**1. Name of the Organism:**

*Vibrio cholerae* Serogroup O1

This bacterium is responsible for Asiatic or epidemic cholera. No major outbreaks of this disease have occurred in the United States since 1911. However, sporadic cases occurred between 1973 and 1991, suggesting the possible reintroduction of the organism into the U.S. marine and estuarine environment. The cases between 1973 and 1991 were associated with the consumption of raw shellfish or of shellfish either improperly cooked or re-contaminated after proper cooking. Environmental studies have demonstrated that strains of this organism may be found in the temperate estuarine and marine coastal areas surrounding the United States.

In 1991 cholera was reported for the first time in this century in South America, starting in Peru. The outbreaks quickly grew to epidemic proportions and spread to other South American and Central American countries, and into Mexico. 1,099,882 cases and 10,453 deaths were reported in the Western Hemisphere between January 1991 and July 1995.

Although the South American strain of *V. cholerae* O1 has been isolated from Gulf Coast waters, presumably transmitted by ships off-loading contaminated ballast water, no cases of cholera have been attributed to fish or shellfish harvested from U.S. waters. However, over 100 cases of cholera caused by the South American strain have been reported in the United States. These cases were travelers returning from South America, or were associated with illegally smuggled, temperature-abused crustaceans from South America.

In the Autumn of 1993, a new strain, a non-O1 never before identified, was implicated in outbreaks of cholera in Bangladesh and India. The organism, *V. cholerae* serogroup O139 (Bengal), causes characteristic severe cholera symptoms. Previous illness with *V. cholerae* O1 does not confer immunity and the disease is now endemic. In the U.S., *V. cholerae* O139 has been implicated in one case, a traveller returning from India. The strain has not been reported in U.S. waters or shellfish.
2. Nature of Acute Disease:

Cholera is the name of the infection caused by *V. cholerae*.

3. Nature of Disease:

   **CDC Case Definition**

   **What is a "Case Definition"?**

   **Overview of Public Health Surveillance**

Symptoms of Asiatic cholera may vary from a mild, watery diarrhea to an acute diarrhea, with characteristic rice water stools. Onset of the illness is generally sudden, with incubation periods varying from 6 hours to 5 days. Abdominal cramps, nausea, vomiting, dehydration, and shock; after severe fluid and electrolyte loss, death may occur. Illness is caused by the ingestion of viable bacteria, which attach to the small intestine and produce *cholera toxin*. The production of cholera toxin by the attached bacteria results in the watery diarrhea associated with this illness.

Infective dose -- Human volunteer feeding studies utilizing healthy individuals have demonstrated that approximately one million organisms must be ingested to cause illness. Antacid consumption markedly lowers the infective dose.

4. Diagnosis of Human Illness:

Cholera can be confirmed only by the isolation of the causative organism from the diarrheic stools of infected individuals.

5. Associated Foods:

Cholera is generally a disease spread by poor sanitation, resulting in contaminated water supplies. This is clearly the main mechanism for the spread of cholera in poor communities in South America. The excellent sanitation facilities in the U.S. are responsible for the near eradication of epidemic cholera. Sporadic cases occur when shellfish harvested from fecally polluted coastal waters are consumed raw. Cholera may also be transmitted by shellfish harvested from nonpolluted waters since *V. cholerae* O1 is part of the autochthonous microbiota of these waters.

6. Relative Frequency of Disease:

Over 200 proven cases of cholera have been reported in the U.S. since 1973, with 90% occurring within the last 5 years. Most of these cases were detected only after epidemiological investigation. Probably more sporadic cases have occurred, but have gone undiagnosed or unreported.
7. Course of Disease and Complications: Individuals infected with cholera require rehydration either intravenously or orally with a solution containing sodium chloride, sodium bicarbonate, potassium chloride, and dextrose (glucose). The illness is generally self-limiting. Antibiotics such as tetracycline have been demonstrated to shorten the course of the illness. Death occurs from dehydration and loss of essential electrolytes. Medical treatment to prevent dehydration prevents all complications.

