<u>Domestic Drinking Water Treatment</u> <u>Methods A Consumer Guide</u>

The Network for Consumer Protection

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Domestic Drinking water Treatment Methods. A consumer guide

Foreword

Dear Consumers,

This document is an attempt at helping consumers in choosing the right kind of water treatment device/method for use at domestic level. This synopsis in no way meant to undermine the efficiency of any specific brand available in the market or to promote one particular brand or manufacturer. It is a blend of minimal scientific information required by the consumer to understand the working of various devices available in the market and a document to help them choose the right option.

This document is by no means a final word on the subject and we will keep improving this document by including new methods that comes in to the market. Suggestions/observations on this count shall always be welcomed in your best interest.

We hope that this guide shall help you wade through the hundreds of choices and choose an option that fits most his needs.

You can direct any query regarding the contents of the guide to the undersigned.

Tariq Masood Malik Project Officer-Water

RATIONALE

Clean drinking water is an important source of life. Its importance, in today's context, can hardly be more emphasized. More than 40 % of hospitals beds are occupied by people suffering from water borne or water related diseases. Under the circumstances, people are bound to try different options available in the market for water treatment.

Keeping in mind the current drinking water scenario, The Network, took all the possible options and tried them under different conditions and over a period of time and came to certain conclusions so that consumers can make informed decisions while treating their home water or before going out to buy water treatment gadgets or disinfectants.

Water that looks clean and smells good may not necessarily be clean. It still may have some pollutants like bacteria, viruses, suspended solids, chemicals or metallic contents. These pollutants have serious health hazards. The most common problems occurring with unclean drinking water are the diseases of the gastro intestinal system.

Pakistan has a high prevalence of diarrheal diseases which is mainly due to unclean water. It is therefore important to use water for drinking cooking and personal hygiene which is free from all such pollutants.

The art of making water safe for drinking ranges from filtration through simple muslin cloth to high tech UV treatment. At some places simple filtration may be enough while at others a combination of various options may be the answer. In order to make a choice amongst the best available and affordable options, one needs to know the functioning of devices which claim to clean water.

Things to consider when selecting a purification system

Before deciding to purchase and use water options please consider the following:

AVAILABLE TECHNOLOGIES

Consider all your options. Its possible a simple remedy may solve your problem and you wont need a high tech filter

CAPACITY/EFFICIENCY

How efficient is the system? Does it temporarily clean your water, will it disinfect for only a few pollutants? Does this method purify enough water to fulfill your family's needs?

SPECIFIC HEALTH CONCERNS

Does your water have any specific problem that needs tobe taken care of? Will the system you are choosing remove that problem?

LEGITIMACY OF MANUFACTURER CLAIMS

Is the manufacturer certified? Is the person selling you the purification system a dealer or just a shop keeper? Incase of complaints or trouble will you have any backup support?

ENVIRONMENTAL FACTORS

If you are choosing a system to purify your water, would it be affected by environmental factors? Eg, if you are disinfecting your well with chlorine, would rainfall affect its disinfection?

OPERATING COST

How much will it cost for installing, running and maintaining the system?

CONSTRUCTION QUALITY

If your are buying a filter, is the housing in good quality, are the taps made of stainless steel, is it leak proof, how long is the UV life?

EASE OF USE

Can the system be operated, and maintained and monitored easily?

HOW WILL YOU KNOW IF THE UNIT IS NOT WORKING PROPERLY? An alarm or indicator light should alert you to a malfunction in electrical filters.

Water Purification Options available in Pakistan

There are a variety of microscopic organisms that can contaminate water supplies and cause potentially serious, even fatal, illnesses. Lately Chemical contamination is also becoming a hazard. The major danger from these infections is fluid loss due to diarrhea and vomiting. This is the case in most rural settings, where lack of treatment causes an otherwise treatable illness to lead to death.

There are numerous methods of water purification. Remember, however, that infections can also be spread through poor personal hygiene, something that purifying your water won't prevent.

Biologically contaminated and Toxic Water

Biologically contaminated water is water that contains microorganisms such as Giardia, or viruses that can lead to infections Toxic water sources contain chemical contamination from pesticide runoffs, mine tailings, and so on. Boiling, filtering, or chemically treating water can remove or kill microorganisms, but it will not remove chemical toxins. This is also the case when using a solar still.

