



Utah Waterborne Pathogen Guidance for Recreational Waters

Updated May 2021

Waterborne Pathogen Advisory Program

The Utah Division of Water Quality (DWQ) Waterborne Pathogen Advisory Program monitors priority recreational waterbodies for fecal contamination then notifies local health departments (LHDs) if results indicate fecal contamination above health advisory thresholds. DWQ's monitoring program operates from May 1 to October 31 and includes monthly routine monitoring at priority waterbodies and more frequent, weekly response monitoring when sample results show fecal contamination. DWQ also coordinates volunteer and agency sample collection, collaborates with LHDs to post advisories and inform the public, provides site-specific guidance to LHDs on factors to consider when issuing or rescinding health advisories for waterborne pathogens, and maintains an active recreational health website (powr.utah.gov) during the recreation season. DWQ partnered with the Utah Department of Health (DOH) to incorporate their subject matter expertise and experience implementing human health-related programs into this jointly issued program guidance document.

This program document:

- Provides guidance for LHDs to determine when a waterborne pathogen-related advisory should be considered, including when an existing advisory can be removed.
- Provides information about the DWQ Recreational Waterborne Pathogen/E. Coli Advisory Program
- Describes DWQ's response to a potential waterborne pathogen issue in high priority recreation waterbodies
- Provides background information about waterborne pathogens in high priority recreation waterbodies

Authority

The local health departments (LHDs) in Utah have the authority to post health advisories and close waterbodies. In the event of a given risk, a LHD may:

- Prepare, publish, and disseminate information necessary to inform and advise the public concerning the health and wellness of the population, specific hazards, and risk factors that adversely affect the health and wellness of the population. [UAC, 26A-1-114, (1)(i)(i)]
- Close theatres, schools, and other public places and prohibit gatherings of people when necessary to protect public health. [UAC, 26A-1-114 (1)(e)]

The Utah Division of Water Quality (DWQ) and Utah Department of Health (DOH) provide supporting roles for the LHDs. DWQ devises and executes sampling plans that prioritize waters that are at-risk for fecal contamination and highest risk for human exposure (State Parks and highly visited beaches). DWQ interprets results, and with the support of DOH, assists LHDs with recreational advisory decision-making.

Background

Fecal Contamination

An important goal of the U.S. Clean Water Act (CWA) is to protect and restore waters for swimming and recreation. One such protection includes detection and estimation of fecal contamination in recreational waterbodies and the associated risk for waterborne pathogens. Thorough reviews and analyses conducted by the U.S. Environmental Protection Agency (EPA) indicate that both human and animal feces in recreational waters pose potential risks to human health, especially in immunocompromised persons and vulnerable individuals. Waterborne pathogens present in fecal contaminated waters can cause severe gastrointestinal distress for those exposed while recreating. Fecal contamination in recreational waterbodies can occur through a variety of sources including, but not limited to:

- People who swim while they are sick with diarrhea or vomiting
- Waste from animals, such as livestock, pets, birds, and other wildlife
- Sewage spills or leaky septic tanks
- Water runoff following rainfall events
- Natural environmental sources

Exposure Routes

Primary contact recreation, such as swimming, bathing, surfing, water skiing, tubing, water play by children, and similar water contact activities where a high degree of bodily contact with the water, immersion, and ingestion are likely, increases the likelihood of illness in fecal contaminated waters.

As with most environmental exposures, children are likely to be at greater risk than adults. Children have smaller body mass, spend more time in contact with the water, and typically swallow more water while

recreating. Children’s bodies are also still developing and may be more sensitive to the effects of exposure.

Sources

All surface waters are susceptible to fecal contamination from point sources, diffuse sources (which may consist of point source and nonpoint source pollution), direct deposition, and resuspension of fecal matter contained in sediments. Fecal contamination and the associated pathogens from both human and animal sources in recreational waters pose potential risks to human health (EPA 2012). Possible human sources of fecal contamination include wastewater treatment plant discharges, failing septic systems, and dispersed sources from recreational users. Livestock and wildlife can also carry both human pathogens and fecal bacteria, and can transmit these microbes to surface waters and other bodies of water (CDC, 1993, 1996, 1998, 2000, 2002, 2004, 2006, 2008, EPA 2012, USDA 2000).

