The Coral Bay Community Council CARE Project

Cistern Water Quality Testing & Results in Coral Bay, St. John, US Virgin Islands

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and Sharon Coldren, M.Sc., CBCC Executive Director
March 25, 2011

Fresh water is a necessary and limited resource, especially on steep sub-tropical islands. A source of clean, healthy fresh water is vital. There are no municipal potable water provisions in the Coral Bay community of St. John. Therefore, we rely largely on roof-catchment rainwater collection in cisterns and trucked water that comes from multiple sources.

The community's drinking water supply, generated largely from roof-catchment rainfall, may be adversely affected by exposure to existing environmental emissions impacting the Coral Bay Watershed community in recent years. These exposures include air pollution from an on-going burning dump on the neighboring island of Tortola, bird and small animal excrement and leaf debris on roofs and gutters, surface water contamination from animal waste due to livestock farming practices, and illicit discharges of chemicals -- all of which can possibly make their way into the community's residential cistern water supplies. In addition, cisterns are made of different materials – plastic, fiberglass, or concrete – which might possibly contaminate the water supply.

The multi-year CBCC EPA CARE Grant (Level II) administered by the Coral Bay Community Council provides funding assistance to continue and expand local efforts to minimize sediment and stormwater pollution of the Coral Bay Watershed, improve local solid waste management, and heighten awareness about other toxic pollution issues by implementing identified pollution assessment, prevention strategies and recommendations presented in the Coral Bay Watershed Management Plan. It provides a platform for investigation of pollution issues faced by the community.

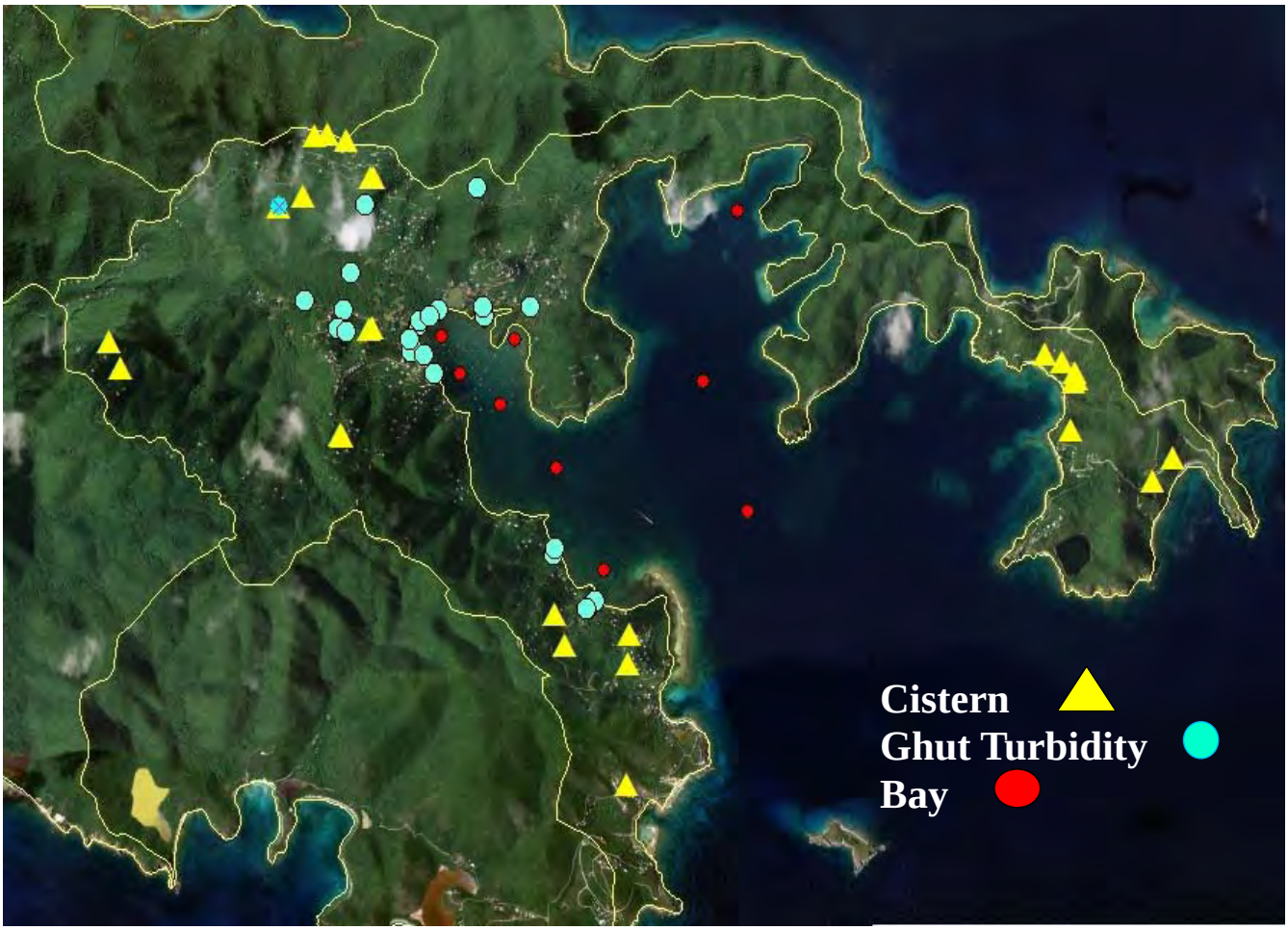
Therefore we have questions to answer: Are there contaminants in our cistern water? Can such a water supply be trusted to be meet drinking water standards?