In the following pages we have tried to summarize some of the options available for cleaning water to make it fit for drinking purposes.

Considerations before making a purchase

Before buying a water treatment system, know the quality of your water supply and if treatment is needed. Consider the simplest and most economical solution to the problem. Removing the source of contamination, obtaining a new source of drinking water, or treating the water with a water treatment system may be appropriate solutions.

IDENTIFYING THE PROBLEM & CHOOSING THE BEST SOLUTION

BACTERIA

First choice or the best treatment plan is to locate and remove the source of Contamination. If this is not possible see if you can use an alternative supply. If this too is not possible consider the following

- Chemical feeder (Continuous disinfection: chlorination)
- Distillation
- UltraViolet treatment

ALKALINITY/ACIDITY (pH)

- Chemical feeder (Continuous disinfection: chlorination)
- Neutralizing filter

SEDIMENT/DIRT/SUSPENDED PARTICALS/TURBIDITY

- Sediment filter
- Reverse osmosis system
- Distillation

HEAVY METALS (such as cadmium, chromium, lead etc)

- Reverse osmosis
- Distillation
- Carbon cartridge

ODOR/TASTE

- Activated carbon filter
- Chemical disinfection

COLOUR

- Yellowish water; yellow stains on china, bathroom fixtures and laundry: These can be caused by "tannins," or harmless acids from water passing peaty soils.
- Brownish water; brownish slime in toilet tanks: Often caused by iron bacteria.
- Blue-green water; green stains on sinks and porcelain fixtures:
 From acid water dissolving copper from pipes and plumbing fixtures.
- Yellow, black stains on bathroom fixtures; tarnished silverware: From hydrogen sulfide.
- Reddish brown material that settles to the bottom of a glass (or the water from the tap appears rusty): Precipitated iron from rusty pipes, wells or ores.
- Reddish brown rusty stains on fixtures, laundry, dishes (but the water from the tap appears clear): From dissolved iron.

ODOR

- Rotten eggs: Hydrogen sulfide.
- Septic or sewage odors: Seepage of septic system discharge into groundwater.
- Chlorine: Excessive chlorination.

TASTE

- Salty: high sodium or magnesium
- Metallic: Acid water or high iron.
- Sharp chemical: Insecticides or herbicides.

WATER PURIFICATION OPTIONS

H

HEAT TREATMENT: SODIS (Solar Water Disinfection)

WHAT IS IT?

It improves the microbiological quality of drinking water, using solar UV-A radiation from sunlight and temperature to inactivate pathogens causing diarrhea. Solar Water Disinfection is easy and inexpensive. This method disinfects contaminated drinking water by placing the water in a clear plastic bottle and leaving it in the sun for just a few hours. Disease causing bacteria are destroyed; water is disinfected and becomes safe to drink

WHO SHOULD USE IT?

Every one can use this method; it is especially good for people living in hotter countries. Communities which lack resources to establish other purification methods can adopt such practices. No formal training or education is needed for using this method.

HOW MUCH DOES IT COST?

It costs only the price of a plastic 1 L clear bottle

HOW LONG DOES IT DISINFECT FOR?

The water present in the bottle is disinfected only. It remains safe to drink unless contaminated by dirty hands.

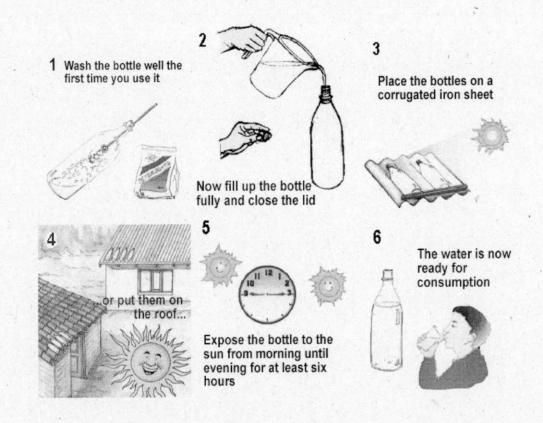
HOW DOES IT WORK?

