2011 Drinking Water Quality
Consumer Confidence Report

The University of Kansas - Lawrence Campus - July 1, 2012

Prepared by the KU-LC Department of Environment, Health & Safety

The purpose of this report is to inform people who work for, attend, or visit the University of Kansas Lawrence Campus (KU-LC) about the quality of the drinking water provided to them by the KU-LC Public Water Distribution System. The KU-LC is committed to providing users a safe, clean and dependable supply of drinking water.

This 2011 Drinking Water Quality Consumer Confidence Report presents the results from analyses conducted by the KU-LC Department of Environment, Health & Safety (KU-LC EHS) and the City of Lawrence of drinking water samples collected on the KU-LC and at the City of Lawrence drinking water treatment plants during the **2011 calendar year** (Tables 1, 2 3 and 4). The overall conclusion of this report, based on the evaluation of these water quality test results, is that the drinking water provided to you by the KU-LC is safe and has not violated any federal or state water quality regulatory compliance standards. The KU-LC and the City of Lawrence, from whom the KU-LC purchases its water, routinely monitor the quality of the drinking water for all contaminants of concern. More information about contaminants and their potential health effects can be obtained by calling the U.S. Environmental Protection Agency's Safe Drinking Water Hotline (800-426-4791) or by visiting their website.

It should be noted that all drinking water, including bottled water, can be presumed to contain small amounts of contaminants. However, the presence of contaminants does not necessarily indicate that the water poses a health risk. The U.S. Environmental Protection Agency (EPA) has regulations that limit the amount of specific contaminants in drinking water provided by public water systems. To better understand the possible health risks associated with the exposure to most contaminants, a person would have to drink two liters of water every day at the allowable EPA maximum contaminant level (MCL) in drinking water for a lifetime (approximately 70 years) to have a one-in-a-million chance of having the described health effect.

In our continuing effort to vigilantly safeguard our drinking water supply, it may be necessary to make improvements in the water distribution system. Therefore, brief interruptions in the drinking water supply may occur from time to time. All public meetings regarding the KU-LC water system are posted on the KU-LC EHS Events website. If you have any questions, comments or concerns about the quality of the drinking water provided to you by the KU-LC or have any question about the information contained in this report, please contact Jon Rossillon, KU-EHS Hazardous Materials/Environmental Protection Manager, by phone (785-864-4089) or by email (jrossillon@ku.edu). We welcome your input.

It should also be noted that some individuals may be more vulnerable to specific contaminants in drinking water than the general population. People who may be more vulnerable include individuals who are immuno-compromised such as those who have cancer and are undergoing chemotherapy, have undergone a recent organ transplant, have HIV/AIDS or other immune system disorders (e.g., rheumatoid arthritis, lupus erythematosus, or multiple sclerosis), some elderly persons, and infants. These individuals or their parent/guardian should seek advice from their health care provider about the potential risk due to exposure to any possible drinking water contaminant.

One potential contaminant, *Cryptosporidium,* is required by EPA to be discussed in this report in order to inform individuals with weakened immune system that resulting symptoms may be worse, last longer, and be life threatening {individuals with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS [especially if their CD4+ T-cell count is lower than $200/mm^3$ – see Center for Disease Control (CDC) web page] or other immune system disorders, some elderly, and infants}. *Cryptosporidium*, a very small, single-celled protozoan parasite, is present in surface waters throughout the US. Ingestion of this pathogen may cause cryptosporidiosis, an abdominal infection. The symptoms of this infection include diarrhea, nausea and abdominal cramps. The City of Lawrence regularly monitors its source waters for this parasite. Guidelines on ways to lessen your risk of exposure to this and other microbiological organisms can be viewed on the EPA/Center for CDC web page or obtained by calling the EPA Safe Drinking Water Hotline (800-426-4791).