Cistern Water Quality Testing – Selection of Testing sites and Tests

Through the U. S. Environmental Protection Agency (EPA) CARE Project, the CBCC recently completed some basic cistern water quality testing to assess whether there are possible water quality concerns in our cisterns in our immediate community. The EPA CARE Project funding allowed for a limited assessment of the community's drinking water quality. To expand the number of tested cisterns, CBCC asked homeowners if they would be willing to directly participate in the project by collecting samples (per our specifications) and paying for the testing of their cistern water supply, as part of CBCC's data collection effort. Several homeowners with purification systems paid for two (2) samples – the unpurified water directly out of their cisterns and the purified water from their taps, in order to provide direct evidence on whether the purification systems work.

In February 2010, twenty (20) Coral Bay homeowners (24 of 26 total tests) agreed to participate in this project task by covering the cost of analysis of their residential cistern water supply ($75 fee per test.) The residential cistern water supplies were screened for presence of bacteriological contaminants, including *Escherichia coli*, Fecal Coliform and *Enterococcus ssp.* bacteria. In addition, other physical characteristics of water supplies normally included in standard drinking water testing, were measured and recorded: pH, conductivity, turbidity, and total dissolved solids in the cistern water supplies. Two (2) additional home cistern sites were selected for testing paid by the grant.

Coral Bay EPA CARE Water Quality Sampling Locations 2009-11



Water supply stored in cisterns constructed from both concrete and fiberglass materials were sampled. Further, samples collected directly from cisterns were tested as "unfiltered/ not purified" in any way, and other samples which had been drawn out of the cistern into the home water pipes and "filtered" (run through several filters and exposed to a UV light source to kill bacteria and viruses in the water) were analyzed separately. CBCC has determined that this kind of filtration & UV light system is readily available on St. John and is being used at local restaurants and in a number of homes and rental villas. The system costs approximately $1,000.00 per house.

A total of 26 cistern samples were collected and processed in a **Standard Drinking Water Analysis** by Ocean Systems Laboratory of St. Thomas, an EPA-Certified Drinking Water Testing

Laboratory.
Additionally two of the water storage cisterns that were included in the above testing , one concrete and one fiberglass, were also sampled and tested for potential Inorganic Chemicals (IOC's) and Metals contaminants that might enter the cistern water as a result of air transport or rainfall. ($325/per test). The two test cisterns were selected partly because they are situated in areas mostly likely to be impacted by airborne contaminants: specifically, one at a residence located just below the main road, and the other located high on Bordeaux Mountain, where smoke and associated emissions from the neighboring British Virgin Islands burning garbage dump is often present in the atmosphere.

The sample analyses returned were quite interesting and illuminating, in the practical context of "safe drinking water supply". The results are discussed at greater length later in this report. Additional information is also provided in this report: including a map reflecting the locations of the residence cisterns sampled, EPA Drinking Water testing guidelines, and available household filtration/purification systems.

The aim of this very preliminary testing survey was to assess how the water quality of drinking water stored in residential cisterns constructed of different types of materials would compare to EPA Drinking Water Standards. Results derived from this preliminary cistern water survey could serve to alert the community residents and health officials of a need for further testing to better assess existing human health risks and corrective measures and/or the benefits of purification systems.

Additional IOC testing is also being performed on surface water ghut drainage to determine the presence of these materials in the terrestrial landscape. Future testing for nitrogen and phosphorous in ghut water flow will also be undertaken for correlation.

See http://water.epa.gov/drink/contaminants/index.cfm#List for a complete list of contaminants focused on US tap water.

EPA Drinking Water Standards

The EPA sets standards that, when combined with other federal and State regulatory provisions for protection of ground water and surface water, become critical to ensuring safe drinking water sources. EPA works with its regional offices, states, tribes and its many partners to protect public health through implementing the Safe Drinking Water Act. Laboratories providing related analytical services must be EPA Certified.

