



# Environmental Investigation of the Taco John's *Escherichia coli* O157:H7 Outbreak Linked to Iceberg Lettuce



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## Abstract

**Introduction:** In December of 2006, the California Department of Public Health (CDPH) was notified of a multi-state *Escherichia coli* O157:H7 outbreak linked to iceberg lettuce. Approximately 80 individuals were sickened – no deaths reported. The U.S. Food and Drug Administration (FDA), working with Minnesota and California public health officials, traced the lettuce to two growing areas in California – Santa Maria (Central Coast) and Buttonwillow (Central Valley).

**Purpose:** Based on a review of the epidemiological and preliminary traceback data, the California Food Emergency Response Team (CaFERT) was mobilized. An environmental investigation was launched focusing on outbreak-control measures, traceback to farms, and identification of possible sites of contamination at the farm level.

**Methods:** CaFERT examined 11 growing fields, interviewed growers, harvesters, coolers and collected 251 environmental samples including water, soil, feces, and product. Samples were tested for *E. coli* O157:H7 and its shiga toxins. Positive isolates were further analyzed to determine if they genetically matched the outbreak strain.

For one implicated farm in Buttonwillow, further investigation was warranted due to 1) identification of the farm as one that supplied product to the implicated out-of-state processor during time period in question, 2) farm's close proximity to two dairies and 3) an environmental sample at a nearby dairy matching the outbreak strain. Irrigation and dairy effluent conveyance systems appeared to be combined into a complex piping network on this farm – raising concerns about microbial cross-contamination potential between fields of lettuce and nearby dairies.

**Results:** Of 251 samples collected, 32 (~13%; all from the farm in Buttonwillow) were positive for *E. coli* O157:H7. Ten of the 32 positives (~31%) genetically matched the outbreak strain; six (60%); one swab, one water, three water and sediment, and one soil) were collected in close proximity to an implicated lettuce growing field, and four (40%; one swab and three water) came from two dairies approximately 0.65–1.8 miles from suspect growing fields.

## Background

On December 14, 2006, the Centers for Disease Control and Prevention (CDC) issued a health alert regarding a foodborne outbreak of *Escherichia coli* O157:H7 that was linked to two Taco John's restaurants located in Minnesota and Iowa. Approximately 80 individuals were sickened in November and December of that year; 32 people in Minnesota (12 confirmed cases, 20 probable, and one with Hemolytic Uremic Syndrome (HUS)), 47 people in Iowa (24 confirmed cases, 23 probable, and two HUS), and a single case in Wisconsin. No deaths were reported. It should be noted that the single case from Wisconsin reportedly ate at 7–9 restaurants during the possible exposure period, one of which was a Taco John's restaurant.

Investigations conducted by the Minnesota Department of Agriculture, Minnesota Department of Health, and the Iowa Department of Public Health identified shredded iceberg lettuce served in the restaurants as the likely vehicle of transmission with dates of exposure occurring between November 27th, 2006 and December 6th, 2006. Illness onsets were reported to have occurred between November 30th – December 9th, 2006 for the Iowa cases, and December 1st–10th, 2006 for the Minnesota cases. The FDA, working in conjunction with Minnesota and California public health officials, traced the lettuce to growing regions in California's Central Coast and Central Valley based on information and records collected from a lettuce processor in Minnesota.

## Activating CaFERT

Based on epidemiological and traceback data, CaFERT (composed of trained and experienced staff from both FDA and CDPH) was mobilized on December 15th, 2006. An environmental investigation was launched focusing on outbreak-control measures, traceback to farms, and identification of possible sites of contamination at the farm level.

The scope of this investigation was confined to the potential source fields, harvesters, coolers, and other entities associated with the implicated lettuce as identified by CaFERT.

## Investigative Approach

Since this investigation covered two growing regions in California, Buttonwillow in Kern County and Santa Maria in Santa Barbara County, two CaFERT teams were dispatched. CaFERT visited 11 growing fields in both suspect geographical areas. Further intensive investigation, however, was warranted for one implicated farm in the Buttonwillow location (California's Central Valley) due to its close proximity to two dairies and an environmental sample at one of the dairies that was a positive match to the outbreak strain. Also, on this one farm in Buttonwillow, the irrigation and dairy effluent conveyance systems (controlled by the grower) appeared to be combined into a complex piping network – an issue that raised concerns about the potential of microbial cross-contamination between the growing fields of lettuce and nearby dairies (Figures 1 & 2).



