

# Clean, Safe Water

**HYDRATION SYSTEMS PROTECT PERSONNEL FROM WATER-BORNE ILLNESSES.**

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Any combatant who is sickened by polluted water can't fight, meaning that invisible organisms or materials in water can take a warrior down as surely as enemy fire.

Fortunately, multiple companies have developed a wide array of systems that can ensure water-borne illness doesn't strike American forces.

These systems are divided into two major groups: storage containers that hold already purified water, and systems that can take highly polluted water and turn it into safe, clean H<sub>2</sub>O.

## **WATER STORAGE**

BAE Systems provides hydration that can slake the thirst of parched troops, with dual water storage systems containing purified water mounted on either side of a long range assault pack.

With 100 ounces in each bladder, plus the option of adding yet another container, that adds up to a super-sized 300 ounces of water, enough for a lengthy mission, according to Sean Martin, director of sales with BAE Systems. A drink tube protrudes from each container, with the mouth piece conveniently located on each shoulder of the combatant.

Martin said troops can use drying and cleaning to ensure that no mold or other organisms grow inside the water storage system, which is easy to inspect to see if the water is clear.

Other hydration systems are able to take polluted water and transform it into pure aqua, safe to drink.

CamelBak offers several hydration systems. They are built into soft goods products such as backpacks of varying sizes depending on the need of the warfighter. Some carry only water and attach directly to MOLLE [Modular Lightweight Load-carrying Equipment] of an

IOTV [Improved Outer Tactical Vest] via DAAS [Direct Armor Attachment System], and others are built into three- to five-day mission capacities.

The amount of water and cargo carried is dependent on the situation, but most common hydration systems carry three liters or 100 ounces of water.

For longer missions, some CamelBak packs contain an overflow pocket which is expandable to fit a jacket, helmet, radio or other items, but most are designed for specific cargo and hydration capacities.

For quick detachment, packs are equipped with side-release buckles on the shoulder harnesses so the bag can be instantly dropped from the warfighter if need be. The DAAS is designed to work the rapid release system of the vest, which means when the warfighter pulls the rapid release handle, the hydration falls with the vest and does not inhibit the user. It is mounted directly to the back of the vest with no need for shoulder straps.

Any hydration system can have problems with mold or other microorganism growth in the moist environment of a water carrier. But proper maintenance can eliminate and prevent the problem.

According to CamelBak, the best way to maintain a hydration system is to clean it after every use, especially keeping it dry. Running purely water (no sugar-based drinks) is the best way to prevent build up. Mold will find a way to grow wherever there is moisture, and more so with sugar-based drinks, so keeping the reservoir clean and dry is a must for preventing build up.

Many military units use CamelBak products.

Blackhawk offerings include the Barrage Hydration Pack that features a 2.6 liter capacity. The packs are available in desert tan, green or mountain camo.

## WATER PURIFICATION

At one time, military water purification systems used basic technologies to purify water.

For example, the Army fielded an ERDLator, which essentially was a downsized municipal water treatment plant mounted on a 2.5-ton truck.

It could take highly polluted water—such as from the Rio Grande near Brownsville, Texas, water that was dark with filth—and turn it into sparkling, clear and, most importantly, safe water.

The ERDLator used a filter to block large objects and sediment, and then settling tank time to remove smaller sediment from the water. After that, the water was piped into a tank. In the middle of the tank was a tube-shaped core made of wire screening that was mounted vertically through the center of the tank. Personnel would cover the screen with a powder to filter the water further, before the water exited through an opening at the bottom of the screen tube. Finally, the water would be chlorinated and run through activated charcoal to remove any bad taste.

More recently, there have been improvements in the water purification process, with reverse osmosis being far more efficient in purification and desalinization than distillation. Reverse osmosis involves water essentially seeping through a membrane. Also, ultraviolet light



The L-3 Water Purification System Series 5.0. [Photo courtesy of L-3 Communications]

may be used to kill disease organisms in water.