Under the Safe Drinking Water Act (SDWA), EPA sets legal limits on the levels of certain contaminants in drinking water. The legal limits reflect both the contaminant levels that are assessed as protective of human health, and treatment that is economically and technologically achievable. Besides prescribing these legal limits, EPA rules set water-testing schedules and methods that water systems must follow. The rules also list acceptable techniques for treating contaminated water. The SDWA gives individual states the opportunity to set and enforce their own drinking water standards if the standards are at least as strong as EPA's national standards. Most states and territories directly oversee the water systems within their borders.

You can find a great deal of information on this subject at:
http://www.epa.gov/safewater/sdwa/current_regs.html

Ocean Systems Laboratory - St. Thomas, St. Croix

Ocean Systems Laboratory is an EPA Certified Lab that has provided our water quality analysis. Below is their description of services:

Ocean Systems Lab provides analytical services to individuals, government, and to private companies. These services include analysis of drinking water as required by Public Water Suppliers, wastewater analysis as required by TPDES permits and ambient waters by government agencies for monitoring the safety of recreational waters. The Laboratory can assist companies in their specialized needs to comply with Federal and Local Regulations. Our headquarters lab is located on St. Croix, and we have an additional laboratory on St. Thomas. The lab was founded by Mary Lou Coulston, PhD and has been serving the Virgin Islands since 1987. For more information: http://www.oceansystemslab.com/index.php

Information provided by Ocean Systems Lab about EPA Drinking Water Standards, testing parameter, and significance of testing results:

1. TC - Total Coliform, an indicator of environmental contamination, comprising of all coliform bacteria. With total coliform, the standard of presence/absence is used because there should be no coliform in the water. Drinking water samples are filtered through a membrane, affixed to a plate of solid media, and incubated for 24 hours. If even one colony is present, we swab it and culture it in liquid media for fecal coliform and E. coli. There are no numbers associated with P or A because presence of one colony indicates contamination and that contamination needs immediate correction. If the residents are not treating their cistern water with bleach and/or UV, then they should consider it strongly, especially if they have coliform present. **One colony or a hundred, your cistern needs treatment.**
2. FC – Fecal Coliform, a collection of coliforms capable of growing at warmer temperatures. The most common member of this group is *E. coli.* These bacteria are an indicator of fecal matter (animal) contamination.
3. E. coli – Escherichia coli, comprised of multiple strains (some harmless) normally found in the lower intestine.
4. Entero - *Enterococci*, bacteria found in the normal intestinal flora of humans and animals. *Enterococci* is typically done for beach studies where the limit is 104 cfu (colony forming units) per 100 ml. But that is for recreational water, not drinking water. In drinking water, zero *enterococci* is preferable since *enterococci* testing is a screen for human fecal pollution. We have seen cases where a septic tank on the property was leaking and contaminating the cistern through cracks or other damage. A cistern testing positive for *enterococci* may mean that human fecal material is entering the water system. Presence of *enterococci* means the water system should be checked immediately for sources of contamination
5. Bkg – Background, rated on a scale of 0 to 5, with 5 being a very heavy amount of background bacteria present and 0 indicating no background bacteria seen. Background bacteria are not coliforms but happen to be detected in the test. Their type is unknown.
6. pH – a measure of acidity(hydrogen ion concentration) of the sample. Drinking water should have a pH of 6 to 8.5.
7. Turbidity – A measure of the amount of suspended particles in water. Drinking water should have a turbidity below 1.00. Turbidity can be an indicator of bacterial contamination. High turbidity can result from bacterial colonies
8. Conductivity - A measure of the ability of a solution to conduct electricity.
9. TDS – total dissolved solids, a measure of dissolved ions in solution.

Coral Bay Cistern Sampling Project Results Unfiltered or Sediment Filter

Color pairs indicate duplicate tests or separate cisterns on the same property

TC	FC	E. coli	Entero	Bkg	pH	Turbidity (NTUs)	TC	FC	Biofilter/UV
P	P	P	0	5	6.45	1.14	P	P	no
P	P	P	3	5	7.49	3.65	P	P	no
A	A	A	0	0	8.24	0.60	A	A	No #
P	P	P	0	5	7.16	0.94	P	P	no
P	P	P	1	5	6.82	0.96	P	P	no
P	P	P	8	5	7.07	0.9	P	P	no
P	P	P	4	4	7.23	0.81	P	P	no
P	P	P	20	5	7.37	1.00	P	P	no
P	A	A	0	2	7.49	0.90	P	A	no
A	A	A	0	1	7.71	2.47	A	A	No
P	A	A	5	3	7.42	2.02	P	A	no
P	P	P	8	4	7.93	0.43	P	P	no
P	A	A	0	3	7.81	0.95	P	A	no
P	P	P	16	5	7.71	2.46	P	P	no
P	P	P	21	5	7.40	1.66	P	P	no
P	P	P	0	1	7.52	0.68	P	P	no
P	P	P	99	5	8.15	1.02	P	P	no

