DEPARTMENT OF THE ARMY
U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND, MARYLAND 21010-5403

REPLY TO
ATTENTION OF:

MCHB-TS-EWS

10 March 2003

EXECUTIVE SUMMARY
WATER QUALITY INFORMATION PAPER NO. 31-032
PREVENTIVE MEDICINE CONCERNS
OF HAND HELD WATER TREATMENT DEVICES

1. PURPOSE. This information paper discusses preventive medicine concerns with the selection, acquisition, and employment of hand held water treatment devices used by individual soldiers to produce potable water in a field environment. It is intended for use by combat/materiel developers as well as preventive medicine and water production personnel.

2. CONCLUSIONS. The Army's vision of field water production includes the concept of decentralized water production. A need exists to enhance the Army's capability to provide individual and squad elements of deployed soldiers the ability to treat water when they cannot be provided with bulk water supplies from Quartermaster logistics sources. Hand held water treatment devices provide means to aid in the production of potable water in short-term and emergency use situations. The Army is not, however, currently planning to design or produce a hand held treatment device for issue to troop units. Army units desiring such devices typically purchase them from local venders, catalogs, or the Internet. Unlike other commercially available treatment devices, there is not an independent third party certification system that can be used to verify manufacturer claims of efficiency and effectiveness, or an Army organization that gives a "seal of approval" for the various hand held treatment devices on the market. The type of hand held device should be selected after applying the principles of risk management, to include factors such as quality of the water to be treated, the duration of the mission, and the potential for existing and intentional contamination.

3. RECOMMENDATIONS. Hand held water treatment devices are not a foolproof method of providing potable water and certain precautions must be taken in their selection and use. While these devices provide a certain level of treatment, the disinfection of the product water is often overlooked. A two-stage process of mechanical filtration with a hand held device, followed by chemical disinfection, is recommended for short-term and emergency use situations. Hand held devices that use only a ceramic filter are recommended when there is sufficient data showing that there are no chemicals in the water, or the intentional contamination of the water source is unlikely. When dealing with poor tasting water or water of unknown quality, a hand held treatment device that uses either a ceramic or fiber filter with a charcoal core is recommended. Hand held devices that use reverse osmosis with a charcoal filter provide the greatest protection against microbial and chemical contamination, although the lifecycle costs and quantity of water produced may be a limiting factor. In all cases, Army units should follow the manufacturer instructions for care and maintenance of the hand held treatment devices.

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2. REFERENCES. Appendix A contains a listing of references.

3. BACKGROUND.

a. CURRENT DOCTRINE. Presently there is no doctrine or policy within the Department of the Army governing the selection and use or maintenance of hand held water treatment devices by Army units.

b. FIELD WATER TREATMENT. The ability of the Army to perform its mission rests on sound combat service support planning, timely support, and proper use of combat service support resources. Potable water is one of the most critical resources that must be available to soldiers in the field. Water supply is usually provided on an area basis by Quartermaster Combat Service Support units using supply point distribution. However, mission requirements often isolate individual soldiers and patrols making the water production point or water distribution network inaccessible. Procuring water in the field often boils down to utilizing available raw water sources, such as a stream, pond, lake, or well. Current methods of disinfecting the raw water include the use of iodine tablets, chlorine ampules, Chlor-Floc®, or boiling. Disinfection with iodine may leave an undesirable taste in the water and operates on the concept of inactivation alone, without the ability to clarify the water. Additionally, some individuals are allergic to iodine. Chlor-Floc® is the only emergency water purification method in the Army inventory with the ability to clarify the water and by means of a chlorine residual, inactivate pathogens. However, if improperly used, pathogenic organisms can be consumed with the flocculent. Given the shortcomings for emergency water disinfection, Army units often purchase commercial, off-the-shelf hand held treatment devices to provide an effective, small, simple, lightweight water treatment device for the individual soldier or squad.

Use of trademarked names does not imply endorsement by the U.S. Army, but is intended only to assist in identification of a specific product.

®Chlor-Floc is a registered trademark of Deatrick & Associates, Inc., Alexandria, Virginia

c. OFFICE OF THE SURGEON GENERAL (OTSG) GUIDANCE ON THE USE OF HAND HELD TREATMENT DEVICES (1995).

(1) The purpose of the following information is to clarify the use of hand held treatment devices. Hand held treatment devices have been sought after to provide individuals and small groups of combat soldiers with the capability to treat water for drinking when they do not have access to supplied drinking water. The problem with the use of these devices is they may not consistently remove and inactivate pathogens from the water.

(2) In the early 1990s, the U.S. Marine Corps conducted tests on a variety of hand held water treatment devices to ensure efficient microbial removal and adequate treatment. They found that while some hand held water treatment devices treated water adequately during laboratory testing, there were significant shortfalls that prohibited use in the field.

