

# Waterborne Disease Outbreaks

## 1. DISEASE REPORTING

### A. Purpose of Reporting and Surveillance

1. To prevent additional cases of waterborne diseases (WBD).
2. To identify sources of exposure for WBD outbreaks.
3. To expand current understanding of the transmission, pathogenesis and community impact of illness caused by known WBD agents.
4. To identify new WBD agents, hazards, or gaps in the water safety system.

### B. Legal Reporting Requirements

1. Health care providers: **Outbreaks immediately notifiable to local health jurisdiction**
2. Hospitals: **Outbreaks immediately notifiable to local health jurisdiction**
3. Laboratories: No requirements for reporting WBD outbreaks; see disease-specific reporting requirements
4. Local health jurisdictions: **Outbreaks immediately notifiable to the Washington State Department of Health (DOH) Communicable Disease Epidemiology Section (CDES)**

Note: there may be other reporting requirements for confirmed or probable cases of specific conditions.

### C. Local Health Jurisdiction Investigation Responsibilities

1. **Immediately notify DOH when an outbreak is suspected.** DOH epidemiologists and water quality specialists are available to assist local health jurisdictions with WBD outbreak investigations as needed. CDES epidemiologists are responsible for coordinating the investigation of multi-county and multi-state WBD outbreaks involving Washington residents.
2. Facilitate the transport of specimens to Public Health Laboratories to assist with confirming an etiologic agent if necessary.
3. Perform an epidemiologic and if indicated an environmental investigation.
4. Implement public health measures to prevent further spread.
5. Report all WBD outbreaks to CDES using the appropriate National Outbreak Reporting System (NORS) forms:

<http://www.cdc.gov/healthywater/statistics/wbdoss/nors/forms.html>

General outbreak form (general information about the outbreak timing, size, etc.) AND

General waterborne form (general information about water exposure) AND

Specific water form (treated recreational, untreated recreational, drinking, other water)

If a harmful algal bloom is suspected, please contact Joan Hardy at the office of environmental health and safety at (360) 236-3173.

## 2. THE EPIDEMIOLOGY OF WATERBORNE DISEASE OUTBREAKS

Waterborne disease (WBD) outbreaks can be categorized by etiologic agent (multiple agents can co-occur), type of water exposure, and means of water contamination. If contaminated water in turn contaminates food (e.g., produce washed in bacteria-contaminated water, shellfish with *Vibrio*), the investigation is for a foodborne outbreak (see guidance: <http://www.doh.wa.gov/notify/guidelines/pdf/foodborne.pdf>).

### A. Etiologic Agents, Descriptions of Illness and Incubation Periods

Etiologic agents of WBD outbreaks can be grouped into four general categories (see Appendix A for overview):

1. **Bacteria** include *Shigella* spp., shiga toxin-producing *Escherichia coli* [e.g., *E. coli* O157:H7], *Campylobacter*, *Salmonella*, typhoid, cholera, and other *Vibrio* species causing gastrointestinal symptoms; as well as other agents including *Mycobacterium avium* (and other species), *Pseudomonas*, *Leptospira*, and *Francisella tularensis*.
2. **Viruses** include hepatitis A virus, norovirus, and historically poliovirus causing gastrointestinal symptoms.
3. **Parasites** include *Cryptosporidium* and *Giardia* causing gastrointestinal symptoms, invasive amoeba (e.g., *Naegleria*), *Schistosoma* (causing schistosomiasis), and endemic trematodes causing cercarial dermatitis (swimmer's itch).
4. **Noninfectious agents** include cyanobacteria (blue green algae) toxins, copper, nitrates, and various chemicals causing contamination of flood waters. Symptoms depend on the agent.

WBD may cause gastrointestinal, skin, or less commonly respiratory or systemic illness. As a result symptoms may include abdominal cramps, vomiting, diarrhea (bloody or non-bloody), hives, rashes, irritated eyes, sore throat, pneumonia, or systemic illness.

### B. Waterborne Disease in Washington State

During recent years, Communicable Disease Epidemiology Section has received 0 to 3 reports of WBD outbreaks per year, involving a few to upwards of hundreds of ill persons. This is similar to the national rate of reported WBD outbreaks, although the true burden of WBD is likely many times higher. Known agents causing waterborne outbreaks in Washington include *Campylobacter*, *Cryptosporidium*, norovirus, shiga toxin-producing *E. coli*, *Giardia*, and hepatitis A. There were large outbreaks reported in 2003 (cross-contaminated drinking water lines causing campylobacteriosis) involving 110 people and 1998 (suspect viral contamination of a swimming lake) involving 248 people.

### C. Reservoirs

Humans are the reservoir of *Shigella* species, hepatitis A virus, typhoid, *Vibrio cholerae* (cholera) norovirus-like agents, and other viruses such as rotavirus and poliovirus.