- Recently trucked in water

Coral Bay Cistern Sampling Project Results – With UV & Sediment Filter

A	A	A	0	0	7.54	0.42	84.4	40	yes
A	A	A	0	3	8.27	0.21	706.0	337	yes
P	P	P	0	3	8.07	0.85	90.3	43	Yes*
A	A	A	0	0	7.87	0.46	92.9	44	yes
A	A	A	0	1	7.51	0.83	90.1	42	yes
A	A	A	0	2	7.89	0.83	197.1	93	yes
A	A	A	0	0	8.42	0.42	190.2	90	yes
A	A	A	0	0	7.60	0.65	71.0	33	yes
A	A	A	0	0	8.51	1.26	441.0	210	yes

* After seeing these negative results, homeowner discovered UV filter light was broken

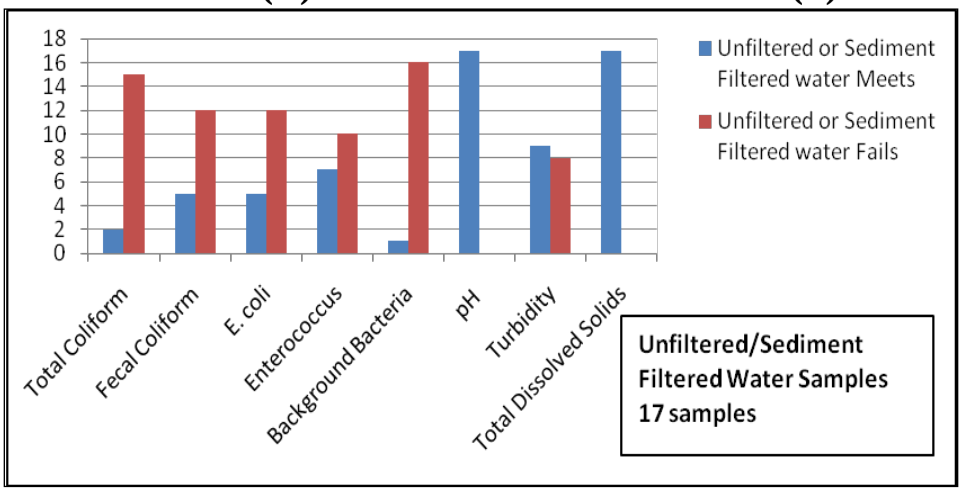
Coral Bay Cistern Sampling Project Results: Paired tests: Pre and Post UV Filter

A	A	A	0	0	8.24	0.6	711	342	No#
A	A	A	0	3	8.27	0.21	706	337	yes
P	P	P	16	5	7.71	2.46	75.8	36	no
A	A	A	0	0	7.6	0.65	71	33	yes
P	P	P	99	5	8.15	1.02	423	202	no
A	A	A	0	0	8.51	1.26	441	210	yes

