aquaya

improving health through clean water innovation

Standard Operating Procedure for the Deployment of Procter & Gamble's PUR Purifier of Water in Emergency Response Settings

The Problem: Drinking Water Contamination

Contaminated drinking water is a major problem during emergencies. Two major sources of contamination are microbial pathogens and suspended matter.

Pathogens. Microbial contamination of water occurs when human and animal fecal matter comes into contact with drinking water sources (such as rivers, lakes, ponds, or groundwater wells). It is common during floods and also during other instances of population displacement because water sources relied upon by displaced people are frequently of poor quality and rarely treated prior to the humanitarian response.

Since diarrhea is a central symptom of gastro-intestinal infections, many water-related illnesses are referred to as diarrheal diseases. The waterborne microorganisms that cause diarrheal diseases are:

(1) bacteria – primarily of the coliform family (e.g. *E. coli*, *Salmonella* and *Shigella*),

(2) protozoan parasites (e.g. *Giardia* and *Cryptosporidium*), and

(3) viruses (e.g. Norwalk and Rotavirus).

Suspended Matter. Suspended solid material (varying combinations of sediment – mud – and organic matter) is also common in contaminated water sources. Depending on their sources, these suspended solids can create health risks in addition to generating unpleasant tastes and odors. Contaminated rivers, lakes, ponds, and wells are frequently "turbid" – laden with a high suspended matter load.

A Solution: PUR

PUR is a powdered mixture that removes pathogenic microorganisms and suspended matter, rendering previously contaminated water safe to drink. PUR was developed by Procter & Gamble (P&G) in collaboration with the US Centers for Disease Control and Prevention (CDC). PUR contains a chlorine disinfectant (calcium hypochlorite) for killing bacteria and an iron salt coagulant (ferric sulfate) for removing suspended matter, protozoa, and viruses. It also contains a buffer, clay and polymer to provide good coagulation and flocculation. All of the ingredients used in PUR are used to purify drinking water in the United States and other developed countries. The difference is that PUR provides these ingredients at the household level rather than in a centralized treatment facility.

PUR is safe for long-term use by the entire family, including infants, and is considered an effective technology by the World Health Organization (WHO). PUR's application results in water quality that meets WHO guidelines.

In field and laboratory studies, PUR has been proven to eliminate disease-causing microorganisms and to remove virtually all suspended material. PUR results in removal of more than 99.99999% of bacteria (including those that cause cholera and typhoid fever), 99.99% of intestinal viruses (including those that cause hepatitis A), and 99.9% of protozoa (including Giardia and Cryptosporidum). In randomized controlled health intervention studies, PUR has been proven to reduce diarrheal disease incidence by up to 90%, with an average of about 50%.

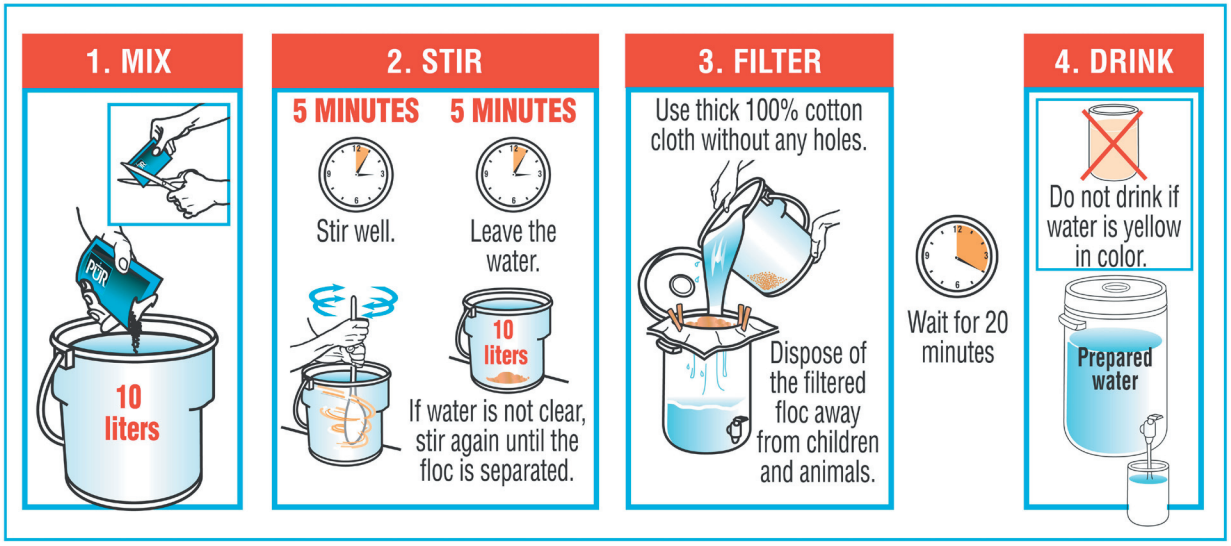
CARE, CDC, AmeriCares, Johns Hopkins University, and the Aquaya Institute have independently monitored PUR in a variety of emergency situations, including floods, refugee camps, and nutrition feeding programs, and concluded that PUR is both practical to use and results in a reduction in diarrheal illness. More than 200 million liters of safe drinking water have been provided by global relief groups using PUR including UNICEF, AmeriCares, Samaritan's Purse, WorldVision, and others in more than 14 countries. P&G received the 2005 Stockholm Industry Water Award for its efforts to provide PUR sachets to global relief groups.

