

E. COLI O157:H7 OUTBREAK FINAL REPORT

PURPOSE

The purpose of this final report is to:

- Describe the magnitude of this outbreak;
- Identify risk factors that caused or contributed to the outbreak;
- Summarize the findings of the environmental, epidemiological and laboratory investigations conducted by the Washoe County Health District (WCHD);
- Document the Washoe County Health District (WCHD) Outbreak Response Team (ORT)'s actions and decisions and support them with data or literature.

INITIATION OF INVESTIGATION

On November 3, 2015, the staff at the Communicable Disease (CD) Program of the Washoe County Health District (WCHD) identified five (5) laboratory reports of specimens positive for *Escherichia coli* (*E. coli*) O157:H7 and one (1) laboratory report positive for *Shiga toxin-producing Escherichia coli* (STEC) among cases that had reported eating at local restaurant A during the time period of October 8 through October 27, 2015. The WCHD Outbreak Response Team (ORT) initiated an outbreak investigation. It was decided to conduct a case control study using the restaurant menu in order to assess the association between exposure and illness. Between November 3 and December 27, 2015, the WCHD ORT collaborated with local restaurant A to conduct an active investigation. The purpose of this report is to provide findings of environmental, epidemiological, and laboratory investigations.

BACKGROUND/CONTEXT

During the period of November 4 through December 14, 2015, the CD program received ten (10) additional laboratory reports positive for *E. coli* O157:H7 and investigated nine (9) probable cases. Thirteen of these cases had also eaten at restaurant A. However, six (6) cases had a common exposure to local restaurant B and no exposure to local restaurant A. It is important to note that all laboratory-confirmed cases had an indistinguishable pulsed field gel electrophoresis (PFGE) pattern of EXHX01.0047 and EXHA26.0015.

The case control study was conducted from November 3 through November 17, 2015 and consisted of twelve cases and sixteen controls. The case control study was discontinued on November 17, 2015 due to a change in the focus of the outbreak. The WCHD CD program was contacted by a Public Health Nurse (PHN) with Contra Costa County, CA on November 16, 2015. The PHN reported two (2) of their local residents that were positive for *E. coli* O157:H7 and had a travel history to Reno. These two cases did not eat at restaurant A, but were the first to have been reported with an exposure to restaurant B. This information resulted in an investigation of commonalities

between the two restaurants. Ultimately a common dessert was identified that was prepared at local manufacturer A. This dessert was a chocolate mousse cake and was laboratory-confirmed as the source of this outbreak. The final case count for this outbreak was 25, of which, 16 were laboratory confirmed and 9 were probable cases based upon symptoms and exposure history. Sixteen of 25 (76%) were Washoe County residents and six of 25 (24%) were out of jurisdictional residents.

ENVIRONMENTAL INVESTIGATION

Methods

On November 3, 2015 Communicable Disease (CD) team and Environmental Health Services (EHS) met to discuss multiple *E. coli* O157:H7 cases of which most recalled eating at restaurant A. At this meeting it was decided that an outbreak investigation be initiated. Between November 3, 2015 and November 20, 2015 the following methods were used in the environmental investigation:

1. Field investigations at suspected restaurants and a manufacturer and collection of information on sources of food supply for menus and recipes.
2. Interviews of employees of Restaurant A to help identify the source of infection. Interview questions included job duties, recent illnesses, recent travel, ill household contacts, recent antibiotic use, employment at other food establishments and any meals consumed at restaurant A. Any ill employees were required to submit a stool sample to the Health Authority for testing of *Shiga toxin-producing E. coli*.
3. Collection of food samples of suspect food from Restaurants A and B and Manufacturer A.
4. Collection of environmental surface samples from Manufacturer A to help identify the source of infection.

