

NATIONAL OUTBREAK REPORTING SYSTEM (NORS) FOR WATERBORNE DISEASE AND OUTBREAKS

CDC 52.12 Form Instructions

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1 INTRODUCTION

This document is a reference manual for public health professionals who use the CDC 52.12 form to report data to the National Outbreak Reporting System (NORS). NORS is a web-based system that has been designed to improve the quality of the data and its usability by local, state and national partners. NORS integrates outbreak reporting for foodborne illnesses, waterborne illnesses and enteric person-to-person illnesses (e.g. norovirus infection). Reports for these outbreaks contain a shared section that asks common questions (e.g. date(s) and location(s) of the outbreak). NORS users will be able to download and analyze data entered into NORS. Further, waterborne disease outbreaks in NORS will be reviewed for inclusion in the Waterborne Disease and Outbreak Surveillance System (WBD OSS). A collaboration between the Council of State and Territorial Epidemiologists (CSTE), the Centers for Disease Control and Prevention (CDC), and the Environmental Protection Agency (EPA), the WBD OSS tracks, analyzes and describes waterborne disease outbreaks on a national level.

The CDC 52.12 has been revised and formatted to facilitate timely entry of detailed waterborne disease outbreak investigation data into the electronic system. Past users of the CDC 52.12 form expressed uncertainty about how to report information for different types of water exposure (e.g. drinking water vs. recreational water); therefore, NORS was organized so that the types of water exposure would be divided into separate parts. Similarly, the revised paper form is organized into parts. The guidance in this document has been organized to correspond to the tabs on the paper form; tabs have been placed at the top of each page to indicate the shared General part, a water-specific Water-General part, and parts for the four types of water exposure: treated recreational water, untreated recreational water, drinking water and water not intended for drinking--excluding recreational water--or water of unknown intent (WNID/WUI). Only one of the four water exposure tabs is completed for one outbreak report. A completed report should contain the General tab, the Water-General tab, and one of four tabs for the type of water exposure implicated in the outbreak.

Data reporting in NORS will take a more systematic and detailed approach, substantially improving the ability to evaluate and incorporate environmental elements and contributing factors into waterborne disease outbreak prevention efforts. To improve the standardization of data, the majority of fields in the electronic version of NORS contain dropdown menus with comprehensive pick lists. The pick lists are included in the appendices to this guidance document to assist CDC 52.12 form users. New values may be added to many of the pick lists, as indicated in the guidance for individual fields. Please complete as many of the fields as possible to improve data quality and enhance data analysis capabilities for your reporting site; however, please note that only **Reporting State** and **Date first case became ill** are required data entry fields in the electronic system. Other fields may be left blank if the questions are not relevant to a particular outbreak or if no answer is available for the question.

2 GENERAL SECTION

Figure 1. The first part of the General tab for the CDC 52.12 form

The image shows the top portion of a form titled "National Outbreak Reporting System Waterborne Disease Transmission". At the top left is the CDC logo. Below it is a paragraph of text explaining the form's purpose and structure. Below the text are two input fields labeled "CDC Report ID" and "State Report ID". At the top right is the CDC logo. At the bottom right is the text "Form Approved OMB No. 0520-0004".

General

National Outbreak Reporting System

Waterborne Disease Transmission

This form is used to report waterborne disease outbreak investigations. This form has 6 parts, indicated by tabs at the top of each page. Part 1 asks for the minimum or basic information about the outbreak investigation. Part 2 asks for epidemiological data and clinical specimen test results. Parts 3, 4, 5 and 6 collect information about types of water exposure (treated recreational water, untreated recreational water, drinking water, and water not intended for drinking/unknown intent). Only 1 of these 4 water exposure parts should be completed for an outbreak investigation report.

CDC USE ONLY

| | |
|---------------|-----------------|
| CDC Report ID | State Report ID |
|---------------|-----------------|

Form Approved
OMB No. 0520-0004

2.1 CDC Report ID

This is a CDC-assigned identification number that will be generated automatically when the report form is entered into NORS. This field should be left blank.

2.2 State Report ID

Each form should be assigned a State Report ID prior to being entered into NORS. The State Report ID is a unique identifier that helps users organize and manage their reports. Once a particular State Report ID has been assigned, it should not be used again. The format of the State Report ID may vary across states but should be consistent for all outbreak reports entered by each state. This format may contain letters, numbers or a combination of both.

Enter the State Report ID in the designated field. If the State Report ID has not been assigned and someone else (e.g. a state coordinator) will assign the number later, leave this field blank. If you are assigning the State Report ID, refer to the format used by your state.

2.3 Primary Mode of Transmission

Figure 2. The Primary Mode of Transmission section.

| General Section | |
|--|---|
| Primary Mode of Transmission <i>(check one)</i> | |
| <input type="checkbox"/> Food <i>(Complete CDC 52.13)</i> | <input type="checkbox"/> Person-to-person <i>(Complete CDC 52.13)</i> |
| <input type="checkbox"/> Water <i>(Complete tabs for General, Water-General and type of water exposure)</i> | <input type="checkbox"/> Environmental contamination other than food/water <i>(Complete CDC 52.13)</i> |
| <input type="checkbox"/> Animal contact <i>(Complete CDC 52.13)</i> | <input type="checkbox"/> Indeterminate/Other/Unknown <i>(Complete CDC 52.13)</i> |

Check the box next to 'Water' to indicate that water exposure resulted in the first cluster of illness in the outbreak. If you are unsure whether the primary mode of transmission was water, please review the guidance below. **Appendix A** provides more detailed information about water and food exposures to help you decide if an outbreak should be reported using the waterborne disease outbreak form (CDC 52.12) or the foodborne disease outbreak form (CDC 52.13).

- **Food** – If initial transmission of illness is associated with ingestion of a common, potentially contaminated food/beverage item (use CDC 52.13 form and instructions).
- **Water** – If initial transmission of illness is associated with ingestion of potentially contaminated water source (including bottled water).
- **Animal contact** – If initial transmission of illness is associated with exposure (physical contact) to farm animals, reptiles or other animals potentially infected with pathogens causing gastrointestinal illness in humans (use CDC 52.13 form and instructions).
- **Person to person** – If initial or predominant transmission of illness is associated with direct contact with an infected case (use CDC 52.13 form and instructions).
- **Environmental contamination other than food/water** – If initial or predominant transmission of illness is associated with an environmental contaminant. Environmental contamination is similar to person-to-person transmission (e.g. if someone vomits in a public restroom and the following day people become sick after visiting the same restroom, although, the initial person is long gone) (use CDC 52.13 form and instructions).
- **Indeterminate/Other/Unknown** – If the source of initial transmission of illness was not identified (use CDC 52.13 form and instructions).

2.4 Investigation Methods

Figure 3. The Investigation Methods section.

| Investigation Methods <i>(check all that apply)</i> | |
|--|--|
| <input type="checkbox"/> Interviews only of ill persons | <input type="checkbox"/> Treated or untreated recreational water venue assessment |
| <input type="checkbox"/> Case-control study | <input type="checkbox"/> Investigation at factory/production/treatment plant |
| <input type="checkbox"/> Cohort study | <input type="checkbox"/> Investigation at original source (e.g., farm, water source, etc.) |
| <input type="checkbox"/> Food preparation review | <input type="checkbox"/> Food product or bottled water traceback |
| <input type="checkbox"/> Water system assessment: Drinking water | <input type="checkbox"/> Environment/food/water sample testing |
| <input type="checkbox"/> Water system assessment: Nonpotable water | <input type="checkbox"/> Other |
| Comments | |
| <hr/> | |
| <hr/> | |

Refer to the following definitions. Please check all that apply:

- **Interviews only of ill persons** – Only ill persons were interviewed.
- **Case-control study**- This is an observational study to evaluate the relationship between an exposure (e.g. eating contaminated food; swimming in contaminated water; having direct contact with an sick person) and a particular outcome (e.g. illness). There are two categories of study participants: people who have the outcome of interest (cases) and people who do not have the outcome of interest (controls). Select this method if both ill persons and well persons who may have had common exposures were interviewed, and this investigation method was completed.
- **Cohort study**- This is an epidemiological study that is used to assess outcomes (e.g. the development of gastrointestinal illness) in a group, or cohort, of people. Study participants are observed over time or counted to determine how many people experience the outcome of interest and when the outcome occurred. Members in a cohort are defined according to their exposure profile (e.g. an exposed group and an unexposed group). In outbreak investigations, a cohort is frequently defined by membership in an organization (e.g. a boy scout troupe attending a week-long camp). Select this method if this investigation method was completed.
- **Food preparation review** – A review of the location where food preparation was conducted (e.g. kitchen in restaurant).
- **Water system assessment: Drinking water** – A drinking water system was investigated.
- **Water system assessment: Nonpotable water** – A nonpotable water system was investigated (e.g. cooling tower, irrigation system).
- **Treated or untreated recreational water venue assessment** – A treated or untreated recreational water source was investigated (e.g. swimming pool, lake, etc).
- **Investigation at factory/production/treatment plant** – A factory, production, or treatment plant was investigated (e.g. poultry processing plant, water treatment facility, etc).
- **Investigation at original source (e.g., farm, water source, etc.)** – The original source of implicated food or water vehicle was investigated (e.g. the poultry farm, lake, well etc).
- **Food product or bottled water traceback** – Traceback of the implicated food, beverage or bottled water was conducted.
- **Environment/food/water sample testing** – Samples were taken from the environment, food, or water for testing.
- **Other** – The investigated method is not listed above (provide additional investigation methods in the comment section below).

Comments: This section is specific to the investigation methods that were used. Please enter any additional information relevant to the investigation methods that were checked above.

2.5 Dates (mm/dd/yyyy)

Figure 4. The Dates section.

| Dates (mm/dd/yyyy) | |
|---|--|
| Date first case became ill (<i>required</i>) ____/____/____ | Date last case became ill ____/____/____ |
| Date of initial exposure ____/____/____ | Date of last exposure ____/____/____ |
| Date of report to CDC (other than this form) ____/____/____ | |
| Date of notification to State/Territory or Local/Tribal Health Authorities ____/____/____ | |

The following dates refer only to primary cases that resulted from the mode of transmission (water) selected above:

Date first case became ill (required field) – Indicate the date the first case became ill

Date last case became ill – Indicate the date the last case became ill

Date first known exposure – Indicate the date when the first known exposure took place among cases.

Date last known exposure – Indicate the date the last known exposure took place among cases.

Date of report to CDC (other than this form) – Enter the date of initial contact with CDC, if CDC was contacted prior completion of outbreak report (via telephone, e-mail, fax, etc),

Date of notification to State/Territory or Local/Tribal Health Authorities – Enter the date that the State/Territory or Local/Tribal Health Authorities first learned about the outbreak.

2.6 Geographic Location

Figure 5. The Geographic Location section.

| Geographic Location |
|---|
| Reporting state: _____ <input type="checkbox"/> Exposure occurred in multiple states <input type="checkbox"/> Exposure occurred in a single state but cases resided in multiple states Other states: _____ |
| Reporting county: _____ <input type="checkbox"/> Exposure occurred in multiple counties in reporting state <input type="checkbox"/> Exposure occurred in a single county but cases resided in multiple counties in reporting state Other counties: _____ |
| City/Town/Place of exposure: _____ <i>Do not include proprietary or private facility names</i> |

The following section refers only to primary cases that resulted from the mode of transmission (water) selected above:

Reporting state (required field)– Enter the state that is reporting the outbreak.

- o **Exposure occurred in multiple states** – Check this box if the outbreak resulted from an exposure that occurred in multiple states, thereby meeting the definition of a multi-state outbreak.
- o **Exposure occurred in a single state, but cases resided in multiple states** – Check this box if exposure occurred in a single state, and ill persons were residents of multiple states. An example would be: residents from New York, Pennsylvania, and Florida (multiple states) attended an event in New York (single state) and became ill from an exposure at the convention.
 - o **Other states:** Enter any other states that were involved in the outbreak.

Reporting county – Enter the county that reported the outbreak.

- **Exposure occurred in multiple counties in reporting state** – Check this box if the outbreak was resulted from an exposure that occurred in multiple counties.
- **Exposure occurred in a single county, but cases resided in multiple counties** – Check this box if the exposure occurred in a single county, and ill persons were residents of multiple counties. An example would be: residents from Fulton, Clayton and Brevard (multiple counties in Georgia) attended an event in Fulton (single county) and became ill from an exposure at the event.
 - **Other counties:** Enter any other counties that may have been involved in the outbreak.

City/Town/Place of exposure – Enter the city, town, or place where the water exposure occurred. DO NOT include proprietary or private facility names.

2.7 Primary Cases

Figure 6. The Primary Cases section.

| Primary Cases | | | | | | |
|---|---------|--|--|---|-------------|---|
| Number of Primary Cases | | Sex (estimated percent of the primary cases) | | | | |
| # Lab-confirmed cases | (A) | Male | | % | | |
| # Probable cases | (B) | Female | | % | | |
| # Estimated total primary ill (if greater than sum A+B) | | | | | | |
| | # Cases | Total # of cases for whom info is available | Approximate percent of primary cases in each age group | | | |
| # Died | | | <1 year | % | 20–49 years | % |
| # Hospitalized | | | 1–4 years | % | 50–74 years | % |
| # Visited Emergency Room | | | 5–9 years | % | ≥ 75 years | % |
| # Visited health care provider (excluding ER visits) | | | 10–19 years | % | Unknown | % |

Only include data for **primary cases** in this section. For outbreaks where multiple modes of transmission are suspected but cannot be separated from one another, classify all cases as primary cases; however, list suspected secondary transmission modes in Secondary Cases. Detail the number of cases by secondary transmission modes under ‘Secondary Cases’ (page 2 of form) if the number of individuals who became ill via a secondary route of transmission can be defined (e.g. person-to-person transmission among household contacts of a case in a foodborne or waterborne disease outbreak).

Number of Primary Cases - laboratory and probable cases

- **# Lab-confirmed cases (A)** – Lab-confirmed primary cases are defined as cases in which a specimen was collected, and a laboratory was able to identify the pathogen(s) or agent(s) responsible for the outbreak.
- **# Probable cases (B)** – Probable primary cases are defined as cases that are suspected of being associated with the implicated pathogen(s) or agent(s) but do not have laboratory confirmation (e.g. a specimen was not collected or submitted to a laboratory)
- **# Estimated total primary ill** – Enter all lab-confirmed and probable cases if estimated total primary ill was greater than the sum of the lab-confirmed and probable cases (e.g. estimated total > A+B)

Number of Primary Cases - # Cases and Total # of primary cases for whom information is available

Cases:

- o **# Died** – Number of deaths that resulted from the outbreak
- o **# Hospitalized** – Number of cases that were hospitalized as a result of the outbreak
- o **# Visited ER** – Number of cases that visited the Emergency Room or Emergency Department as a result of the outbreak
- o **# Visited Health care provider (excluding ER visits)** – Number of cases that visited a healthcare provider as a result of the outbreak

Total # of primary cases for whom information is available:

- o **# Died** – Total number of primary cases for whom information is available regarding death.
- o **# Hospitalized** – Total number of primary cases for whom information is available regarding hospitalization
- o **# Visited ER** – Total number of primary cases for whom information is available regarding emergency room visits
- o **# Visited Health care provider (excluding ER visits)** – Total number of primary cases for whom information is available regarding healthcare provider visits.

Sex – Enter the estimated percent distribution for males and females using the total number of primary cases for whom information is available. Enter the exact percent distribution, if known. If you do not have the percentages but you do have the counts for male and female, you may enter the counts instead; however, note on the form that the numbers are not percentages so that the data will be entered correctly into NORS.

Approximate Percentage of Cases in Each Age Group – Enter the approximate percent distribution in the provided categories using the total number of primary cases for whom information is available. Enter the exact percent distribution, if known. If you do not have the percentages but you do have the counts for each of the age categories, you may enter the counts instead; however, note on the form that the numbers are not percentages so that the data will be entered correctly into NORS.

2.8 Incubation Period

Figure 7. The Incubation Period and Duration of Illness sections.

| General | | | | | |
|--|--|------------------|--|--|------------------|
| Incubation Period, Duration of Illness, Signs or Symptoms for Primary Cases only | | | | | |
| Incubation Period (circle appropriate units) | | | Duration of Illness (among recovered cases-circle appropriate units) | | |
| Shortest | | Min, Hours, Days | Shortest | | Min, Hours, Days |
| Median | | Min, Hours, Days | Median | | Min, Hours, Days |
| Longest | | Min, Hours, Days | Longest | | Min, Hours, Days |
| Total # of cases for whom info is available | | | Total # of cases for whom info is available | | |
| <input type="checkbox"/> Unknown incubation period | | | <input type="checkbox"/> Unknown duration of illness | | |

Complete the table for incubation period in primary cases:

The incubation period is the time between the implicated exposure and the clinical onset of illness for primary cases. For example, if cases ingested contaminated water on April 30th and episodes of diarrhea started March 4th, the incubation period would be 5 days.

Enter the shortest, median, and longest incubation period, and the total number of primary cases for whom information is available. If sufficient data are not available to calculate a particular range, leave that range blank. In addition, select the appropriate units (minutes, hours, or days).

Check the “Unknown incubation period” box if there are no data regarding the incubation period.

2.9 Duration of Illness

Complete the table for duration of illness among the primary cases who have recovered:

The duration of illness is the time between the onset of the first symptom to the end of final gastrointestinal symptoms. For example, a case had episodes of diarrhea that started on March 4th and vomiting that started on March 5th. The diarrhea ended on March 6th, but vomiting continued until March 7th, so the duration of illness would be 4 days.

Enter the shortest, longest and median duration of illness, and the total number of primary cases for whom information is available among those who have recovered. If sufficient data are not available to calculate a particular range, leave that range blank. In addition, select the appropriate units (minutes, hours, or days).

Check the “Unknown duration of illness” box if there are no data regarding the duration of illness.

2.10 Signs or Symptoms

Figure 8. The Signs or Symptoms section.

| Signs or Symptoms <i>(*refer to terms from appendix, if appropriate, to describe other common characteristics of cases)</i> | | |
|---|--------------------------------|---------------------------------------|
| Feature | # Cases with signs or symptoms | Total # cases for whom info available |
| Vomiting | | |
| Diarrhea | | |
| Bloody stools | | |
| Fever | | |
| Abdominal cramps | | |
| HUS | | |
| Asymptomatic | | |
| * | | |
| * | | |
| * | | |

Complete the table for signs or symptoms in primary cases:

A few common symptoms have been listed in the field titled Feature. Refer to **Appendix B** for a standardized list containing additional signs and symptoms. A new symptom may be added if it is not already in the list. For each sign or symptom, enter the number of cases (numerator) for whom specific symptom information is known in the field titled # Cases with signs or symptoms. Enter the total number of cases who provided information about a particular sign or symptom in the field titled Total # of cases for whom info available.

2.11 Secondary Cases

Figure 9. The Secondary Cases section.

| Secondary Cases | | |
|---|--|-----|
| Mode of Secondary Transmission <i>(check one)</i> | Number of Secondary Cases | |
| <input type="checkbox"/> Food <input type="checkbox"/> Water <input type="checkbox"/> Animal contact <input type="checkbox"/> Person-to-person <input type="checkbox"/> Environmental contamination other than food/water <input type="checkbox"/> Indeterminate/Other/Unknown | # Lab-confirmed secondary cases | (A) |
| | # Probable secondary cases | (B) |
| | Total # of secondary cases (if greater than sum A+B) | |
| | Total # of cases (Primary + Secondary) | |

A secondary case is one in which the person was not directly exposed to the source (e.g., water) that was implicated an outbreak, but had another exposure that led to illness (most commonly person-to-person contact with a primary case). Cases that became ill via a clearly defined secondary mode of transmission should be detailed in Secondary Cases. For outbreaks where multiple modes of transmission are suspected but cannot be separated from one another, classify all cases as primary cases; however, list suspected secondary transmission modes in Secondary Cases.

Secondary Mode of Transmission (Please select only one): This field refers only to secondary mode of transmission (if more than one mode of transmission, the secondary mode of transmission would yield the second cluster of illness in the outbreak). For definitions of each type of mode of transmission, refer to the definitions provided on page 6 for primary mode of transmission.

Number of Secondary Cases: Only include secondary cases; Information on the primary cases should be completed in the Primary Cases fields.

Complete the table about laboratory and probable cases by filling in the following:

- **# Lab-confirmed secondary cases (A)** – Lab-confirmed secondary cases are defined as cases in which a specimen was collected, and a laboratory was able to identify pathogen(s).
- **# Probable secondary cases (B)** – Probable secondary cases are defined as cases that are suspected of being associated with the implicated pathogen(s) but do not have laboratory confirmation (e.g. a specimen was not collected or submitted to a laboratory)
- **Total # of secondary cases** – Enter all lab-confirmed and probable cases if estimated total secondary ill was greater than the sum of the lab-confirmed and probable cases (e.g. estimated total > A+B)
- **Total # of cases (Primary + Secondary)** – Add the estimated total of primary cases to the total # of secondary cases and enter the sum of the two numbers in the space provided.

2.12 Environmental Health Specialists Network

Figure 10. The Environmental Health Specialists Network (EHS-Net) section.

| Environmental Health Specialists Network <i>(if applicable)</i> | | |
|---|-----------|-----------|
| EHS-Net Evaluation ID: 1.) _____ | 2.) _____ | 3.) _____ |

This section is used to link outbreak investigation reports with additional data from environmental investigations. If an ID number has been assigned to data collected by the Environmental Health Specialists Network (EHS-Net), enter it in the field for the EHS-Net Evaluation ID. There are extra spaces where additional EHS-Net ID numbers may be entered, if needed. For waterborne disease outbreaks, the EHS-Net Evaluation ID field will only be applicable to states that are participating in the EHS-Net Water program (additional states participate in the foodborne disease program, EHS-Net Food).

2.13 Traceback (of food and bottled water only, not public water)

Figure 11. The Traceback section.

| Traceback <i>(for food and bottled water only, not public water)</i> | | | | |
|--|---|--------------------|---------|----------|
| <input type="checkbox"/> Please check if traceback conducted | | | | |
| Source name <i>(if publicly available)</i> | Source type <i>(e.g. poultry farm, tomato processing plant, bottled water factory)</i> | Location of source | | Comments |
| | | State | Country | |
| | | | | |
| | | | | |
| | | | | |

A traceback is conducted by local, state and/or federal authorities to find out where the food or bottled water came from, as far back to its origin or source as possible. Check the box if a traceback was attempted for bottled water, regardless of its success, and complete the following:

- **Source Name (if publicly available)** Enter the source from which the bottled water came. For example, this would be a particular spring or lake.
- **Source Type** Enter the facility from which the bottled water came. For example, this would be a source such as a bottled water factory.
- **Location- State** Enter the state from which the contaminated bottled water came. If the water did not originate in the United States, enter the area, province, or region.
- **Location- Country** Enter the country from which the contaminated water came.

Comments Enter the agency that conducted the traceback and any additional comment(s) pertaining to the information found in the traceback.

2.14 Recall

Figure 12. The Recall section.

| Recall |
|---|
| <input type="checkbox"/> Please check if any food or bottled water product was recalled |
| Type of item recalled: |
| Comments: |

Please check the box if any food or bottled water involved in the outbreak was recalled. Information about the recall may be included in the fields for the **Type of item** recalled (e.g. sparkling water) and **Comments** (e.g. example brand, lot numbers for the recalled item).

2.15 Reporting Agency

Figure 13. The Reporting Agency section.

| Reporting Agency | |
|---------------------|----------------------|
| Agency name: _____ | E-mail: _____ |
| Contact name: _____ | Contact title: _____ |
| Phone no.: _____ | Fax no.: _____ |

Enter your agency name, contact name, phone number, e-mail address, contact title and fax number.

2.16 Remarks

Figure 14. The Remarks section.

| Remarks |
|--|
| <i>Briefly describe important aspects of the outbreak not covered above. Please indicate if any adverse outcomes occurred in special populations (e.g., pregnant women, immunocompromised persons)</i> |
| |
| |
| |

Briefly describe important aspects of the outbreak not covered above. Please indicate if any adverse outcomes occurred in special populations (e.g., pregnant women, immunocompromised persons)

2.17 Attachments

Please attach any pertinent documents, such as agency reports on the outbreak, MMWR articles and/or journal publications to the outbreak report form. The information in these documents can be particularly helpful to outbreak coordinators who were not involved in the outbreak. Updated or additional documents may also be sent at a later date.