Common sources of fecal contamination include people who swim while they are experiencing GI upset, waste from animals, such as livestock, pets, waterfowl, and other wildlife, effluent from wastewater treatment, sewage spills or leaky septic tanks, unmaintained portable toilets, primitive camping, and natural environmental sources. The magnitude and duration of fecal contamination may vary across different waters, because these sources can contribute to both chronic and acute levels of fecal contamination. For example, wastewater treatment plant discharge could present a chronic issue whereas a diarrheal incident may show a single, acute issue (EPA 2012).

Adverse Health Effects

Exposure to waterborne pathogens from fecal contamination can cause a variety of health effects, from relatively mild to potentially serious (EPA 1986; EPA 2012; WHO 2003). Symptoms depend on many factors, including the route and length of exposure.

Symptoms

- Diarrhea
- Nausea
- Vomiting
- Abdominal pain
- Respiratory infection
- Skin infection
- Ear infection
- Eye infection
- Rash
- Fever
- Headache

Guidance

Fecal Indicator Bacteria

Several methods and indicators can be used for detecting and quantifying levels of fecal contamination in recreational waters, including fecal indicator bacteria (FIB), specifically, enterococci and *Escherichia coli* (*E. coli*) for fresh water. Although most strains of FIB are not pathogenic, they demonstrate characteristics that make them good indicators of fecal contamination (i.e., often of fecal origin, simple methods of detection, and quantification) and thus, indirectly indicate the potential presence of fecal pathogens capable of causing gastrointestinal (GI) illnesses (Prüss 1998, Marion et al. 2010, Wiedenmann et al. 2006, and others).

While the available science and information on direct, rapid, and reliable detection of specific pathogens in recreational waters is progressing quickly, these methods are not ready for full implementation at the national or state levels. Therefore, the available body of information and science supports using enterococci and *E. coli* as indicators of the presence of waterborne pathogens associated with fecal contamination as recommended in EPA's Recreational Water Quality Criteria (RWQC) (EPA 2012).

FIB can be quantified using various analytical methods, including those in which the organisms are grown (cultured) and those in which their DNA is extracted from an environmental sample and quantified using quantitative polymerase chain reaction (qPCR). While qPCR shows great promise as a rapid and precise detection and quantitation method for FIB, the EPA still currently recommends the use of culture-based methods in waterborne pathogen water-quality programs as they are the more scientifically defensible method presently available. Culture-based methods also provide a historical association with previous water-quality data in states that already have standards based on those indicators.

Assessment and Advisory Criteria

DWQ has conducted fecal contamination monitoring and data collection for over two decades, primarily focused on the assessment of Utah's waterbodies for CWA Section 303(d) purposes using numeric criteria in Utah rule [R317-2-14](https://rules.utah.gov/publicat/code/r317/r317-002.htm#E16) (<https://rules.utah.gov/publicat/code/r317/r317-002.htm#E16>). These criteria refer to elements of state water quality standards (WQS) expressed as constituent concentrations or levels, representing a quality of water that supports a particular use. When criteria are met, water quality will generally protect the designated use, including primary contact recreation. Criteria adopted by the State become the relevant standard for developing permit limits, assessing waters, and developing total maximum daily loads (TMDLs) for waters that do not meet the WQS.

In recent years, DWQ has also implemented a fecal contamination advisory program, called the *E. coli* Advisory Program, based partially on assessment monitoring and data collection. Recently, with feedback and collaborative efforts from local health departments (LHDs) and updated water quality guidance recommendations from EPA, DWQ and DOH implemented a restructuring of the advisory program in

2020. Now known as the Waterborne Pathogen Advisory Program, the new program contains updated guidance, thresholds, and objectives distinctly separate from the assessment program.

As mentioned earlier, Utah’s previous *E. coli* advisory programs based advisory thresholds on EPA’s 1986 Water Quality Criteria recommendations (EPA 1986), which were the same criteria used in the water quality beneficial use assessment program (Table 1). These recommendations included different single sample maximum of statistical threshold values (STVs) from culture-based methods appropriate for different levels of beach usage (i.e. use intensities). Previous advisory thresholds were set at 409 cfu/100mL for primary contact recreation (2A) waters and 668 cfu/100mL for infrequent primary contact recreation (2B waters).

