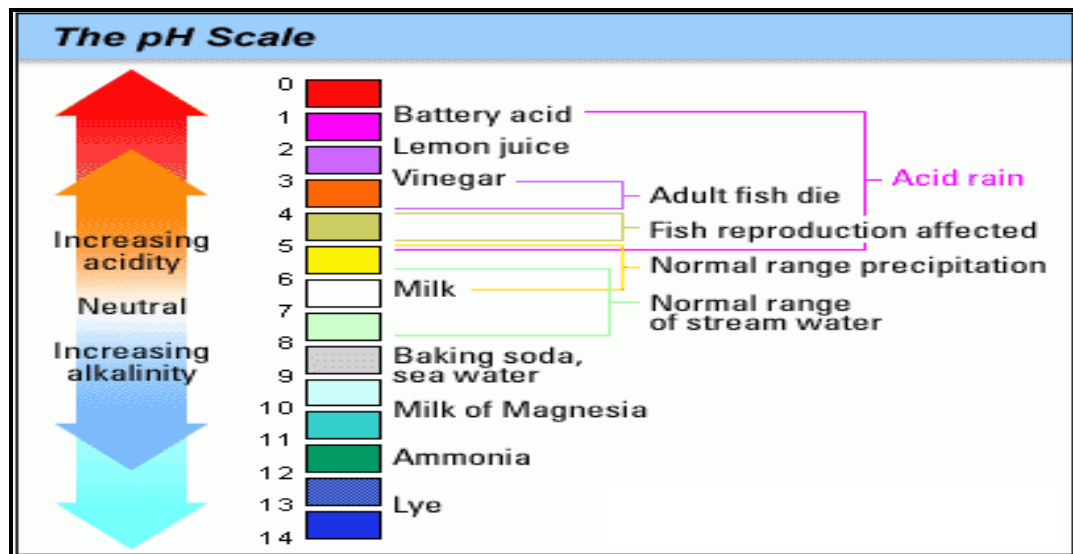
	MCL	SR0117339	SR0117339 D	SR0120517	SR0120517 D	SR0154487 R	SR0154487 D
1,1,1,2-Tetrachloroethane	---	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	0.20	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	---	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	---	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	1.0	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	---	ND	ND	ND	ND	ND	ND
1,1-Dichloropropene	---	ND	ND	ND	ND	ND	ND
1,2,3-Trichlorobenzene	---	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	---	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	---	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	---	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	---	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	---	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	0.5	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	0.6	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	---	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	---	ND	ND	ND	ND	ND	ND
1,3-Dichloropropane	---	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	4.0	ND	ND	ND	ND	ND	ND
2,2-Dichloropropane	---	ND	ND	ND	ND	ND	ND
2-Butanone	---	ND	ND	ND	ND	ND	ND
2-Chloroethylvinylether	---	ND	ND	ND	ND	ND	ND
2-Chlorotoluene	---	ND	ND	ND	ND	ND	ND
2-Hexanone	---	ND	ND	ND	ND	ND	ND
4-Chlorotoluene	---	ND	ND	ND	ND	ND	ND
Acetone	---	ND	ND	ND	ND	ND	ND
Benzene	1.0	ND	ND	ND	ND	ND	ND
Bromobenzene	---	ND	ND	ND	ND	ND	ND
Bromochloromethane	0.3	ND	ND	ND	ND	ND	ND
Bromoform	5.0	ND	ND	ND	ND	ND	ND
Bromomethane	---	ND	ND	ND	ND	ND	ND
Carbon Disulfide	---	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	0.3	ND	ND	ND	ND	ND	ND
CFC-11	---	ND	ND	ND	ND	ND	ND
CFC-12	---	ND	ND	ND	ND	ND	ND
Chlorobenzene	---	ND	ND	ND	ND	ND	ND
Chloroethane	---	ND	ND	ND	ND	ND	ND
Chloroform	7.0	ND	ND	ND	ND	ND	ND
Chloromethane	---	ND	ND	ND	ND	ND	ND
Cis-1,2-Dichloroethene	---	ND	ND	ND	ND	ND	ND
Cis-1,3-Dichloropropene	---	ND	ND	ND	ND	ND	ND
Dibromochloromethane	---	ND	ND	ND	ND	ND	ND
Dibromomethane	---	ND	ND	ND	ND	ND	ND
Dichlorobromomethane	---	ND	ND	ND	ND	ND	ND
Ethylbenzene	---	ND	ND	ND	ND	ND	ND
Ethylene dibromide	---	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	---	ND	ND	ND	ND	ND	ND
Isopropylbenzene	---	ND	ND	ND	ND	ND	ND
m, p-Xylene	---	ND	ND	ND	ND	ND	ND
Methyl Iodide	---	ND	ND	ND	ND	ND	ND
Methyl Isobutyl Ketone	---	ND	ND	ND	ND	ND	ND
Methyl t-Butyl Ether	---	ND	ND	ND	ND	ND	ND
Methylene Chloride	5.0	ND	ND	ND	ND	ND	ND
Naphthalene	---	ND	ND	ND	ND	ND	ND
n-Butylbenzene	---	ND	ND	ND	ND	ND	ND
n-Propylbenzene	---	ND	ND	ND	ND	ND	ND
o-Xylene	---	ND	ND	ND	ND	ND	ND
p-Isopropyltoluene	---	ND	ND	ND	ND	ND	ND
sec-Butylbenzene	---	ND	ND	ND	ND	ND	ND
Styrene	---	ND	ND	ND	ND	1.2	1.2
tert-Butylbenzene	---	ND	ND	ND	ND	ND	ND
Tetrachloroethene	---	ND	ND	ND	ND	ND	ND
Toluene	---	ND	ND	ND	ND	ND	ND
Trans-1,2-Dichloroethene	---	ND	ND	ND	ND	ND	ND
Trans-1,3-Dichloropropene	---	ND	ND	ND	ND	ND	ND
Trichloroethene	---	ND	ND	ND	ND	ND	ND
Vinyl Acetate	---	ND	ND	ND	ND	ND	ND
Vinyl Chloride	0.02	ND	ND	ND	ND	ND	ND