3 WATER- GENERAL

3.1 Type of Water Exposure

Figure 15. The Type of Water Exposure section.

| Water-General | | | |
|--|---|--|---|
| Waterborne Disease and Outbreaks - General | | | |
| Type of Water Exposure (check ONE box) | | | |
| <input type="checkbox"/> Water intended for recreational purposes – treated venue (e.g., pool, spa/whirlpool/hot tub, spray pad) | <input type="checkbox"/> Water intended for recreational purposes – untreated venue (e.g., freshwater lake, hot spring, marine beach) | <input type="checkbox"/> Water intended for drinking (includes water used for bathing/showering) | <input type="checkbox"/> Water not intended for drinking or water of unknown intent (e.g., cooling/industrial, occupational, decorative/ display) |

Check the box next to the type of water exposure that is believed to have led to the waterborne disease outbreak or illness. Note that recreational water is separated into treated and untreated water exposures. If an outbreak involved both treated and untreated recreational venues, select the type of water exposure that reflects the venue that had the most compelling epidemiological and environmental evidence linking it to the waterborne disease outbreak or illness. If it is unclear which type of recreational water exposure to select, choose the type that reflects the first exposure experienced by the first reported case. Additional information about the outbreak may be attached to the outbreak report and/or included in the remarks section on page 2 or in the remarks section at the end of the tab that is completed for type of water exposure.

- 1. Water intended for recreational purposes- treated venue-** Select this type of exposure if recreational water illnesses (RWIs) were associated with treated water. Examples include: cryptosporidiosis from a swimming pool; legionellosis from a whirlpool or hot tub; and giardiasis from a spray pad. Recreational water exposures in home environments, such as fill-and-drain kiddie pools, also fall into this category, as do illnesses stemming from chemical exposures (e.g. chloramines at an indoor pool, pH imbalances, releases of chlorine gas in the water).
- 2. Water intended for recreational purposes- untreated venue-** Select this type of exposure if RWIs were associated with untreated water in a natural setting. Examples include: cercarial dermatitis from a freshwater pond; cryptosporidiosis from a lake; or norovirus infection from a swimming beach. A chemical exposure, such as contact with an algaecide on a freshwater pond, would also be included in this category.
- 3. Water intended for drinking.** Select this type of exposure if the illness was associated with drinking water in a distribution system or bottled water. This includes showering and bathing exposures where the water source is part of a drinking water distribution system. For example, some non-recreational legionellosis outbreaks fall into this category. This type of exposure does not include water that was not intended for ingestion (e.g. water from a stream by a hiking trail) regardless of whether or not the water was treated by an individual prior to being consumed.
- 4. Water not intended for drinking or water of unknown intent-** Select this type of exposure if the illness was associated with water that was not intended for drinking (excluding recreational water) or if the type of water exposure cannot be categorized as drinking or recreational water. This type of water includes—but is not limited to—water used in cooling towers, industrial processes, agricultural processes, occupational settings, and decorative or display settings (e.g. decorative fountains).

3.4 Symptoms

Figure 18. The Symptoms section.

| Symptoms | |
|---|-------|
| For each category, indicate # of persons with: | |
| Gastrointestinal symptoms/ conditions | _____ |
| Respiratory symptoms/ conditions | _____ |
| Skin symptoms/conditions | _____ |
| Ear symptoms/conditions | _____ |
| Eye symptoms/conditions | _____ |
| Neurologic symptoms/ conditions | _____ |
| Wound infections | _____ |
| Other, specify (e.g., hepatitis A, leptospirosis): | _____ |
| _____ | _____ |

This section complements the symptoms list in the General section by combining symptoms into categories that can be used to describe the outbreak according to illness type. For example, nausea and vomiting would be categorized as gastrointestinal symptoms/conditions. Please enter the number of people with each symptom/condition. Use the 'Other' category and write in the symptom/condition if the common or predominant symptoms for the illness are poorly described using the existing categories.

3.5 Route of Entry

Figure 19. The Route of Entry section.

Route of Entry

Ingestion

Contact

Inhalation

Other, specify:

Unknown

Select the route(s) of entry associated with this outbreak. Route of entry refers to the water exposure that resulted in illness. Responses should reflect known routes of entry, rather than suspected routes of entry.

Ingestion- Intentional and/or accidental ingestion of water.

Contact- Physical contact with water that does not involve ingestion or inhalation.

Inhalation- This may include inhalation of mist, steam, or larger water droplets.

Other- Add a known route of entry if it is not already listed.

Unknown- Use this category if the route of entry is only suspected or cannot be determined. If an unlisted route of entry is only suspected, please select 'Unknown' and include a comment about the suspected route of entry in the Remarks section at the end of the outbreak report.

3.6 Epidemiologic Data

Figure 20. The Epidemiologic Data section.

| Epidemiologic Data | | | | | | | | | | |
|---|---------------------------|-------------------------|------------------------|----------------------|---|---------------|------------------|---|----------------------------|--|
| 1. Estimated total number of persons with primary exposure: _____ | | | | | | | | | | |
| 2. Were data collected from comparison groups to estimate risk? <input type="checkbox"/> Yes (specify in table below) <input type="checkbox"/> No <input type="checkbox"/> Unknown | | | | | | | | | | |
| If No or Unknown , was water the only common source shared by persons who were ill? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown | | | | | | | | | | |
| Exposure (Vehicle/Setting) <i>(e.g., pool—waterpark; hot spring; well water)</i> | Total # Exposed (A) | # Ill Exposed (B) | Total # Not Exposed | # Ill Not Exposed | Attack Rate (%) (B/A) | Odds Ratio | Relative Risk | p-Value <i>(provide exact value, if known)</i> | 95% Confidence Interval | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Attack rate for residents of reporting state: _____ % | | | | | Attack rate for non-residents of reporting state: _____ % | | | | | |

Estimated total number of persons with primary exposure- Enter the estimated number of people with the primary exposure, regardless of whether they became ill or not. Note: The actual total number of persons with primary exposure is preferred if the information is available.

Were data collected from comparison groups to estimate risk?- Check ‘yes’ if an epidemiologic study (e.g. case-control, cohort) was conducted to calculate an odds ratio or relative risk for one or more exposures.

- **If No or Unknown, was water the only common source shared by persons who were ill? -** Check ‘yes’ if an investigation indicated that there were no other common exposures (e.g. food) that could account for the illnesses. If it is suspected that water is the only common source but there is no supporting evidence, check unknown.

Epidemiologic Data Table

Enter findings from epidemiological investigations into this table. Each of the following bullets represents a column in which you can enter data. **Attack Rate** will be automatically calculated in NORS using the numbers entered for ‘Total # Exposed’ and ‘# Ill Exposed.’ Additional findings (e.g. a local or state outbreak investigation report) may also be attached to the CDC 52.12 form.

- **Exposure (Vehicle/Setting)**- This field is used to describe the type of exposure, vehicle or variable that was evaluated by the epidemiological study. Examples include: Cooling Tower, Drinking Water Dispenser, and specific pool environments, such as 'Pool- Water Slide.' Refer to **Appendix D** for a list of common exposures. If the appropriate exposure, vehicle or variable is not on the list, please write it in the Exposure field.
- **Total # Exposed (A)**- This is the total number of people in the study who were exposed.
- **# Ill Exposed (B)**- This is the number of people who were exposed and became ill, according to the case definition for the study.
- **Total # Not Exposed**- This is the total number of people in the study who were not exposed.
- **# Ill Not Exposed**- This is the total number of people in the study who were not exposed but became ill, according to the case definition for the study.
- **Attack Rate (%) (B/A)**- The attack rate is the proportion of exposed persons who became ill out of the total number of people exposed. If numbers are entered into 'Total # Exposed' and '# Ill Exposed,' the attack rate will be calculated automatically by the electronic system when the data are entered into NORS.
- **Odds Ratio**- The odds ratio (OR) is commonly reported for a case-control study. This value describes the odds of exposure in cases relative to the odds of exposure in controls.
- **Relative Risk**- The relative risk (RR) is a measure that is more commonly reported for cohort studies. This measure describes the risk of disease in exposed persons relative to the risk of disease in unexposed persons.
- **p-Value**- Please enter the exact p-Value that was calculated (entries such as '<0.001' cannot be entered into the electronic system). The p-Value can be used to evaluate the statistical significance of ORs and RRs.
 - The p-Value is the probability of observing a result as extreme or more extreme than the one observed, under the assumption that the null hypothesis (determined by the investigator) is true.
 - In a more general sense, the p-Value is the probability that the observed differences in a particular comparison, such as exposure to a suspected spa among ill people versus exposure to the same spa among healthy people, could have happened by chance alone, assuming that the group of people that became ill and the group of people that remained healthy were the same in all other ways.
 - CDC uses a p-Value of 0.05 to evaluate the statistical significance of waterborne disease outbreak analyses. For example, CDC would consider the epidemiological evidence for waterborne illness to be strong if the odds of developing *Pseudomonas*-related folliculitis were higher in people who used a spa at a recreational facility compared to the odds in people who attended the same facility but did not use the spa, and the p-Value was less than 0.05 (e.g. OR=1.8, p=0.008).
- **Confidence Interval**- A confidence interval (CI) can be used to provide a range for the true value of an OR or an RR and a level of confidence that the true value will be within that range. For example, when the upper and lower limits of a 95% CI are calculated for an OR, it is then possible for the investigator to state that he/she is 95% confident that the true OR will fall between those two numbers. A CI may also be used to evaluate the statistical significance in place of a p-Value—for example, if a 95% CI for an OR or an RR does not contain the number one, the ratio measure is considered significant at p=0.05.

Attack rate for residents of reporting state- The attack rate is the proportion of exposed residents of the reporting state who became ill out of the total number of state residents exposed. Enter the attack rate that reflects the exposure most strongly associated with the outbreak.

Attack rate for non-residents – The attack rate is the proportion of exposed non-residents from other states who became ill out of the total number of non-residents exposed. If information is available about non-residents, enter the attack rate that reflects the exposure most strongly associated with the outbreak. The exposure used for the resident and non-resident attack rate fields should be the same.

3.7 Clinical Specimens- Laboratory Results

Figure 21. The beginning of the Clinical Specimens Laboratory Results section.

Clinical Specimens - Laboratory Results *(refer to the laboratory findings from the outbreak investigation)*

1. Were clinical diagnostic specimens taken from persons? Yes No *(go to next tab)* Unknown *(go to next tab)*

If **Yes**, from how many persons were specimens taken? _____

Data in this section help to describe the etiology of the outbreak. If clinical diagnostic specimens (e.g. stool samples, blood samples, urine samples) were collected during the outbreak, please answer yes to question one and enter the number of persons who provided samples. (note--the number of specimens collected for testing may be greater than the number of persons who submitted samples).

Some outbreaks might have multiple etiologies. CDC considers a pathogen to be responsible for an outbreak if $\geq 5\%$ of all the positive clinical specimens test positive for the pathogen.

Specimen Description Table

Figure 22. The Clinical Specimens Description section.

| Water-General | | |
|----------------|--------------------|---|
| Specimen Type* | Specimen Subtype** | Tested for § <i>(list all that apply)</i> |
| | | |
| | | |
| | | |
| | | |

* Specimen Type: 1- Autopsy Specimen (specify subtype), 2-Biopsy (specify), 3-Blood, 4-Bronchial Alveolar Lavage (BAL), 5-Cerebrospinal Fluid (CSF), 6-Conjunctiva/Eye Swab, 7-Ear Swab, 8-Endotracheal Aspirate, 9-Saliva, 10-Serum, 11-Skin Swab, 12-Sputum, 13-Stool, 14-Urine, 15-Vomitus, 16-Wound Swab, 17-Unknown

** Specimen Subtype: 1-Bladder, 2-Brain, 3-Dura, 4-Hair, 5-Intestine, 6-Kidney, 7-Liver, 8-Lung, 9-Nails, 10-Skin, 11-Stomach, 12-Wound, 13-Other, 14-Unknown

§ Tested for: 1-Bacteria, 2-Chemicals/Toxins, 3-Fungi, 4-Parasites, 5-Viruses

Enter information about the specimens that were collected and tested. If a specimen type was tested for multiple categories of disease agents (e.g. parasites and bacteria), enter a row for each category of disease agent.

- **Specimen Type-** The specimen type (e.g. blood, stool) will typically be identified on the laboratory report. There is an option for 'unknown' if no information is available about the specimen type. Specimen types are listed on the form below the Specimen Description Table.
- **Specimen Subtype-** If an autopsy specimen or a biopsy specimen was tested, enter a subtype for the specimen. Specimen subtypes are listed on the form below the Specimen Description Table. There is an option for 'unknown' if you have no information about the specimen subtype.
- **Tested for-** This field describes, in a general sense, what the specimens were being tested for. These pathogens and agent categories are listed on the form below the Specimen Description Table.

Etiology Table

Figure 23. The Clinical Specimens Etiology section.

Enter positive findings in the table below. If tests for a specific pathogen/agent were negative, please also list that pathogen/agent and fill in the Specimen Type, Specimen Subtype, Test Type, Total # of People Tested and Total # of People Positive.

| Clinical Specimen Row Number | Genus/ Chemical/ Toxin | Species | Serotype/ Serogroup/ Serovar | Genotype/ Subtype | |
|------------------------------|------------------------------|------------------------|------------------------------|-------------------|---------------------|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| Clinical Specimen Row Number | Confirmed as Etiology ? | Concentration (number) | Unit (e.g., oocysts, CFU) | Specimen Type * | Specimen Subtype ** |
| 1 | <input type="checkbox"/> yes | | | | |
| 2 | <input type="checkbox"/> yes | | | | |
| 3 | <input type="checkbox"/> yes | | | | |
| 4 | <input type="checkbox"/> yes | | | | |
| 5 | <input type="checkbox"/> yes | | | | |
| Clinical Specimen Row Number | Test Type § | Total # People Tested | Total # People Positive | | |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |

* Specimen Type: 1- Autopsy Specimen (specify subtype), 2-Biopsy (specify), 3-Blood, 4-Bronchial Alveolar Lavage (BAL), 5-Cerebrospinal Fluid (CSF), 6-Conjunctiva/Eye Swab, 7-Ear Swab, 8-Endotracheal Aspirate, 9-Saliva, 10-Serum, 11-Skin Swab, 12-Sputum, 13-Stool, 14-Urine, 15-Vomit, 16-Wound Swab, 17-Unknown

** Specimen Subtype: 1-Bladder, 2-Brain, 3-Dura, 4-Hair, 5-Intestine, 6-Kidney, 7-Liver, 8-Lung, 9-Nails, 10-Skin, 11-Stomach, 12-Wound, 13-Other, 14-Unknown

§ Test Type: 1-Culture, 2-DNA or RNA Amplification/Detection (e.g., PCR, RT-PCR), 3-Microscopy (e.g., fluorescent, EM), 4-Serological/Immunological Test (e.g., EIA, ELISA), 5-Phage Typing, 6-Chemical Testing, 7-Tissue Culture Infectivity Assay

Refer to the laboratory report and final outbreak report for information about the etiology of the outbreak. Please report positive findings and negative findings (if a test for a specific pathogen returned null findings). Some of the information may be absent from the report, depending on the testing that was performed (e.g., although a species may have been identified, it may not have been genotyped). If tests were performed on a subset of specimens to determine the species or subtype of a particular microorganism, please report the results for the total set of specimens, as well as the subset (e.g., If 20/25 people tested for positive for *Cryptosporidium*, of whom 11 were *C. hominis*-positive and 9 were *C. parvum*-positive, enter one row of data for the 20/25 people who were *Cryptosporidium*-positive and separate rows for the 11/20 and 9/20 people who tested positive for *C. hominis* and *C. parvum*, respectively). This will provide important information about the number of people who were tested and the strength of the evidence at each level of testing.

- **Genus/Chemical/Toxin-** This field provides the broadest description of the pathogen or agent for which the clinical specimen tested negative or positive. Enter this information based on the laboratory report data. Refer to **Appendix E** for the reference list of microorganisms, chemicals and toxins.
- **Species-** This field is for known species of each genus of bacteria, parasite or virus. Refer to **Appendix E** for the reference list of microorganisms, chemicals and toxins. Note that there are 6 species categorizations for *Escherichia coli*: enteroaggregative, enterohemorrhagic, enterotoxigenic, enteropathogenic, enteroinvasive, and other. These categories provide information about the type and severity of the outbreak. The table below summarizes the main categories (adapted from http://www.cdc.gov/foodborneoutbreaks/guide_fd.htm).
 - Not all laboratories are able to perform the analyses necessary to categorize *E. coli*. Most commonly, state laboratories will only provide information about enterohemorrhagic *E. coli* (e.g. *E. coli* O157:H7) versus all other types of *E. coli*. Please note that CDC may be able to provide these states with additional laboratory diagnostic testing of *E. coli*.

Table 1. Descriptions of the species categorizations for *Escherichia coli*.

| <i>Escherichia coli</i> category | Incubation Period | Clinical Syndrome | Laboratory Confirmation |
|--|-----------------------------|---|--|
| Enteroaggregative (EAEC) | Variable | Diarrhea, mild abdominal pain and fever. Blood and fecal leukocytes not common. | Isolation of organism of same enteroaggregative serotype from stool of two or more ill persons. EAEC is defined by its pattern of adherence to HEp-2 cells in culture. |
| Enterohemorrhagic/Shiga-toxin-producing (<i>E. coli</i> O157:H7 and others) | 1-10 days; usually 3-4 days | Diarrhea (often bloody), abdominal cramps (often severe), little or no fever | Isolation of <i>E. coli</i> O157:H7 or other Shiga-like toxin-producing <i>E. coli</i> from clinical specimen from two or more ill persons |
| Enterotoxigenic (ETEC) | 6-48 hrs | Diarrhea, abdominal cramps, nausea; vomiting and fever less common | 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 |
| Enteropathogenic (EPEC) | Variable | Diarrhea, fever, abdominal cramps | Isolation of organism of same enteropathogenic serotype from stool of two or more ill persons |
| Enteroinvasive (EIEC) | Variable | Diarrhea (might be bloody), fever, abdominal cramps | Isolation of same enteroinvasive serotype from stool of two or more ill persons |
| Other | Other – may vary | Other – may vary | Other – may vary |

* Source: 9th Edition of the Manual of Clinical Microbiology, 2007, American Society for Microbiology, Washington, DC/editor in chief, PR Murray; editors EJ Baron, JH Jorgensen, ML Landry, and MA Pfaller.

- **Serotype/Serogroup/Serovar-** A serotype, serogroup or serovar refers to a subtype that is determined by conducting molecular testing on surface antigens of the microorganism (e.g. *Legionella pneumophila* s1). This approach to subtyping is more common for bacteria, fungi and viruses than parasites. This information may be available on the laboratory report. If testing is not available at the state laboratory, CDC may be able to provide laboratory testing assistance. Refer to **Appendix E** for the reference list of microorganisms, chemicals and toxins.
- **Genotype/Subtype-** The genotype/subtype refers to a subtype that is determined by conducting molecular testing to describe the genetic composition of the microorganism. These methods are primarily used for subtyping parasites such as *Cryptosporidium* spp. This information may be available on the laboratory report. If testing is not available at the state laboratory, CDC may be able to provide laboratory testing assistance.
- **Confirmed as etiology?-** A checkmark in this field indicates that the clinical specimens tested positive for the pathogen or chemical/toxin and that this is the etiology of the outbreak.
- **Concentration-** The concentration is a count of microorganisms or chemical particles. The units for the concentration are entered in the next field. For example, if 28 oocysts/L of *Cryptosporidium hominis* were measured, the concentration would be 28. There may not be a concentration if the results from multiple specimens are being reported together, however, for a single specimen or a case with a chemical exposure, a concentration should be available.
- **Unit-** The unit refers to the amount of the microorganism or chemical that was measured by the laboratory (e.g. oocysts/L; mg/L, parts per million [ppm], colony forming units [CFU], most probable number [MPN]). As with concentration, there may not be a unit if the results from multiple specimens are being reported together, however, for a single specimen or a case with a chemical exposure, a unit of measure should be available.
- **Specimen Type-** This will correspond to data in the **Specimen Type** column of the Specimen Description Table if data have been entered in that table.
- **Specimen Subtype** - This will correspond to data in the **Specimen Subtype** column of the Specimen Description Table if data have been entered in that table.
- **Test Type-** This field describes the method of testing used to identify the microorganism. If multiple methods were used, select the method that provided the most detailed information (e.g., if a microorganism was found using microscopy and then genotyped using polymerase chain reaction (PCR), select 'DNA or RNA Amplification/Detection (e.g. PCR, RT-PCR)').
- **Total # People Tested-** This field is used to indicate how many people were tested for the pathogen or agent. This information provides a denominator to determine the proportion of people who tested positive for each pathogen or agent.
- **Total # People Positive-** This field indicates the number of people who tested positive for a given pathogen or agent. This information may be used to calculate the proportion of people who tested positive overall and is used to calculate the proportion of positive people, by pathogen or agent, when multiple pathogens or agents have been implicated.

3.8 Isolates

Figure 24. The Isolates section.

| Isolates | | |
|----------------------|--|--|
| State Lab Isolate ID | Specimen Profile 1 (e.g., PFGE, MLVA, or genotype) | Specimen Profile 2 (e.g., PFGE, MLVA, or genotype) |
| | | |
| | | |
| | | |

This table captures additional information about the molecular patterns of pathogens found in biological specimens. If laboratory data or the final outbreak report provides data about a DNA pattern (aka a ‘fingerprint’) for a pathogen that was determined using pulse-field gel electrophoresis (PFGE) or a similar molecular testing method (e.g., MLVA), the lab isolate ID number and the pattern can be entered into this table. To learn more about current uses of PFGE patterns in outbreak investigations, refer to the web site for PulseNet (<http://www.cdc.gov/pulsenet>). PulseNet is a foodborne disease surveillance program that includes a searchable database of PFGE patterns. The development of similar processes for parasites will improve waterborne disease surveillance by supporting efforts to identify parasitic outbreaks that are not clustered in one geographic area (e.g. matching patterns would provide evidence of a waterborne disease outbreak that might otherwise be missed if several cases of cryptosporidiosis lived in different states but visited the same water park)

- **State Lab Isolate ID-** This is the isolate identification number assigned by the state laboratory. This is a unique identifier for the isolate.
- **Specimen Profile 1-** This field is for the entry of a molecular subtyping result, such as a combination of letters and numbers that represents a unique subtype (e.g. PFGE pattern)
- **Specimen Profile 2-** This field is for the entry of the molecular subtyping method used (e.g. PFGE, MLVA).

4 REC WATER-TREATED

4.1 Recreational Water Vehicle Description

Figure 25. The Recreational Water Vehicle Description section for treated water venues.

| Rec Water-Treated | | | |
|---|--|---|--|
| Recreational Water – Treated Venue | | | |
| Recreational Water Vehicle Description | | | |
| Water Vehicle Number <i>(e.g., 1, 2, 3)</i> | Water Type <i>(e.g., spa/whirlpool/hot tub; pool- swimming pool; pool- waterpark)</i> | Water Subtype <i>(select indoor, outdoor, or unknown)</i> | Setting of Exposure <i>(e.g., club, requiring membership; hotel/motel/lodge/inn; waterpark)</i> |
| | | | |
| | | | |
| | | | |
| Water Vehicle Number <i>(e.g., 1, 2, 3)</i> | USUAL Water Treatment Provided at Venue <i>(e.g., no treatment; coagulation; disinfection; flocculation; filtration (pool); unknown)</i> | Venue Treatment Subtype <i>(disinfection or pool filtration: e.g., UV; chlorine dioxide; bag filter; cartridge filter; unknown)</i> | Chlorination Subtype <i>(chlorine disinfection only- e.g., gaseous; sodium hypochlorite; cyanurates /stabilized chlorine)</i> |
| | | | |
| | | | |
| | | | |
| Water Vehicle Number <i>(e.g., 1, 2, 3)</i> | Fill Water Type <i>(e.g., public water supply; sea water; untreated ground or surface water; unknown)</i> | IF PUBLIC WATER WAS USED TO FILL, USUAL Water Treatment Provided for Fill Water Before Coming to the Venue <i>(e.g., no treatment; disinfection; filtration (treatment plant); unknown)</i> | IF PUBLIC WATER WAS USED TO FILL, Fill Water Treatment Subtype <i>(disinfection or pool filtration: e.g., UV; chlorine dioxide; bag filter; cartridge filter; unknown)</i> |
| | | | |
| | | | |
| | | | |

Recreational Water Vehicle Tables

These three related tables allow you to describe one or more treated water venues that were associated with the outbreak. Refer to **Appendix G** for standard lists of values for the following fields.