Animals and birds are the primary reservoirs of *Campylobacter jejuni*, *Cryptosporidium*, shiga toxin-producing *E. coli*, *Francisella tularensis*, *Giardia*, leptospires, schistosomes, and *Salmonella* species. Humans can carry and have caused waterborne outbreaks due to *E. coli*, cryptosporidia and *Giardia*.

Environmental reservoirs occur for *Legionella* species, non-cholera *Vibrio*, non-tuberculosis *Mycobacterium* species, schistosomes, amoeba, and algae. There may also be WBD due to an altered aquatic environment such as added chlorine, added copper sulfate, or altered water pH. Some chemical contaminants may be volatilized from contaminated water. Intentional water contamination could occur.

#### D. Modes of Transmission

By definition, WBD agents are transmitted through water, although many of these agents can also be transmitted through other routes, such as food, animal contact, or directly person-to-person. Intentional contamination of water could occur. Typical route of entry into the body is through ingestion or skin contact, less commonly intranasal or through inhalation. A waterborne outbreak might initially be investigated as a foodborne outbreak until the water exposure is recognized or vice versa. For reporting purposes, the point at which contamination occurred separates foodborne from waterborne outbreaks (see Appendix B).

WBD outbreaks can be grouped into four general types of water exposure:

1. Recreational water, treated includes swimming pools, interactive fountains, water slides, spas, whirlpools, and hot tubs.
2. Recreational water, untreated includes lakes, rivers, streams, hot springs, and ocean beaches.
3. Drinking water (also used for showering or bathing) includes tap water, well water, bottled water, and contaminated water served as ice or in a beverage.
4. Other water includes decorative or display fountains, grocery store misting devices, cooling towers, and agricultural or industrial water.

Certain etiologic agents of WBD outbreaks such as *Legionella*, amoeba and algae occur naturally in water. Water can be contaminated by feces of wild animals or birds or through run-off from farms with domestic herds or flocks. Wild or domestic animal carcasses can also contaminate water. An ill person can contaminate recreational water through vomiting or more commonly diarrhea. Drinking water systems can become contaminated if wells or pipes are breached and surface water enters. Human sewage can contaminate natural bodies of water, more commonly in countries without developed sanitation infrastructure.

#### E. Periods of Communicability

The communicable period of those infected with bacteria, viruses or parasites varies. See Appendix A and agent-specific guidelines at: <http://www.doh.wa.gov/notify/forms/>.

#### F. Treatment

Though treatment varies with the etiologic agent, most WBD illnesses require only adequate hydration. Treatment recommendations for some specific WBD agents would be the same as for foodborne infections and can be found in:

Centers for Disease Control and Prevention. Diagnosis and Management of Foodborne Illnesses A Primer for Physicians and Other Health Care Professionals. MMWR 2004;53 (RR04):1–33. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5304a1.htm>

### G. Susceptibility/Immunity

There is general susceptibility to these agents. There are vaccines for a few of the infectious agents that have the potential to be waterborne (e.g., hepatitis A, cholera, typhoid, and polio). Infants and persons with lowered gastric acidity may be infected with lower inocula of some bacteria. Infants, the elderly, immunosuppressed persons, and sometimes persons with chronic medical conditions are more likely to suffer serious illness from diarrhea agents.

## 3. WATERBORNE OUTBREAK DEFINITIONS

A waterborne disease (WBD) outbreak is an incident in which 1) two or more epidemiologically-linked persons experience a similar illness after exposure to the same water source and 2) epidemiologic evidence implicates the water as the likely source of the illness.

### Clinical Description

Depends upon etiologic agent (see Appendix A and individual disease guidelines).

### Laboratory criteria for diagnosis

Depend upon etiologic agent (see Appendix A and individual disease guidelines).

### Case classification (2010)

*Confirmed:* Any outbreak of an infectious disease, chemical poisoning or toxin-mediated illness where water is indicated as the source by an epidemiological investigation.

### CDC Comment

The implicated water in a WBD outbreak may be drinking water, recreational water, water not intended for drinking (e.g., water used for agricultural purposes or in a cooling tower) or water of unknown intent. The route of exposure may be ingestion, inhalation, intranasal, or contact. The agent associated with the WBD outbreak may be a microbe, chemical, or toxin. Water testing to demonstrate contamination or identify the etiologic agent is preferred, but not required for inclusion as an outbreak. Chemicals (including disinfection byproducts) in drinking water or in recreational water that cause health effects either through water exposure or by volatilization leading to poor air quality are included.

Reports of WBD outbreaks received through the National Outbreak Reporting System (NORS) are captured in the Waterborne Disease and Outbreak Surveillance System (WBDOSS). Although not reported through NORS, the WBDOSS also accepts single cases of chemical exposure, wound infection (e.g., *Vibrio* skin infection) and other illnesses, (e.g., *Naegleria* infections) that are epidemiologically linked to water exposure as well as aquatic facility-related health events (e.g., chemical mixing accidents or air quality problems). However, these single cases or aquatic facility-related health events are not reported nor analyzed as WBD outbreaks.

