Cistern Workshops Questions from Attendees

The Q&A below are consolidated responses from all USVI workshops held in 2024-2025.

Chlorine Treatment

1. **Is it safe for people to drink water from their cistern if they boil it first?** Slide 23 and 43.
   a. Boiling water is a short-term treatment method that removes bacteria and viruses and can boil off some volatile disinfectant byproducts (DBPs), depending on how long the water is boiled. It is important to let solids settle, then decant or filter out sediments and vegetative debris before boiling. Boiling does not remove heavy metals and other non-volatile chemicals.
2. **Is boiling good for removing chlorine?** Slide 43.
   a. Yes, boiling water can remove chlorine since chlorine is a volatile chemical. This means that it readily evaporates when heated. All residual chlorine should be removed by boiling for 15 to 20 minutes, at a slow boil. After boiling water, be sure to store it in a sanitized container. To sanitize the storage container, triple-rinse the storage container with treated water first, pour the treated water out, then put in boiled water.
3. **How much chlorine is needed to clean?**
   a. Slides 28-31. How much chlorine is needed depends on the volume of water to be treated. The chlorine treatment concentrations needed to maintain a safe system is 0.2-2.0 mg/L (parts per million).
   b. Slides 27, 30-31. Check your chlorine weekly because free chlorine is lost in many ways, you will need to test to check the level of free chlorine to determine if you need to add more chlorine to keep your water sanitized.
4. **Can you use Clorox instead of bleach on your cistern? Is there a difference between bleaches used for your cistern?** Slides 24-25.
   a. Clorox is a brand name and is bleach (Sodium Hypochlorite). No matter the brand, select "regular" bleach.

b. Avoid purple or scented bleaches.
c. Avoid "outdoor bleach" as they are full of chemicals to inhibit algae growth and insect populations. These chemicals are poisonous and should not be allowed into your cistern.

5. **Do we have to worry about the amount of chlorine that reaches the septic system?**
   a. Review this additional information https://www.epa.gov/sites/default/files/2015-06/documents/disinfection_small.pdf
   b. Yes! Be kind to your septic system. When shocking the pipes with high chlorine solutions, drain the fixtures into a tub and/or sink and let the chlorine rich water sit in the tub and/or sink until the chlorine levels have lowered.
   c. You can use chlorine test strips to test the sitting water to make sure that the levels are safe for septic systems.
   d. Be sure that chlorine levels are below 2 mg/L. The lower the levels, the kinder you are to your system.
6. **At this measured concentration of 0.2-2 mg/L (parts per million), I assume the water is safe to drink even without filtration, correct?** Slide 22 & 23.
   a. Some people are more tolerant of chlorine levels in water. If the water is in this range and is palatable, it is safe.
   b. Add prefiltration, A good example is reuseable spin down filter or a method to ensure sediments and vegetative materials are out of the cistern, to make sure that no DBPs are formed in the presence of this amount of chlorine.
   c. We recommend a chlorine residual level of 0.5-1.0 mg/L for drinking. At levels above 2.0 mg/L one can readily smell and feel the effects internally and on the skin.
7. **A resident offered this information: For what it's worth, Ocean Systems Laboratory that does much of the water testing on St. Thomas recommends almost double the bleach amount for cisterns: they say 60oz per 10,000**

gallons in their emailed document. It is confusing for consumers. Would double the chlorine treatment also affect the carcinogenic by products? Slides 30 & 31.

a. We recommend using the dosing reference tables provided to treat your cistern. How much chlorine is needed for your cistern not only depends on the volume of water in your cistern but also the percentage (%) of sodium hypochlorite in the solution of chlorine.

8. **Does the free (available) chlorine dissipate over time?** Slide 27.
   a. Yes. Free chlorine will dissipate with time, in heat or sun, and in the presence of bacteria as it sterilizes the water.
   b. Weekly testing of chlorine levels in your cistern will help you understand how frequently chlorine dosing needs to be used.
9. **Does it matter the exact amount of water that is in the at the time of adding bleach or just the length, depth, and width of the cistern?** Slides 28-33.
   a. When doing a chlorination treatment, always use the water volume that is presently in the cistern to determine the amount of chlorine/bleach to add.
   b. Measure the water level to calculate volume. Make sure you have a way to measure the water level easily.
   c. Follow quick reference charts and maintain records of the treatment frequency and concentrations needed.