Table 1

- **Water Vehicle Number-** This field is provided in each table so that rows can be related to each other more easily. Multiple rows in tables two and three can be linked to a single row in table one by writing in the Water Vehicle Number for the appropriate row in table one.
- **Water Type-** Water Type refers to types of treated recreational water venues, such as a spa or pool. Note that some settings are combined, such as spa/whirlpool/hot tub. Also note that some water types have been divided into multiple categories with standardized names (e.g., pool--swimming pool, pool--waterpark). The water type is further detailed in the water subtype and setting of exposure columns.
- **Water Subtype-** this field will allow you to indicate if the water environment was indoors, outdoors or unknown.
- **Setting of Exposure-** This field allows you to report descriptors that explain where the exposure to water occurred. For example, this field allows you to differentiate between a swimming pool at a camp and a swimming pool at a hotel. Note that some settings are combined, such as hotel/motel/lodge/inn.

Table 2

- **Water Vehicle Number-** Refer to Table 1.
- **USUAL Water Treatment Provided at Venue-**This field allows you to enter information about the usual water treatments provided at the venue, regardless of whether or not these treatments were operating correctly at or just prior to the time of the outbreak.
- **Venue Treatment Subtype-** This field provides subtypes for disinfection and filtration treatments frequently used in treated recreational water venues.
- **Chlorination Subtype-** This field provides subtypes specifically for chlorination disinfection methods.

Table 3

- **Water Vehicle Number-** Refer to Table 1.
- **Fill Water Type-** This field includes types of fill water frequently used in treated recreational water venues (e.g., the type of water used to fill up a swimming pool).
- **IF PUBLIC WATER WAS USED TO FILL, USUAL Water Treatment Provided for Fill Water Before Coming to the Venue-** If public water was selected as the fill water type, complete this field to give more information about water treatment provided before the water reached the venue (e.g. treatment prior to the water meter or property line). Enter information about the usual water treatments, regardless of whether or not these treatments were operating correctly at or just prior to the time of the outbreak.
- **IF PUBLIC WATER WAS USED TO FILL, Fill Water Treatment Subtype-** If public water was selected as the fill water type and either disinfection or filtration was selected as the usual water treatment type, complete this field to give more information about the disinfection or filtration method used to treat the water before it arrived at the venue (e.g. subtype for disinfection or filtration treatment prior to the water meter or property line).

4.2 Recreational Water Quality

Figure 26. The Recreational Water Quality section for treated water venues.

| Recreational Water Quality | |
|---|---|
| Did the venue meet state or local recreational water quality regulations? | <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/> Not applicable |
| If No, explain: _____ | |
| Was there a pool operator on the payroll with state-approved training or certification? | <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown |

Did the venue meet state or local recreational water quality regulations?- Respond using to the water quality regulations for the state or local jurisdiction (e.g., county) where the water exposure that was associated with the outbreak occurred. If the outbreak involved residents of multiple states, the state with the implicated venue(s) should answer ‘yes’, ‘no’, ‘unknown’ or ‘not applicable’, and the other states should answer ‘not applicable’.

- Answer ‘yes’ if the outbreak involved one or more venues (e.g. a commercial water park and a community swimming pool) in one or more jurisdictions and the response would be ‘yes’ for all of the venues according to the regulations for the state where the exposure occurred.
- Answer ‘no’ if the outbreak involved one or more venues (e.g. a commercial water park and a community swimming pool) in one or more jurisdictions and the response would be ‘no’ for even one of the venues according to the regulations for the state where the exposure occurred. Provide an explanation in the text box if ‘no’ is selected.
- Answer ‘unknown’ if the response would be ‘unknown’ for one or more venues where the exposure occurred.
- Answer ‘not applicable’ if none of the exposures occurred at venues in the reporting state or if state or local recreational water quality regulations were not applicable to the venue.

Was there a pool operator on the pay roll with state-approved training or certification?- If the outbreak involved residents of multiple states, the state with the implicated venue(s) should answer 'yes', 'no', or 'unknown', and the other states should answer 'unknown'.

- Answer 'yes' if the outbreak involved one or more venues (e.g. a commercial water park and a community swimming pool) in one or more jurisdictions and the response would be 'yes' for all of the venues with reference to the training or certification standards for the state where the exposure occurred.
- Answer 'no' if the outbreak involved one or more venues (e.g. a commercial water park and a community swimming pool) in one or more jurisdictions and the response would be 'no' for even one of the venues with reference to the training or certification standards for the state where the exposure occurred.
- Answer 'unknown' if you are responding about one or more venues in another state or if the outbreak involved one or more venues in one or more jurisdictions and the response would be 'unknown' for even one of the venues.

4.3 Laboratory Section - Recreational Water Samples from Treated Venues

Figure 27. The beginning of the Recreational Water Laboratory section and the Water Quality Results table.

| Laboratory Section - Recreational Water Samples from Treated Venues | | | | | | |
|--|--------|--|---|---|---|---|
| Was water from treated recreational water venues tested? | | <input type="checkbox"/> Yes (specify in table below) <input type="checkbox"/> No <input type="checkbox"/> Unknown | | | | |
| Results | | 1 | 2 | 3 | 4 | 5 |
| Sample | | | | | | |
| Source of Sample <i>(e.g., swimming pool, hot tub)</i> | | | | | | |
| Additional Description of Source of Sample <i>(e.g., specific location, time of day, backwash sample, etc.)</i> | | | | | | |
| Date <i>(mm/dd/yyyy)</i> | | | | | | |
| Volume Tested | Number | | | | | |
| | Unit | | | | | |
| Temperature | Number | | | | | |
| | Unit | | | | | |
| Residual/Free Disinfectant Level <i>(# total and combined disinfectant levels given, total - combined = free)</i> | Number | | | | | |
| | Unit | | | | | |
| Combined Disinfectant Level <i>(# total and free disinfectant levels given, total - free = combined)</i> | Number | | | | | |
| | Unit | | | | | |
| pH | | | | | | |

This section collects information about water samples that were collected from the recreational venue. These data provide evidence regarding water quality, as well as the presence of specific pathogens in the water associated with the outbreak.

Was water from treated recreational water venues tested? - Respond to this question to indicate whether or not water was tested.

Water Quality Results Table

- **Sample** - This number allows you to associate your water sample with results in the following Microbiology table.
- **Source of Sample**- Enter the source of the water sample.
- **Additional Description of Source of Sample**- Provide additional information that will help to explain the source of the sample. For example, one sample might be “pool- deep end” while another might be “pool-backwash”
- **Date**- This is the date that the sample was collected.
- **Volume Tested (Number, Unit)**- Complete this section if a specific amount of water was collected for testing.
- **Temperature (Number, Unit)**- Complete this section if a temperature was recorded for the water sample.
- **Residual/Free Disinfectant Level (Number, Unit)**- Complete this section if a residual or free disinfectant level was recorded for the water sample. This field refers to the level of disinfectant that has not reacted with other compounds in the water and is still available to effectively inactivate microorganisms in the water. If only the total disinfectant level and the combined disinfectant level are known:
(Residual or Free)=Total-Combined.
- **Combined Disinfectant Level (Number, Unit)**- Complete this section if a combined disinfectant level was recorded for the water sample. This field refers to the level of disinfectant that has combined with organic compounds in the water and is no longer available to work as an effective disinfectant (e.g. chloramines). If only the total disinfectant level and the residual/free disinfectant level are known:
Combined=Total-(Residual or Free).
- **pH**- Complete this field if a pH level was recorded for the water sample.

4.4 Microbiology or Chemical/Toxin Analysis

Figure 28. The Microbiology or Chemical/Toxin Analysis section for treated water venues.

| Rec Water-Treated | | | | | |
|--|------------------------------|------------------------|------------------------------|-------------------|---|
| Microbiology or Chemical/Toxin Analysis (refer to the laboratory findings from the outbreak investigation) | | | | | |
| Sample Number | Genus/ Chemical/ Toxin | Species | Serotype/ Serogroup/ Serovar | Genotype/ Subtype | PFGE Pattern |
| | | | | | |
| | | | | | |
| Sample Number | Test Results Positive? | Concentration (number) | Unit (e.g., oocysts, CFU) | Test Type* | Test Method (reference: National Environmental Methods Index: http://www.nemi.gov) |
| | <input type="checkbox"/> yes | | | | |
| | <input type="checkbox"/> yes | | | | |
| | <input type="checkbox"/> yes | | | | |

* Test Type: 1-Culture, 2-DNA or RNA Amplification/Detection (e.g., PCR, RT-PCR), 3-Microscopy (e.g., fluorescent, EM), 4-Serological/Immunological Test (e.g., EIA, ELISA), 5-Phage Typing, 6-Chemical Testing, 7-Tissue Culture Infectivity Assay

Microbiology or Chemical/Toxin Analysis Results Table

Refer to the laboratory report and final outbreak report for information. Please report positive findings and negative findings (if a test for a specific pathogen returned null findings). Some of the information may be absent from the report, depending on the testing that was performed (e.g., although a species may have been identified, it may not have been genotyped). If tests were performed to determine the species and/or subtype a particular microorganism from a water sample, please report the results for the total set of specimens, as well as the subset (e.g., If a sample tested positive for *Cryptosporidium* oocysts, enter the results, along with the concentration, if available. Then enter a separate row of data to report the species, if known.)

- **Sample Number-** Enter the sample number that corresponds to the appropriate sample from the Water Quality Results Table.
- **Genus/Chemical/Toxin-** This field provides the broadest description of the pathogen or agent for which the clinical specimen tested negative or positive. Enter this information based on the laboratory report data. Refer to the first column in **Appendix E**. If the appropriate genus, chemical or toxin is not on the list, please write it in the Genus/Chemical/Toxin field.
- **Species-** This field is for known species of each genus of bacteria, parasite or virus. Enter a new value if the species was identified but is missing from the pick list. Find the appropriate genus in **Appendix E** and refer to the second column for a list of known species. If the species is not on the list, please write it in the Species field. Note that there are 6 species categorizations for *Escherichia coli*: enteroaggregative, enterohemorrhagic, enterotoxigenic, enteropathogenic, enteroinvasive, and other. These categories provide information about the type and severity of the outbreak. The table below summarizes the main categories (adapted from http://www.cdc.gov/foodborneoutbreaks/guide_fd.htm).
 - Not all laboratories are able to perform the analyses necessary to categorize *E. coli*. Most commonly, state laboratories will only provide information about enterohemorrhagic *E. coli* (e.g. *E. coli* O157:H7) versus all other types of *E. coli*. Please note that CDC may be able to provide these states with additional laboratory diagnostic testing of *E. coli*.

Table 2. Descriptions of the species categorizations for *Escherichia coli*.

| <i>Escherichia coli</i> category | Laboratory Confirmation |
|--|---|
| Enteroaggregative (EAEC)[†] | Isolation of organism of enteroaggregative serotype from a water sample. EAEC is defined by its pattern of adherence to HEp-2 cells in culture. |
| Enterohemorrhagic/Shiga-toxin-producing (<i>E. coli</i> O157:H7 and others) | Isolation of <i>E. coli</i> O157:H7 or other Shiga-like toxin-producing <i>E. coli</i> from a water sample. |
| Enterotoxigenic (ETEC) | Isolation of organism of serotype, demonstrated to produce heat-stable (ST) and/or heat-labile (LT) enterotoxin, from a water sample. |
| Enteropathogenic (EPEC) | Isolation of organism of enteropathogenic serotype from a water sample |
| Enteroinvasive (EIEC) | Isolation of enteroinvasive serotype from a water sample. |
| Other | Other – may vary |

- **Serotype/Serogroup/Serovar-** A serotype, serogroup or serovar refers to a subtype that is determined by conducting molecular testing on surface antigens of the microorganism (e.g. *Legionella pneumophila* s1). This approach to subtyping is more common for bacteria, fungi and viruses than parasites. This information may be available on the laboratory report. If testing is not available at the state laboratory, CDC may be able to provide laboratory testing assistance. Matching serotypes/serogroups/serovars from water and biological samples provide stronger environmental evidence that the pathogens or agents responsible for the outbreak were transmitted through exposure to contaminated water. Refer to **Appendix E** for the reference list of microorganisms, chemicals and toxins.

[†] Source: 9th Edition of the Manual of Clinical Microbiology, 2007, American Society for Microbiology, Washington, DC/editor in chief, PR Murray; editors EJ Baron, JH Jorgensen, ML Landry, and MA Pfaller.

- **Genotype/Subtype-** The genotype/subtype refers to a subtype that is determined by conducting molecular testing to describe the genetic composition of the microorganism. These methods are primarily used for subtyping parasites such as *Cryptosporidium* spp. This information may be available on the laboratory report. If testing is not available at the state laboratory, CDC may be able to provide laboratory testing assistance. Matching genotypes/subtypes from water and biological samples provide stronger environmental evidence that the pathogens or agents responsible for the outbreak were transmitted through exposure to contaminated water.
- **PFGE Pattern-** The PFGE pattern, or fingerprint, can be used to differentiate genetically similar pathogens. Matching PFGE patterns from water and biological samples are strong environmental evidence that the pathogens or agents responsible for the outbreak were transmitted through exposure to contaminated water.
- **Test Results Positive?-** A checkmark in this field indicates that the water sample tested positive for the pathogen or chemical/toxin.
- **Concentration-** The concentration is a count of microorganisms or chemical particles. The units for the concentration are entered in the next field. For example, if 5 oocysts/L of *Cryptosporidium hominis* were measured, the concentration would be 5. There will typically be a concentration for initial test that have positive results, however, there may not always be a concentration for more complex tests that provide species or subtyping results.
- **Unit-** The unit refers to the amount of the microorganism or chemical that was measured by the laboratory (e.g. oocysts/L, mg/L, parts per million [ppm], colony forming units [CFU], most probable number [MPN]). As with concentration, there may not always be a unit to enter into this field.
- **Test Type-** This field describes the method of testing used to identify the microorganism. If multiple methods were used, select the method that provided the most detailed information (e.g., if a microorganism was found using microscopy and then genotyped using polymerase chain reaction (PCR), select 'DNA or RNA Amplification/Detection (e.g. PCR, RT-PCR)').
- **Test Method-** This field provides information about the water testing methods that were used on the sample. Many of the method numbers refer to standard testing procedures or approved EPA methods. Refer to the National Environmental Methods Index (NEMI) at <http://www.nemi.gov> to compare and contrast methods for either microbiological testing or chemical testing. Common method numbers for this field are listed in **Appendix F** and contain the following information: method source, official method number, and method summary description.

4.5 Factors Contributing to Recreational Water Contamination and/or Increased Exposure in Treated Venues

Figure 29. The Contributing Factors section for treated water venues.

| Factors Contributing to Recreational Water Contamination and/or Increased Exposure in Treated Venues | | |
|--|----------------------------|--------------------------|
| Factors (check all that apply)** | Documented/ Observed*** | Suspected*** |
| PEOPLE | | |
| Out of compliance with bather load/density requirements | <input type="checkbox"/> | <input type="checkbox"/> |
| Primary intended use of water is by diaper/toddler-aged children (e.g., kiddie pool) | <input type="checkbox"/> | <input type="checkbox"/> |
| Heavy use by child care center groups | <input type="checkbox"/> | <input type="checkbox"/> |
| Fecal/vomitus accident | <input type="checkbox"/> | <input type="checkbox"/> |
| Patrons continued to swim when ill or within 2 weeks of being ill | <input type="checkbox"/> | <input type="checkbox"/> |
| Operator error | <input type="checkbox"/> | <input type="checkbox"/> |
| Intentional contamination (explain in remarks) | <input type="checkbox"/> | <input type="checkbox"/> |
| FACILITY DESIGN | | |
| Combined pool filtration systems led to cross-contamination | <input type="checkbox"/> | <input type="checkbox"/> |
| Hygiene facilities inadequate or distant (e.g., no toilets, no diaper changing facilities) | <input type="checkbox"/> | <input type="checkbox"/> |
| Spray feature water demand higher than treatment system capacity so water returns to features and bypasses filtration/treatment system | <input type="checkbox"/> | <input type="checkbox"/> |
| No supplemental disinfection installed that would have inactivated pathogen (e.g., <i>Cryptosporidium</i>) | <input type="checkbox"/> | <input type="checkbox"/> |
| Water temperature $\leq 30^{\circ}\text{C}$ ($\leq 86^{\circ}\text{F}$) | <input type="checkbox"/> | <input type="checkbox"/> |
| Cross-connection with wastewater or non-potable water | <input type="checkbox"/> | <input type="checkbox"/> |
| Disinfectant control system malfunctioning, inadequate, or lacking (e.g., hand feed) | <input type="checkbox"/> | <input type="checkbox"/> |
| Incorrect settings on disinfectant control system | <input type="checkbox"/> | <input type="checkbox"/> |
| pH control system malfunctioning, inadequate, or lacking (e.g., hand feed) | <input type="checkbox"/> | <input type="checkbox"/> |
| Incorrect settings on pH control system | <input type="checkbox"/> | <input type="checkbox"/> |
| Filtration system malfunctioning or inadequate (e.g., low flow rate) | <input type="checkbox"/> | <input type="checkbox"/> |
| Supplemental disinfection system malfunctioning (e.g., ultraviolet light, ozone) | <input type="checkbox"/> | <input type="checkbox"/> |
| MAINTENANCE | | |
| Insufficient system checks so breakdown detection delayed | <input type="checkbox"/> | <input type="checkbox"/> |
| No preventive maintenance programs to reduce breakdowns | <input type="checkbox"/> | <input type="checkbox"/> |
| Remote monitoring system in use | <input type="checkbox"/> | <input type="checkbox"/> |
| Ventilation insufficient for indoor aquatic facilities | <input type="checkbox"/> | <input type="checkbox"/> |
| Chemical handling error (e.g., chemical hookup, improper mixing or application) | <input type="checkbox"/> | <input type="checkbox"/> |
| Maintenance chemicals not flushed from system before opening to swimmers | <input type="checkbox"/> | <input type="checkbox"/> |
| Low or zero water flow combined with continuous feed of chemicals resulted in excess chemicals in water | <input type="checkbox"/> | <input type="checkbox"/> |
| Extensive slime/biofilm formation | <input type="checkbox"/> | <input type="checkbox"/> |
| Recent construction | <input type="checkbox"/> | <input type="checkbox"/> |
| Cyanurate level excessive | <input type="checkbox"/> | <input type="checkbox"/> |
| Lack of draining/cleaning | <input type="checkbox"/> | <input type="checkbox"/> |
| Stagnant water in spa piping was aerosolized | <input type="checkbox"/> | <input type="checkbox"/> |
| No aquatics operators on payroll who have received state/local certified training | <input type="checkbox"/> | <input type="checkbox"/> |
| Untrained/inadequately trained staff on duty | <input type="checkbox"/> | <input type="checkbox"/> |
| POLICY AND MANAGEMENT | | |
| Unclear communication chain for reporting problems | <input type="checkbox"/> | <input type="checkbox"/> |
| Inadequate water quality monitoring (e.g., inadequate test kit, inadequate testing frequency) | <input type="checkbox"/> | <input type="checkbox"/> |
| Employee illness policies absent or not enforced | <input type="checkbox"/> | <input type="checkbox"/> |
| Missing or poor chemical handling policies, practices, and training | <input type="checkbox"/> | <input type="checkbox"/> |
| No operator on duty at the time of incident | <input type="checkbox"/> | <input type="checkbox"/> |
| Facility falls outside aquatic health code | <input type="checkbox"/> | <input type="checkbox"/> |
| No shock/hyperchlorination policy | <input type="checkbox"/> | <input type="checkbox"/> |
| Other, specify: | <input type="checkbox"/> | <input type="checkbox"/> |
| Unknown | <input type="checkbox"/> | <input type="checkbox"/> |

** Only check off what was found during investigation
 *** "Documented/Observed" refers to information gathered through document reviews, direct observations, and/or interviews. "Suspected" refers to factors that probably occurred but for which no documentation (as defined previously) is available.

Please select factors that were found during the investigation. Each contributing factor that is selected has two check boxes so that the user can indicate whether the factor was 'Documented/Observed' or 'Suspected.' 'Documented/Observed' refers to information gathered during document reviews, direct observations and/or interviews. 'Suspected' refers to factors that probably occurred but for which no documentation or observable evidence is available. Additional guidance for some of the factors is included below.

In a multi-venue outbreak (e.g. multiple community pools), please select factors if they were documented/observed or suspected for at least one venue. Clarification can be provided in the Remarks section.

1) People

- Out of compliance with bather load/density requirements
- Primary intended use of water is by diaper/toddler-aged children (e.g. kiddie pool)
- Heavy use by child care center groups
- Fecal/vomit accidents
- Patrons continued to swim when ill or within 2 weeks of being ill
- Operator error
- Intentional contamination (explain in remarks)- *Please add a comment in the Remarks section to explain the cause of the contamination.*

2) Facility Design

- Combined pool filtration systems led to cross contamination
- Hygiene facilities inadequate or distant (e.g no toilets, no diaper changing facilities)
- Spray feature water demand higher than treatment system capacity so water returns to features and bypasses filtration/treatment system
- No supplemental disinfection installed that would have inactivated pathogen (e.g. *Cryptosporidium*)- *For example, this would apply in a cryptosporidiosis outbreak if the pool had chlorination but no UV disinfection.*
- Water temperatures $\geq 30^{\circ}\text{C}$ ($\geq 86^{\circ}\text{F}$)
- Cross connection with wastewater or non-potable water

3) Maintenance: Equipment and Operation

- Disinfectant control system malfunctioning, inadequate, or lacking (e.g. hand feed)
- Incorrect settings on disinfectant control system
- pH control system malfunctioning inadequate, or lacking (e.g. hand feed)
- Incorrect settings on pH control system
- Filtration system malfunctioning or inadequate (e.g. low flow rate)
- Supplemental disinfection system malfunctioning (e.g. ultraviolet light, ozone)
- Insufficient system checks so breakdown detection delayed- *For example, a breakdown in the system was not detected promptly because the system was not checked often enough or thoroughly enough.*
- No preventive maintenance programs to reduce breakdowns- *For example, there was a lack of scheduled maintenance to keep the components of the system in good working order.*
- Remote monitoring system in use
- Ventilation insufficient for indoor aquatic facilities
- Chemical handling error (e.g. chemical hookup, improper mixing or application)- *For example, a chemical feed line was not clamped before disconnecting, resulting in a spill or chemical mixing (e.g., chlorine and acid) OR chemicals were mixed together or applied incorrectly (e.g. by staff members).*
- Maintenance chemicals not flushed from system before opening to swimmers- *For example, the pool was not closed to swimmers during maintenance or was reopened before maintenance steps were completed.*
- Low or zero water flow combined with continuous feed of chemicals resulted in excess chemicals in water
- Extensive slime/biofilm formation
- Recent construction
- Cyanurate level excessive
- Lack of draining/cleaning
- Stagnant water in spa piping was aerosolized

4) Policy and Management

- No aquatics operators on payroll who have received state/local certified training
- Untrained/inadequately trained staff on duty
- Unclear communication chain for reporting problems
- Inadequate water quality monitoring (e.g. inadequate test kit, inadequate testing frequency)
- Employee illness policies absent or not enforced
- Missing or poor chemical handling policies, practices, and training
- No operator on duty at the time of incident
- Facility falls outside aquatic health code
- No shock or hyperchlorination policy

5) Unknown or insufficient information to assign deficiencies

4.6 Remarks

Figure 30. The Remarks section for treated water venues.

| Remarks |
|---------|
| |

Please comment on important elements or results of the outbreak investigation that were not captured by the questions in the electronic form.