## 4. DIAGNOSIS AND LABORATORY SERVICES

### A. Laboratory Diagnosis

Waterborne disease (WBD) outbreaks may or may not be laboratory confirmed. In general, confirming the specific etiologic agent in an outbreak requires detecting the agent in clinical specimens from at least 2 ill persons. Guidelines for confirming the etiologic agent of a WBD outbreak are available in Appendix C and for specific agents that can also cause foodborne outbreaks at:

[http://www.cdc.gov/outbreaknet/references\\_resources/guide\\_confirming\\_diagnosis.html](http://www.cdc.gov/outbreaknet/references_resources/guide_confirming_diagnosis.html)

### B. Tests Available

#### 1. Washington State Public Health Laboratories (PHL)

PHL has the capability to test **clinical specimens** from patients for many waterborne bacterial or parasitic agents and norovirus, to confirm bacterial and parasitic agents tested commercially, and to speciate or subtype isolates of *Salmonella*, *Legionella*, *Shigella*, and shiga toxin-producing *E. coli*. PHL does not test clinical specimens for hepatitis A but this test is widely available in commercial labs. In outbreak situations involving unusual agents, additional testing may be available through Centers for Disease Control and Prevention (CDC). Consult with Communicable Disease Epidemiology Section (CDES) prior to collecting specimens to assure proper handling. Different test kits are used for different agents (e.g., specimens for enteric bacteria are collected using transport medium while specimens for parasites are collected using preservative).

PHL also has the capability to test **water specimens** for many bacterial pathogens, when indicated in the context of an outbreak investigation. Collection of environmental samples must follow established protocols. PHL does not test water for norovirus or for parasites.

For additional information regarding testing clinical and water specimens at PHL for pathogens also common as foodborne agents, see *Foodborne Disease and the Public Health Labs: A Foodborne Pathogen Quick Reference Guide for Food Sanitarians* available at: <http://www.doh.wa.gov/EHSPHL/PHL/foodguide.pdf>

Note that PHL require all clinical specimens have two patient identifiers, a name **and** a second identifier (e.g., date of birth) both on the specimen label and on the submission form. Due to laboratory accreditation standards, specimens will be rejected for testing if not properly identified. Also include specimen source and collection date.

PHL has the capacity for limited chemical testing including lead or nitrates.

#### 2. King County Environmental Laboratory (KCEL)

KCEL has the capability to test **environmental samples** from lakes and other water bodies for suspected freshwater biotoxins (HABs – harmful algae blooms). Analyses are available for microcystins, anatoxin-a, saxitoxins, and cylindrospermopsin. Washington State Department of Ecology (Ecology)'s Freshwater Algae Control Program funds the cost of toxicity tests while local agencies or lake managers pay for shipping. In situations where people have symptoms but tests for the four biotoxins are negative, additional testing may be available through Centers for Disease Control and Prevention (CDC).

### C. Specimen Collection

For instruction regarding collecting and shipping clinical and water specimens to PHL, see: <http://www.doh.wa.gov/EHSPHL/PHL/Forms/DirServ30.pdf>

Collection of environmental samples must follow established protocols. Consult with Ecology prior to collecting water samples to obtain a sample number and to assure proper handling. Most local health jurisdictions have sample kits available for use to test and ship for toxic cyanobacteria.

## 5. ROUTINE INVESTIGATION and CONTROLLING FURTHER SPREAD

Waterborne disease (WBD) outbreaks can be detected through health care provider notifiable condition reporting, report of a group affected with a shared exposure, individual complaints relating to the same exposure, speciation and/or molecular analysis of isolates in the laboratory (e.g., pulse field gel electrophoresis [PFGE]), and syndromic surveillance systems. Although a general approach to investigations can be given, each specific situation will vary.

As a first step, evaluate whether the initial complaint is consistent with a point source exposure of any type. A time-space cluster of cases may be an outbreak, or could occur by chance. A social group with several episodes of illness following an event might assume there is a connection even though different agents with different transmission routes are involved. Even if an outbreak is probable, the group may have shared both food and water exposures as well as having been in close contact so the route of transmission is unclear.

If preliminary information suggests an outbreak, determine the most likely agent(s) from the incubations period (if known), reported symptoms, durations of illness, and suspect sources. Widely varying symptoms and incubation periods do not suggest an outbreak. However, some agents can cause secondary cases, which would not share the initial exposure. The National Outbreak Reporting System (NORS) forms can guide the investigation if an outbreak is likely:

<http://www.cdc.gov/healthywater/statistics/wbdoss/nors/forms.html>

### A. Systematically collect information from patients to characterize the outbreak.

The following information is used to evaluate the occurrence of a WBD outbreak:

1. Identifiers and demographics, including name, address, telephone number, age, sex, and other relevant factors such as occupation, residence, classroom, unit/wing/ward, cell block, etc.
2. Symptoms, including vomiting, diarrhea, bloody diarrhea, fever, abdominal cramps, jaundice, respiratory irritation, rash, systemic illness, and any others mentioned.
3. Date and time of symptom onset and how long symptoms lasted (duration).
4. Travel including locations, water consumption, and recreational water exposures. Pertinent details for travel involving cruise ships or hotels/motels include dates, name of ship or hotel, and use of pools, spas, hot tubs, or other water recreational sites.
5. Common activities and water consumption history for a period of at least 72 hours before illness onset.