Some excellent systems are available. For example, L-3 offers assets such as the Water Purification System Series 5.0. The system is man-portable, weighing approximately 70 pounds in a rugged Pelican Case about the size of a small suitcase. But it provides outsized capabilities, cranking out in excess of 1,000 gallons of purified water each day.

The Series 5.0 is the only portable mechanical filtration system to pass the stringent Emergency Military Operations Microbiological Water Purifiers NSF Protocol P248 testing.

Passing the P248 testing verifies that L-3's Series 5.0 does indeed remove 99.99 percent of viruses and bacteria such as, Cryptosporidium, Giardia, E. coli and Vibrio (Cholera), just to name a few.

"The L-3 system gives water-borne impurities including heavy metal, viruses and chemical contaminants, a one-two-three punch that knocks them out," Sandra Atkinson, L-3 marketing, explained. "We have three treatment systems, all in one case," she said.

The Series 5.0 system uses ultraviolet light to kill microorganisms in the water. Carbon and sediment filters remove particles, color, taste and odor. The unit also uses reverse osmosis (RO) membranes for an add layer of purification. The ROs are automatically flushed every 30 minutes to remove impurities from the membranes for continuous reliable operation. There is also a strainer at the bottom of the water intake float, to prevent large debris from entering the system. Actually, L-3 offers an entire family of water

purification systems, Atkinson explained, and all of them are man-portable: there is a 700 gallon-per-day (gpd) unit that weighs just 60 pounds, a 350 gpd unit weighing but 40 pounds, and a 180 to 200 gpd unit tipping the scales at a minuscule 20 pounds (weight of a unit varies depending on whether it contains water, and the amount of water).

Each of the L-3 Water Purification Systems can be set up and producing purified water in four minutes or less, and the unit restows in 45 seconds. The systems require an external water source, such as a stream or lake, and an external power source, Atkinson continued, with the systems able to run off any power source such as generator power, AC, DC, 12 or 24 volt vehicle power or standard 110 or 220 volt power. Solar power is also a viable option, requiring from 250 to 400 Watts.

Military organizations are currently evaluating L-3's water purifications systems, Atkinson said.

Another provider of water purification systems is Aspen Water Inc. Ed Atchley, vice president of marketing with Richardson, Texas-based Aspen Water Inc., explained how the firm's systems are used widely throughout the military, in places such as Afghanistan, Iraq and the Pacific, and in commands such as SOUTHCOM, AFRICOM and CENTCOM. Aspen Water systems also are used by the Army, Navy, Air Force and Marine Corps, he noted.

"I've been designing and building water purification systems for 20 years," Atchley said.

One of the attractions of the Aspen Water systems is that they can be set up, produce water and be torn down in 15 minutes, Atchley said. There are no bladders or settling tanks on the Aspen Water unit, he said.



Ed Atchley

Among units the firm offers is the 2000DM, a lightweight desalination system capable of being transported by a HMMWV and powered by its 24-volt electrical system. The 5500M, an updated version of the most popular Aspen Water model, produces 5,000 to 5,500 gallons of purified water per day from any non-saline water source. Aspen Water systems can use any AC or DC power source, he continued. The company also offers a portable solar power station.

Then there is the 1800BC/BP, a multi-tasked backpack and briefcase unit, using unrestricted rechargeable batteries.

These units also can be used to provide clean water to victims of natural disasters, so that water-borne disease epidemics don't erupt, he added, noting that FEMA uses them.

WorldWater & Solar Technologies Inc. of Princeton, N.J., makes a water purification system that operates on solar power fed into battery assets. Davinder Sethi, Ph.D., chief operating officer with WorldWater, and Melissa G. Burns, vice president of marketing, discussed their water purification technologies in an interview.

The Mobile Max Pure and its solar panels can be carried on a trailer or placed directly on the ground. It forms a seven-foot cube when stowed (transportable in an international shipping container, in an aircraft, or sling-loaded), with a quick 20- to 30-minute set-up time by two personnel, including deploying the 3-kW solar array that feeds power to batteries providing 24-hour operation.

