

Ecological Purification System

renamed from Slow Sand Filtration.

EPS 2025-OBW
Nov. Part 1:1-7
7 slides

Part 1.

Treatment System for Safe Water by Wise Use of Natural Phenomena

An English invention of Slow Sand Filtration to make artificial spring water for safe drinking water is re-defined in Japan as Ecological Purification System.

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Professor Emeritus of Shinshu University
cwsckmt@yahoo.co.jp

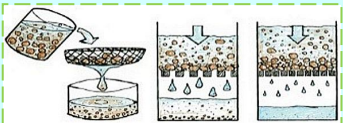
JICA Okinawa training from Nov. 17. to Dec.12. in 2025. Managed by Okinawa Blue Water

2025年度 JICA 沖縄課題別研修：
「水の安全保障の実現に向けた浄水・水道技術」
Water Purification and
Water Supply Management
for Achieving Water Security

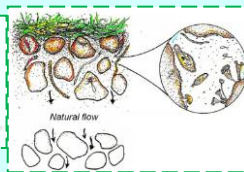
***Nakamoto joins from
Nov.21. to Nov.27. in
Okinawa and web-
contributes Nov.17.
and Dec.11-12. from
Nagano, 2025.***

I proposed the new name of
Ecological Purification System
instead of **Slow Sand Filter**.

Slow Sand Filtration



**Ecological
Purification
System**



Timor
Lest

Fiji

Antigua and Barbuda

St. Lucia (2)

Barbados (2)

St. Vincent and the Grenadines

Grenada

I found this EPS is our technology for ours in Ueda, Nagano.



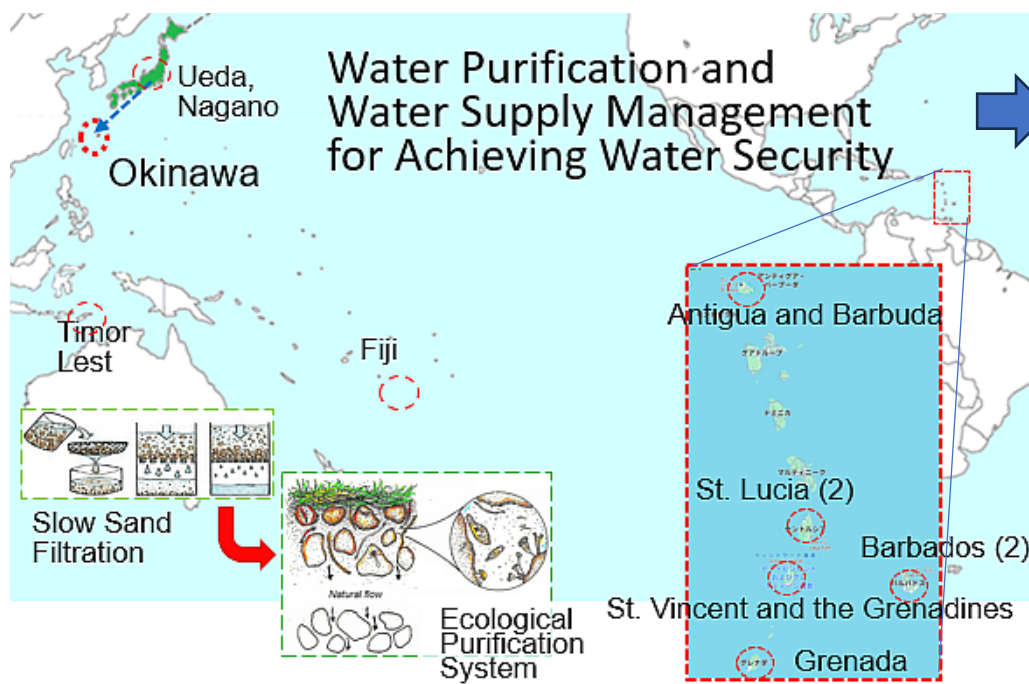
53 seconds
<https://www.youtube.com/watch?v=b7wPQIKVIMY>



SSF in UK

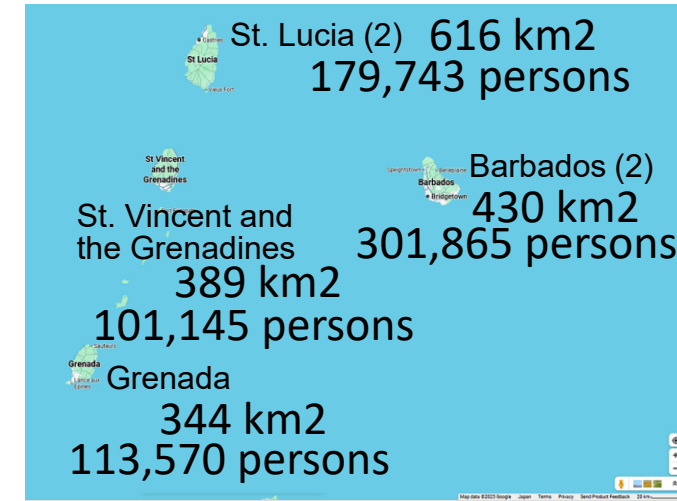
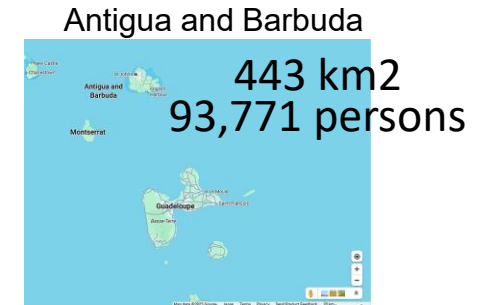
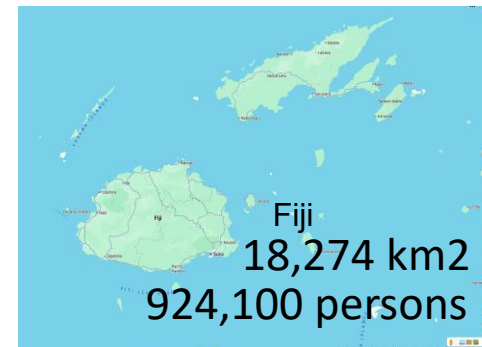
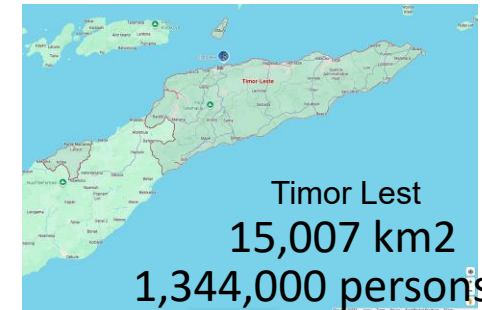
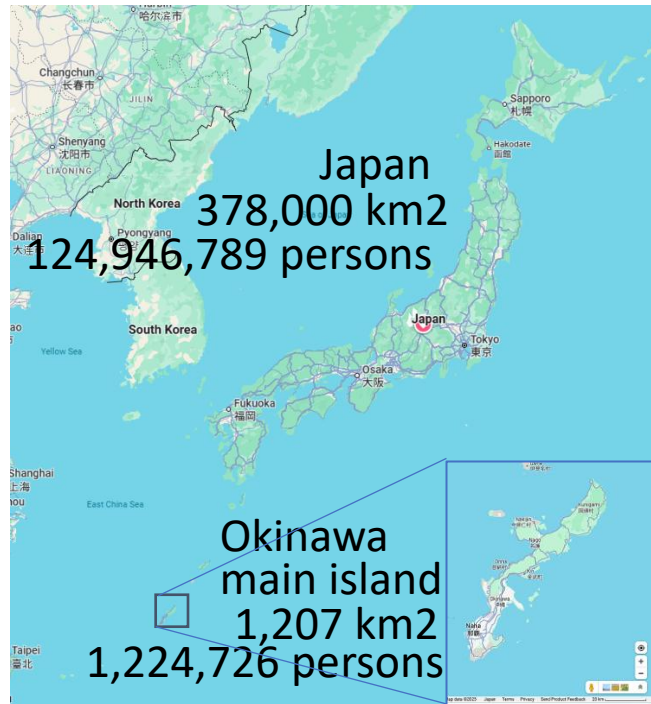


EPS from Japan to the world.



Small-Scale purification system of **Ecological Purification System** that **we can build and maintain by ourselves.**

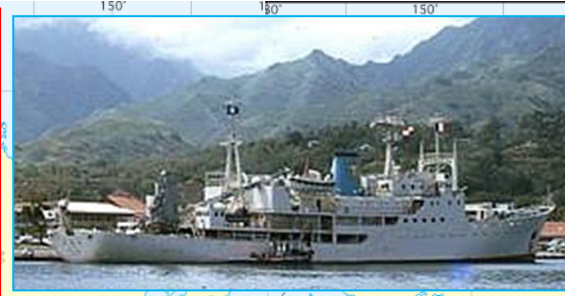
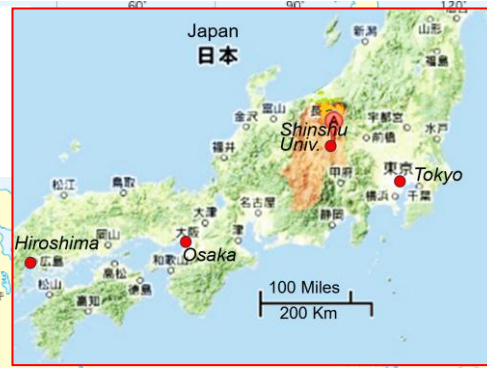
EPS is Treatment System for Safe Drinking Water by Wise Use of Natural Phenomena.



You have to learn suitable knowledge and technology for your countries.

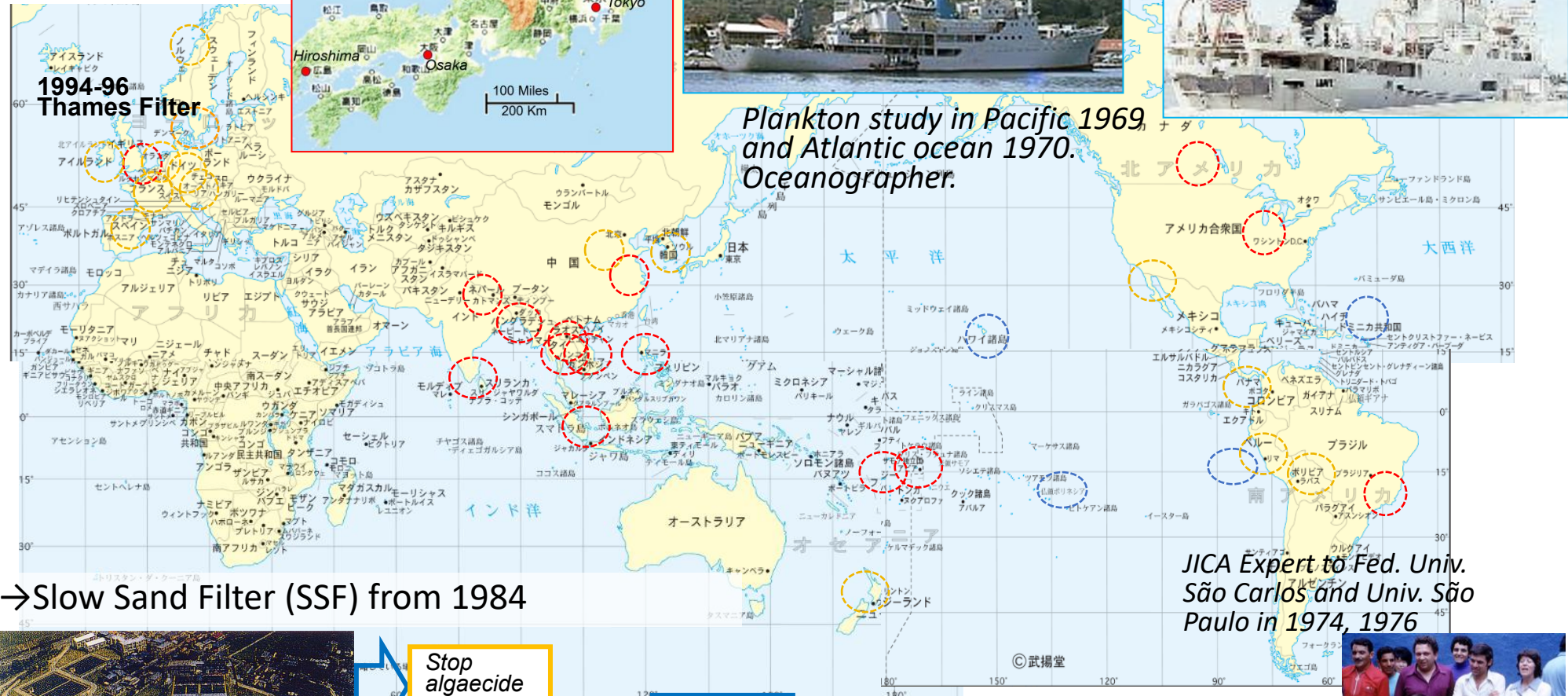
I was born in May, 1942 in Tokyo.

→ Tokyo Metropolitan Univ.: **Biology**
Plankton, pond, reservoir, ocean and stream.



Plankton study in Pacific 1969
and Atlantic ocean 1970.
Oceanographer.

1994-96
Thames Filter



Odor problem of tap in Ueda city

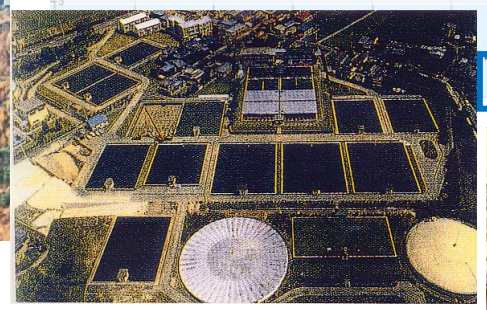
→Shinshu Univ.:
Applied Biology, 1975
→Eutrophication study
on Reservoir

1975: Reservoir study



Bad algae

→Slow Sand Filter (SSF) from 1984



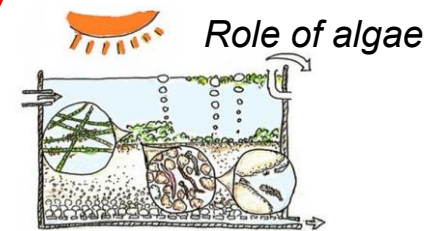
Stop
algaeicide



Turn to
delicious
tap water

Retired in 2008,
Prof. Emeritus.

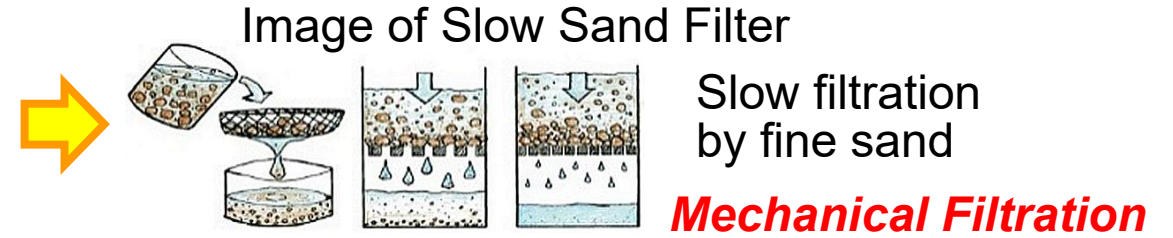
Reservoir
control of
eutrophication



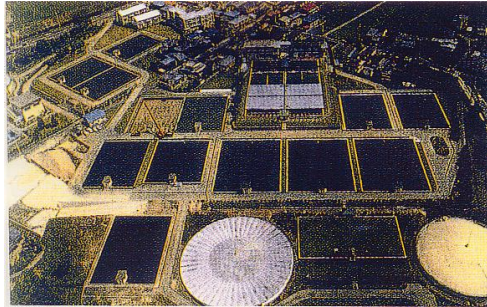
→Wise Use of Biological Phenomena



I noticed that Principle of Purification mechanism to make artificial safe drinking water had been misunderstood as mechanical filter by the name of Slow Sand Filter.



Slow sand filter was constructed in 1923 (over 100 years ago) in Ueda city, Nagano Prefecture.



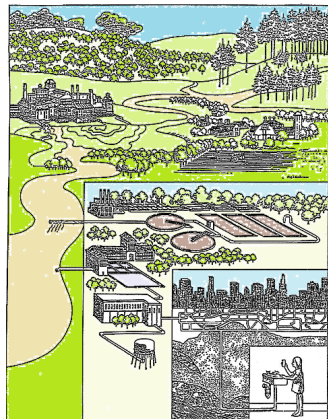
When Sugadaira Reservoir was constructed in 1968, odor problem was happened in tap water.



They believed that algae produced odor substance in the reservoir and pass to the filtrate of slow sand filter.

Algae are Bad.

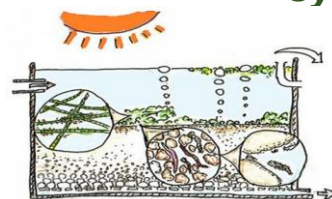
IS THE WATER
SAFE TO DRINK?
Harris Report 1974



Cancer risk by
chlorine addition



**Safe and delicious
tap water by
Ecological
Purification
System.**



→ I proposed that Rename to
Ecological Purification System

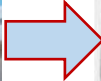
4min. 31 sec. YouTube



<https://www.youtube.com/watch?v=0KZq3dpORps&t=17s>



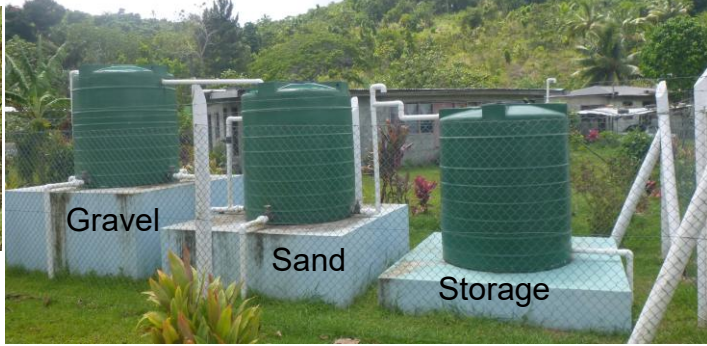
JICA EPS training in Miyako-Jima, in Aug. 2011.