- Names, addresses, phone numbers, and other locating information of anyone else who might be involved in the outbreak, both people who are sick and people who are not, and if applicable the name of the coordinator of a group activity.

Three different NORS forms should be completed for each confirmed WBD outbreak:

The NORS General Section obtains information about investigation methods, dates of onsets and exposures, geographic location, demographic characteristics of primary cases, incubation and duration of illnesses, major symptoms, presence of secondary cases, and identified commercial products associated with the outbreak.

The NORS General Waterborne form obtains information about the type of water exposure, associated events, route of entry, results of case-control or cohort investigations, and laboratory test results for cases.

The four NORS specific water forms are designed for treated recreational water, untreated recreational water, drinking water, and other water. Each of these forms includes a description, laboratory test results for the water, and factors contributing to contamination. Only one of the four is used for a given investigation.

NORS forms are at: <http://www.cdc.gov/healthywater/statistics/wbdoss/nors/forms.html>. CDC toolkits for waterborne outbreak investigation include extensive case/control interview forms, sample case tracking line lists (add columns for symptoms reported), environmental health outbreak investigation surveys for swimming pools, and sample notification letters. See: <http://www.cdc.gov/healthywater/emergency/toolkit/#guides>

#### **B. Attempt to identify additional cases.**

Case finding methods might include sending provider alerts, identifying and contacting others potentially exposed to the suspected source, checking laboratories reports, or releasing a media alert.

#### **C. Confirm the existence of an outbreak.**

To confirm an outbreak, local health jurisdictions should look at preliminary information about the cases and consider a number of questions, including the following:

- Are there two or more people from different households with the same clinical illness resulting from a common exposure such as ingesting the same water or from visiting the same site?
- Are the clinical signs and symptoms, along with the incubation period, consistent with an illness resulting from the reported exposure?
- Are the illnesses similar and consistent with a known WBD agent?
- Is the number of illnesses more than what would be expected in this group of people or in the population as a whole?
- Are there reports of potentially associated cases from multiple sources?
- Did the group have additional shared exposures (e.g., food, beverages) in the same time frame as the water exposure?
- Are there other common exposures or contacts among those affected (e.g., personal, occupational, or multiple common gatherings) that could explain transmission?

8. Does the demographic information (age, ethnicity, etc.) suggest a common source?

[Note: These questions provide guidance and are not strict criteria.]

**D. Formulate a hypothesis about the WBD agent and arrange for appropriate clinical laboratory testing, if necessary. Facilitate testing of stool specimens from ill persons associated with the outbreak. Consult with Communicable Disease Epidemiology Section (CDES) for testing at Public Health Laboratories.**

1. Refer ill persons for clinical evaluation and testing if symptoms are severe, if bloody diarrhea is reported, or if the patients are vulnerable to complications due to age or disability.
2. For gastrointestinal illness collect fresh stool as soon as possible after onset of illness. The more symptoms a person has when specimens are collected, the more likely the etiologic agent will be recovered. See Section 4C for additional details regarding specimen collection.
3. Collect specimens from as many people as possible. The criterion for confirming that an outbreak was caused by a specific agent depends on isolating the agent from at least two people involved in the outbreak.

**E. Develop a preliminary case definition that includes time, place, and person.**

A case definition is used in an outbreak and differs from the case definition for a specific condition. An example of a case definition for an outbreak could be:

Diarrhea with abrupt onset between July 25 and July 26, 2008 (time) in any person at least 2 years of age (person) who swam in Lake A on July 24, 2008 (place).

**G. Communicate with the environmental health specialist who will conduct the field investigation.**

The goals of the joint epidemiologic and environmental investigation are to identify the infectious agent in the environment, the mode of transmission, the water source, and the source of the contamination. Consider the likely agent based on symptoms, symptom duration, and incubation period. Source of exposure might also suggest an agent (e.g., salt water or fresh water organism). As appropriate, obtain additional information:

1. Were there any unusual circumstances or practices operative just before the outbreak began that could have contaminated water? Power outages? Water back-ups? Other equipment failures?
2. Were there any unusual weather circumstances just before the outbreak began? Heavy rains? Floods?
3. Were any water facility staff ill during the incubation period of the suspect WBD agent? When did they become ill? With which water sources did they work?
4. Do the water facility staff ingest or have body contact with the water they work with?

**H. Implement immediate control measures based on the likely WBD agent and source.**

Depending on circumstances, immediate control measures may include issuing a boil water order, posting warnings at a lake, closing a facility, or recalling a commercial product.