8. Target Populations: All people are believed to be susceptible to infection, but individuals with damaged or undeveloped immunity, reduced gastric acidity, or malnutrition may suffer more severe forms of the illness.

9. Food Analysis: *V. cholerae* serogroup O1 and O139 may be recovered from foods by methods similar to those used for recovering the organism from the feces of infected individuals. Pathogenic and non-pathogenic forms of the organism exist, so all food isolates must be tested for the production of cholera enterotoxin.

10. Selected Outbreaks: Literature references can be found at the links below.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMWR 44(20):1995</td>
<td>Since the onset of the <em>Vibrio cholera</em> epidemic in Latin America in 1991, most cases of cholera in the United States have occurred among persons traveling to the United States from cholera-affected areas or who have eaten contaminated food brought or imported from these areas. In December 1994, a cluster of cholera cases occurred among persons in Indiana who had shared a meal of contaminated food brought from El Salvador.</td>
</tr>
<tr>
<td>MMWR 44(11):1995</td>
<td>The cholera epidemic caused by <em>Vibrio cholerae</em> O1 that began in January 1991 has continued to spread in Central and South America. In southern Asia, the epidemic caused by the newly...</td>
</tr>
</tbody>
</table>
recognized strain *V. cholerae* O139 that began in late 1992 also has continued to spread. This report updates surveillance findings for both epidemics.

**MMWR 42(33):1993**

Following the epidemic spread of cholera in Peru (1), in April 1991, health officials in neighboring Bolivia established a surveillance system to detect the appearance and monitor the spread of cholera in their country. The first confirmed case in Bolivia was reported on August 26, 1991; by December 31, 1991, a total of 206 cases had been reported, and 21,324 probable and confirmed cases were reported during 1992. This report summarizes cholera surveillance in Cochabamba.

**MMWR 42(26):1993**

Epidemics of cholera-like illness caused by a previously unrecognized organism occurred recently in southern Asia. This report documents the first case of cholera imported into the United States that was caused by this organism, the newly described toxigenic *Vibrio cholerae* O139 strain.

**MMWR 42(21):1993**

During February 7-May 10, 1992, an epidemic of cholera caused by *Vibrio cholerae* O1, serotype *Ogawa*, affected 1044 persons in Western Burundi, a small country in central Africa.

**MMWR 42(05):1993**

On July 2, 1991, during routine monitoring, the Food and Drug Administration (FDA) isolated toxigenic *Vibrio cholerae* O1, serotype Inaba, biotype El Tor from oysters and intestinal contents of an oyster-eating fish taken from closed oyster beds in Mobile Bay. This isolate was indistinguishable from the Latin American epidemic strain and differed from the strain of *V. cholerae* O1 that is endemic to the Gulf Coast.

**MMWR 41(36):1992**

Approximately one case of cholera per week is being reported in the United States. Most of these cases have been acquired during international travel and involve persons who return to their homelands to visit family or foreign nationals visiting relatives in the United States. The following report summarizes case reports from four states during 1992.

**MMWR 40(49):1991**

During August 1991, three cases of cholera in Maryland were associated with the consumption of frozen coconut milk imported from Asia. Following an investigation, the product was recalled, and no other cases have been reported.

**MMWR 40(30):1991**

Through June 26, 1991, four cases of cholera had been reported in New York and this report described a new laboratory procedure used to confirm the vehicle of transmission in this outbreak.

**MMWR 40(17):1991**

Through April 30, 1991, epidemic cholera has been reported
from five countries in South America: Brazil, Chile, Colombia, Ecuador, and Peru. In addition, in the United States a total of 10 confirmed cases of epidemic-associated cholera have been reported in Georgia, New Jersey, and Florida. This report summarizes information regarding the cases reported in New Jersey and Florida.

A case of importation of cholera from Peru to the United States is detailed.

The cholera outbreak in Peru is reported on and the update of the South American endemic.