For rural people from 2013 in Fiji.



To make artificial spring water from surface water.



EPS for Fiji village



tap



Key is Roughing filter.

EPS Nagano Japan



Miyako-Jima, Okinawa



Fiji Samoa



Pacific islands



SPREP
Secretariat of the Pacific Regional
Environment Programme

Pacific Regional Environment Programme

太平洋地域環境計画事務局

<https://www.sprep.org/>

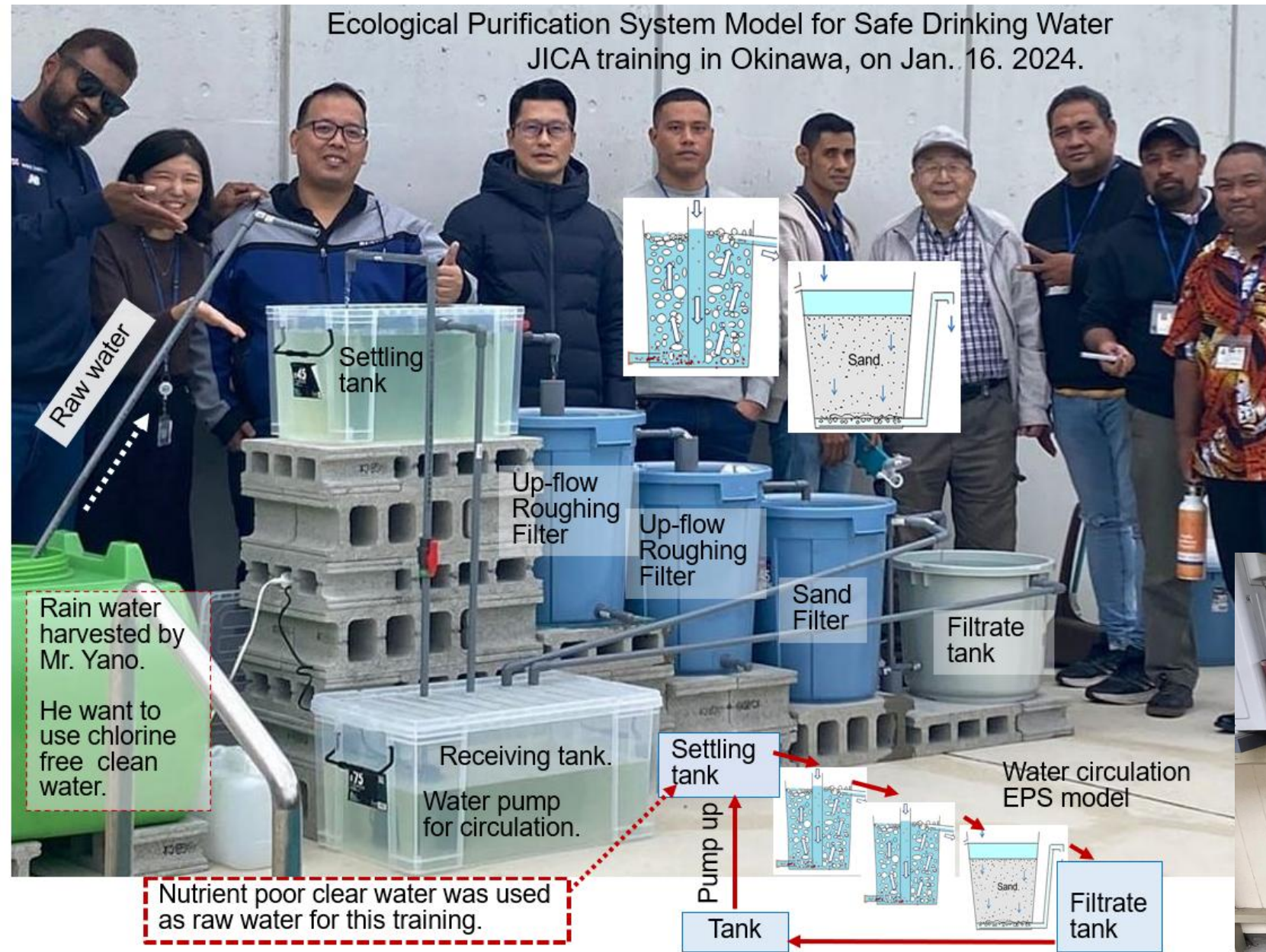


Safe water access in rural areas to build climate resilience in Fiji, Papua New Guinea and Solomon Islands

<https://www.sprep.org/news/safe-water-access-in-rural-areas-to-build-climate-resilience-in-fiji-papua-new-guinea-and-solomon-islands>



Ecological Purification System Model for Safe Drinking Water JICA training in Okinawa, on Jan. 16. 2024.





After 5months,
 still crystal-clear
 water produce
 Thanks to Dr.
 Nakamoto, Yano
 San, Maho San,
 Mariko San and all
 EPS member for the
 knowledge &
 support all this time.
 I feel proud & thank
 full for the
 knowledge I gain
 from JICA KCCP
 Program.

In addition, I want to share to all of you, up-flow filtration method is super value, value
 for money, maintenance & stress free as to compare to normal downflow filtration.
 From Mr. Mohamed Zairi, a trainee from Malaysia.

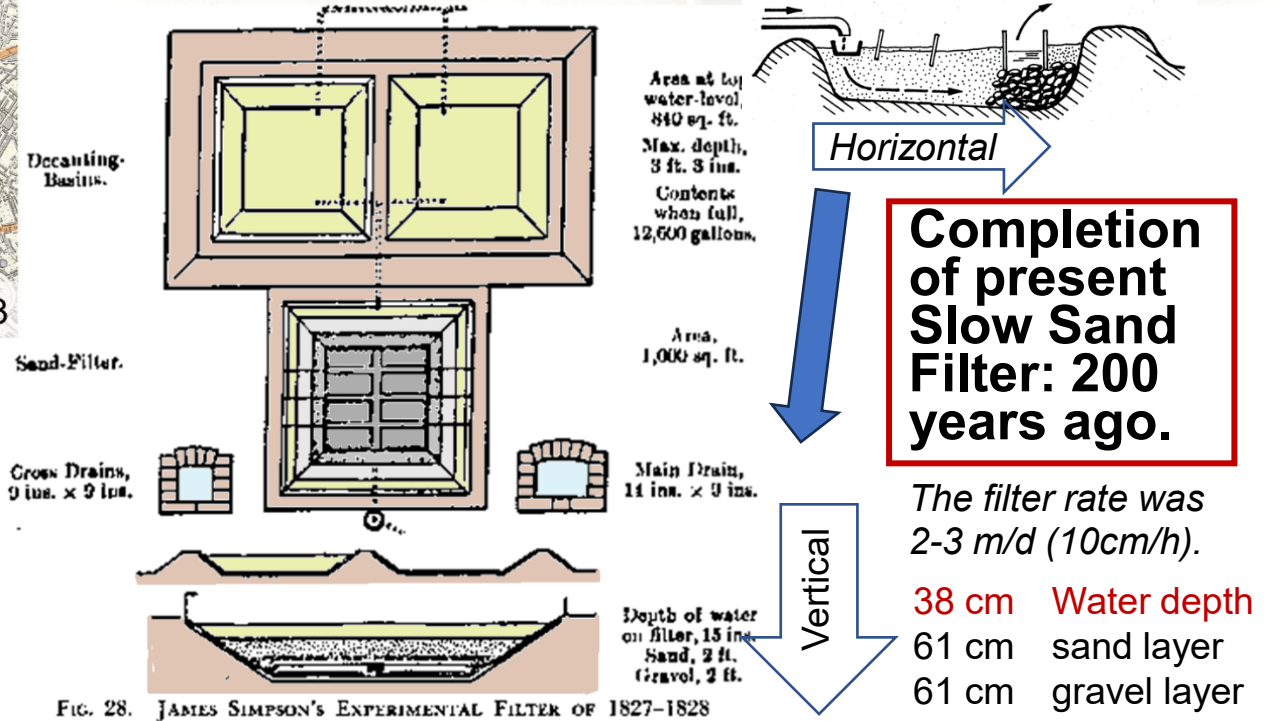
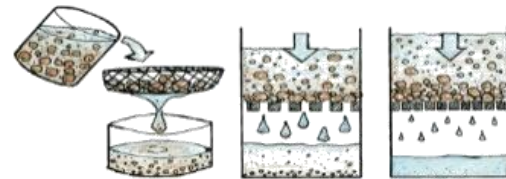
Invention of **SSF** in UK and a new technology of **Rapid Sand Filter** for turbid water in USA.

Refocus to SSF as risk free safe treatment system.

During the Industrial Revolution, the population gathered in cities. The rivers in cities were polluted.



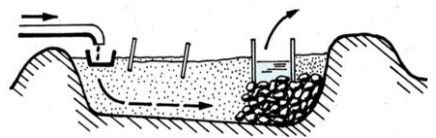
James Simpson examined vertical type of slow sand filter from 1827-1828 and made a practical plant in 1829.



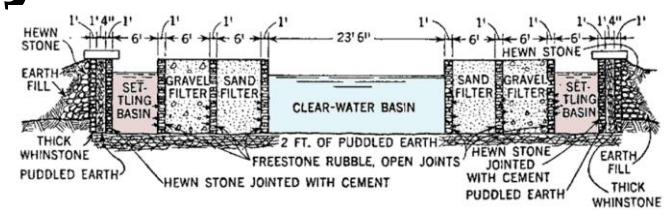
They believed that **Slow Sand Filter** purified by **slow** filtration with **fine sand**.

They believed this was **mechanical reduction** with **fine sand**.

Vertical is the key of slow sand filtration.

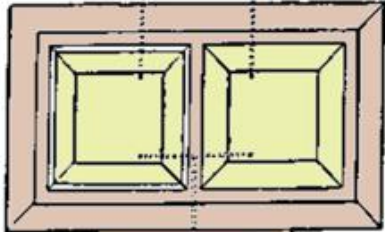


Horizontal filter



The **shallow** depth and the **vertical** flow allowed creatures to be **active and safe** near the surface of sand layer.

Settling basin



Vertical Slow Sand Filter

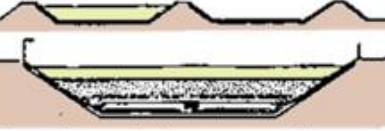
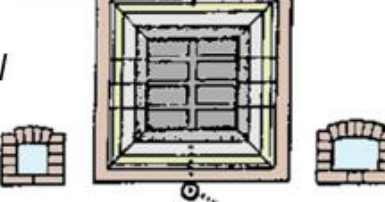


FIG. 28. JAMES SIMPSON'S EXPERIMENTAL FILTER OF 1827-1828

Area at top water-level, 840 sq. ft.
Max. depth, 3 ft. 3 ins.
Contents when full, 12,600 gallons.

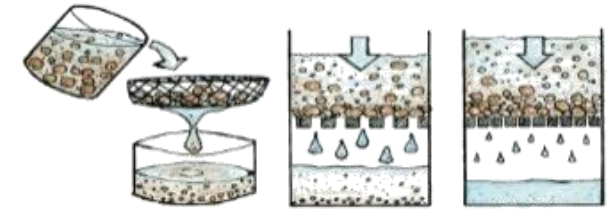
Area, 1,000 sq. ft.

Main Drain, 14 ins. x 9 ins.

Depth of water on filter, 15 ins.
Sand, 2 ft.
Gravel, 2 ft.

Vertical

Image of Slow Sand Filter.

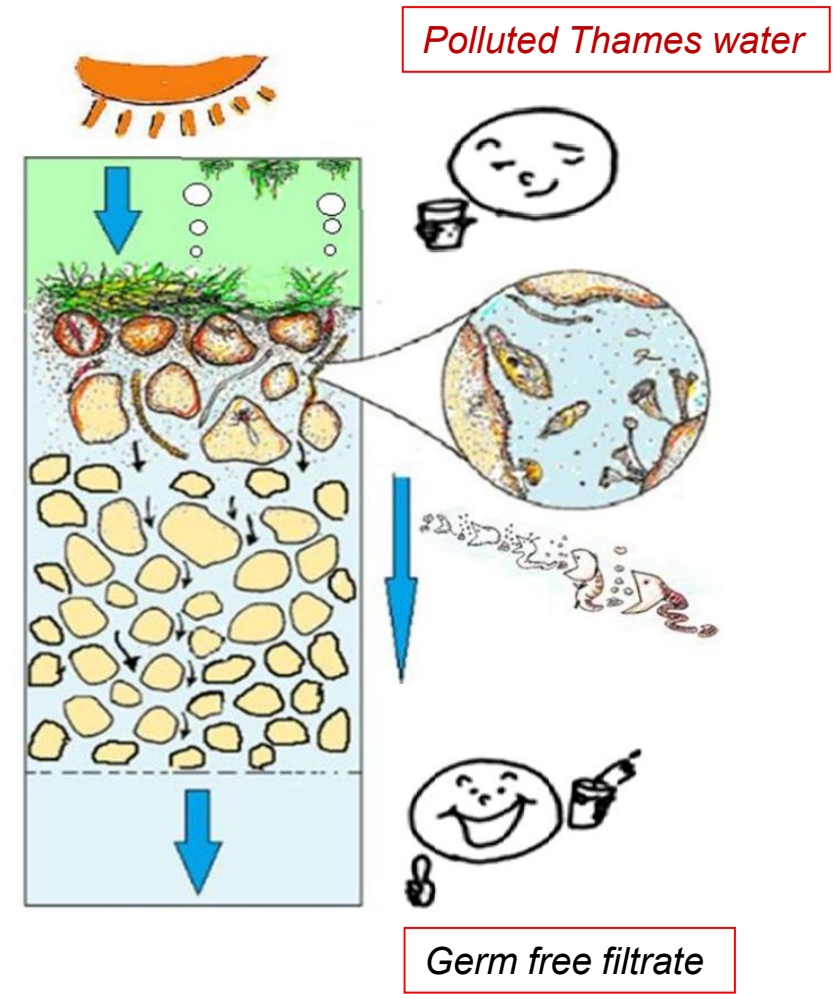


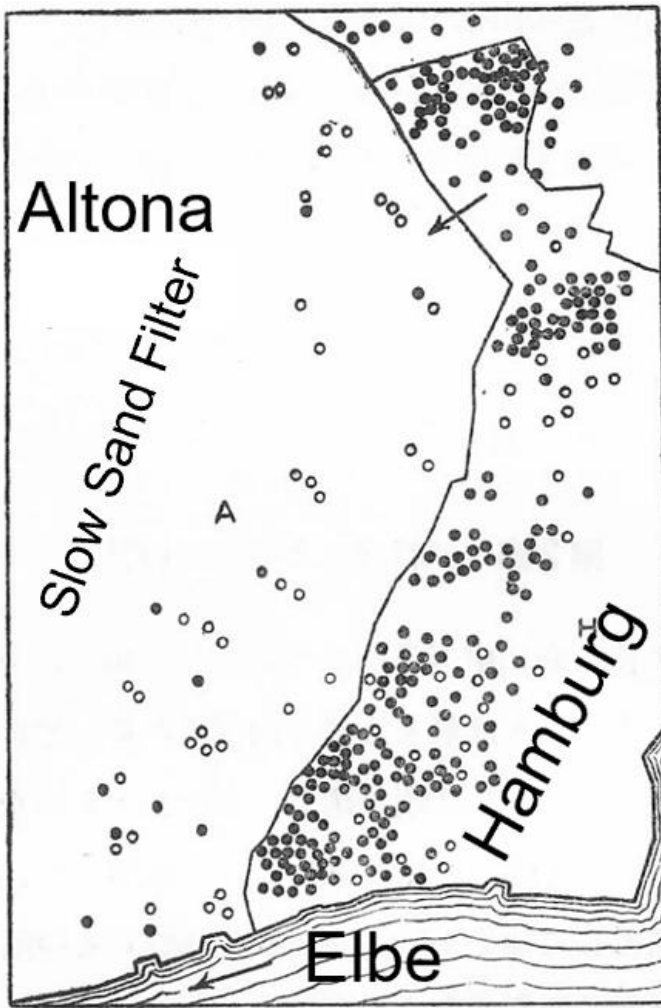
Shallow depth

38 cm	Water depth
61 cm	sand layer
61 cm	gravel layer

Filter rate was 2-3 m/d (10cm/h).

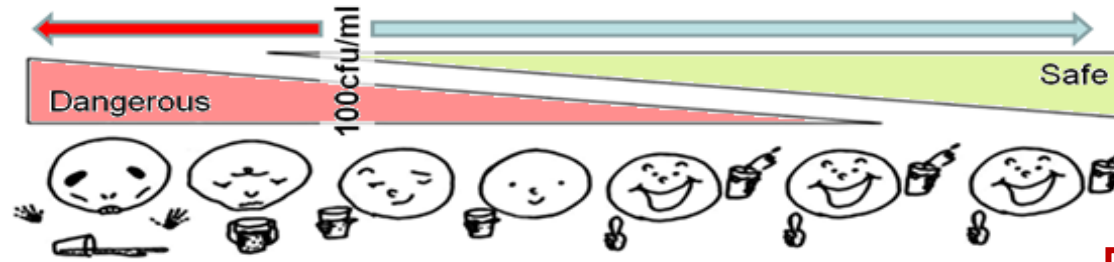
Simpson's filter is **vertical**.
The sand will not move even if the flow speed changes high or slow.





The **clear proof of the filtration** was provided in **1892**. This was **133 years ago**. **Hamburg** suffered from a cholera epidemic that infected and caused more than 7,500 deaths, while **Altona** was few.

Dr. **Robert Koch** tested the bacteria in the water with slow sand filtration. When bacterial counts were less than **100 colony-forming units per mL** (cfu/mL), epidemics of cholera and typhoid were reduced.



Present WHO safe standard for bacteria is referred to this 100 cfu/mL by Dr. R. Koch.

This idea is so called
Acceptable Risk.



