

# Certified Naturally Grown Aquaponic Produce Standards



## Outline

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## Appendix A

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### 1. System Design and Components

There are a wide variety of forms and configurations that successful aquaponic systems may take, such as

- Media-filled bed system (also known as flood and drain),
- Deep water culture (also known as raft, deep flow, channel, float),
- Nutrient Film Technique,
- Aeroponics,
- Vertical Systems,
- and others.

Certified Naturally Grown does not require any particular design or kind of system. However, CNG does require that Producers ensure that their aquaponic system is designed to adequately perform certain functions that are critical to the overall health of an aquaponic system, such as:

#### *Water circulation*

- Required: Producers must ensure their system is designed to provide sufficient water circulation, typically at a rate that recirculates the water volume of the fish tank(s) each hour.
- Recommended: Producers are encouraged to design systems that take advantage of gravity, and minimize the number of pumps and energy required to circulate the water.

#### *Aeration*

- Required: Producers must ensure their system is designed to provide sufficient aeration to support the health of the fish, plants, and beneficial bacteria.

### *Degassing*

- Required: Producers must ensure their system is designed to allow methane, carbon dioxide, and nitrogen gas to be released. This may occur in a separate degassing tank, through vigorous aeration, or in the process of flowing through the system, if properly designed.

### *Biofiltration*

- Required: Producers must provide sufficient surface area for nitrifying bacteria to colonize. Depending on the system design, there may be sufficient surface in the fish tanks, grow beds, and other system components to support adequate populations of nitrifying bacteria, while others may require a separate biofilter – a container filled with loose media to increase the surface area. Care should be taken to ensure that the population of nitrifying bacteria is sufficient to match the ammonia produced by the fish.

### *Removal of fish waste solids*

- Required: Producers must ensure fish waste solids are removed from the system. This is commonly accomplished by, for example, a drum filter, settling tank, swirl sedimentation, or static filters.
- Prohibited: Animals or organisms must not be solely relied upon to consume fish waste solids online within the system.

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## **2. Materials for Main System Components and Growing Media/Root Support**

- Allowed: Allowed materials are subject to review if scientific studies indicate that a material poses a risk to the health of fish, plants, consumers, or producers.
  - Gravel
  - Silica rock
  - Expanded clay aggregate
  - Perlite
  - Vermiculite
  - Sand
  - Peat
  - Coir
  - Soil and compost, allowed only when used as part of a hybrid system where the water ‘dead ends’ (does not recirculate from that section of the system)
  - Polystyrene \*CNG recommends polystyrene that does not contain hexabromocyclododecane (HBCD), and that producers using polystyrene take measures to extend its useful life, such as careful handling, sizing rafts appropriately to prevent breaking, and painting the top surface with non-toxic, fish-safe paint to protect from UV light

- Rockwool
  - Compressed grow plugs made from peat or coir that do not contain synthetic fertilizers
  - Rigid PVC (polyvinyl chloride), rated for potable water
  - ABS totes and tanks (acrylonitrile butadiene styrene)
  - HDPE (high density polyethylene)
  - MDPE (medium density polyethylene)
  - LDPE (low density polyethylene)
  - Fiberglass tanks with food grade resin
  - Cement, as long as it does not come into contact with system water
  - Treated wood, as long as it does not come into contact with system water
  - Polyethylene film
  - Polyethylene tubing
  - Acrylic
  - Polypropylene
  - IBC totes, new or repurposed: allowed only if (i) they were a component of the system at time of certification (they cannot be added as components to an already-certified system), and (ii) the tote was purchased new and unused, or the producer can obtain verification from source that their repurposed IBC tote(s) had previously been used only for food grade materials
  - Vinyl hoses or liners \*discouraged
  - EPDM liners (ethylene propylene diene monomer) \*discouraged
- Prohibited:
    - Roofing materials that contain flame retardants
    - Compressed grow plugs or plug trays that contain synthetic fertilizers
    - Plastics that contain BPA (Bisphenol A)
    - IBC totes: prohibited from being added as a new component to a certified system, and, re-purposed IBC totes can not be grandfathered in if the producer is unable to obtain verification from the source that the IBC tote had only been used for food grade materials
    - Recycled plastics

### **3. Water Sources**

Water quality is a critical component of any AP operation. CNG requires producers to take measures necessary to ensure that all incoming water is as clean and safe as possible.

Producers must adhere to all local, state, and federal regulations regarding food safety and water used to produce food. Should any of the standards described below appear to contradict local, state, or federal regulations, the producer must adhere to the regulations and notify CNG of the conflict. Certified Naturally Grown is not a food safety certification program. CNG does not in any way certify food safe production practices.