Units of measurement = Parts Per Billion (ug/L)

ND = Not detected at the specified laboratory detection limit
1 – MCL = Maximum Contamination Level
R = Resample taken 10/29/2015

Water Quality Abbreviations and Notes:

- Analyte:** The chemical or metal that is being tested for in the water sample.
- Result:** The level of the chemical or mineral detected by the laboratory in this water sample.
- ND:** Non-Detect, the chemical or metal was not detected in this water sample.
- Unit:** The unit of measure reported by the laboratory.
- mg/l:** milligrams per liter, or 1 part per million.
- MCL:** "Maximum Contaminant Level". The water quality standard established by state or federal regulation.
- #/100ml:** The number of bacteria colonies detected in 100 milliliters of water.
Note: An MCL of "0.00" means that there should be no bacteria detected in the water sample.
- uS/cm:** microSiemens per centimeter, a measurement of the ability of the water to conduct an electrical charge (sometimes reported as microMhos). Used to help determine the presence of some chemical ions.
- pH:** A numerical measure of the level of acidity or alkalinity of the water. See the table below.



- ppb:** Parts per billion often expressed as micrograms per liter (ug/L)
- Unit:** The unit of measure reported by the laboratory.
- #/100ml:** Unit of measure for *Bacteria* test, the number of bacteria colonies detected in 100 milliliters of water. Note: An MCL of "0/100" means that there should be zero bacteria detected in the 100 milliliter water sample.
- (---):** The Environmental Protection Agency and/or the Centers for Disease Control and Prevention have not established a health-risk based maximum contaminant level (MCL) for this chemical, metal, or property.

APPENDIX A

Sampling for Volatile Organic Compounds

LRI Drinking Water Well Sampling Program

In 2007, several program participants and members of the Graham Land Use Advisory Commission asked why 'volatile organic compounds' (VOC) had not been included in the original LRI Landfill residential drinking water sampling program. They asked to have the sampling program modified to include testing for these volatile organic compounds. As a result of the request and inquiries, the sampling program was modified to include a limited suite of approximately 68 VOCs for analysis.

The program modification included a provision to test each participating well once every five-year period for VOCs. This modification began during the Fall 2007 sampling event with the testing of nine residential wells for VOCs. Seven residential wells were sampled and tested for VOCs during the Fall 2010 sampling event. To date, forty-two Spring Participant wells have been sampled for VOC's and forty-five Fall Participant wells, for a total of 87 wells tested for VOCs.

Where do VOCs come from?

Common artificial sources of VOCs are many and varied, but can include paint thinners, dry cleaning solvents, and some constituents of petroleum-based fuels (e.g., gasoline and natural gas). Landfills, through the anaerobic digestion of waste generate methane gas, which is also considered a VOC.