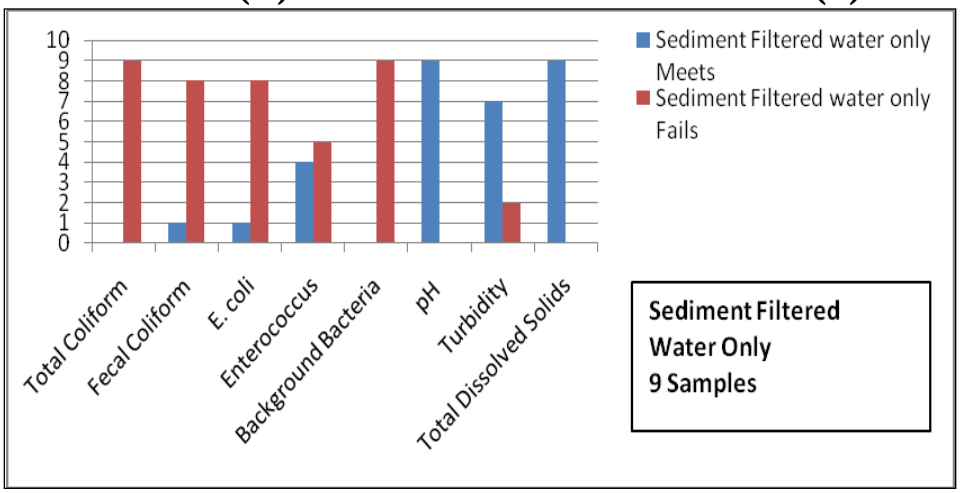
- Recently trucked in water

Cistern Test Results by Group

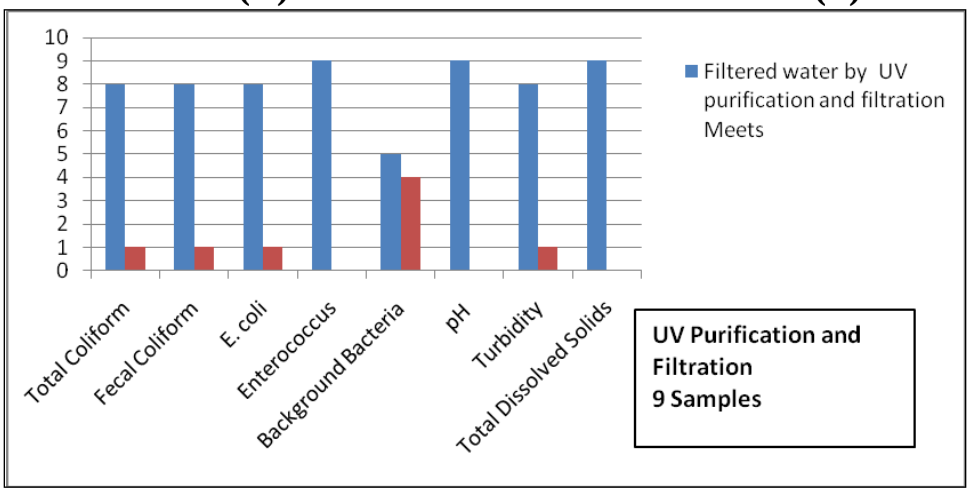
Meets: Absent (A) BLUE **Fails: Present (P) RED**



Meets: Absent (A) BLUE **Fails: Present (P) RED**



Meets: Absent (A) BLUE **Fails: Present (P) RED**



Cistern Results Statistics and Observations (Based on 26 test results)

Unfiltered or Sediment Filtered Samples

- 12/17 (70%) of samples tested positive for Fecal Coliform presence.
- 12/17 (70%) of samples tested positive for *E. coli* bacteria presence.
- 10/17 (59%) of samples tested positive for *Enterococcus* bacteria presence.
- 16/17 (94%) of samples tested positive for general background bacteria presence.

UV Filtered Samples

- 1/9 (11%) of samples tested positive for Fecal Coliform presence.
- 1/9 (11%) of samples tested positive for *E. coli* presence.
- 0/9 (0%) of samples tested positive for *Enterococcus* bacteria presence.
- 4/9 (44%) of samples tested positive for general background bacteria presence.

Summary Observations

- The unfiltered vs. UV purified samples from the same cisterns in 2 cases showed pre-filter contamination of water sample, but no contamination after UV Purification.
- The single contaminated UV Filtered sample was found to have a dirty filter and a UV bulb burned out.
- In general Filtered/UV water has significantly less or no bacteria present in samples.
- Sediment filters do not remove or filter bacteria and can be breeding sites. There was no improvement in biological contaminants absence with use of filters only.
- In some unfiltered cisterns, bacteria were present, the water drunk on a continuing basis and residents reported no signs of intestinal distress.
- The pH of the water ranged from 6.45-8.51.
- The turbidity ranged from 0.21 – 3.65 ntu
- The total dissolved solids (TDS) ranged from 21-342 mg/l.

General Testing Observations

1.While this sampling effort was small statistically, it is likely that it reflects the conditions in most similar cisterns in the USVI.
2.Unfiltered cisterns or cisterns filtered with sediment filters only are likely to be contaminated with many types of bacteria or other contaminants which can lead to health issues, but these health issues do not seem to be widespread.
3.UV/Filtered water systems produce a drinking water supply that under these tests is uncontaminated by bacteria. In order to produce uncontaminated water, these UV Filtration Systems must be properly maintained.
4.Inorganic chemicals (IOCs) and materials carried on the wind and dropped with rainfall do not show contamination levels for the 20+ contaminants of most concern.

Inorganic Chemicals Sampling (IOC'S) Results and Observations:

Inorganic Chemicals Testing (IOC) – Cistern study design

Listed in the results of the IOC testing are 20+ elements that are known to be of health concern. These contaminants could be present because the potable water is generated from roof-catchment and is therefore exposed to ambient air pollution, surface water contamination, cistern surface materials (fiberglass, plastic, wood, cement), animal waste or other organic materials in the community environment. CBCC selected two voluntary participants for the residential cistern water quality survey that were considered representative. One location was high in the watershed. The other site was lower in elevation and was located alongside and just below the main road, Route 10, Centerline Road.

A sample Analytical Report on the IOC's is included in the Appendix. This is a single report on one of 4 samples (2 for each cistern tested to assure quality results), all of which are similar in result. The 20+ chemicals and metals tested for in both types of cistern water indicated that materials were "ND" - not detectable/ below sampling threshold and in some cases materials were detected but were below accepted safe maximum contaminant level. Therefore CBCC concludes that it is not necessary to do additional testing at this time, or to recommend that government professionals or community residents be actively concerned about this kind of drinking water supply contamination unless specific evidence warrants it.