The risk of contamination from metals, pesticide or other residues varies regionally and by source (municipal, well, rain, or surface). For example, municipal water is unlikely to have concerning levels of heavy metals, but many municipalities add chlorine and/or chloramine, which are dangerous to fish health. In contrast, water from shallow wells in agricultural areas likely represent a higher risk of synthetic pesticide residues.

Because of variation in the risk of contamination by water source and by region, CNG requires that producers contact local experts regarding the contaminant(s) that are the most common based on their water source as well as the local hydrology, geology, and land use. Sources of information include: local or state health department officials, Natural Resource Conservation Service agents, state environmental protection or pollution control agencies, local well drilling and water testing companies, and others. Water testing labs must adhere to EPA guidelines for water testing.

### *Municipal Water*

- Required: Conduct an annual test or obtain annual test report from municipality, with particular attention to levels of chlorine, chloramine, and heavy metals.
- Recommended: Producers should test water at the point of use for heavy metals, especially for lead.
- Prohibited: Water that exceeds the EPA Guidelines for Heavy Metals in Reclaimed Water for Irrigation.

### *Municipal Water Treatment*

- Allowed: Allowed methods to remove chlorine and/or chloramine include off-gassing, activated carbon filters, reverse osmosis, UV treatment, ozone, and other appropriate oxidizing techniques.
- Prohibited: Synthetic chemical dechlorinators and chloramine removers.

### *Well Water*

- Required:
  - Producer must contact local experts to determine a list of pesticides and heavy metals that are the most common contaminant concerns in their area for which well water should be tested. Local experts include environmental protection, natural resource, and pollution control agencies; health department officials; local well drilling and water testing companies; and others.
  - Producer must keep records of the dates and results of such inquiries, including the names and affiliations of local experts consulted, a list of which contaminants the experts noted, whether the producer tested for these contaminants, and the results of the tests.
  - Testing for contaminants most common in the region must occur before first use, or before the operation can be fully CNG certified.
  - Well water must be tested annually.
  - Producers must use appropriate filtration or treatment methods based on contaminants identified by the annual test. Depending on the target contaminants, these may include UV, activated carbon filter in the case of chlorine injection, ozone, oxidation, and reverse osmosis.
- Recommended:
  - In addition to annual testing, wells should be tested after any relevant geological activity that may impact groundwater (for example, flooding, drilling, earthquakes, or hydraulic fracturing in the region).
- Prohibited:
  - Water that exceeds the EPA Guidelines for Heavy Metals in Reclaimed Water for Irrigation

- Water that includes significant levels of pesticides, fertilizers, or other contaminants of concern.

*Rainwater*, that is collected and stored (where allowed by local regulations)

- Required:
  - Must be stored in a closed, food-grade container.
  - First flush diverter appropriately sized to the catchment area, flushing a minimum of 0.1-0.5 gallons per 10 sq. ft. of catchment area.
  - Stored rainwater must be tested for heavy metals and pesticide residues before first use.
  - Filtration or treatment through UV, activated carbon filter, ozone, oxidation, and reverse osmosis, as appropriate.
- Allowed:
  - Catchment surfaces: polycarbonate greenhouse material, other poly greenhouse films, or metal that is coated with food grade paint. Other materials will be considered on a case-by-case basis, and evaluated on their leaching potential.
  - Storage tank materials: fiberglass with food-grade resin lining, virgin polyethylene (not recycled or re-used).
  - Rainwater that falls directly into the system for outdoor systems.
- Prohibited:
  - Catchment surfaces made from asbestos-cement tiles, asphalt, tar, coated terracotta tiles, lead acrylic or bitumen-based paints, pressure-treated wood, or zinc roofing (unless painted with food safe paint).
  - Storage tank materials made from repurposed or recycled plastic, BPA, or vinyl.
  - Storing rainwater for more than three days without the use of chlorine or testing for contaminants

*Surface water*

- Prohibited: The use of surface water is prohibited because of the increased risk of runoff carrying synthetic fertilizers, pesticides, herbicides, other contaminants, and pathogenic bacteria.

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#### **4. Monitoring**

Responsible producers regularly monitor various indicators including water temperature, pH, levels of ammonia, nitrites, nitrates, and dissolved oxygen. We require that producers keep logs when monitoring these indicators, though because of the variation in design, configuration, and the needs of the particular fish and plant species used, we do not layout specific target ranges for these measures.