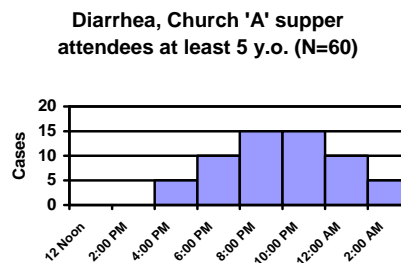
## I. Consider testing hypotheses with an epidemiologic study.

1. Determine if initial interviews and the number of affected persons will support an epidemiologic study.
2. Get as complete a list as possible of all the people who likely shared exposure; lists could be available from an event organizer or from reservation lists.
3. Develop a questionnaire to systematically collect information on symptoms and pertinent exposures.
4. Administer the questionnaire to as many people as possible, both sick and well, as soon as possible after the first cases are reported. It is important to remember that people's memories may become less reliable.
5. After finalizing a case definition, analyze the data to obtain the following:

**Demographic profile:** the number of cases by age group and sex.

**Symptom profile:** the percentage of cases with vomiting, diarrhea, bloody diarrhea, fever, abdominal cramps, jaundice, respiratory symptoms, rash, systemic illness, and any other symptoms.

**Epidemic curve:** the number of cases by time of onset of symptoms.



**Event attack rate:** the number of cases divided by the total number of people exposed. The event attack rate can only be calculated if the total number of people exposed is known (e.g., entire group from an office attending a lake party).

**Median incubation period:** the time it takes 50% of the cases to have onset of symptoms after exposure to the WBD agent. The median incubation period can only be calculated if the time of exposure is known.

**Water-specific attack rate:** the percentage of people who became ill after water exposure (table 1, column 4).

**Other specific attack rate:** the percentage of people who became ill after a specific exposure (e.g., food item).

**Relative risk:** for a cohort, the percentage of people who became ill after water exposure, divided by the percentage of people who became ill after not having water exposure (Table 1, column 8).

**P value:** The probability the elevated relative risk is due only to chance.  $P < .05$  means that chance is a very unlikely explanation (less than 5 times out of a 100) for the difference in relative risks. However, this shows association and is not proof of causation.

When a cohort is studied, attack rates can be developed for illness among exposed and illness among unexposed, and the relative risk is a ratio of these rates (rate ratio).

Table 1 is an example of a data table using the information collected from a review of consumed water items to identify the likely water item that was contaminated.  $P < 0.05$  is the usual cut-off to say the water (or another exposure) is "statistically significantly associated with illness" (last column).

Water Item	EXPOSED to Water			NOT EXPOSED to Water			Statistics	
	Number Sick	Number Well	Attack Rate	Number Sick	Number Well	Attack Rate	Relative Risk	P value
Wading pool	55	45	55%	5	95	5%	11	<.001
Spray fountain	40	60	40%	20	80	20%	2	.004
Swimming pool	30	70	30%	30	70	30%	1	1
Formulas	A	B	$A \div (A+B) = X\%$ ill exposed $\div$ total exposed	C	D	$C \div (C+D) = Y\%$ ill unexposed $\div$ total unexposed	$X\% \div Y\%$ ratio of attack rates	*

\* Statistical programs, such as Epi Info, SAS or SPSS are commonly used to calculate *P* values. Epi Info is a CDC-developed statistical software package available for free downloading at: <http://www.cdc.gov/epiinfo/index.htm>.

**J. Implement and evaluate further control measures**

Depending on additional information, further environmental control measures may include: Posting ongoing water quality conditions at the water source, providing ongoing information to local media sources, formal closure of a designated area used for swimming, limiting access to the facility by target groups (e.g. bathers in diapers), or contacting neighboring beach facility owners about conditions and advising public information at these sites to limit access for whole body bathing use.

Persons with vomiting or diarrhea should not maintain water recreation facilities during the period they are having symptoms and wait at least two weeks before engaging in whole body contact with bathing water.

**K. Report findings to DOH**

Report all WBD outbreaks to CDES.

**6. CONTROLLING FURTHER SPREAD**

Patients with diarrhea and their close contacts should be instructed in good hand washing and food-handling practices. More specific follow-up of cases and contacts varies with the etiologic agent. Please refer to the Surveillance and Reporting Guidelines (<http://www.doh.wa.gov/notify/forms/>) for guidance on individual notifiable diseases. Consult with Communicable Disease Epidemiology Section for any other conditions.

## 7. MANAGING SPECIAL SITUATIONS

Report unusual agents to Communicable Disease Epidemiology Section.

## 8. ROUTINE PREVENTION

For overview recommendations see: <http://www.cdc.gov/healthywater/>.

Use only safe sources for drinking water including during recreational activities. If water quality is uncertain, boil or chemically treat water before using it for drinking, rinsing uncooked foods, or brushing teeth.

Wash hands after using the toilet or changing diapers. Shower with soap before swimming in pools. Do not enter swimming areas when ill with vomiting or diarrhea. Do not let children ill with vomiting or diarrhea enter swimming areas even if they have special swim diapers or swim pants.