Results

1. On November 3, 2015 the general manager for Restaurant A was called to inform him of multiple *E. coli* O157:H7 cases that had exposure to this facility. The general manager was informed that EHS would need to interview all employees and also obtain a list of all food suppliers, menus and a list of all employees. The general manager was asked to have as many employees as possible at the restaurant on November 4, 2015 for EHS to conduct interviews on site.
2. On November 4, 2015 EHS took a team of staff to Restaurant A to conduct employee interviews. EHS staff was able to conduct 47 interviews on site. While on site conducting interviews one (1) employee was identified as having gastrointestinal symptoms during the interview and was excluded from work and required to submit a stool sample for testing of *Shiga toxin-producing E. coli*. Restaurant A provided EHS staff a list of all employees, list of all food purveyors and a copy of all menus including dessert and drink menus. Restaurant A was required to conduct a deep cleaning of entire facility and disinfect with 1000ppm chlorine/water solution, ensure staff had no bare hand contact with ready to eat

foods and to report any ill staff or customers to the WCHD. Eight (8) additional employee interviews were conducted between November 5, 2015 and November 13, 2015. An additional employee was identified with having gastrointestinal symptoms and was excluded from work and required to submit a stool sample for testing of *Shiga toxin-producing E. coli*. A total of 55 employees were interviewed for Restaurant A.

3. On November 9, 2015 and November 12, 2015 EHS was notified that the stool sample test results for both employees were negative. The general manager was notified that these employees could return to work.
4. On November 9, 2015 the general manager from Restaurant A notified the WCHD that they were voluntarily closing the restaurant.
5. Between November 4, 2015 and November 13, 2015 numerous phone calls and email correspondence were made with Restaurant A to obtain all ingredients for all menu items. It was noted that there were some desserts that were purchased from Manufacturer A and not made at Restaurant A. Ingredient items were obtained from Manufacturer A.
6. On November 13, 2015 EHS received a list of suspect food items from CD based on case-control study and it was decided that EHS staff would go to Restaurant A to try to obtain food samples for these suspect food items. A team of EHS staff members went out to Restaurant A and met with general manager regarding suspect food items. While on site 21 food samples were obtained following WCHD food sampling protocols and delivered to the Nevada State Public Health Lab (NSPHL) for testing for *E. coli*. See the following table:

Table 1. Food Samples Collected at Restaurant A by WCHD, *E. coli* O157:H7 Outbreak, November 2015

No.	Sample Name	Date Collected
1	Cilantro mint mix from reach-in @ 44F	11/13/2015
2	Pico De Gallo from top of reach-in @ 26F	11/13/2015
3	Cilantro from top of reach-in @ 26F	11/13/2015
4	Sweet mini pepper mix from top of reach-in #3 @ 26F	11/13/2015
5	Avocado cilantro lime puree from top of reach-in @ 26F	11/13/2015
6	Succotash from top of reach-in @ 36F	11/13/2015
7	Sweet mini pepper mix from top of reach-in #1 @ 36F	11/13/2015
8	Sweet mini pepper mix from bottom of reach-in #1 @ 36F	11/13/2015
9	Sliced tomatoes from walk-in unit @ 30F	11/13/2015
10	Black bean salsa from walk-in unit @ 30F	11/13/2015
11	Two whole green peppers from walk-in unit @ 30F	11/13/2015
12	Two whole yellow peppers from walk-in unit @ 30F	11/13/2015
13	Two whole red peppers from walk-in unit @ 30F	11/13/2015
14	Two whole tomatoes from walk-in unit @ 30F	11/13/2015
15	Succotash from walk-in unit @ 30F	11/13/2015
16	Two bunches of cilantro from box in server walk-in @ 40F	11/13/2015
17	Two bunches of cilantro from drawers in walk-in @ 40F	11/13/2015
18	Frozen corn from walk-in freezer @ 4F	11/13/2015
19	One jar whole dried bay leaves from dry storage	11/13/2015
20	One jar whole dried oregano from dry storage	11/13/2015
21	Four cans of chipotle peppers from dry storage	11/13/2015

