Shellfish Poisoning: Paralytic, Domoic Acid, or Diarrhetic

Types and exposures	• **Paralytic shellfish poisoning (PSP)**: saxitoxin primarily from dinoflagellates in bivalve shellfish (such as clams, mussels, oysters, geoducks, etc.); 0-7 cases a year in Washington • **Domoic acid (amnesic) shellfish poisoning (DASP)**: domoic acid from diatoms in shellfish, crabs, or small fish; Washington cases in 1991; monitoring may be preventing illnesses • **Diarrhetic shellfish poisoning (DSP)**: diarrhetic shellfish toxins from dinoflagellates in bivalve shellfish; first Washington cases in 2011 • *Cooking or freezing does not inactivate the toxins*
Signs and symptoms	• **PSP**: Paresthesias (tingling) of the mouth and extremities, may be loss of coordination, cranial nerves affected (speech, swallowing) or respiratory arrest; can be gastrointestinal symptoms • **DASP**: vomiting, diarrhea and cramps followed by headache, dizziness, confusion, permanent short-term memory loss, motor weakness or paralysis, seizures, cardiac arrhythmias, coma • **DSP**: severe diarrhea, may be nausea, vomiting, abdominal cramps, and chills • Note that the above toxins are **not** affected by heating or freezing
Incubation	• **PSP**: minutes to hours • **DASP**: gastrointestinal symptoms within 24 hours, neurological symptoms within 48 hours • **DSP**: 30 minutes to 36 hours
Case classification	**Clinical criteria**: Consistent clinical presentation (See Types above) **Laboratory criteria:** toxin identified from implicated food
	Confirmed: Lab confirmed OR Clinical with epi link to confirmed case / **Probable:** Clinical with no lab confirmation and no epi link
Differential diagnosis	**Neurologic**: stroke, meningitis, epilepsy, botulism, ciguatera toxicity, organophosphates, phenytoin toxicity, tetrodotoxin, scombroid, malignancy, etc. **Gastrointestinal**: multiple bacterial and viral agents including *Vibrio* and norovirus
Treatment	Supportive; may require ventilator support (PSP) or extended rehabilitation (DASP)
Duration	PSP and DSP: several days; DASP: may be persisting neurologic impairment
Laboratory testing	Testing can be done for implicated shellfish if compatible symptoms; no testing of clinical specimens from patient • **Best specimens**: shellfish consumed in the hour to two days before onset including type of shellfish, and site and date of harvest/purchase; include commercial tags if available • Keep all specimens **cold, ship cold** with biotoxin or food form and indicated test requested. Specimen Collection and Submission Instructions: see page 28 http://www.doh.wa.gov/Portals/1/Documents/Pubs/301-016-PHLDirectoryServices.pdf
Public health actions **EMERGENCY**	If illness is consistent (note that symptoms can be variable): • **IMMEDIATELY report to DOH CD-Epi at 877-539-4344 or 206-418-5500**. Provide case history, suspected exposures and the name and phone/pager of attending provider • Report the information to the DOH Shellfish Program immediately (360-236-3330) if shellfish from Washington are implicated • If within 2 days of exposure: identify others exposed to the same product, educate about symptoms and where to seek medical care • Prevent further exposures to harvested shellfish with a hold on restaurant or grocery sales Infection Control - None

Shellfish Poisoning: Paralytic, Domoic Acid, or Diarrhetic

1. DISEASE REPORTING

A. Purpose of Reporting and Surveillance

1. To identify whether the source of transmission is a major public health concern (e.g., a commercial shellfish product or recreational harvest area) and to prevent further transmission from such sources.
2. To identify others who shared the exposure and educate them regarding symptoms of shellfish poisoning to facilitate rapid diagnosis.
3. When the source is a risk to only a few individuals (e.g., shellfish harvested from an area closed to harvesting), to inform those individuals how they can reduce their risk of future exposure.

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: no requirements for reporting.
4. Local health jurisdictions: **immediately notifiable to the Washington State Department of Health (DOH) Office of Communicable Disease Epidemiology (OCDE) (206-418-5500 or 1-877-539-4344)**.