In order to understand the sources of contaminants, the sources of drinking water need to be reviewed. The sources of drinking water include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it naturally dissolves minerals and can also pick up materials associated with the soil, plants, and substances associated with animal and human activities. In some instances, these materials may be considered contaminants and, if present in high enough concentrations, pose a risk to human health.

The two primary drinking water sources for the KU-LC are the Kansas River and Clinton Lake. Six Kansas River alluvial wells are used occasionally and represent a very minor source of drinking water. An assessment of these water sources was completed by the state of Kansas in 2003. The results of that source water assessment can be viewed on the Kansas Department of Health and Environment (KDHE) web page.

Contaminants in drinking water fall into one of five categories:

- **Microbial contaminants:** for example, pathogens that may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.

- **Inorganic chemical contaminants:** for example, salts and metals that can be naturally occurring and also originate from urban stormwater runoff, industrial and domestic wastewater discharges, oil and gas production, mining, and farming.

- **Organic chemical contaminants:** these are synthetic and volatile organic chemicals that can arise as byproducts of industrial processes and petroleum production as well as from gas stations, urban stormwater runoff, and septic systems.

- **Pesticides:** chemical preparations used to kill or control pests (e.g., herbicides for plants and insecticides for insects) that may come from many sources including agriculture, urban stormwater runoff, residential, and commercial activities.

- **Radioactive contaminants**: radionuclides found naturally in the soil or the result of oil/gas production and mining activities as a result of their extraction processes.

To assist you in understanding this report, the following explanations for abbreviations and definitions of various terms used in this report are provided:

AL – **Action Level** – The concentration of lead or copper in drinking water that, when exceeded, triggers the need for treatment techniques or other actions.

EPA – **United States Environmental Protection Agency** – The Federal Regulatory Agency responsible for establishing for drinking water standards.

KDHE – **Kansas Department of Health and Environment** – The State of Kansas Regulatory Agency responsible for establishing drinking water standards.

Langelier Saturation Index (LSI) – The LSI is the pH change required to bring water to equilibrium in respect to calcium carbonate. If LSI is a positive number, lime (calcium carbonate) can readily precipitate out of water to form a white crust, called scale, on the walls of metal water delivery pipes. This scale can readily form on metallic surfaces although the water will not be corrosive. If LSI is a negative number, there is no potential for scale to form as the water will dissolve calcium carbonate; however the water may be corrosive. Other factors needed to calculate the LSI include the pH, alkalinity, calcium hardness, total dissolved solids and the temperature of the water.

Lead and Copper 90th Percentile – The concentration of lead or copper in a water sample that is the 90th percentile rank (ordered by concentration) of all samples.

MCL – **Maximum Contaminant Level** – The highest concentration level of a contaminant that is allowed in drinking water. The MCL is set as close to the MCL goal (MCLG) as feasible using the best available treatment technology.

MCLG – **Maximum Contaminant Level Goal** – The contaminant concentration at or below which there is no known or predicted health risk.

MFL – **Million Fibers per Liter** – A measure of the number of asbestos fibers present in the water longer than ten micrometers (10 µm or 4/10,000 of an inch) in length.

MRDL – **Maximum Residual Disinfectant Level** – The highest concentration level of residual disinfectant (i.e., chlorine) that is allowed in drinking water.

MRDLG – **Maximum Residual Disinfectant Level Goal** – The concentration level of residual disinfectant (i.e., chlorine) in drinking water at or below which there is no known or predicted health risk. The MRDLG allows for a margin of safety.

µmhos/cm – **Micromhos per Centimeter** – These units express the ability of a material (e.g., water) to conduct the flow of an electrical current (i.e., the specific conductance). The more electrically conductive a material is, the higher the mho (pronounced mō) value reading. In relation to drinking water, specific conductance is related to water temperature and the amount of dissolve minerals in the water. It does not identify the specific minerals that are present.