- Place the bottles on a corrugated surface to allow Maximum sunlight exposure and heat from the surface as well.
- Use mineral water or glass bottle of one to two liter
- The best time is from 9:00 a.m. to 2:00 p.m., when the solar intensity reaches its highest levels. Expose it to sunlight for 3 to 6 hours in sunny conditions and for full day in cloudy weather.
- Do not use turbid water; pre filter turbid water though cloth
- Do not fill the water fill leave at least one inch space at the top. Shake the bottle for fifteen second. This is called aeration.

- Replace scratched, damaged, or cloudy bottles with new bottles.
- Use of solar disinfection should be combined with good hygiene such as washing hands after using the toilet, after cleaning a baby, after handling animals and before eating in order to reduce the incidence of disease.

WHAT ARE ITS LIMITATIONS?

- It does not change the chemical water quality
- It requires relatively clear water (turbidity less than 30 NTU) and suitable weather conditions
- It is not useful to treat large volumes of water
- It does not purify the water completely, and is therefore not recommended for babies and the elderly or sick.





HEAT TREATMENT: BOILING

WHAT IS IT?

Boiling is the most certain way of killing all microorganisms. Water temperatures above 160° F (70° C) kill all pathogens within 30 minutes and above 185° F (85° C) within a few minutes. So in the time it takes for the water to reach the boiling point (212° F or 100° C) from160° F (70° C), all pathogens will be killed, even at high altitude. To be extra safe, let the water boil rapidly for one minute, especially at higher altitudes since water boils at a lower temperature. This is an expensive and energy consuming method and it should only be used as a last resort when all other options are not available.

WHO SHOULD USE IT?

People who need to use the water for either specific purposes, such as preparing babies milk, or direct drinking. It is the best method to be used when there is a known risk in the water. No other method completely kills pathogens other than boiling.

HOW MUCH DOES IT COST?

It costs the amount of fuel required for boiling vigorously for 5 mins

HOW LONG DOES IT DISINFECT FOR?

It remains safe to drink unless contaminated by dirty hands or utensils. The boiled water should be kept covered.

HOW DOES IT WORK?

 Boiling brings the water to over 100C. at this temperature bacteria get killed and fungal spores break. Thereby purifying the water.

WHAT ARE ITS LIMITATIONS

It causes salts to separate out and settle down at the bottom of the boiling pot. This results in a loss of essential minerals needed to the body.

Boiled water also tastes "flat" and in certain customs is not liked because there is a concept that this water is prepared only for the sick.

CHLORINATION: Powder and Liquid Bleach

WHAT IS IT?

Chlorine is available in dry form as either a powder or pellets (calcium hypochlorite) or in liquid form (sodium hypochlorite).as bleach. Also called chloride of lime or chlorinated lime.

WHO SHOULD USE IT?

This method is best used for large quantities of water. Or water bodies where other disinfectant methods cannot be used, such as underground wells. It's a good way to quickly disinfect water while traveling.

HOW MUCH DOES IT COST?

It costs the price of the powder, which is less then Rs 20/packet. And 25 Rs per bottle.

HOW LONG DOES IT DISINFECT FOR?

It is relatively quick to disappear from the water due to its volatile nature, water left open has a short holding time, and levels of chlorine need to be maintained and monitored. It remains safe to drink unless contaminated by dirty hands or utensils. The water should be kept covered.

HOW DOES IT WORK?

The chlorine reacts with the bodies of the bacteria, and causes their destabilization, and disruption of normal functions. This leads to their ultimate death.

WHAT ARE ITS LIMITATIONS

- It does not change the chemical water quality.
- It needs to be repeated periodically.
- the system must be monitored
- It causes an unpleasant smell and odor in the water.
- Disinfection by products are a health concern.

(For tips on how to make a chlorine solution please refer to appendix)



CHLORINATION: Aquatabs ®

WHAT IS IT?

These are commercially available chlorination tablets containing Sodium dichloroisocyanurate.

WHO SHOULD USE IT?

This is a quick, easy way to disinfect water that needs to be consumed immediately. It is ideal for traveling, and being used in emergency situations. no training or skill required in its use.

HOW MUCH DOES IT COST?

One packet containing 10 tablets costs Rs 50.

HOW LONG DOES IT DISINFECT FOR?