5 REC WATER-UNTREATED

5.1 Recreational Water Vehicle Description

Figure 31. The Recreational Water Vehicle Description section for untreated water venues.

| Rec Water-Untreated | | |
|---|--|---|
| Recreational Water – Untreated Venue | | |
| Recreational Water Vehicle Description | | |
| Water Type <i>(e.g., canal; lake; river/stream; ocean)</i> | IF SPRING OR HOT SPRING, Water Subtype <i>(select indoor, outdoor or unknown)</i> | Setting of Exposure <i>(e.g., beach- public; camp/cabin/recreational area)</i> |
| | | |
| | | |
| | | |

Recreational Water Vehicle Table

This table allows you to describe one or more untreated water venues that were associated with the outbreak. Refer to **Appendix H** for standard lists of values for the following fields.

- **Water Type**- Water Type refers to the most commonly reported types of untreated recreational water venues, such as a stream or lake. Note that some settings are combined, such as lake/reservoir/impoundment. Also note that some water types have been divided into multiple categories with standardized names. The water type is further detailed in the water subtype and setting of exposure columns.
- **IF SPRING OR HOT SPRING, Water Subtype**- This field will allow you to indicate whether the location of a spring or hot spring was indoors, outdoors or unknown.
- **Setting of Exposure**- This field allows you to select descriptors that explain where the exposure to water occurred (e.g. beach, park). Note first that some settings are combined, such as camp/cabin/recreational area.

5.2 Recreational Water Quality

Figure 32. The Recreational Water Quality section for untreated water venues.

| Recreational Water Quality | |
|--|---|
| Did the venue meet state or local recreational water quality regulations? | <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/> Not applicable |
| If No, explain: _____ | |
| Did the venue meet Environmental Protection Agency (EPA) recreational water quality standards? | <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/> Not applicable |
| If No, explain: _____ | |

Did the venue meet state or local water quality regulations?- Respond using to the water quality regulations for the state or local jurisdiction where the water exposure that was associated with the outbreak occurred. If the outbreak involved residents of multiple states, the state with the implicated venue(s) should answer 'yes', 'no', 'unknown' or 'not applicable', and the other states should answer 'not applicable'.

- Answer 'yes' if the outbreak involved one or more venues (e.g.more than one lake) in one or more jurisdictions and the response would be 'yes' for all of the venues according to the regulations for the state where the exposure occurred.
- Answer 'no' if the outbreak involved one or more venues (e.g. more than one lake) in one or more jurisdictions and the response would be 'no' for even one of the venues according to the regulations for the state where the exposure occurred. Provide an explanation in the text box if 'no' is selected.
- Answer 'unknown' if the response would be 'unknown' for one or more venues where the exposure occurred.
- Answer 'not applicable' if none of the exposures occurred at venues in the reporting state or if state or local recreational water quality regulations were not applicable to the venue(s).

Did the venue meet the Environmental Protection Agency (EPA) recreational water quality standards?- Respond for the state or local jurisdiction where the water exposure that was associated with the outbreak occurred. If the outbreak involved residents of multiple states, the state with the implicated venue(s) should answer 'yes', 'no', 'unknown' or 'not applicable', and the other states should answer 'not applicable'.

- Answer 'yes' if the outbreak involved one or more venues (e.g. more than one lake) in one or more jurisdictions and the response would be 'yes' for all of the venues.
- Answer 'no' if the outbreak involved one or more venues (e.g. more than one lake) in one or more jurisdictions and the response would be 'no' for even one of the venues. Provide an explanation in the text box if 'no' is selected.
- Answer 'unknown' if the response would be 'unknown' for one or more venues where the exposure occurred.
- Answer 'not applicable' if none of the exposures occurred at venues in the reporting state or if EPA regulations were not applicable to the venue(s).

5.3 Laboratory Section - Recreational Water Samples from Untreated Venues

Figure 33. The beginning of the Recreational Water Laboratory section and the Water Quality Results table

| Laboratory Section - Recreational Water Samples from Untreated Venues | | | | | |
|---|--------|---|---|---|---|
| Was water from untreated recreational water venues tested? <input type="checkbox"/> Yes (specify in table below) <input type="checkbox"/> No <input type="checkbox"/> Unknown | | | | | |
| Results | 1 | 2 | 3 | 4 | 5 |
| Sample | | | | | |
| Source of Sample <i>(e.g., lake or stream)</i> | | | | | |
| Additional Description of Source of Sample <i>(e.g., specific location, time of day, etc)</i> | | | | | |
| Date <i>(mm/dd/yyyy)</i> | | | | | |
| Volume Tested | Number | | | | |
| | Unit | | | | |
| Temperature | Number | | | | |
| | Unit | | | | |

This section collects information about water samples that were collected from the recreational venue. These data provide evidence regarding water quality, as well as the presence of specific pathogens in the water associated with the outbreak.

Was water from untreated recreational water venues tested?- Respond to this section to indicate whether or not water was tested.

Water Quality Results Table

- **Sample** - This number allows you to associate your water sample with results in the following Microbiology table.
- **Source of Sample**- Enter the source of the water sample.
- **Additional Description of Source of Sample**- Provide additional information that will help to explain the source of the sample. For example, one sample might be “lake- swim area” while another might be “lake-wading area”
- **Date**- This is the date that the sample was collected.
- **Volume Tested (Number, Unit)**- Complete this section if a specific amount of water was collected for testing.
- **Temperature (Number, Unit)**- Complete this section if a temperature was recorded for the water sample.

5.4 Water Quality Indicator

Figure 34. The Water Quality Indicator section for untreated water venues.

| Water Quality Indicator | | | |
|-------------------------|------------------------------|------------------------|------------------|
| Sample Number | Type (e.g., fecal coliforms) | Concentration (number) | Unit (e.g., CFU) |
| | | | |
| | | | |
| | | | |
| | | | |

Water Quality Indicator Table

Water quality data may be helpful when an investigator is trying to determine the source of an outbreak. For example, if a laboratory did not find *Giardia* spp. in a water sample from an implicated lake, fecal coliform levels above EPA standards would provide environmental evidence to support the argument that the lake was the source of the outbreak.

- **Sample Number**- This field allows you to pick the sample number that corresponds with the appropriate sample from the Water Quality Results Table.
- **Type**- Select the type of water quality indicator for which the water was tested. If more than one water quality indicator was tested, enter a separate row for each line of data. Total coliforms and fecal coliforms are both examples of water quality indicators.
- **Concentration**- The concentration is a count of microorganisms or chemical particles. The units for the concentration are entered in the next field. For example, if 250 colony forming units (CFU) of fecal coliforms were measured, the concentration would be 250.
- **Unit**- The unit refers to the amount of the microorganism or chemical that was measured by the laboratory (e.g. oocysts/L; mg/L, parts per million [ppm], CFU, most probable number [MPN]).

5.5 Microbiology or Chemical/Toxin Analysis

Figure 35. The Microbiology or Chemical/Toxin Analysis section for untreated water venues.

| Microbiology or Chemical/Toxin Analysis (refer to the laboratory findings from the outbreak investigation) | | | | | |
|--|------------------------------|------------------------|------------------------------|-------------------|---|
| Sample Number | Genus/ Chemical/ Toxin | Species | Serotype/ Serogroup/ Serovar | Genotype/ Subtype | PFGE Pattern |
| | | | | | |
| | | | | | |
| | | | | | |
| Sample Number | Test Results Positive? | Concentration (number) | Unit (e.g., oocysts, CFU) | Test Type* | Test Method (reference: National Environmental Methods Index: http://www.nemi.gov) |
| | <input type="checkbox"/> yes | | | | |
| | <input type="checkbox"/> yes | | | | |
| | <input type="checkbox"/> yes | | | | |
| | <input type="checkbox"/> yes | | | | |

*Test Type: 1-Culture, 2-DNA or RNA Amplification/Detection (e.g., PCR, RT-PCR), 3-Microscopy (e.g., fluorescent, EM), 4-Serological/Immunological Test (e.g., EIA, ELISA), 5-Phage Typing, 6-Chemical Testing, 7-Tissue Culture Infectivity Assay

Microbiology or Chemical/Toxin Analysis Results Table

Refer to the laboratory report and final outbreak report for information. Please report positive findings and negative findings (if a test for a specific pathogen returned null findings). Some of the information may be absent from the report, depending on the testing that was performed (e.g., although a species may have been identified, it may not have been genotyped). If tests were performed to determine the species and/or subtype a particular microorganism from a water sample, please report the results for the total set of specimens, as well as the subset (e.g., If a sample tested positive for *Cryptosporidium* oocysts, enter the results, along with the concentration, if available. Then enter a separate row of data to report the species, if known.)

- **Sample Number-** Enter the sample number that corresponds with the appropriate sample from the Water Quality Results Table.
- **Genus/Chemical/Toxin-** This field provides the broadest description of the pathogen or agent for which the clinical specimen tested negative or positive. Enter this information based on the laboratory report data. Refer to the first column in **Appendix E**. If the appropriate genus, chemical or toxin is not on the list, please write it in the Genus/Chemical/Toxin field.
- **Species-** This field is for known species of each genus of bacteria, parasite or virus. Enter a new value if the species was identified but is missing from the pick list. Find the appropriate genus in **Appendix E** and refer to the second column for a list of known species. If the species is not on the list, please write it in the Species field. Note that there are 6 species categorizations for *Escherichia coli*: enteroaggregative, enterohemorrhagic, enterotoxigenic, enteropathogenic, enteroinvasive, and other. These categories provide information about the type and severity of the outbreak. The table on the next page summarizes the main categories (adapted from http://www.cdc.gov/foodborneoutbreaks/guide_fd.htm).
 - Not all laboratories are able to perform the analyses necessary to categorize *E. coli*. Most commonly, state laboratories will only provide information about enterohemorrhagic *E. coli* (e.g. *E. coli* O157:H7) versus all other types of *E. coli*. Please note that CDC may be able to provide these states with additional laboratory diagnostic testing of *E. coli*.

Table 3. Descriptions of the species categorizations for *Escherichia coli*.

| <i>Escherichia coli</i> category | Laboratory Confirmation |
|--|---|
| Enteroaggregative (EAEC)[‡] | Isolation of organism of enteroaggregative serotype from a water sample. EAEC is defined by its pattern of adherence to HEp-2 cells in culture. |
| Enterohemorrhagic/Shiga-toxin-producing (<i>E. coli</i> O157:H7 and others) | Isolation of <i>E. coli</i> O157:H7 or other Shiga-like toxin-producing <i>E. coli</i> from a water sample. |
| Enterotoxigenic (ETEC) | Isolation of organism of serotype, demonstrated to produce heat-stable (ST) and/or heat-labile (LT) enterotoxin, from a water sample. |
| Enteropathogenic (EPEC) | Isolation of organism of enteropathogenic serotype from a water sample |
| Enteroinvasive (EIEC) | Isolation of enteroinvasive serotype from a water sample. |
| Other | Other – may vary |

- **Serotype/Serogroup/Serovar-** A serotype, serogroup or serovar refers to a subtype that is determined by conducting molecular testing on surface antigens of the microorganism (e.g. *Legionella pneumophila* s1). This approach to subtyping is more common for bacteria, fungi and viruses than parasites. This information may be available on the laboratory report. If testing is not available at the state laboratory, CDC may be able to provide laboratory testing assistance. Matching serotypes/serogroups/serovars from water and biological samples provide stronger environmental evidence that the pathogens or agents responsible for the outbreak were transmitted through exposure to contaminated water. Refer to **Appendix E** for the reference list of microorganisms, chemicals and toxins.
- **Genotype/Subtype-** The genotype/subtype refers to a subtype that is determined by conducting molecular testing to describe the genetic composition of the microorganism. These methods are primarily used for subtyping parasites such as *Cryptosporidium* spp. This information may be available on the laboratory report. If testing is not available at the state laboratory, CDC may be able to provide laboratory testing assistance. Matching genotypes/subtypes from water and biological samples provide stronger environmental evidence that the pathogens or agents responsible for the outbreak were transmitted through exposure to contaminated water.
- **PFGE Pattern-** The PFGE pattern, or fingerprint, can be used to differentiate genetically similar pathogens. Matching PFGE patterns from water and biological samples are strong environmental evidence that the pathogens or agents responsible for the outbreak were transmitted through exposure to contaminated water.
- **Test Results Positive?-** A checkmark in this field indicates that the water sample tested positive for the pathogen or chemical/toxin.
- **Concentration-** The concentration is a count of microorganisms or chemical particles. The units for the concentration are entered in the next field. For example, if 25 oocysts/L of *Cryptosporidium hominis* were measured, the concentration would be 25. There will typically be a concentration for initial tests that have positive results, however, there may not always be a concentration for more complex tests that provide species or subtyping results.
- **Unit-** The unit refers to the amount of the microorganism or chemical that was measured by the laboratory (e.g. oocysts/L, mg/L, parts per million [ppm], colony forming units [CFU], most probable number [MPN]). As with concentration, there may not always be a unit to enter into this field.

[‡] Source: 9th Edition of the Manual of Clinical Microbiology, 2007, American Society for Microbiology, Washington, DC/editor in chief, PR Murray; editors EJ Baron, JH Jorgensen, ML Landry, and MA Pfaller.

- **Test Type-** This field describes the method of testing used to identify the microorganism. If multiple methods were used, select the method that provided the most detailed information (e.g., if a microorganism was found using microscopy and then genotyped using polymerase chain reaction (PCR), select 'DNA or RNA Amplification/Detection (e.g. PCR, RT-PCR)').
- **Test Method-** This field provides information about the water testing methods that were used on the sample. Many of the method numbers refer to standard testing procedures or approved EPA methods. Refer to the National Environmental Methods Index (NEMI) at <http://www.nemi.gov> to compare and contrast methods for either microbiological testing or chemical testing. Common method numbers for this field are listed in **Appendix F** and contain the following information: method source, official method number, and method summary description.

5.6 Factors Contributing to Recreational Water Contamination and/or Increased Exposure in Untreated Venues

Figure 36. The Contributing Factors section for untreated water venues.

| Rec Water-Untreated | | | |
|--|--|--------------------------|--------------------------|
| Factors Contributing to Recreational Water Contamination and/or Increased Exposure in Untreated Venues | | | |
| Factors (check all that apply)* | Documented/ Observed** | Suspected** | |
| PEOPLE | Out of compliance with bather load/density requirements | <input type="checkbox"/> | <input type="checkbox"/> |
| | Primary intended use of water is by diaper/toddler aged children (e.g., kiddie pool) | <input type="checkbox"/> | <input type="checkbox"/> |
| | Heavy use by child care center groups | <input type="checkbox"/> | <input type="checkbox"/> |
| | Fecal/vomitus accident | <input type="checkbox"/> | <input type="checkbox"/> |
| | Patrons continued to swim when ill or within 2 weeks of being ill | <input type="checkbox"/> | <input type="checkbox"/> |
| | Operator error | <input type="checkbox"/> | <input type="checkbox"/> |
| SWIM AREA DESIGN | Intentional contamination (explain in remarks) | <input type="checkbox"/> | <input type="checkbox"/> |
| | Hygiene facilities inadequate or distant (e.g., no toilets, no diaper changing facilities) | <input type="checkbox"/> | <input type="checkbox"/> |
| | Malfunctioning or inadequate onsite wastewater treatment system*** ‡ | <input type="checkbox"/> | <input type="checkbox"/> |
| | Poor siting/design of onsite wastewater treatment system*** ‡ | <input type="checkbox"/> | <input type="checkbox"/> |
| | Stagnant or poorly circulating water in swim area | <input type="checkbox"/> | <input type="checkbox"/> |
| | Heavy rainfall and runoff | <input type="checkbox"/> | <input type="checkbox"/> |
| | Sanitary sewer overflow (SSO) impact*** | <input type="checkbox"/> | <input type="checkbox"/> |
| | Combined sewer overflow (CSO) impact*** | <input type="checkbox"/> | <input type="checkbox"/> |
| | Domestic animal contamination (e.g., livestock, pets) | <input type="checkbox"/> | <input type="checkbox"/> |
| | Wildlife contamination - Birds | <input type="checkbox"/> | <input type="checkbox"/> |
| WATER QUALITY | Wildlife contamination - Mammals | <input type="checkbox"/> | <input type="checkbox"/> |
| | Wildlife contamination - Fish kill | <input type="checkbox"/> | <input type="checkbox"/> |
| | Wastewater treatment plant effluent flows past swim area | <input type="checkbox"/> | <input type="checkbox"/> |
| | Wastewater treatment plant malfunction*** | <input type="checkbox"/> | <input type="checkbox"/> |
| | Sewer line break*** | <input type="checkbox"/> | <input type="checkbox"/> |
| | Nearby biosolid/land application site (e.g., human or animal waste application) | <input type="checkbox"/> | <input type="checkbox"/> |
| | Contamination from agricultural chemical application (e.g., fertilizer, pesticides) | <input type="checkbox"/> | <input type="checkbox"/> |
| | Contamination from chemical pollution not related to agricultural application | <input type="checkbox"/> | <input type="checkbox"/> |
| | Water temperature ≥30°C (≥86°F) | <input type="checkbox"/> | <input type="checkbox"/> |
| | Seasonal variation in water quality (e.g., lake/reservoir turnover events) | <input type="checkbox"/> | <input type="checkbox"/> |
| POLICY AND MANAGEMENT | Inappropriate dumping of sewage into water body (e.g., boat, RV) | <input type="checkbox"/> | <input type="checkbox"/> |
| | Algal bloom | <input type="checkbox"/> | <input type="checkbox"/> |
| | Dumping of ballast water | <input type="checkbox"/> | <input type="checkbox"/> |
| | Tidal wash (i.e., tide exchange or influence by inland water) | <input type="checkbox"/> | <input type="checkbox"/> |
| | Aquatics operator has not received state/local certified training | <input type="checkbox"/> | <input type="checkbox"/> |
| | Untrained/inadequately trained staff on duty | <input type="checkbox"/> | <input type="checkbox"/> |
| | Unclear communication chain for reporting problems | <input type="checkbox"/> | <input type="checkbox"/> |
| | Employee illness policies absent | <input type="checkbox"/> | <input type="checkbox"/> |
| | No operator on duty at the time of incident | <input type="checkbox"/> | <input type="checkbox"/> |
| | Other, specify: | <input type="checkbox"/> | <input type="checkbox"/> |
| Unknown | <input type="checkbox"/> | <input type="checkbox"/> | |

* Only check off what was found during investigation

** "Documented/Observed" refers to information gathered through document reviews, direct observations, and/or interviews. "Suspected" refers to factors that probably occurred but for which no documentation (as defined previously) is available.

*** The release of sewage does not have to occur on the property in which persons have become ill. The sewage release may have occurred at a distant site but still affected the property in question.

‡ "Onsite wastewater treatment system" refers to a system designed to treat and dispose of wastewater at the point of generation, generally on the property where the wastewater is generated (e.g., septic systems or other advanced on site systems). However, contamination that originates from these systems can still occur off the property where treatment and disposal takes place due to migration of contaminants from malfunctioning systems or poor siting and design.

Please select factors that were found during the investigation. Each contributing factor that is selected has two check boxes so that the user can indicate whether the factor was 'Documented/Observed' or 'Suspected.' 'Documented/Observed' refers to information gathered during document reviews, direct observations and/or interviews. 'Suspected' refers to factors that probably occurred but for which no documentation or observable evidence is available. Additional guidance for some of the factors is included below.

In a multi-venue outbreak (e.g. multiple swimming beaches), please select factors if they were documented/observed or suspected for at least one venue. Clarification can be provided in the remarks section.

1) People

- Out of compliance with bather load/density requirements
- Primary intended use of water is by diaper/toddler aged children (e.g., kiddie pool area)
- Heavy use by child care center groups
- Fecal/vomit accident
- Patrons continued to swim when ill or within 2 weeks of being ill
- Operator error
- Intentional contamination (explain in remarks)- *Please add a comment in the Remarks section to explain the cause of the contamination*

2) Swim Area Design

- Hygiene facilities inadequate or distant (e.g. no toilets, no diaper changing facilities)
- Malfunctioning or inadequate onsite wastewater treatment***≠
- Poor siting/design of onsite wastewater treatment system***≠
- Stagnant or poorly circulating water in swim area

***The release of sewage does not have to occur on the property in which persons have been ill. The sewage release may have occurred at a distant site but still affected the property in question.

≠“Onsite wastewater treatment system” refers to a system designed to treat and dispose of wastewater at the point of generation, generally on the property where the wastewater is generated (e.g. septic systems or other advanced onsite systems). However, contamination that originates from these systems can still occur off the property where treatment and disposal takes place due to migration of contaminants from malfunctioning systems or poor siting and design.

3) Water Quality

- Heavy rainfall and runoff
- Sanitary sewer overflow (SSO) impact***- *An SSO is an unintentional discharge of raw sewage from a municipal sanitary sewer. Refer to the following EPA site for more information: http://cfpub.epa.gov/npdes/home.cfm?program_id=4*
- Combined sewer overflow (CSO) impact***- *A combined sewer system collects several types of waste water in the same pipe. A CSO occurs when the volume of water exceeds the system or treatment facility's capacity and sewer water is discharged into natural water systems. Refer to the following EPA site for more information: (http://cfpub.epa.gov/npdes/home.cfm?program_id=5)*
- Domestic animal contamination (e.g., livestock, pets)
- Wildlife contamination - Birds
- Wildlife contamination - Mammals
- Wildlife contamination - Fish kill
- Wastewater treatment plant effluent flows past swim area
- Wastewater treatment facility malfunction***
- Sewer line break***
- Nearby biosolid/land application site (e.g., human or animal waste application)
- Contamination from agricultural chemical application (e.g., fertilizer, pesticides)
- Contamination from chemical pollution not related to agricultural application
- Water temperatures $\geq 30^{\circ}\text{C}$ ($\geq 86^{\circ}\text{F}$)

6 DRINKING WATER

6.1 Drinking Water Vehicle Description

Figure 38. The Drinking Water Vehicle Description section.

| Drinking Water | | | | | | |
|---|-------------------------------------|--|---|---|--|---|
| Drinking Water Vehicle Description | | | | | | |
| Water Type* <i>(e.g., commercially-bottled water, community water system, individual water system)</i> | Public Water System EPA ID Number** | Water Source <i>(select ground water, surface water or unknown)</i> | Water Source Description <i>(e.g., spring; well; lake)</i> | Setting of Exposure <i>(e.g., airport, mobile home park)</i> | USUAL Water Treatment Provided <i>(e.g., no treatment, disinfection, home filtration)</i> | Water Treatment Subtype <i>(disinfection or filtration; e.g., boiling; chlorine; rapid sand filter; reverse osmosis)</i> |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

*Water system definitions: Community and noncommunity water systems are public water systems that have that have ≥ 15 service connections or serve an average of ≥ 25 residents for ≥ 60 days/year. A community water system serves year-round residents of a community, subdivision, or mobile home park. A noncommunity water system serves an institution, industry, camp, park, hotel, or business and can be nontransient or transient. Nontransient systems serve ≥ 25 of the same persons for > 6 months of the year but not year-round (e.g., factories and schools), whereas transient systems provide water to places in which persons do not remain for long periods (e.g., restaurants, highway rest stations, and parks). Individual water systems are small systems not owned or operated by a water utility that have < 15 connections or serve < 25 persons.

** Number used for EPA reporting that uniquely identifies the water system within a specific state. The water system ID number can be found at <http://www.epa.gov/safewater/dwinfo/index.html> by first selecting a state and then selecting a county.

Drinking Water Vehicle Table

This table allows you to describe one or more drinking water systems that were associated with the outbreak. Refer to **Appendix I** for standard lists of values for the following fields.