N – **Nitrogen** – atom; atomic weight 14.0067. When nitrate concentrations are presented "as N," it refers to only the weight of the nitrogen in each molecule of nitrate [Nitrate (NO_3) weight = 62.0049 while Nitrate as N weight = 14.0067].

N/A – **Not Applicable** or **Not Available** – The information does not apply for this contaminant and/or category or is not available (e.g., not measured).

ND – **Not Detected** – The detection limit for a compound (e.g., the lowest concentration of a contaminant that can be measured) is determined by the analytical method that is used. If the concentration of a contaminant is listed as ND, it may still be present, however, below the level detectable by that method.

NTU – **Nephelometric Turbidity Units** – The turbidity of water (i.e., clarity, cloudiness) is expressed in terms of NTU units. Turbidity, an optical property of water, is caused by suspended particles in the water that either scatter or absorb light. These particles can be both inorganic (e.g., soil) and organic (e.g., algae). The more suspended particles in the water, the more light is scattered and the more turbid the water would appear. A water sample with a turbidity level of five (5) NTU would appear noticeably cloudy.

P – **Phosphorus** – atom; atomic weight 30.9737. The portion of the total phosphorus or orthophosphate (PO_4^{-3}) represented by only the weight of the phosphorus atoms [the weight of Orthophosphate (PO_4^{-3}) = 94.9713 while the weight of Orthophosphate as P = 30.9737].

pCi/L – **Picocuries per Liter** – As a unit to measure radioactivity, a picocurie is an extremely small amount of radioactivity (10^{-12} of a curie or 1 millionth of a millionth of a curie).

pH Units – pH units measure how acidic or alkaline (i.e., basic) a solution is. A pH of 7 is neutral. The pH is a measure of the concentration of free hydrogen ions (H^+) in the solution. Specifically, pH is the negative logarithm of the hydrogen ion concentration ($pH = -\log[H^+]$). Therefore, a lower pH unit represents a larger concentration of hydrogen ions – i.e., more acidic. Also, a change of one pH unit represents a 10-fold change in the concentration of hydrogen ions (e.g., a solution having a pH 6 has 10 times more hydrogen ions than a pH 7 solution).

ppb – **Parts per billion** is a concentration expression of a solution equivalent to micrograms per liter (µg/L); 3 ppb is equal to 3 µg/L. To put into perspective what a part per billion represents, the total population of humans on the planet in 2011 was approximately 7 billion. Therefore, if you are in a classroom with a total of 21 people, that would equal 3 ppb of the world's total population.

ppm – **Parts per million** is a concentration expression for a solution equivalent to milligrams per liter (mg/L); 3 ppm is equal to 3 mg/L. To put into perspective what a part per million represents, if you are a freshman at KU and are living in a dorm room with two other roommates, the population of your dorm room (3) would equal one part per million of the total population of the state of Kansas (there were ~3 million people in Kansas in 2011).

RAA – Running Annual Average is the average concentration of a substance present in samples obtained over the reporting year (January through December).

SMCL – **Secondary Maximum Contaminant Level** is established by the Kansas Department of Health and Environment (KDHE) with the guidance of United States Environmental Protection Agency (EPA). These secondary contaminants do not pose a health risk; rather they affect various aesthetic qualities of drinking water (e.g., taste, odor, and color).

TT – **Treatment Technique** – A process (i.e., technology), when installed, leads to the reduction in the level of a contaminant (e.g., turbidity and organic carbon).

Table 1 presents the tests results for primary contaminants conducted on water samples collected directly from the KU-LC drinking water distribution system. Total coliform and fecal coliform bacteria are tested on a monthly schedule. Copper and lead are tested every three years. These sampling schedules are established by the EPA under the National Primary Drinking Water Regulations (40 CFR 141 & 143).