Table 1: Utah Numeric Criteria for Recreational Waterbodies

Parameter	Numeric Criteria for Recreation	
	2A	2B
<i>E. coli</i> 30-day Geometric Mean (cfu/100mL)	126	206
<i>E. coli</i> Maximum (cfu/100mL)	409	668

Advisory Guidance

In the updated RWQC (EPA 2012), EPA removed the 1986 recommendations and there are no longer different criteria recommendations for different use intensities. Instead, EPA provided states with a precautionary Beach Action Value (BAV) for use in monitoring and notification programs (Table 2). The BAV is provided for states to use as a tool to evaluate immediate risk to recreators, not assessment and determining use attainment. Alerting recreationists, especially families with children, to the level of water quality on a given beach day, in real time, allows for better protection of human health. Intermountain states such as Idaho, Wyoming, Arizona, and Colorado have all adopted the BAV as the lower threshold when recommending or placing a fecal contamination advisory on a beach or waterbody. This guidance is recommending thresholds to match recommendations by the EPA (EPA 2012) and benchmark with other intermountain states. This update includes the adoption of the BAV of 235 cfu/100mL as the lower threshold for a waterborne pathogen warning advisory (Table 2, Table 3).

Table 2: Beach Action Value for *Escherichia coli*

Parameter	BAV
-----------	-----

Priority Waterbodies

In order to separate the waterborne pathogen and *E. coli* water quality use assessment from the recreational health advisory program, DWQ and DOH adopted a new strategy for prioritizing at-risk waterbody monitoring during the recreation season. Instead of using formal designated uses such as “2A: Frequent Primary Contact Recreation” and “2B: Infrequent Primary Contact Recreation” ([R317-2-6.2; https://rules.utah.gov/publicat/code/r317/r317-002.htm#E8](https://rules.utah.gov/publicat/code/r317/r317-002.htm#E8)), waterbodies are considered for the potential exposure risk to recreators from waterborne pathogens. In this context, risk is defined as primary contact recreation that includes activities where immersion and ingestion are likely and there is a high degree of bodily contact with the water, such as swimming, bathing, surfing, waterskiing, tubing, skin diving, water play by children, or similar water-contact activities.

A statewide list of priority waters is established through past advisory programs, information on annual visitation, and environmental contextual parameters such as distance from urban or agricultural areas. This list includes major waters such as State Parks and National Parks. To further augment the list of priority waters, Local Health Departments (LHDs) are contacted for their input on where recreators are engaging in primary contact recreation activities that may not have been identified by DWQ.

Public Health Advisories for Waterborne Pathogens

DWQ and DOH have developed a two-tier approach to public health advisories for waterborne pathogens. These advisories rely on detection and enumeration of *E. coli* bacteria from culture-based methods. Typically, the highest level of advisory indicated by any of the measures is recommended to be protective of public health. Table 3 summarizes the recommended public health advisory tiers. Example advisory signs can be found at wp.deq.utah.gov. Once an advisory is issued (Figure 1), at least one week of data indicating that the hazard has passed is recommended before removing the advisory.

Health Watch

Local health departments, UDEQ, UDOH, and other waterborne pathogen response agencies may receive information that suggests an unknown fecal contamination and/or waterborne pathogen source may exist. Such indicators include animal or human illness and/or reports of observed fecal contamination sources such as restroom or septic leakage, sewer overflow, livestock or waterfowl fecal matter, and others. Frequently this information arrives well before data upon which to base an advisory decision can be collected or analyzed. In order to inform both local health departments and the public of the latest recreational health dangers of a given water body, a pre-advisory tier is included in the Utah Waterborne Pathogen Advisory approach. The Health Watch tier is not a formal advisory level, but

instead indicates that increased monitoring and surveillance are strongly recommended and water body users should be cautious depending on specifics of the event and waterbody .

Waterborne Pathogens, Crop Irrigation, and Livestock Watering

Contact the Utah Department of Agriculture for guidance: ag.utah.gov; (801) 538-7100.

Waterborne Pathogen Contacts

Report Contamination: UDEQ 24-hour Spill Hotline: (801) 536-4123

Immediate Health Concerns : Call your physician and/or Utah Poison Control Center (800)-222-1222