Appendix

Coral Bay Cistern Drinking Water Standards
Test Results (26 samples)
February 2010

The results for the sampling are below. See page 4 for information on interpreting the results. Please remember this is a limited sample of cisterns and results should not be construed to apply to all cisterns.

P – Present
A - Absent

Total coliform	Fecal coliform	E. coli	Entero-coccus	Bkg bacteria	pH	Turbidity (NTUs)	Cond. (uS)	TDS (mg/L)	UV Filter
P	P	P	0	5	6.45	1.14	175.2	83	no
P	P	P	3	5	7.49	3.65	67.3	32	no
A	A	A	0	0	7.54	0.42	84.4	40	yes
A	A	A	0	3	8.27	0.21	706.0	337	yes
A	A	A	0	0	8.24	0.60	711.0	342	no
P	P	P	0	3	8.07	0.85	90.3	43	yes
A	A	A	0	0	7.87	0.46	92.9	44	yes
P	P	P	0	5	7.16	0.94	44.6	21	no
P	P	P	1	5	6.82	0.96	45.3	22	no
P	P	P	8	5	7.07	0.90	366.0	173	no
P	P	P	4	4	7.23	0.81	356.0	169	no
P	P	P	20	5	7.37	1.00	83.3	39	no
P	A	A	0	2	7.49	0.90	104.6	49	no
A	A	A	0	1	7.51	0.83	90.1	42	yes
A	A	A	0	1	7.71	2.47	136.5	65	no
P	A	A	5	3	7.42	2.02	51.4	24	no?
A	A	A	0	2	7.89	0.83	197.1	93	yes
A	A	A	0	0	8.42	0.42	190.2	90	yes
P	P	P	8	4	7.93	0.43	74.2	35	no
P	A	A	0	3	7.81	0.95	76.7	36	no
P	P	P	16	5	7.71	2.46	75.8	36	No
A	A	A	0	0	7.60	0.65	71.0	33	yes
P	P	P	21	5	7.40	1.66	57.5	27	no
P	P	P	0	1	7.52	0.68	114.6	54	no
A	A	A	0	0	8.51	1.26	441.0	210	yes
P	P	P	99	5	8.15	1.02	423.0	202	no

NATIONAL TESTING LABORATORIES, LTD.
556 South Mansfield, Ypsilanti, MI 48197-5166
(440) 449-2525 • Fax (440) 449-8585

ANALYTICAL REPORT

PAGE 1 OF 2 SAMPLE CODE: 715694

Date: 02/15/10 Report #: 715694 Laboratory ID #: 0055

Client: OCEAN SYSTEMS LABORATORY
OF ST. THOMAS
6501 RED HOOK PLAZA #201
ST. THOMAS, USVI 00802-1306

Date Collected: 02/03/10
Time Collected: 08:00
[redacted]
STL 1031

Date received at lab: 02/04/10 Time received at lab: 10:20
PWS ID: 19
Collected by : A.WADE
The results herein conform to NELAC standards, where applicable, unless otherwise narrated in the body of the report. Test results were calculated on a wet weight basis. The uncertainty of the test results are available upon request.

NOTE: "*" The MCL (Maximum Contaminant Level) or an established guideline has been exceeded for this contaminant.
"ND" This contaminant was not detected at or above our lower reporting limit (LRL).
"NA" Not Analyzed

Fed Id #	Analysis Performed	Method	MCL (mg/l)	LRL	Level Detected	Anal Date
Inorganic chemicals - metals:						
1002	Aluminum	200.7	0.2**	0.05	0.10	02/09/10
1074	Antimony	200.8	0.006	0.003	ND	02/09/10
1005	Arsenic	200.8	0.010	0.002	ND	02/09/10
1010	Barium	200.8	2	0.10	ND	02/09/10
1075	Beryllium	200.8	0.004	0.001	ND	02/10/10
1079	Boron	200.7	---	0.10	ND	02/09/10
1015	Cadmium	200.8	0.005	0.001	ND	02/09/10
1016	Calcium	200.7	---	2.0	5.4	02/09/10
1020	Chromium	200.8	0.1	0.007	ND	02/09/10
1022	Copper	200.8	1.3**	0.002	0.015	02/09/10
1028	Iron	200.7	0.3**	0.020	ND	02/09/10