Coliform bacteria are commonly found in the environment (e.g., in soils, surface waters and on vegetation) and are usually harmless. Coliform bacteria will not likely cause illness. Fecal coliform and *Escherichia coli* (commonly called *E. coli*) are bacteria that originate only from human or animal fecal waste. If fecal coliform and/or *E. coli* bacteria are present in drinking water, these microbes may cause short-term health effects such as diarrhea, cramps, nausea, or headaches. These microbes may pose a more significant health risk to infants, young children, the elderly, and people with severely compromised immune systems.

Table 1. Primary Drinking Water Contaminants monitored from KU campus water supply system (January - December 2011 except where indicated).

Parameter	Concentration Goal (EPA MCLG)	Highest Level Allowed (EPA MCL)	Highest Level Detected	Range
Total Coliform Bacteria	0.00%	5% of monthly samples are positive (2 samples out of 40)	0.00%	N/A
Fecal Coliform Bacteria	0 samples	Routine sample and repeat sample are Total Coliform Positive; also one sample is Fecal Positive/E. Coli Positive	0 samples	N/A
Total Trihalomethanes (THM) (2008-2009)	None	80 ppb	125.2 ppb	29.1 - 125.2 ppb
Haloacetic Acids (HAA) (2008-2009)	None	60 ppb	88.1 ppb	ND - 88.1 ppb
Total Chlorine	MRDLG = 4.0 ppm	MRDL = 4.0 ppm	3.5 ppm	0.4 - 3.5 ppm

Parameter	Concentration Goal (EPA MCLG)	Highest Level Allowed (EPA MCL)	90th Percentile	Range
Copper (tested in 2011)	1.3 ppm	1.3 ppm **(AL)**	0.120 ppm	0.005 - 0.140 ppm
Lead (tested in 2011)	0 ppb	15 ppb **(AL)**	3.8 ppb	ND – 5.6 ppb

Ingestion of lead can cause serious health problems especially for pregnant women, infants and young children. These health problems include damage to the kidneys, liver, and neurological system including the brain. The most common sources of lead are the ingestion of lead-based paint (banned in 1978; homes built before 1960 may contain lead-based paint) and/or contaminated soils. Lead in drinking water is not a common source of lead poisoning. The source of lead in drinking water is primarily from the water delivery system (e.g., pipes, solder, and brass fixtures). When water has been sitting for several hours, flushing the tap for a time period of 30 seconds to 2 minutes before using the water for drinking or cooking can minimize the potential for lead exposure. Information on lead in drinking water is available from the EPA's Safe Drinking Water Hotline (800-426-4791) or at their web page.

Although copper is an essential nutrient (Recommended Daily Allowance 0.9 milligram for both adult men and women over the age of 19; *Dietary Reference Intakes Essential Guide Nutrient Requirements,* Food and Nutrition Board, National Institute of Medicine, National Academies, 2006), excess copper consumption over a short period of time can result in temporary gastrointestinal distress (e.g., nausea, vomiting, diarrhea and stomach cramps). People drinking water containing excessive copper over many years may suffer liver or kidney damage. Individuals with Wilson's Disease, a rare inherited (genetic) disorder (~1 in 30,000 people), should consult their personal physician if copper is detected in their drinking water. The main source of copper in drinking water is the leaching of copper from water delivery pipes and bathroom fixtures due to corrosive (acidic) water. In water systems that have been sitting unused for several hours, running the water for time period of 30 to 60 seconds before using it for drinking or cooking will significantly reduce the concentration of copper.

Table 2 presents the results of tests for primary contaminants in the drinking water sampled at the City of Lawrence drinking water treatment plants (*2012 Consumer Confidence Report*, City of Lawrence). Total organic carbon (TOC) has no health effects; however, total organic carbon provides a medium for the formation of disinfection byproducts (e.g., trihalomethane and haloacetic acid compounds; Table 1) that may have possible carcinogenic (e.g., bladder cancer), reproductive and developmental effects. Turbidity also has no health effects; however, turbidity can interfere with disinfection and provide a medium for microbial growth. The primary source of the contaminants listed in Table 2 is the erosion of natural deposits (e.g., soil). Other sources include runoff of pesticides (e.g., pesticides use on row crops or residential properties), decay products of natural and human-made deposits, water additives (e.g., fluoride which helps prevent tooth decay), and runoff of fertilizers (e.g., from agricultural areas or residential properties).