(3) The most significant shortfall of hand held treatment devices is their inability to ensure microbiologically safe drinking water. While all commercially available hand held treatment devices filter the water, only a few also disinfect the water. In most cases, a measurable disinfectant residual cannot be maintained to ensure adequate disinfection and prevent subsequent microbial contamination. The disinfection capability and the filters can only be used for a limited time before they need cleaning or replacement. At the end of the hand held treatment device's useful life, it may still produce clear looking water. However, the user has no way of knowing if the water is safe to drink. Other important concerns include their inability to treat salt water, brackish water, commonly found chemicals, and nuclear, biological, and chemical (NBC) contaminated water. Additionally, microbiological contamination of the product water can occur through improper cleaning procedures.

(4) Guidance from the OTSG states that the only acceptable emergency individual water treatment items for military use include iodine tablets, Chlor-floc® and chlorine based compounds such as calcium hypochlorite or sodium hypochlorite. If a commercially available hand held water treatment device is used, the filtered water must be disinfected with iodine tablets, Chlor-floc®, or a chlorine-based compound to ensure microbiologically safe drinking water in accordance with Field Manual (FM) 21-10 and FM 10-52.

d. CONTAMINANTS OF SHORT-TERM MILITARY SIGNIFICANCE.

(1) Microbiological Contamination - Raw water sources carry many organisms that cause intestinal disease. As described in Technical Bulletin Medical (TB MED) 577, the microbes found naturally in the water along with contamination from external sources can cause many waterborne diseases of military concern in humans, such as diarrheal disorders, salmonellosis, shigellosis, cholera, amebiasis, giardiasis, cryptosporidosis and non-diarrheal disorders, such as infectious hepatitis, viral Hepatitis A, typhoid fever, schistosomiasis and leptospirosis, among many others.

– Protozoans, which include *Giardia lamblia*, *Cryptosporidium* and *Entamoeba histolytica*, cause gastrointestinal illness, diarrhea, vomiting and cramps. Protozoans are the largest of the waterborne pathogens ranging in size from 2 to 15 microns.

– Bacteria, which include *Escherichia coli* that causes diarrhea, *Shigella* that causes dysentery, *Campylobacter* that causes diarrhea, vomiting and fever, *Vibrio cholerae* that causes cholera and *Salmonella* that causes typhoid. Bacterium range in size from 0.2 to 1 micron.

– Viruses, which include Hepatitis A and E that cause hepatitis, Norwalk virus that causes headache, fever and intestinal discomfort, rotavirus that also causes headache, fever and intestinal discomfort, echovirus that causes meningitis and diarrhea and poliovirus that causes polio. Viruses are the smallest of the waterborne pathogens ranging in size from 0.02 to 0.1 micron.

– Turbidity is a physical parameter that measures the cloudiness of the water, but can be used to indicate the microbiological quality of the water. Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites and some bacteria.

(2) Chemical Contamination - The health effects of greatest concern for military populations exposed to elevated concentrations of chemical contaminants of military significance in field water are often not direct; rather, they are associated with the dehydration of military personnel. The chemical constituents of concern listed in the Tri-Service Standards (published separately in 1996 and applied as an addendum to TB MED 577) are chloride, magnesium, sulfate, arsenic, cyanide and lindane. Chloride, magnesium and sulfate all create a risk of dehydration caused by acute laxative action and/or by decreasing the palatability of the water. Arsenic has toxic effects on the human body; cyanide acts as a chemical asphyxiate, and lindane is a representative pesticide in use worldwide.

(3) NBC Contamination - Threats of chemical agent contamination include hydrogen cyanide, threat agents, Trichothecene Mytoxin T-2 and Radioactivity, which all have performance-degrading effects occurring after ingestion of concentrations in field water greater than the recommended interim standards.

4. FINDINGS AND DISCUSSION. Over the course of the past decade several organizations have contemplated the use of hand held devices during deployments. The following discussion is a culmination of these organization's "wish lists" for the selection and procurement of the appropriate water treatment device. These organizations include the U.S. Army Airborne Test Board, John F. Kennedy Special Warfare Center and School, Special Forces Command, the Naval Facilities Engineering Service and the U.S. Marine Corps System Command, to mention a few.

a. GUIDELINES FOR FILTER SPECIFICATIONS.

(1) Primary Criteria of Concern.

– Maximize Water Production Rate - One liter of potable water should be produced at least every 5 minutes.

– Minimize Weight (lbs) - Individual water treatment devices should weigh less than three pounds.

– Life of Filter - The water treatment device should have a minimum production lifetime of 360 liters if the unit is expendable, or a minimum filter life of 360 liters between servicing.

– Compact Design to Pack - The unit must be transportable in a standard rucksack, individual load bearing equipment (external stowage preferred), and/or the cargo pocket of the battledress uniform or overgarment.

– Disinfection - The water treatment device should have the ability to disinfect non-potable water and provide an adequate residual to prevent recontamination.

(2) Secondary Criteria of Concern.

– The device should have an early warning service indicator of some type.

– The device should have the ability to be stored and transported at -25° Fahrenheit when dry and from 32° to 160° Fahrenheit when wet.