Other Cistern Water Treatment

10. **Given the different filtration systems, what is the best?** Slides 22 & 36-42.
    a. The best filtration system depends on your household needs, health considerations, cost, and setup limitations (determine how much room you have available for the filtration system).
11. **My system uses point of use filters throughout the house. I lose track of the changing of the filters and sometimes I don't use chlorine because the concentration is too harsh on my plants.**

a. Slide 48. Maintain a log (or put a sticker on the filter) to keep track of when filters are changed.

b. Slides 29-31, 50-51. Use the right amount of chlorine by testing concentration in your cistern water before treatment (test for residual chlorine). Measure your cistern water volume to accurately treat.

c. Slides 30-31. Use volume calculations and reference charts to target a treatment concentration goal of 0.2-2 mg/L (parts per million). Test water for chlorine after treatment and weekly to optimize dosing frequency and amount. Routine monitoring of cistern chlorine concentration will help ensure reliable, safe drinking water.

12. **Is there a difference of effectiveness between the whole house system and a point of use 3-stage filter system, and can those two be used together and how?** Treating cistern water is best done in steps (slide 37-39):

a. Slides 12-13. Filter out sediments and debris before (if possible) it enters your cistern. Inspect and remove floating debris regularly. Using a flashlight, regularly check the bottom of your cistern for solids buildup; remove solids buildup as soon as possible.

b. Slides 28-31. Chlorinate water in your cistern by first calculating the amount of water in your cistern. To calculate the amount of water in a rectangular cistern, measure (in feet) the length of the cistern, width of the cistern, and depth of the water. Multiply *length* x *width* x *water depth* x 7.48 (multiplying by 7.48 converts water volume from cubic feet to gallons). Next, use the dosing charts to determine the appropriate amount of chlorine for the volume of water in the cistern. Add the appropriate amount of chlorine to the cistern water, then mix the chlorine into the cistern water by using a hose siphon the water will run from the bottom of the cistern and place the output into the top of the cistern, running a pump, or by turning on your faucets. Run the water until you can smell chlorine, then test it – looking for a concentration of 0.2-2 mg/L (parts per million).

c. Slide 37. A whole house filter system is a 3-stage filter (sediment removal, carbon, and mixed resin/osmotic filter) that treats water going to all the taps or faucets in the home. The point-of-use filter is a filtration system installed at a single tap or faucet in the home. You can use them alone or in tandem. If you have a whole house system leading to a point-of-use filter, the point of use system will last much longer than indicated on the label because the water is pre-treated with the whole house filter system. The point-of-use filter becomes a polisher that further protects the user in instances when the water is unused and sits in the pipes for hours or days.

13. **Is Reverse Osmosis (RO) better than the 3-stage filtration process?** Slide 42.
    a. It's very expensive, uses a lot of water, and requires frequent maintenance.
    b. The water is higher in purity than when using a 3-stage filter. It's not practical unless you have a high purity need in your house (dialysis is one instance where this is the preferred water).
    c. A point-of-use RO can be used on water already treated with a 3-stage filter to save money and limit intense treatment of water that does not require it.
14. **Can you have a 3-stage filter and a UV instead of using chlorine?** Slides 36-40.
    a. Yes. UV lights can be used to sterilize viruses and bacteria, in place of chlorine. However, chlorine should still be used to periodically disinfect the distribution pipes and system.
15. **Are you incentivizing in any way to purchase one of these [cartridge-based filters] so that people can get assistance doing that?**
    a. Slide 6. EPA and DPNR do not provide funding or incentives for the use of specific treatment systems or products.
    b. Slide 12. Look for the NSF label and track manufacturers incentives or purchasing promotions.
16. **How effective is UV filtration in making rainwater potable, and what contaminants does it not remove?** Slide 40.
    a. It is important to remember that the UV treatment is not a filter.

b. UV treatment kills or inactivates microorganisms with strong ultraviolet light spectrum as the water flows past the bulb.

c. This treatment disinfects the water by inactivating microorganisms like viruses and bacteria; however, it does not remove sediment, heavy metals, pesticides and herbicides, volatile organic compounds, chlorine or disinfection byproducts, salts and minerals, nitrates, or other contaminants effecting taste and odor.