Table 2. Primary Drinking Water Contaminants Monitored at the Lawrence Drinking Water Treatment Plants (January to December 2011).

Parameter	Concentration Goal (EPA MCLG)	Highest Level Allowed (EPA MCL)	Highest Level Detected	Range
Arsenic	0 ppb	10 ppb	3.8 ppb	ND - 3.8 ppb
Asbestos (08/19/2004)	7 MFL	7 MFL	ND	N/A
Atrazine	3 ppb	3 ppb	0.3 ppb	ND - 0.3 ppb
Barium	2 ppm	2 ppm	0.120 ppm	0.019 - 0.120 ppm
Chloramine (RAA)	4 ppm	4 ppm	3.6 ppm	3.5 - 3.6 ppm
Chromium	100 ppb	100 ppb	1.7 ppb	ND - 1.7 ppb
Combined Radium (isotopes 226 & 228)	0 pCi/L	5 pCi/L	1.0 pCi/L	ND - 1.0 pCi/L
Fluoride	4 ppm	4 ppm	0.97 ppm	0.20 - 0.97 ppm
Nitrate (as N)	10.0 ppm	10.0 ppm	1.3 ppm	ND - 1.3 ppm
Selenium	50 ppb	50 ppb	3.4 ppb	ND - 3.4 ppb
Total Organic Carbon	N/A	TT	3.75 ppm	2.93 - 3.75 ppm
Turbidity (RAA)	N/A	TT	0.395 NTU	0.010 - 0.395 NTU
Uranium (2006)	0 ppb	30 ppb	1.0 ppb	0.8 - 1.0 ppb

Table 3 is a list of secondary contaminants detected in the drinking water at the City of Lawrence drinking water treatment plants. These are not federally regulated as they do not pose a health risk. KDHE sets limits for these contaminants to assure that the public receives the best quality water possible. The major source of secondary contaminants is the erosion of natural deposits (e.g., soil). Another source is additives to control corrosion of water delivery pipes (e.g., orthophosphorous).

Table 3. Secondary Drinking Water Contaminants Detected in the Drinking Water During Monitoring at the Lawrence Drinking Water Treatment Plants (January to December 2011).

Parameter	Highest Level Allowed (SMCL)	Highest Level Detected	Range Detected
Alkalinity (as mg/L $CaCO_3$)	300 ppm	120 ppm	40 - 120 ppm
Aluminum	0.05 - 0.20 ppm	0.23 ppm	0.012 - 0.23 ppm
Calcium	200 ppm	43 ppm	24 - 43 ppm
Chloride	250 ppm	100 ppm	13 - 100 ppm
Corrosivity	0 Langelier Saturation Index (non-corrosive)	0.22 Langelier Saturation Index	0.19 - 0.22 Langelier Saturation Index
Magnesium	150 ppm	20 ppm	9.3 - 20 ppm
Nickel	0.1 ppm	0.0019 ppm	ND - 0.0019 ppm
Orthophosphate (as P)	N/A	0.2 ppm	ND - 0.2 ppm
pH	6.5 – 8.5 pH Units	9.9 pH Units	8.0 - 9.9 pH Units
Potassium	100 ppm	11 ppm	2.9 - 11 ppm
Radon	N/A	14 pCi/L	ND - 14 pCi/L
Silica	50 ppm	15 ppm	1.3 - 15 ppm
Sodium	100 ppm	100 ppm	15 - 100 ppm
Specific Conductance	1,500 µmhos/cm	1,300 µmhos/cm	310 - 1,300 µmhos/cm
Sulfate	250 ppm	150 ppm	27 - 150 ppm
Total Dissolved Solids	500 ppm	500 ppm	160 - 500 ppm
Total Hardness (as mg/L CaCO3)	400 ppm	190 ppm	100 - 190 ppm
Total Phosphorus (as P)	5 ppm	0.36 ppm	ND - 0.36 ppm