- **Water Type-** The water type is further detailed in the remaining columns of the table. The following definitions may be used to differentiate among community, noncommunity and individual systems:
 - Community water system: A public water system that has ≥ 15 service connections used by year-round residents or regularly serves ≥ 25 year-round residents. A community water system might be owned by a private or public entity providing water to a community, subdivision, or mobile home park.
 - Nontransient Noncommunity Water System: A public water system that is not a community system. A nontransient noncommunity water system has ≥ 15 service connections or serves ≥ 25 of the same persons for >6 months/year (e.g. a factory or school) but does not serve year-round residents.
 - Transient Noncommunity Water System: A public water system that is not a community system. A transient noncommunity water system has ≥ 15 service connections or serves an average of ≥ 25 people for ≥ 60 days/year where persons do not remain for long periods of time (e.g. restaurants, highway rest stations, and parks).
 - Individual/Private Water System (also known as Non-Public Water System): A water system that does not meet the Environmental Protection Agency’s (EPA) definition for a public water system. An individual/private water system is not owned or operated by a water utility. It has < 15 service connections or serves < 25 people.

- **Public Water System EPA ID Number-** This is the number used for EPA reporting that uniquely identifies the water system within a specific state. The water system ID number can be found at <http://www.epa.gov/safewater/dwinfo/index.html> by first selecting a state and then selecting a county.
- **Water Source-** Enter whether or not the water was groundwater (well or spring water), surface water, or unknown.
- **Water Source Description-** Enter the correct type of water source description. Note that some water source descriptions are combined, such as Lake/Reservoir/Impoundment.
- **Setting of Exposure-** Enter descriptors that explain where the exposure to water occurred (e.g. Hospital/Health Care Facility, Indoor Place of Work/Office) Note that some settings are combined, such as Hotel/Motel/Lodge/Inn.
- **USUAL Water Treatment Provided-** Complete this section to provide more information about the type of water treatment usually provided before water use or water consumption. Treatment can occur at any point in the distribution system. If filtration usually occurred, specify whether it was done at the treatment plant or at home/point-of-use. Enter information about the usual water treatments, regardless of whether or not these treatments were operating correctly at or just prior to the time of the outbreak.
- **Water Treatment Subtype-** Complete this section to provide more information about the disinfection or filtration method used to treat the water.

6.2 Drinking Water Quality

Figure 39. The Drinking Water Quality section.

Drinking Water Quality

Did the drinking water system have any monitoring violations in the 1 month prior to the outbreak?

Yes No Unknown Not applicable

If Yes, explain: _____

Did the drinking water system have any maximum contaminant level (MCL) violations in the 1 month prior to the outbreak?

Yes No Unknown Not applicable

If Yes, explain: _____

Did the drinking water system have any violations in the 12 months prior to the outbreak?***

Yes No Unknown Not applicable

If Yes, explain: _____

***Sources of information about past violations can be obtained from utility records, consumer confidence reports (water quality reports), or violation records from state or local health departments

Sources of information about past violations can be obtained from utility records, consumer confidence reports (water quality reports), or violation records from state or local health departments.

- If one or more drinking water systems was involved in the outbreak (e.g. a community water system and an individual/private water system), respond 'yes' if at least one drinking water system had a past violation of the type and time period specified in the question. Provide an explanation in the text box if 'yes' is selected.
- If there were no known violations but information is not available for one (or more) drinking water system(s), respond 'unknown.'

6.3 Laboratory Section - Drinking Water

Figure 40. The beginning of the Laboratory section and the Water Quality Results table.

| Laboratory Section - Drinking Water | | | | | |
|---|---------------|---|---|---|---|
| Was drinking water tested? <input type="checkbox"/> Yes (specify in table below) <input type="checkbox"/> No <input type="checkbox"/> Unknown | | | | | |
| Results | | | | | |
| Sample | 1 | 2 | 3 | 4 | 5 |
| Source of Sample | | | | | |
| Additional Description of Source of Sample <i>(e.g., kitchen faucet, well, reservoir)</i> | | | | | |
| Date <i>(mm/dd/yyyy)</i> | | | | | |
| Volume Tested | Number | | | | |
| | Unit | | | | |
| Temperature | Number | | | | |
| | Unit | | | | |
| Residual/Free Disinfectant Level <i>(if total and combined disinfectant levels given, total - combined = free)</i> | Number | | | | |
| | Unit | | | | |
| pH | | | | | |
| Turbidity (NTU) | | | | | |

This section collects information about drinking water samples. These data provide evidence regarding water quality, as well as the presence of specific pathogens in the water associated with the outbreak.

Was drinking water tested?- Respond to this section to indicate whether or not water was tested.

Water Quality Results Table

- **Sample-** This number allows you to associate your water sample with results in the following Microbiology table.
- **Source of Sample-** Enter the source of the water sample.
- **Additional Description of Source of Sample-** Provide additional information that will help to explain the source of the sample. For example, one sample might be “tap” while another might be “reservoir”
- **Date-** This is the date that the sample was collected.
- **Volume Tested (Number, Unit)-** Complete this section if a specific amount of water was collected for testing.
- **Temperature (Number, Unit)-** Complete this section if a temperature was recorded for the water sample.
- **Residual/Free Disinfectant Level (Number, Unit)-** Complete this section if a residual or free disinfectant level was recorded for the water sample. This field refers to the level of disinfectant that has not reacted with other compounds in the water and is still available to effectively inactivate microorganisms in the water. If only the total disinfectant level and the combined disinfectant level are known: (Residual or Free)=Total-Combined.
- **pH-** Complete this field if a pH level was recorded for the water sample.
- **Turbidity (NTU)-** Complete this field if turbidity was measured for the water sample. Turbidity describes the amount of suspended matter in the sample.

6.4 Water Quality Indicator

Figure 41. The Water Quality Indicator section for drinking water.

| Drinking Water | | | |
|-------------------------|------------------------------|------------------------|------------------|
| Water Quality Indicator | | | |
| Sample Number | Type (e.g., fecal coliforms) | Concentration (number) | Unit (e.g., CFU) |
| | | | |
| | | | |
| | | | |

Water Quality Indicator Table

Water quality data may be helpful when an investigator is trying to determine the source of an outbreak. For example, if *Campylobacter jejuni* was present in clinical specimens from an outbreak that was epidemiologically linked to a particular well but no *Campylobacter* spp. were found in well water samples, positive findings for fecal coliforms would provide environmental evidence to support the argument that the well was the source of the outbreak.

- **Sample Number-** Enter the sample number that corresponds to the appropriate sample from the Water Quality Results Table.
- **Type-** Enter the type of water quality indicator for which the water was tested. If more than one water quality indicator was tested, enter a separate row for each line of data. Total coliforms and fecal coliforms are both examples of water quality indicators.
- **Concentration-** The concentration is a count of microorganisms or chemical particles. The units for the concentration are entered in the next field. For example, if 250 colony forming units (CFU) of fecal coliforms were measured, the concentration would be 250.
- **Unit-** The unit refers to the amount of the microorganism or chemical that was measured by the laboratory (e.g. oocysts/L; mg/L, parts per million [ppm], CFU, most probable number [MPN]).

6.5 Microbiology or Chemical/Toxin Analysis

Figure 42. The Microbiology or Chemical/Toxin Analysis section for drinking water.

| Microbiology or Chemical/Toxin Analysis (refer to the laboratory findings from the outbreak investigation) | | | | | |
|--|------------------------------|------------------------|------------------------------|-------------------|---|
| Sample Number | Genus/ Chemical/ Toxin | Species | Serotype/ Serogroup/ Serovar | Genotype/ Subtype | PFGE Pattern |
| | | | | | |
| | | | | | |
| Sample Number | Test Results Positive? | Concentration (number) | Unit (e.g., oocysts, CFU) | Test Type* | Test Method (reference: National Environmental Methods Index: http://www.nemi.gov) |
| | <input type="checkbox"/> yes | | | | |
| | <input type="checkbox"/> yes | | | | |
| | <input type="checkbox"/> yes | | | | |

* Test Type: 1-Culture, 2-DNA or RNA Amplification/Detection (e.g., PCR, RT-PCR), 3-Microscopy (e.g., fluorescent, EM), 4-Serological/immunological Test (e.g., EIA, ELISA), 5-Phage Typing, 6-Chemical Testing, 7-Tissue Culture Infectivity Assay

Microbiology or Chemical/Toxin Analysis Results Table

Refer to the laboratory report and final outbreak report for information. Please report positive findings and negative findings (if a test for a specific pathogen returned null findings). Some of the information may be absent from the report, depending on the testing that was performed (e.g., although a species may have been identified, it may not have been genotyped). If tests were performed to determine the species and/or subtype a particular microorganism from a water sample, please report the results for the total set of specimens, as well as the subset (e.g., If a sample tested positive for *Cryptosporidium* oocysts, enter the results, along with the concentration, if available. Then enter a separate row of data to report the species, if known.)

- **Sample Number-** This field allows you to pick the sample number that corresponds with the appropriate sample from the Water Quality Results Table.
- **Genus/Chemical/Toxin-** This field provides the broadest description of the pathogen or agent for which the clinical specimen tested negative or positive. Enter this information based on the laboratory report data. Refer to the first column in **Appendix E**. If the appropriate genus, chemical or toxin is not on the list, please write it in the Genus/Chemical/Toxin field.
- **Species-** This field is for known species of each genus of bacteria, parasite or virus. Enter a new value if the species was identified but is missing from the pick list. Find the appropriate genus in **Appendix E** and refer to the second column for a list of known species. If the species is not on the list, please write it in the Species field. Note that there are 6 species categorizations for *Escherichia coli*: enteroaggregative, enterohemorrhagic, enterotoxigenic, enteropathogenic, enteroinvasive, and other. These categories provide information about the type and severity of the outbreak. The table below summarizes the main categories (adapted from http://www.cdc.gov/foodborneoutbreaks/guide_fd.htm).
 - Not all laboratories are able to perform the analyses necessary to categorize *E. coli*. Most commonly, state laboratories will only provide information about enterohemorrhagic *E. coli* (e.g. *E. coli* O157:H7) versus all other types of *E. coli*. Please note that CDC may be able to provide these states with additional laboratory diagnostic testing of *E. coli*.

Table 4. Descriptions of the species categorizations for *Escherichia coli*.

| <i>Escherichia coli</i> category | Laboratory Confirmation |
|--|---|
| Enteroaggregative (EAEC)[§] | Isolation of organism of enteroaggregative serotype from a water sample. EAEC is defined by its pattern of adherence to HEp-2 cells in culture. |
| Enterohemorrhagic/Shiga-toxin-producing (<i>E. coli</i> O157:H7 and others) | Isolation of <i>E. coli</i> O157:H7 or other Shiga-like toxin-producing <i>E. coli</i> from a water sample. |
| Enterotoxigenic (ETEC) | Isolation of organism of serotype, demonstrated to produce heat-stable (ST) and/or heat-labile (LT) enterotoxin, from a water sample. |
| Enteropathogenic (EPEC) | Isolation of organism of enteropathogenic serotype from a water sample |
| Enteroinvasive (EIEC) | Isolation of enteroinvasive serotype from a water sample. |
| Other | Other – may vary |

[§] Source: 9th Edition of the Manual of Clinical Microbiology, 2007, American Society for Microbiology, Washington, DC/editor in chief, PR Murray; editors EJ Baron, JH Jorgensen, ML Landry, and MA Pfaller.

- **Serotype/Serogroup/Serovar-** A serotype, serogroup or serovar refers to a subtype that is determined by conducting molecular testing on surface antigens of the microorganism (e.g. *Legionella pneumophila* s1). This approach to subtyping is more common for bacteria, fungi and viruses than parasites. This information may be available on the laboratory report. If testing is not available at the state laboratory, CDC may be able to provide laboratory testing assistance. Matching serotypes/serogroups/serovars from water and biological samples provide stronger environmental evidence that the pathogens or agents responsible for the outbreak were transmitted through exposure to contaminated water. Refer to **Appendix E** for the reference list of microorganisms, chemicals and toxins.
- **Genotype/Subtype-** The genotype/subtype refers to a subtype that is determined by conducting molecular testing to describe the genetic composition of the microorganism. These methods are primarily used for subtyping parasites such as *Cryptosporidium* spp. This information may be available on the laboratory report. If testing is not available at the state laboratory, CDC may be able to provide laboratory testing assistance. Matching genotypes/subtypes from water and biological samples provide stronger environmental evidence that the pathogens or agents responsible for the outbreak were transmitted through exposure to contaminated water.
- **PFGE Pattern-** The PFGE pattern, or fingerprint, can be used to differentiate genetically similar pathogens. Matching PFGE patterns from water and biological samples are strong environmental evidence that the pathogens or agents responsible for the outbreak were transmitted through exposure to contaminated water.
- **Test Results Positive?-** A checkmark in this field indicates that the water sample tested positive for the pathogen or chemical/toxin.
- **Concentration-** The concentration is a count of microorganisms or chemical particles. The units for the concentration are entered in the next field. For example, if 1 oocyst/L of *Cryptosporidium hominis* were measured, the concentration would be 1. There will typically be a concentration for initial tests that have positive results, however, there may not always be a concentration for more complex tests that provide species or subtyping results.
- **Unit-** The unit refers to the amount of the microorganism or chemical that was measured by the laboratory (e.g. oocysts/L, mg/L, parts per million [ppm], colony forming units [CFU], most probable number [MPN]). As with concentration, there may not always be a unit to enter into this field.
- **Test Type-** This field describes the method of testing used to identify the microorganism. If multiple methods were used, select the method that provided the most detailed information (e.g., if a microorganism was found using microscopy and then genotyped using polymerase chain reaction (PCR), select 'DNA or RNA Amplification/Detection (e.g. PCR, RT-PCR)').
- **Test Method-** This field provides information about the water testing methods that were used on the sample. Many of the method numbers refer to standard testing procedures or approved EPA methods. Refer to the National Environmental Methods Index (NEMI) at <http://www.nemi.gov> to compare and contrast methods for either microbiological testing or chemical testing. Common method numbers for this field are listed in **Appendix F** and contain the following information: method source, official method number, and method summary description.

6.6 Factors Contributing to Drinking Water Contamination and/or Increased Exposure to Contaminated Drinking Water

Please select factors that were found during the investigation. Each contributing factor that is selected has two check boxes so that the user can indicate whether the factor was 'Documented/Observed' or 'Suspected.' 'Documented/Observed' refers to information gathered during document reviews, direct observations and/or interviews. 'Suspected' refers to factors that probably occurred but for which no documentation or observable evidence is available. Please check only one box for each contributing factor. Additional guidance for some of the factors is included below.

In a multi-system outbreak (e.g. both a nontransient noncommunity and an individual system were involved), please select a factor if it was documented/observed or suspected for at least one venue. Clarification can be provided in the remarks section.

1. **Did a problem with the source water (i.e. ground or surface water) contribute to the disease or outbreak?** Answer yes if a factor was either 'Documented/Observed' or 'Suspected.' Select the appropriate factor(s) or add the factor to the list.

Figure 43. The Contributing Factors section regarding source water for drinking water.

| Factors Contributing to Drinking Water Contamination and/or Increased Exposure to Contaminated Drinking Water | | |
|--|----------------------------|--------------------------|
| Did a problem with the source water (i.e., ground water or surface water) contribute to the disease or outbreak? <input type="checkbox"/> Yes (specify in table below) <input type="checkbox"/> No <input type="checkbox"/> Unknown | | |
| Source Water Factors (check all that apply)** | Documented/ Observed*** | Suspected*** |
| Sanitary sewer overflow (SSO)**** | <input type="checkbox"/> | <input type="checkbox"/> |
| Combined sewer overflow (CSO)**** | <input type="checkbox"/> | <input type="checkbox"/> |
| Malfunctioning on-site wastewater treatment system **** ≠ | <input type="checkbox"/> | <input type="checkbox"/> |
| Sewage treatment plant malfunction *** | <input type="checkbox"/> | <input type="checkbox"/> |
| Sewer line break *** | <input type="checkbox"/> | <input type="checkbox"/> |
| Poor siting/design of on site wastewater treatment system **** ≠ | <input type="checkbox"/> | <input type="checkbox"/> |
| Nearby biosolid/land application site (e.g., human or animal waste application) | <input type="checkbox"/> | <input type="checkbox"/> |
| Contamination from agricultural chemical application (e.g., fertilizer, pesticides) | <input type="checkbox"/> | <input type="checkbox"/> |
| Contamination from chemical pollution not related to agricultural application | <input type="checkbox"/> | <input type="checkbox"/> |
| Contamination by a chemical that the current treatment methods were not designed to remove | <input type="checkbox"/> | <input type="checkbox"/> |
| Domestic animal contamination (e.g., livestock, concentrated feeding operations, pets) | <input type="checkbox"/> | <input type="checkbox"/> |
| Wildlife contamination - Birds | <input type="checkbox"/> | <input type="checkbox"/> |
| Wildlife contamination - Mammals | <input type="checkbox"/> | <input type="checkbox"/> |
| Wildlife contamination - Fish kill | <input type="checkbox"/> | <input type="checkbox"/> |
| Flooding/heavy rains | <input type="checkbox"/> | <input type="checkbox"/> |
| Algal bloom | <input type="checkbox"/> | <input type="checkbox"/> |
| Seasonal variation in water quality (e.g., lake/reservoir turnover events, resort community with seasonal loading) | <input type="checkbox"/> | <input type="checkbox"/> |
| Low water table (e.g., drought, over-pumping) | <input type="checkbox"/> | <input type="checkbox"/> |
| Ground water under direct influence of surface water (e.g., shallow well)≠ ≠ | <input type="checkbox"/> | <input type="checkbox"/> |
| Contamination through limestone or fissured rock (e.g., karst) | <input type="checkbox"/> | <input type="checkbox"/> |
| Contaminated recharge water | <input type="checkbox"/> | <input type="checkbox"/> |
| Use of an alternate source of water by a water utility | <input type="checkbox"/> | <input type="checkbox"/> |
| Mixing of raw water from different sources | <input type="checkbox"/> | <input type="checkbox"/> |
| Improper construction or location of a well or spring | <input type="checkbox"/> | <input type="checkbox"/> |
| Water system intake failure (e.g., cracked well casing, cracked intake pipe) | <input type="checkbox"/> | <input type="checkbox"/> |
| Intentional contamination (explain in remarks) | <input type="checkbox"/> | <input type="checkbox"/> |
| Other, specify: | <input type="checkbox"/> | <input type="checkbox"/> |
| Unknown | <input type="checkbox"/> | <input type="checkbox"/> |

** Only check off what was found during investigation

*** "Documented/Observed" refers to information gathered through document reviews, direct observations, and/or interviews. "Suspected" refers to factors that probably occurred but for which no documentation (as defined previously) is available.

**** The release of sewage does not have to occur on the property in which persons have become ill. The sewage release may have occurred at a distant site but still affected the property in question.

≠ "On site wastewater treatment system" refers to a system designed to treat and dispose of wastewater at the point of generation, generally on the property where the wastewater is generated (e.g., septic systems or other advanced on site systems). However, contamination that originates from these systems can still occur off the property where treatment and disposal takes place due to migration of contaminants from malfunctioning systems or poor siting and design.

≠ ≠ Any water beneath the surface of the ground with substantial occurrence of insects or other macroorganisms, algae, or large-diameter pathogens (e.g., *Giardia intestinalis* or *Cryptosporidium*), or substantial and relatively rapid shifts in water characteristics (e.g., turbidity, temperature, conductivity, or pH) that closely correlate with climatic or surface water conditions. Direct influence must be determined for individual sources in accordance with criteria established by the state.

- Sanitary sewer overflow (SSO)***- An SSO is an unintentional discharge of raw sewage from a municipal sanitary sewer. Refer to the following EPA site for more information: http://cfpub.epa.gov/npdes/home.cfm?program_id=4
- Combined sewer overflow (CSO)***-A combined sewer system collects several types of waste water in the same pipe. A CSO occurs when the volume of water exceeds the system or treatment facility's capacity and sewer water is discharged into natural water systems. Refer to the following EPA site for more information: http://cfpub.epa.gov/npdes/home.cfm?program_id=5
- Malfunctioning onsite wastewater treatment system *** ≠
- Sewage treatment plant malfunction ***
- Sewer line break ***
- Poor siting/design of wastewater treatment system *** ≠
- Nearby biosolid/land application site (e.g. human or animal waster application)
- Contamination from agricultural chemical application (e.g., fertilizer, pesticides)
- Contamination from chemical pollution not related to agricultural application

- Contamination by a chemical that the current treatment methods were not designed to remove
- Domestic animal contamination (e.g., livestock, concentrated feeding operations, pets)
- Wildlife contamination – Birds
- Wildlife contamination – Mammals
- Wildlife contamination – Fish Kill
- Flooding/heavy rains
- Algal bloom
- Seasonal variation in water quality (e.g., lake/reservoir turnover events, resort community with seasonal loading)
- Low water table (e.g., drought, over-pumping)
- Ground water under direct influence of surface water (e.g. shallow well)≠
- Contamination through limestone or fissured rock (e.g., karst)
- Contaminated recharge water (e.g. a groundwater supply replenished with contaminated surface water, which includes rain, that reached it by traveling through the soil.
<http://www.epa.gov/OCEPAterms/rterms.html>)
- Use of an alternate source of water by a water utility
- Mixing of raw water from different sources- *raw water is water that has not undergone treatment for microorganisms and metal/chemical contaminants.*
- Improper construction or location of a well or spring
- Water system intake failure (e.g., cracked well casing, cracked intake pipe)
- Intentional Contamination (explain in remarks)- *Please add a comment in the Remarks section to explain the cause of the contamination*
- Unknown

***The release of sewage does not have to occur on the property in which persons have been ill. The sewage release may have occurred at a distant site but still affected the property in question.

≠“Onsite wastewater treatment system” refers to a system designed to treat and dispose of wastewater at the point of generation, generally on the property where the wastewater is generated (e.g. septic systems or other advanced onsite systems). However, contamination that originates from these systems can still occur off the property where treatment and disposal takes place due to migration of contaminants from malfunctioning systems or poor siting and design.

≠ Any water beneath the surface of the ground with substantial occurrence of insects or other macroorganisms, algae, or large-diameter pathogens (e.g. *Giardia intestinalis* or *Cryptosporidium*), or substantial and relatively rapid shifts in water characteristics (e.g. turbidity, temperature, conductivity, or pH) that closely correlate with climatologic or surface water conditions. Direct influence must be determined for individual sources in accordance with criteria established by the state.

2. **Did a problem with the water treatment prior to entry into a house or building contribute to the disease or outbreak?** Answer yes if a factor was either 'Documented/Observed' or 'Suspected.' Select the appropriate factor(s) below or add the factor to the list.

Figure 44. The Contributing Factors section regarding water treatment for drinking water.

| Drinking Water | | |
|---|---------------------------|--------------------------|
| Factors Contributing to Drinking Water Contamination and/or Increased Exposure to Contaminated Drinking Water | | |
| Did a problem with the water treatment prior to entry into a house or building contribute to the disease or outbreak? | | |
| <input type="checkbox"/> Yes (specify in table below) <input type="checkbox"/> No <input type="checkbox"/> Unknown | | |
| Treatment Factors (check all that apply)* | Documented/ Observed** | Suspected** |
| Change in treatment process | <input type="checkbox"/> | <input type="checkbox"/> |
| No disinfection | <input type="checkbox"/> | <input type="checkbox"/> |
| Temporary interruption of disinfection | <input type="checkbox"/> | <input type="checkbox"/> |
| Chronically inadequate disinfection | <input type="checkbox"/> | <input type="checkbox"/> |
| No filtration | <input type="checkbox"/> | <input type="checkbox"/> |
| Inadequate filtration | <input type="checkbox"/> | <input type="checkbox"/> |
| Deficiencies in other treatment processes | <input type="checkbox"/> | <input type="checkbox"/> |
| Corrosion in or leaching from pipes or storage tanks | <input type="checkbox"/> | <input type="checkbox"/> |
| Pipe/component failure or break (e.g., pipes, tanks, valves) | <input type="checkbox"/> | <input type="checkbox"/> |
| Contamination during construction or repair of pipes/components | <input type="checkbox"/> | <input type="checkbox"/> |
| Construction or repair of pipes/components without evidence of contamination | <input type="checkbox"/> | <input type="checkbox"/> |
| Operator error | <input type="checkbox"/> | <input type="checkbox"/> |
| Other, specify: | <input type="checkbox"/> | <input type="checkbox"/> |
| Unknown | <input type="checkbox"/> | <input type="checkbox"/> |

- Change in treatment process
- No disinfection
- Temporary interruption of disinfection
- Chronically inadequate disinfection
- No filtration
- Inadequate filtration
- Deficiencies in other treatment processes
- Corrosion in or leaching from pipes or storage tanks
- Pipe/component failure or break (e.g., pipes, tanks, valves)
- Contamination during construction or repair of pipes/components
- Construction or repair of pipes/components without evidence of contamination
- Operator error
- Unknown

3. Did a problem with the distribution system contribute to the disease or outbreak? Answer yes if a factor was either 'Documented/Observed' or 'Suspected.' Select the appropriate factor(s) below or add the factor to the list.