UDEQ: (801) 536-4300

wp.deq.utah.gov

Kate Fickas kfickas@utah.gov

Ben Holcomb bholcomb@utah.gov

Ellen Bailey ellenbailey@utah.gov

UDOH: (801) 538-6191

Alejandra Maldonado alejandramaldonado@utah.gov

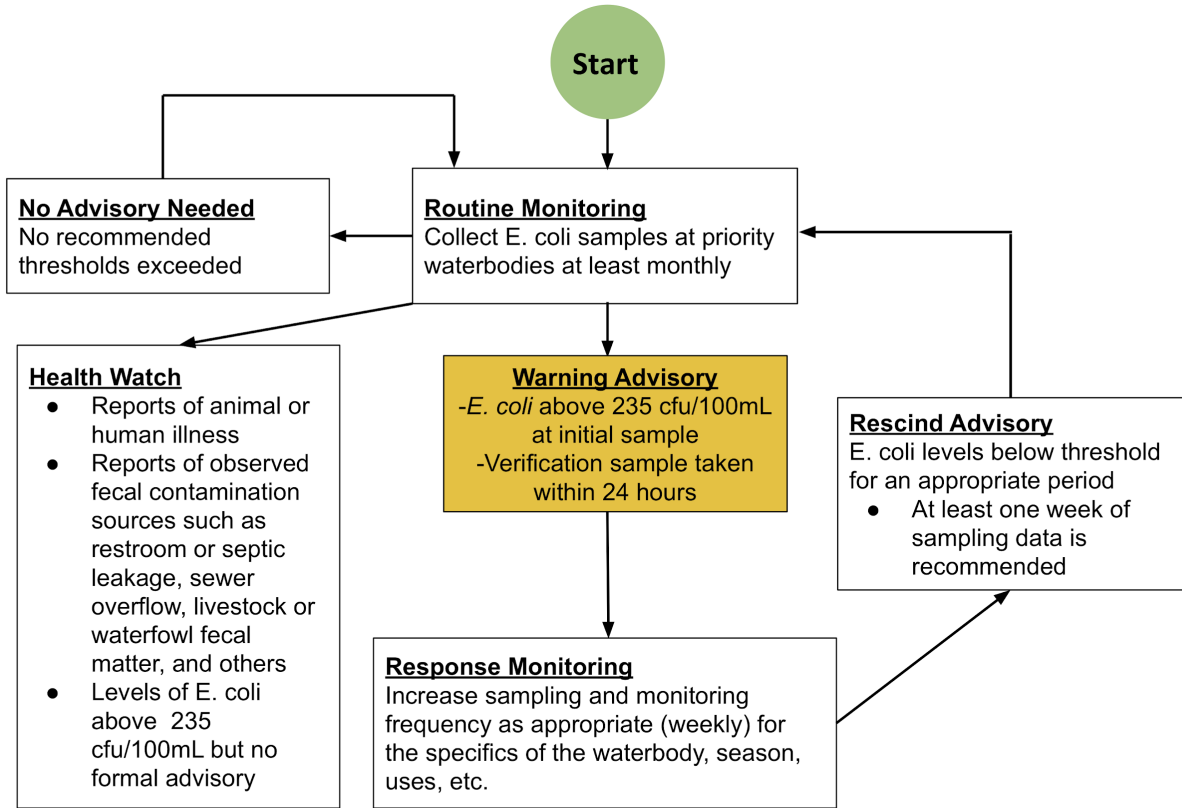
Table 3: UDOH/UDWQ Recommended Waterborne Pathogen Advisory Thresholds

Health Watch		Warning Advisory
<p>This is not a formal advisory level. Rather, these are indicators that fecal contamination and/or waterborne pathogens may exist or may become more severe. Increased monitoring and surveillance are strongly recommended. Indicators may include:</p> <ul style="list-style-type: none"> • Reports of animal or human illness • Reports of observed fecal contamination sources such as restroom or septic leakage, sewer overflow, livestock or waterfowl fecal matter, and others • Levels of <i>E. coli</i> above 235 cfu/100mL but no formal advisory <p>Consider cautioning users of the waterbody depending on specifics of the event and waterbody.</p>	<p><i>E. coli</i> (cfu/100mL)¹</p>	<p>235</p>
	<p>Health Risks¹</p>	<p>Nausea, vomiting, diarrhea, eye, skin, or respiratory infection, and other short term health effects</p>
	<p>Recommended Actions</p>	<p>Issue WARNING advisory</p>
		<p>Post WARNING signs</p>
<p>Sampling recommended at least weekly</p>		

Guidance sources

1 U.S. EPA 2012. EPA’s Recreational Water Quality Criteria. U.S. Environmental Protection Agency: Washington, DC. OFFICE OF WATER 820-F-12-058.