Radiation is a natural part of the environment and all people receive exposure to radioactivity that naturally occurs in the soil, water, air, and food. The amount of radiation from radon that is in the drinking water supplied to the KU-LC Campus is presented in **Table 3**. Radon is the largest natural contributor to the public's radiation dose. Radon is created when uranium decays to radium which then decays to radon. Radon is a colorless, odorless and tasteless gas therefore cannot be detected by a person's senses. Radon is a known human carcinogen. Drinking water containing radon can increase the risk of both lung and stomach cancer. Breathing air containing radon is the second leading cause of lung cancer and the leading cause among non-smokers. The primary source of radon found in indoor air is from radon gas moving up through the soil entering buildings though cracks and holes in the foundation. The amount of radon entering from that source presents a much greater risk than radon found in the drinking water distribution system which is usually very small. EPA has proposed, but has not adopted, a regulation to reduce radon in drinking water (National Primary Drinking Water Regulations; Radon-222 40 CFR Parts 141 & 142). One of the two proposed options includes a multimedia mitigation (MMM) program to reduce radon exposure (a component of the "Alternative Maximum Contamination Level"). For additional information, contact the Kansas Radon Program by phone (800-693-5343) or visit their website or call EPA's Radon Hotline (800-SOS-RADON).

The water supplied to the KU-LC is derived almost entirely from surface water sources (the Kansas River and Clinton Lake). Surface waters have a much lower concentration of radon when compared with groundwater sources. Generally, radon concentrations in drinking water derived from surface waters ($\bar{x}$ <11 pCi/l) are less than one-fiftieth of that in drinking water derived from well waters ($\bar{x}$ >540 pCi/l).

The concentration of N-Nitrosodimethylamine (NDMA) in drinking water is presented in **Table 4**. NDMA is considered a priority pollutant by EPA; however, no federal standard has been established. NDMA is considered an "emerging contaminant." Sources of NDMA found in drinking water include effluent from industries such as tanneries, pesticide manufacturing plants, rubber and tire manufacturing plants, alkylamine manufacturing industries, fish processing industries, foundries, and dye manufacturing plants. NDMA exposure may also occur through the ingestion of food that contains nitrosamines, such as smoked and cured meats (e.g., beacon and smoked sausage), as well as eating fish and cheese, drinking beer and breathing or inhaling cigarette smoke. NDMA is also a byproduct of wastewater and drinking water treatment plants that use chloramines for disinfection. The City of Lawrence water treatment plants do use chloramines for disinfection purposes. NDMA is considered an emerging drinking water contaminant because of its potential carcinogenicity and toxicity.

Table 4. Additional Monitoring at the Lawrence Drinking Water Treatment Plants (January to December 2011).

Parameter	Alternative Maximum Contaminant Level (EPA AMCL)	Highest Level Allowed (EPA MCL)	Highest Level Detected	Range
N-nitrosodimethylamine (NDMA)	N/A	N/A	0.0024 ppb	ND - 0.0024 ppb

Web Links for Additional Drinking Water Quality Information

KU Department of Environment, Health & Safety
KDHE Public Water Supply Section
KDHE Source Water Assessment Reports
Proposed Radon in Drinking Water Rule (EPA)
EPA Ground Water and Drinking Water
2012 Consumer Confidence Report, City of Lawrence

Note:* *Some of these data and information presented in this report are from the 2012 Consumer Confidence Report, City of Lawrence. The format has been modified. This report is available on the KU-LC EHS website (http://www.ehs.ku.edu/documents/ehs_reports/index.aspx).