

Bacterial Contamination

Of Surface Waters In Kansas

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

Water is important to the citizens of Kansas. All of us depend on water for drinking, agriculture, industry, recreational, and household use. In addition, wildlife and aquatic life depend on quality surface water for their existence.

Concerns exist in Kansas about the quality of our surface water. The most common health-threatening contamination of Kansas surface waters is bacterial contamination. Monitoring of surface water in 1994 by the Kansas Department of Health and Environment (KDHE) found that 75 percent of Kansas streams and 7 percent of lakes were impaired by bacterial contamination. Bacteria are considered to be an impairment of primary and secondary water uses in most river basins in Kansas. Because of the threat to human health and widespread surface water contamination, concern and awareness of bacterial contamination of surface water in Kansas are increasing.

Understanding Bacterial Contamination

Surface water often contains a variety of pathogens including viruses, fungi, protozoans, and bacteria. Human health risks generally occur when there is fecal contamination from human sources. However, certain pathogens deriving from animal sources, such as domestic livestock, pets, and wildlife, can be human health threats. Some common waterborne diseases include typhoid, hepatitis, dysentery, giardiasis, and cryptosporidiosis. Bacteria represent the largest number of organisms present in

surface water, are easily grown under laboratory conditions, and have been the most closely scrutinized. For that reason, fecal coliform bacteria (FCB) levels in surface water are monitored and used as indicators of other fecal contamination and for risk of disease associated with drinking, swimming, or other uses of the water. It is assumed that if FCB levels in water are high, there is a high probability that there are other fecal pathogens present.

FCB are associated with fecal material, but similar organisms may be found naturally in soil, the surface of leaves, and water. Bacterial levels in water vary widely depending upon the time of the year, rainfall, environmental conditions, and distance from the source of contamination. Typically, bacterial levels in water decrease with distance from the source of contamination. FCB are always present in the digestive tracts of warm-blooded animals and are found in their wastes. Fecal bacteria require a food source and warm, moist conditions for survival and once in the water and the environment, begin to die. Therefore, FCB presence in surface water is considered an indication of a nearby source of contamination.

Kansas Water Quality Standards for Bacterial Contamination

KDHE has responsibility for water quality monitoring of surface waters of Kansas for environmental pollutants, including FCB. Surface water samples are systematically collected and tested to

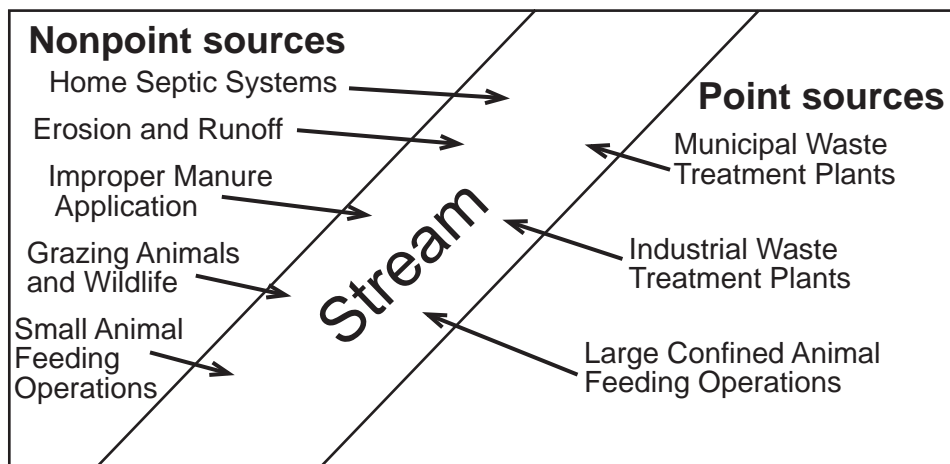
determine if the water meets the water standards for FCB contamination.

Allowable levels of FCB in surface water depend upon the intended use of the water. The allowable limit for finished drinking water for FCB is less than one colony forming unit (CFU) per 100 mL of water. Since Kansas surface water may be impaired by FCB, surface water used for drinking purposes must undergo considerable treatment before use.