Children in diapers should have frequent diaper changes. During an outbreak, some jurisdictions have excluded diapered children from water recreation facilities. Generally, a more aggressive public media campaign has shown improved success where local park and pool managers, day care institutions, and other common areas of congregation work to inform the public of potential problems and educate the public to not enter the water for two weeks after any incidents of diarrhea.

## ACKNOWLEDGEMENTS

We would like to acknowledge the Oregon Department of Human Services for developing the format of this document.

## UPDATES

New guideline February 2011.

**APPENDIX A: COMMON AGENTS OF WATERBORNE DISEASE OUTBREAKS****Incubation Periods and Symptoms of Common Waterborne Illness Agents\***

Agent	Incubation Period	Symptoms						
		Duration / Communicable to others	Diarrhea	Bloody diarrhea	Vomiting	Fever	Rash, Skin	Other
<b>Blue-green algae (liver toxins)</b>	30 minutes to 24 hours (generally slower acting)	Unknown / not communicable	+		+++		++	jaundice, abdominal pain, shock
<b>Blue-green algae (neurotoxins)</b>	few minutes to 24 hours (generally fast acting)	Unknown / not communicable	+				++	gasping, tingling, weakness, convulsions
<b>Swimmer's itch</b>	1-48 hours	7 days / not communicable					itchy red papules	
<b>Pseudomonas</b>	0.3-5 days	To 5 days / not communicable					itchy folliculitis	
<b>Vibrio (skin)</b>	3-72 hours	varies / not communicable				++	ulcer	cellulitis
<b>Norovirus-type agents</b>	0.5-2 days	1-2 days / communicable	+++		+++	+		aching, headache
<b>Salmonella and typhoid</b>	0.5-5 days	3-7 days / communicable	+++	+	+	+++		cramps
<b>Shigella</b>	1-7 days	4-7 days / communicable	+++	+	+	+++		cramps
<b>E. coli O157:H7</b>	1-8 days	5-10 days / communicable	+++	++	+			cramps, HUS
<b>Campylobacter</b>	1-10 days	2-5 days	+++	+	+	+++		cramps
<b>Legionella / Pontiac fever</b>	2-10 days – pneumonia	varies / not communicable	+			+++		pneumonia
<b>Leptospira</b>	2-30 days (typ. 5-14)	varies / not communicable				+++	++	systemic, highly variable
<b>Cryptosporidium</b>	1-12 days	2+ weeks / communicable	+++			+		
<b>Francisella tularensis</b>	1-14 days (typ. 3-5)	varies / not communicable				+++	may be ulcer	highly variable
<b>Giardia</b>	3-25 days	1-4 weeks / communicable	+++					greasy stool, wt loss
<b>Hepatitis A</b>	15-50 days	1-2+ weeks / communicable	++		+	+++		jaundice, fatigue

\*These are only guidelines; incubation periods and symptoms reported by patients affected by these agents may be outside of the ranges listed above. Communicable indicated person-to-person transmission.

A good reference is Control of Communicable Diseases Manual published by the American Public Health Association.

**APPENDIX B: CRITERIA FOR CONFIRMATION OF WATERBORNE OUTBREAKS**

The Centers for Disease Control and Prevention has established criteria for confirming the etiology when a foodborne outbreak has been identified which have been adapted. Original criteria can be found at

[http://www.cdc.gov/outbreaknet/references\\_resources/guide\\_confirming\\_diagnosis.html](http://www.cdc.gov/outbreaknet/references_resources/guide_confirming_diagnosis.html)

Etiologic agent	Confirmation Criteria
<b>Bacterial</b>	<p><b>Note that ill persons would have a shared exposure.</b></p> <p><b>*Tests Available at WA State Public Health Laboratories are indicated by an asterisk</b></p>
1. <i>Campylobacter jejuni/coli</i>	<p>*Isolation of organism from clinical specimens from two or more ill persons</p> <p><u>OR</u></p> <p>Isolation of organism from epidemiologically implicated water</p>
2. <i>Escherichia coli</i>	
a. Enterohemorrhagic ( <i>E. coli</i> O157:H7 and others)	<p>*Isolation of <i>E. coli</i> O157:H7 or other Shiga-like toxin-producing <i>E. coli</i> of same PFGE pattern from clinical specimen from two or more ill persons</p> <p><u>OR</u></p> <p>Isolation of <i>E. coli</i> O157:H7 or other Shiga-like toxin-producing <i>E. coli</i> of same PFGE pattern from epidemiologically implicated water</p>
b. Enterotoxigenic (ETEC)	<p>Isolation of organism of same serotype, demonstrated to produce heat-stable (ST) and/or heat-labile (LT) enterotoxin, from stool of two or more ill persons</p>
c. Enteropathogenic (EPEC)	<p>Isolation of organism of same enteropathogenic serotype from stool of two or more ill persons</p>
d. Enteroinvasive (EIEC)	<p>Isolation of same enteroinvasive serotype from stool of two or more ill persons</p>
3. <i>Francisella tularensis</i>	<p>*Isolation of organism from clinical specimens from two or more ill persons</p> <p><u>OR</u></p> <p>Fourfold titer increase in two or more ill persons (presumptive: elevated without increase)</p>
4. Leptospirosis	<p>Fourfold titer increase in two or more ill persons (presumptive: elevated without increase)</p> <p><u>OR</u></p> <p>Demonstration of <i>Leptospira</i> by immunofluorescence in clinical specimens from two or more ill persons</p> <p><u>OR</u></p> <p>Isolation of organism from clinical specimens from two or more ill persons</p>
5. <i>Pseudomonas</i>	<p>Isolation of organism from clinical specimens from two or more ill persons</p>
6. <i>Mycobacterium balnei</i> or <i>marinum</i>	<p>*Isolation of organism from clinical specimens from two or more ill persons</p>
7. <i>Mycobacterium avium</i>	<p>*Isolation of organism from clinical specimens from two or more ill persons</p>
8. <i>Salmonella</i> , nontyphoidal	<p>*Isolation of organism of same serotype from clinical specimens from two or more ill persons</p> <p><u>OR</u></p> <p>*Isolation of organism from epidemiologically implicated water</p>