Cistern Equipment, Roofs, and System Features

17. **How is the Department of Health (DOH) preventing the use of equipment that is not approved by NSF? How does the DOH know that items out there ARE safe for locals to use before the equipment reaches suppliers?**

    a. Slide 6. Cistern water use and treatment are NOT regulated by EPA or DPNR. We are providing workshops in an effort to inform cistern users of the best practices that can help ensure better water quality and protect their own health.

    b. Slide 12. NSF is a seal found on products and equipment which indicates that the National Science Foundation has tested and verified a product for the use that is indicated on the packaging. Identifying and purchasing products with this seal is a good first step. NSF isn't the only third-party verifier.

    c. Slides 25-26 and 36. Practice reading the labels. They will indicate where the products were made, the sources of materials / ingredients, and whether the product was third-party tested. The label will help you know how long a filter will last be based on the size of the household it will service and the amount of flow it will treat.

18. **Do you have an opinion on the run-off from solar panels on our house roofs?** Slide 12.

    a. It is best to ensure the sealants and materials that comprise your solar system are not made of metals or contain VOCs that could be harmful to your health.

b. There are also NSF certified solar products.
c. There are different types of solar mounts out there, so be vigilant about what is installed on your roof that could affect your water quality.

19. **Is NSF the only group for potable materials?** Slide 12.
    a. NSF has the strictest and most robust certification program. There are other reputable certifications through the Water Quality Association (WQA) has the "Gold Seal Certification Program" and the International Association of Plumbing and Mechanical Officials (IAPMO).
20. **What are cistern mats?**
    a. The formal name for a cistern mat is "reuseable drain cover." This is a rubber mat that is larger than the cistern access and covers the access door as an extra layer of protection.

Contaminants and Sources of Contaminants

21. **How do I bring the pH up on my cistern water?**
    a. Sodium Hydroxide salt pellets, lime, baking soda or drinking water safe pH adjustment pellets drops can be used. Obtain pH test strips that read in the range of 6-8 to accurately measure your water's pH.
22. **Why are there algae in my filter that I use for my cistern?**
    a. It's perfectly natural and occurs regularly in the pre-filter. Algae feed on nutrients and sunshine so a tiny speck getting through can lead to a colony in a system if is not periodically cleaned.
    b. A little bit of chlorine in your system will combat those algae. The chlorine will break it up, kill it and flush it out.
    c. In addition to adding chlorine regularly, you may want to change out pre-filters more frequently.
23. **How do I remove PAH and heavy metal contaminants?** Slide 38.
    a. Granular activated carbon (GAC) is effective at removing some PAHs and metal contaminants.

24. **Speaking of metals, do we have lead issues here in the Virgin Islands?**
    a. Referred to Mr. Harold Mark at DPNR. Most homes have PVC running to and from cisterns. DPNR's contact information is 340.773.1082, harold.mark@dpnr.gov
    b. The homeowners should inspect their sink and interior fixtures, for this is where lead is likely to accumulate, especially if the fixtures were installed prior to 1986. Most internal pipes are made of copper but may have lead solder at the joints. If you are unsure, test your water for lead, and as needed, replace your fixtures with an NSF "lead free" alternative.
    c. Also remember to flush your drinking water lines before use, especially if the faucet has been unused for more than 5 days.
25. **Are the PVC pipes that are used here, are they sealed so that the PVC doesn't break down?**
    a. You should obtain litmus pH test strips to monitor your water's pH. Keeping the pH between 6.8-7.6 will limit the corrosion action of water on PVC pipes.
26. **Is there any resin exposure with any of these treatments?**
    a. Mixed resin is made up of polymeric plastics, so this type of material picks up and binds contaminants.
    b. You can install a carbon filter after the mixed plastic resin to remove any plastic byproducts that will come out.
    c. If the ion exchange medium is sand, there are no issues with plastic byproducts. Mixed resins are often KDF.
27. **What are some practical, low-cost measures that people can use at home to better protect themselves from ingesting contaminated water from their cistern, especially elderly people?**
    a. Keep a backup source of water for emergencies and in case the cistern water becomes suspect. Be prepared!
    b. Keep back up filters and generators for pumps and UV lights.