Once operational, if the unit is operating with a fresh-water point source, it can produce a huge 30,000 gallons per day of safe potable water for troops, using multi-media filtration and ultra violet light.

If water is brackish, or if the system is processing sea water, the solar-powered unit still produces 3,000 or 4,000 gallons daily, using multimedia pre-filters and several reverse osmosis membranes.

The unit can produce chemical-free water, but if desired, other items such as chlorination or a separate activated charcoal treatment can be added, Sethi and Burns explained.

As a bonus, the solar power system produces more electricity than is required to charge batteries and run the water purification unit, so the excess power, AC or DC as needed, can be used to juice up rechargeable batteries that troops carry for electronic systems, meaning they don't have to carry heavy non-rechargeable batteries in their already weighty packs.

Burns and Sethi also offered a broader perspective on the issue of water purification, and just how critical it is for military units in war. This can be literally a matter of life and death, they noted.

"Any [local] environmental water source would require purification before consumption" by warriors, Burns said, except for very deep wells.

If locally available polluted water sources aren't treated in mobile plants such as those provided by WorldWater, then drinking water may have to be trucked in by convoys to supply combatants.

But the more convoys travel risky roads in theater, the more chances that personnel in the convoys will be struck by bullets from snipers, or that vehicles will be demolished by IEDs. "Many of the convoys at risk of being attacked transport fuel and water," Burns observed.

Water obtained locally by purification units lessens the number of water-supply convoys. Further, solar-powered purification units don't require fuel, lessening the number of fuel convoys. And the electricity that the solar-powered unit provides to personnel to charge their batteries further lessens the need for fuel for on-site generators.

Mobile water purification systems also can be used to generate good will for the military, such as providing safe and healthy water to



The WorldWater & Solar Technologies portable unit, the Mobile MaxPure system, purifies polluted water, using electrical power generated by the solar array.

civilians who otherwise would become ill drinking polluted water. Or the purification systems can be used in disaster relief efforts, where the military aids victims of storms, tsunamis, earthquakes and the like, Burns observed.

What's next for WorldWater? The company is working on a smaller solar-powered Mobile Max Pure, so compact it may be half to one-quarter the size of the existing system. It may take six to nine months to develop.

And the company is working on a project for the Office of the Secretary of Defense Rapid Fielding Directorate, developing a system that would provide warriors with solar-powered water purification, satellite communications and electrical power. The timeline for completion might be around the end of the year.

Hydro-Photon Inc., of Blue Hill, Maine, offers the handheld SteriPEN water purification system, in the Protector or Defender versions.

Pam Aubuchon-Fields, marketing manager with the company, provided details on the systems.

Using ultraviolet light, the units in seconds kill common water-borne disease microorganisms in clear water, such as viruses, bacteria and protozoa. Those pollutants include giardia and cryptosporidium.

The olive drab Protector is intended for use by military personnel.

Defender destroys over 99.9 percent of bacteria, viruses and protozoa, including cryptosporidium and giardia, and disinfects a liter of water in 90 seconds. The AA-battery-powered Defender involves no pumping, warming up, filters, testing or waiting. The unit weighs 5.7 ounces.

## MARITIME

The Navy is moving forward in hydration, too. Water desalination systems long ago banished the complaint penned by Samuel Taylor Coleridge in *The Rime of the Ancient Mariner*, about "water, water everywhere, nor any drop to drink."

Now, the oceans can be converted into giant reservoirs of potable water, with a little help from technology. And that technology soon will be even better.

The Office of Naval Research issued a request for information, seeking ideas from industry as to how ocean water desalination systems can be improved: Specifically, industry must propose how the amount of clean, potable water for sailors can be increased by 65 percent, while reducing the amount of energy needed to produce a gallon of drinkable water by 65 percent.

ONR anticipates that more than one contract award will result from the solicitation of ideas. ★

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