For a **community** system, the distribution system refers to the pipes and storage infrastructure under the jurisdiction of the water utility prior to the water meter (or property line if the system is not metered). For **noncommunity and nonpublic water systems**, the distribution system refers to the pipes and storage infrastructure prior to entry into a building or house.

Figure 45. The Contributing Factors section regarding the distribution system for drinking water.

| Did a problem with the distribution system contribute to the disease or outbreak? <input type="checkbox"/> Yes (<i>specify in table below</i>) <input type="checkbox"/> No <input type="checkbox"/> Unknown (NOTE: For a community water system, the distribution system refers to the pipes and storage infrastructure under the jurisdiction of the water utility prior to the water meter (or property line if the system is not metered). For noncommunity and nonpublic water systems, the distribution system refers to the pipes and storage infrastructure prior to entry into a building or house) | | |
|--|---------------------------|--------------------------|
| Distribution and Storage Factors (<i>check all that apply</i>)* | Documented/ Observed** | Suspected** |
| Cross-connection of potable and nonpotable water pipes resulting in backflow | <input type="checkbox"/> | <input type="checkbox"/> |
| Low pressure or change in water pressure in the distribution system | <input type="checkbox"/> | <input type="checkbox"/> |
| Change in water flow direction in the distribution system | <input type="checkbox"/> | <input type="checkbox"/> |
| Mixing of treated water from different sources | <input type="checkbox"/> | <input type="checkbox"/> |
| Pipe/component failure or break (e.g., pipes, tanks, valves) | <input type="checkbox"/> | <input type="checkbox"/> |
| Corrosion in or leaching from pipes or storage tanks | <input type="checkbox"/> | <input type="checkbox"/> |
| Contamination of mains during construction or repair | <input type="checkbox"/> | <input type="checkbox"/> |
| Construction or repair of mains without evidence of contamination | <input type="checkbox"/> | <input type="checkbox"/> |
| Scheduled flushing of the distribution system | <input type="checkbox"/> | <input type="checkbox"/> |
| Contamination of storage facility | <input type="checkbox"/> | <input type="checkbox"/> |
| Aging water distribution components (e.g., pipes, tanks, valves) | <input type="checkbox"/> | <input type="checkbox"/> |
| Water temperature $\geq 30^{\circ}\text{C}$ ($\geq 86^{\circ}\text{F}$) | <input type="checkbox"/> | <input type="checkbox"/> |
| Intentional contamination (explain in remarks) | <input type="checkbox"/> | <input type="checkbox"/> |
| Other, specify: | <input type="checkbox"/> | <input type="checkbox"/> |
| Unknown | <input type="checkbox"/> | <input type="checkbox"/> |

- Cross-connection of potable and nonpotable water pipes resulting in backflow (*e.g., non-potable water enters the potable water supply at the point of cross-connection*)
- Low pressure or change in water pressure in the distribution system
- Change in water flow direction in the distribution system
- Mixing of treated water from different sources
- Pipe/Component failure or break (e.g., pipes,tanks,valves)
- Corrosion in or leaching from pipes or storage tanks
- Contamination of mains during construction or repair (*e.g., a water main*)
- Construction or repair of mains without evidence of contamination (*e.g., a water main*)
- Scheduled flushing of the distribution system
- Contamination of storage facility
- Aging water distribution components (e.g., pipes, tanks, valves)
- Water Temperature $\geq 30^{\circ}\text{C}$ ($\geq 86^{\circ}\text{F}$)
- Intentional contamination (explain in remarks)- *Please add a comment in the Remarks section to explain the cause of the contamination.*
- Unknown

4. Did a problem occur after the water meter or outside the jurisdiction of a water utility that contributed to the disease or outbreak? Answer yes if a factor was either ‘Documented/Observed’ or ‘Suspected.’ Select the appropriate factor(s) below or add the factor to the list.

The following are examples that would fall into this category: a problem in a service line leading to a house/building; a problem in the plumbing inside a house/building; a problem during shipping/hauling; a problem during storage other than in the distribution system; a problem at the point of use; a problem involving commercially bottled water.

Figure 46. The Contributing Factors section regarding water after the water meter or outside the jurisdiction of the water utility for drinking water.

| Did a problem occur after the water meter or outside the jurisdiction of a water utility that contributed to the disease or outbreak? (e.g., in a service line leading to a house/building, in the plumbing inside a house/building, during shipping/hauling, during storage other than in the distribution system, at the point of use, involving commercially-bottled water) | | |
|---|---------------------------|--------------------------|
| <input type="checkbox"/> Yes (specify in table below) <input type="checkbox"/> No <input type="checkbox"/> Unknown | | |
| Factors Not Under the Jurisdiction of a Water Utility or Factors at the Point of Use (check all that apply)* | Documented/ Observed** | Suspected** |
| Legionella species in water system | <input type="checkbox"/> | <input type="checkbox"/> |
| Cross-connection of potable and nonpotable water pipes resulting in backflow | <input type="checkbox"/> | <input type="checkbox"/> |
| Lack of backflow prevention in plumbing | <input type="checkbox"/> | <input type="checkbox"/> |
| Low pressure or change in water pressure in the plumbing | <input type="checkbox"/> | <input type="checkbox"/> |
| Change in water flow direction in the plumbing | <input type="checkbox"/> | <input type="checkbox"/> |
| Corrosion in or leaching from pipes or storage tanks | <input type="checkbox"/> | <input type="checkbox"/> |
| Pipe/component failure or break (e.g., pipes, tanks, valves) | <input type="checkbox"/> | <input type="checkbox"/> |
| Aging plumbing components (e.g., pipes, tanks, valves) | <input type="checkbox"/> | <input type="checkbox"/> |
| Contamination of plumbing during construction or repair | <input type="checkbox"/> | <input type="checkbox"/> |
| Construction or repair of plumbing without evidence of contamination | <input type="checkbox"/> | <input type="checkbox"/> |
| Deficiency in building/home-specific water treatment after the water meter or property line | <input type="checkbox"/> | <input type="checkbox"/> |
| Deficiency or contamination of equipment/devices using or distributing water | <input type="checkbox"/> | <input type="checkbox"/> |
| Contamination during commercial bottling | <input type="checkbox"/> | <input type="checkbox"/> |
| Contamination during shipping, hauling, or storage | <input type="checkbox"/> | <input type="checkbox"/> |
| Contamination at point of use – Tap | <input type="checkbox"/> | <input type="checkbox"/> |
| Contamination at point of use – Hose | <input type="checkbox"/> | <input type="checkbox"/> |
| Contamination at point of use – Commercially-bottled water | <input type="checkbox"/> | <input type="checkbox"/> |
| Contamination at point of use – Container, bottle, or pitcher | <input type="checkbox"/> | <input type="checkbox"/> |
| Contamination at point of use – Unknown | <input type="checkbox"/> | <input type="checkbox"/> |
| Water temperature $\geq 30^{\circ}\text{C}$ ($\geq 86^{\circ}\text{F}$) | <input type="checkbox"/> | <input type="checkbox"/> |
| Intentional contamination (explain in remarks) | <input type="checkbox"/> | <input type="checkbox"/> |
| Other, specify: | <input type="checkbox"/> | <input type="checkbox"/> |
| Unknown | <input type="checkbox"/> | <input type="checkbox"/> |

* Only check off what was found during investigation

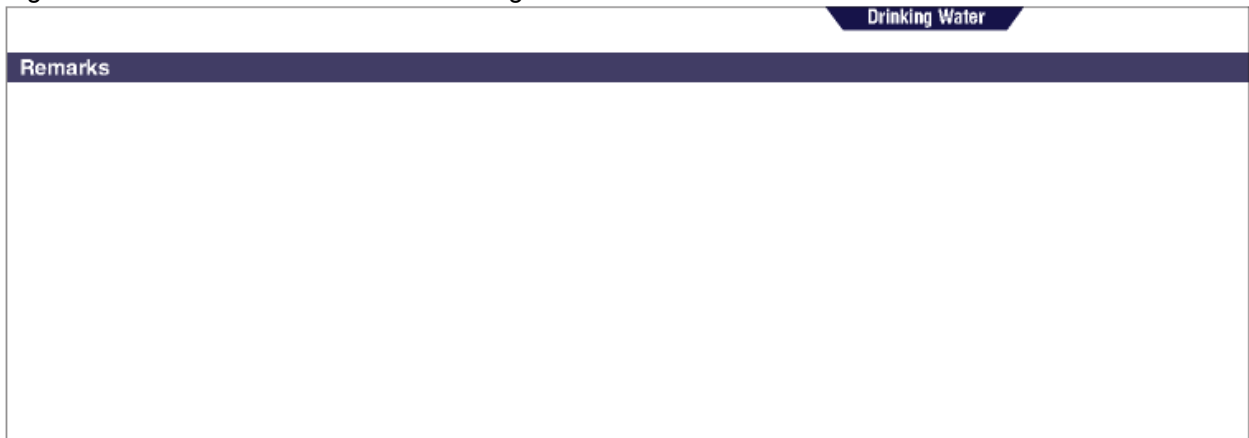
** “Documented/Observed” refers to information gathered through document reviews, direct observations, and/or interviews. “Suspected” refers to factors that probably occurred but for which no documentation (as defined previously) is available.

- Legionella species in water system
- Cross-connection of potable and nonpotable water pipes resulting in backflow (eg., non-potable water enters the potable water supply at the point of cross-connection)
- Lack of backflow prevention in plumbing (e.g., lack of a backflow prevention device)
- Low pressure or change in water pressure in the plumbing
- Change in water flow direction in the plumbing
- Corrosion in or leaching from pipes or storage tanks
- Pipe/component failure or break (e.g., pipes, tanks, valves)
- Aging plumbing components (e.g., pipes, tanks, valves)
- Contamination of plumbing during construction or repair
- Construction or repair of plumbing without evidence of contamination
- Deficiency in building/home-specific water treatment after the water meter or property line
- Deficiency or contamination of equipment/devices using or distributing water (e.g., drink machine, kidney dialysis machine)
- Contamination during commercial bottling or making beverage or ice
- Contamination during shipping, hauling, or storage

- Contamination at point of use - Tap
- Contamination at point of use - Hose
- Contamination at point of use – Commercially-bottled water
- Contamination at point of use – Container, bottle, or pitcher
- Contamination at point of use – Unknown
- Water Temperature $\geq 30^{\circ}\text{C}$ ($\geq 86^{\circ}\text{F}$)
- Intentional Contamination (explain in remarks) *Please add a comment in the Remarks section to explain the cause of the contamination.*
- Unknown

6.7 Remarks

Figure 47. The Remarks section for drinking water.



The image shows a screenshot of a web form. At the top right, there is a dark blue tab labeled "Drinking Water". Below this, there is a dark blue header bar with the word "Remarks" in white text. The main area of the form is a large, empty white rectangle, intended for users to enter their remarks.

Please comment on important elements or results of the outbreak investigation that were not captured by the questions in the electronic form.

7 WNID/WUI

7.1 Intent for Use

Figure 48. The Intent for Use section for water not intended for drinking or water of unknown intent (WNID/WUI).

| WNID/WUI |
|--|
| Water Not Intended for Drinking or Water of Unknown Intent (WNID/WUI) |
| Intent for Use |
| <p>What was the intended use for the implicated water? <i>(check all that apply)</i></p> <p><input type="checkbox"/> Cooling/Air Conditioning (e.g., cooling tower, swamp cooler)</p> <p><input type="checkbox"/> Mister (e.g., produce in grocery store, public cooling system)</p> <p><input type="checkbox"/> Ornamental (e.g., a decorative non-interactive fountain intended for public display and not designed for swimming or recreational use)</p> <p><input type="checkbox"/> Industrial/Occupational (e.g., steam cleaner)</p> <p><input type="checkbox"/> Agricultural Irrigation</p> <p><input type="checkbox"/> Waste water</p> <p><input type="checkbox"/> Other (specify): _____</p> <p><input type="checkbox"/> Unknown</p> |

What was the intended use for the implicated water?- Select an option from the list to describe the intended use of the water that led to the waterborne outbreak or illness, if known. Water that is not intended for drinking or recreational purposes often involves cooling processes/air conditioning, industrial processes, agricultural processes, waste water, occupational settings, and decorative or display settings.

7.2 Water Description

Figure 49. The Water Description section for WNID/WUI.

| Water Description | | | |
|--|--|---|---|
| Water Type <i>(e.g., cooling tower; drainage ditch; fountain- ornamental)</i> | Setting of Exposure <i>(e.g., airport; hospital/health care facility; nursing home; park- state park)</i> | USUAL Water Treatment Provided <i>(e.g., no treatment; disinfection; settling/sedimentation)</i> | Water Treatment Subtype <i>(disinfection or filtration: e.g., boiling; chlorine; rapid sand filter; reverse osmosis)</i> |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Water Description Table

This table allows the user to describe one or more water vehicles that were associated with the outbreak. Refer to **Appendix J** for standard lists of values for the following fields.

- **Water Type-** The water type is further detailed in the water subtype and setting of exposure columns.
- **Setting of Exposure-** Enter descriptors that explain where the exposure to water occurred. Note that some settings are combined, such as hotel/motel/lodge/inn,

- **USUAL Water Treatment Provided-** Enter information about the usual water treatments provided, regardless of whether or not these treatments were operating correctly at or just prior to the time of the outbreak.
- **Water Treatment Subtype-** Complete this section to provide more information about the disinfection or filtration method used to treat the water.
- **Water Treatment Subtype-** This section provides subtypes for disinfection and filtration treatments.

7.3 Laboratory Section

Figure 50. The beginning of the Laboratory section and the Water Quality Results table.

| Laboratory Section | | | | | |
|---|---------------|----------|----------|----------|----------|
| Was the implicated water tested? <input type="checkbox"/> Yes (specify in table below) <input type="checkbox"/> No <input type="checkbox"/> Unknown | | | | | |
| Results | | | | | |
| Sample | 1 | 2 | 3 | 4 | 5 |
| Source of Sample | | | | | |
| Additional Description of Source of Sample <i>(e.g., stream not intended for drinking, main A/C unit)</i> | | | | | |
| Date <i>(mm/dd/yyyy)</i> | | | | | |
| Volume Tested | Number | | | | |
| | Unit | | | | |
| Temperature | Number | | | | |
| | Unit | | | | |
| Residual/Free Disinfectant Level <i>(if total and combined disinfectant levels given, total - combined = free)</i> | Number | | | | |
| | Unit | | | | |
| Turbidity (NTU) | | | | | |
| pH | | | | | |

This section collects information about water samples. These data provide evidence regarding water quality, as well as the presence of specific pathogens in the water associated with the outbreak.

Was the implicated water tested?- Respond to this section to indicate whether or not water was tested.

Water Quality Results Table

- **Sample** - This number allows you to associate your water sample with results in the following Microbiology table.
- **Source of Sample-** Enter the source of the water sample.
- **Additional Description of Source of Sample-** Provide additional information that will help to explain the source of the sample. For example, one sample might be “stream by hiking trail” while another might be “main A/C unit.”
- **Date-** This is the date that the sample was collected.
- **Volume Tested (Number, Unit)-** Complete this section if a specific amount of water was collected for testing.
- **Temperature (Number, Unit)-** Complete this section if a temperature was recorded for the water sample.
- **Residual/Free Disinfectant Level (Number, Unit)-** Complete this section if a residual or free disinfectant level was recorded for the water sample. This field refers to the level of disinfectant that has not reacted with other compounds in the water and is still available to effectively inactivate microorganisms in the water. If only the total disinfectant level and the combined disinfectant level are known: (Residual or Free)=Total-Combined.
- **Turbidity (NTU)-** Complete this field if turbidity was recorded for the water sample. Turbidity describes the amount of suspended matter in the sample.
- **pH-** Complete this field if a pH level was recorded for the water sample.

7.4 Water Quality Indicator

Figure 51. The Water Quality Indicator section for WNID/WUI.

| Water Quality Indicator | | | |
|-------------------------|------------------------------|------------------------|------------------|
| Sample Number | Type (e.g., fecal coliforms) | Concentration (number) | Unit (e.g., CFU) |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Water Quality Indicator Results Table

Water quality data may be helpful when an investigator is trying to determine the source of an outbreak. For example, if a laboratory did not find *Giardia* spp. in a water sample from a stream by a hiking trail (e.g., water not intended for drinking), fecal coliform levels above EPA standards would provide environmental evidence to support the argument that the stream was the source of the outbreak.

- **Sample Number-** Enter the sample number that corresponds to the appropriate sample from the Water Quality Results Table.
- **Type-** Enter the type of water quality indicator for which the water was tested. If more than one water quality indicator was tested, enter a separate row for each line of data. Total coliforms and fecal coliforms are both examples of water quality indicators.
- **Concentration-** The concentration is a count of microorganisms or chemical particles. The units for the concentration are entered in the next field. For example, if 250 colony forming units (CFU) of fecal coliforms were measured, the concentration would be 250.
- **Unit-** The unit refers to the amount of the microorganism or chemical that was measured by the laboratory (e.g. oocysts/L; mg/L, parts per million [ppm], CFU, most probable number [MPN]).

7.5 Microbiology or Chemical/Toxin Analysis

Figure 52. The Microbiology or Chemical/Toxin Analysis section for WNID/WUI.

| WNID/WUI | | | | | |
|--|------------------------------|------------------------|------------------------------|-------------------|---|
| Microbiology or Chemical/Toxin Analysis (refer to the laboratory findings from the outbreak investigation) | | | | | |
| Sample Number | Genus/ Chemical/ Toxin | Species | Serotype/ Serogroup/ Serovar | Genotype/ Subtype | PFGE Pattern |
| | | | | | |
| | | | | | |
| | | | | | |
| Sample Number | Test Results Positive? | Concentration (number) | Unit (e.g., oocysts, CFU) | Test Type* | Test Method (reference: National Environmental Methods Index: http://www.nemi.gov) |
| | <input type="checkbox"/> yes | | | | |
| | <input type="checkbox"/> yes | | | | |
| | <input type="checkbox"/> yes | | | | |
| | <input type="checkbox"/> yes | | | | |

* Test Type: 1-Culture, 2-DNA or RNA Amplification/Detection (e.g., PCR, RT-PCR), 3-Microscopy (e.g., fluorescent, EM), 4-Serological/Immunological Test (e.g., EIA, ELISA), 5-Phage Typing, 6-Chemical Testing, 7-Tissue Culture Infectivity Assay

Microbiology or Chemical/Toxin Analysis Results Table

Refer to the laboratory report and final outbreak report for information. Please report positive findings and negative findings (if a test for a specific pathogen returned null findings). Some of the information may be absent from the report, depending on the testing that was performed (e.g., although a species may have been identified, it may not have been genotyped). If tests were performed to determine the species and/or subtype a particular microorganism from a water sample, please report the results for the total set of specimens, as well as the subset (e.g., If a sample tested positive for *Cryptosporidium* oocysts, enter the results, along with the concentration, if available. Then enter a separate row of data to report the species, if known.)

- **Sample Number-** Enter the sample number that corresponds to the appropriate sample from the Water Quality Results Table.
- **Genus/Chemical/Toxin-** This field provides the broadest description of the pathogen or agent for which the clinical specimen tested negative or positive. Enter this information based on the laboratory report data. Refer to the first column in **Appendix E**. If the appropriate genus, chemical or toxin is not on the list, please write it in the Genus/Chemical/Toxin field.
- **Species-** This field is for known species of each genus of bacteria, parasite or virus. Enter a new value if the species was identified but is missing from the pick list. Find the appropriate genus in **Appendix E** and refer to the second column for a list of known species. If the species is not on the list, please write it in the Species field. Note that there are 6 species categorizations for *Escherichia coli*: enteroaggregative, enterohemorrhagic, enterotoxigenic, enteropathogenic, enteroinvasive, and other. These categories provide information about the type and severity of the outbreak. The table on the next page summarizes the main categories (adapted from http://www.cdc.gov/foodborneoutbreaks/guide_fd.htm).
 - Not all laboratories are able to perform the analyses necessary to categorize *E. coli*. Most commonly, state laboratories will only provide information about enterohemorrhagic *E. coli* (e.g. *E. coli* O157:H7) versus all other types of *E. coli*. Please note that CDC may be able to provide these states with additional laboratory diagnostic testing of *E. coli*.

Table 5. Descriptions of the species categorizations for *Escherichia coli*.

| <i>Escherichia coli</i> category | Laboratory Confirmation |
|--|---|
| Enteroaggregative (EAEC) | Isolation of organism of enteroaggregative serotype from a water sample. EAEC is defined by its pattern of adherence to HEp-2 cells in culture. |
| Enterohemorrhagic/Shiga-toxin-producing (<i>E. coli</i> O157:H7 and others) | Isolation of <i>E. coli</i> O157:H7 or other Shiga-like toxin-producing <i>E. coli</i> from a water sample. |
| Enterotoxigenic (ETEC) | Isolation of organism of serotype, demonstrated to produce heat-stable (ST) and/or heat-labile (LT) enterotoxin, from a water sample. |
| Enteropathogenic (EPEC) | Isolation of organism of enteropathogenic serotype from a water sample |
| Enteroinvasive (EIEC) | Isolation of enteroinvasive serotype from a water sample. |
| Other | Other – may vary |

- **Serotype/Serogroup/Serovar-** A serotype, serogroup or serovar refers to a subtype that is determined by conducting molecular testing on surface antigens of the microorganism (e.g. *Legionella pneumophila* s1). This approach to subtyping is more common for bacteria, fungi and viruses than parasites. This information may be available on the laboratory report. If testing is not available at the state laboratory, CDC may be able to provide laboratory testing assistance. Matching serotypes/serogroups/serovars from water and biological samples provide stronger environmental evidence that the pathogens or agents responsible for the outbreak were transmitted through exposure to contaminated water. Refer to **Appendix E** for the reference list of microorganisms, chemicals and toxins.
- **Genotype/Subtype-** The genotype/subtype refers to a subtype that is determined by conducting molecular testing to describe the genetic composition of the microorganism. These methods are primarily used for subtyping parasites such as *Cryptosporidium* spp. This information may be available on the laboratory report. If testing is not available at the state laboratory, CDC may be able to provide laboratory testing assistance. Matching genotypes/subtypes from water and biological samples provide stronger environmental evidence that the pathogens or agents responsible for the outbreak were transmitted through exposure to contaminated water.
- **PFGE Pattern-** The PFGE pattern, or fingerprint, can be used to differentiate genetically similar pathogens. Matching PFGE patterns from water and biological samples are strong environmental evidence that the pathogens or agents responsible for the outbreak were transmitted through exposure to contaminated water.
- **Test Results Positive?-** A checkmark in this field indicates that the water sample tested positive for the pathogen or chemical/toxin.
- **Concentration-** The concentration is a count of microorganisms or chemical particles. The units for the concentration are entered in the next field. For example, if 5 oocysts/L of *Cryptosporidium hominis* were measured, the concentration would be 5. There will typically be a concentration for initial tests that have positive results, however, there may not always be a concentration for more complex tests that provide species or subtyping results.
- **Unit-** The unit refers to the amount of the microorganism or chemical that was measured by the laboratory (e.g. oocysts/L; mg/L, parts per million [ppm], colony forming units [CFU], most probable number [MPN]). As with concentration, there may not always be a unit to enter into this field.