c. Thorough and frequent maintenance prevents contamination from entering the cistern in the first place.

d. Visually inspect your cistern water (with a flashlight) in the cistern after every rainstorm or potentially impactful event, like construction on your home. Check for cracks, sediment on bottom, floating or suspended debris, and wildlife. If you see any wildlife, examine deeper for signs of nesting and defecation. If you cannot repair or clean yourself, contact someone for assistance.

e. Visually inspect and clean UV lights to remove film and calcium buildup. The light is not effective if these are present. Wipe down with chlorinated water for film and vinegar water for scale.

f. Remove, inspect and clean faucet screens annually or more frequently to remove sediment and insect larvae, which contribute to bacteria buildup.

28. What causes a moldy smell from contaminated water after washing clothes and what is the remediation?

a. The smell could likely come from sedimentation or particulates from vegetative debris that, when treated by chlorine in your system, will give you a tannin odor. The first recommendation would be to inspect the inside of the cistern and clean out any debris.

b. Mold builds up in washing machines in humid environments. Remove your clothes promptly after the wash cycle ends to prevent mold from developing.

29. Are there any concerns for people who live next to or near a gas station? Is there any concern of contamination to your cistern from a gas station or other source through groundwater or vapor intrusion?

a. If you can smell it, the concentration is high enough to potentially enter your cistern via air and water. High concentration of VOCs in the air has the potential to contaminate a water sample when conducting monitoring. Another concern is leaking underground storage tanks UST. Leaking

underground UST has great potential to contaminate groundwater sources, and may seep into leaking pipes and cracked cisterns.

b. Slides 22 and 38. The best way to remove VOCs from drinking water is to use an activated carbon filter. This could be a point-of-use filter that is installed at the faucet or under the sink. There are some affordable options that are pitcher or water dispenser based.
c. It is critical to keep up with regular maintenance, change filters according to manufacturer recommendations, and make sure you have a few back-up filters.
d. Slide 36. When selecting a filter, make sure that it targets and removes VOCs.

Maintenance & Sealants

30. Residents mentioned that they had a problem with a leakage, an apparent crack in the cistern.

a. To repair the crack mentioned he chipped it out and sealed the damage with hydraulic cement. He has had no leakage for 20 years now.
b. He also decreased the water level by 1 ½ feet and lost storage of about 6000 gallons. This reduced pressure on the repaired area.

31. Residents discussed issues with trees that were close to their home and how the vegetation made its way into gutter and downspouts.

a. If planting a tree near your house, plant it far from home. Allow enough distance for the full-grown version of the tree's canopy to be 1-2 feet away from your roof, so that there are no similar issues. If a tree is planted close to your house, it is good practice to cut back tree branches to reduce the likelihood of collecting leaves in your gutters. Periodically check and clean gutters. Additionally, if the tree has an extensive root system that can impact your cistern structure, it may call for removal.

32. What type of sealant should be used for a cistern cover?

If you don't have a closure with a seal, fluids and wildlife can get through and your water will get contaminated.

a. A seal could be just putting a type of tape or lining on the bottom of the cistern cover that will cover any gaps between the cover and opening as it is laid into the slot.
b. Other residents gave examples of what they have done to seal their cistern, including the use of rubber gaskets (food grade), PVC lids, tape and an encasement covering (not necessarily kid friendly).

33. **Are there different recommended considerations when cleaning a cistern where PAH contaminants could be present? I heard that PAHs need to be steam cleaned and to consider dangerous vapors from PAH when accessing their potentially contaminated cisterns?**
    a. If you know PAHs were present then yes, steam cleaning and possibly replastering your cistern would decrease any potential exposure.
    b. Once you complete (a) and/or if you suspect that you have PAHs, have your water tested to see if PAHs are present.
34. **My cistern is cracked and has a slow leak. I've heard this is a common problem. Are cistern liners better than the old school cement-based coatings for water quality?**
    a. Review this article: Rainwater Cisterns: Design, Construction, and Treatment.
    b. Yes, increased maintenance and resealing of a cistern is common in older cisterns.
        i. The first step is to make sure that the cistern is structurally stable and does not need additional reinforcements. Also ensure that there has not been any soil instability around the crack.
        ii. Choosing between a cistern liner or re-lining with hydraulic cement depends on the priorities of the owner.
        iii. When installed properly, cistern liners can provide a great seal without the need to be touched up periodically like hydraulic cement. Liners

can be an expensive initial investment and can tear easily, requiring patching – which can lead to other issues.

iv. Additionally, it can be difficult to obtain materials to install or patch a liner, whereas hydraulic cement is more readily available and stable.