Because Aquatabs are meant primarily for drinking water in small quantities. The water is safe unless contaminated by dirty hands or dirty utensils.

HOW DOES IT WORK?

- Each tablet contains 20 mg of free chlorine. The chlorine reacts with the bodies of the bacteria, and causes their destabilization, and disruption of normal functions. This leads to their ultimate death.
- One tablet is added to 10L of water, and left to stand for 30 minutes, after which the water can be consumed.

WHAT ARE ITS LIMITATIONS

- It does not change the chemical water quality.
- It can only be used for small amounts of water
- It causes an unpleasant smell and odor in the water.

CHEMICAL DISINFECTION: Mussafa® Sachet

WHAT IS IT?

Each sachet contains Ac 0.1 % oligodynamic silver.

WHO SHOULD USE IT?

This is a quick, easy way to disinfect water that needs to be consumed immediately. It is ideal for traveling, and being used in emergency situations. no training or skill required in its use.

HOW MUCH DOES IT COST?

One packet costs Rs 45

HOW LONG DOES IT DISINFECT FOR?

a single bag is sufficient for drinking water needs of a family of 6 for almost 1 month.

- HOW DOES IT WORK?
 - The water should already have been filtered so as to make it free of dissolved components.
 - One bag of Mussafa (¼ kg) is to be placed in a 6 liter cooler or water container (e g Pitcher). The container can be re filled and the anti bacterial action lasts for a month.
 - Silver ions use three main mechanisms to control bacterial growth.
 - a) Remove hydrogen atoms from sulfur on bacteria and viruses. Sulphur atoms then join and block bacterias respiration.
 - b) Inhibit DNA replication by interfering with DNA unwinding.
 - c) Alter the bacterial membrane with enzyme mechanisms.
- WHAT ARE ITS LIMITATIONS
 - Rarely reported long term hazards of silver, which may leach through the bag are kidney or liver failures

CHEMICAL DISINFECTION: Pottasium permagnate (pinky)

WHAT IS IT?

This is a chemical powder commonly known as pinky.

WHO SHOULD USE IT?

Pinky is used for disinfecting water that is to be used for washing, and personal hygiene. It is used to disinfect water storage tanks. is applied primarily for problems with taste/odor, manganese, and trihalomethane (THM).

HOW MUCH DOES IT COST?

It costs about Rs 5/packet

HOW LONG DOES IT DISINFECT FOR?

It disinfects as long as it is still present on the walls of the tank, or colour is visible in the water.

- HOW DOES IT WORK?
 - It disrupts the normal functioning of bacterial cells leading to their death.
 - It converts oxidizable chemicals, such as ferrous iron, into their corresponding oxides that are removed by subsequent treatment steps or remain soluble and no threat.
 - The average dosage is about 1 mg/L
 - It acts as an antifungal agent and prevents growth of colonies.
 - A paste or suspension is made and painted on the walls of the tanks, or a few drops are added to the water.
 - The colour of the water should be a very light pink.
 - A 10 gm packet is sufficient to clean a 10* 10*10 Cft water tank. The water needs to be filtered for other in-organic pollutants and dissolved materials.
 - Water should not be drunk for 24 hours.

WHAT ARE ITS LIMITATIONS

- The water tank is rendered unusable for 24 hours.
- The water becomes pink in colour, and may stain bathroom fixtures.

FILTERATION: Sediment filters

WHAT IS IT?

Porcelain filter or polypropylene filter removes all the undisclosed particles like sand dust and algae etc. Large particles are trapped on near the surface of the polypropylene filter cartridge and small particles are trapped throughout the inner layer of the cartridge.

WHO SHOULD USE IT?

Sediment cartridges need to be used where water isn't clear. If there is visible dirt, or soil in the water, of if the colour is chalky or dark.

HOW MUCH DOES IT COST?

A single cartridge costs around Rs 300, and initial installation charges vary from Rs 1000-3000

HOW LONG DOES IT DISINFECT FOR?

It depends on the quality of the water being filtered. Recommendations are that the cartridge be changed after 3 months

HOW DOES IT WORK?

The filter has tiny pores (holes) in it, which allow water to pass, but retain suspended matter.