** Source: 9th Edition of the Manual of Clinical Microbiology, 2007, American Society for Microbiology, Washington, DC/editor in chief, PR Murray; editors EJ Baron, JH Jorgensen, ML Landry, and MA Pfaller.

- **Test Type-** This field describes the method of testing used to identify the microorganism. If multiple methods were used, select the method that provided the most detailed information (e.g., if a microorganism was found using microscopy and then genotyped using polymerase chain reaction (PCR), select 'DNA or RNA Amplification/Detection (e.g. PCR, RT-PCR)').
- **Test Method-** This field provides information about the water testing methods that were used on the sample. Many of the method numbers refer to standard testing procedures or approved EPA methods. Refer to the National Environmental Methods Index (NEMI) at <http://www.nemi.gov> to compare and contrast methods for either microbiological testing or chemical testing. Common method numbers for this field are listed in **Appendix F** and contain the following information: method source, official method number, and method summary description.

7.6 Factors Contributing to Contamination and/or Increased Exposure to Contaminated Water

Figure 53. The Contributing Factors section for WNID/WUI.

| Factors Contributing to Contamination and/or Increased Exposure to Contaminated Water | | |
|---|---------------------------|--------------------------|
| Factors (check all that apply)* | Documented/ Observed** | Suspected** |
| Cooling tower/evaporative condenser – shutdown for >3 days without draining to waste | <input type="checkbox"/> | <input type="checkbox"/> |
| Cooling tower/evaporative condenser – lack of a maintenance program | <input type="checkbox"/> | <input type="checkbox"/> |
| Cooling tower/evaporative condenser – lack of a qualified water quality specialist | <input type="checkbox"/> | <input type="checkbox"/> |
| Cooling tower/evaporative condenser – presence of scale or corrosion | <input type="checkbox"/> | <input type="checkbox"/> |
| Cooling tower/evaporative condenser – presence of dirt, organic matter, or other debris in the cold water basin | <input type="checkbox"/> | <input type="checkbox"/> |
| Cooling tower/evaporative condenser – absence of drift eliminators | <input type="checkbox"/> | <input type="checkbox"/> |
| Cooling tower/evaporative condenser – presence of damaged drift eliminators | <input type="checkbox"/> | <input type="checkbox"/> |
| Cooling tower/evaporative condenser – history of recent repairs to the device | <input type="checkbox"/> | <input type="checkbox"/> |
| Cooling tower/evaporative condenser – siting of device near building air intakes | <input type="checkbox"/> | <input type="checkbox"/> |
| Cooling tower/evaporative condenser – siting of device near windows that can be opened | <input type="checkbox"/> | <input type="checkbox"/> |
| Cooling tower/evaporative condenser – siting of device in immediate area of kitchen exhaust fans, live plants, truck bays, or other sources of organic matter | <input type="checkbox"/> | <input type="checkbox"/> |
| Cooling tower/evaporative condenser – construction on the premises of the device within 6 months before the index case | <input type="checkbox"/> | <input type="checkbox"/> |
| Cooling tower/evaporative condenser – construction within 100 meters of the premises of the device within 6 months before the index case | <input type="checkbox"/> | <input type="checkbox"/> |
| Ornamental fountain – presence of submerged lighting | <input type="checkbox"/> | <input type="checkbox"/> |
| Ornamental fountain – lack of a written cleaning and maintenance program | <input type="checkbox"/> | <input type="checkbox"/> |
| Ornamental fountain – presence of dirt, organic matter, or other debris in the water basin | <input type="checkbox"/> | <input type="checkbox"/> |
| Broken/damaged sewer pipe | <input type="checkbox"/> | <input type="checkbox"/> |
| Recycling of water | <input type="checkbox"/> | <input type="checkbox"/> |
| Water temperature $\geq 30^{\circ}\text{C}$ ($\geq 86^{\circ}\text{F}$) | <input type="checkbox"/> | <input type="checkbox"/> |
| Other, specify: | <input type="checkbox"/> | <input type="checkbox"/> |
| Unknown | <input type="checkbox"/> | <input type="checkbox"/> |
| * Only check off what was found during investigation | | |
| ** "Documented/Observed" refers to information gathered through document reviews, direct observations, and/or interviews. "Suspected" refers to factors that probably occurred but for which no documentation (as defined previously) is available. | | |

Please select factors that were found during the investigation. Each contributing factor that is selected has two check boxes so that the user can indicate whether the factor was 'Documented/Observed' or 'Suspected.' 'Documented/Observed' refers to information gathered during document reviews, direct observations and/or interviews. 'Suspected' refers to factors that probably occurred but for which no documentation or observable evidence is available.

7.7 Remarks

Figure 54. The Remarks section for WNID/WUI.

| Remarks |
|--|
| <p>Epidemic and laboratory assistance for the investigation of a waterborne disease outbreak is available upon request by the State Health Department to the Centers for Disease Control and Prevention. Please enter this report into the National Outbreak Reporting System (NORS). State/Local investigation reports and questionnaires can also be attached to the report in the electronic system. Communications and requests for epidemic and laboratory assistance may be directed to: Waterborne Disease and Surveillance Coordinator, Division of Parasitic Diseases, National Center for Zoonotic, Vector-Borne, and Enteric Diseases, Coordinating Center for Infectious Diseases, CDC 4770 Buford Highway, NE, MS F-22, Atlanta, GA, 30341-3724 or (770) 488-7775</p> |

Please comment on important elements or results of the outbreak investigation that were not captured by the questions in the electronic form.

8 APPENDICES

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8.1 Appendix A- Foodborne and Waterborne Disease Outbreak Reporting Guidelines

Table 6. Guidelines for reporting disease outbreaks in NORS (foodborne versus waterborne).

| Source of Outbreak (suspected or known) | Reporting Guidelines for NORS |
|---|--|
| FOOD | <ul style="list-style-type: none"> • If a contaminated food goes in your mouth and makes you sick – it’s foodborne • If food is produced or prepared using contaminated water and then the contaminated food is consumed – it’s foodborne |
| WATER | <ul style="list-style-type: none"> • If contaminated water goes in your mouth or you breath it or you contact it in another way and it makes you sick – it’s waterborne |
| ICE | <ul style="list-style-type: none"> • If ice is made with contaminated water – it’s waterborne • 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 become ill) -- it’s waterborne • If ice is made with contaminated water and is used to cool a food product— it’s foodborne • If ice is already made and then becomes contaminated through handling – it’s foodborne • If it is unknown how the ice became contaminated – it’s foodborne |
| BEVERAGES PREPARED WITH WATER | <ul style="list-style-type: none"> • If the beverage is made with contaminated water – it’s waterborne; • If the beverage is already made and then becomes contaminated through handling – it’s foodborne • If the flavoring (e.g., frozen orange juice concentrate) is contaminated – it’s foodborne; • If it is unknown how the beverage became contaminated – it’s foodborne |
| DRINK MIX/SODA MACHINES | <ul style="list-style-type: none"> • 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) – it’s waterborne • If the drink is contaminated through handling after it is dispensed or contamination of the spout on the machine – it’s foodborne; • If the flavoring is contaminated before it is put into the machine – it’s foodborne; • If it is unknown how the beverage became contaminated – it’s foodborne |
| BOTTLED WATER | <ul style="list-style-type: none"> • If bottled water is contaminated anywhere in the chain from source water through production, storage, transportation, distribution, and point of use – it’s waterborne |
| FLAVORED DRINKS (note: flavoring does not include carbonation) | <ul style="list-style-type: none"> • If flavoring is added to bottled water and then it becomes contaminated or if the flavoring is contaminated – it’s foodborne; • If the water is contaminated before the flavoring is added – it’s waterborne; • If it is unknown how the flavored bottled water became contaminated – it’s foodborne |

8.2 Appendix B- Symptoms and Signs

Note: Additional signs or symptoms may be added to this list.

A-H

- Abdominal cramps
- Anaphylaxis
- Anorexia
- Arthralgia
- Asymptomatic
- Bloody stools
- Bradycardia
- Bronchitis/Pneumonitis
- Bullous skin lesions
- Chills
- Coma
- Conjunctivitis-allergic
- Conjunctivitis-infectious
- Conjunctivitis-other/unknown
- Cough
- Death
- Dehydration
- Descending paralysis
- Diarrhea
- Diplopia
- Dizziness
- Encephalitis
- Fainting/syncope
- Fatigue/lethargy
- Fever
- Flushing
- Folliculitis
- Headache
- Hepatitis
- HUS
- Hypotension

I-Z

- Itching
- Jaundice
- Keratitis
- Lethargy
- Malaise
- Meningitis
- Meningoencephalitis
- Myalgia
- Nausea
- Noninfectious rash
- Otitis externa (swimmer's ear)
- Otitis media
- Parasthesia
- Photophobia
- Pneumonia
- Septicemia
- Shock
- Shortness of breath
- Sinus infection
- Sore throat
- Tachycardia
- Temperature reversal
- Thrombocytopenia
- Urticaria
- Vertigo
- Vomiting
- Wheezing

8.3 Appendix C- Associated Events

Note: Additional events may be added to this list.

- Banquet
- Bar Mitzvah/Bat Mitzvah
- Class/Training
- Concert
- Convention
- Demonstration/Protest/Rally
- Fair/Festival
- Field trip
- Funeral
- Mass evacuation/Disaster
- Meeting
- Party
- Picnic
- Religious ceremony or service
- Reunion
- Rodeo
- Sporting Event/Game/Tournament
- Tour
- Wedding
- Workshop

8.4 Appendix D- Exposure (Vehicle/Setting)

Note: Additional exposures, vehicles or settings may be added to this list.

- Bulk Water Purchase
- Canal
- Commercially-Bottled Water
- Cooling Tower
- Dialysis Machine
- Drain
- Drainage Ditch
- Drink Mix/Soda Machine (dispensing or mixing fountain)
- Drinking Water Dispenser (e.g., container, bottle, pitcher, cooler)
- Evaporative Condenser/Air Conditioning Unit
- Faucet/Tap
- Filter
- Fountain - Interactive (A fountain intended for or accessible to recreational use)
- Fountain - Ornamental (A decorative non-interactive fountain intended for public display and not designed for swimming or recreational use)
- Fountain – Unknown Intent
- Hot Spring
- Lake/Reservoir/Impoundment
- Manicure Bath
- Mist/Steam - Mister
- Mist/Steam - Device Producing Mist or Steam as a Side-Effect of Use (e.g., steam cleaner) Ocean
- Pedicure Bath
- Plumbing – Home/Building
- Pond
- Pool – Waterpark
- Pool – Kiddie/Wading (private – e.g., backyard)
- Pool – Kiddie/Wading (public)
- Pool – Swimming Pool
- Pool – Water Slide
- Pool – Wave Pool
- Puddle
- River/stream
- Sediment
- Shower
- Sink
- Spa/Whirlpool/Hot Tub
- Spray Pad/Splash Pad/Wet Deck
- Spring
- Storage Tank
- Swamp
- Water Distribution System Under the Jurisdiction of a Water Utility
- Well

8.5 Appendix E Etiology List (*Clinical Specimens, Water Sample sections*)

Table 7. Etiology picklists for clinical specimen results and water sample results. Additional values may be added to each column of this table.

| Genus/Chemical/Toxin | Species | Serotype/Serogroup/Serovar |
|--------------------------------|---------------|----------------------------|
| Bacterium - unspecified | . | . |
| Chemical - unspecified | . | . |
| Parasite - unspecified | . | . |
| Virus - unspecified | . | . |
| 2,4-Dichlorophenoxyacetic Acid | . | . |
| 1,1-Dichloroethylene | . | . |
| Acanthamoeba | culbertsoni | . |
| Acanthamoeba | divionensis | . |
| Acanthamoeba | healyi | . |
| Acanthamoeba | palestinensis | . |
| Acanthamoeba | polyphaga | . |
| Acanthamoeba | castellanii | . |
| Acanthamoeba | astronyxis | . |
| Acanthamoeba | hatchetti | . |
| Acanthamoeba | rhyodes | . |
| Acanthamoeba | unknown | . |
| Acrylamide | . | . |
| Adenovirus | . | . |
| Aeromonas | hydrophilia | . |
| Aeromonas | caviae | . |
| Aeromonas | veronii | biovar sobria |
| Aeromonas | unknown | . |
| Aeromonas | other | . |
| Alachlor | . | . |
| Amnesic Shellfish Poison | . | . |
| Anasakidae | spp | . |
| Angiostrongylus | cantonensis | . |
| Angiostrongylus | costaricensis | . |
| Anisakiasis | . | . |
| Anisakis | simplex | . |
| Arcobacter | butzleri | . |
| Arsenic | . | . |
| Astrovirus | . | . |
| Atrazine | . | . |
| Bacillus | cereus | . |
| Bacillus | other | . |
| Bacillus | subtilis | . |
| Bacillus | unknown | . |
| Balamuthia | mandrillaris | . |
| Benzene | . | . |
| Blastocystis | hominis | . |
| Bromate | . | . |

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| | | |
|-------------------------|--------------|--|
| Bromine | . | . |
| Brucella | spp | . |
| Cadmium | . | . |
| Calicivirus | norovirus | Genogroup I (GI), non typeable by GI probes |
| Calicivirus | norovirus | GI / Norwalk cluster |
| Calicivirus | sapovirus | London cluster |
| Calicivirus | norovirus | Genogroup II (GII), non typeable by GII probes |
| Calicivirus | norovirus | GI / P1A |
| Calicivirus | norovirus | GI / undefined cluster by sequence |
| Calicivirus | norovirus | GIV |
| Calicivirus | norovirus | Unspecified |
| Campylobacter | unknown | . |
| Campylobacter | coli | . |
| Campylobacter | fetus | . |
| Campylobacter | lari | . |
| Campylobacter | jejuni | . |
| Campylobacter | other | . |
| Chloramines | . | . |
| Chlordane | . | . |
| Chlorine | . | . |
| Chlorine Dioxide | . | . |
| Chlorine Gas | . | . |
| Chlorite | . | . |
| Chromium | . | . |
| Ciguatoxin | . | . |
| Cleaning Agents | . | . |
| Clostridium | botulinum | . |
| Clostridium | other | . |
| Clostridium | perfringens | . |
| Clostridium | unknown | . |
| Copper | . | . |
| Cryptosporidium | hominis | . |
| Cryptosporidium | parvum | . |
| Cryptosporidium | spp | . |
| Cyclospora | cayatenensis | . |
| Dientamoeba | fragilis | . |
| Diphyllobothrium | latum | . |
| Endolimax | nana | . |
| Entamoeba | coli | . |
| Entamoeba | dispar | . |
| Entamoeba | gingivalis | . |
| Entamoeba | histolytica | . |
| Enterobacter | other | . |
| Enterobacter | cloacae | . |
| Enterobacter | unknown | . |
| Enterococcus | faecium | . |

| | | |
|----------------------------------|--------------------------|-----------------|
| Enterococcus | faecalis | . |
| Enterococcus | other | . |
| Enterococcus | unknown | . |
| Enterovirus | spp. | . |
| Enterovirus | Coxsackievirus A | serotypes 1-24 |
| Enterovirus | Coxsackievirus B | serotypes 1-6 |
| Enterovirus | Echovirus | serotypes 1-34 |
| Enterovirus | Enterovirus | serotypes 68-72 |
| Enterovirus | unknown | . |
| Enterovirus | other | . |
| Escherichia | coli., Enteroaggregative | O127 |
| Escherichia | coli., Enteroaggregative | O7 |
| Escherichia | coli., Enteroaggregative | Unspecified |
| Escherichia | coli., Enterohemorrhagic | O172 |
| Escherichia | coli., Enterohemorrhagic | O2 |
| Escherichia | coli., Enterohemorrhagic | Unspecified |
| Escherichia | coli., Enteroinvasive | O167 |
| Escherichia | coli., Enteroinvasive | O28 |
| Escherichia | coli., Enteroinvasive | Unspecified |
| Escherichia | coli., Enteropathogenic | O158 |
| Escherichia | coli., Enteropathogenic | O18 |
| Escherichia | coli., Enteropathogenic | Unspecified |
| Escherichia | coli., Enterotoxigenic | O173 |
| Escherichia | coli., Enterotoxigenic | O6 |
| Escherichia | coli., Enterotoxigenic | Unspecified |
| Escherichia | coli., Other | . |
| Ethylene Glycol | . | . |
| Fluoride | . | . |
| Gasoline and Gasoline Byproducts | . | . |
| Giardia | intestinalis | . |
| Haloacetic Acids | . | . |
| Heavy metals | . | . |
| Helicobacter | canadensis | . |
| Helicobacter | pylori | . |
| Hepatitis | A | . |
| Hepatitis | E | . |
| Heptachlor | . | . |
| Histamine | . | . |
| Hydrochloric (Muriatic) Acid | . | . |
| Iodamoeba | butschlii | . |
| Isospora | belli | . |
| Lead | . | . |
| Legionella | anisa | . |
| Legionella | benidorm | . |
| Legionella | birminghamensis | . |
| Legionella | bozemanii | serogroup 1 |
| Legionella | bozemanii | serogroup 2 |
| Legionella | bozemanii | Unspecified |
| Legionella | cincinnatiensis | . |

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| | | |
|------------|---------------|--------------|
| Legionella | denver | . |
| Legionella | dumoffii | . |
| Legionella | erythra | . |
| Legionella | feeleii | serogroup 1 |
| Legionella | feeleii | serogroup 2 |
| Legionella | feeleii | Unspecified |
| Legionella | gormanii | . |
| Legionella | hackeliae | serogroup 1 |
| Legionella | hackeliae | serogroup 2 |
| Legionella | hackeliae | Unspecified |
| Legionella | jordanis | . |
| Legionella | lansingensis | . |
| Legionella | longbeachae | serogroup 1 |
| Legionella | longbeachae | serogroup 2 |
| Legionella | longbeachae | Unspecified |
| Legionella | maceachernii | . |
| Legionella | micdadei | . |
| Legionella | oakridgensis | . |
| Legionella | parisiensis | . |
| Legionella | pneumophila | serogroups 1 |
| Legionella | pneumophila | serogroup 2 |
| Legionella | pneumophila | serogroup 3 |
| Legionella | pneumophila | serogroup 4 |
| Legionella | pneumophila | serogroup 5 |
| Legionella | pneumophila | serogroup 6 |
| Legionella | pneumophila | serogroup 7 |
| Legionella | pneumophila | serogroup 8 |
| Legionella | pneumophila | serogroup 9 |
| Legionella | pneumophila | serogroup 10 |
| Legionella | pneumophila | serogroup 11 |
| Legionella | pneumophila | serogroup 12 |
| Legionella | pneumophila | serogroup 13 |
| Legionella | pneumophila | serogroup 14 |
| Legionella | pneumophila | serogroup 15 |
| Legionella | pneumophila | Unspecified |
| Legionella | sainthelensi | serogroup 1 |
| Legionella | sainthelensi | serogroup 2 |
| Legionella | sainthelensi | Unspecified |
| Legionella | tucsonensis | . |
| Legionella | wadsworthii | . |
| Legionella | unknown | . |
| Legionella | other | . |
| Leptospira | interrogans | . |
| Leptospira | borgpeterseni | . |
| Leptospira | inadai | . |
| Leptospira | noguchii | . |
| Leptospira | santarosai | . |
| Leptospira | weillii | . |
| Leptospira | kirschneri | . |
| Listeria | monocytogenes | . |
| Listeria | unknown | . |
| Listeria | other | . |
| Mercury | . | . |

| | | |
|--|---------------------------|---|
| Microcoleus | lyngbyei (chthonoplastes) | . |
| Microcystin toxin (blue-green algae) | . | . |
| Microsporidium | spp. | . |
| Microsporidium | africanum | . |
| Microsporidium | ceylonensis | . |
| Enterocytozoon | bieneusi | . |
| Encephalitozoon | intestinalis | . |
| Encephalitozoon | cuniculi | . |
| Encephalitozoon | hellem | . |
| Brachiola | algerae | . |
| Brachiola | connori | . |
| Brachiola | vesicularum | . |
| Nosema | ocularum | . |
| Nosema-like microsporidian | . | . |
| Pleistophora | ronneafiei | . |
| Trachipleistophora | anthropophthera | . |
| Trachipleistophora | hominis | . |
| Vittaforma | corneae | . |
| Vittaforma-like microsporidian | . | . |
| Monosodium glutamate (MSG) | . | . |
| Mushroom toxins | . | . |
| Mycobacterium | avium complex | . |
| Mycobacterium | avium | . |
| Mycobacterium | intracellulare | . |
| Mycobacterium | paratuberculosis | . |
| Mycobacterium | abscessus | . |
| Mycobacterium | mucogenicum | . |
| Mycobacterium | fortuitum | . |
| Mycobacterium | spp. | . |
| Mycobacterium | unknown | . |
| Mycotoxins | . | . |
| Naegleria | australiensis | . |
| Naegleria | fowleri | . |
| Naegleria | gruberi | . |
| Naegleria | italica | . |
| Brevetoxin (Neurotoxic Shellfish Poison) | . | . |
| Nitrate | . | . |
| Nitrite | . | . |
| Other | . | . |
| Other bacterial | . | . |
| Other byproducts of disinfection | . | . |
| Other chemical | . | . |
| Other etiology | . | . |
| Other natural toxins | . | . |
| Other parasitic | . | . |
| Other viral | . | . |
| Saxitoxin (Paralytic Shellfish Poison) | . | . |
| Pesticides | . | . |
| Pharmaceuticals | . | . |
| Plant toxins (Herbal toxins) | . | . |
| Plesiomonas | shigelloides | . |
| Polychlorinated Biphenyls | . | . |
| Proteus | mirabilis | . |

| | | |
|--------------------------|--------------------|------------------------|
| Proteus | other | . |
| Proteus | unknown | . |
| Pseudomonas | aeruginosa | . |
| Pseudoterranova | decipens | . |
| Puffer fish tetrodotoxin | . | . |
| Reovirus | . | . |
| Rotavirus | . | . |
| Salmonella | unknown | . |
| Salmonella | enterica | Aarhus |
| Salmonella | enterica | Unspecified |
| Salmonella | enterica | Zwickau |
| Salmonella | other | . |
| Scombroid toxin | . | . |
| Selenium | . | . |
| Shigella | boydii | serotype 1 |
| Shigella | dysenteriae | serotype 16 |
| Shigella | flexneri | serotype 1 unspecified |
| Shigella | unknown | . |
| Shigella | boydii | serotype 19 |
| Shigella | dysenteriae | serotype 1 |
| Shigella | dysenteriae | Unspecified |
| Shigella | flexneri | serotype Variant X |
| Shigella | flexneri | serotype Variant Y |
| Shigella | flexneri | Unspecified |
| Shigella | other | . |
| Shigella | sonnei | . |
| Sodium Hydroxide | . | . |
| Staphylococcus | aureus | MRSA |
| Staphylococcus | aureus | Other (instead of .) |
| Staphylococcus | other | . |
| Staphylococcus | unknown | . |
| Streptococcus | Group A | . |
| Streptococcus | Group B, C or G | . |
| Streptococcus | other | . |
| Streptococcus | unknown | . |
| Toxaphene | . | . |
| Toxoplasma | gondii | . |
| Trichinella | spiralis | . |
| Trichinella | spp | . |
| Trichloroethylene | . | . |
| Trihalomethanes | . | . |
| Vibrio | vulnificus | . |
| Vibrio | cholerae | O1 |
| Vibrio | cholerae | Other |
| Vibrio | other | . |
| Vibrio | parahaemolyticus | Other |
| Vibrio | unknown | . |
| Vinyl Chloride | . | . |
| Uranium | . | . |
| Yersinia | enterocolitica | . |
| Yersinia | other | . |
| Yersinia | pseudotuberculosis | . |
| Yersinia | unknown | . |