<p><b>9. <i>Salmonella</i> Typhi</b></p>	<p>*Isolation of organism from clinical specimens from two or more ill persons  <u>OR</u>                  *Isolation of organism from epidemiologically implicated water</p>
<p><b>10. <i>Shigella</i> spp.</b></p>	<p>*Isolation of organism of same PFGE pattern from clinical specimens from two or more ill persons  <u>OR</u>                  *Isolation of organism of same PFGE pattern from epidemiologically implicated water</p>
<p><b>11. Naturally occurring Harmful Algal Blooms (blue-green algae/ toxic cyanobacteria)</b></p>	<p><u>Anatoxin-a:</u>                  History of swimming, head immersion and/or accidental swallowing of bloom water AND either demonstration of algal cells in feces or toxin demonstrated in blood (or other tissues and body fluids at autopsy such as liver and vitreous fluid). Note: False positive detection of phenylalanine, which has the same MW as anatoxin-a, in tissues and body fluids may confound the diagnosis.</p> <p><u>Cylindrospermopsin:</u>                  Acute gastrointestinal illness with abnormal liver function tests AND confirmed exposure (ingestion or immersion) to water with confirmed blue-green bloom of cyanobacterial species capable of cylindrospermopsin production .</p> <p><u>Microcystins:</u>  <i>Suspect case</i>                  Gastrointestinal illness <b>and</b> ingested water or contaminated food from water with cyanoHAB bloom  <u>OR</u>                  Dermal symptoms <b>and</b> skin contact to water with a cyanoHAB bloom  <u>OR</u>                  Jaundice, visual disturbances, abdominal pain, nausea, vomiting, bad taste in mouth <b>and</b> routine dialysis with water source with a cyanoHAB bloom</p> <p><i>Confirmed case</i>                  Meets suspect case definition <b>and</b> positive assay in clinical specimen and/or vector</p> <p>Confirmation testing of cyanotoxin in blood serum may be available through coordination with CDC. A microtiter plate format ELISA kit for human, dog and cattle serum is available from ABRAXIS.</p>
<p><b>12. <i>Vibrio</i> including <i>V. cholerae</i></b></p>	<p>*Isolation of organism from clinical specimens from two or more ill persons  <u>OR</u>                  *For <i>Vibrio cholerae</i>, Isolation of organism from epidemiologically implicated water</p>
<p><b>Chemicals</b></p>	
<p><b>1. Cnidarians</b></p>	<p>Suspect: Likely exposure to nematocysts (stinging cells of jellyfish)</p>
<p><b>2. Chemical hazards, inorganic: pH, hydrogen sulfide, nitrogen trichloride, any contaminant that is recognized in drinking water standards</b></p>	<p>When contaminants exceed maximum contaminant levels for drinking water, a screening approach is recommended with a general guide of ten times the levels set in drinking water levels as a concentration to begin further evaluation. It will take specific evaluation of the contaminant and the potential routes of exposure through swimming.</p> <p>e.g., inorganic levels of nitrogen trichloride in excess of 0.05 ppm (WHO) in the atmosphere</p>
<p><b>3. Chemical hazards, organic: gasoline additives, chlorine byproducts, lipophilic organic contaminates, chlorinated biphenyls, chloroform volatile organics (THM, [haloacetic acids], other organic fractions)</b></p>	<p>Demonstration of high levels of volatile disinfection byproducts in epidemiologically implicated water. When contaminants exceed maximum contaminant levels for drinking water, a screening approach is recommended with a general guide of ten times the levels set in drinking water levels as a concentration to begin further evaluation. It will take specific evaluation of the contaminate and the potential routes of exposure through swimming</p>