– The device should be capable of hand operation and maintenance by the 5th percentile female through the 95th percentile male soldiers dressed in mission oriented protective posture III and cold weather clothing.

– Minimal training should be required for use and maintenance.

– The device should be capable of day and night operation with no special tools or equipment.

– The device should have a storage life of at least 3 years (5 years preferred).

b. TYPES OF FILTERS AVAILABLE.

(1) Carbon Filters - Carbon filters are primarily used to improve the palatability of the water. Activated carbon reduces chlorine, iodine and other chemicals, such as pesticides and herbicides, and restores the natural taste of water. Some larger microbiological contaminants, such as *Giardia* and *Cryptosporidium*, will be removed from the treated water. However, activated carbon alone cannot offer adequate protection against bacteria.

(2) Ceramic Filters - Microporous ceramics employ the principle of depth filtration. Particles and microorganisms are trapped in the outer layers of the pores rather than just on the surface alone. Contaminants down to 0.2 to 0.3 micron in their smallest dimension can be effectively trapped and removed by ceramic filtration. Ceramic filters may be cleaned for 100 percent flow rate recovery after clogging. The media can be cleaned multiple times and thus provides cost-efficient filtration.

(3) Ceramic Filters with Impregnated Silver - The impregnation of silver in the ceramic filter acts to reduce any bacterial growth accumulations that might occur in the ceramic with time.

Although the nominal density of the ceramic element prevents individual bacteria from passing through the ceramic material, when bacteria starts to grow and cells divide, penetration of the ceramic structure of the element can occur and contaminate the inside of the filter element. The likelihood of bacteria breakthrough due to growth through the ceramic filter is reduced with the impregnated silver, along with periodic cleaning and/or sterilization of the ceramic element's exterior surface.

(4) Ceramic Filters with Carbon - Ceramic filters that include carbon, efficiently utilize the two technologies, incorporating the ability to remove chemical constituents from the water with the ability to produce microbiologically pure drinking water.

(5) Glass Fiber Filters - Some units use pleated filter elements composed of glass fiber strands instead of a ceramic filter. These types of filter elements are usually one-time use items that cannot be cleaned, although some manufactures have encased a glass fiber filter inside another type of filter that can be cleaned. The absolute pore sizes for glass fiber filters are usually not as small as what ceramic technology can obtain.

(6) Reverse Osmosis Units - Reverse osmosis uses applied pressure to overcome osmotic pressure, forcing raw water across a water permeable membrane that is essentially impermeable to dissolved solutes. Reverse osmosis is commonly used to convert brackish water or seawater to drinking water. Reverse osmosis is an effective method of reducing the concentration of total dissolved solids and many impurities found in water. Common contaminants treated by reverse osmosis include many ions and metals, organic chemicals, particles and some pesticides. Reverse osmosis units are capable of removing microbial particulates, but are often not designed with microbial removal as a primary concern.

