1. **DISEASE REPORTING**

**A. Purpose of Reporting and Surveillance**

1. To prevent further transmission from cases.
2. To identify outbreaks and potential sources of ongoing transmission.
3. To prevent further transmission from such sources.

**B. Legal Reporting Requirements**

1. Health care providers: **immediately notifiable to local health jurisdiction**.
2. Health care facilities: **immediately notifiable to local health jurisdiction**.
3. Laboratories: Shiga toxin-producing *E. coli* (enterohemorrhagic *E. coli* including, but not limited to, *E. coli* O157:H7) and Shiga-toxin positive stool assays **immediately notifiable to local health jurisdiction**; submission of stool specimen or isolate to the Washington State Department of Health (DOH) Public Health Laboratories (PHL) is required (2 business days).
4. Veterinarians: Suspected human cases **immediately notifiable to the local health jurisdiction**; animal cases may be notifiable to Washington State Department of Agriculture (see: [http://apps.leg.wa.gov/WAC/default.aspx?cite=16-70](http://apps.leg.wa.gov/WAC/default.aspx?cite=16-70)).
5. Local health jurisdictions: notifiable to DOH Office of Communicable Disease Epidemiology (CDE) within 7 days of case investigation completion or summary information required within 21 days.

**C. Local Health Jurisdiction Investigation Responsibilities**

1. Perform case investigations for all confirmed, probable and suspect cases per Section 5. Begin investigation upon receipt of case report.
2. Report all confirmed, probable and suspect cases to CDE through the Public Health Issues Management System (PHIMS) using the [DOH Shiga toxin-producing *E. coli* case report form](#).
   
   a) Report Shiga toxin-producing *E. coli* with Hemolytic Uremic Syndrome (HUS) as Shiga toxin-producing *E. coli* (STEC).
   
   b) Report post-diarrheal HUS as suspect Shiga toxin-producing *E. coli* (STEC).
   
   c) Beginning 2011, HUS without a preceding diarrheal illness is no longer reportable.
3. Assure that labs forward the first isolate from each patient to the Public Health Laboratories (PHL) for confirmation of serotype and molecular sub-typing. If a laboratory identifies Shiga toxin in a stool specimen but does not perform stool culture, assure that a stool specimen in broth be sent to PHL for culture.
2. THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agents

*E. coli* are Gram-negative bacteria classified into serotypes by antigens in their cell wall (“O”) and in their flagella (“H”); most serotypes are non-pathogenic. Enterohemorrhagic *E. coli* are now referred to as “Shiga toxin-producing *E. coli*” (STEC) or sometimes “Verotoxin- producing *E. coli*” (VTEC). In Washington the most common STEC is *E. coli* O157:H7 but other less common STEC strains can cause similar illnesses. Non-motile O157:H7 and non-O157 STEC (e.g., O126, O111, O103) are less commonly identified causes of enterohemorrhagic infection, but are increasing among reported cases as laboratory testing methods evolve. The information in these guidelines is primarily based on studies of O157:H7 infections and outbreaks.

B. Clinical Manifestations

Mild, non-bloody diarrheal illness is common and asymptomatic STEC infections occur; these clinical manifestations will be rarely diagnosed if they are not part of an outbreak. Most persons with confirmed STEC report bloody stools which typically begin 6–48 hours after the initial onset of non-bloody diarrhea. Diarrhea will likely be accompanied by abdominal pain and cramps; pain and cramps may be severe and may sometimes be the chief complaint. Nausea and vomiting are common. Fever is generally absent or low-grade in contrast to other bacterial enteric infections. Complications include thrombotic thrombocytopenic purpura (TTP) and hemolytic uremic syndrome (HUS).