C. Local Health Jurisdiction Investigation Responsibilities

1. **Immediately** begin an investigation to determine the likelihood of the diagnosis and potential sources of exposure.
2. Notify OCDE (206-418-5500 or 1-877-539-4344) or the DOH Shellfish Program (360-236-3330) of potential sources of exposure; prevent consumption of remaining potentially contaminated shellfish.
3. Facilitate the collection and transport of potentially contaminated shellfish for testing at Washington State Public Health Laboratories.
4. Report all *confirmed* and *probable* cases to OCDE (see definitions below). Complete the standard case report form (http://www.doh.wa.gov/Portals/1/Documents/5100/210-040-ReportForm-SFPoison.pdf) and enter the data into the Public Health Issues Management System (PHIMS) or other electronic reporting system.

2A. PARALYTIC SHELLFISH POISONING AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Paralytic shellfish poisoning (PSP) is caused by ingesting shellfish containing saxitoxins, heat-stable toxins produced by a type of phytoplankton called dinoflagellates, including

species of *Alexandrium*. Molluscan shellfish (with hinged shells such as clams, mussels, oysters, geoduck, etc.) are filter feeders that ingest the phytoplankton and concentrate the toxins in their systems. The concentration of saxitoxins in shellfish often increases when warm temperatures, sunlight and nutrient–rich water cause plankton to rapidly reproduce or "bloom." The presence of "red tides" or reddish discoloration of the water during an algae bloom are not necessarily associated with increased levels of saxitoxins and toxic algae blooms can also occur without discoloration of the water. Blooms of the causative *Alexandrium* species occur several times each year, primarily from April through October. After concentrating toxin, most shellfish remain toxic for several weeks after the bloom subsides. However, some shellfish species including butter clams can remain toxic for more than a year after a bloom.

B. Description of Illness

Paralytic shellfish poisoning presents with neurologic symptoms frequently accompanied by gastrointestinal symptoms. Paresthesias (tingling, numbness) of the mouth and extremities are the initial and most common neurologic complaint. In severe cases, ataxia (loss of coordination), dysphonia (difficulty speaking), dysphagia (difficulty swallowing) and total muscle paralysis with respiratory arrest and death may occur (if supportive care is not received). Symptoms usually resolve within a few days and recovery is complete.

C. Paralytic Shellfish Poisoning in Washington State

In recent years, DOH has received 0–7 reports of paralytic shellfish poisoning (PSP) annually. The Shellfish Program tests Washington shellfish for marine biotoxins year round. Areas are closed to harvesting if shellfish toxin levels exceed 80 µgm/100 gm. The DOH 24-hour PSP hotline (800-562-5632) tracks shellfish harvest areas closed due to marine biotoxins. Most paralytic shellfish poisoning cases occur in individuals or small groups gathering shellfish from areas closed to recreational (non-commercial) harvesting.

D. Reservoirs

Paralytic shellfish poisoning is particularly common in bivalve mollusks (e.g., clams, oysters) harvested from colder waters above 30° N and below 30° S latitude, but may occur in tropical waters as well. In the United States, paralytic shellfish poisoning is primarily a problem in Alaska, California, Washington, and the New England states.

E. Modes of Transmission

Paralytic shellfish poisoning is acquired by eating shellfish containing the toxin. *Cooking or freezing does not inactivate the toxin.*

F. Incubation Period

Symptoms occur minutes to hours after eating contaminated shellfish.

G. Period of Communicability

Paralytic shellfish poisoning is not transmitted from person to person.

H. Treatment

Symptoms resolve spontaneously in a few days. Treatment is supportive and may require intensive care and ventilatory support for a short period.

2B. DOMOIC ACID POISONING AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Domoic acid shellfish poisoning, also called amnesic shellfish poisoning, results from ingesting molluscan shellfish or crabs with high levels of domoic acid, a heat-stable toxin produced by marine diatom species of the genus *Pseudo-nitzschia.* Anchovies and sardines can also accumulate the toxin. The first reported outbreak was in 1987 in Prince Edward Island, Canada, involving over 100 cases and three deaths. Subsequent avian outbreaks have been identified in pelicans and cormorants in California.

B. Description of Illness

Gastrointestinal symptoms of vomiting, diarrhea and abdominal cramps begin within 24 hours. Neurological symptoms may occur within 48 hours including headache, dizziness, confusion, permanent short-term memory loss, motor weakness or paralysis, seizures, profuse respiratory secretions, cardiac arrhythmias, coma and possibly death.