They believed SSF was
mechanical reduction of impurity by slow filtration with fine sand.

It was found that SSF could eliminate pathogens and spread all over the world as English Filter.



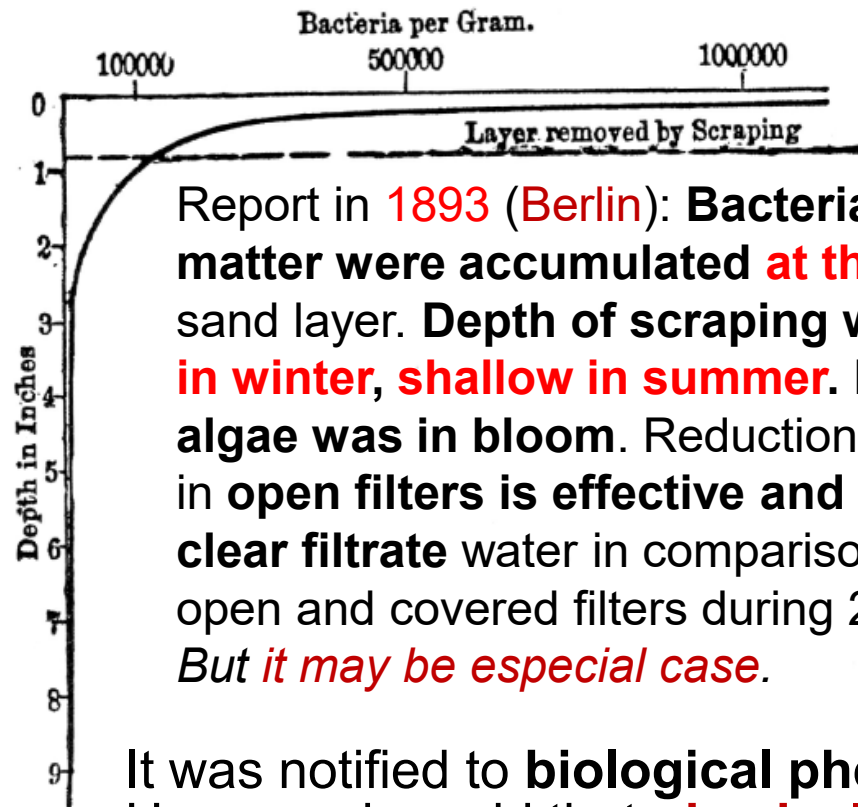
Wash our hands!
Reduce the risk.



Monster Soup commonly called Thames Water on the Metropolitan Water supply in 1828.



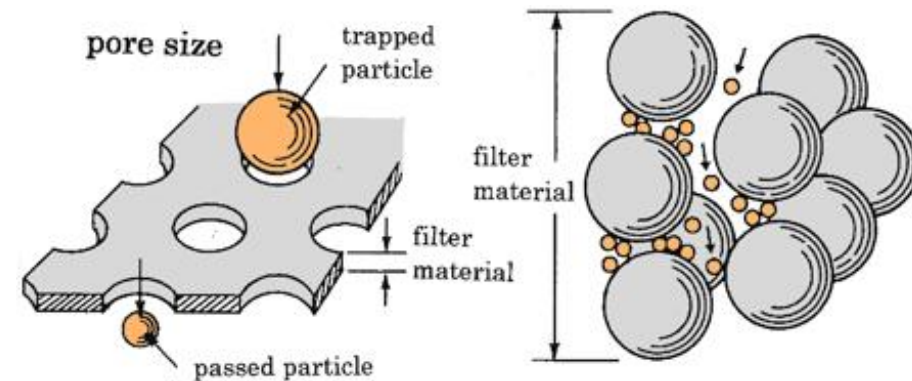
1832 : The great common sewers discharged into the Thames river. This was the Source of the Southwark Water Works.



Report in 1893 (Berlin): Bacteria and dirty matter were accumulated **at the top** of sand layer. Depth of scraping was **deep in winter, shallow in summer**. However, algae was in bloom. Reduction of bacteria in open filters is effective and more clear filtrate water in comparison with open and covered filters during 20 years. *But it may be especial case.*

It was notified to biological phenomenon. However, he said that **physical process was main.**

M.N.Baker 1949. The Quest for Pure Water



Removal of pathogens is not explained by these phenomena in comparison with size of microbial pathogens and opening space of sand grains. We can operate the filter without any clog during long filter run.

We can not explain the reduction mechanism of pathogens by physical phenomena.



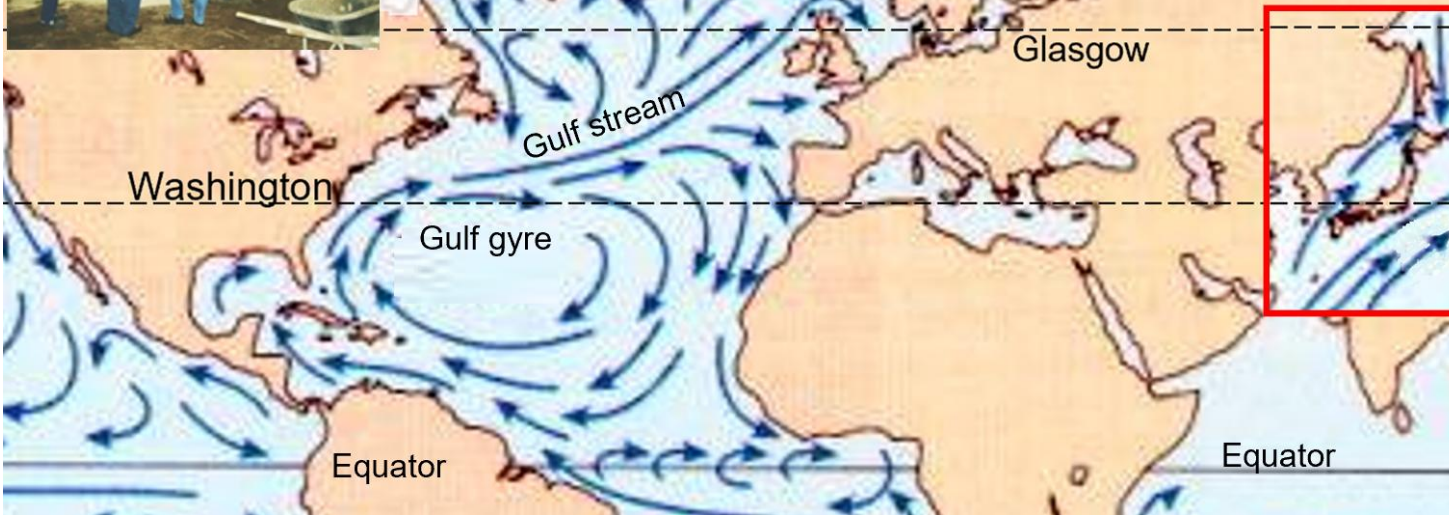
Covered filter,
Albany, NY, US



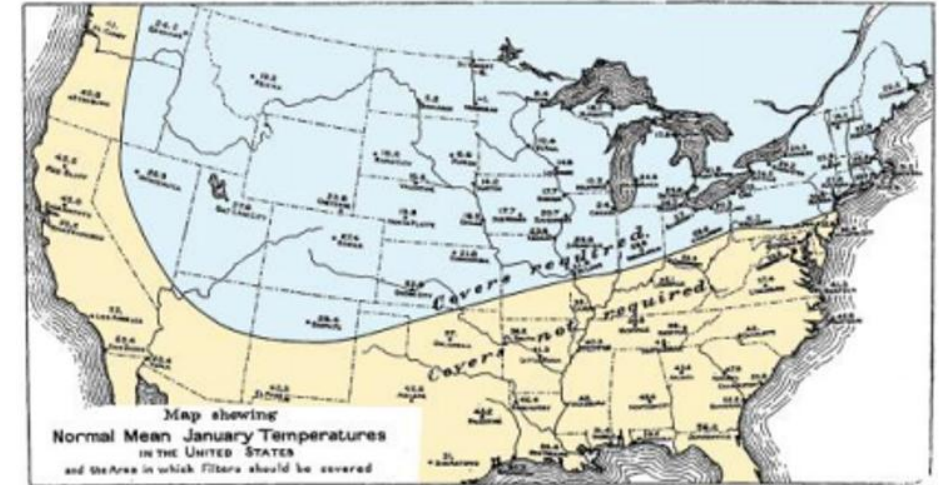
Winter
Thames
Filter



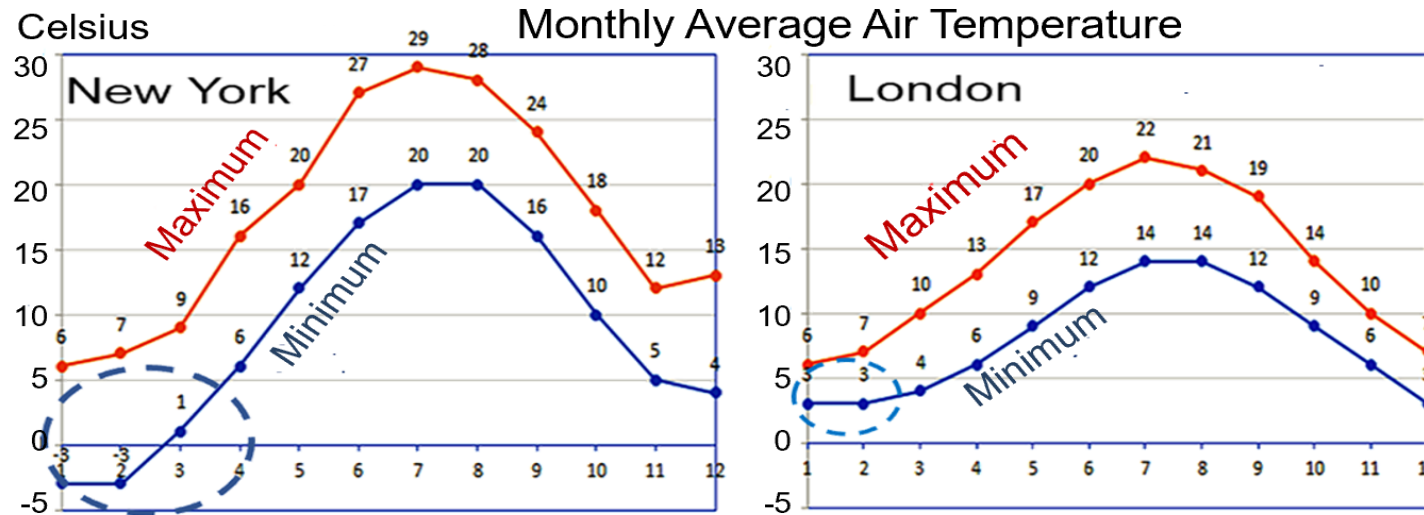
February
Glasgow



The average temperature in January is below 0°C. Covered filter was required.



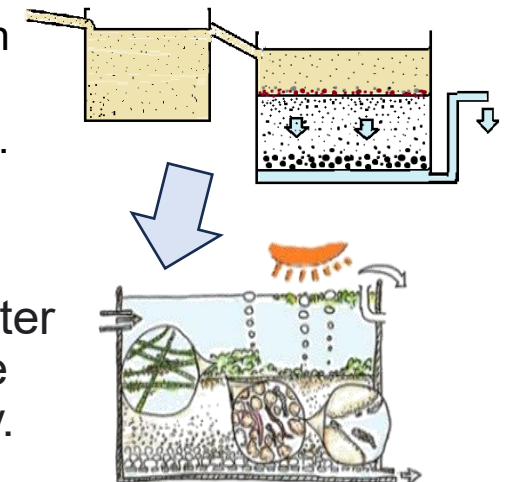
Winter temperatures in North America were cold and biological activity was weak. And the viscosity of water was high in winter.



New York has cold winter and hot summers.

London is not cold even in winter due to the warm current.

The turbidity of rivers in the continental plain is fine and difficult to sink.



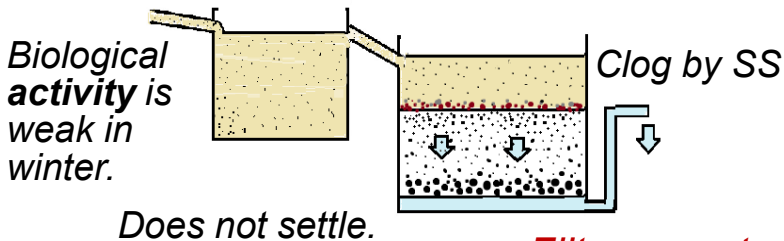
Safe drinking water was made by the biological activity.

Non-polluted river in new continent: poor food for small organisms
 1882: NJ, USA, Coagulation treatment : Origin of Rapid sand filter
 1910: NJ, USA, Chlorine treatment Completion of **American Filter**

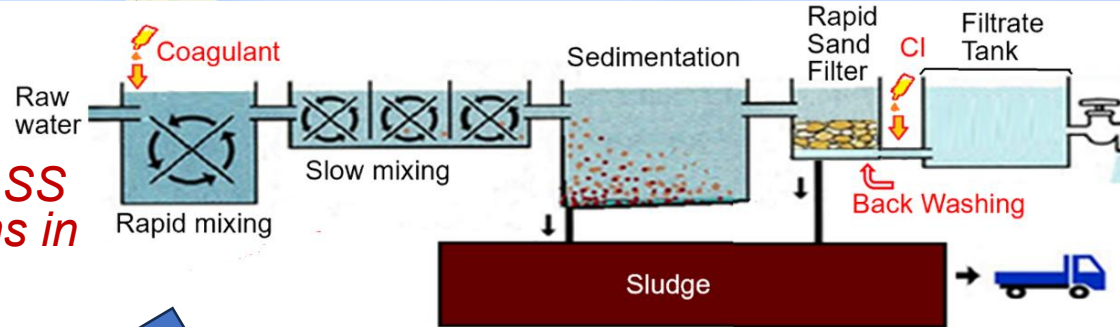
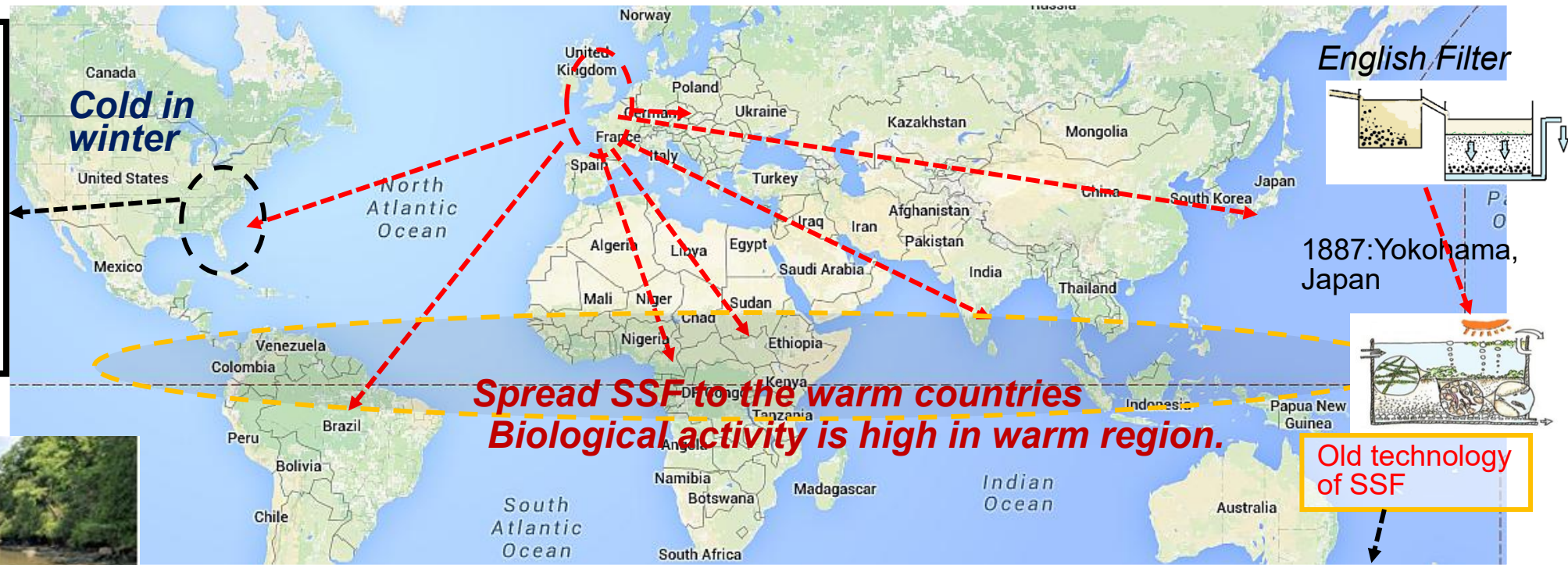
Fine much suspended solid



Non-polluted water contains fine SS and poor food for small organisms in continent rivers in USA.



Filter easy to brock by suspended solid.



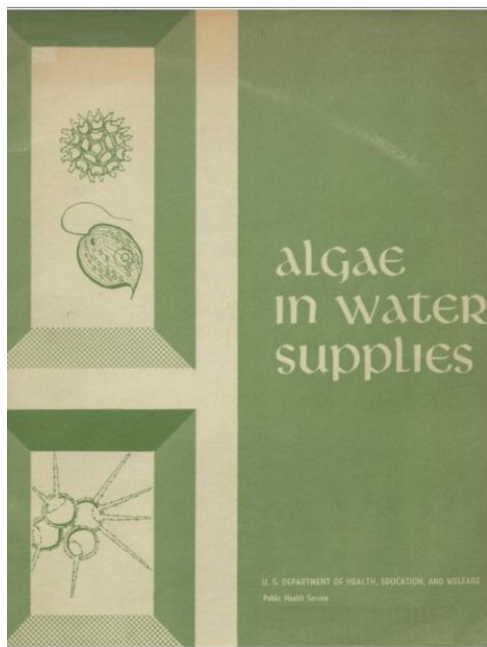
Rapid Sand Filter is chemical treatment.

People loves new technology.

This is American Commercial Filter.

RSF spread to the world.