HUS complicates 2–15% of diagnosed *E. coli* O157:H7 cases, depending on age, and occurs less commonly after infections due to non-O157 STEC. Children under 5 years are most frequently affected.* HUS is characterized by acute onset of microangiopathic hemolytic anemia, renal injury, and low platelet count. Early clinical signs of HUS may include decreased urine output, pallor, and lethargy. The degree and duration of renal failure in patients with the syndrome is variable but long-term dialysis may be needed. In addition, there is an increased risk of stroke and other thrombosis-related complications. TTP, another complication of *E. coli* O157:H7 infection which primarily affects adults, resembles HUS but includes fever and neurologic signs such as seizures or confusion.

*Clin Infect Dis 2009 Nov 15;49(10):1480-5

C. Shiga toxin-producing *E. coli* in Washington State

DOH receives 150-250 reports of STEC each year. *E. coli* O157:H7 was first identified in Washington during 1986 outbreaks in Seattle, Spokane, and Walla Walla. Sources implicated in *E. coli* O157:H7 outbreaks in Washington have included animal exhibits, beef, produce, raw milk, and recreational water. Six to eighteen cases of HUS have been reported annually in Washington in recent years.

D. Reservoirs

*E. coli* are ubiquitous in the intestines of warm-blooded vertebrates. Cattle are the best characterized reservoir species for *E. coli* O157:H7 and up to 50–80% of cattle herds (beef and dairy) may be colonized. The organism does not cause illness in bovines. There is no effective method to eradicate the organism from herds. Other potential sources of human infection include deer, elk, sheep, and goats. There are rare reports of *E. coli*
O157:H7 being isolated from other species including dogs, horses, flies and seagulls. The reservoirs for non-O157 STEC are not well characterized.

**E. Sources and Modes of Transmission**

Fecal-oral transmission is the most common mode of transmission. For E. coli O157:H7, common exposures are ingestion of contaminated food or direct contact with animals on farms or at petting zoos. Undercooked beef (especially hamburger), foods cross-contaminated from raw beef, and raw milk contaminated with cattle feces are the prototypical sources of common-source outbreaks. Venison is another potential source.

Contaminated produce, including leafy greens, alfalfa sprouts, and unpasteurized apple cider are other recognized exposure sources. Person-to-person transmission can occur directly (households, child care centers, institutions) or indirectly (contaminated drinking or recreational water).

In all of these modes of transmission, the infectious dose is very low.

**F. Incubation Period**

1–8 days; usually 2–6 days (longer incubations are possible but uncommon)

**G. Period of Communicability**

Adults will typically excrete E. coli O157:H7 for up to a week but up to one third of children will excrete the pathogen for as long as 3 weeks. Prolonged carriage is uncommon, but can occur.

**H. Treatment**

Supportive therapy with hydration is usually sufficient to treat this infection. Most people recover within 5–10 days without antibiotics and most experts do not recommend the use of antibiotics for treatment. Some studies have shown that the use of antibiotics is associated with the development of HUS. Antidiarrheal agents, such as loperamide (Imodium®), should also be avoided.

Data from the Foodborne Diseases Active Surveillance Network found young children have an increased risk of HUS after E. coli O157 infection, while elderly have the highest rate of death associated with E. coli O157 infection, regardless of developing HUS. These findings support recommendations that young children and elderly persons should receive aggressive supportive care during early stages of illness due to E. coli O157:H7.*

Although the O157:H7 serotype may be more likely to cause hospitalization and HUS, non-O157 E. coli infections do result in bloody diarrhea, hospitalization, and HUS. In several small case series, up to 20-30% of identified non-O157 infections resulted in HUS. Consequently, non-O157 E. coli infections should be treated as aggressively as disease due to O157:H7 infections.**

Children with bloody diarrhea should be closely monitored for the development of HUS. If a complete blood cell count with smear, blood urea nitrogen and creatinine are normal 3 days after the resolution of diarrhea, it is unlikely HUS will develop.

*Clin Infect Dis 2009 Nov 15;49(10):1480-5

** Clin Infect Dis 2006 Dec 15;43(12):1587-95
3. CASE DEFINITION

A. Clinical Criteria for Diagnosis

STEC infections are characterized by diarrhea of variable severity and abdominal cramps. Diarrhea is often bloody but non-bloody diarrhea does occur. Illness may be complicated by HUS or TTP and can lead to neurological complications, intestinal perforation or stroke. Asymptomatic infections can also occur.