** Denotes Secondary Maximum Contaminant Level (SMCL)

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ANALYTICAL REPORT

 SAMPLE CODE: 715694

Fed Id #	Analysis Performed	Method	MCL (mg/l)	LRL	Level Detected	Anal Date
1030	Lead	200.8	0.015	0.001	ND	02/09/10
1031	Magnesium	200.7	---	0.10	0.24	02/09/10
1032	Manganese	200.8	0.05**	0.004	ND	02/09/10
1035	Mercury	200.8	0.002	0.0002	ND	02/09/10
1036	Nickel	200.8	---	0.005	ND	02/09/10
1042	Potassium	200.7	---	1.0	1.5	02/09/10
1045	Selenium	200.8	0.05	0.002	ND	02/09/10
1050	Silver	200.8	0.1**	0.002	ND	02/09/10
1052	Sodium	200.7	---	1	4	02/09/10
1085	Thallium	200.8	0.002	0.001	ND	02/09/10
1095	Zinc	200.8	5**	0.004	0.070	02/09/10

** Denotes Secondary Maximum Contaminant Level (SMCL)

Inorganic chemicals - other, and physical factors:

1025	Fluoride	300.0	4	0.10	ND	02/04/10
1055	Sulfate	300.0	250**	5	ND	02/04/10

These test results may be used for compliance purposes as required.

David J. Vesey, Lab Director

Home Cistern Water Filtration System – filter and lamp replacement - A photo essay

Complete set of new replacement filters: 10 micron size - first
5 micron size - second
Charcoal filter third – right before UV Lamp

First sediment filter holder –for pre-cleaning of cistern contaminants/sediment placed near outlet of pressure tank:

Regular purification unit: 1 sediment filtration chamber, 1 charcoal filter chamber and 1 UV Lamp chamber. These filter units are installed by a plumber with shut off valves in the pipes, so filter chambers can be opened and filters replaced routinely:

Removing the Filter:

Dirty filter and dirty water – in first chamber.

After two dirty sediment filter chambers – note that the water is clear around the “dirty” charcoal filter to be replaced too:

Burnt out UV bulb – in glass sleeve – this takes instructions to remove correctly!

UV bulb and glass chamber

Dirty filters – the red color is probably African dust and the charcoal filter did not get the dust because of the earlier filtration:

Signal bulb is ON again – UV lamp is working! Clean water being produced!

Cistern Water Maintenance Recommendations:

1. A filtration and UV light purification system should be installed after your pressure tank and before the piping into the home.

2. Although it is often recommended by government authorities and others that cisterns should be emptied and cleaned every couple of years; several of our test cisterns had not been cleaned in 10 years, and still yielded pure "post UV purification and filtration" water. Based on the testing results, non- UV purified cisterns, regardless of how often cleaned, are almost certainly contaminated. We see no reason to recommend this costly activity for water purity reasons, unless there is a known contaminant concern.

Cisterns can be contaminated with bacteria, viruses, hydrocarbons from leaking fuel tanks, pesticides from farms, fecal Coliform from septic tanks, dirt, leaves, plant toxins, just about anything that can wash off the roof or seep in from the ground! (see http://www.oceansystemslab.com/waterqualitytips.php for more information.)

Take care that debris does not enter the cistern by keeping downspouts screened and cleaned and keeping the catchment area (roof) as clean as possible. Cisterns need to be emptied and cleaned periodically to remove the muck that builds up on the bottom.

3. Chlorine and bleach are generally not considered to be smart and healthy maintenance (see below).

4. If the home is not used for a while, the water in the pipes should be flushed through the system, so that freshly purified water is drunk.

5. Sediment filters should be changed every few months (depending on water usage); UV light bulbs should be checked routinely and changed out on a schedule.

Use Caution with Chlorine! *-From Ocean Systems Lab website:*

Drinking chlorinated water can be hazardous to your health as chlorine reacts with the organic material washed into the cistern from the roof causing the formation of tri-halomethanes. To get rid of the contaminants formed from the addition of chlorine a charcoal filter is needed.
A word of caution: If the chlorine is not kept up, the bacteria will thrive and go right through the charcoal filter. So be wise, monitor the chlorine and keep it up. Also change the charcoal filter regularly. We recommend monthly filter changes with cisterns. The safest cistern treatment to use is an ultraviolet system.

HOW TO GET HOME WATER SYSTEM TESTING

If you would like to get your own cistern water tested, contact Ocean Systems Lab in St. Thomas at 340-714-1911.

Ultraviolet Water Purification -UV

From http://www.home-water-purifiers-and-filters.com/ultraviolet-filter.php

Ultraviolet water purification lamps produce UV-C or "germicidal UV," radiation of much greater intensity than sunlight. Almost all of a UV lamp's output is concentrated in the 254 nanometers (nm) region in order to take full advantage of the germicidal properties of this wavelength. Most ultraviolet purification systems are combined with various forms of filtration, as UV light is only capable of killing microorganisms such as bacteria, viruses, molds, algae, yeast, and oocysts like cryptosporidium and giardia. UV light generally has no impact on chlorine, VOCs, heavy metals, and other chemical contaminants. Nevertheless, it is probably the most cost effective and efficient technology available to homeowners to eliminate a wide range of biological contaminants from their water supply. Recent testing has also shown that UV can be effective at destroying certain VOC's, although we would not specifically recommend the technology for VOC reduction.