On August 17, 1988, a 42-year-old man was treated at an emergency room in Rifle, Colorado. On August 15, he had eaten approximately 12 raw oysters from a new oyster-processing plant in Rifle. The patient had no underlying illness, was not taking medications, and had not traveled outside the region during the month before onset. The oysters had been harvested on August 8, 1988, in a bay off the coast of Louisiana. During a 6-day period, eight other persons shared the oysters purchased by the patient. None became ill.

Four cases of cholera acquired in Louisiana and one case acquired in Florida have been detected since mid-August 1986. All five patients were hospitalized with severe diarrhea and had stool cultures yielding toxigenic Vibrio cholerae 01, serotype Inaba.

Since mid-August 1986, a total of 12 cases of cholera have been identified among nine families living in New Orleans and in other towns in six parishes within a 200-mile radius to the south and west of New Orleans. None of the patients had traveled abroad within the past year. All patients recovered following intravenous fluid therapy. Seven patients had stool cultures yielding toxigenic Vibrio cholerae O1, biotype El Tor, serotype Inaba. The remaining five patients did not have stool cultures performed but had vibriocidal antibody titers greater than or equal to 1280, suggesting recent infection with V. cholerae O1.

For more information on recent outbreaks see the CDC.

Literature references can be found at the links below.
<table>
<thead>
<tr>
<th>Background Resources:</th>
<th>CDC brochures on the prevention of cholera.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>English</strong></td>
<td>Center for Disease Control and Prevention of Food Illness Fact Sheet</td>
</tr>
<tr>
<td><strong>Spanish</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Portuguese</strong></td>
<td></td>
</tr>
<tr>
<td>Cholera Prevention FAQ's</td>
<td>In the past decade, outbreaks of human illness associated with the consumption of raw vegetables and fruits (or unpasteurized products produced from them) have increased in the United States. Pathogens such as <em>Listeria monocytogenes</em>, <em>Clostridium botulinum</em>, and <em>Bacillus cereus</em> are naturally present in some soil, and their presence on fresh produce is not rare. <em>Salmonella</em>, <em>Escherichia coli O157:H7</em>, <em>Campylobacter jejuni</em>, <em>Vibrio cholerae</em>, parasites, and viruses are more likely to contaminate fresh produce through vehicles such as raw or improperly composted manure, irrigation water containing untreated sewage, or contaminated wash water. Treatment of produce with chlorinated water reduces populations of pathogenic and other microorganisms on fresh produce but cannot eliminate them. Reduction of risk for human illness associated with raw produce can be better achieved through controlling points of potential contamination in the field; during harvesting; during processing or distribution; or in retail markets, food-service facilities, or the home.</td>
</tr>
<tr>
<td>&quot;Produce Handling and Processing Practices&quot; (1997) Emerging Infectious Diseases 3(4).</td>
<td>Available from the GenBank <a href="#">Taxonomy database</a>, which contains the names of all organisms that are represented in the genetic databases with at least one nucleotide or protein sequence.</td>
</tr>
<tr>
<td>Loci index for genome <em>Vibrio cholerae</em></td>
<td>None currently available.</td>
</tr>
<tr>
<td>12. Molecular Structural Data:</td>
<td></td>
</tr>
<tr>
<td><strong>CDC/MMWR</strong></td>
<td>The CDC/MMWR link will provide a list of Morbidity and Mortality Weekly Reports at CDC relating to this organism or toxin. The date shown is the date the item was posted on the Web, not the date of the MMWR. The summary statement shown are the initial words of the overall document. The specific article of interest may be just one article or item within the overall report.</td>
</tr>
<tr>
<td><strong>NIH/PubMed</strong></td>
<td>The NIH/PubMed button at the top of the page will provide a list of research abstracts contained in the National Library of Medicine's MEDLINE database for this organism or toxin.</td>
</tr>
</tbody>
</table>
AGRICOLA

The AGRICOLA button will provide a list of research abstracts contained in the National Agricultural Library database for this organism or toxin.

mow@cfsan.fda.gov

January 1992 with periodic updates