B. Laboratory Criteria for Diagnosis

A laboratory diagnosis is made by isolating STEC from a clinical specimen. E. coli O157:H7 isolates may be assumed to be Shiga toxin-producing. For all other E. coli isolates, Shiga toxin production or the presence of Shiga toxin genes must be determined to be considered STEC.

C. Case Definition

1. Suspect

A clinically compatible case with Shiga toxin identified from a clinical specimen OR
A case of post-diarrheal HUS or TTP.

2. Probable

Isolation of E. coli O157 from a clinical specimen, without confirmation of H7 antigen or Shiga toxin production OR
A clinically compatible case that is epidemiologically linked to a confirmed or probable case OR
A clinically compatible case with an elevated antibody titer to a known Shiga toxin-producing E. coli serotype (serology is not available commercially).

3. Confirmed

Isolation of Escherichia coli O157:H7 or a Shiga toxin-producing E. coli from a clinical specimen. The O and H antigen serotypes should be reported when available.

4. DIAGNOSIS AND LABORATORY SERVICES

A. Diagnosis

STEC infection is confirmed by isolation of E. coli that produces Shiga toxin or is identified as the specific O157:H7 serotype from a clinical specimen. Many STEC infections are missed due to testing policies at commercial laboratories. It is recommended that all stool specimens submitted for diagnosis of community-acquired diarrhea be simultaneously cultured for E. coli O157 on selective and differential agar and also assayed for non-O157 E. coli with tests that detect shiga toxin. The pair of tests should be done regardless of patient age, season of the year, or presence or absence of blood in the stool.

Stools should be tested as early as possible in the course of the illness, since bacteria and/or Shiga toxin may be difficult to detect in the stool after one week of illness. Early detection of STEC contributes to proper patient management, especially among young children and elderly persons.
All STEC isolates should be forwarded to PHL for confirmation, serotyping (determining the type of O and H antigens), and pulsed-field gel electrophoresis (PFGE) subtyping as soon as possible. Laboratories that only use non-culture assays, such as enzyme immunoassay (EIA), should submit a stool specimen in broth for culture.

**B. Tests Available at Washington State Public Health Laboratories (PHL)**

PHL can perform stool culture for STEC and/or confirm the identification of an isolate. Enzyme immunoassays (EIA) are used to detect the presence of Shiga toxin (Verotoxin). Non-O157 STEC are presumptively serotyped and then sent to CDC for confirmation.

PHL sub-types all STEC isolates by pulsed field gel electrophoresis (PFGE). Isolates with indistinguishable PFGE patterns are consistent with, but do not prove, a common source. Isolates with dissimilar PFGE patterns are likely to be from different sources.

Serologic tests for anti-O157 antibody levels are available at CDC for special circumstances.

Food samples from suspected outbreaks can be tested for STEC at PHL if approved by Communicable Disease Epidemiology. Try to obtain original food packaging.

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

**C. Specimen Collection**

For stool culture, use a sterile applicator swab to collect stool, insert the swab into Cary-Blair transport medium, push the cap on tightly, label the tube, and mail immediately. Specimens in Cary-Blair Transport Medium that cannot be mailed to the WA State PHL within 24hrs after collection should be refrigerated at 4°C until ready to be shipped and should be maintained and shipped on cold packs. Enclose a completed PHL Enteric Bacteriology form (available at: http://www.doh.wa.gov/Portals/1/Documents/5230/302-013-Micro.pdf) with all isolates and stool specimens.