WHAT ARE ITS LIMITATIONS

It gets clogged quickly, if not changed bacteria and algae will start to grow on it.
If the cartridge is not changed when needed, it may result in the filtered sample being dirtier than the source, because it picks up dirt while passing through

FILTERATION: carbon cartridges

WHAT IS IT?

Carbon is a black powder that removes chlorine, both dissolved and free ammonia iron and toxic elements, as water passes through it the granular activated carbon improves taste makes the water odorless.

WHO SHOULD USE IT?

Carbon cartridges need to be used where ever there is a smell or colour problem, or if the taste of the water is too sharp or bitter.

HOW MUCH DOES IT COST?

A single cartridge costs around Rs 300, and initial installation charges vary from Rs 1000-3000

HOW LONG DOES IT DISINFECT FOR?

It depends on the quality of the water being filtered. Recommendations are that the cartridge be changed after 3 months

- HOW DOES IT WORK?
 - Carbon filters remove chemicals by the process of adsorption (as opposed to absorption). i.e. adhesion in a thin layer of molecules to the surfaces of solid bodies in which they are in contact." Carbon attracts certain chemicals at the molecular level much in the way that a magnet attracts and holds metal filings
- WHAT ARE ITS LIMITATIONS
 - It does not have an equivalent removal capacity for inorganic compounds such as iron, lime scale, nitrates, hardness minerals (such as calcium and magnesium), or soluble heavy metals like chromium or cadmium

FILTERATION: Biosand Filter

WHAT IS IT?

The Bio Sans filter is a slow sand filter which is specifically designed for intermittent use. This allows the concrete filters to be built on a scale which is suitable for use by individual households. Prior to this improvement in design, slow sand filters were typically large scale centralized community filters reliant upon a continuous flow of water to ensure effective treatment. A technology used effectively to treat water for more than 150 years has allowed for a much broader spectrum of consumers to access it at very low costs.

Slow sand filters have been proven to almost entirely remove the disease causing organisms found in water. The Bio Sand Filter technological adaptation of slow sand filtration has proven as effective as traditional slow sand filters in both laboratory and field tests. The technology has been introduced in more than 30 countries by various organizations.

WHO SHOULD USE IT?

These filters are ideal for places that lack power supplies, they are easy to construct and can filter an unlimited amount of water. Their maintenance is simple and no special skill is required in their operation.

HOW MUCH DOES IT COST?

They cost between 1200 to 2000 Rs

HOW LONG DOES IT DISINFECT FOR?

The water passing through the sand gets disinfected, and remains clean unless contaminated by dirty storage or handling.

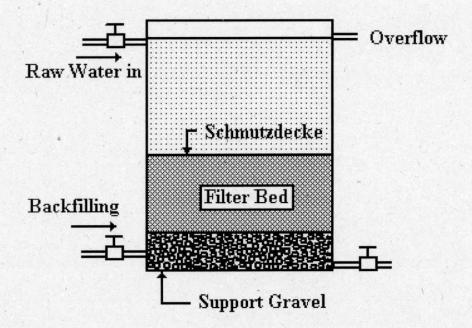
HOW DOES IT WORK?

Water is poured into the top the filter as needed, where a
diffuser plate placed above the sand bed dissipates the
initial force of the water. Traveling slowly through the sand
bed, the water then passes through several layers of gravel
and collects in a pipe at the base of the falter.

 At this point the water is propelled through plastic piping encased in the concrete exterior and out of the filter for the user to collect

WHAT ARE ITS LIMITATIONS / MAINTAINANCE

- The biological layer typically takes one to two weeks to develop to maturity in a new filter. Removal efficiency and the subsequent effectiveness of the filter increases throughout this period.
- Continued use of the filter causes the pore openings between the sand grains to become clogged with debris. As a result the flow rate of water through the filter decreases. To Clean the filter the surface of the sand must be agitated thereby suspending captured material in the standing layer of water. The dirty water can then simply be removed using a small container. The process can be repeated as many times as necessary to regain the desired flow rate.
- After cleaning a re-establishment of the biological layer takes place, quickly returning removal efficiency to its previous level.



biosand filter

ULTRAVIOLET LIGHT

WHAT IS IT?

Ultraviolet light systems make use of the ability of this portion of the light spectrum to kill bacteria. Such systems are only effective on bacteria, viruses and some algae.