Table 1. Contaminants And Filter Removal Capabilities

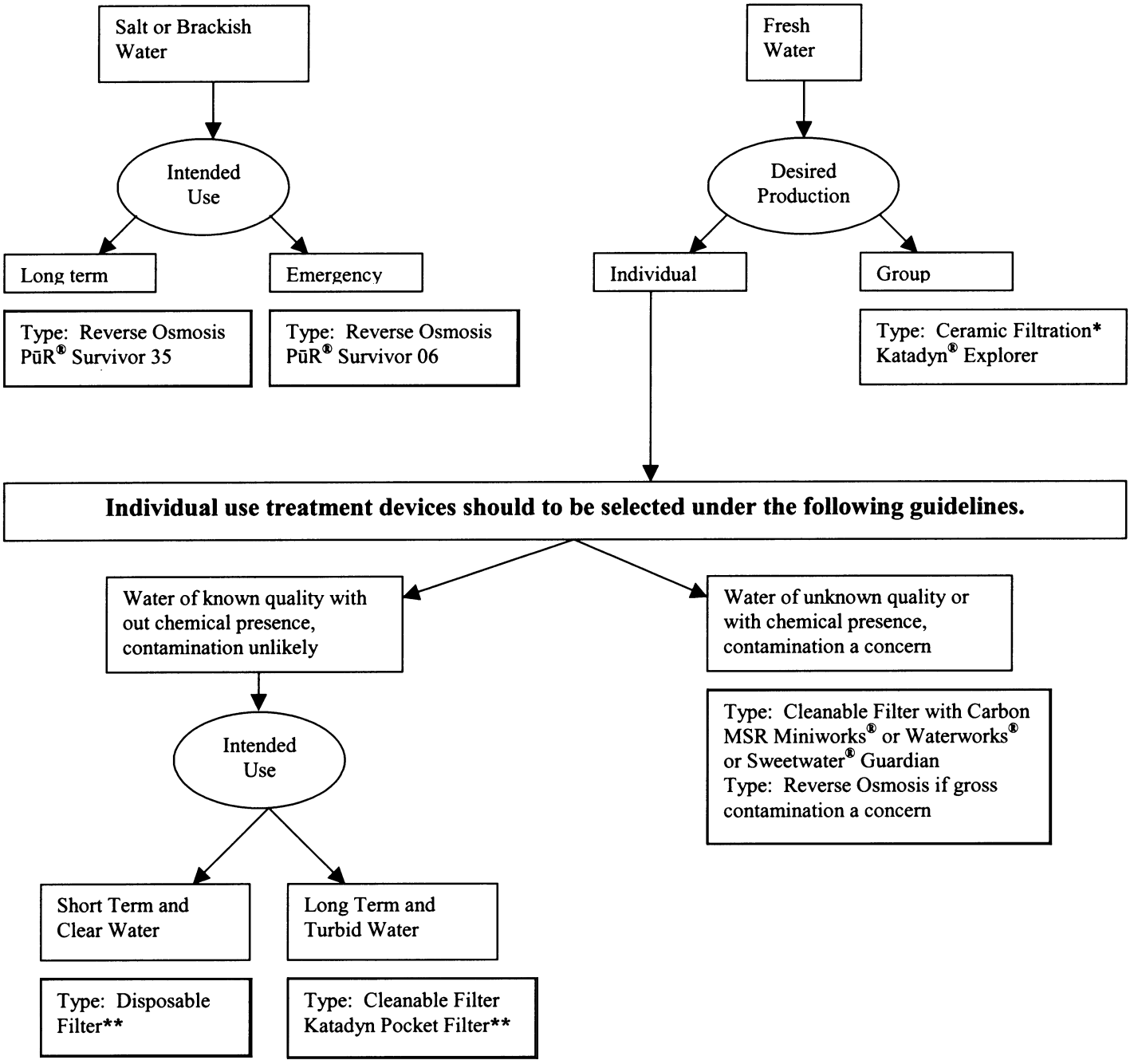
Type of Contaminant	Type of Filter				
	Carbon Filter	**Ceramic or Glass Filter**	**Ceramic Filter w/ silver**	**Ceramic Filter w/ carbon**	**Reverse Osmosis**
Microbiological	NO	YES	YES	YES	YES
Organic	YES	NO	NO	YES	YES*
Metals	NO	NO	NO	NO	PARTIAL
Radioactivity	NO	NO	NO	NO	PARTIAL
Inorganic	NO	NO	NO	NO	PARTIAL*

* Oil, gasoline, or other petroleum-based compounds may destroy the membrane depending on the membrane type.

* Some membranes are subject to degradation by oxidants, such as free chlorine.

c. FILTER CAPABILITIES. The U.S. Environmental Protection Agency (EPA) has set standards of 99.9999 percent removal of bacteria, 99.9 percent removal of protozoa and 99.99 percent removal of viruses in the EPA Guide of Standard Protocol For Microbiological Purifiers. When a filter meets the removal standard for all three classes of organisms, it can claim the title of Microbiological Water "Purifier" for that water treatment device. Of the field reliable filters available on the market, a second step employing the application of a chemical disinfectant is required to meet the EPA guide for virus removal. In Table 1, the performance rating for microbiological contaminants is for only 99.9999 percent removal of bacteria and 99.9 percent removal of protozoa.

d. CHOOSING THE APPROPRIATE FILTER. The type of hand held device should be selected after applying the principles of risk management to include factors such as quality of the water to be treated, the duration of the mission, and the potential for existing and intentional contamination. The intended duration of use of the item is important. Questions to answer include: (1) "Will the filter be the primary source of potable water, or only a backup for emergency purposes?"; (2) "What kind of source water will be used in the filter - is the water fresh, brackish or saline?"; (3) "How turbid is the water and does the quality change frequently with rain and flooding?"; (4) "Is the water palatable, and (5) Does it have a distinct odor?" The decision-making flowchart shown in Figure 1 uses the answers to these questions to assist in the selection and employment of a hand held treatment device. Appendix B contains a more complete listing of available hand held treatment devices by vendors. Facts including the price, weight, water production output, filter life, effective pore size and vendor contact information are listed for each device.



*The flowchart ends here because the Katadyn® Expedition Filter is the only squad size filter available, not because the type has to be a ceramic filtration device

**It should be noted that a cleanable filter with a carbon core can also be used when a chemical presence is not indicated.

Figure 1. Flowchart To Determine an Appropriate Hand Held Treatment Device

e. COMMERCIALLY AVAILABLE HAND HELD WATER FILTRATION UNITS.

(1) Ceramic Filters with Carbon.