- Required:
  - Monitoring of temperature and pH at least weekly
  - Monitoring of dissolved oxygen, ammonia, nitrites, and nitrates at least monthly
- Recommended:

- Daily monitoring of temperature and pH.
  - Weekly monitoring of dissolved oxygen, ammonia, nitrites, and nitrates.
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## 5. Inputs for pH Adjustment

It is likely that producers will occasionally need to adjust the pH by adding materials to reach the appropriate pH balance. The majority of pH buffering materials are synthetic, however, at this time small amounts of these materials are considered necessary to achieve and maintain a steady pH appropriate for production and fish wellbeing. CNG allows these synthetic materials, at least until further developments yield a natural alternative.

- Allowed:
    - calcium carbonate (ag lime) from dolomitic lime, oystershell flour, etc.  
Mined/crushed – not processed.
    - calcium hydroxide (hydrated lime)
    - potassium hydroxide (pearlash or potash)
    - potassium carbonate
    - potassium bicarbonate
    - nitric acid
    - phosphoric acid
    - muriatic acid
    - acetic acid
    - sulfuric acid
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## 6. Waste Use & Disposal

Certified Naturally Grown strongly encourages producers to minimize waste, recapture nutrients, and reuse or recycle materials where possible. Any actions to reuse, recycle, compost, or otherwise dispose of wastes must comply with local, state, and federal regulations.

### *Fish Waste Solids*

Solids removed from an aquaponics system have the potential to become a valuable resource or a waste product.

- Recommended:
  - Solids can be composted and used or sold as a soil amendment.
  - An offline aerobic digester may be used to mineralize the fish waste solids, which can then be reintroduced to the system.
- Discouraged:
  - Disposal of solids in municipal sewage system or septic system.

### *Nutrient-Rich Water*

If system is well monitored and maintained, water discharge will be infrequent. If it becomes necessary to discharge nutrient-rich water into the environment, it should be managed in such a way to recapture nutrients wherever possible, and to prevent excess nutrients from overwhelming natural waterways.

- Recommended:
    - Applying nutrient-rich water to pasture, soil-based crops, or constructed wetlands in order to maximize nutrient recapture. (As with all CNG standards, local, state, and federal regulations take precedence over CNG standards and recommendations).
  - Discouraged:
    - Nutrient-rich water should not be applied within 50 feet of natural water bodies including rivers, streams, lakes, or natural wetlands.
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## 7. Crop Production and Management

### *Sources of Seeds and Planting Stock*

- Required: The producer must use Certified Naturally Grown or certified organic seeds, annual seedlings, and planting stock, except that:
  - Non-CNG or non-organic, untreated seeds and planting stock may be used to produce a CNG crop when an equivalent CNG or organic variety is not commercially available. Before purchasing non-CNG, non-organic seeds, the producer must inquire with at least three commercial organic seed suppliers to determine that they don't offer the variety the producer seeks in organic or CNG form. The producer must keep records of which seed suppliers were consulted for each variety of conventional seeds planted.
  - Non-CNG, non-organic annual seedlings may be used to produce a crop when a temporary variance has been granted (these variances are given primarily because of an extreme natural disaster)
- Prohibited:
  - Seeds that are chemically treated or genetically modified
  - Seedlings or planting stock that was raised with synthetic fertilizers, synthetic pesticides, synthetic fungicides, or synthetic wetting agents
  - Non-CNG or non-organic planting stock to be used to produce a perennial crop may be sold, labeled, or represented as Certified Naturally Grown only after the planting stock has been maintained under a system of CNG management for a period of no less than 1 year

### *Plant Nutrients*

- Recommended: Producers should design and manage their system to match fish stocking densities with crop production in order to minimize the need for supplemental nutrients.
- Allowed:
  - Chelated iron
  - Calcium and potassium, generally as added for pH adjustment
  - OMRI-approved nutrient solutions, if suitable for aquaponic systems

- Worms, allowed only if rinsed once upon receipt; allowed to feed on wet corn meal, oatmeal, or cream of wheat for 24 hours to purge their system; and then rinsed a second time immediately before being introduced to the system
- Prohibited:
  - Synthetic forms of the following: nitrogen, magnesium, sulfur, boron, manganese, zinc, copper, molybdenum, nickel

### *Pest and Disease Management*

- Required:
  - All pest and disease management practices must be in compliance with food safety regulations and local laws governing product applications for pest and disease management.
- Recommended:
  - Producers are encouraged to rely primarily on biosecurity practice, sanitation practices, cultural practices, physical barriers, and biological pest control to prevent and manage pest and disease pressures.
- Allowed:
  - Natural and non-synthetic substances, including microbial, botanical, and mineral based substances, may be used to manage pests and disease, so long as they're used with sufficient caution to protect fish health.
- Prohibited:
  - Synthetic pesticides
  - Copper-based pesticides
  - Petrochemical-based pesticides and fungicides

## **8. Fish Management**

Certified Naturally Grown does not offer certification for the fish in an aquaponic system. However, since the fish are an essential component of any aquaponic system, there are certain CNG standards for fish management.