<b>Parasitic</b>	
<b>1. <i>Cryptosporidium</i> spp.</b>	*Demonstration of oocysts in stool or in small-bowel biopsy of two or more ill persons <u>OR</u> Demonstration of organism in epidemiologically implicated water
<b>2. <i>Cyclospora cayetanensis</i></b>	*Demonstration of the parasite by microscopy or molecular methods in stool or in intestinal aspirate or biopsy specimens from two or more ill persons <u>OR</u> Demonstration of the parasite in epidemiologically implicated water
<b>3. <i>Giardia intestinalis</i></b>	*Demonstration of the parasite in stool or small-bowel biopsy specimen of two or more ill persons
<b>4. Swimmer's itch</b>	No specific tests
<b>Viral</b>	
<b>1. Hepatitis A</b>	Detection of immunoglobulin M antibody to hepatitis A virus (IgM anti-HAV) in serum from two or more persons who consumed epidemiologically implicated water
<b>2. Norovirus (NoV)</b>	*Detection of viral RNA in at least two bulk stool or vomitus specimens by real-time or conventional reverse transcriptase-polymerase chain reaction (RT-PCR) <u>OR</u> Visualization of viruses (NoV) with characteristic morphology by electron microscopy in at least two or more bulk stool or vomitus specimens <u>OR</u> Two or more stools positive by commercial enzyme immunoassay (EIA)
<b>3. Astrovirus</b>	Detection of viral RNA in at least two bulk stool or vomitus specimens by real-time or conventional reverse transcriptase-polymerase chain reaction (RT-PCR) <u>OR</u> Visualization of viruses (NoV) with characteristic morphology by electron microscopy in at least two or more bulk stool or vomitus specimens <u>OR</u> Two or more stools positive by commercial enzyme immunoassay (EIA)

**APPENDIX C: REPORTING OF WATERBORNE OUTBREAKS THROUGH NORS**

Use the appendix to determine if an outbreak is Waterborne or Foodborne for NORS reporting.

**Source of Outbreak****(Known or Suspected) Reporting Guidelines for NORS**

<b>Food</b>	<ul style="list-style-type: none"> <li>▪ If contaminated food goes in the mouth – Foodborne</li> <li>▪ If food is produced or prepared using contaminated water and then the contaminated food is consumed – Foodborne</li> </ul>
<b>Water (drinking, recreational [untreated, treated], other)</b>	<ul style="list-style-type: none"> <li>▪ If contaminated water goes in the mouth, is breathed in (swimming in a pool, shower or other aerosol, while sitting in a hot-tub or jet spa), or there is contact with the body in another way – Waterborne</li> <li>▪ If small children are sitting in the water assume ingestion - Waterborne</li> </ul>
<b>Ice</b>	<ul style="list-style-type: none"> <li>▪ If ice is made with contaminated water – Waterborne</li> <li>▪ If ice is made with contaminated water and then added to a beverage (e.g. ice was made with contaminated water and only people who consume drinks containing ice became ill) – Waterborne</li> <li>▪ If ice is made with contaminated water and is used to cool a food product – Foodborne</li> <li>▪ If ice is already made and then becomes contaminated through handling – Foodborne</li> <li>▪ If it is unknown how the ice became contaminated – Foodborne</li> </ul>
<b>Beverages Prepared with Water</b>	<ul style="list-style-type: none"> <li>▪ If the beverage is made with contaminated water – Waterborne</li> <li>▪ If the beverage is already made and then becomes contaminated through handling – Foodborne</li> <li>▪ If the flavoring (e.g., frozen orange juice concentrate) is contaminated – Foodborne</li> <li>▪ If it is unknown how the beverage became contaminated – Foodborne</li> </ul>
<b>Drink Mix/Soda Machines</b>	<ul style="list-style-type: none"> <li>▪ If the water entering the machine is contaminated or if there is a problem with the internal plumbing of the machine resulting in contamination (e.g., cross-connections, backflow of carbonated water resulting in copper leaching) – Waterborne</li> <li>▪ If the drink is contaminated through handling after it is dispensed or contamination of the spout on the machine – Foodborne</li> <li>▪ If the flavoring is contaminated before it is put into the machine – Foodborne</li> <li>▪ If it is unknown how the beverage became contaminated – Foodborne</li> </ul>
<b>Bottled Water</b>	<ul style="list-style-type: none"> <li>▪ If bottled water is contaminated anywhere in the chain from source water through production, storage, transportation, distribution, and point of use – Waterborne</li> </ul>
<b>Flavored Drinks (note: flavoring does not include carbonation)</b>	<ul style="list-style-type: none"> <li>▪ If flavoring is added to bottled water and then it becomes contaminated or if the flavoring is contaminated – Foodborne</li> <li>▪ If the water is contaminated before the flavoring is added – Waterborne</li> <li>▪ If it is unknown how the flavored bottled water became contaminated – Foodborne</li> </ul>