Algae in water supplies:

an illustrated manual on the identification, significance, and control of algae in water supplies. C. M. Palmer 1962

Algae had been trouble for the conventional filter (rapid sand filter) in US. Taste and odor algae, filter clogging algae are important in water supplies (Rapid Sand Filter).

<http://digital.library.unt.edu/ark:/67531/metadc9129/m1/>



ALGAE IMPORTANT IN WATER SUPPLIES

TASTE AND ODOR ALGAE



FILTER CLOGGING ALGAE

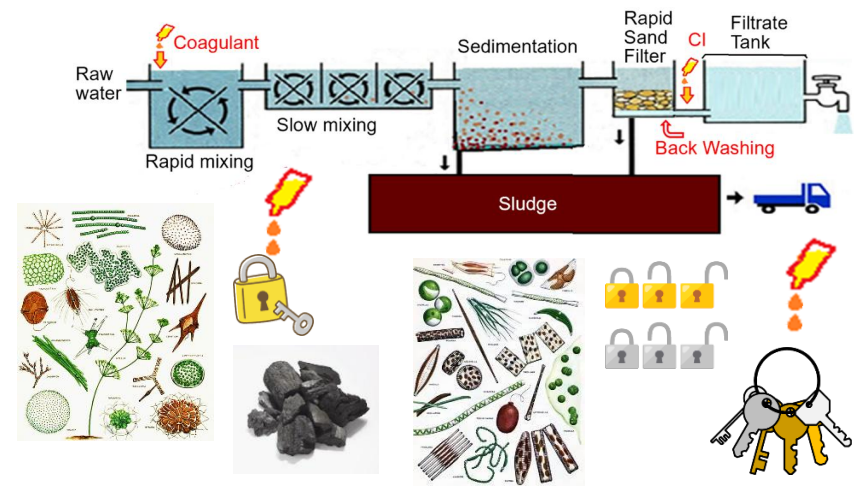


*In slow sand filter, the algae and other aquatic microorganisms may play a **useful part in the treatment process.***

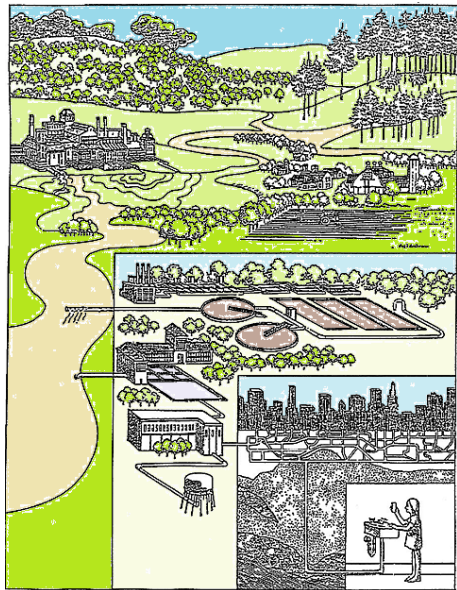
They form a loose, slimy layer over the surface of the sand and act as a filter. The algae in this layer release oxygen during photosynthesis, and the oxygen in turn is utilized by aerobic saprophytic bacteria, fungi, and protozoa which establish themselves in and on the filter. This permits the decomposition or stabilization of the organic material that was present in the raw water. In p.22.

Main focus of this book is **how to kill algae** for **Rapid Sand Filter.**

Refocus to Slow Sand Filtration as chemical free treatment instead of chemical treatment of Rapid Sand Filter.



Filter problem : Odor, taste and filter clog problem caused by algae. New chemicals were developed one after another.



IS THE WATER SAFE TO DRINK?

By Robert H. Harris and Edward M. Brecher, and the Editors of Consumer Reports
PART 1: THE PROBLEM

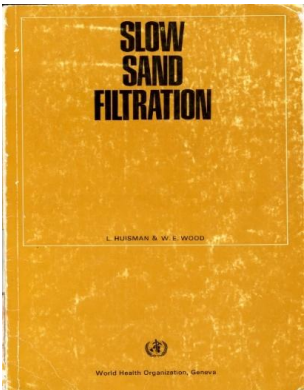
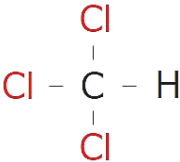
Robert H. Harris et. al. 1974
Consumer Report.

Chlorine sterilization is essential for rapid filtration of **chemical treatment**. There is a warning that trihalomethane, which are **cancer risk** substances, are generated by adding chlorine.



Rachel Carson 1962 **Silent Spring**. Pesticides and herbicides have been pointed out the risk of chemical hazards through biological concentrations through the food chain.

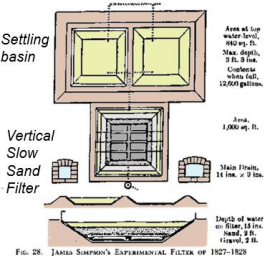
That was Chlorine compound.



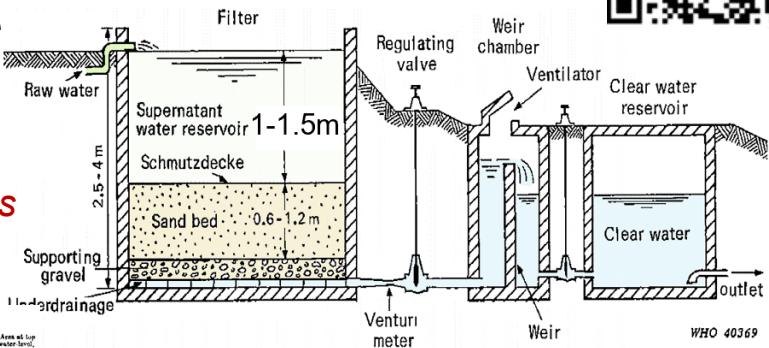
WHO published a manual of Slow Sand Filtration which is **chemical free treatment** for safe drinking water in 1974.



Water depth is 1-1.5 m.

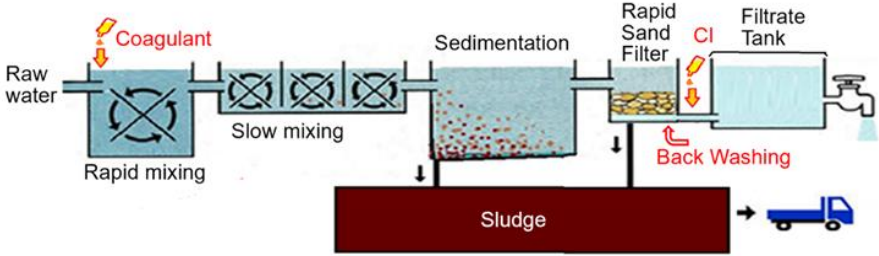


Simpson filter in 1827 is 38 cm.

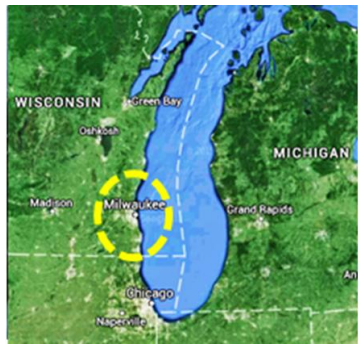


The diarrhea-causing crypt parasites passed through the backwashing process of the rapid sand filtration.

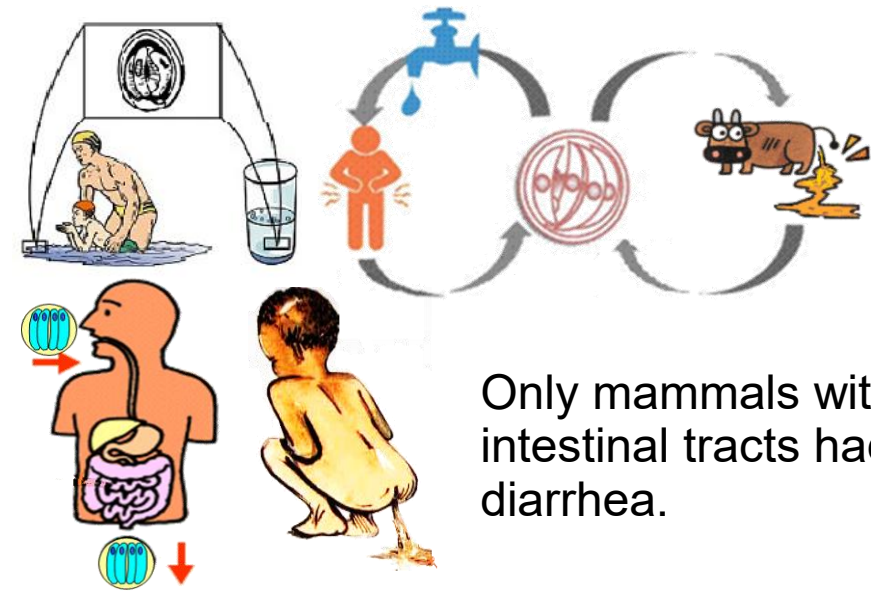
It became clear that RSF was a deadly process.



In April 1993, an outbreak of massive diarrhea in 400,000 people due to Crypto-protozoa occurred in Milwaukee, USA. The dormant protozoa had thick shells and passed through the rapid filter ponds and were not killed by the final chlorine.



In In September 1994, the American Water Works Association held a slow filtration workshop in Salem, Oregon, USA.



They said Refocus, Re-discovery, Timeless Technology for Modern Application.

However, people loves New Technology.

This is big problem.

JournalAWWA
Volume 88, Issue 12 December 1996
Pages 8-8

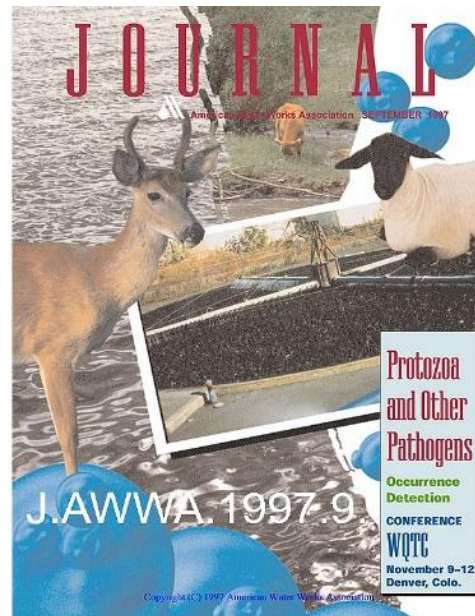
Acceptable Microbial Risk

Charles N. Haas

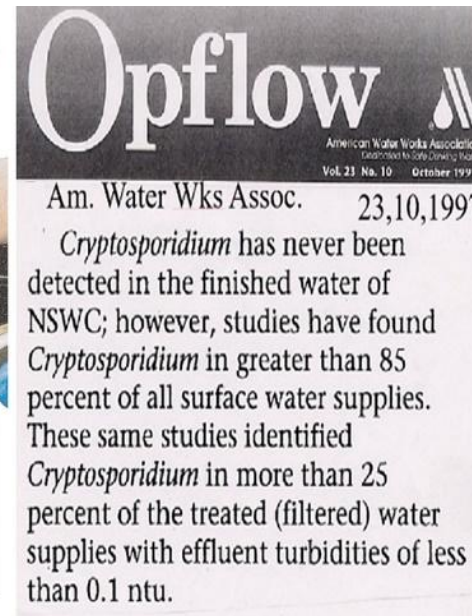
JournalAWWA
Volume 89, Issue 12 December 1997
Pages 14-15

Slow Sand Filtration: Still a Timeless Technology Under the New Regs?

Stephen A. Tanner



Crypto-protozoa are detected in more than 85% of surface water, but no crypto-
protozoa are detected in treated water.



Am. Water Wks Assoc. 23,10,1997
Cryptosporidium has never been detected in the finished water of NSW; however, studies have found *Cryptosporidium* in greater than 85 percent of all surface water supplies. These same studies identified *Cryptosporidium* in more than 25 percent of the treated (filtered) water supplies with effluent turbidities of less than 0.1 ntu.



So Many Oocysts, So Few Outbreaks
Floyd Frost, Gunther F. Craun, Rebecca Calderon, and Stephen A. Hubbs
For centuries people have known that after an infection, immunity is less likely to become ill from subsequent exposure. The ancient Chinese, realizing that those who survived childhood smallpox became immune to the disease, intentionally infected their children. Modern vaccination programs are variants of this ancient approach. Unfortunately, prior infection does not uniformly protect people from contracting subsequent diseases caused by all pathogens. Some infections confer immunity for varying periods of time; others confer little or no immunity at all. Although prior infection with *Cryptosporidium* has been associated with a more common occurrence of disease is "endemic." With endemic disease, most exposures result in asymptomatic infections rather than illness. The significance of endemic infections is seldom recognized. If a large number of people in a community are immune to illness caused by *Cryptosporidium* oocysts because of prior infections (corresponding to high levels of endemic infection), fewer illnesses will result from each new exposure. Eventually, such a large percentage of the community's population becomes immune that new exposures cause few illnesses. This phenomenon was observed in the case of typhoid fever. However, this may prevent detection of the scattered illnesses associated with consumption of drinking water contaminated with oocysts. Continued low-level contamination may maintain such a high degree of immunity in the population that overt outbreaks of waterborne cryptosporidiosis are prevented. Therefore, surveillance programs that rely only on the detection of cases of illness may not be sufficient to assess the risk of water-

So Many Oocysts are detected everywhere, but there are almost no diarrheal infections.



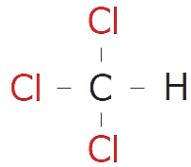
*What is real risk?
What is more safe
treatment?*



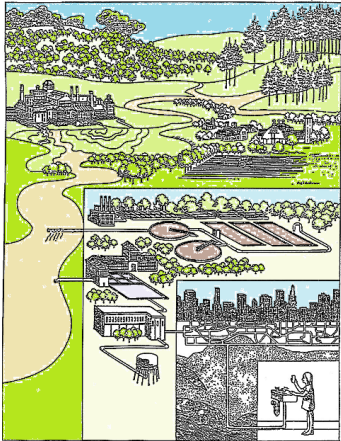
With slow sand filtration, they can trust that it will be absolutely safe even if it is contaminated with crypto-
protozoa. SSF plant was constructed in 1997 at Central Bridge, NY, USA.

IS THE WATER SAFE TO DRINK?

Harris Report 1974



Robert H. Harris and others 1974 pointed out the risk of formation of tri-halo-methane by chemical addition of chlorine.

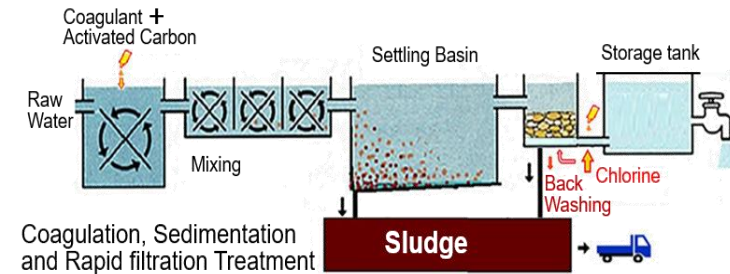


Winnipeg, Canada

Northern Pike in Canadian brown stream. Brown water is originated from peat land.



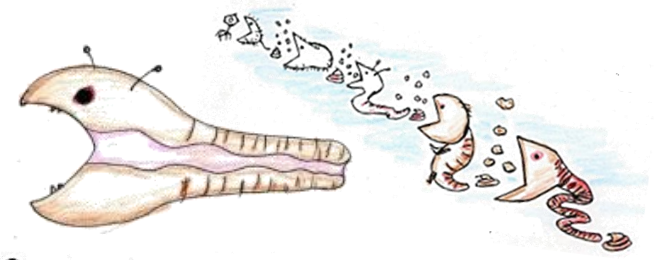
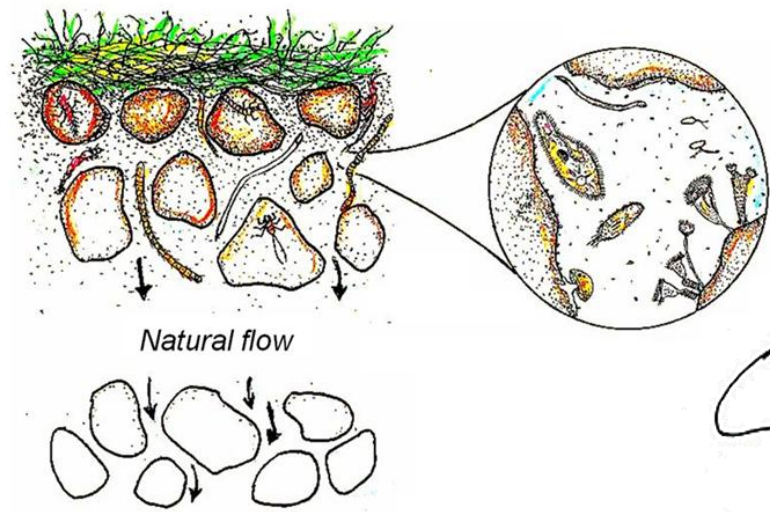
Water color is brown in the filter pond in Edinburgh in Scotland. Raw water comes from peat land.



Brown water is not good. This idea came from chemical treatment. Rapid Sand Filter produces Cancer Risk by chlorine addition.

