2022 Drinking Water Quality
Consumer Confidence Report

The University of Kansas - Lawrence Campus – June 28, 2023

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 (KUDS). The University is committed to providing users a safe, clean, and dependable supply of drinking water.

This 2022 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 from the KUDS and at the City of Lawrence Drinking Water Treatment Plants (LWTP) during the **2022 calendar year (CY)** (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 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.

All drinking water, including bottled water, can be presumed to contain small amounts of contaminants (i.e., any physical, chemical, biological, or radiological substance or matter in water). 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 80 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 News website. If you have any questions, comments, or concerns about the quality of the drinking water provided to you by the KU-LC or if you have any questions about the information contained in this report, please contact Jon Rossillon, KU-LC 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, those with 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.

A discussion in this report about one potential contaminant, *Cryptosporidium,* is required by EPA in order to inform individuals with a weakened immune system that resulting symptoms due to infection 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) website] 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 intestinal 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 CDC website 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 can include rivers, lakes, streams, ponds, reservoirs, springs, and/or 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 our drinking water. An assessment of these water sources was completed by the State of Kansas Department of Health and Environment in 2003.

Contaminants in drinking water fall into one of five categories:

- **Microbial contaminants:** for example, microbial pathogens may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- **Inorganic chemical contaminants:** for example, salts and metals can be naturally occurring or may originate from urban stormwater runoff, industrial and domestic wastewater discharges, oil and gas production, mining, and farming.
- **Organic chemical contaminants:** these include synthetic organic chemicals and volatile organic chemicals that can arise as byproducts of industrial processes and petroleum production as well as from gas stations, agricultural pesticide runoff, urban stormwater runoff, and septic systems.
- **Pesticides:** these are chemical preparations used to kill or control pests (e.g., herbicides for plants and insecticides for insects) that come from sources including agriculture runoff, urban stormwater runoff, residential and commercial users.
- **Radioactive contaminants**: radionuclides are found naturally in the soil or from 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 additional treatment techniques or other actions.

EC$^+$ – ***Escherichia coli*** **(*E. coli*) positive** refers to a water sample that has been tested and found to have *E. coli* bacteria present.

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

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

KUDS – **University of Kansas Distribution System** – The drinking water distribution system of Kansas University Lawrence campus.

LWTP – **Lawrence Water Treatment Plants** – The drinking water treatment facilities for the City of Lawrence from which the KUDS purchases its drinking 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.

LRAA – **Locational Running Annual Average** – Compliance with the MCL for the two groups of disinfection byproducts (trihalomethanes and haloacetic acid compounds) is calculated for each monitoring location separately to determine if each sampling location is in compliance with the MCL over the reporting period.

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 human health risk.

MPA – **Monitoring Period Average** – Average concentration of all sample results collected during a defined time frame.

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 dissolved minerals in the water. It does not identify the specific minerals that are present.

N – **Nitrogen** – an atom; atomic weight 14.006. For example, when nitrate concentrations are presented "as N," it refers to only the weight of the nitrogen in each molecule [Nitrate (NO_3) weight = 62.004 while NO_3 as N weight = 14.006].

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, at a concentration below the level detectable by that method.

NTU – **Nephelometric Turbidity Units** – The turbidity of water (i.e., cloudiness) is expressed in terms of NTU units. An optical property, turbidity is caused by suspended particles in the water that either scatter or absorb light. These particles can be both inorganic (e.g., clay or silt) or 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** – an atom; atomic weight 30.97. When the concentration of a molecule containing phosphorus is presented "as P," it refers to only the weight of phosphorus in that molecule, e.g., orthophosphate (PO_4^{-3}), represented by the weight of the phosphorus atoms [the weight of Orthophosphate (PO_4^{-3}) = 94.97 while the weight of PO_4^{-3} as P = 30.97].

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 basic (i.e., alkaline) 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 pH 6 solution has 10 times more hydrogen ions than a pH 7 solution).

ppb – **Parts per billion** is a concentration expression equivalent to micrograms per liter (µg/L); 3 ppb is equal to 3 µg/L. To put into perspective what a ppb is, if you were on a water polo team (7 players on your team in the pool), your team would equal about 1 ppb of the world's population (7.4 billion people in 2017).

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 ppm represents, if you wanted to retire at the age of about 54 with $1 million, you would have to save $50 per day beginning the day you were born ($50/day would equal 1 ppm of $1 million).

RAA – **Running Annual Average** is the average concentration of a substance present in all samples from all sites (i.e., all samples are pooled) to determine the overall average concentration is in compliance with MCL over the reporting period.

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

TC$^+$ – **Total Coliform positive** refers to a water sample that has been tested and found to have coliform bacteria present.

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

Table 1 presents the tests results for Primary Contaminants conducted on water samples collected directly from either the LWTP or the KUDS. For example, although copper is an essential nutrient (Recommended Daily Allowance 0.9 milligram for both adult men and women over the age of 19: *Institute of Medicine, Food and Nutrition Board. Dietary Reference Intakes. Washington, DC: National Academies Press; 2001*), 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 to 4 in 100,000 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 period of 30 seconds to 2 minutes before using it for drinking or cooking will significantly reduce the concentration of copper.