Instructions for handling food specimens can be found in the PHL Directory of Services: http://www.doh.wa.gov/Portals/1/Documents/Pubs/301-016-PHLDirectoryServices.pdf

**5. ROUTINE CASE INVESTIGATION**

A routine case investigation should be performed for all confirmed, probable and suspect STEC cases. Although the O157:H7 serotype is more likely to cause serious illness and HUS, non-O157 *E. coli* infections do result in hospitalization and HUS. In several small case series, up to 20-30% of identified non-O157 infections resulted in HUS.* Consequently, infection control measures for non-O157 *E. coli* infections should be as aggressive as those measures used to control O157:H7 infections.

*Clin Infect Dis. 2006 Dec 15;43(12):1587–95

**A. Manage the Case**

1. Hospitalized patients should be treated with standard precautions. Contact precautions should be used for diapered or incontinent persons for the duration of the illness or to
control institutional outbreaks.

2. Cases should be educated regarding effective hand washing, particularly after using the toilet, changing diapers, and before preparing or eating food. The importance of proper hygiene must be stressed, as excretion of the organism may persist for several weeks.

3. School Restrictions: Children should not attend school as long as they have diarrhea.

4. Work and Child Care Restrictions: Food handlers, child care attendants, child care attendees, and healthcare workers require two negative stool specimens before returning to work or child care. The stool specimens should be collected 24 hours apart and not sooner than 48 hours after the last dose of antibiotics, if antibiotics were given. (Antibiotics are not recommended for treating illness due to STEC or asymptomatic carriage of STEC.) Persons may continue to be infectious for several weeks after diarrhea resolves and should be cautioned accordingly especially with regards to hand washing.

The Washington State Retail Food Code requires food employees to report STEC infections to their person in charge (employer).

- **Excluding food employees:** The person in charge of a food establishment must notify the local health officer of STEC-infected food employees, and must exclude any STEC-infected food employees from the food establishment.

- **Restricting food employees:** If a food establishment serves a highly susceptible population, the person in charge must restrict any food employee who is known to have exposure to STEC.

- **Removal of exclusion or restriction:** The person in charge of a food establishment and all food employees must comply with orders issued by the local health officer for excluding employees from a food establishment or restricting employee activities due to a diagnosed or suspected STEC infection until the local health officer rescinds the order.

(See Part 2, subgroup B: [WAC Chapter 246-215](#))

Stool specimens to document that fecal shedding of the organism has stopped are not routinely indicated, except for the purpose of lifting work and child care restrictions.

**B. Identify Potential Sources of Infection**

Take a detailed 8-day food history using the [DOH Shiga toxin-producing E. coli case report form](#). This form has a white section to capture information that should be entered into PHIMS and a gray section to document details regarding exposure history. Complete both sections of the form. CDE may request that a copy of the form be submitted via fax during an outbreak or cluster investigation. Ask about possible exposures during the 8 days before onset of symptoms (longer incubations are possible but uncommon), including:

1. Household members or other contacts with a diarrheal illness. If one is identified, obtain the name, phone number or address and clinical information of the ill person. Anyone meeting the suspect or probable case definition should be investigated and reported in the same manner as a confirmed case.
2. Travel outside Washington or the United States, or contact with others who have traveled outside the United States. Determine locations and dates of travel.

3. Contact with diapered children with diarrhea, or children in child care or other setting for preschool children.

4. Any special or restricted diet. If yes, describe the diet type and reasons.

5. Types of food products typically purchased, such as selecting mostly organic products. If yes, describe organic items most often bought.

6. Sources of food such as grocery stores, warehouse stores, ethnic markets, etc. List store names and locations.

7. Restaurant or other food service meals. Obtain the name and location of the restaurant and date of the meal.

8. Public gatherings where food was consumed. Obtain the date, location, and sponsor of the event.

9. Handling or eating beef. Obtain details about any beef consumed such as stores of purchase, dates of purchase, brand, size of package, type of meat (e.g., lean or extra-lean hamburger, frozen patties), organic, and how the product was thawed/handled/cooked. Any raw beef is potentially a source of kitchen contamination, but intact cuts of meat (e.g., steaks, roasts) sold at retail are less likely to cause multi-household outbreaks.