WHO SHOULD USE IT?

An ultraviolet tube must be used if no other chemical method of disinfection is being done. Sediment and Carbon filters are individually not enough to make water fit for drinking.

HOW MUCH DOES IT COST?

A uv tube costs between 500 to 1000 Rs, without installation.

HOW LONG DOES IT DISINFECT FOR?

Disinfection depends on the amount of time water has in the presence of the light, this is called contact time. A sufficient contact time is needed to kill microbes.

HOW DOES IT WORK?

 UVC light inactivates microorganisms by damaging their genetic material (DNA) and rendering them unable to replicate

WHAT ARE ITS LIMITATIONS

- UV light bulbs, the source of UV disinfection treatment, are designed to be covered by quartz sleeves. These sleeves often develop a film which reduces the effectiveness of your UV treatment, and which requires an acid wash to clean.
- The flow rate is very important to ensure that water has enough contact time to be disinfected.

The Three Module Filters

Due to the ease of use and demand, the water filtration market has seen a boom in Pakistan in the recent years. As a result there are hundred of vendors in each city who are into selling water filters. Tough there are just a few manufacturing concerns who make the units indigenously, mostly the hosing for the water filters is made locally and it is claimed that material used in the filters is imported. Today, there are over 200 different brands of filters on the market and a lot of confusion in the consumer's mind. The industry had largely been self regulated.

Three module filters easily available in the markets are the most commonly used water treatment method in our households. With the worsening situation of water quality and subsequent diseases and deaths have led the people to buy these treatment gadgets.

There is a mushroom growth of fake three module filter manufacturers in the country The parts of the filters are mainly imported from Taiwan and China while some are made in Pakistan. And there are two main markets in Lahore and Karachi wherefrom the so called manufacturers procure these parts and place their labels on them to make it an independent brand. In reality, all the brands contain similar filter parts and one brand's efficiency hardly differs from the others. Even sometimes, a relatively low priced filter performs better then the costly one.

Before going on to decide which filter to buy the consumers should look into hidden costs of the domestic filters systems. These have been elaborated below: Most of the filters are a combination of three processes. Slow sand or porcelain filtration, activated carbon filtration and ultraviolet light disinfection.

Price range 1500/- to 15,000/-Rs.

Installation:

Installation of water filters is done by the provider, at the POU (point of use) eg kitchen installation is mostly done mostly free of charge. But some vendors charge a nominal service fee of Rs 100/ to 200/-. The installation needs a water inlet and an electrical connection.

Hidden cost of owning a filter system

Filter replacement costs

What is it going to take to maintain the filter over a lifetime of use? Some filter replacement cartridges run as high as Rs 80 to Rs 250 (for porcelain and carbon filters) per quarter depending upon usage. The UV lamp has to be replaced only if it fuses and the replacement cost ranges from 1,000/-to 1500/- per quarter. If possible it is best to buy equipment cartridges directly from the manufacturer because that insures the lowest possible prices.

System Warranty

How long is the unit guaranteed to last? Some cheaper units have only one year limited warranty or have an extended warranty up to 5 years with regular replacement. In general, the longer the available warranty the better because this is a direct indication of the manufacturer's commitment to the product and to consumer service.

Company Longevity

How long the company has been in the business and what are the prospects for staying in business? In other words will the company still be around in the next 10, 20 years? The importance of longevity is availability of filter replacement cartridges and replacement parts as needed. Most filter cartridges are not interchangeable and many consumers have no option but to abandon the unit after buying a filter unit the manufacturer of which is out of business. The best advice is to stick with recognized industry leaders that have been in the water filtration business for the last ten years or longer.

Some consumer tips

- There are many thousands products on the market that claim to provide the consumer with purest water available, everything from filtration systems and distillation units to bottled water. There are for instance, over 200 different water filters on the market.
- You need to evaluate competing, often contradictory, statements and determine which claims are accurate and which advertisements are nothing more than creative writing. An improperly maintained water filter can actually incubate trapped bacteria and release them into the filtered water.

- A product's performance as well as the accuracy of its advertising literature should be tested and certified by an independent and disinterested third party. If a product is certified by a reputable
- organization like Pakistan council of Research in Water Resources (PCRWR) or the Pakistan Council for Scientific and Industrial Research (PCSIR)) you can be assured that a product's advertisement are not misleading and the product will perform as specified.

