A PRELIMINARY ASSESSMENT OF CISTERN WATER QUALITY IN SELECTED HOTELS AND GUEST HOUSES IN THE U.S. VIRGIN ISLANDS

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 The authors of this report wish to emphasize that the results of the study are only preliminary, and no generalized inferences should be drawn based upon this report.

ABSTRACT

Tourism is the most important industry in the Virgin Islands, which brings in millions of dollars of revenue to the local government. Since maintaining good water quality is important for tourism, an attempt was made in this preliminary study to assess the bacteriological quality of cistern water in selected hotels, resorts, and guest houses on St. Thomas, U.S. Virgin Islands.

Our results indicate considerable variability in cistern water quality between different hotels and guest houses. Those establishments that maintained close supervision with regard to disinfection procedures maintained water quality that was acceptable under the Safe Drinking Water Standards. There were, however, other establishments which were unable to provide water of acceptable quality for drinking purposes.

While total coliform count and turbidity are the established indicators of cistern water quality at the present time, testing for fecal coliforms and Pseudomonas aeruginosa may be more appropriate to ensure the safety of cistern water in the Virgin Islands.

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INTRODUCTION

The number one industry in the Virgin Islands is tourism, which brings in millions of dollars of revenue to the local government. On St. Thomas there are six hotels with more than 100 rooms; however, an estimated 75 percent of all lodging places have 50 or fewer rooms. The mountainous terrain makes water distribution a problem. The solution has been the development of cistern water systems.

Under the Virgin Islands Code, every building (except for federal buildings which are exempt from the local code) must have its own cistern. This includes all hotels and guest houses. These cisterns range from small 1,500 gallon cisterns for small residential cottages, to a large 700,000 gallon system which supplies all the water needs of a hotel complex in St. Thomas.

As part of an ongoing investigation into cistern water quality in the territory, we focused on cistern water quality of a few randomly selected hotels and guest houses on St. Thomas for purposes of comparing the results to the Safe Drinking Water Standards (SDWS). The results are to be used to assess if those standards are the best ones to use for cistern water systems, or whether standards specific for such systems should be established.

While cisterns may vary in size and construction, as well as the type of water they may hold (rain, trucked in, potable,

well water, and RO/distilled water), all cisterns share some common features which set them apart from a potable water supply. These include being exposed to the environment, thus subjected to external contamination; and being built in conjunction with a roof-top collection system for the harvesting of rainfall.

Hotels and guest houses (Inns) in the Virgin Islands are mandated under the Safe Drinking Water Act of 1974 and as amended in 1986 to have their water tested on a quarterly basis. Currently, only the total coliform count and turbidity of the sample are required under the Safe Drinking Water Act (SDWA) of 1974 and as amended in 1986. If the sample contains more than 1 total coliform per 100 mL, and/or has a turbidity greater than 1.0 NTU, the sample is in violation of the mandates of the Safe Drinking Water Standards (SDWS). Next year additional tests will be required. In the event a sample tests positive for total coliforms, repeat samples must be collected within 24 hours of notification, in addition the total coliform positive sample must be analyzed for fecal coliforms or E. coli. Finally the hotel must maintain a disinfectant residual at all times of no less than 0.2 mg/L; in lieu of this the hotel may substitute heterotrophic plate counts (Standard Plate Count). If the count does not exceed 500 total organisms per mL, the system is considered to have a "detectable" residual for compliance purposes. Systems in violation of this requirement must install filtration unless

the State determines that the violation was not caused by a deficiency of treatment of the source water (34). The standards for pH and conductivity are more aesthetic than practical and are rarely enforced. The pH should be as close to neutral as possible between 6.5 - 8.5. Total dissolved solids (TDS) which cause conductivity, should be less than 500 mg/L.

The total coliform bacteria has been the indicator of choice in determining potable water quality since 1914 (4). Since coliforms are frequently associated with fecal contamination, the presence of coliforms in a potable water supply indicates that the supply has been contaminated. As the number of coliforms increase, so does the probability of encountering enteric pathogens since there is a high degree of correlation between coliforms and enteric pathogens (4,5,24).

In two previous cistern studies we found that 74 percent of the samples from privately owned cisterns, and 49 percent of the samples from public housing cisterns were not in compliance with the Safe Drinking Water Standards. The environment in which the cisterns are in close contact with has an abundance of coliform bacteria (11,14,19,28,29) which are not necessarily of human origin. They are frequently present in the leaf debris, dust, soil deposits, and animal droppings which may have accumulated on the roof and in the gutters (11,28,29). Also, the total coliform standard does not adequately predict the occurrence of Pseudomonas

aeruginosa, a naturally occurring opportunistic pathogen found in soil and water (13,25); our studies show that there is no correlation between it and the total coliform (16,29). Indeed in both of the studies mentioned before, Ps. aeruginosa was found in 69 percent and 49 percent of the private residential and public housing cisterns respectively, with it being present in the absence of total coliform almost 16 percent of the time on average.

While most Virgin Islanders drink their own cistern water, with many claiming to suffer no ill effects, visitors may not be immune since most of them come from large cities where drinking water is usually treated and protected from external contamination.

In this study, we attempted to make a preliminary assessment of cistern water quality in selected hotels and guest houses on St. Thomas in relation to the Safe Drinking Water Standards as set by the U.S. Environmental Protection Agency. In addition we determined the relative occurrence of the opportunistic pathogen Pseudomonas aeruginosa occurring in hotel and guest house cisterns and compared it to free chlorine residual. This study was also used to gather data upon which to base recommendations for alternate regulations for cistern stored water.