7. On November 17, 2015 EHS was notified from NSPHL that all 21 food samples tested negative for *E. coli*.
8. On November 17, 2015 CD informed EHS that a new *E. coli* case was received and the case did not have exposure to Restaurant A but ate dessert from Restaurant B. CD asked EHS to obtain information from Restaurant B on where they receive the desserts they serve or if they make them in house. Staff from EHS contacted Restaurant B regarding desserts and it was determined that all desserts came from Manufacturer A. After discussion with CD, it was determined that EHS would go to Restaurants A and B and Manufacturer A to obtain food samples of desserts (chocolate mousse/marquise and lemon tarts) cases had consumed.
9. On November 17, 2015 two (2) teams from EHS went to obtain food samples. One (1) team went to Restaurant A and B and another team went to Manufacturer A to obtain dessert samples of chocolate mousse/marquise and lemon tart. The following is a table of the food samples obtained:

Table 2. Food Samples Collected by WCHD from Restaurant A, B and Manufacturer A, *E. coli* O157:H7 Outbreak November 2015

No.	Sample Name	Date Collected
22	One square chocolate marquise, reach-in @ 38F rest. A	11/17/2015
23	Four round chocolate marquise, reach-in @ 38F rest. A	11/17/2015
24	Four round chocolate marquise, walk-in @ 38F rest. A	11/17/2015
25	Lemon pine nut tart, freezer @ 0F, manufac. A	11/17/2015
26	Four chocolate mousse, freezer @ 0F, manufac. A	11/17/2015
27	Four chocolate marquise, freezer @ 0F manufac. A	11/17/2015
28	Four chocolate mousse, walk-in @ 37F rest. B	11/17/2015

10. On November 17, 2015 while on site at manufacturer A EHS staff learned that the meat department at Manufacturer A had used the Hobart mixer in the bakery area to mix some raw pork sausage. This is the same Hobart mixer that was used to make the chocolate mousse/marquise dessert for both Restaurant A and Restaurant B.
11. On November 19, 2015 NSPHL notified EHS that one sample of chocolate mousse/marquise dessert from Restaurant A and one sample of chocolate mousse/marquise dessert from Manufacturer A were positive for *Shiga toxin*. After a discussion with the CD team it was determined that environmental surface samples needed to be obtained from Manufacturer A to try determine source of cross contamination with equipment.
12. On November 19, 2015 a team from EHS went to Manufacturer A and obtained eight (8) environmental surface swabs from Hobart mixer and butcher shop area and also one (1) food sample of raw pork from drying box. See following table:

Table 3. Environmental Surface Swabs Collected at Manufacturer A by WCHD, *E. coli* O157:H7 Outbreak, November 2015

No.	Sample Name	Date Collected
29	60qt. Hobart mixer outside of screen guard	11/19/2015
30	60qt. Hobart mixer inside of screen guard	11/19/2015
31	60qt. Hobart mixer underside surface of planetary gear	11/19/2015

32	60qt. Hobart mixer inside of solid metal safety cage	11/19/2015
33	60qt. Hobart mixer attachment arm	11/19/2015
34	60qt. Hobart mixer handle	11/19/2015
35	Handles of hand sink in butcher shop	11/19/2015
36	Surface of meat scale in butcher shop	11/19/2015
37	Food sample of whole Pork Coppa from drying box @ 60F	11/19/2015