C. Domoic Acid Shellfish Poisoning in Washington State

In 1991 high domoic acid levels were identified in Washington shellfish and 29 cases of illness were retrospectively associated with razor clams. In recent years, monitoring has identified domoic acid at unsafe levels in razor clams and Dungeness crab from Washington's coast, as well as its presence in clams, mussels, and oysters. No cases have been confirmed since 1991, which may reflect testing and closures of risk areas.

D. Reservoirs

Domoic acid poisoning is associated with bivalve mollusks, crabs, sardines, or anchovies harvested from both coasts but particularly the Pacific Coast during late summer and fall. In the United States, domoic poisoning has affected primarily marine birds.

E. Modes of Transmission

Domoic acid shellfish poisoning is acquired by eating molluscan shellfish or crabs containing the toxin. *Cooking or freezing does not inactivate the toxin.*

F. Incubation Period

Symptoms occur 15 minutes to 38 hours after eating contaminated shellfish.

G. Period of Communicability

Domoic acid shellfish poisoning is not transmitted from person to person.

H. Treatment

Treatment is supportive and may require extended rehabilitation.

2C. DIARRHETIC SHELLFISH POISONING AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Diarrhetic shellfish poisoning (DSP) is caused by eating shellfish containing heat stable diarrhetic shellfish toxins produced by marine dinoflagellates including *Dinophysis*. Molluscan shellfish concentrate the toxins. The Netherlands reported the first outbreak in the 1960s. Europe and Japan are the areas most affected, but cases occur worldwide.

B. Description of Illness

Diarrhetic shellfish poisoning is characterized by severe diarrhea, sometimes with nausea, vomiting, abdominal cramps, and chills. No fatalities have been reported.

C. Diarrhetic Shellfish Poisoning in Washington State

In 2011, three cases in a family were associated with cooked mussels from Puget Sound (Sequim Bay): http://wwwnc.cdc.gov/eid/article/19/8/12-1824_article

D. Reservoirs

Diarrhetic shellfish poisoning is associated with bivalve mollusks.

E. Modes of Transmission

Diarrhetic shellfish poisoning is acquired by eating shellfish containing diarrhetic shellfish toxins. *Cooking or freezing does not inactivate the toxin.*

F. Incubation Period

Symptoms occur 30 minutes to 36 hours of eating contaminated shellfish.

G. Period of Communicability

Diarrhetic shellfish poisoning is not transmitted from person to person.

H. Treatment

Treatment is supportive and may require rehydration and electrolyte replacement.

3. CASE DEFINITIONS

Paralytic Shellfish Poisoning

A. Clinical Criteria for Diagnosis

Onset of neurological symptoms (paresthesias, ataxia, cranial nerve abnormalities, paralysis, etc.) with or without gastrointestinal symptoms within minutes to hours of shellfish ingestion.

B. Laboratory Criteria for Diagnosis

Identification of saxitoxin in epidemiologically implicated food.

C. Case Definition

Probable: A clinically compatible case that is not laboratory confirmed and not epidemiologically linked to a confirmed case.

Confirmed: A case that is laboratory confirmed OR a case that meets the clinical case definition, is not laboratory confirmed, and is epidemiologically linked to a laboratory confirmed case.

Domoic Acid Shellfish Poisoning

A. Clinical Criteria for Diagnosis

Onset of gastrointestinal symptoms (vomiting, diarrhea and abdominal cramps) within 24 hours of shellfish ingestion with or without neurological symptoms (headache, dizziness,

confusion, memory loss, motor weakness, paralysis, seizures) within 48 hours of shellfish ingestion.

B. Laboratory Criteria for Diagnosis

Identification of domoic acid in epidemiologically implicated food.

C. Case Definition

Probable: A clinically compatible case that is not laboratory confirmed and not epidemiologically linked to a confirmed case.

Confirmed: A case that is laboratory confirmed OR a case that meets the clinical case definition, is not laboratory confirmed, and is epidemiologically linked to a laboratory confirmed case.

Diarrhetic Shellfish Poisoning

A. Clinical Criteria for Diagnosis

Onset of diarrhea or other gastrointestinal symptoms within 0.5-36 hours of shellfish ingestion

B. Laboratory Criteria for Diagnosis

Identification of diarrhetic shellfish toxin in epidemiologically implicated food.

C. Case Definition

Probable: A clinically compatible case that is not laboratory confirmed and not epidemiologically linked to a confirmed case.

Confirmed: A case that is laboratory confirmed OR a case that meets the clinical case definition, is not laboratory confirmed, and is epidemiologically linked to a laboratory confirmed case.