How UV Works

"UV water treatment offers many advantages over other forms of water treatment for microbiological contaminants. Most importantly, it does not introduce any chemicals to the water, it produces no bi-products, and it does not alter the taste, pH, or other properties of the water. Accordingly, in addition to producing safe drinking water, it is not harmful to your plumbing and septic system. Further, it is easy and cost-effective to install and maintain without any special training. Ultraviolet purification uses a UV light source (lamp) which is enclosed in a protective transparent sleeve (usually quartz). The lamp is mounted such that water passing through a flow chamber is exposed to the UV-C light rays. When harmful microbes are exposed to the UV rays, their nucleic acid absorbs the UV energy, which then scrambles the DNA structure of the organism. The cell is rendered sterile and can no longer reproduce. The cell is now considered dead and is no longer a threat.

UV treatment is an excellent choice to eliminate biological contamination from most home drinking water, whether your home is on a municipal water system or untreated private system (well, lake water, etc.). Its sole purpose is to kill harmful biological contaminants, and therefore should always be combined with other forms of filtration (GAC / carbon block, KDF, or reverse osmosis) for reduction of heavy metals, chlorine, VOC's, and other chemical contaminants.

What contaminants does UV light destroy?

There are no micro-organisms known to be resistant to UV, unlike chlorination. UV is known to be highly effective against bacteria, viruses, algae, molds and yeasts, and disease causing oocysts like cryptosporidium and giardia. In practice, bacteria and viruses are the cause of most major waterborne pathogenic diseases. Of these enteric viruses, hepatitis virus and Legionella pneumophila have been shown to survive for considerable periods in the presence of chlorine, but are readily eliminated by UV treatment. For most microorganisms, the removal efficiency of UV for

microbiological contaminants such as bacteria and virus generally exceeds 99.99%. Specifically, the following are moved to an efficiency of greater than 99.99%: E-coli, Salmonella typhl (Typhoid fever), Salmonella enteritidis (Gastroenteritis), Vibrio cholerae (Cholera), Mycobacetrium Tuberculosis (Tuberculosis), Legionella pneumophila (Legionnaires' Disease), Influenza Virus, Polio virus, and Hepatitus A Virus (better than 90%). Countertop UV systems are generally not recommended for removing oocysts such as giardia and cryptosporidium unless equipped with a 0.5 micron carbon block pre-filter since the exposure time the contaminant has to the UV ray is not always long enough to provide an adequate UV dose for disinfection of these more complex organisms. Whole house UV systems like the Trojan UV Max on the other hand, are capable or killing waterborne oocysts at household flow rates when a properly sized model is selected for the application. From [*http://www.home-water-purifiers-and-filters.com/ultraviolet-filter.php*](http://www.home-water-purifiers-and-filters.com/ultraviolet-filter.php)

UV Water Filtration Dealers

There are many UV/Filtration Systems on the market. Locally, St. John Ice sells a PURA™ model that we have tested and found acceptable. St. John Ice supplied several of the UV units that were sampled and tested in Coral Bay. The units all performed well. For more information, please contact Alan Johnson (340-693-8825). These units cost approximately $1000 plus installation. A complete set of 3 replacement filters costs about $35. A replacement UV lamp costs approx. $65.

Poly-Caribe in St. Thomas sells Atlantic Ultraviolet Sanitron™ units - 12 gal. per minute or 20 gal. per minute for larger-sized water pumps. 340-775-4660. Local East End resident Jay Swartley (340-715-3002) is very knowledgeable about these units.

For additional information: Try a web search on “UV Water Filtration units”.
*heartspring.net/**water**_filters_guide.html*

For information and discussions about this report, please contact Barry Devine at 340-514-3532.

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The Coral Bay Community Council (CBCC) received a $300,000 cooperative assistance agreement (grant) from the US Environmental Protection Agency (EPA) in January 2009 under the EPA CARE program: “Community Action for a Renewed Environment”. The project’s goal is: Minimizing Environmental Toxins in the Coral Bay Watershed. Primary focus has been on improving stormwater management and implementing the Coral Bay Watershed Management Plan. Additional efforts have focused on Water Quality--including potable drinking water cistern water quality: Air Quality--focusing on the burning garbage dump upwind of Coral Bay in the British Virgin Islands; and improving local Solid Waste management -- by encouraging removal of the collection bins from the mangrove area and encouraging recycling and other waste management improvements.