13. On November 19, 2015 EHS required Manufacturer A to conduct a thorough cleaning of all surface areas of the 60qt Hobart mixer and then disinfect entire mixer with 1000ppm chlorine solution. This also was required for all hand sinks and food contact surfaces. Manufacturer A was ordered to cease and desist using any of the mixers in the baking area for mixing any raw meat items from the butcher shop. All equipment/pans that are shared between bakery and butcher shop must go through a thorough cleaning and sanitizing step after each use to reduce the risk of cross contamination. If any equipment cannot be run through the dishwasher or 3-compartment sink they are not allowed to be shared between bakery and butcher shop.
14. On November 20, 2015 NSPHL notified EHS that both chocolate marquise food samples were positive for *E. coli* O157:H7. The PFGE patterns of these isolates were indistinguishable (Xbal pattern was EXHX01.0047 and BlnI pattern was EXHA26.0015), which indicates the infection was from a common source.
15. On November 20, 2015 both Restaurant A and Manufacturer A were notified of positive *E. coli* O157:H7 test results.
16. On November 20, 2015 EHS staff went to Restaurant B to obtain food samples of the same type of sausage that was made at manufacturer A. See following table:

Table 4. Food Samples Collected at Restaurant B. by WCHD, *E. coli* O157:H7 Outbreak, November 2015

No.	Sample Name	Date Collected
38	Thai stick sausage from cook line @ 37F	11/20/2015
39	Thai stick sausage in ROP package, walk-in @ 36F	11/20/2015

17. On November 23, 2015 NSPHL notified EHS that all environmental surface swabs were negative for *E. coli*.
18. On November 24, 2015 Restaurant A decided to re-open.
19. On December 2, 2015 NSPHL notified EHS that all pork food samples were negative for *E. coli*.

EPIDEMIOLOGICAL INVESTIGATION

Methods

The epidemiological investigation included the following:

1. Development of a case definition in order to characterize cases;
2. Interviews of cases using routine investigation forms to identify meal companions at local restaurant A;

3. Interviews of cases and their meal companions to identify foods eaten at local restaurant A using the restaurant menu;
4. Hypothesis generation;
5. Case control study to test hypothesis;
6. Additional interviews of those cases that had an exposure to local restaurant B.

The final case definition for this outbreak is as follows:

Clinical criteria: A clinically compatible case for this outbreak is defined as a person who developed the following symptoms within 8 days of meeting the epidemiological criteria (defined below):

- Diarrhea AND/OR
- Bloody diarrhea with or without fever, nausea, vomiting, or abdominal cramps.

*Diarrhea is defined as three (3) or more loose stools during any 24 hour period

Epidemiological Criteria: An epidemiologically compatible case for this outbreak is defined as a person who either ate at or worked at a food establishment that either prepared or sold the chocolate mousse cake from local manufacturer A between September 29, 2015 and November 7, 2015.

Case Classification:

Confirmed: A confirmed case is defined as a person who meets the clinical criteria, the epidemiological criteria, and has laboratory confirmation for *Shiga Toxin-Producing Escherichia Coli (STEC)*.

Probable: A probable case is defined as a person who meets the clinical criteria and the epidemiological criteria, but has an absence of a laboratory confirmation.

The initial hypotheses were:

1. An unknown food item provided by restaurant A caused the illness in patrons and employees;
2. A symptomatic food handler of restaurant A contaminated foods and then caused the patrons and employees who ate there become ill.

A case control study was performed to assess the association between exposure and illness. Cases were those confirmed and probable cases. Those individuals who consumed meals with the cases but did not develop symptoms within 8 days after the meal were selected as the controls. Specific food items consumed at restaurant A for both cases and controls were obtained using the restaurant menu. Ingredients (or recipe) for each food item were provided by restaurant A. The association between the food, especially in the form of ingredient, and illness were evaluated using bivariate analyses by uncorrected chi-square. All analyses were conducted using MS Excel and Epi Info 7.