Figure 1: Waterborne Health Advisory Flow Chart



References

- CDC, 1993. Moore, A.C., Herwaldt, B.L., Craun, G.F., Calderon, R.L., Highsmith, A.K., Juranek, D.D. Surveillance for Waterborne Disease Outbreaks - United States, 1991-1992. Morbidity and Mortality Weekly Report 42: 1-22.
- CDC, 1996. Kramer, M.H., Herwaldt, B.L., Craun, G.F., Calderon, R.L., Juranek, D.D. Surveillance for Waterborne-Disease Outbreaks - United States, 1993-1994. Morbidity and Mortality Weekly Report 45: 1-33.
- CDC, 1998. Levy, D.A., Bens, M.S., Craun, G.F., Calderon, R.L., aHerwaldt, B.L. Surveillance for Waterborne-Disease Outbreaks - United States, 1995-1996. Morbidity and Mortality Weekly Report 47: 1-33.
- CDC, 2000. Barwick, R.S., Levy, D.A., Craun, G.F., Beach, M.J., Calderon, R.L. Surveillance for Waterborne Disease Outbreaks - United States, 1997-1998. Morbidity and Mortality Weekly Report 49: 1-35.
- CDC, 2002. Lee, S.H., Levy, D.A., Craun, G.F., Beach, M.J., Calderon, R.L. Surveillance for Waterborne-Disease Outbreaks - United States, 1999-2000. Morbidity and Mortality Weekly Report 51: 1-48.
- CDC, 2004. Yoder, J.S., Blackburn, B.G., Craun, G.F., Hill, V., Levy, D.A., Chen, N., Lee, S.H., Calderon, R.L., Beach, M.J. Surveillance for Waterborne-Disease Outbreaks Associated with Recreational Water - United States, 2001-2002. Morbidity and Mortality Weekly Report 53: 122.
- CDC, 2006. Dziuban, E.J., Liang, J.L., Craun, G.F., Hill, V., Yu, P.A., Painter, J., Moore, M.R., Calderon, R.L., Roy, S.L., Beach, M.J. Surveillance for Waterborne Disease and Outbreaks Associated with Recreational Water - United States, 2003-2004. Morbidity and Mortality Weekly Report 55: 1-30.
- CDC, 2008. Yoder, J.S., Hlavsa, M.C., Craun, G.F., Hill, V., Roberts, V., Yu, P.A., Hicks, L.A., Alexander, N.T., Calderon, R.L., Roy, S.L., Beach, M.J. Surveillance for Waterborne Disease and Outbreaks Associated with Recreational Water Use and Other Aquatic Facility-Associated Health Events - United States, 2005-2006. Morbidity and Mortality Weekly Report 57: 1-38. 57: 1-38.
- EPA, 1986. Quality Criteria for Water. U.S. Environmental Protection Agency: Washington, DC. OFFICE OF WATER 440/5-86-001
<https://www.epa.gov/sites/production/files/2018-10/documents/quality-criteria-water-1986.pdf>
- EPA, 2012. Recreational Water Quality Criteria. U.S. Environmental Protection Agency: Washington, DC. OFFICE OF WATER 820-F-12-058.
<https://www.epa.gov/sites/production/files/2015-10/documents/rwqc2012.pdf>
- Marion, J.W., Lee, J., Lemeshow, S., Buckley, T.J., 2010. Association of Gastrointestinal Illness and Recreational Water Exposure at an Inland U.S. Beach. Water Research 44(16): 4796-4804.
- Prüss, A., 1998. Review of Epidemiological Studies on Health Effects from Exposure to Recreational

Water. *International Journal of Epidemiology* 27(1): 1-9

Wiedenmann, A., Krüger, P., Dietz, K., López-Pila, J.M., Szewzyk, R., Botzenhart, K. 2006. A Randomized Controlled Trial Assessing Infectious Disease Risks from Bathing in Fresh Recreational Waters in Relation to the Concentration of *Escherichia coli*, Intestinal Enterococci, *Clostridium perfringens*, and Somatic Coliphages. *Environmental Health Perspectives* 114(2): 228-236.

WHO, 2003. World Health Organization. Guidelines for safe recreational water environments, Volume 1, Chapter 8: Algae and cyanobacteria in fresh water. Available online at:
www.who.int/water_sanitation_health/publications/srwe1/en

USDA, 2000. Waterborne Pathogens in Agricultural Watersheds. United States Department of Agriculture, Natural Resources Conservation Service, Watershed Science Institute.