Figure 1. Map of Implicated Farm and Vicinity Water Conveyance System, and Location of *E. coli* O157:H7 Samples that Positively Matched the Taco John's Outbreak Strain.



Figure 2. A photo of a water pipe manifold with labels; Dairy 1 = Maya Dairy, Dairy 2 = West Star North Dairy.

## Samples Collection

During the course of the investigation, CaFERT examined the 11 growing fields, interviewed growers, harvesters, coolers and collected 251 samples from the two identified geographical areas in California (Table 1). Of the 251 samples, 57 (22%) samples were collected from the Santa Maria area and the remaining 194 (77%) were from the Buttonwillow location.

Types of samples collected included cattle biosolids, environmental swabs (sponge and Moore), fecal matter, field lettuce residue, sediment, soil, and water (Table 1, Figure 3). These samples were tested for *E. coli* O157:H7 and its shiga toxins. Isolates that were positive for *E. coli* O157:H7 were further analyzed using pulse field gel electrophoresis (PFGE) to determine if the isolates genetically matched the Taco John's outbreak strain (CDC PulseNet reference # 0612MEXH-1ml).

Table 1. An overview of the different types of samples collected at the two identified geographic areas in California during the investigation of the Taco John's *Escherichia coli* O157:H7 outbreak associated with iceberg lettuce.

Location	Sampling location	Sample Type										Total # of Samples
		Air	Cattle biosolids	Environmental	Fecal matter	Feces	Field lettuce residue	Soil	Water	Woods & sediment	Other	
Buttonwillow	Maya Dairy	6	1	1	1	1	1	1	1	1	1	13 (25%)
	West Star North Dairy	6	4	2	3	3	3	3	3	3	3	33 (65%)
Santa Maria	A & A Farms	0	0	0	0	0	0	0	0	0	0	0
	Black Road	0	0	0	0	0	0	0	0	0	0	0
	Butterfield	0	0	0	0	0	0	0	0	0	0	0
	Chico Canyon Creek & S	0	0	0	0	0	0	0	0	0	0	0
	Elmer's	0	0	0	0	0	0	0	0	0	0	0
	Elmer's (Chico)	0	0	0	0	0	0	0	0	0	0	0
	Elmer's (Chico) (green)	0	0	0	0	0	0	0	0	0	0	0
	Elmer's (Chico) (red)	0	0	0	0	0	0	0	0	0	0	0
	Elmer's (Chico) (yellow)	0	0	0	0	0	0	0	0	0	0	0
	Elmer's (Chico) (white)	0	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	<b>251</b>	<b>6</b>	<b>5</b>	<b>3</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>57</b>

\* All samples collected were averted from materials (n=16 cattle and n=10 soil from domestic and wild animals) with the exception of one human fecal sample.  
\*\* Field lettuce  
\*\*\* Field residue  
§ Values in parenthesis reflect percentage relative to total number of samples collected.

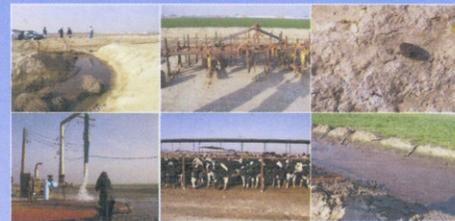


Figure 3. Illustration types of samples collected and collection locations.

## Results and Analysis

Of the 251 collected samples, 32 (13%) were positive for the bacterial pathogen *E. coli* O157:H7. All 32 positive samples for the pathogen came from the 194 samples collected at the Buttonwillow location, specifically Wegis Ranch and its neighboring dairies (Table 2, Figure 4). All samples (n=57) collected from the Santa Maria area were negative for *E. coli* O157:H7.