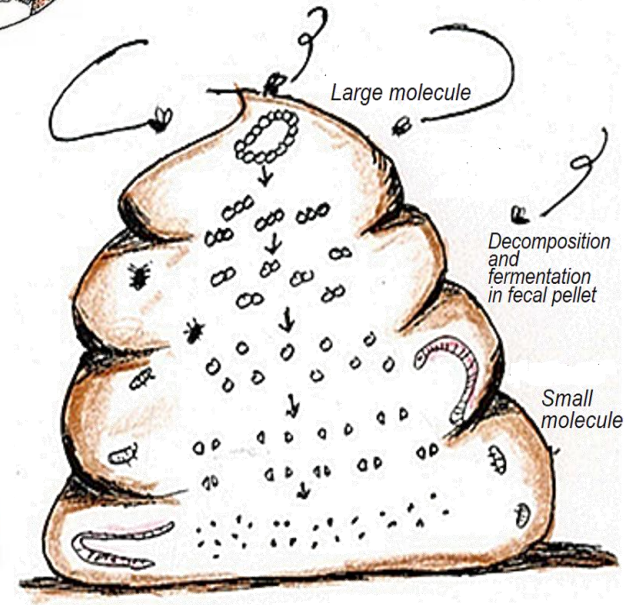
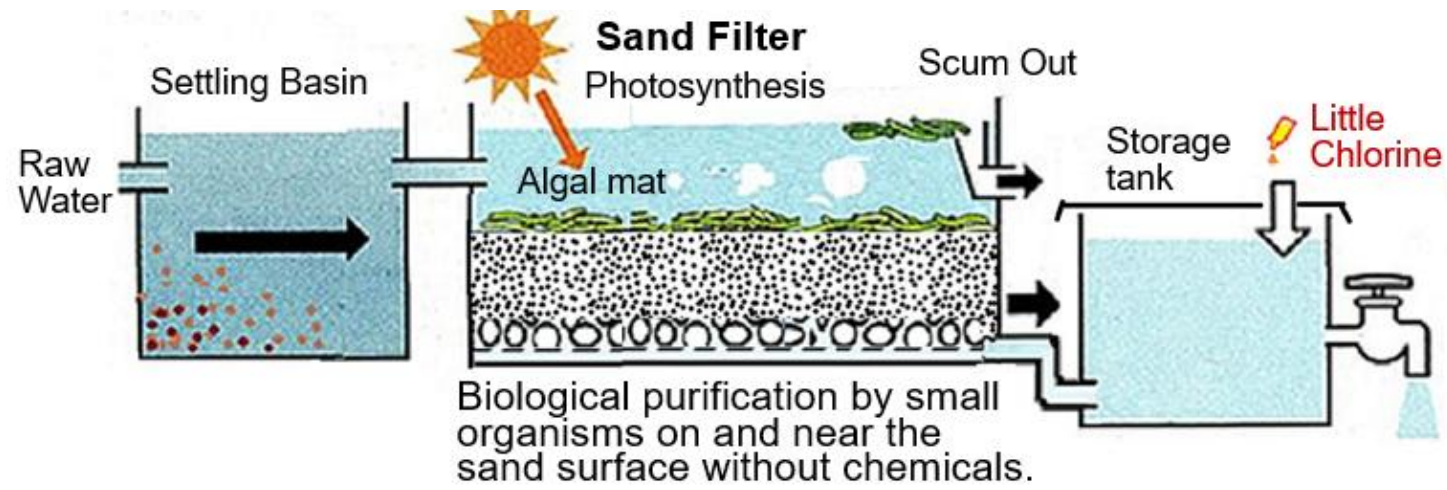


Vartry Waterworks, Dublin, Ireland. I could see brown water in open clear water tank. The filtrate water tank is not covered. They have served from 1860s.

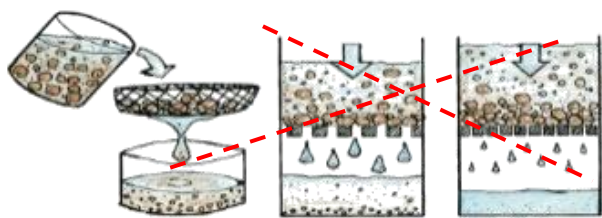


Purification is done by small organisms near the surface.

Large molecules are broken to small molecules under anaerobic condition in fecal pellets.



Function of Slow Sand Filter is to make an artificial natural spring water.

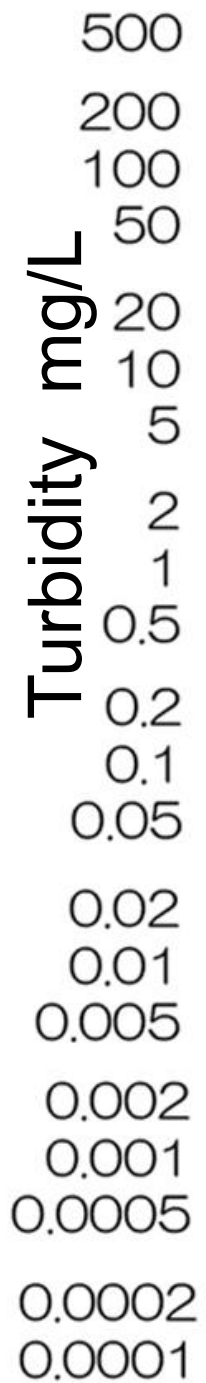


This is not mechanical filter.

Chemical free delicious water.



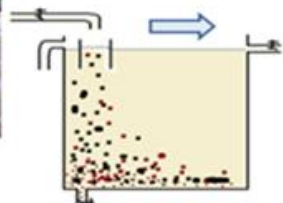
Turbidity mg/L



Storm event



Major turbid matter in mountain stream is easily set within several hours.



Coagulant + Chlorine
Rapid Sand Filter

2 degrees
Jap. standard

After Crypto
outbreak.

Recommended
to 0.1 degrees

SS passes by
backwash.



Chlorination
is essential.



Purified
by small
organisms

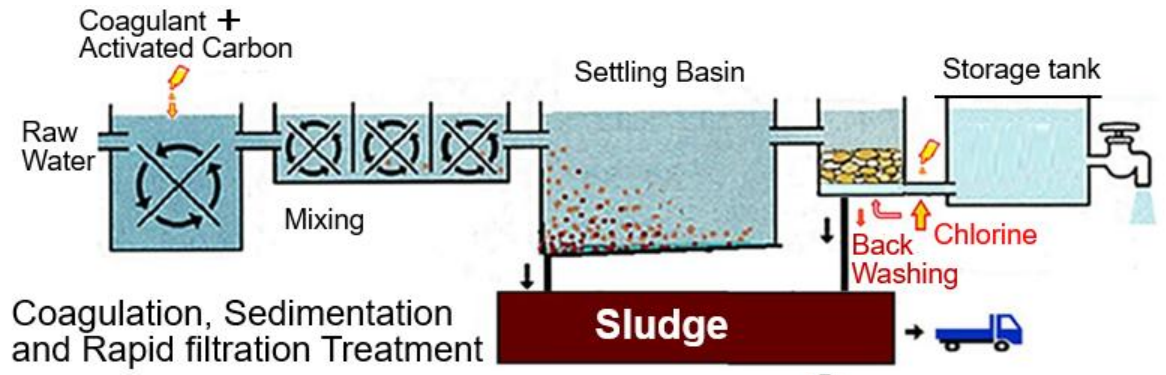
Natural
spring



Super clean
and delicious.



Artificial Natural spring water



This is a
commercial
filter.

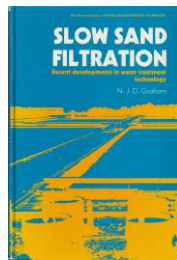


Part 3.



Luiz Di Bernardo, Univ. São Paulo, Brazil: Roughing filter test (Master student report 1980)

1988
London

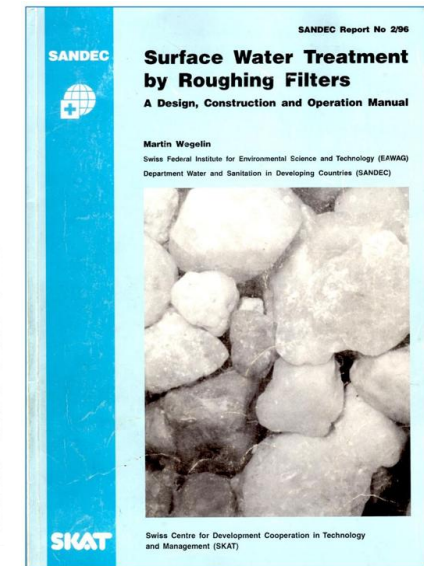


International pilot experiments in Columbia, (IRC : Holland), Peru, Brazil, UK, Switzerland etc.

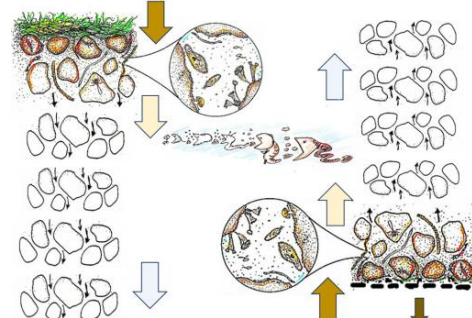
Martin Wegelin reported past roughing filters.

Swiss Federal Institute of Aquatic Science and Technology

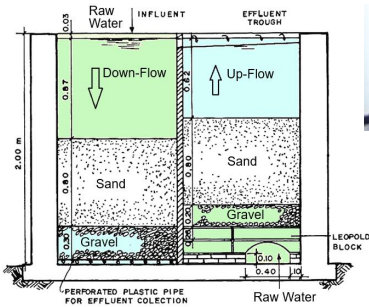
1996



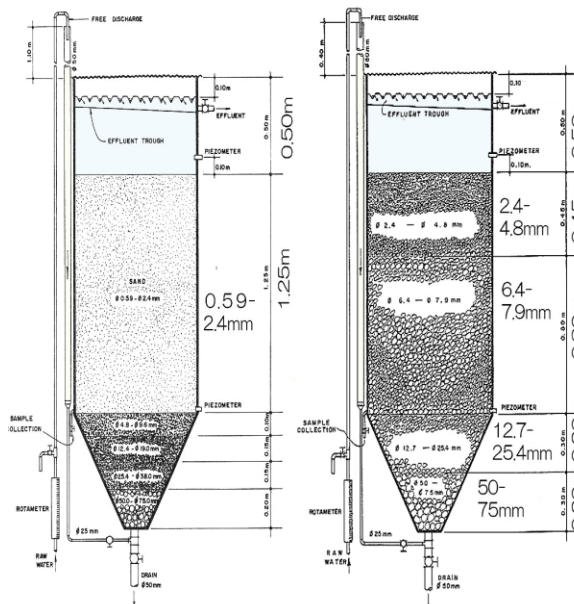
<https://www.ircwash.org/sites/default/files/Wegelin-1996-Surface.pdf>



Down-Flow and Up-Flow Drain



I visited São Carlos, Brazil in Aug. 1995. He still examined URF.

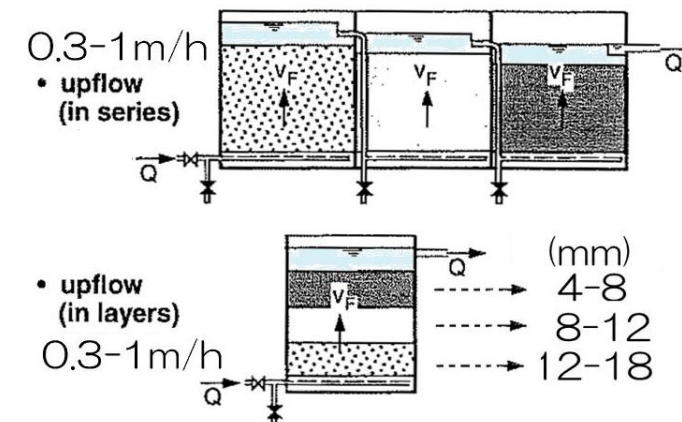


Sand URF and Gravel URF



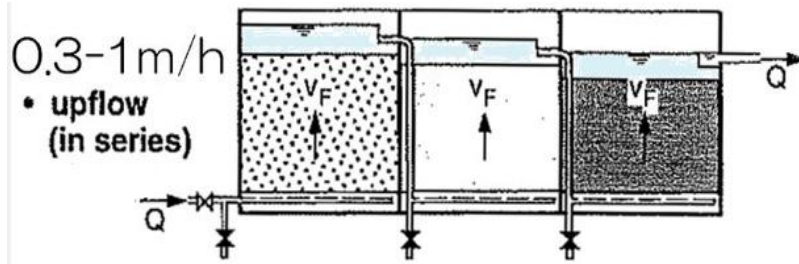
Nakamoto was a JICA advisor of the control of a reservoir ecosystem to São Paulo Univ. in 1974 and Federal Univ. of São Carlos in 1976.

Surface Water Treatment by Roughing Filters.

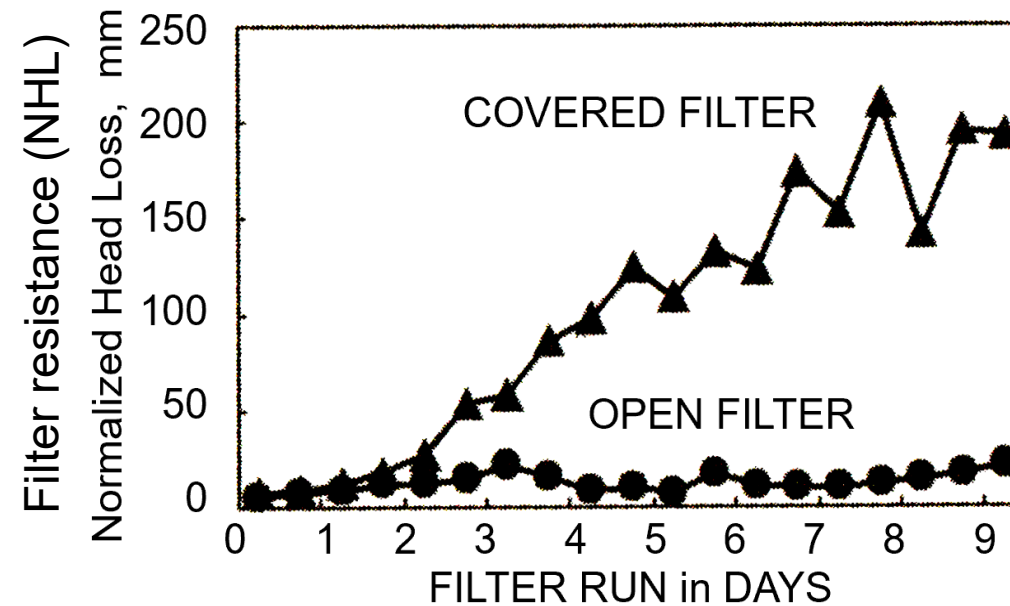
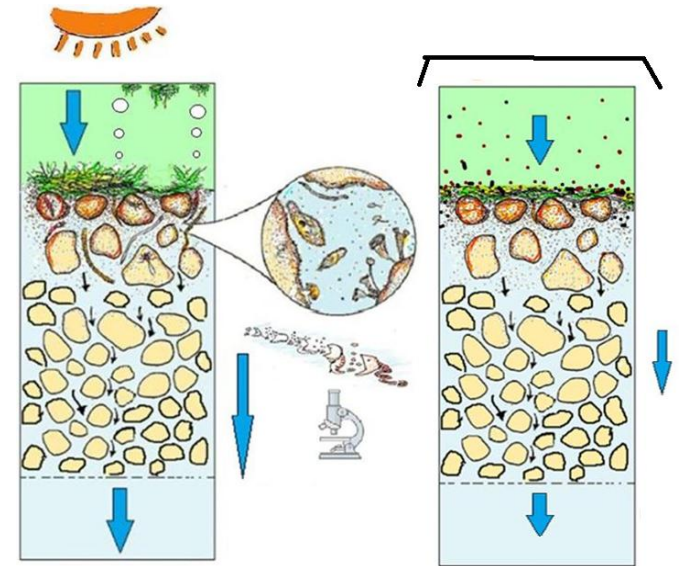


Luiz Di Bernardo and Martin Wegelin believe the main action is based by mechanical reduction. They could not understand biological phenomena.

I examined the performance of **URF** to eliminate SS from an irrigation canal water.



Effect of **open** filter and **covered** filter.



The resistance of Covered filter increased almost every day.

But filter resistance (NHL) of Open filter was almost constant.

Algae helped animal activity. The biological community reduced the filter resistance.

Mr. Fumio KIZUKI
OISCA (The Organization for Industrial,
Spiritual and Cultural Advancement-
International)



There are sedimentation tank,
several gravel filter, and slow
sand filter.

Polluted water turns to safe and
reliable water quality.

Polluted water of River Kanda,
Tokyo is pumped up.



OISCA Tokyo:
polluted water (Kanda river)
→ gravel filter
→ gravel filter
→ small sand filter
→ safe water



No detection of coli-form bacteria, lead,
herbicides of Atrazine and Simazine.

Nitrate N concentration : 2.0 mg/l, Nitrite
N: 0 mg/l, pH8.5, total hardness: 250 mg/l
and residual chlorine 0 mg/l.

Mr. Fumio KIZUKI knew this EPS is reliable technology and applied it for villagers.

*Wise use of natural phenomena.
We can easily get safe drinking water by ourselves.*

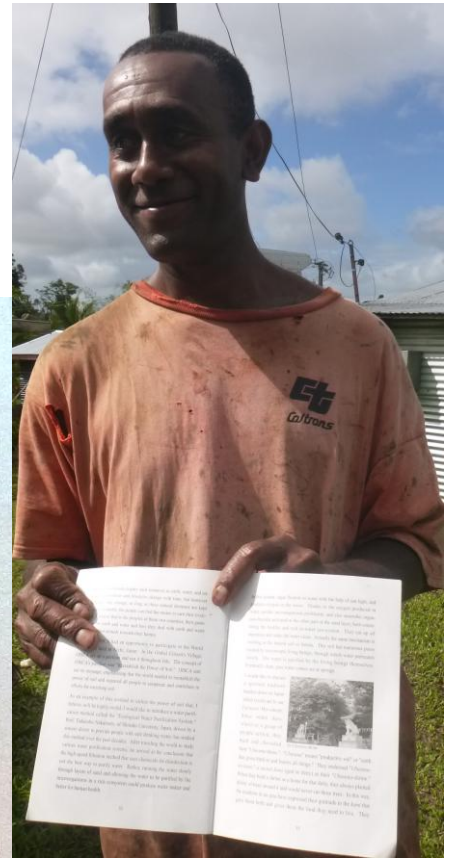
Sri Lank: three Up flow roughing filters
→ sand filter → safe drinking water (300 liters / day).
This water is the demand of safe drinking and cooking water for 5-6 families.