Results

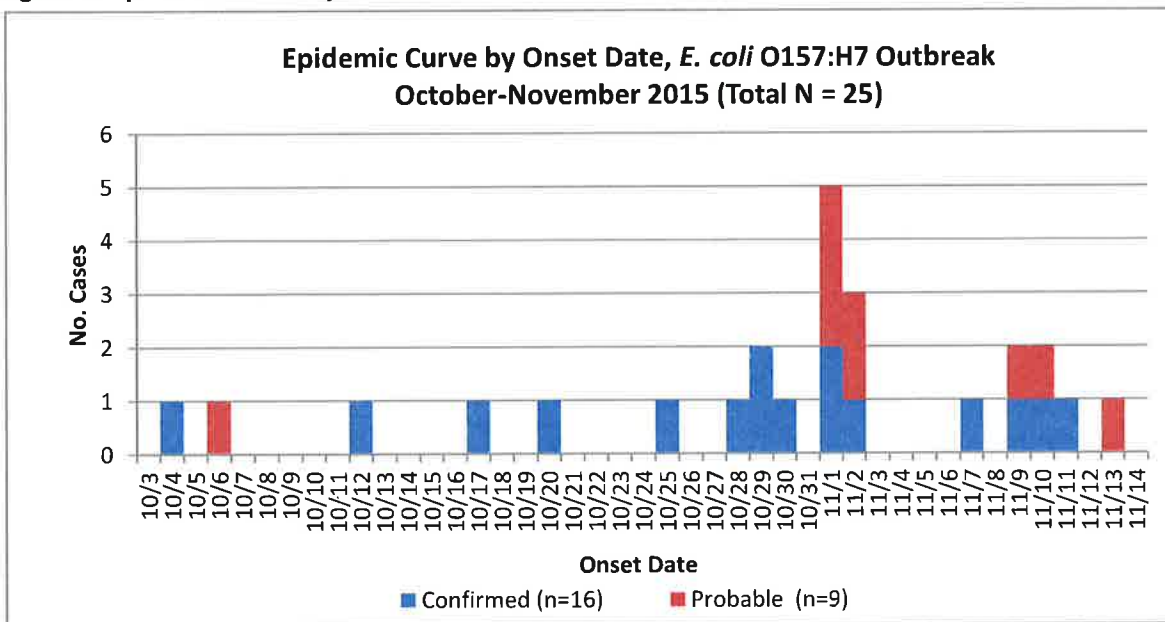
Descriptive Epidemiology

As of the closure date of this outbreak, December 27, 2015, a total of 25 cases met outbreak case definition. Of the 25 cases, 16 were confirmed and nine (9) were probable. Of the 16 confirmed cases, 11 were patrons of restaurant A and five (5) were patrons of restaurant B. Of the nine (9) probable cases, seven (7) were patrons of restaurant A and two (2) were employees of restaurant A.

Of the 25 cases, 14 (56%) were female and 11 (44%) were male. The median age of was 34 years (range 6-82 years). The onset dates ranged from October 4 to November 13, 2015. The median incubation period was 3.5 days (range 1-7 days). The Epidemic Curve is seen in Figure 1.

The clinical symptoms include diarrhea (100%), bloody diarrhea (79%), abdominal cramps (79%), vomiting (40%), and fever (40%). The duration of illness is known for seven (7) cases, as many cases were still symptomatic at the time of interview, the median duration was 5 days (range 4-30 days). Of the 25 cases, 19 (76%) sought medical care. Eleven (44%) were hospitalized due to this illness and five (20%) developed Hemolytic Uremic Syndrome (HUS). No fatalities were reported. Nineteen were Washoe County residents, four (4) were California residents, one (1) was an Oregon resident, and one (1) was a Nebraska resident.

Figure 1. Epidemic Curve by Onset Date, *E. coli* O157:H7 Outbreak, October-November, 2015



Case-Control Study

The ORT identified 119 food items from the menu of restaurant A, which resulted in identifying 387 ingredients. On November 13, 2015, initial bivariate analysis was performed to assess the association between the 387 ingredients and outcome. Initial analysis included 11 cases and 14 controls. Finding showed statistical significance for gold bell peppers (OR 7.2, 95% CI 1.06-48.64, P=0.032), green bell peppers (OR 7.2, 95% CI 1.06-48.64, P=0.032), cilantro (OR 6.6, 95% CI 1.14-38.83, P=0.028), and oregano (OR 6.6, 95% CI 1.14-38.83, P=0.028). However, subsequent laboratory

testing of all four (4) ingredients was negative. The ORT team continued to interview further cases and controls in order to perform further analysis; however the suspected source of the outbreak was identified prior to performing further analysis and resulted in the discontinuation of the case control study on November 17, 2015. At the time of discontinuation the ORT had interviewed 12 cases and 16 controls.