10. Consumption of wild game meat, jerky and/or dried meats. Collect detailed information regarding the product such as home preparation method, and activities related to deer or elk hunting (slaughtering, processing, or consuming game meat).

11. Consumption of raw or unpasteurized products such as milk, cheese, juice or cider, or other unpasteurized products. Identify the brands and/or sources, and dates of consumption. If a commercial raw or unpasteurized product is named, notify Communicable Disease Epidemiology (CDE) immediately.

12. Consumption of fresh or frozen fruit, leafy greens, and vegetables. Obtain purchase information including facility and location, brand and date of purchase.

13. Source(s) of drinking water and recreational water exposures. Obtain details about time and location of exposure. Water used only after boiling need not be included. If a public water supply is implicated, consult CDE.

14. Contact with animals. Obtain details about types of animals and locations where exposure to animals may have occurred. Be sure to ask about backyard animals and visits to locations containing animals (petting zoo, dairy farm, pet shop, etc.), even if no direct contact is reported.

15. Occupational exposures. Evaluate and document the potential for exposure to human or animal excreta.

C. Manage Contacts and Others Exposed

1. **Symptomatic contacts:** All contacts with symptoms compatible with STEC should be referred to a healthcare provider for assessment and laboratory testing. Persons in contact
with a probable or confirmed case of STEC are probable cases, and should be managed and reported as such using separate forms.

2. **Asymptomatic contacts:** Testing an asymptomatic household member or other close contact who works as a food handler, healthcare worker, child care worker, or attends child care should be considered.

3. **Education:** All contacts should be educated about transmission routes, symptoms, and effective hand washing, particularly after using the toilet, changing diapers, and before preparing or eating food.

4. If a suspected source of infection is identified and has the potential for transmitting infection to a defined population, advise persons who come in contact with this source on measures to avoid exposure (e.g., boil water or drink bottled water until private well is decontaminated).

**D. Environmental Evaluation and Measures**

None, unless a commercial food service facility, child care center, or water supply is suspected as the source of infection.

**6. MANAGING SPECIAL SITUATIONS**

**A. Possible Foodborne or Waterborne Outbreaks**

Call Communicable Disease Epidemiology immediately if you suspect a common-source outbreak (877 539-4344).

**B. Case Attends or Works in a Child Care Facility**

1. Interview the operator and inspect the written attendance records to identify other possible cases among staff or attendees during the previous month. Note: **WAC 170-295-3030** specifies that the operator keep a log of illnesses.

2. Review food handling, hand washing techniques, and diaper changing practices with the operator and staff.

3. If other cases are suspected, refer those currently ill to a health care provider for assessment and collect stool specimens from attendees and staff with a history of diarrheal illness in the past 3 weeks. This is important because STEC illnesses may be mild, and diarrhea may be non-bloody.

4. Exclude cases (including those who are asymptomatic) from child care facilities until they have two negative stool specimens collected at least 24 hours apart and at least 48 hours after discontinuation of antibiotics (Note: Antibiotics are not recommended for the treatment of illness due to STEC or asymptomatic carriage of STEC).

5. Parents of children in the same child care group as an STEC case should be notified of the occurrence of STEC illness in the group. Day care operators are required to notify these parents that their child was exposed to a communicable disease through a letter or posted notification (**WAC 170-295-3030**). The local health jurisdiction may use this notification as an opportunity to ask parents about gastrointestinal symptoms (especially diarrhea) in their child and add the following elements to the notification:

- Children should be monitored carefully for signs of illness such as diarrhea, cramps,
nausea and vomiting.

- Medical care should be sought if such symptoms occur and the provider informed of the occurrence of STEC illness in the facility.
- The daycare operator or local health jurisdiction should be notified should symptoms occur.
- A symptomatic child should not be brought to the daycare facility nor placed in any other group of children.
- Information on the illness and how transmission can be prevented.

