

GUIDELINES FOR WET STORAGE OF BI-VALVES MOLLUSCAN SHELLFISH

California Conference for Directors of Environmental Health

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I. BACKGROUND

Wet storage systems are for the temporary storage of shellfish from approved areas, de-sanding, and improving palatability. Wet storage systems are not designed to increase the safety of shellfish. The central and overriding concern with wet storage systems is to protect the molluscan shellfish from sources of contamination.

Typically, wet storage systems are found in food markets and restaurants. Each system (one lot of a specific species) must have its own dedicated and separate tank or aquarium, filter, pump, chiller, water disinfection unit and connecting piping.

II. SCOPE

The California Conference for Directors of Environmental Health recommends that local environmental health jurisdictions in California use these guidelines in order to standardize the way molluscan shellfish are stored at retail. These guidelines were developed in cooperation with the California Department of Health Services Food and Drug Branch and are designed to help ensure the safest construction and operation of wet storage systems.

III. DEFINITIONS

1. Molluscan Bi-valves: Filter feeding shellfish, including; Oysters, Clams, Mussels, Geoduck, and Scallops.
2. Wet Storage: Live shellfish, submerged under water or subjected to heavy spraying.

IV. PLAN REVIEW

The materials used to construct wet storage systems shall be smooth, non-contaminating, non-toxic, noncorrosive, designed and installed to be easily cleaned and sanitized. All plans indicating fish tanks, seafood tanks, aquaria or similar seafood holding units, should be questioned regarding any intention to wet store live molluscan bi-valves. Using the terms molluscan bi-valves, shellfish, and wet storage can be confusing to the operator or his agent. Inquire if the tanks will be used for live oysters, clams, mussels, geoduck, or scallops.

The operator should be encouraged to seek the advice and services of a company familiar with the design and installation of wet storage systems. Plans shall be drawn to scale and include type of molluscan shellfish to be held, design and construction, validation of disinfection system, operational plans and monitoring parameters, and sample records (see page 4, *Monitoring: #6*). The evaluation of the manufacturers validation study includes flow rates, product loads, bacteriological quality, and turbidity levels.

V. STRUCTURAL FACTORS

1. **Tank or Aquarium:** Acceptable materials may include tempered glass, acrylic, and polyester or epoxy gel coated fiberglass. Ceramic tile with epoxy grout is not an acceptable material. All other materials must be evaluated for compliance with applicable standards for food contact surfaces. Finally, design of the tanks shall preclude self-service.

2. **Re-circulating system:** The tanks shall be designed to provide adequate and consistent flow of water for proper circulation and assure efficient drainage (no dead spots). Design must incorporate appropriate mechanisms to assure adequate oxygenation of water, usually through appropriate aeration units, cascading of water or spray. Shell stock in submerged re-circulating wet storage systems must remain submerged to assure flow of water through product during storage. Shellfish in spray-type re-circulating wet storage systems shall be supplied with water that is sprayed in a fan-shape and stored off the bottom of the tank to prevent submersion of shellfish. To assure proper circulation of water, shell stock shall be stored in trays approved by the local environmental health jurisdiction. The maximum depth of shellstock should not exceed 3 inches. Plumbing must meet applicable NSF Standards (NSF Standard 61) and be compatible for use in salt-water applications. Typically, PVC Schedule 40, meeting ASTM 1785, is used. Plumbing shall not contaminate wet storage water due to cross connections or piping dead-legs. Design shall include appropriate sampling and system clean out sites.
3. **Filter System:** This may be one or a combination of several materials and may include crushed coral, activated charcoal and polyester fiber matting. Sand filters are becoming increasingly popular. Keep in mind that all materials and systems shall be designed for use in salt-water applications and be effective in controlling turbidity so that the water will not become cloudy. The filter system shall be cleaned and sanitized in sufficient frequency to prevent contamination of water. Filter systems should be listed to ANSI/NSF 42, 53, or 61.
4. **Pump:** Must be designed for use in potable water systems, yet be resistant to the corrosive effects of salt water. The pump shall correlate with the ultraviolet (UV) system. These systems work together. It must be noted that pumps tested to ANSI/NSF 50 (the swimming pool standard) have not been evaluated for use with potable water. UL 1018 safety standard for "Electric Aquarium" does cover pumps for salt-water application.
5. **Chiller:** The chiller shall be designed for use in potable water systems, yet be resistant to the corrosive effects of salt water. It shall be located prior to the disinfection unit. CURFFL requires live Molluscan bi-valves to be maintained at 45°F. or below. Natural pathogens such as *Vibrio* proliferate in warmer waters.
6. **Disinfection system:** Typically, an UV system is used to disinfect the water. Properly sized UV systems are effective in destroying pathogenic microbes. Since pathogens multiply exponentially, the water must be treated immediately prior to introduction into the wet storage tank. The cleaner the water after filtration, the more effective the UV treatment (i.e. turbidity is low). UV systems designed for saltwater aquariums have been accepted. Disinfection systems shall be sized for flow rate and be compatible with the pump. A flow meter shall be installed between the filter and the UV system. The disinfection unit must be able to disinfect the storage water to a non-detectable coliform bacteria level (<2MPN/100 ml), for the duration of storage, using the APHA Recommended Procedures for the Examination of Seawater and Shellfish. Proper operation of the disinfection system must be demonstrated through a validation study (See NSSP Model Ordinance, Chapter 10 for proper procedures to validate the system and testing methods) and verified through routine laboratory analysis. As NSF certified UV systems are available (Standard 55) their use is required. UV systems work with the pump to produce 15910 Microwatt seconds/cm² minimum killing dose. UV bulbs must be replaced pursuant to manufacturer's specifications. The UV lights shall have an indicator, usually a colored light that shows the light is on and be on at all times when shellfish are in the wet storage system.