LABORATORY INVESTIGATION

A total of 55 specimens were collected and tested. Of the 55 specimens, 16 were human specimens, 31 were food samples, and 8 were surface swabs. All environmental specimens were cultured and serotyped at the Nevada State Public Health Laboratory (NSPHL). Some human specimens had the initial cultures performed at commercial laboratories. Pulsed-Field Gel Electrophoresis (PFGE) testing on all environmental samples and human specimens was performed by the NSPHL.

Human Specimens

E. coli O157:H7 was isolated from fifteen stool specimens. The PFGE patterns of these isolates were indistinguishable (Xbal pattern was EXHX01.0047 and BlnI pattern was EXHA26.0015), which indicates the infection was from a common source. One (1) specimen was positive for STEC and was sent to CDC for further identification. As of the date of this report the results are still pending, however this case consumed the implicated food item (chocolate mousse cake) from restaurant A. The NSPHL sent nine (9) specimens to the Washington State Public Health Laboratory for whole genome sequencing (WGS). At the time of this report all WGS results are still pending.

Food Samples

A total of thirty-one (31) food samples were collected by the EHS division and included the following: Cilantro mint mix, Pico de Gallo, Fresh Cilantro (3), Sweet mini pepper mix (3), Avocado cilantro lime puree, Succotash (2), Sliced tomatoes, Black bean salsa, Green peppers whole, Yellow peppers whole, Red peppers whole, Tomatoes whole, Frozen corn, Dried bay leaves, Dried oregano, Chipotle peppers in a can, Chocolate marquise square (2), Chocolate marquise round (4), Lemon pine nut tart, Coppa, Thai stick sausage (2). Two (2) of these samples were positive for *E. coli* O157:H7 (chocolate marquise square). The remaining 29 samples were negative for *E. coli*. Please refer to Environmental Investigation section for detailed dates of collection.

Surface Swabs Samples

A total of eight (8) surface swabs were collected by the EHS division and included the following: 60qt Hobart mixer outside guard, 60qt Hobart mixer inside guard, 60qt Hobart mixer underside surface of planetary gear, 60qt Hobart mixer inside of solid metal safety cage, 60qt Hobart mixer attachment arm, 60qt Hobart mixer handle, handles of hand sink in butcher shop, and scale in butcher shop. All these samples were negative for *E. coli*. Please refer to Environmental Investigation section for detailed dates of collection.

DISCUSSIONS AND CONCLUSIONS

Escherichia coli (*E. coli*) bacteria normally live in the intestines of people and animals. Most *E. coli* are harmless and actually are an important part of a healthy human intestinal tract. However, some *E. coli* are pathogenic, meaning they can cause illness, either diarrhea or illness outside of the intestinal tract. These types of *E. coli* are called *shiga toxin-producing E. coli* (STEC) and can cause diarrhea. STEC can be transmitted through contaminated water or food, or through contact with ill animals or persons. The most commonly identified STEC in North America is *E. coli* O157:H7

The symptoms of *E. coli* O157:H7 infections vary for each person but often include severe stomach cramps, diarrhea (often bloody), and vomiting. If there is fever, it usually is not very high (less than 101°F/less than 38.5°C). Most people get better within 5–7 days. Some infections are very mild, but others are severe or even life-threatening. Around 5–10% of those who are diagnosed with STEC infection develop a potentially life-threatening complication known as hemolytic uremic syndrome (HUS). Clues that a person is developing HUS include decreased frequency of urination, feeling very tired, and losing pink color in cheeks and inside the lower eyelids. Persons with HUS should be hospitalized because their kidneys may stop working and they may develop other serious problems. Most persons with HUS recover within a few weeks, but some suffer permanent damage or die.