35. **How do you suggest maintaining a water system in a vacation home that's used once or twice a year?**

For extended absences there are two options:

a. If the property does not need water use while you are away:
    i. Drain all fixtures and appliances to avoid potential issues that could come from stagnant water or issues that flood your home.
    ii. Be sure that your cistern is clean and isolated from the collection system when you leave. Make sure that inlets and outlets are periodically inspected to make sure critters can't get in.
    iii. Before you return, schedule a roof and collection system inspection and cleaning, and cistern inspection.
b. If water use is needed for water features and landscaping, hire a maintenance service provider and:
    i. Have them open and run all the fixtures and flush toilets periodically.

Have them clean and maintain the rain collection system. **Emergency Plans and Actions**

36. **Pre hurricane prep for cisterns – there is conflicting advice out there – where do I go for information?**

See the DPNR website and comprehensive guidance, which can be found under resources, Environmental Protection: https://dpnr.vi.gov/wp-content/uploads/2023/08/USVI-Rainwater-Catchment-Systems-Comprehensive-Guide_JAN2025.pdf

a. Slide 47. When preparing for a hurricane, you want to make sure you have enough safe drinking water for at least 2 weeks.
b. Slide 7. Isolate your system by closing all inlet valves and disconnecting the downspout.

c. As you would, with other hurricane preparedness, secure any loose parts and, if your system requires electricity to treat and pump your water, have a back-up plan to be able to energize your system, if possible.
d. Slide 8 and 13. If you don't have backup plans, know what parts of your system are most vulnerable to take in water. Cover these areas if possible.

Slide 47. Be sure to clean your catchment and inspect your collection system before you begin collecting water again. **Other Available Resources**

37. **Will there be another session like this? I believe more people would like to gain this knowledge.**
    a. At this moment there are not any other session scheduled. The recording of the Zoom meeting and presentation slides will be available on the DPNR website to view and/or download: Resources - Virgin Islands Department of Planning and Natural Resources
38. **Many Virgin Islands' residents simply do not have the resources or support to do the preventative maintenance to ensure that their cisterns are free from contaminants. For example, draining and cleaning the cistern regularly is a costly process. Do you have any practical, low-cost tips on what my mom and other residents can do to avoid ingesting contaminated cistern water and better protect themselves?**
    a. Performing regular maintenance will help keep the collection system clean and protected:
        i. Check that the inlet has a filter.
        ii. Make sure the overflow outlets are screened.
        iii. Clear the gutters and downspout when needed. This can reduce the need for expensive maintenance work.
        iv. Remove vegetative debris and wildlife or habitats as soon as possible.
        v. Be proactive and find solutions for the parts of the maintenance plan that may be outside of your ability to complete. For instance, if you are

unable to work on your roof, enter your cistern, or flush your lines, make arrangements to hire a contractor or get someone to help.

vi. Obtain tools for regular maintenance, such as a ladder, landscape blower, garden hose, broom/brush, and biodegradable dish soap. These items can be used for other household maintenance. With cleaning and with proper care, they can last a long time.

b. For water treatment:
    i. Use chlorine dosing reference charts to target bacteria.
    ii. Consider using a pretreatment like the reuseable spin-down filter to remove larger sediments and filter through an activated carbon filter.
    iii. The activated carbon filter will remove a wide range of contaminants including VOCs and DBPs.
c. Plan and save for more expensive periodic maintenance like deep cleaning.
    i. Keep wildlife out of the system!
    ii. Deep cleaning, which requires draining and refilling the cistern, should only be necessary every 3-5 years if you perform the recommended routine maintenance.
        1. A deep clean could be scheduled at the end of dry season, when the water level may be low, and completed before the rainy season begins.
        2. Use water conservation methods to make sure the household can get by until rainfall replenishes the cistern.