8.6 Appendix F- Test Method

Note: Additional values may be added by contacting NORSadmin@cdc.gov

- ASTM D1067-Alkalinity or acidity in water
- ASTM D1125-Electrical conductivity and resistivity (field, routine lab- static samples)
- ASTM D1179-Fluoride (ion selective electrode)
- ASTM D1292-Odor in water
- ASTM D1293-pH (routine/continuous measurement)
- ASTM D1688-Copper (atomic absorption, direct)
- ASTM D1688-Copper (atomic absorption, graphite furnace)
- ASTM D2036-Cyanides
- ASTM D2972-Arsenic (atomic absorption, graphite furnace)
- ASTM D2972-Arsenic (atomic absorption, hydride generation)
- ASTM D3223-Mercury, total (analytical procedure)
- ASTM D3559-Lead (atomic absorption, graphite furnace)
- ASTM D3645-Beryllium (atomic absorption, graphite furnace)
- ASTM D3697-Antimony (AAS)
- ASTM D3859-Selenium (gaseous hydride AAS)
- ASTM D3859-Selenium (graphite furnace AAS)
- ASTM D3867-Nitrite, Nitrate (automated cadmium reduction)
- ASTM D3867-Nitrite, Nitrate (manual cadmium reduction)
- ASTM D4327-Anions (ion chromatography)
- ASTM D511-Calcium, magnesium (AAS)
- ASTM D511-Calcium, magnesium (complexometric titration)
- ASTM D516-Sulfate (turbidimetry)
- ASTM D5317-Chlor. organic acids (GC, electron capture device)
- ASTM D859-Silica (colorimetric)
- EPA 100.1-Asbestos (TEM)
- EPA 100.2-Asbestos (TEM)
- EPA 110.1-Color (spectrophotometry)
- EPA 110.2-Color (spectrophotometry)
- EPA 110.3-Color (spectrophotometry)
- EPA 1103.1(modified)-E. coli (membrane filtration plating, modified mTEC agar)
- EPA 150.1-pH (electrometric method)
- EPA 150.2-pH
- EPA 1600-Enterococci (membrane filtration, mEI agar)
- EPA 1604-Total coliforms, E. coli, drinking water (membrane filtration)
- EPA 1605-Aeromonas, finished water (membrane filtration)
- EPA 1613-Dioxins, furans (HRGC/HRMS)
- EPA 1622 Geno-Test method 1622 + genotyping
- EPA 1622-Cryptosporidium (filtration/IMS/FA microscopy)
- EPA 1623 Geno-Test method 1623+genotyping
- EPA 1623-Cryptosporidium, Giardia (filtration/IMS/FA microscopy)
- EPA 200.7-Metals (ICP-AES)
- EPA 200.8-Metals (ICP/MS)
- EPA 200.9-Trace elements (GFAA)
- EPA 245.1-Mercury (CVAA)
- EPA 245.2-Mercury (CVAA, automated)
- EPA 300.0-Inorganic anions (ion chromatography)
- EPA 300.1-Anions (IC)

- EPA 335.4-Cyanide, total (colorimetry)
- EPA 350.1-Ammonia (colorimetry, automated)
- EPA 353.2-Nitrate-Nitrite Nitrogen (colorimetry)
- EPA 365.1-Phosphorus, all forms (semi-automated colorimetry)
- EPA 375.2-Sulfate (colorimetry)
- EPA 413.1-Oil, Grease (extraction and gravimetry)
- EPA 418.1-Petroleum hydrocarbons, total recoverable (extraction, adsorption, I-R)
- EPA 502.2-VOCs (GC/PID/ELCD)
- EPA 504.1-EDB, DCBP, 123TCP (GCECD)
- EPA 505-Pesticides, PCBs (GC-ECD)
- EPA 506-Phthalate, adipate esters (GCPID)
- EPA 507-Pesticides (GCNPD)
- EPA 508.1-Chlor. pesticides, herbicides, organohalides (GCECD)
- EPA 508A-PCBs (GCECD)
- EPA 508-Chlor. pesticides (GCECD)
- EPA 515.1-Chlor. acids (GC/ECD)
- EPA 515.2-Chlor. acids (GCECD)
- EPA 515.3-Chlor. acids (GC/ECD)
- EPA 524.3-VOCs (GCMS)
- EPA 525.2-Organics (GCMS)
- EPA 531.1-Carbamates (HPLC, post-column deriv.)
- EPA 547-Glyphosphate (HPLC, post-column deriv.)
- EPA 548.1-Endothall by FID (GCMS)
- EPA 548.1-Endothall by MS (GCMS)
- EPA 549.2-Diquat, Paraquat (HPLC/UV)
- EPA 550.1-PAHs (HPLC/UV/FL)
- EPA 550-PAHs (HPLC/UV/FL)
- EPA 551.1-Chlor. compounds (GC-ECD)
- EPA 552.1-Haloacetic acid, dalapon (GCECD)
- EPA 552.2-Haloacetic acid, dalapon (GCECD)
- EPA 555-Chlor. acids (HPLC/UV)
- EPA 600/4-84-013-USEPA Manual of Methods for Virology
- EPA 601-Gas chromatography (electrolytic conductivity detection)
- Hach 10029-E. coli (m-ColiBlue24 broth, membrane filtration)
- SM 2120-Color (visual comparison)
- SM 2150-Odor (threshold odor test)
- SM 2320-Alkalinity (titration)
- SM 2510-Conductivity (lab method)
- SM 2540-Solids (total dissolved solids, 180° C)
- SM 2550-Temperature (laboratory and field)
- SM 3111-Metals (FLAA)
- SM 3112-Metals (cold-vapor AAS)
- SM 3113-Metals (GFAA)
- SM 3114-Arsenic, selenium (hydride generation/AAS)
- SM 3120-Metals (ICP)
- SM 3500-Ca-Calcium (EDTA, titrimetric)
- SM 3500-Mg-Magnesium (calculation)
- SM 4110-Anions (ion chromatography)
- SM 4110-Fluoride (SM 4110 with modifications)
- SM 4500-Cl⁻-Chloride (potentiometric)
- SM 4500-ClO₂-Chlorine dioxide (amperometric, method I)
- SM 4500-CN-Cyanide (amenable to chlor.)
- SM 4500-CN-Cyanide (ion selective electrode)

- SM 4500-CN-Cyanide in distillate (colorimetric)
- SM 4500-CN-Cyanide, total (after distillation)
- SM 4500-F⁻-Fluoride (complexone)
- SM 4500-F⁻-Fluoride (ion-selective electrode)
- SM 4500-F⁻-Fluoride (prelim. distillation)
- SM 4500-F⁻-Fluoride (SPADNS)
- SM 4500-H+B-pH (potentiometry)
- SM 4500-NO₂-Nitrite (colorimetry)
- SM 4500-NO₃-Nitrate (after cadmium reduction)
- SM 4500-NO₃-Nitrate (automated cadmium reduction)
- SM 4500-NO₃-Nitrate (nitrate electrode)
- SM 4500-P-Phosphorus (ascorbic acid)
- SM 4500-P-Phosphorus (automated ascorbic acid reduction)
- SM 4500-SiO₂-Silica (automated method for molybdate-reactive silica)
- SM 4500-SiO₂-Silica (heteropoly blue)
- SM 4500-SiO₂-Silica (molybdosilicate)
- SM 4500-SO₄²⁻-Sulfate (automated methylthymol blue)
- SM 4500-SO₄²⁻-Sulfate (gravimetric, drying of residue)
- SM 4500-SO₄²⁻-Sulfate (gravimetric, ignition of residue)
- SM 4500-SO₄²⁻-Sulfate (turbidimetric)
- SM 5540-Surfactants (anionic surfactants as MBAS)
- SM 6610-Carbamate pesticides (HPLC)
- SM 6651-Glyphosphate herbicide (liquid chrom. post-column fluor.)
- SM 9222-Coliforms, total (membrane filtration)
- SM 9222-E. coli (membrane filtration, MUG-fluorescent detection)
- SM 9222-Fecal coliforms (membrane filtration)
- SM 9260-Pathogenic bacteria, *Aeromonas*
- SM 9260-Pathogenic bacteria, *Campylobacter jejuni*
- SM 9260-Pathogenic bacteria, *E. coli* O157:H7
- SM 9260-Pathogenic bacteria, *Legionella*
- SM 9260-Pathogenic bacteria, *Leptospira*
- SM 9260-Pathogenic bacteria, *Mycobacterium*
- SM 9260-Pathogenic bacteria, *Salmonella* (general qualitative isolation, identification)
- SM 9260-Pathogenic bacteria, *Salmonella* (immunofluorescence identification)
- SM 9260-Pathogenic bacteria, *Salmonella* (quantitative procedures)
- SM 9260-Pathogenic bacteria, *Shigella*
- SM 9260-Pathogenic bacteria, *Vibrio cholerae*
- SM 9260-Pathogenic bacteria, *Yersinia enterocolitica*
- USGS I-1250-85-Color (visual comparison)
- USGS-NWQL I-1030-85-Alkalinity (electrometric titration)
- USGS-NWQL I-1700-85-Silica, dissolved (colorimetric, molybdate blue)
- USGS-NWQL I-2601-90-Phosphorus, orthophosphate (colorimetry)
- USGS-NWQL I-2700-85- Silica (colorimetric, dissolved)
- USGS-NWQL I-3300-85-Cyanide, total (colorimetric, pyridine-pyrazolone)
- USGS-NWQL I-3720-85-Silver (AAS, chelation-extraction)

8.7 Appendix G- Treated Recreational Water: Vehicle Description Table

Note: If additional values may be added to a list, this information is indicated at the top of the list.

Water Type- Additional water types may be added to this list.

- Fountain - Interactive (A fountain intended for or accessible to recreational use). Also known as a Spray Pad/Splash Pad/Wet Deck
- Pool – Waterpark
- Pool – Kiddie/Wading (private – e.g., backyard)
- Pool – Kiddie/Wading (public)
- Pool – Swimming Pool
- Pool – Water Slide
- Pool – Wave Pool
- Spa/Whirlpool/Hot Tub
- Unknown

Water Subtype

- Indoor
- Outdoor
- Unknown

Setting of Exposure- Additional settings may be added to this list.

- Airport
- Apartment/Condominium
- Beach – Private
- Beach – Public
- Beach - Nonspecific
- Camp/Cabin/Recreational Area
- Child Care/Daycare Center
- Church
- Club (Requiring Membership)
- Community/Municipality
- Factory/Industrial Facility
- Farm/Rural/Agricultural Setting
- Hall/Meeting Facility
- Hospital/Health Care Facility/Nursing Home
- Hotel/Motel/Lodge/Inn
- Manicure Bath
- Military Facility
- Native American Reservation
- Office
- Park – Amusement
- Park - Community/Municipal
- Park – Forestry Service
- Park - State Park
- Park - National Park
- Park – Waterpark
- Park – Nonspecific
- Pedicure Bath
- Prison/Jail/Incarceration Facility (Juvenile/Adult)
- Private Residence
- Public Outdoor Area
- Resort
- Restaurant/Cafeteria
- School/College/University
- Ship/Boat – Cruise
- Ship/Boat – Other - Unspecified
- Store
- Subdivision/Neighborhood
- Temporary Event - Festival/Fair
- Temporary Event - Other – Unspecified
- Trailer Park
- Zoo
- Unknown

USUAL Water Treatment Provided at Venue- Additional water treatments may be added to this list.

- No Treatment
- Coagulation
- Flocculation
- Disinfection
- Filtration at Pool
- Unknown

Venue Treatment Subtype- Additional water treatment subtypes may be added to these lists.

Disinfection:

- Chlorine
- Chlorine Dioxide
- Biguanide
- Bromine
- Copper-Silver Ionization Unit
- Hydrogen Peroxide
- Ozone
- Povidine
- Ultraviolet (U.V.)
- Unknown

Filtration at Pool:

- Bag Filter
- Cartridge Filter
- Sand Filter
- Diatomaceous Earth
- Unknown

Chlorination Subtype- Additional chlorination subtypes may be added to this list.

- Gaseous
- Sodium hypochlorite
- Calcium hypochlorite
- Stabilized chlorine/cyanurates
- Onsite chlorine generator (e.g., sodium chloride, MIOX)
- Unknown

Fill Water Type- Additional fill water types may be added to this list.

- Mineral/Hot Spring Water
- Public Water Supply
- Sea Water
- Untreated Ground Water (e.g., well, spring)
- Untreated Surface Water (e.g., lake water, river water)
- Unknown

IF PUBLIC WATER WAS USED TO FILL, USUAL Water Treatment Provided for Fill Water Before Coming to the Venue- Additional water treatments may be added to this list.

- No Treatment
- Coagulation
- Flocculation
- Disinfection
- Distillation
- Filtration at Treatment Plant (do not include home filters)
- Settling (Sedimentation)
- Softening
- Other Chemical Addition (e.g., fluoride, oxidation, metals removal, corrosion control)
- Unknown

IF PUBLIC WATER WAS USED TO FILL, Fill Water Treatment Subtype- Additional water treatment subtypes may be added to these lists.

Disinfection:

- Boiling/Heating/Pasteurization
- Chlorine
- Chloramine (Chlorine and Ammonia)
- Chlorine Dioxide
- Copper-Silver Ionization Unit
- Cyanurates/Stabilized Chlorine
- Ozone
- Ultraviolet (U.V.)
- Unknown

Filtration:

- Activated Carbon
- Reverse Osmosis
- Bag Filter
- Cartridge Filter
- Rapid Sand
- Slow Sand
- Diatomaceous Earth
- Unknown

8.8 Appendix H- Untreated Recreational Water: Vehicle Description Table

Note: If additional values may be added to a list, this information is indicated at the top of the list.

Water Type- Additional water types may be added to this list.

- Canal
- Hot Spring
- Lake/Reservoir/Impoundment
- Ocean
- Pond
- Puddle
- River/Stream
- Spring
- Swamp
- Unknown

IF SPRING OR HOT SPRING, Water Subtype

- Indoor
- Outdoor
- Unknown

Setting of Exposure- Additional settings may be added to this list.

- Airport
- Apartment/Condominium
- Beach – Private
- Beach – Public
- Beach - Nonspecific
- Camp/Cabin/Recreational Area
- Child Care/Daycare Center
- Church
- Club (Requiring Membership)
- Community/Municipality
- Factory/Industrial Facility
- Farm/Rural/Agricultural Setting
- Hall/Meeting Facility
- Hospital/Health Care Facility/Nursing Home
- Hotel/Motel/Lodge/Inn
- Manicure Bath
- Military Facility
- Native American Reservation
- Office
- Park – Amusement
- Park - Community/Municipal
- Park – Forestry Service
- Park - State Park
- Park - National Park
- Park – Waterpark
- Park – Nonspecific
- Pedicure Bath
- Prison/Jail/Incarceration Facility (Juvenile/Adult)
- Private Residence
- Public Outdoor Area
- Resort
- Restaurant/Cafeteria
- School/College/University
- Ship/Boat – Cruise
- Ship/Boat – Other - Unspecified
- Store
- Subdivision/Neighborhood
- Temporary Event - Festival/Fair
- Temporary Event - Other – Unspecified
- Trailer Park
- Zoo
- Unknown

8.9 Appendix I- Drinking Water: Vehicle Description Table

Note: If additional values may be added to a list, this information is indicated at the top of the list.

Water Type

- Commercially-Bottled Water
- Bulk Water Purchase
- Community Water System
- Nontransient Noncommunity Water System
- Transient Noncommunity Water System
- Individual/Private Water System
- Unknown

Water Source (Source of untreated or raw water used to produce drinking water)

- Ground Water
- Surface Water
- Unknown

Water Source Description

Ground Water

- Spring
- Well (Drilled)
- Well (Dug)
- Well (Bored)
- Well- unknown

Surface Water

- Lake/Reservoir/Impoundment
- Pond
- Puddle/Canal/Swamp
- River/Stream
- Unknown

Setting of Exposure- Additional settings may be added to this list.

- Airport
- Apartment/Condominium
- Beach – Private
- Beach - Public
- Beach – Nonspecific
- Bus Station
- Camp/Cabin/Recreational Area
- Child Care/Daycare Center
- Church/Other Place of Worship
- Club (Requiring Membership)
- Community/Municipality
- Factory/Industrial Facility
- Farm/Rural/Agricultural Setting
- Hall/Meeting Facility
- Hospital/Health Care Facility/Nursing Home
- Hotel/Motel/Lodge/Inn
- Indoor Place of Work/ Office
- Native American Reservation
- Military Facility
- Mobile Home Park
- Outdoor Place of Work
- Park – Amusement
- Park - Community/Municipal
- Park – Forestry Service
- Park - State Park
- Park - National Park
- Park – Waterpark
- Park – Nonspecific
- Prison/Jail/Incarceration Facility (Juvenile/Adult)
- Private Residence
- Public Outdoor Area
- Resort
- Restaurant/Cafeteria
- School/College/University
- Ship/Boat – Cruise
- Ship/Boat - Other - Unspecified
- Store
- Subdivision/Neighborhood
- Street Vendor
- Temporary Event - Festival/Fair
- Temporary Event - Other –unspecified
- Train Station
- Zoo
- Unknown

USUAL Water Treatment Provided

- No Treatment
- Aeration
- Coagulation
- Flocculation
- Disinfection
- Distillation
- Filtration at Treatment Plant (**do not** include home filters)
- Home/Point-of-Use Filtration
- Settling (Sedimentation)
- Softening
- Other Chemical Addition (e.g., fluoride, oxidation, metals removal, corrosion control)
- Unknown

Water Treatment Subtype- Additional water treatment subtypes may be added to these lists.

Disinfection:

- Boiling/Heating/Pasteurization
- Chlorine
- Chlorine Dioxide
- Chloramine (Chlorine and Ammonia)
- Copper-Silver Ionization Unit
- Cyanurates/Stabilized Chlorine
- Ozone
- U.V.
- Unknown

Filtration at Treatment Plant:

- Activated Carbon
- Bag Filter
- Cartridge Filter
- Diatomaceous Earth
- Membrane Microfiltration
- Rapid Sand
- Reverse Osmosis
- Slow Sand
- Ultrafiltration
- Unknown

Home/Point-of-Use Filtration:

- Reverse Osmosis
- Activated Carbon
- ≤ 1 micron absolute pore size
- Unknown

8.10 Appendix J- WUI/WNID: Vehicle Description Table

Note: If additional values may be added to a list, this information is indicated at the top of the list.

Water Type

- Bulk Water Purchase
- Cooling Tower
- Drainage Ditch
- Evaporative Condenser/Air Conditioning Unit
- Fountain - Ornamental (A decorative non-interactive fountain intended for public display and not designed for swimming or recreational use)
- Fountain – Unknown Intent
- Hot Spring
- Lake/Reservoir/Impoundment
- Mist/Steam - Mister
- Mist/Steam - Device Producing Mist or Steam as a Side-Effect of Use (e.g., steam cleaner)
- Ocean
- Pond
- Puddle/Canal/Swamp
- Public Drinking Water
- River/Stream
- Spring
- Treated Wastewater Effluent
- Untreated Sewage
- Well
- Unknown

Setting of Exposure- Additional settings may be added to this list.

- Airport
- Apartment/Condominium
- Beach – Private
- Beach - Public
- Beach – Nonspecific
- Bus Station
- Camp/Cabin/Recreational Area
- Child Care/Daycare Center
- Church/Other Place of Worship
- Club (Requiring Membership)
- Community/Municipality
- Factory/Industrial Facility
- Farm/Rural/Agricultural Setting
- Hall/Meeting Facility
- Hospital/Health Care Facility/Nursing Home
- Hotel/Motel/Lodge/Inn
- Indoor Place of Work/ Office
- Native American Reservation
- Military Facility
- Mobile Home Park
- Outdoor Place of Work?
- Park – Amusement
- Park - Community/Municipal
- Park – Forestry Service
- Park - State Park
- Park - National Park
- Park – Waterpark
- Park – Nonspecific
- Prison/Jail/Incarceration Facility (Juvenile/Adult)
- Private Residence
- Public Outdoor Area
- Resort
- Restaurant/Cafeteria
- School/College/University
- Ship/Boat – Cruise
- Ship/Boat - Other - Unspecified
- Store
- Subdivision/Neighborhood
- Street Vendor
- Temporary Event - Festival/Fair
- Temporary Event - Other –unspecified
- Train Station
- Zoo
- Unknown

USUAL Water Treatment Provided- Additional water treatments may be added to this list.

- No Treatment
- Coagulation
- Flocculation
- Disinfection
- Distillation
- Filtration at Treatment Plant (**do not** include home filters)
- Home/Point-of-Use Filtration
- Settling (Sedimentation)
- Softening
- Other Chemical Addition (e.g., fluoride, oxidation, metals removal, corrosion control)
- Unknown

Water Treatment Subtype- Additional water treatment subtypes may be added to these lists.

Disinfection:

- Boiling/Heating/Pasteurization
- Chlorine
- Chlorine Dioxide
- Chloramine (Chlorine and Ammonia)
- Copper-Silver Ionization Unit
- Cyanurates/Stabilized Chlorine
- Ozone
- U.V.
- Unknown

Filtration at Treatment Plant:

- Activated Carbon
- Bag Filter
- Cartridge Filter
- Diatomaceous Earth
- Membrane Microfiltration
- Rapid Sand
- Reverse Osmosis
- Slow Sand
- Ultrafiltration
- Unknown

Home/Point-of-Use Filtration:

- Reverse Osmosis
- Activated Carbon
- ≤ 1 micron absolute pore size
- Unknown

9 REFERENCES

- Centers for Disease Control and Prevention. Guide to confirming a diagnosis of a foodborne disease (accessed February 2008): http://www.cdc.gov/foodborneoutbreaks/guide_fd.htm. Also published in: Center for Disease Control and Prevention. CDC Surveillance Summaries, March 17, 2000. MMWR 2000; 49(No.SS-1) and recently updated July 27, 2006.
- Centers for Disease Control and Prevention. Enterohemorrhagic *Escherichia coli* (accessed February 2008): http://www.cdc.gov/ncidod/dbmd/diseaseinfo/enterohemecoli_t.htm
- Centers for Disease Control and Prevention. Enterotoxigenic *Escherichia coli* (ETEC) (accessed February 2008): http://www.cdc.gov/ncidod/dbmd/diseaseinfo/etec_g.htm
- Centers for Disease Control and Prevention. PulseNet website (accessed March, 2008): (main page) <http://www.cdc.gov/pulsenet> (what is PulseNet?) <http://www.cdc.gov/pulsenet/whatis.htm>
- Dzuiban, E.J., Liang, J.L., Craun, G.F., *et al.* Surveillance for waterborne disease and outbreaks associated with recreational water. United States, 2003–2004. In: *Surveillance Summaries*, December 22, 2006. MMWR 2006;55(No. SS-12):1–30.
- Griffiths, T. (2003). *The Complete swimming pool reference, second edition*. Champaign, IL: Sagamore Publishing.
- Liang J.L., Dziuban E.J., Craun G.F., *et al.* Surveillance for waterborne disease and outbreaks associated with drinking water and water not intended for drinking—United States, 2003–2004. In: *Surveillance Summaries*, December 22, 2006. MMWR 2006;55(No. SS-12):31–65.
- Nataro, J.P., Bopp, C.A., Fields, P.I., Kaper, J.B., Strockbine, N.A. (2007). Chapter 43, *Escherichia, Shigella, and Salmonella*. In PR Murray (Editor-in chief), EJ Baron, JH Jorgensen, ML Landry, and MA Pfaller (Eds.), *9th Edition of the manual of clinical microbiology* (pp. 670-687), American Society for Microbiology, Washington, DC.
- Pool operator's manual, a guide for safe and healthy operation of swimming and spa pools.* (1997). Washington State Public Health Association and Washington State Environmental Association. Brainerd, MN: Bang Printing.
- Weiss, NA. (2005). *Introductory Statistics, seventh edition*. United States: Pearson Education, Inc.
- Rothman, K.J., Greenland, S. (1998). *Modern epidemiology, second edition*. Philadelphia, PA: Lippincott-Raven Publishers.
- U.S. Environmental Protection Agency, Office of Water. Combined sewer overflows (accessed February 2008): http://cfpub.epa.gov/npdes/home.cfm?program_id=5
- U.S. Environmental Protection Agency, Office of Water. Sanitary sewer overflows (accessed February 2008): http://cfpub.epa.gov/npdes/home.cfm?program_id=4
- U.S. Environmental Protection Agency. Terms of environment: glossary, abbreviations and acronyms (accessed February, 2008): <http://www.epa.gov/OCEPAterms/aterms.html>