OISCA International

*I met Niko-San in Fiji, in June, 2017.
He showed his OISCA text (Sept. 2006) on EPS.*

As an example of this method to utilize the power of soil that, I believe, will be highly useful, I would like to introduce a water purification method called the "Ecological Water Purification System." Prof. Tadanobu Nakamoto, of Shinshu University, Japan, driven by a sincere desire to provide people with safe drinking water, has studied this method over the past decades. After traveling the world to study various water purification systems, he arrived at the conclusion that the high speed filtration method that uses chemicals for disinfection is not the best way to purify water. Rather, running the water slowly through layers of sand and allowing the water to be purified by the microorganisms in a rich ecosystem could produce water tastier and better for human health.



*2017/6/20
Niko-San participated OISCA training in Fukuoka, Japan, in 2007 during 1 year.
He remember my work on Ecological Purification System.*

If you think something is good, first check it out for yourself.

It doesn't have to be perfect.

It's okay to fail. You can gain something from it.

I was inspired by OISCA's Kizuki's attitude and his ability to get things done.

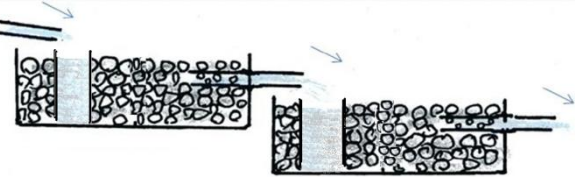


To keep continuous flow by a small pump



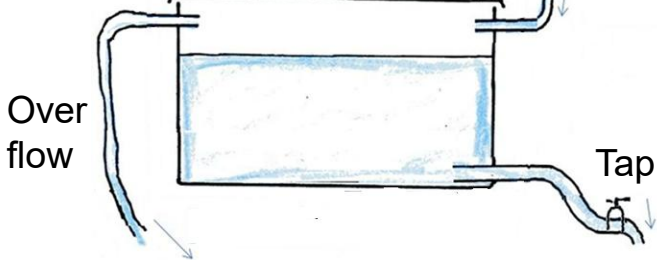
Up-flow roughing filter
To make subsurface suspension free clean water in the flood plain.

keep out small animals



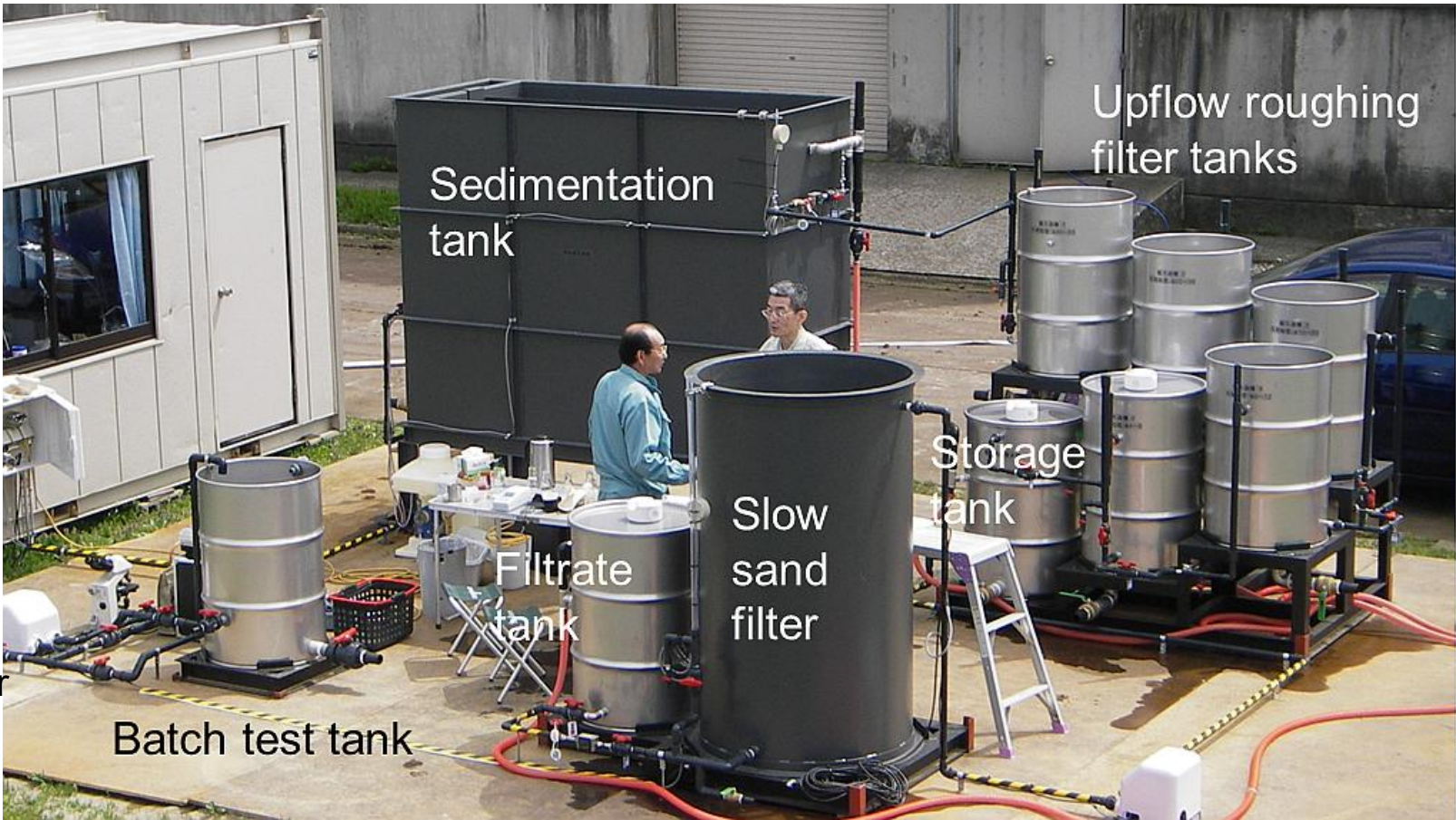
Filtrate storage tank
keep out dust and light

Filtrate

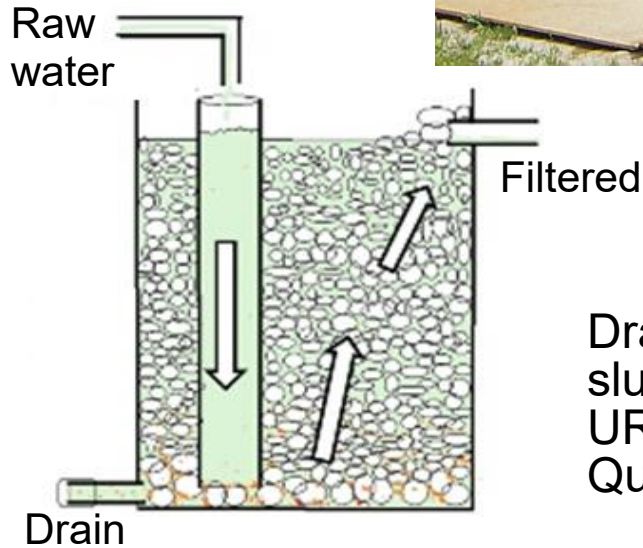


Under drainage porous pipe covered with mesh cloth.

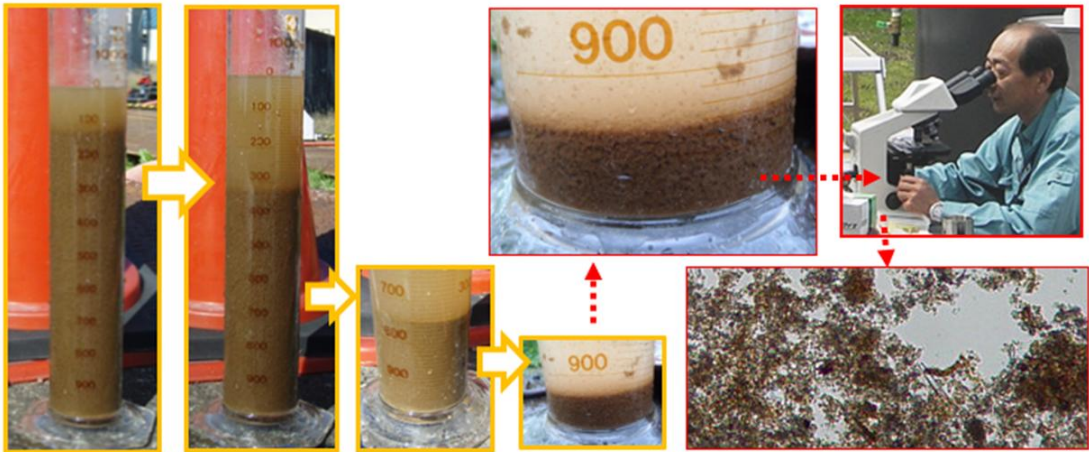
We examined the performance of **URF** to eliminate SS in river water by pilot experiment.



Up-flow Roughing Filter (Gravel Filter)



Drained sludge from URF settled Quickly.



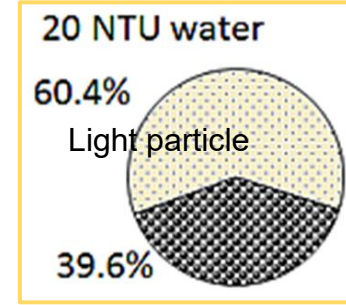
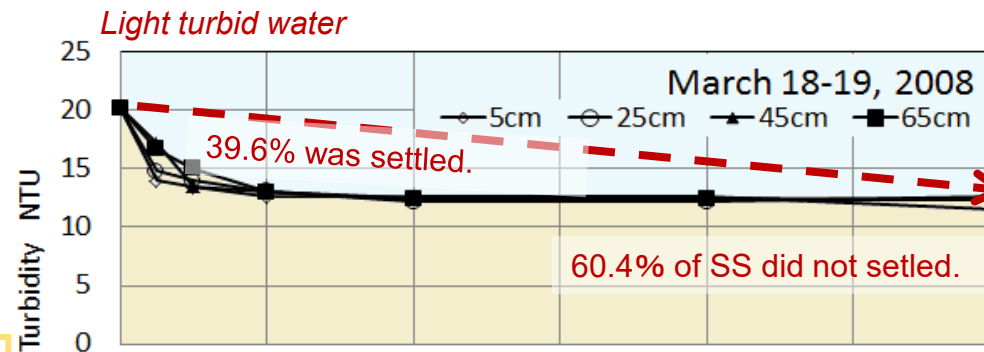
Coagulated particles like an activated sludge.



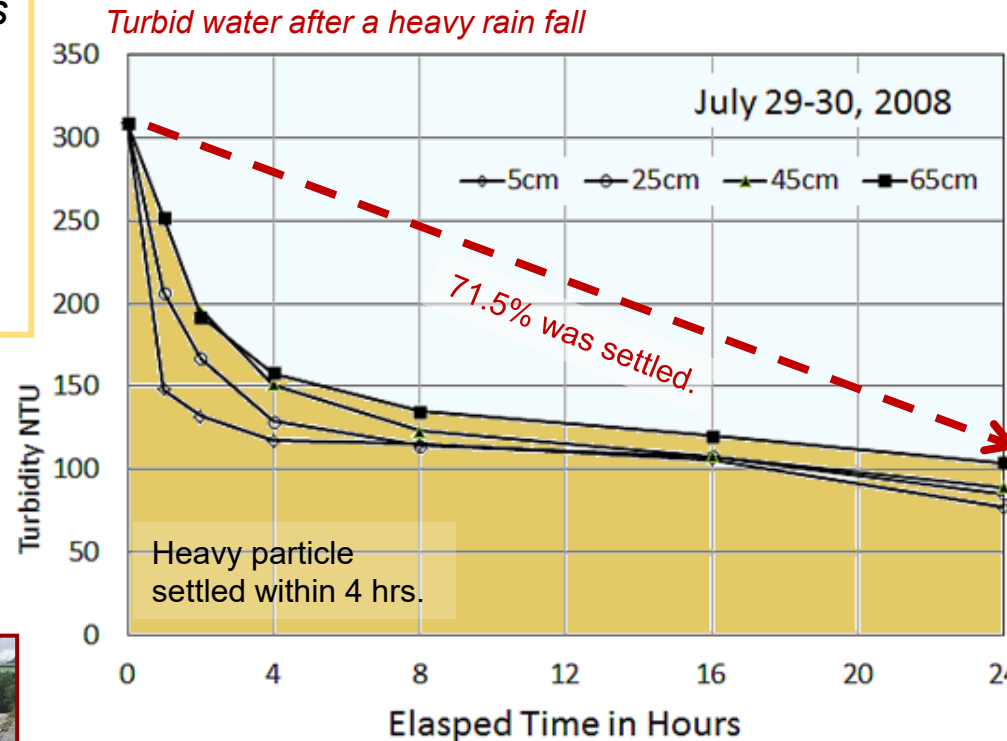
There were extremely small particles like as colloidal particles in case of small turbidity, like as less than 20 NTU. The rapid settling of turbid matters was observed **within 4 hrs.** However, a large portion of turbidity did not decrease.



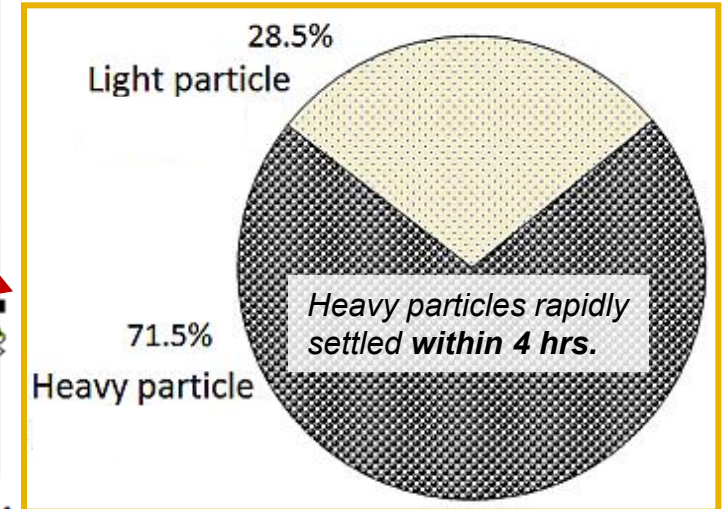
Light and small particle which is not easily settled.



Light turbid water: small turbidity, a large portion of light particle.

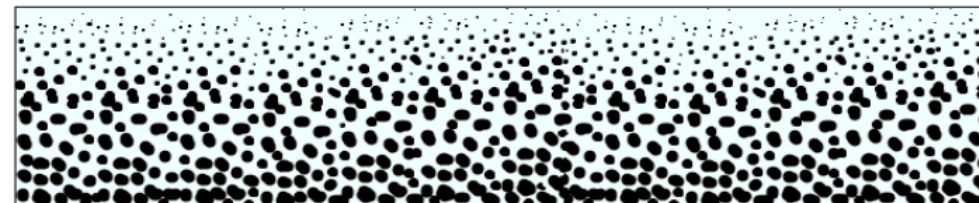


In case of turbid water, a large portion was heavy particles.



4 hrs. settling is enough.

After heavy storm event, river water becomes dirty and rapidly increases.



A large amount of heavy and large particles in a storm water.

EPS-Use of Natural Process-**Chemical Free** : **Gentle for small organisms**



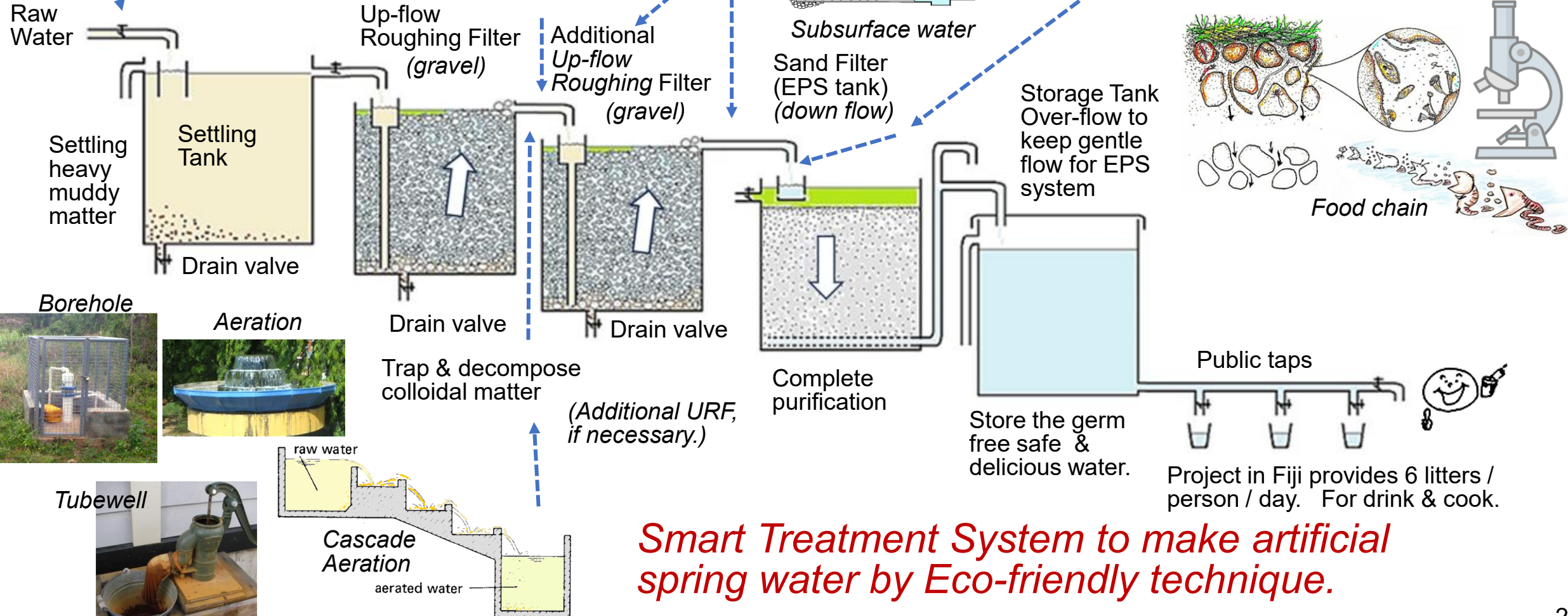
Surface stream



Reservoir



Clean spring water



Smart Treatment System to make artificial spring water by Eco-friendly technique.