Regarding the Buttonwillow location and the 32 (16.5%) samples found positive for the pathogen *E. coli* O157:H7:

- Ten samples (31%) were found to genetically match the Taco John's outbreak strain (Table 2, Figure 5).
- Of these ten samples (two swabs, four water, three water and sediment, and one soil), six (60%; one swab, one water, three water and sediment, and one soil) were collected in close proximity to a suspect lettuce growing field, with the remaining four (40%; one swab and three water) coming from the two dairies near the suspect growing farms (Figure 5).
- Of these ten samples:
  - One swab sample was collected from a covered alley flush along Maya Dairy's southern border adjacent to Wegis Ranch.
  - One sample was collected from West Star North Dairy's waste water lagoon.
  - Two water samples were collected from West Star North Dairy at the southeast corner of Field 228 which is adjacent to suspect Field 227.
  - The six remaining samples (one swab of the inside of an irrigation riser, one water, three water and sediment, and one soil) from Wegis Ranch came from the southeast corner of Field 225 and the southeast corner of Field 226 (Table 2, Figure 5). Both locations were across an access road from Field 212 which was implicated in the initial traceback document. Some of the samples collected within 50 feet of Wegis Field 212.

Table 2. Results of samples collected at the Wegis Ranch and Vicinity in Buttonwillow, California – the area where samples matching the outbreak strain of the Taco John's *Escherichia coli* O157:H7 associated with iceberg lettuce were identified.

Sampling Location	Sample Type	Sample Type										Total # of Samples
		Air	Cattle biosolids	Environmental	Fecal matter	Feces	Field lettuce residue	Soil	Water	Woods & sediment	Other	
Maya Dairy	Yes	0	0	0	0	0	0	0	0	0	0	0
Wegis Ranch	Yes	0	0	0	0	0	0	0	0	0	0	0
West Star North Dairy	Yes	0	0	0	0	0	0	0	0	0	0	0
Wegis Ranch Total	Yes	0	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	<b>Yes</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

\* Refer to field materials from description (e.g. single and wildlife animals)  
\*\* Values in parenthesis indicate number of positive samples for *E. coli* O157:H7 that were also found to be a positive match to the Taco John's outbreak strain  
\*\*\* Values in parenthesis indicate percentage relative to total number of samples collected.

## Overall Summary

An examination of the area's water irrigation system in addition to irrigation system maps obtained from Wegis management revealed multiple points of confluence between the local water district piping system, Maya Dairy's waste water discharge system, West Star North Dairy's waste water discharge system and the area's irrigation system.

A key finding in this investigation was the dairy wastewater blending and distribution system used by the Wegis Ranch to irrigate crops and distribute water. Because this system has been found to have inadequate backflow protection devices, it presented a possible route for conveyance of contaminated water to fields adjacent to the suspect lettuce growing fields associated with this outbreak. The six matching *E. coli* O157:H7 samples (of water, soil, and environmental swabs) collected from the dairies came from areas where blended water was routed.

In addition to the presence of two large dairies in close proximity to Wegis Ranch, numerous signs of wildlife intrusion were also observed in the vicinity and at the different growing fields. Animal activity around fields is usually a concern as it may contribute to product contamination.



Figure 4. Map and summary of positive samples for *E. coli* O157:H7. Fields of interest are # 212, 207, and 227.

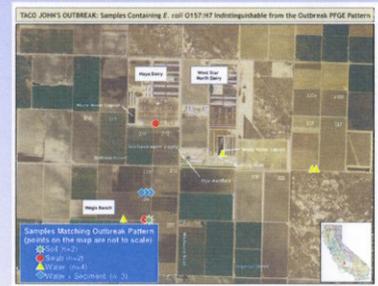


Figure 5. Map and summary of positive samples for *E. coli* O157:H7 matching the Taco John's outbreak strain. Fields of interest are # 212, 207, and 227.

## Acknowledgements

- CaFERT members of California Department of Public Health (CDPH) and US Food and Drug Administration (US-FDA)
- CDPH:
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  - Food Safety Inspection Unit
  - Food and Drug Branch Laboratory
  - Microbial Diseases Laboratory
- US-FDA:
  - San Francisco District
  - Los Angeles District
  - Center for Food Safety and Applied Nutrition (CFSAN)
  - Emergency Operations
- Centers for Disease Control
- California Department of Food and Agriculture
- Other federal, state and local agencies

## Related websites

- CDC Website: [www.cdc.gov](http://www.cdc.gov)
- FDA Website: [www.fda.gov](http://www.fda.gov)
- FDB Website: [www.cdph.ca.gov/program](http://www.cdph.ca.gov/program)

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