In regard to lead, 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 the 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 usually 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 period of 30 seconds to 2 minutes before using the water for drinking or cooking can minimize the potential for lead exposure. Copper and lead are tested every three years as per regulation (40 CFR 141, EPA Lead and Copper Rule). Information on lead in drinking water is available from the EPA's Safe Drinking Water Hotline (800-426-4791) or at their website.

The KUDS drinking water is tested for total coliform and *Escherichia coli* (abbreviated as *E. coli*) bacteria on a monthly schedule. This sampling schedule is established by the EPA under the National Primary Drinking Water Regulations (40 CFR 141). 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. *E. coli*, on the other hand, is a more restricted group of coliform bacteria that almost always originates in human or animal waste. The presence of *E. coli* in water

Table 1. Primary Drinking Water Contaminants from KUDS and LWTP (2022 CY).

Parameter	Concentration Goal (MCLG)	Highest Level Allowed (MCL)	90th Percentile	Range	Location Sampled
COPPER AND LEAD MONITORING					
Copper (tested in 2020)	1.3 ppm	1.3 ppm (AL)	0.230 ppm	0.010 - 0.340 ppm	**KUDS**
Lead (tested in 2020)	0.0 ppb	15.0 ppb (AL)	5.7 ppb	<1.0 – 8.8 ppb	**KUDS**

Parameter	Concentration Goal (MCLG)	Highest Level Allowed (MCL)	Highest Level Detected	Range	Location Sampled
MICROBIOLOGICAL CONTAMINANTS					
Escherichia coli (*E. coli* = **EC**) **Bacteria**	0 samples	Routine sample - EC+, Repeat sample TC+ Routine sample - TC+, Repeat sample EC+ Repeat sample is TC+ and EC not tested Routine sample - EC+, No required repeat samples taken	0 samples	N/A	**KUDS**
Turbidity	N/A	1 NTU	0.42	ND - 0.420	**LWTP**
DISINFECTANTS AND DISINFECTION BYPRODUCTS					
Chloramine	MRDLG = 4.0 ppm	MRDL = 4.0 ppm	3.50 ppm (RAA)	2.2 - 4.6 ppm	**LWTP**
			3.59 ppm (MPA)		**LWTP**
Total Haloacetic Acids (HAA)	0 ppb	60 ppb	31 ppb (LRAA)	18 - 55 ppb	**KUDS**
Total Chlorine	MRDLG = 4.0 ppm	MRDL = 4.0 ppm	3.4 ppm	ND - 3.4 ppm	**KUDS**
Total Trihalomethanes (TTHM)	0 ppb	80 ppb	61 ppb (LRAA)	35 - 83 ppb	**KUDS**
ORGANIC CONTAMINANTS					
Atrazine	3.00 ppb	3.00 ppb	0.51 ppb	ND - 0.51 ppb	**LWTP**
Dicmba	N/A	N/A	1.2 ppb	ND - 1.2 ppb	**LWTP**
2,4-D	70 ppb	70 ppb	0.34 ppb	ND - 0.34	**LWTP**
INORGANIC CONTAMINANTS					
Arsenic	0.0 ppb	10.0 ppb	1.5 ppb	ND - 1.5 ppb	**LWTP**
Barium	2.000 ppm	2.000 ppm	0.100 ppm	0.019 - 0.100 ppm	**LWTP**
Chromium (total)	100.0 ppb	100.0 ppb	3.40 ppb	ND - 3.40 ppb	**LWTP**
Fluoride	4.0 ppm	4.0 ppm	0.60 ppm	ND - 0.60 ppm	**LWTP**
Nitrate (as N)	10.0 ppm	10.0 ppm	0.63 ppm	ND - 0.63 ppm	**LWTP**
Selenium	50.00 ppb	50.00 ppb	3.70 ppb	ND - 3.70 ppb	**LWTP**
RADIONUCLIDE CONTAMINANTS					
Radium Isotope 228	0.00 pCi/L	5.00 pCi/L	ND pCi/L	ND pCi/L	**LWTP**
Gross Alpha & Beta	0.00 pCi/L	15.00 pCi/L	1.00 pCi/L	ND - 1.00 pCi/L	**LWTP**

is a strong indication of recent human or animal waste contamination which makes them an excellent indicator organism. Most strains of *E. coli* bacteria are harmless and are an important part of a healthy human digestive tract; however, certain strains (e.g., *E. coli* O157:H7) may cause illness. Sources of *E. coli* contamination include runoff from feedlots and agricultural areas where manure fertilizer is used, wildlife that use the source water as part of their natural habitat, runoff from areas contaminated with pet manure, septic system failure, and wastewater treatment plants if the water is inadequately treated. *E. coli* 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. In rare cases, *E. coli* infection can lead to kidney failure and death. Microbial growth, like *E. coli*, can be influenced by turbidity (i.e., cloudiness caused by particles in the water such as soil or organic material) which, while posing no health risk itself, can interfere with disinfection and provide a medium for microbial growth.