MiniWorks® Ceramic Filter

Weight	15.5 ounces
Estimated Cost	$69.95

The Mountain Safety Research (MSR) MiniWorks® filter unit combines a Marathon ceramic element with an inner core of activated carbon. The ceramic filter has an absolute pore size of 0.3 micron designed to meet the EPA's "purifier" requirements for bacteria and protozoa removal. The activated carbon core provides the means to remove chemical contaminants from the water. Chemical concentrations will be reduced for chemicals, such as pesticides, iodine and chlorine as they are absorbed by the activated carbon. The ceramic filter was designed to be cleaned by essentially removing the outermost layer of the ceramic filter. As this ceramic element gets smaller and smaller in diameter, the unit approaches the point where the cartridge is no longer considered an effective barrier against microbial contamination. The point at which this "limit" is reached is determined by a small caliper which, when it fits or slides over the exterior diameter of the ceramic element, determines when the cartridge element must be replaced. The replacement filter can be purchased for $35.

WaterWorks® Ceramic Filter

Weight	19 ounces
Estimated Cost	$129.95

The MSR WaterWorks® II is similar in design to the MSR MiniWorks® with an additional stage of filtration. After the water passes through the 0.3 micron ceramic filter, a second filtration stage is provided by a 0.2 micron membrane prior to the activated carbon. The second stage microfilter is, in effect, a fail-safe feature. The filter housing of the WaterWorks® II is seated at either end with double seals to reduce the likelihood of seal failure and is composed of polyurethane where the MiniWorks® consists of polycarbonate. The WaterWorks® uses the same replacement filter as the MiniWorks® that can be purchased for $35 and a replacement membrane can be purchased for $40.

®Miniworks and ®WaterWorks are registered trademarks of Cascade Designs, Inc., Seattle, Washington

(2) Ceramic Filters with Impregnated Silver.

Katadyn® Pocket Filter

Weight	21 ounces
Estimated Cost	$199.00

The Katadyn® Pocket Filter utilizes a 0.2 micron ceramic filter impregnated with fine silver powder. The silver impregnation prevents the filter from being contaminated with microbial growth. It does not, however, provide any significant microbial treatment to the processed water. As with most ceramic filters, the ceramic surface of the filter element should be cleaned when the accumulated particles make the pumping more difficult and the output flow less than normal. As the filter becomes smaller with each cleaning, a plastic gauge determines when the minimum diameter of the ceramic is reached, indicating that the filter needs to be replaced. The filter housing is constructed of extremely strong, durable materials, such as aluminum, polypropylene and ceramic. The manufacturer rates the filter element for up to 13,000 gallons.

Katadyn® Expedition Filter

Weight	12 pounds
Estimated Cost	$890.00

The Katadyn® Expedition Filter has the same capabilities as the Katadyn® Pocket Filter with a scaled up design. The Expedition Filter contains a ceramic filter element with a Nickel plated, brass housing. The Expedition is designed to provide potable water to groups or squad size elements. The filter can produce one gallon per minute of processed water with a filter that can be cleaned up to 300 times yielding up to 26,000 gallons of water before having to be replaced.

(3) Glass Woven Filters with Carbon.

SweetWater® Guardian Filter

Weight	11 ounces
Estimated Cost	$49.99

®Katadyn is a registered trademark of Katadyne, U.S.A., Inc., Scottsdale, Arizona.

The SweetWater® Guardian Filter employs a labyrinth depth filter with a pore size of 0.2 micron to screen out protozoa and bacteria. The filter is composed of a glass fiber matrix surrounded by a layer of granulated activated carbon, and is easily cleaned with a round brush provided with the filter. A replacement safety indicator is imbedded inside the filter material. After repeated cleanings a screen-like layer becomes visible so you know when it is time to replace your filter cartridge. Replacement filters can be purchased at a price of $30 and are rated by the manufacturer as capable of treating 200 gallons of water. The unit is designed for an optional disinfection cartridge to be plugged into its base adding penta-iodine as a chemical disinfectant.

PūR® Hiker

Weight	14 ounces
Estimated Cost	$59.95

The PūR® Hiker uses a disposable filter element with a pore size of 0.3 micron. The pleated filter element is composed of glass fiber strands with an activated carbon core and is rated by the manufacturer to treat up to 200 gallons of water. Replacement filters can be purchased for $25. Some vendors have an iodinated resin cartridge available as an add-on to the Hiker to provide chemical disinfection.

(4) Reverse Osmosis Units.

PūR® Survivor 06

Weight	2.5 pounds
Estimated Cost	$625.00

The PūR® Survivor 06 is designed strictly for emergency purposes. Most commonly, the Survivor 06 is placed into emergency life rafts aboard ocean going crafts. The slow output of treated water, less than one liter per hour, limits the practical application of this unit. The reverse osmosis membrane allows water molecules to pass but prevents the passage of salt molecules. When enough pressure is applied to the seawater, it will force water molecules through the membrane to the fresh water side, leaving the salt molecules behind. The membrane has a salt rejection on average of 98.4 percent with a minimum rejection of 95.3%.