The incubation period is usually 3-4 days after the exposure, but may be as short as 1 day or as long as 10 days. The symptoms often begin slowly with mild belly pain or non-bloody diarrhea that worsens over several days. HUS, if it occurs, develops an average 7 days after the first symptoms, when the diarrhea is improving.

STEC live in the guts of ruminant animals, including cattle, goats, sheep, deer, and elk. The major source for human illnesses is cattle. STEC that cause human illness generally do not make animals sick. Other kinds of animals, including pigs and birds, sometimes pick up STEC from the environment and may spread it. Exposures that result in illness include consumption of contaminated food, consumption of unpasteurized (raw) milk, consumption of water that has not been disinfected, contact with cattle, or contact with the feces of infected people. Some foods are considered to carry such a high risk of infection with *E. coli* O157 that health officials recommend that people avoid them completely. These foods include unpasteurized (raw) milk, unpasteurized apple cider, and soft cheeses made from raw milk. Sometimes the contact is pretty obvious (working with cows at a dairy or changing diapers, for example), but sometimes it is not (like eating an undercooked hamburger or a contaminated piece of lettuce). People have become infected by swallowing lake water while swimming, touching the environment in petting zoos and other animal exhibits, and by eating food prepared by people who did not wash their hands well after using the toilet.

Almost everyone has some risk of infection. Non-specific supportive therapy, including hydration, is important. Antibiotics should not be used to treat this infection. There is no

evidence that treatment with antibiotics is helpful, and taking antibiotics may increase the risk of HUS. Antidiarrheal agents like Imodium® may also increase that risk.¹

The chocolate mousse cake prepared at manufacturer A and distributed to restaurant A and restaurant B was laboratory confirmed as the definitive cause of this outbreak. All 16 laboratory confirmed cases had an exposure to either restaurant A or restaurant B and also recalled consuming the chocolate mousse cake. All nine (9) probable cases had exposure to either restaurant A or restaurant B. Of the nine (9) probable cases, seven recalled consuming the chocolate mousse cake.

A limitation to the case-control study was the sample size of the controls. The control selection was limited to the well meal companions of each case. The small sample size of controls likely affected the statistical power of the study. In addition, early active case finding was lacking for this outbreak investigation.

The routine surveillance procedures of the CD Program of WCHD were effective in quickly identifying restaurant A as the initial common exposure. The effective communication and collaboration among the WCHD, the NSPHL, out of jurisdictional public health agencies, and the involved facilities made this outbreak investigation a success.

RECOMMENDATIONS FOR CONTROLLING DISEASE AND/OR PREVENTING/MITIGATION EXPOSURE

The following recommendations were implemented at Manufacturer A as a result of outbreak investigation:

- Discontinue using the Hobart mixers in the bakery area for any raw meat products from the butcher shop area to reduce the risk of cross contamination.
- Ensure all shared equipment between the bakery department and the butcher shop is properly cleaned and sanitized after each use to reduce the risk of cross contamination.
- Exclude any ill employees with symptoms of gastroenteritis for 48 after symptoms have resolved.
- Ensure no bare hand contact with ready to eat foods.
- Ensure all raw food is properly stored away from or below all ready to eat foods.
- Continue to deep clean and sanitize (1000 ppm bleach/water solution or equivalent sanitizer) facility on a regular basis to include bakery area, butcher shop area and dishwashing area.

¹ Centers for Disease Control and Prevention (2015). E.Coli (Esherichia coli). Retrieved from <http://www.cdc.gov/ecoli/general/index.html>

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