### *Fish Species*

- Required: Some fish species commonly used in aquaponics may be restricted or prohibited in certain areas (for example, several tilapia species are not allowed in most California counties). The producer must ensure that their fish comply with state and local regulations.

### *Fish Sex Selection*

- Prohibited: Hormonal sex reversal treatment is not permitted to occur online (within the system).

### *Fish Sources*

- Recommended:



- When acquiring new stock, producers should avoid introducing disease and parasites by following biosecurity practices and purchasing from trusted sources.
- New stock should undergo a quarantine and observation period before being introduced to established stock.
- Purchased stock should have a health certificate.
- Allowed: On-site breeding

### *Fish Feed*

These standards are subject to review in 2018. At that point the availability and cost of organically grown fish feed will be assessed to determine whether it's feasible to expect CNG aquaponic producers to source feed made from organically grown ingredients.

- Recommended:
  - Fish feed that does not contain fish meal from over-fished wild stocks
  - Fish feed that is organically grown
- Allowed:
  - Fish feed that is conventionally grown
- Prohibited:
  - Fish feed that contains:
    - Medications
    - Hormones
    - Human or other animal waste
  - Supplemental feed such as duckweed and black soldier fly larvae that are potential vectors for contaminants

### *Fish Health*

- Required:
  - Producers must employ good management practices that ensure stable environmental conditions and biosecurity practices to prevent the introduction of pathogens to promote fish health and prevent fish diseases.
- Recommended:
  - Producers should have a way to quarantine and treat diseased fish offline when needed.
  - When disease does occur, treatments that do not require conventional medicines are encouraged (e.g. offline salt or temperature treatments) as appropriate for the disease and fish species.
- Allowed:
  - If the above treatments are not sufficient or appropriate, antibiotics specific for food fish are allowed only if the treatment occurs off-line in a tank that is decoupled from the system.
    - Fish treated with antibiotics must be quarantined outside the CNG system for a time equal or greater to the withdrawal times indicated by [FDA guidance on aquaculture drugs](#).
    - Any fish waste generated during the quarantine period cannot be used in the re-circulating system.
    - When antibiotics are used, producers must record the date, drug, dose, and number of fish treated. This must be available for the inspector to review. Frequent use of antibiotics (more than 3 times

per year) will trigger a deeper review of sourcing, sanitation and biosecurity practices.

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## 9. Location and Buffers

Producers must ensure that their operation is sufficiently protected from potential sources of contamination, which vary considerably by location and neighboring land uses. In agricultural areas, sources of contaminations may include drift of pesticides, herbicides, genetically modified pollen, and other prohibited substances. In urban or industrial areas, sources of contamination may include lawn chemicals, or point-source pollution from industrial or commercial uses.

*For all producers:*

- Recommended: Producers should contact neighbors to discuss adjacent land uses and activities to obtain information about potential contamination risks, and to notify neighbors that Producer is seeking Certified Naturally Grown status.

*For outdoor producers:*

- Required: Outdoor operations must take measures to ensure that there is an adequate buffer to prevent contamination. The required size of the buffer varies based on the neighboring activities, what substances are used, how they are applied, prevailing wind patterns, and any physical barriers between potential sources of risk and the aquaponic system. See below for general recommendation. The adequacy of actual buffers will be determined in consultation between the producer, Certified Naturally Grown staff, and inspectors.
- Recommended:

Neighboring land use	Recommended buffer
Urban/residential, where neighboring parcels may be sprayed with home use synthetic herbicides, pesticides, or fertilizers (applied by hand, low to the ground)	20 ft or more tall windbreaks
Conventional crops, where synthetic chemicals are sprayed low to the ground	25 ft or more tall windbreaks
Conventional orchard or tree farm, where spray is angled upwards and intended to cover tall vegetation/trees	100 ft or more tall windbreaks
Crops, orchards, or tree farms, spray is applied aerially by helicopter or crop dusting plane	200 ft or more tall windbreaks

*For indoor producers:*

- Required: Indoor producers must ensure that the design and placement of their ventilation and air quality system prevents contamination.