®SweetWater is a registered trademark of Cascade Designs, Inc., Seattle, Washington
®PūR is a registered trademark of Procter & Gamble, Cincinnati, Ohio

PūR® Survivor 35		
Weight	7 pounds	
Estimated Cost	$1550.00	

The PūR® Survivor 35 uses the same membrane technology as the Survivor 06 and is rated with the same salt rejection capability. However, the Survivor 35 is capable of producing 4.5 liters per hour. Operation of the pump forces seawater over the surface of the membrane at 800 psi, where 10 percent passes through as pure water. The remaining 90 percent is redirected to an energy recovery system that aids in pumping. Despite the pressure involved, pumping the Survivor requires little effort.

f. HISTORICALLY PROVEN MODELS. The Marine Corps Research, Development, and Acquisition Command worked with the Naval Facilities Engineering Service Center, formerly known as the Naval Civil Engineering Laboratory, to investigate commercially available water treatment devices. The U. S. Army Medical Research and Material Command, headquartered at Fort Detrick, Maryland has also conducted tests on individual water treatment devices. Separate studies found the Katadyn® Pocket filter and the MSR Waterworks® filter to be the best overall commercially available individual water filters evaluated to meet military requirements. However, the devices could not be recommended for use without requiring the final step of disinfection in accordance with the OTSG guidance and FM 21-10 and FM 10-52.

5. CONCLUSIONS. The Army's vision of field water production includes the concept of decentralized water production. A need exists to enhance the Army's capability to provide individual and squad elements of deployed soldiers the ability to treat water when they cannot be provided with bulk water supplies from Quartermaster logistics sources. Hand held water treatment devices provide means to aid in the production of potable water in short-term and emergency use situations. The Army is not, however, currently planning to design or produce a hand held treatment device for issue to troop units. Army units desiring such devices typically purchase them from local vendors, catalogs, or the Internet. Unlike other treatment devices, there is not an independent third party certification system that can be used to verify manufacturer claims of efficiency and effectiveness, or an Army organization that gives a "seal of approval" for the various hand held treatment devices on the market. The type of hand held device should be selected after applying the principles of risk management to include factors such as quality of the water to be treated, the duration of the mission, and the potential for existing and intentional contamination.

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reverse osmosis with a charcoal filter provide the greatest protection against microbial and chemical contamination, although the lifecycle costs and quantity of water produced may be a limiting factor. In all cases, Army units should follow the manufacturer instructions for care and maintenance of the hand held treatment devices.

7. ADDITIONAL ASSISTANCE. For further information on this information paper or other Field Water issues contact the United States Army Center for Health Promotion and Preventive Medicine, 5158 Blackhawk Rd, Building E-1675 ATTN: MCHB-TS-EWS, Aberdeen Proving Grounds, Maryland 21010 or telephonically at 410-436-3919 DSN 584-3919. You can also post messages or questions to the following e-mail address at Water.Supply@apg.amedd.army.mil

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APPENDIX A
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APPENDIX B
MANUFACTURER DATA FOR HAND HELD WATER FILTERS

		SPECIFICATIONS						CAPABILITIES
Company	Product	Capacity (L)	Output (L/min)	Pore Size (microns)	Weight (lbs)	Unit Price	Replacement Filter	Contaminant Removal
Cascade Designs \ Sweetwater - http://www.cascadedesigns.com/sweetwater/								
	Guardian Microfilter	750	1.25	0.2	0.7	$50	$30	Bacteria, Protozoa
	WalkAbout Microfilter	470	1.25	0.2	0.6	$40	$20	Bacteria, Protozoa
First Need - http://www.firstneed.com/								
	First Need Deluxe	470	1.7	0.4	1	$84	$38	Bacteria, Protozoa and Viruses
Katadyn - https://www.katadyn.net/								
	Camp Gravity Filter	20,000	0.08	0.2	1.5	$99	$69	Bacteria, Protozoa
	Expedition Filter	26,000	4	0.2	12	$890	$90	Bacteria, Protozoa
	Mini Ceramic	7,500	0.5	0.2	0.5	$89	$59	Bacteria, Protozoa
	Mini Carbon	550	0.5	0.2	0.5	$69	$29	Chemicals, Protozoa
	Combi Filter	13,000	1.21	0.2	1.75	$149	$75	Bacteria, Protozoa, Chemicals
	/ Carbon Component	60	--	--	--	--	$12	
	Pocket Water Filter	13,000	0.86	0.2	1.5	$199	$139	Bacteria, Protozoa
MSR - https://www.msrcorp.com/								
	MiniWorks Ceramic Fi	not available	0.76	0.3	1	$70	$35	Bacteria, Protozoa, Chemicals
	WaterWorks II Ceramic	not available	0.74	0.2	1.2	$130	$35 + $40	Bacteria, Protozoa, Chemicals
PuR - http://www.purwater.com/								
	Explorer Purifier	400	1.5	0.3	1.25	$130	$50	Bacteria, Protozoa and Viruses
	Scout Purifier	400	1	0.3	0.9	$85	$45	Bacteria, Protozoa and Viruses
	Voyager Purifier	400	1	0.3	0.7	$65	$35	Bacteria, Protozoa and Viruses
	Hiker Microfilter	800	1.5	0.3	0.7	$60	$25	Bacteria, Protozoa, Chemicals
	Survivor 35 RO		0.1		7	$1,550		Salt Rejection 98.4% avg (95.3% min.)
	Survivor 06 RO		0.02		2.5	$625		Salt Rejection 98.4% avg (95.3% min.)

