Date: 13 August 1980

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Subject: Coarse-grained filters research

1. Background

The Regional Medical Inspector's Office in Martinique requested from PAHO information on simplified projects of water systems to supply a public wash-house, whose main objective would be the control of bilharziasis.

We propose the execution of the following research project in order to complement our communication AMRO-2070-2013-90.

2. Objective

To find through experimentation the design and operation parameters of a coarse-grained filter, to be used together with public wash-houses, as part of a bilharziasis control program.

3. Pilot unit description

Vertical coarse-grained filters formed by 2" to 4" diameter pipes will be used for the experiments. These pipes must preferentially be made of plexiglass or, in lack of them, of any plastic material (PVC) (Graphic 1).

Gravel with 0.5, 1.0 and 1.5 cm diameter should be used, respectively, for the different experiments. In pipes (A) and (B) aerobic and anaerobic conditions will be maintained, respectively, using a head tank over the pipe (B).

Each pipe is provided with four outlets to take samples, indicated by (a), (b), (c), (d), and with the respective water inlet and outlet systems. Filtration velocities will be regulated through (e) and (f) valves. These velocities will be of 0.10, 0.30, 0.60 and 1.00 m/hour (Graphic 1).
4. **Experiments description**

a. Units must be filled with 0.5 cm gravel for the first experiment, 1.0 cm for the second one, and so forth.

b. Water inlet to each filter must be regulated so as to obtain 0.10 m/hour velocities for the first five days, 0.20 m/hour for the sixth to tenth days, and so on.

c. Samples of raw and clear water to 0.50, 1.00, 1.50 and 2.00 m of depth filter should be taken every six hours, and the following parameters analyzed: physical (turbidity, color), chemical (pH), biological (total count of bacteria, MPN/Coli fecal x 100 ml, and number of miracidium) using the enclosed form.

5. **Data analysis**

Data included within the following values should be accepted for establishing design criteria, values outside this range are rejected as outliers:

\[ X \text{ acceptable} = \bar{x} \pm 6 \]

being \( \bar{x} = \frac{\sum x}{n} \)  
\[ \sigma = \sqrt{\frac{\sum (\bar{x} - x)^2}{n}} \]

being \( x = \) measured values \( \quad n = \) number of data \( \bar{x} = \) arithmetic mean \( \sigma = \) standard deviation

In order to establish design criteria, we suggest to use the methodology described in:


Annex
EXPERIMENTS WITH COARSE-GRAINED FILTERS

Experiment N° ____________________

Date ____________________

Gravel ____________ (2) cm

Coarse-grained filter ________ (1)

Hour ____________________

Filtration velocity ________ (3) m/hour

<table>
<thead>
<tr>
<th>Depth of sample (m)</th>
<th>Physical</th>
<th>Chemical</th>
<th>Biological</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Turbidity</td>
<td>Color</td>
<td>pH</td>
</tr>
<tr>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>0.50</td>
<td>(4)</td>
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<tr>
<td>1.00</td>
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<td></td>
</tr>
<tr>
<td>1.50</td>
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<td></td>
<td></td>
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<tr>
<td>2.00</td>
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</tbody>
</table>
INSTRUCTIONS TO USE THE FORM

(1) Specify the type of filter: aerobic (A) and aerobic (B)

(2) Specify the size of gravel: 0.50, 1.00, 1.50 or 2.00 cm

(3) Specify the filtration velocity

(4) Data of physical, chemical and biological characteristics of raw water

(5) Data of physical, chemical and biological characteristics of clear water to 0.50, 1.00, 1.50 and 2.00 m of depth