Using the Bucket Model in JICA training

EPS 2025-OBW
Nov. Part 4:30-39
10 slides

Part 4.

I studied on ecological function of Miyako-Jima wks from 1997. I made a video on EPS function of Miyako wks in March 2004 and published a book (How to make delicious water) in August 2005. ———→



JICA training began in 2006.



<https://www.youtube.com/watch?v=r1LIPuQliu0&t=16s>

Quest for Safe and Delicious Tap Water, Miyako-Jima, Island in March 2004. /15:22
With English subtitle version in Oct. 2007.



JICA made Video in 2008

Ecological Purification System : JICA training for SIWA, April 18, 2013 at Miyako-Jima.



Slow sand filtration: creating clean, safe water (Full ver) in 2020 /26min



https://www.youtube.com/watch?v=V6_uDZE_I8E&t=1218s

Slow sand filtration: (Digest ver) in 2021 /3:26



<https://www.youtube.com/watch?v=QAH1SoAgfL0&t=37s>

<https://www.youtube.com/watch?v=NCI9oeNM0aI>

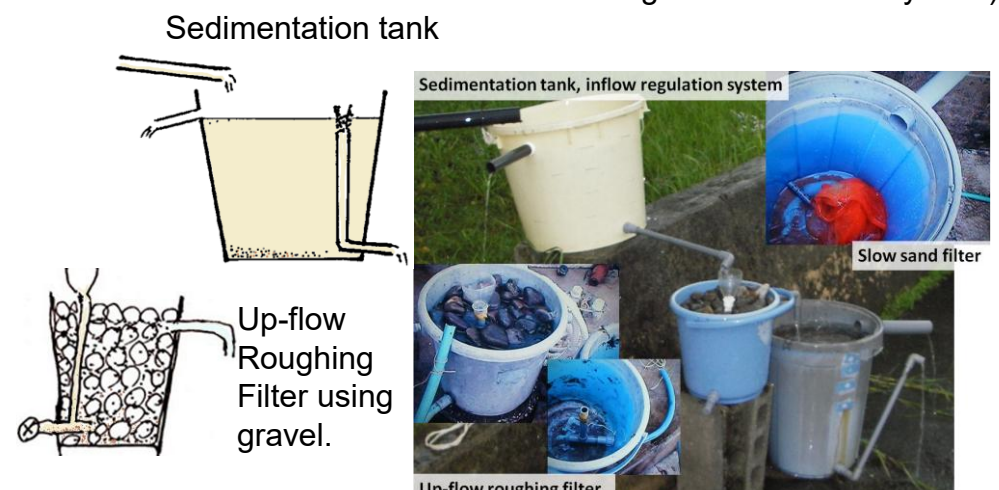
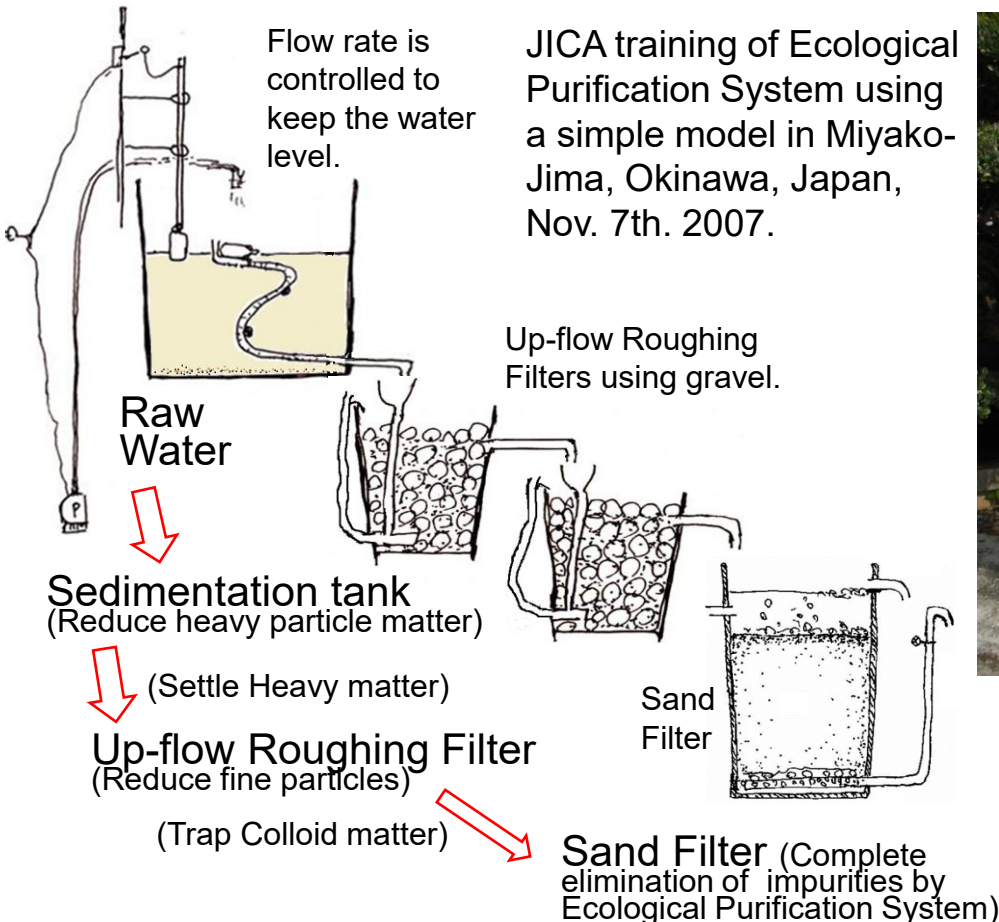




JICA EPS training
started in Miyako-
jima, Okinawa, in
2006.



Sodeyama purification plant



JICA training of Ecological
Purification System using
a simple model in Miyako-
Jima, Okinawa, Japan,
Nov. 7th. 2007.



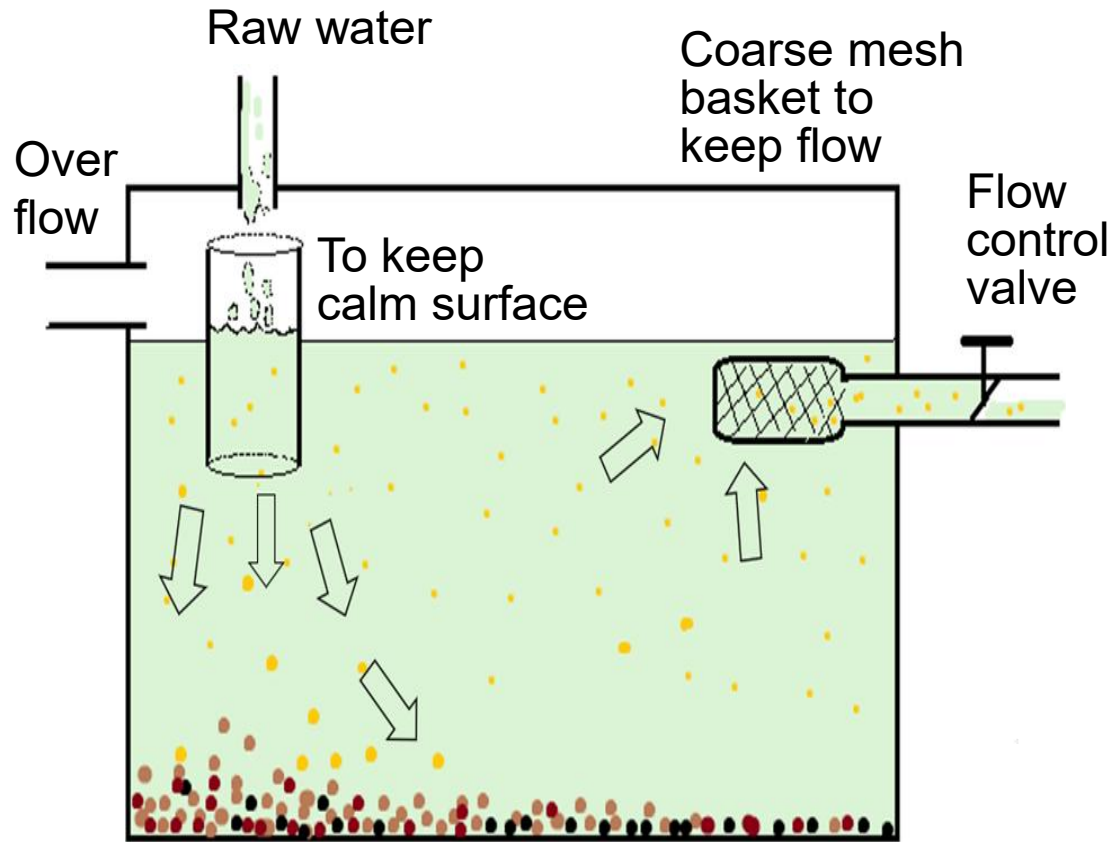
わかる! 国際情勢 外務省 ODA白書 2014年7月1日
Ministry of Foreign Affairs of Japan

Vol.116 Ministry of Foreign Affairs of Japan, July 1, 2014

「未来への投資」としてのODA ～ 国際協力60周年



Receiving Tank (Settling Tank)

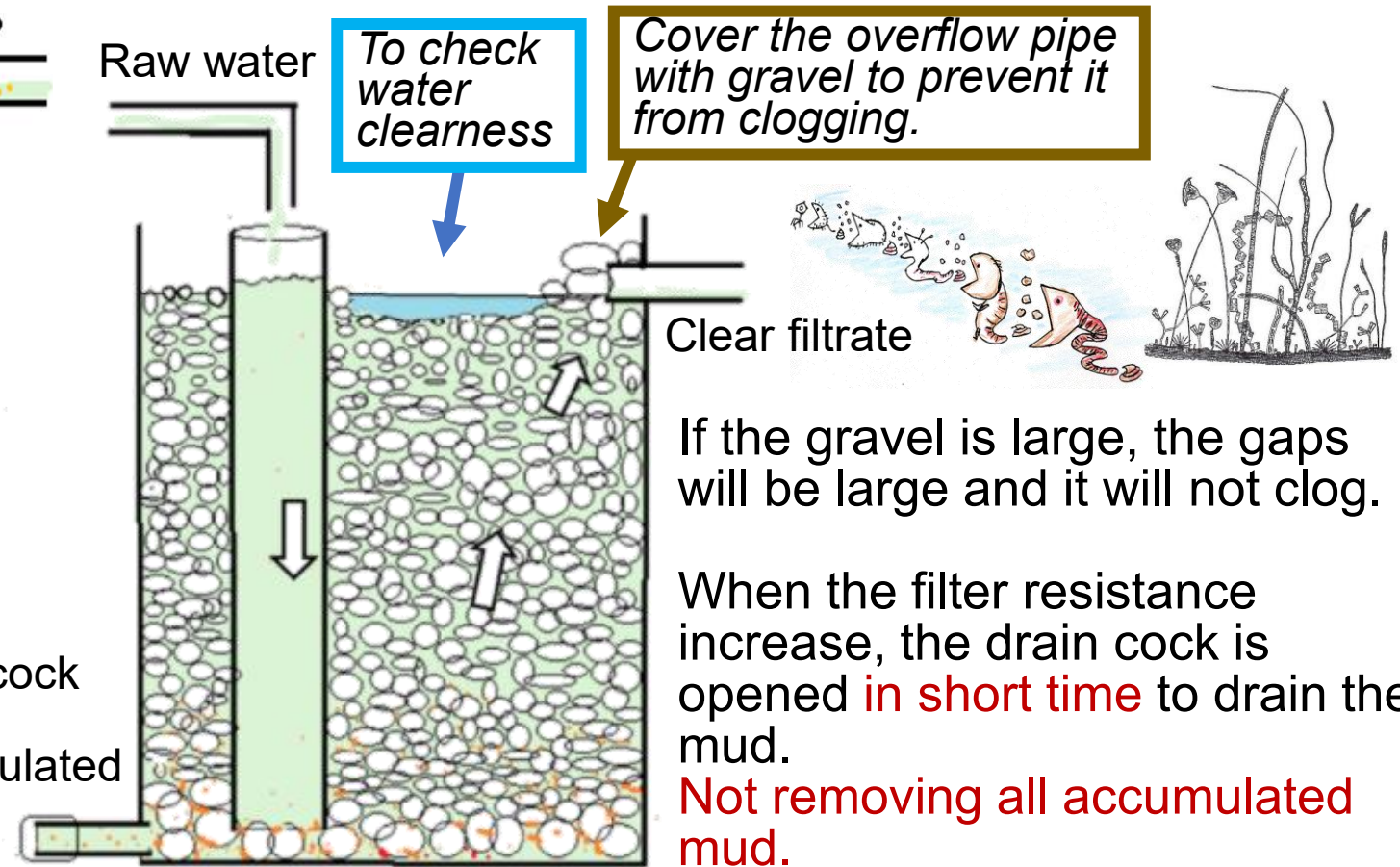


Heavy particulate matters are easily settled.
However, colloidal light particles like silt material are not settled in this settling tank.

Up-Flow Roughing Filter (URF) : Gravel Filter

Additional URF if necessary.

Colloidal fine particles adhesive to the surface of gravels. Small animals scrape them and produces fecal pellets. Fecal pellets accumulated to the bottom.



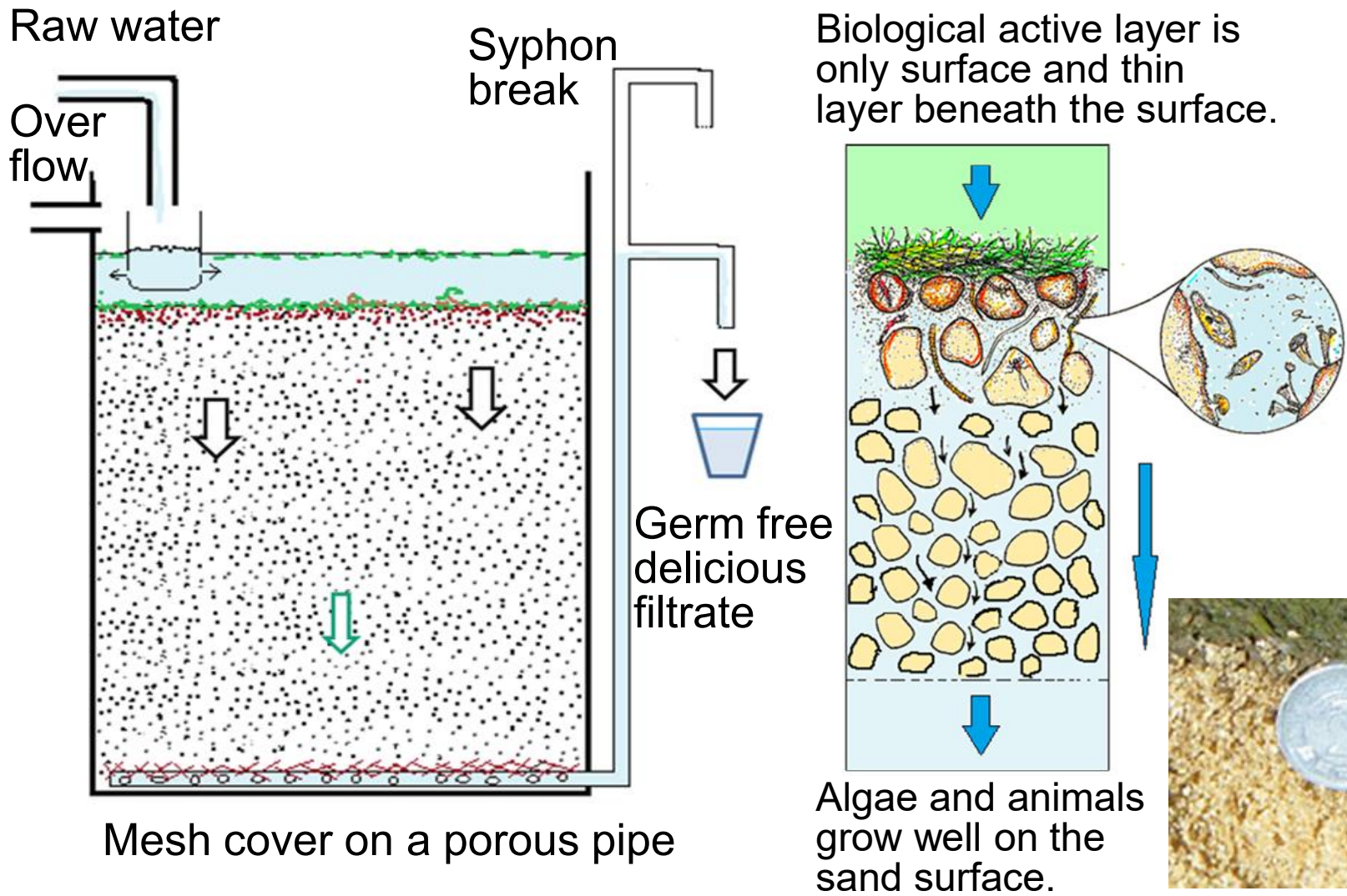
If the gravel is large, the gaps will be large and it will not clog.

When the filter resistance increase, the drain cock is opened **in short time** to drain the mud.

Not removing all accumulated mud.