SAMPLE VENDOR CATALOG INFORMATION

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PHONE ( ) _____ Between Hours of 9 a.m. - 5 p.m.

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NAME _____
IN CARE OF _____
STREET ADDRESS _____
CITY _____ STATE _____ ZIP _____
WE WILL SHIP TO MULTIPLE ADDRESSES FOR $5.50/$7.50 PER ADDRESS. PLEASE USE ADDITIONAL PAPER IF NECESSARY.

5-DIGIT ITEM NO.	1st COLOR CHOICE	2nd COLOR CHOICE	SIZE	QTY.	PAGE NO.	DESCRIPTION	PRICE EACH	PRICE TOTAL

Did you include all colors and sizes for this order?

CHECK AMT. ENCLOSED $ _____
MONEY ORDER
VISA (16 numbers)
DISCOVER/NOVUS (16 numbers)
MASTER CARD (16 numbers)
AMERICAN EXPRESS (15 numbers)
Card Number
Exp. Yr.
Credit Card Expiration Date Required

AMOUNT FOR GOODS
NJ RESIDENTS ONLY ADD 6% SALES TAX
SHIPPING & HANDLING $ _____
TOTAL

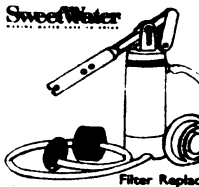
SEND A CATALOG TO A FRIEND

NAME _____
STREET ADDRESS _____
CITY _____ STATE _____ ZIP _____

Water Purifiers/Filters

SweetWater Numerous safety features including Filter Replacement Safety Indicator & Pressure Relief System. The 0.2 micron (absolute) filter is the most rugged & field reliable - OK to freeze & impact safe.

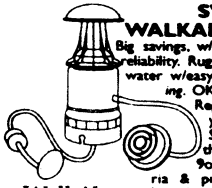
SWEETWATER GUARDIAN MICROFILTER



Universally reviewed & praised as "easiest to pump". Lever-action handle folds flat. Cleanable w/simple brushing in less than a minute. No parts to lose or maintain. OK to freeze & impact safe. Unique Filter Replacement Safety Indicator, visible after about 100 brushings, tells you to change filter. Pressure Relief System prevents forcing bacteria through filter. Includes: Carry Bag, 75 micron Prefilter, & Universal Water Bottle Adapter. Wt.: 11oz. Eliminates: 99.9999+% bacteria & protozoan parasites. Flow: 1.25 liters/min. w/new cartridge. Cartridge Life: up to 200 gal. 7"x2¼".

No. 62900-G $49.95
No. 62901-G Replacement Filter Cartridge $29.99
No. 62957-G Cleaning Brush $3.50

SWEETWATER WALKABOUT MICROFILTER



Big savings, w/o compromising microbiological reliability. Rugged & Reliable. Handles muddy water w/easy less-than-one-minute brush cleaning. OK to freeze & impact safe. Filter Replacement Safety Indicator tells you to change filter. Pressure Relief System prevents bacteria "push-through" or filter rupture. Wt: 9oz. Eliminates: 99.9999+% bacteria & protozoan parasites. Flow: 0.9 liters/min. w/new cartridge. Cartridge Life: up to 125 gal. 6¼" ht.

No. 62910-G $34.99
No. 62911-G Replacement Filter $18.95
No. 62958-G Cleaning Brush $3.50

SWEETWATER SILT STOPPER II

Unique prefilter fits any brand of filter or purifier to reduce need for cleaning and extend filter life. Stops all microscopic algae, silt and cysts that prematurely clog the primary filter so that it can focus on the truly tiny bugs that matter. Backflush to clean, filter element is replaceable. Wt. 1oz.

No. 62912-G $9.99
No. 62913-G Replacement Filter - 3 pack $8.99

FIRST NEED® DELUXE "DIRECT CONNECT™" PURIFICATION DEVICE

Only "purifier" certified to EPA Standards (cysts, bacteria and viruses) without using chemicals. Removes pesticides - provides deliciously refreshing water instantly on one pass through. Ecological, actually removes microbes using reliable molecular capture, ultrafine microstraining (to 0.1 microns) and other purification mechanisms. Self-cleaning pre-filter. Mounts directly to trail and bike bottles and dromedary bags. Sealed canister protects users from accumulated cysts. Backwashable. 100 gallon capacity. Includes tote bag and gravity feed kit. Wt. 15oz. Bottle not included.