6. If more than one case is suspected among attendees or workers, LHJs should inspect the facility.

7. Instruct the day care operator to call the LHJ immediately if new cases of diarrhea occur.

8. LHJs should follow-up with the child care center to ensure that surveillance and appropriate prevention measures are being carried out. Manage newly symptomatic children as outlined above.

9. Closure of the facility should be considered if it has been shown that transmission is occurring within the facility and if exclusion and sanitation controls are not adequate to stop ongoing transmission. Before closing a facility, the LHJ should assess the potential for spread to other day care settings in the community by dispersal of the children. Parents should be cautioned regarding placing their children in other child care groups, since asymptomatic shedding of the organism may occur.

C. Cases Linked to Raw Milk Products

Environmental evaluation of the dairy will be a necessary part of any further investigation. Dairy investigations will be conducted by the Washington State Department of Agriculture.

D. Case Resides at a Health Care or Residential Care Facility

Determine if there has been any unusual incidence of diarrheal illness within the past month. If so, investigate these reports to identify possible common-source outbreaks or continuing sources of exposure. If indicated, conduct a sanitary inspection of the facility. The extent of further investigation depends on circumstances.

7. ROUTINE PREVENTION

A. Vaccine Recommendations: None.

B. Prevention Recommendations for STEC and Other Enteric Illnesses

Advise individuals on measures to avoid further or future exposures including:

1. Avoid eating raw or undercooked meat, especially hamburger. Hamburger prepared at home should be cooked to an internal temperature of at least 160° F. While it is best to use a thermometer, cook at least until there is no red or pink remaining and meat juices have no color.

2. Avoid cross-contamination with meat or other potentially contaminated foods.
3. Wash fruits and vegetables thoroughly before consumption. Peel when possible.

4. Wash hands after caring for diapered children or incontinent persons, after using the toilet, and after handling soiled clothing or linens.

5. Wash hands after handling pets, fowl, other animals, raw meat, and raw poultry, and always before food preparation.

6. Avoid unpasteurized milk, and other unpasteurized products including soft cheese, juices, and cider.

7. Avoid drinking or swallowing untreated surface water. Untreated water should be boiled or otherwise disinfected before consumption.

8. Persons with diarrhea should not use recreational water venues (e.g., pools, lakes, interactive fountains, water parks) until 2 weeks after symptoms resolve.

9. Persons with diarrhea should not prepare food for others.

**ACKNOWLEDGEMENTS**

This document is a revision of the Washington State Guidelines for Notifiable Condition Reporting and Surveillance published in 2002 which were originally based on the Control of Communicable Diseases Manual (CCDM), 17th Edition; James Chin, Ed. APHA 2000. We would like to acknowledge the Oregon Department of Human Services for developing the format and select content of this document.

**UPDATES**

10/9/07 Section 7B (8): Persons with STEC should not use recreational water venues until 2 weeks after symptoms resolve.

9/1/2010 General terminology: Shiga toxin-producing *E. coli* (STEC) replaces most references to EHEC to reflect updated usage.

Section 1B.3 Organism identification immediately notifiable by laboratories anticipated 2011.

Section 1C.2 HUS without preceding diarrheal disease no longer notifiable anticipated 2011.

Section 2H: Young children and elderly should receive aggressive supportive therapy during the early stages of STEC O157 disease as they are at higher risk of death regardless of whether or not they develop HUS.

Section 3B: Updates to laboratory criteria for diagnosis.

Section 4A: Updates to guidelines for clinical laboratory diagnosis of STEC.

Section 5A: Added request to complete standardized supplemental STEC food history form.

Section 6B: Added to recommendations for management of cases in a child care facility.

**January 2011:** The Legal Reporting Requirements section has been revised to reflect the 2011 Notifiable Conditions Rule revision.

**November 2011:** Section 6A: Language was clarified regarding exclusion of persons in high risk occupations.

**January 2013:** The content of Section 5 was reorganized.

**February 2014:** Updated guideline to reflect significant changes to STEC case report form. Information regarding submission of Cary-Blair Medium updated to reflect PHL guidance.