EPS (Sand) Filter (Natural Down Flow)

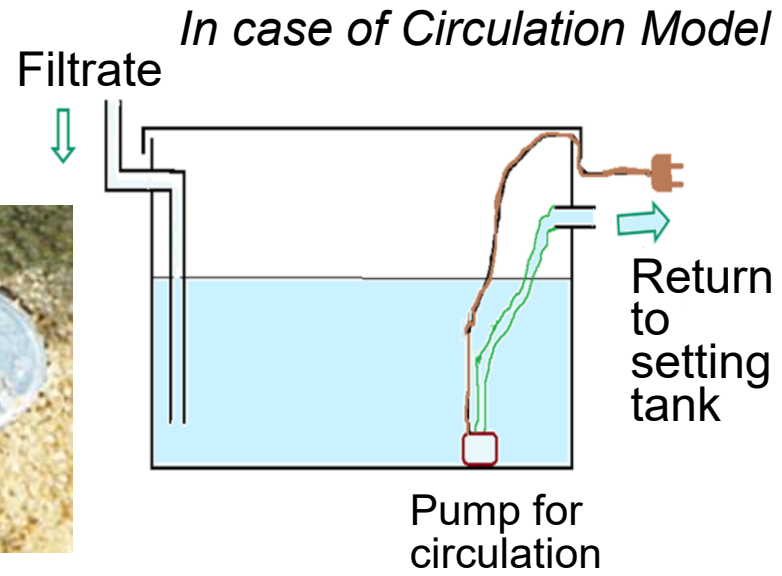
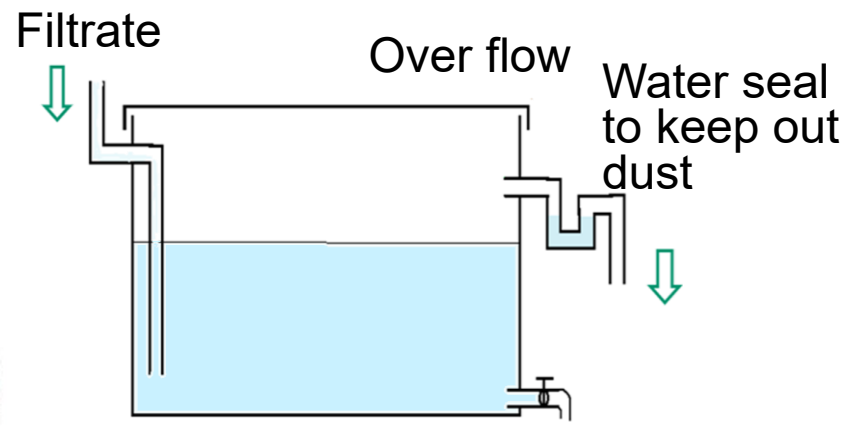
Ecological Purification System

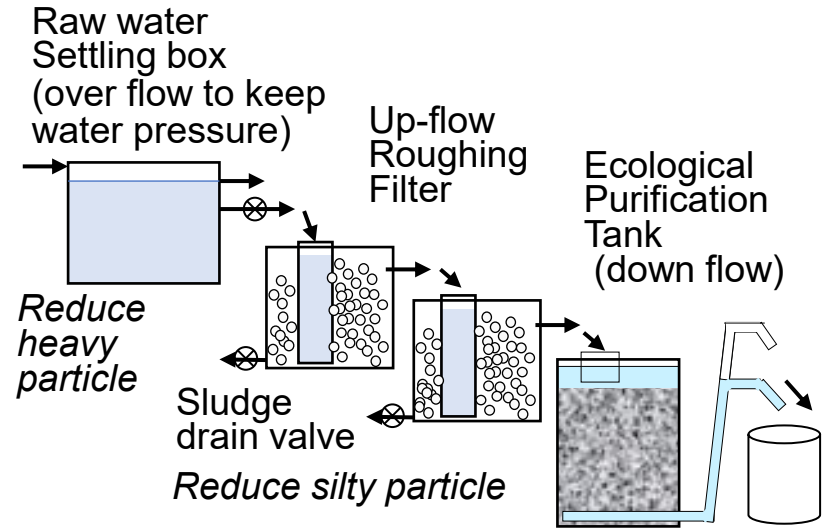


Deep sand layer is a guarantee layer for emergency.

Storage (Filtrate) Tank

Cover for Storage tank is required to keep out dust.





Filter rate can be measured using a cup and is regulated by a cock.

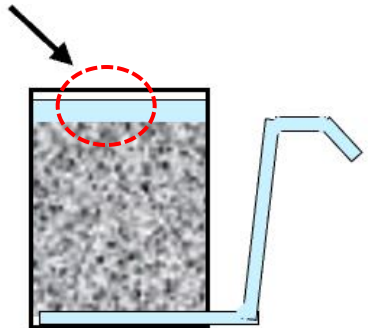
Filter area = 30.5 cm x 44 cm = 1,342 cm²

In case of Present Thames filter rate (40cm/h = 9.6m/d)

Filtrate/min = 1,342 cm² x 40 cm/h / 60 (min) = 895 cm³(ml)/min

Filtrate/h = 1,342 cm² x 40 cm/h = 53,680 cm³/h = 53.7 liter/h

Filtrate/d = 53.7 liter x 24 hrs = 1.29 m³/d



Shallow water depth over sand is important to **keep aerobic condition.**

Passing time of water is shorter in shallower depth.
And higher flow rate is also better to keep aerobic condition.

	unit	Simpson 1829	English Filter	Present Thames Filter	Experiment in Samoa
Flow rate	m/d	2	4.8	9.6	20
	cm/h	8.3	20	40	83
Flow rate in sand layer (50% porosity)	cm/h	16.7	40	80	167
Passing time of 1 m sand layer	hr	6	2.5	1.25	0.6
Passing time of upper active 1 cm	min	3.6	1.5	0.75	0.36

JICA Training on Ecological Purification System (EPS) in Okinawa, Japan in 2022

DIY EPS bucket model making 2022 - YouTube / 38:01

<https://www.youtube.com/watch?v=jz94KfKLL3E>



NGO Okinawa
Blue Water





ECOLOGICAL PURIFICATION SYSTEM (EPS)

JULY 20/2017 @ HIROSHIMA INTERNATIONAL PLAZA

Un sistema ecológico, económico y replicable que puede ser utilizado por pequeñas, medianas y grandes comunidades. Este sistema fue desarrollado por el Doctor Nobutada Nakamoto

– Ecological Purification System



Daniel Castro

2017/07/20 に公開

<https://www.youtube.com/watch?v=Ye-POV6qBU0&t=39s>



JICA-Hiroshima, July, 2018
Microscopic organisms



11th Pacific Water and Waste water conference, Noumena, New Caledonia, August, 2018



I used a transparent container to show how it works at the conference exhibition site.

If the container is transparent, algae will grow on the inside walls. In reality, a container that blocks light is better.

Ecological Purification System for Safe Drinking Water

- Application of Natural Process -

Eco-friendly technique to make artificial spring water

NAKAMOTO Nobutada, Dr. Science
Prof. Emeritus of Shinshu University, Japan



Fig.0. Fijian EPS using rain harvest tanks in a village.

August 2018



I distributed this textbook. You can download this.

<https://eps.watervision.jp/wp-content/uploads/2025/04/EPStext-NC-2019.pdf>

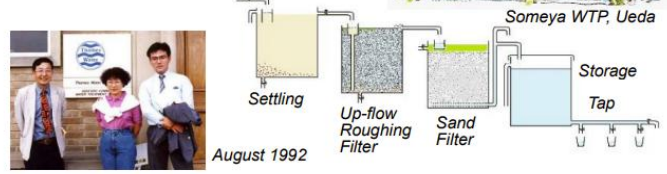
Ecological Purification System for Safe Drinking Water

Contents

1. Smart technology 3
2. Ecological point on slow sand filter 4-7
3. Refocus to chemical free SSF 8-10
4. Food chain 11-12
5. Bubble formation 13-17
6. Algal succession 18-20
7. Biological active layer 21-22
8. Filter resistance 23-27
9. Flow rate 28-29
10. Up-flow Roughing Filter 30-33
11. Instant purification 34-35
12. Dry and rewetting 36-37
13. Aeration 38
14. Capacity 39-40
15. JICA training 41-46
16. Samoa 47-50
17. Fiji 51-62
18. China 63-65
19. Social contribution 66-72
20. Acceptable risk 73-75
21. From Japan to the world 76
22. Ecological sense 77-80



Cast off skins of midge larvae



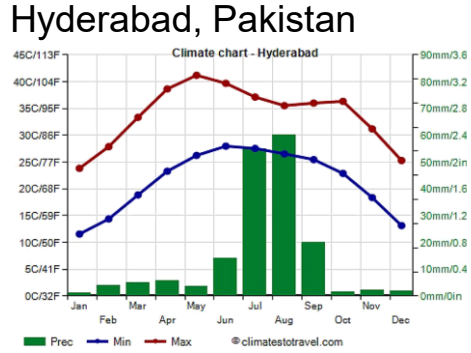
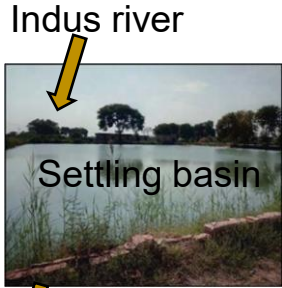
2

Miller site



<http://www.cwsc.or.jp/files/pdf/EPStext-NC-2019.pdf>

URF is the best pre-treatment for turbid water



Coagulation treatment



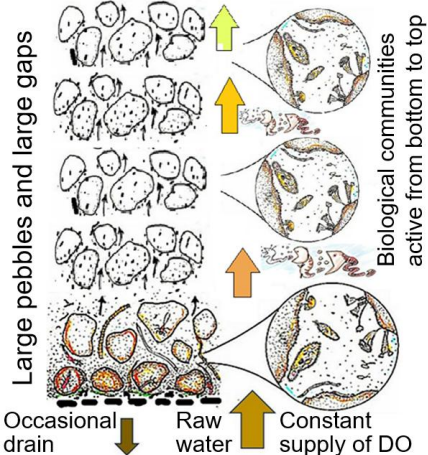
Turbid water Measuring unit



Biological communities (Flocculant) in URF trap and decompose turbid matter.

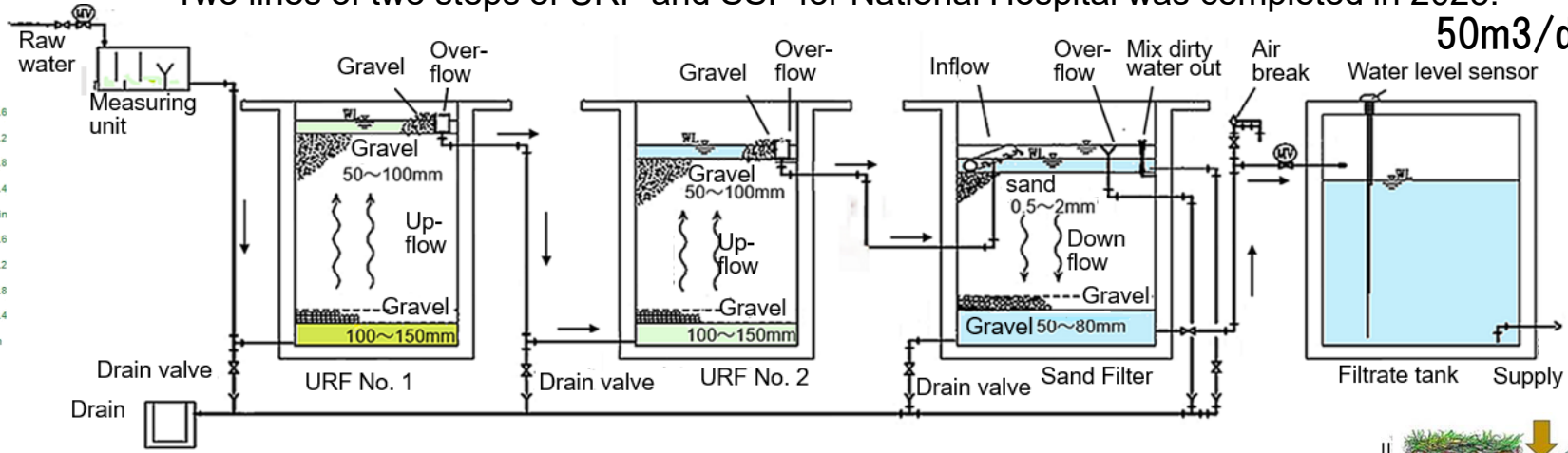


Test run

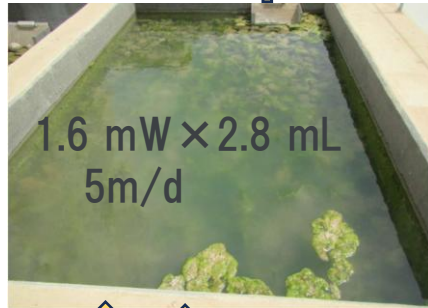


Two lines of two steps of URF and SSF for National Hospital was completed in 2025.

50m3/day



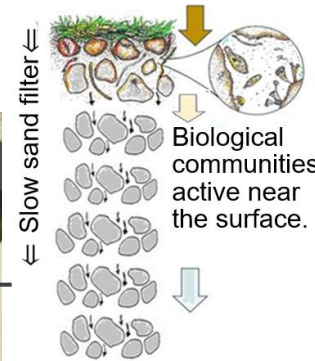
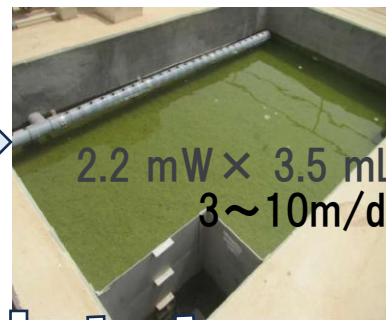
URF No. 1



URF No.2



Sand filter



To storage

The URF does not become clogged with large gravel. DO is constantly supplied from the bottom, keeping the biological community active.

It is sufficient to drain a small amount of sludge from the URF from time to time. Do not remove it all.

It is better to have shallow water in the sand tank so that there is no shortage of oxygen at night.

A faster flow rate is better.

When biological communities are active, they capture and break down dissolved substances and turbidity that react with living organisms.

When the biological community is active, clogging does not occur.

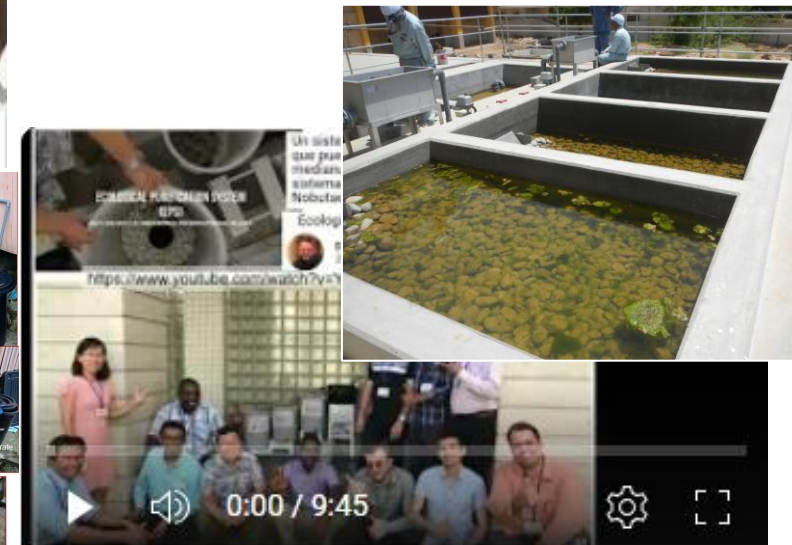




<https://youtu.be/uMdhSdxOSsQ>
9 min 45 seconds

Mr. RAMJUG Jawaharlall (Guyana Water Incorporated/ Operations/ Head of Non-Revenue Water) returned back to Guyana from JICA training in Feb. 2015. He made a bucket model of EOS. He mad a video on 3rd of September, 2025 and sent us.

I provided additional explanations to the video on Jim's smartphone. I also added photos of the training model created at JICA Hiroshima, a video of trainees in Malaysia, and the construction of a purification plant in Pakistan in 2025.



Ecological Purification System
renamed from Slow Sand Filtration.

Part 1.

Treatment System for Safe Water by Wise Use of Natural Phenomena
An English invention of Slow Sand Filtration to make artificial spring water for safe drinking water is re-defined in Japan as Ecological Purification System.

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JICA Okinawa training from Nov. 17. to Dec. 12. in 2025. Managed by Okinawa Blue Water

Nakamoto joins from Nov. 21. to Nov. 27. in Okinawa and web-contributes Nov. 17. and Dec. 11-12. from Nagano, 2025.

I proposed the new name of Ecological Purification System instead of Slow Sand Filter.

2:50

<https://youtu.be/jXP1efkgK8>



Invention of SSF in UK and a new technology of Rapid Sand Filter for turbid water in USA.

Part 2.

During the Industrial Revolution, the population gathered in cities. The rivers in cities were polluted.

James Simpson examined vertical type of slow sand filter from 1827-1828 and made a practical plant in 1829.

They believed that Slow Sand Filter purified by slow filtration with fine sand.

They believed this was mechanical reduction with fine sand.

Completion of present Slow Sand Filter: 200 years ago.

The filter rate was 2-3 m/d (10cm/h).

38 cm Water depth
61 cm sand layer
61 cm gravel layer

2:50

https://youtu.be/i0_MjvFavVc



Up-flow Roughing Filter eliminates Suspended Matter without Chemicals.

Part 3.

Rapid Sand Filter

Down flow and Up-flow Roughing Filter Experiment

Master Thesis of Costa, R.H.R.: Univ. São Paulo, Brazil in 1980

Prof. Luiz Di Bernardo, Univ. São Paulo

Robert H. Harris et. al. 1974 Consumer Report. IS THE WATER SAFE TO DRINK?

Chlorine sterilization is essential for rapid filtration of chemical treatment. There is a warning that tri-halo-methane, which are cancer risk substances, are generated by adding chlorine.

Research engineers researched ways to prevent turbidity without using chemicals.

3:13

<https://youtu.be/9aCIRzJwQME>



Using the Bucket Model in JICA training

Part 4.

I studied on ecological function of Miyako-Jima wks from 1997. I made a video on EPS function of Miyako wks in March 2004 and published a book (How to make delicious water) in August 2005.

JICA training began in 2006.

Quest for Safe and Delicious Tap Water, Miyako-Jima, Island in March 2004. /15:22 With English subtitle version in Oct. 2007.

Ecological Purification System : JICA training for SIWA, April 18, 2013 at Miyako-Jima.

Slow sand filtration: creating clean, safe water (Full ver) in 2020 /26min

Slow sand filtration: (Digest ver) in 2021 /3:26

4:51

<https://youtu.be/P9bZnQVXzbq>