4. DIAGNOSIS AND LABORATORY SERVICES

A. Diagnosis

Tests are not readily available to detect saxitoxin, domoic acid, or diarrhetic shellfish toxins in clinical specimens from a patient and are not required for case classification. Confirm the diagnosis in a patient with compatible clinical symptoms by toxin testing of epidemiologically implicated shellfish or seafood.

B. Services Available at the Washington State Public Health Laboratories (PHL)

PHL can test shellfish for saxitoxins, domoic acid and diarrhetic shellfish toxins. If implicated product is available, consult the Office of Communicable Disease Epidemiology or DOH Shellfish Program to arrange for testing. Include full details about the source of the product such as beach of collection, commercial shellfish tags from a restaurant, or point of purchase.

For food or environmental specimens, have an identifier that will link back to the patient (e.g., name) both on the specimen label and on the submission form. Mark on the submission form that there is an associated illness. Due to laboratory accreditation standards, specimens will be rejected for testing if not properly identified.

C. Specimen Collection

For instructions on collecting or shipping shellfish to PHL, contact the Shellfish Program (360) 236-3330. Use a biotoxin or food form. The PHL Directory of Services has instructions for handling food specimens:
http://www.doh.wa.gov/Portals/1/Documents/Pubs/301-016-PHLDirectoryServices.pdf

When submitting commercial food specimens, keep the food item in the original package and include all available documentation regarding the purchase of the item including date and location of purchase, and receipts if available. Ship cold.

5. ROUTINE CASE INVESTIGATION

Interview the case and others who may be able to provide pertinent information.

A. Evaluate the Diagnosis

Review the clinical presentation and determine the likelihood of the diagnosis. The likelihood of the diagnosis will help to determine how aggressively to recall shellfish while confirmatory tests are pending.

B. Manage the Case

No infection control measures since the disease is not spread from person to person.

Treatment is supportive. Case follow up is not needed after treatment.

Contact management is needed only for shared consumption (See 5D).

C. Identify Potential Sources of Infection

Ask the case about shellfish consumed in the hour to two days before onset. Identify sources of shellfish particularly from Washington, Oregon, coastal Texas, and Canadian coastal provinces. Collect details for the type of shellfish eaten, site of harvest/purchase, and date of harvest/purchase. Report the information to the DOH Shellfish Program immediately (360-236-3330) if shellfish from Washington are implicated.

D. Management of Other Potentially Exposed Persons

It is urgent to **immediately** contact persons who shared an exposure with the case and who are still in their incubation periods. Provide information about symptoms and where to obtain treatment if symptoms develop. Office of Communicable Disease Epidemiology is available for healthcare provider consultations (206-418-5500 or 877-539-4344).

E. Environmental Evaluation

Perform a trace-back investigation to determine where the implicated shellfish were harvested. Collect information about the supplier and harvest site of the shellfish. Obtain legally required shellfish tags from retail sites. If possible, obtain shellfish samples for testing at Washington State Public Health Laboratories.

Prevent further consumption of shellfish from the same harvest area until information is gathered by putting a hold on shellfish from the same lot in a restaurant or grocery store. The DOH Shellfish Program is responsible for recalling shellfish harvested from the same site if needed and for initiating a closure for harvesting shellfish from a location.

6. MANAGING SPECIAL SITUATIONS

If an outbreak of shellfish poisoning is suspected, notify Office of Communicable Disease Epidemiology immediately: 206-418-5500 or 1-877-539-4344.

7. ROUTINE PREVENTION

A. Immunization Recommendations: none

B. Prevention Recommendations

1. Before harvesting shellfish, consult the 24 hour PSP Hotline 1-800-562-5632 or the DOH website:
    a. Emergency closures at https://fortress.wa.gov/doh/eh/portal/odw/si/BiotoxinBulletin.aspx
    b. Map of shellfish harvest areas closed due to marine biotoxins at https://fortress.wa.gov/doh/eh/maps/biotoxin/biotoxin.html
2. Biotoxins are not destroyed by cooking or freezing. Eat shellfish from safe areas only, either commercial products or as identified in the shellfish harvest area closure map.

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

October 2010: Domoic acid poisoning was added to the guideline including description in Section 2B and case definition in Section 3.

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

November 2013: Diarrhetic Shellfish Poisoning added and prior Section 5 and 6 were combined.

March 2016: Face sheet added.