



WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: The Application of Slow Sand Filtration Technology For Kosrae State, Federated States of Micronesia: A pilot Project

Focus Category: TRT, WS, SW

Keyword Numbers : Streams, Water Quality Control, Slow Sand Filter

Duration: March 1999 to March 2000

Fiscal Year 1999 Federal Funds : Federal \$33,201

Non-Federal Funds Allocated: Non-Federal \$36,019

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Congressional District of University Performing the Research: N/A

Statement of the Critical Regional or State Problem

Surface water is widely used throughout the high islands of the FSM and particularly in Kosrae as a major source of drinking water. In all cases this water is heavily contaminated and unfit for human consumption without treatment. Study by the Hawaii Department of Health (1991) indicates that Kosrae has one of the highest incidences of water related diseases in the world. According to this study the rate of water born diseases for Kosrae was 44 times higher that the highest incidence rate recorded for the State of Hawaii, and 5700 times higher that recorded for the U.S. as a whole.

Steps were taken in 1984 to reduce this high rate of disease with the construction of the Toful -Lelu diversion and treatment system. This system, the largest water system in Kosrae, serves approximately 2,500 people. The facility consists of a low dam intake and a rapid sand filter. The problem is that the rapid sand filter has never been in operation since its construction. The filter system is very complex and has been plagued with breakdowns due to the harsh tropical environment and the lack of training in maintenance and operation of such a complex system. This is very typical of technology for water treatment that is introduced where the environment and training of those operating the system are not accounted for in the original designs.

Water systems in Kosrae, as in all of the Western Pacific islands, must operate under very adverse economic, social, and environmental conditions. These adverse conditions include:

1. Lack of sufficient funds to build high-cost treatment systems.
2. Water systems with very low budgets for operation and maintenance.
3. Water system personnel that are not trained in the operation of sophisticated treatment systems.
4. The islands' remote location makes it very difficult to obtain spare parts and treatment supplies.
5. The harsh tropical environment that tends to corrode or disintegrate all metal parts.

What is needed is a water treatment system that not only reduces the levels of harmful disease causing organisms, but can also remain operational under these adverse conditions. The treatment system must be effective and also economical to build and simple to operate and maintain. The use of locally available materials in the treatment system is especially important because of the extreme remoteness of the islands and their lack of economic foundations to pay for high priced treatment systems.

Statement of the Results and Benefits of the Information Expected

The primary product of this project will to develop recommendations and design criteria for the use of slow sand filtration technology to improve the quality of the surface water supplies of Kosrae Island. The study will explore the use of locally available materials as the filter media in hopes of developing a design that is not only easy to operate and maintain but also one that is economical to build.

The major potential impact of this project will be that a technology will be available to the people of Kosrae to filter their previously unfiltered badly contaminated water supplies. This change will greatly reduce the potential for water born diseases on the island. This will result in greatly reducing the physical suffering and hardships of the people due to these diseases. It will also reduce the financial burden of the government in providing health care both on and off island to those suffering from water born disease. There is a great potential for this technology to be transferred to other islands in the Western Pacific whose people suffer from the use of contaminated untreated surface waters. A secondary benefit will be training of water utility personnel in the operation of slow sand filters. Personnel from Kosrae Sanitation Division of the Department of Health Services will also receive extensive training in the carrying out of the various water qualities testing procedures that will be required for this project.

Nature, Scope, and Objectives of the Research

The primary goal of this project is to improve the quality of drinking water supplies for the island of Kosrae using slow sand filtration technology. However, before slow sand filtration is recommended for specific source water several questions must be answered. These include:

- Can this technology produce a safe and attractive finished water from the specific source water?
- Will the filtration cycle length (the time period between filter scrapings) be acceptable?
- What is tolerable cycle length? Most successful plants today have cycle length of 1.5 to 2 months or longer (Cleasby, 1991).
- Is it possible to use local materials as media?
- What size of plant is required with the costs involved and what training level is required?

To answer these questions we are proposing to install a pilot slow sand filter at the Toful-Lelu diversion site on Toful stream. The results of this project will be valuable for other small water systems throughout the FSM. For example, Pohnpei State has 14 untreated small community water supply system whose source water is contaminated surface water. There are four similar systems in Yap and Chuuk State FSM. All stand to benefit greatly from this pilot study. The objectives of this pilot study are to:

- Measure the level of turbidity, heavy metals, bacteria, and pH of the Tofol stream.
- Design and construct three pilot slow sand filters using three different media which will include commercially available filter sand, locally available manufactured sand from basalt rock, and locally available coral sand.
- Train the Kosrae Sanitation Division of the Department of Health Services personnel in monitoring the performance of the pilot plants.
- Evaluate the results and prepare design criteria for full sized slow sand filtration plants for Kosrae State.