*For producers sharing greenhouse space with other producers:*

- Required: Producers sharing greenhouse space must ensure that there is a physical barrier between their operation and any areas where prohibited substances may be used. The other producer must notify the CNG producer and turn off any air circulation prior to spraying any substances prohibited by CNG standards. Both the CNG producer and the other producer(s) sharing the greenhouse space are required to co-sign a declaration detailing this understanding.
  - Recommended: Producers who need to share greenhouse space are encouraged to share with producers who don't spray substances prohibited by CNG standards.
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## 10. Energy

Certified Naturally Grown encourages producers to continually evaluate their practices to examine ways where energy use can be reduced, energy can be used more efficiently, and/or supplemented or replaced with renewable energy.

- Recommended:
  - Producers should aim to minimize energy use when making decisions about siting, housing; ventilation; insulation; gravity-assisted water circulation; energy efficient pumps, aerators, and lighting; and other aspects of their operation.

Producers should consider opportunities to purchase or generate renewable energy to reduce fossil fuel use.

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## 11. Record Keeping

Up-to-date and accurate records will help producers and Inspectors alike assess the operation and management of the aquaponics system.

- Required:
  - Producers must keep a log that includes the following information:
    - Temperature, at least weekly
    - pH, at least weekly
    - Dissolved oxygen, at least monthly
    - Ammonia, at least monthly
    - Nitrites, at least monthly
    - Nitrates, at least monthly
    - Date, amount, and name of any plant pest control substance used
    - Date, amount, and name of any plant disease control substance used
    - Date, treatment, dose (if applicable), and withdrawal time for any medical treatments administered for fish
    - Date and results of water tests
    - Producers must keep receipts and other documentation of seed and transplant sources including, when conventional seeds are used, a register of which three seed suppliers were consulted to determine that the seed variety

wasn't available in CNG or organic form, for each variety of conventional seeds planted.

- Producers must keep records of inquiries to relevant experts with knowledge of likely contaminants in the local water supply, including the date the inquiry was made, the name and affiliation of the person contacted, and a list of which contaminants the expert/s noted were commonly found in water from the local area.

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## 12. Inspections

Certified Naturally Grown is a Participatory Guarantee System (PGS), where the Inspector provides at least two functions: an opportunity for the producer and Inspector to share knowledge about best practices, and provide an audit to make sure the producer understands the CNG standards and that they are being upheld.

### *Eligible Inspectors:*

- Aquaponics producer who is CNG or certified organic
- Aquaponics producer who is not certified
- Aquaponics instructors/educators
- Hydroponics producer
- Soil-based farmer who is CNG or certified organic\*

*\*If there are no aquaponics producers within an hour drive who are able to conduct an inspection, producers may rely on a soil-based farmer who is CNG or certified organic to serve as an inspector provided that the soil-based farmer a) is approved in advance by CNG staff and b) reviews an informational document provided by CNG prior to the inspection. Additionally, once the inspection materials are submitted, they will be reviewed by an aquaponics producer or review committee. This review may turn up questions or concerns that must be addressed before the inspection requirement is considered to have been met.*

### *Exclusions:*

- Inspections cannot be 'exchanged' within a 12-month period. For example, if Producer A conducts an inspection of Producer B's operation, then Producer B cannot conduct an inspection of Producer A's operation that year. Producer A must find another eligible inspector.
- Individuals with familial ties to the Producer are not eligible to serve as their inspector.
- Individuals who are employees of the Producer are not eligible to serve as their inspector.

### *Frequency:*

- Inspections are required once annually (with a 4-month grace period)

### *Work Requirement:*

- CNG producers are expected to conduct at least one inspection for another CNG aquaponic producer annually. If there is one who needs an inspection within a 60-minute drive, then the inspection shall be conducted on-site. If there is no CNG producer within a 60-minute drive who requires an inspection, then the work requirement may be fulfilled by reviewing the inspection documents from another aquaponic operation seeking certification, provided by CNG staff. If no inspection reports require reviewing, the work requirement may be waived until there is a CNG aquaponic producer who needs an inspection.

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## Appendix A: EPA Limits for Heavy Metals in Reclaimed Water for Irrigation

EPA Limits for Constituents in Reclaimed Water for Irrigation – Long Term Use	
	Mg/L
Aluminum	5
Arsenic	0.1
Barium	0.1
Boron	0.75
Cadmium	0.01
Chromium	0.1
Cobalt	0.05
Copper	0.2
Fluoride	1
Iron	5
Lead	5
Lithium	2.5
Manganese	0.2
Molybdenum	0.01
Nickel	0.01
Selenium	0.02
Vanadium	0.1
Zinc	2