Note: All components for a single wet storage system shall be color-coded or numbered and have arrows to indicate direction of water flow, specifically for that individual system. For example Tank #1 may hold oysters. The color assigned to that oyster system is red. Pipes from the Oyster tank → Filter Bed → Pump → Sand Filter → flow meter → Chiller → UV System → back to the tank; will be marked red (an indelible ink or paint must be used). Pipes from the Clam Tank might be identified with green paint, mussels yellow etc. Direction of the water flow, typically with painted or etched arrows, must also be marked on the pipes.

Floor sinks or trench drains, with appropriately sized mesh to prevent scales from clogging drains shall be included. Floor drains for wash down shall also be installed where necessary.

VI. OPERATIONAL FACTORS

Operational factors need to be considered if you are going to allow wet storage tanks in the retail setting. The following operational factors will play a major role in the safety of consuming molluscan shellfish by consumers. Conditions of retail wet storage should be strictly controlled to assure that the shellfish are not contaminated by wet storage and the shellfish traceability is maintained. The conditions were put into three categories; SOP (Standard Operating Procedures) of the firms operations, Design/Review (designs of the wet storage systems are reviewed by the local health department for compliance), and Monitoring (the daily monitoring of the equipment, system, and other factors to maintain the system is properly maintained).

A. Standard Operating Procedures

1. *Contamination from other species:* Contamination can result if water contacts other species even if the water is treated by filtration and UV disinfection.
2. *Contamination from Gulf Oysters:* Contamination with *Vibrio vulnificus* will result if Gulf of Mexico harvested shellfish is mixed in the same tank or water system with non-Gulf of Mexico shellfish.
3. *No commingling:* It is not acceptable to allow the mixing of different lots of shellfish or shellfish from different harvest areas in the aquaria.
4. *Preventive maintenance by trained staff:* Either properly trained wet storage tank manufacturer personnel or the properly trained store personnel shall maintain the preventive maintenance of the system.

B. Design/Review

1. *No self-service:* Shellfish wet storage tanks shall be accessed only by authorized employees using sanitary utensils to add and remove shellfish.
2. *Potable water:* Water used in wet storage systems shall be supplied from potable or other approved sources.
3. *Replacement of water:* Failure to change the water frequently can result in the build-up of nitrates and turbidity in the storage water. High turbidity and nitrate concentration will cause the death of the shellfish.
4. *System:* Wet storage system has its own dedicated tank or aquarium, filter, pump, chiller, UV disinfection unit, and connecting piping.
5. *Materials:* Materials used to construct wet storage systems shall be smooth, non-contaminating, non-toxic, and designed and installed to be easily cleaned and sanitized.
6. *Clearance:* Adequate clearance shall be maintained between the shell stock and the bottom of tank.

C. Monitoring

1. *Shellfish kept alive:* The wet storage system environment must contain adequate dissolved oxygen to keep the shellfish alive.
2. *Safety of chemicals and sanitizers:* No unsafe chemicals can be used to treat the water or clean and sanitize the equipment.
3. *Dead shellfish:* Failure to keep shellfish alive results in the loss of that food for legal sale. Live shellfish or seafood that die by means other than slaughter is adulterated. They cannot be sold, frozen and sold, or used in cooked foods. Dead shellfish shall be discarded.
4. *UV system:* Failure to check that the UV disinfection system is constantly on will result in contamination of the product (i.e. when the retail food establishment is closed, is the system still on when shellfish are in the tanks). The UV bulb should be changed at least once per year and the plastic sleeve cleaned at least every two weeks.
5. *Bacteriological testing:* Certified testing labs to maintain water quality shall conduct periodic testing for bacterial contamination in the tanks. Testing for coliforms should be weekly, or at a frequency required by the local enforcement agency. Samples shall be taken after the UV disinfection system. There shall be no detectable levels of coliforms in the water after the UV unit.
6. *Record keeping:* Record keeping by the retail food facilities for wet storage shall include inspection of the water treatment system (UV disinfection system), water testing, maintenance records, shellfish traceability, temperature controls, and cleaning and sanitizing of the tanks.
7. *Other monitoring factors:*
 - Salt used to manufacture artificial seawater shall be food grade (free of harmful contaminants and ingredients).
 - Temperature of the water is at or below 45°F.
 - Presence of cloudiness shall be monitored daily at the start of the each workday and corrected when necessary.
 - The UV indicator light shall be on.
 - The traceability of shellfish must be maintained while in the wet storage tanks.