In order of preference the three stage filters that The Network has tested and approved for use at domestic level:

Sediment filter (1st stage)

S#	Pore Size	Specifications	manufacturing	Claims to reduce
01	0.3 micron	Polyethylene Filter	Pure	Bacteria,lead rust and pending materail
02	1 Micron (nominal)	RBI- 934, Resin Bonded Cellulose Sediment Filter Cartridge	Pentair Water Treatment , USA	Medium fine sand ,dirt. Silt, dust particles, scale partifcles.
03	1 micron (nominal)	PD-1-934 POLYDEPTH Filter Cartridge	Pentair Water Treatment , USA	sediments
04	1 micron nominal insode core winding 5 micron nominal outer side winding	PP-5 MS-G 5 micron Gold	So Safe Water Purification Products	Dirt

GAC (Granular Activated Carbon) 2nd stage

S#	Pore Size	Specifications	Manufacturing	Reduces
01	Not given	CTO, 100% pure carbon	ZFS Enterprises	
02	5 micron	CTO Carbon Filter Cartridge	China	Chlorine, bad taste and odors
03	1 micron	GAC 101 D Acid Washed Coconut Shell Based	So- Safe Water Purification Products	Chlorine, insecticide, pesticides, herbicides, unpleasant taste and odor.

Ultra Violet Lamp (3rd stage)

S#	UV Range	Made in	Specifications	manufacturing	Functional Characteristics
01	11 Watt	Polland	TUV 11 Watt T5 4 P Se	Philips	No information given
02	18 Watt	USA	Gold series 50,00 uw/sec/cm2 Life 10,000 Hrs	So-Safe	
			Activitated with getter material		

APPENDIX 1

ITEM TO BE CLEANED	LIQUID BLEACH AMOUNT	WATER AMOUNT	CLEANING STEPS
Clean drinking water	1/8 teaspoon	1 gallon	 Mix 1/8 of a teaspoon bleach per 1 gallon of water add it to the water let it stand for 30 minutes before using it.
Cloudy drinking water	1/4 teaspoon	1 gallon	 Mix ¼ teaspoon bleach per 1 gallon water. add it to water let it stand for about 30 minutes before using it.
Water storage containers	1 teaspoon	1 cup	 Mix soap and clean water in a container. shake or stir to clean the inside of the container. mix 1 teaspoon bleach per 1 cup water and pour it into the container. shake it so to let me cover the inside surfaces. cover and let it stand for 30 minutes. rinse well with clean water.

APPENDIX 2

A2 De	efinitions of commonly used terms		
Boiling	Having reached the boiling point; steaming or bubbling up under the action of heat		
Chlorination	Disinfection of water by the addition of small amounts of chlorine or a chlorine compound		
Cleaning	An act or instance of making clean		
Disinfection	To cleanse so as to destroy or prevent the growth or disease-carrying microorganisms		
Distillation	The volatilization or evaporation and subsequent condensation of a liquid, as when water is boiled in a retort and the steam is condensed in a cool receiver		
Filtration	The act or process of filtering, especially the process of passing a liquid or gas, such as air, through a filter in order to remove solid particles.		
Ion Exchange	A reversible chemical reaction between an insoluble solid and a solution during which ions may be interchanged, used in water softening and in the separation of radioactive isotopes.		
Pasteurization	To expose to an elevated temperature for a period of time sufficient to destroy certain microorganisms, as those that can produce disease or cause spoilage or undesirable fermentation of food, without radically altering taste or quality.		
Purification	To make pure; free from anything that debases, pollutes adulterates, or contaminates:		
Reverse Osmosis			
Uv Radiation	Of or relating to the range of invisible radiation wavelengths from about 4 nanometers, on the border of the x-ray region, to about 380 nanometers, just beyon the violet in the visible spectrum. This type of light is use to disinfect water		
Water Softener	Look at ion exchange		

To know more details log onto www.thenetwork.org.pk or contact 051 2261085 fax 051.2262495. Adress: 40-A Ramazan Plaza, G 9 Mkz, Isb tariq@thenetwrok.org.pk