Disinfectants (e.g., chlorine and chloramine) are an essential element of drinking water treatment because of the protection they provide against waterborne disease-causing microorganisms. These disinfectants can react with naturally occurring materials in the water to form byproducts such as trihalomethanes and haloacetic acids. An extensive research effort is currently underway to better understand the potential health risks (e.g., bladder cancer) associated with exposure to disinfection byproducts. Because of these potential health concerns, the KU campus drinking water is monitored four times per year for these byproducts.

The primary source of the inorganic contaminants listed in Table 1 (e.g., arsenic, barium, chromium, fluoride, and selenium) is the erosion of natural deposits. Sources of pesticides (e.g., the herbicides atrazine and 2,4-D, used to control broadleaf weeds; dicamba used to control annual, biennial and perennial broadleaf weeds) include runoff from areas where pesticides have been applied (e.g., agricultural or residential properties). Fluoride is added to drinking water by the LWTP to help prevent tooth decay. The EPA also lists fluoride as a Secondary Contaminant with a Secondary MCL of 2.0 mg/liter. That SMCL is intended as a guideline for an upper boundary level in areas which have high levels of naturally occurring fluoride. Tooth discoloration and/or pitting is caused by excess fluoride exposures during the formative period prior to eruption of the teeth in children eight-years old and younger. The level of the SMCL was set based upon a balancing of the beneficial effects of tooth protection and the undesirable effects of excessive exposures leading to discoloration. Information about the CDC recommendations regarding optimal fluoridation levels and the beneficial effects for tooth decay protection can be found on CDC's Community Water Fluoridation page.

Table 2 is a list of Secondary Contaminants detected in the drinking water at the LWTP. These secondary contaminants primarily affect the aesthetic qualities of drinking water (e.g., taste and odor) and are not federally regulated as they do not pose any health risks; however, they do have recommended Secondary MCL. The primary source of secondary contaminants is the erosion and leaching of natural deposits (e.g., soil).

Table 2. Secondary Drinking Water Contaminants Having Recommended SMCL Monitored at the LWTP.

Parameter	SMCL	Highest Level Detected	Range
Aluminum	0.05 - 0.20 ppm	0.053 ppm	ND - 0.053 ppm
Chloride	180 ppm	180 ppm	21 - 180 ppm
Iron	0.30 ppm	0.04 ppm	ND - 0.04
pH	6.5 – 8.5 pH Units	9.1 pH Units	7.7 - 9.1 pH Units
Sulfate	250 ppm	150 ppm	21.0 - 150.0 ppm
Total Dissolved Solids	500 ppm	620 ppm	210 - 620 ppm
Zinc	5 ppm	0.01 ppm	ND - 0.01 ppm

Table 3 is a list of drinking water parameters designated to be monitored as part of the Unregulated Contaminant Monitoring Rule (UCMR 3) program. These samples were collected at the LWTP. As specified by the Safe Drinking Water Act, EPA reviews contaminants that have been targeted through existing prioritization processes, including previous UCMR contaminants and the Contaminant Candidate List. These contaminants were identified based on current research about their occurrence and their health effect risk factors. This monitoring provides a basis for future regulatory actions to protect public health.

Table 4 is a list of supplemental parameters meant to provide additional information to the public about the water quality of the drinking water. There are no health risks associated with these parameters. Although total organic carbon (TOC) has no health effects, it provides a medium for the formation of disinfection byproducts (e.g., trihalomethanes and haloacetic acid compounds; Table 1) that may have possible carcinogenic effects (e.g., bladder cancer).

Table 3. These parameters are monitored at the LWTP as specified by the Unregulated Contaminant Monitoring 3 program (sampled during the 2022 CY).

Parameter	Highest Level Detected	Range
Hexavalent Chromium	2.60 ppb	0.02 - 2.60 ppb
Molybdenum	7.20 ppb	ND - 7.20 ppb
Strontium	490 ppb	210 - 490 ppb
Vanadium	5.50 ppb	ND - 5.50 ppb

Table 4. Supplemental Drinking Water Parameters Collected at the LWTP (2022 CY).

Parameter	Highest Level Detected	Range
Alkalinity (as mg/L $CaCO_3$)	142 ppm	52 - 142 ppm
Bromide	0.08 ppm	0.01 - 0.08 ppm
Calcium	53 ppm	38 - 53 ppm
Specific Conductance	960 µmhos/cm*	330 - 960 µmhos/cm5
Total Hardness (as mg/L $CaCO_3$)	290 ppm	140 - 290 ppm
Total Organic Carbon	3.88 ppm	2.60 - 3.88 ppm
Magnesium	17 ppm	ND - 17 ppm
Nickel	0.0041 ppm	ND - 0.0041 ppm
Orthophosphate (as P)	0.32 ppm	0.08 - 0.32 ppm
Perchlorate	1.30 ppm	ND - 1.30 ppm
Potassium	12.0 ppm	3.3 - 12.0 ppm
Silica	11.0 ppm	0.31 - 11.0 ppm
Sodium	150.0 ppm	21.0 - 150.0 ppm
Total Phosphorus (as P)	0.36 ppm	0.13 - 0.36 ppm