Allowable FCB levels for recreation vary depending upon the type of recreational use. The standards are based on a geometric mean of five separate daily samples. For primary recreational contact use, the allowable standard for FCB is 200 CFU/100 mL of water. Primary contact would include swimming and other recreational uses in which it is likely that water would be ingested by humans. For secondary recreational contact, e.g., boating and fishing, the standard is 2,000 CFU/100 mL of water.

Sources of Bacterial Contamination

Most surface waters in Kansas contain FCB. Most FCB enter streams and rivers through direct deposition of wastes into water, or runoff of wastes from areas with high concentrations of domestic livestock, wildlife, or human wastes. Potential sources of FCB include feedlots, grazing lands, septic systems, municipal wastewater treatment plants, and sewer overflows. Wildlife is thought to be less a contributing source of FCB than are domestic livestock or humans.



Sources of bacterial contamination

Since the passage of the Federal Clean Water Act in 1972, significant improvements have been made to municipal and industrial wastewater treatment plants. In addition, large confined livestock operations were required to eliminate the off-site movement of their livestock wastes. This has resulted in reduced levels of FCB in Kansas surface water. The reduction in these point sources of FCB has resulted in greater emphasis being placed on nonpoint sources of FCB contamination. Nonpoint sources of FCB contamination include runoff from small livestock feeding operations, pastures, and failing septic systems. Typically, individual nonpoint sources of pollution are more difficult to identify and regulate. In addition, there may be thousands of individual nonpoint sources in a watershed, each contributing only a small amount to the problem. The accumulative effect can impair water resources.

Controlling Bacterial Contamination

Reductions of FCB levels in surface water can be accomplished through proper waste collection, treatment, disposal, and land management. Practices that reduce bacterial survival and introduction into surface waters are most effective. In

municipal treatment plants, chemical or ultraviolet treatment kill pathogens in the waste water. Bacteria can be reduced by urban storm water management systems that reduce runoff rates and volumes and allow for filtering by vegetative buffer areas. With septic systems, proper site selection and management uses the soil to filter out bacteria and eliminate it. With livestock feeding operations, it may be necessary to construct livestock waste containment structures and develop management plans for land application of



With livestock feeding operations, it may be necessary to construct livestock waste containment structures and develop management plans for land application of wastes.

wastes. Reducing bacterial contamination from grazing lands may be accomplished by improved grazing management and, in certain situations, by limiting livestock access to streams.

Health Hazards

What are the health hazards associated with bacterial contamination of streams and lakes? Will high FCB levels in surface water mean that we should not swim, fish, or use the water as a source of drinking water? These are difficult questions to answer. The source of contamination is just as important as the level of contamination. If the source of the water contamination is human, there is a much higher likelihood of illness. Most illnesses are caused by pathogens that are species specific. There is a much lower chance of human illnesses being caused by a disease that affects swine. Therefore, if high FCB levels in water are derived primarily from domestic livestock or wildlife, there is less risk to humans of swimming in the water than if the FCB is derived from a human source.

Surface water FCB monitoring and testing results indicate the level of contamination by fecal wastes of all warm-blooded animals, not just humans. New methods are being developed to identify the animal source of a FCB sample. The bacteria may get in the water from runoff containing the wastes of livestock, wildlife, or pets. In addition, some coliform bacteria live naturally in soil or water.

Daniel L. Devlin

Extension Specialist and Coordinator
Environmental Quality

Charles Rice

Department of Agronomy

George Marchin

Division of Biology

Kevin Anderson

Department of Agronomy

Publications from Kansas State University are available on the World Wide Web at: <http://www.oznet.ksu.edu>

Contents of this publication may be freely reproduced for educational purposes. All other rights reserved. In each case, credit Daniel L Devlin et al., *Bacterial Contamination*, Kansas State University, August 2000.

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

MF-2460

August 2000

It is the policy of Kansas State University Agricultural Experiment Station and Cooperative Extension Service that all persons shall have equal opportunity and access to its educational programs, services, activities, and materials without regard to race, color, religion, national origin, sex, age or disability. Kansas State University is an equal opportunity organization. Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914, as amended. Kansas State University, County Extension Councils, Extension Districts, and United States Department of Agriculture Cooperating, Marc A. Johnson, Director.