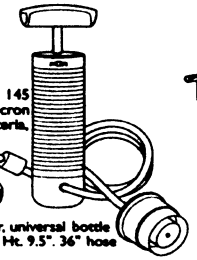
No. 81249-G $83.99
No. 81252-G Replacement Canister $36.99

PUR HIKER MICROFILTER

Unique AntiClog pleated filter has over 10 times more filtering area than any other microfilter. Eliminates bacteria, protozoa and Giardia. The Activated Carbon core reduces pesticides and chemicals, producing fresh tasting water. Comfortable, sturdy handle makes it easy to pump 1 liter/minute. EasyFill bottle adapter connects directly to all common water bottles for convenient filling. Acorn pre-filter works in all water conditions. Includes carry case. Cartridge capacity 200 gallons. Wt. 11oz. Size: 6½"x2¾" dia.

No. 55812-G $59.95
No. 55809-G Replacement Cartridge $24.99

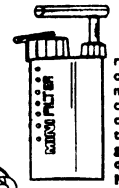
PUR GUIDE MICROFILTER



Features Anti-Clog Technology: 145 square inches of pleated 0.3 micron glassfiber filtration. Eliminates bacteria, protozoa, and giardia. Carbon Core reduces pesticides and chemicals. Filters up to 1 quart per minute at 36 strokes per minute. Cartridge capacity depends on water quality. Includes prefilter, universal bottle adapter, and carry bag. Wt. 14oz. Ht. 9.5". 36" hose length.

No. 55824-G $79.95
No. 55826-G Guide Replacement Cartridge-can be used to update Pur Scout to a filter. $39.95

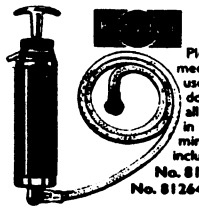
KATADYN MINIFILTER



The 0.2 micron pore size safely removes bacteria and parasites including carriers of such illnesses as giardiasis, cholera, typhoid, salmonella and traveller's diarrhea. Ceramic element can be cleaned about 100 times yielding a total output of up to 1000 gallons. 30" suction hose, technical manual, cleaning brush and measuring gauge are contained within the filter. Filters 1/2 quart per minute. Size: 1¾"x2½"x7". Wt. 8oz.

No. 81272-G $88.95
No. 81265-G Replacement Filter $59.99

KATADYN WATER FILTER



Please note: the Katadyn is a mechanical, ceramic micro filter and uses no chemicals (healthier). Filters down to 0.2 microns (will remove all giardia, fungi, parasites, etc.) Built in pump produces about a quart a minute. Zippered carrying pouch included. Size 10"x2". Wt. 23oz.

No. 81260-G $199.95
No. 81264-G Replacement Filter $165.00

Please Note: If you live in the State of Iowa we are unable to sell you any water purification system, due to Iowa Department of Public Health Restrictions. We apologize for any inconvenience.

MSR MINIWORKS™ CERAMIC FILTER

Removes bacteria, pesticides, Giardia and Cryptosporidia, iodine, chlorine and odors. Marathon Ceramic 205 element. Ceramic gauge measuring tool tells you when ceramic needs replacing. Easy to use pump handle. 90 seconds/liter flow rate. Threads directly to 32oz. wide-mouth Nalgene bottle or Dromedary bags. Measures just under 8" long x 4" wide. Wt. 14oz. Stuff sack included.

No. 21118-G Miniworks™ $69.95
No. 58859-G Repl. Ceramic Element $29.99
No. 87703-G Parts Kit: Includes O-ring, check valve, and intake sponge. $8.95

MSR DELUXE DROMEDARY BAGS

Wide mouth for easy filling, smaller mouth for easier pouring, and squirt top. Screws onto MSR filters.

No. 87706-G 2 liter $19.95
No. 87707-G 4 liter $22.95
No. 87725-G 6 liter $27.95
No. 87710-G 10 liter $29.95

SUPPLIER CONTACT INFORMATION

MANUFACTURERS

General Ecology
151 Sheree Blvd.
Exton, PA 19341
Phone 610-363-7900 or 800-441-8166
Fax 610-363-0412
www.generalecology.com

Katadyn USA Inc
3020 North Scottsdale Road
Scottsdale, AZ 85251
Phone: 602-990-3131
www.katadyn.net

Mountain Safety Research
Post Office Box 24547
Seattle, Washington 98124
Phone 206-624-7048 or 800-877-9677
Fax 206-224-6492
www.msrcorp.com

PUR
9300 North 75th Avenue
Minneapolis, Minnesota 55428
Phone 612-541-1313 or 800-787-5463
Fax 612-541-1230
www.purwater.com

Sweetwater
2505 Trade Centre Avenue, Suite D
Longmont, CA 80503
Phone 1-800-531-9531
www.cascadedesigns.com/sweetwater/

VENDORS

Campmor Inc.
29 Parkway
Upper Saddle River, NJ 07458
Phone 1-888-CAMPMOR, 1-888-226-7667
www.campmor.com

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Fax 1-253-891-2523
www.rei.com

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