PUR comes in a 4 gram sachet labeled in English. Each sachet treats 10 liters of water. The sachets arrive from the manufacturing facility in cartons containing 20 strips of 12 sachets each, for a total of 240 sachets per carton. Each carton is 25 cm x 11 cm x 15.5 cm (length, width, height).

Supplies Needed to Use PUR

PUR requires only a few simple tools that most target beneficiaries of disaster assistance should have at their disposal:

- a scissor or knife to open the sachet,
- a spoon or other implement to stir the water,
- a cloth fabric to filter the treated water, and
- two vessels (i.e. buckets) with volume capacity of 10 liters or more – the first to be used for the treatment process and the second to be used for storing the treated water.

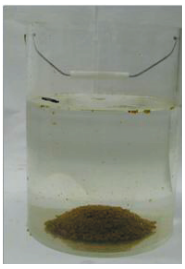


aquaya

How to Use PUR

(see also previous page)






The treatment procedure is as follows:

1. Open a PUR sachet using a pair of scissors. Add the contents of the sachet to a vessel containing 10 liters (2.5 gallons) of contaminated water. One simple way to measure a 10 liter volume is to use a 2-liter bottle five times. Extreme precision is unnecessary: if there are slightly more or less than 10 liters, the treatment procedure will still be effective.

2. Stir the powder steadily and vigorously in the water for five minutes. After adding the powder to the water, the water will become temporarily colored, and after a minute or two, large particles or "floc" will begin to form, with the water becoming clear in the process. At the end of five minutes, stop stirring and let the floc settle to the bottom of the container. If the water is still colored, it can be mixed again and left to rest for another few minutes.

3. Once the water looks clear, and the floc, or precipitated material, is at the bottom of the bucket, filter the water through a clean cloth into a clean storage container. The filter must be a cotton cloth that prevents the floc particles from passing through.

4. Wait 20 minutes before drinking the water. This is an important step, because it is during this time that remaining pathogenic bacteria are killed. The water should be stored in a container with a lid if available to keep it safe from recontamination.

Other Important Tips for PUR Application

- Roughly a single sachet per household per day for emergency use is an appropriate amount for distribution. Two 12-sachet strips will treat 240 liters of water, and should be sufficient to support a household for three weeks.

- It is important to stir the water vigorously for the floc to form properly. This visual sign is the signal that the product is working properly. The floc will form even if PUR is added to clear water.

- The floc from the water treatment process should be disposed of in the latrine or on the ground away from children and animals.

- Water that is still colored or cloudy after treatment should not be drunk. If floc accidentally gets into the treated water (by accidentally dropping the filter cloth into the water, for example), then another cloth should be used to refilter the treated water into a clean container.

- The chlorine in the water gradually disappears, and after 24 hours it will not be present in sufficient concentration to remove microbes. It is important to store and dispense drinking water so as to avoid recontamination.

- Water from the storage container should always be dispensed into another container, such as a cup or glass for drinking. Unwashed hands and utensils should never be dipped into the treated water because this is how treated water becomes re-contaminated. A solid cover on the treated water is preferred. If a lid is not available, a large plate or a towel may be used.

- A simple test to determine whether the cloth is adequate is to use it to filter the water. If the "floc" does not pass through the cloth then it is working correctly. A cotton cloth works best and you should not be able to see through the cloth. On the other hand, the cloth should not be so thick that it takes a prohibitively long time to filter the water.

aquaya

Recommendations for Overcoming Potential Obstacles to a Successful Distribution of PUR

A number of factors may limit the adoption of PUR in disaster settings and must be addressed to achieve successful PUR distribution:

(1) Lack of familiarity with the product and its usage, resulting in misperceptions of labor and time demand, and associated logistical challenges,
(2) chlorine odor and taste,
(3) color change during treatment process,
(4) lack of available buckets and cloth, and
(5) acceptance by govement officials and community leaders.

Each of these obstacles should be carefully addressed in order to achieve a successful PUR distribution. Experience with PUR in a variety of emergency relief situations has shown that by addressing these obstacles with a team of trainers, emergency relief groups can successfully distribute PUR.

Familiarization and education on PUR usage. PUR is a new product that many disaster victims will not recognize. *To be most effective, PUR should be distributed to communities with an accompanying demonstration of its usage. Teams of emergency responders should train hygiene educators to perform initial demonstrations as well as provide an opportunity for follow-up questions by community members.* A demonstration in which the presenter prepares PUR-treated water using a local source of water is the best way to educate people on proper use. It is important that the presenter drink the water at the end of the presentation to show confidence in the product. The presentation should emphasize that the amount of labor required for using PUR is roughly five minutes, even though the full treatment process requires 30 minutes. The instructions for using PUR should be provided in the local language(s). An effective way to do this is to translate the instructions into local language(s) and put them, along with the pictorial instructions, on a laminated card or on a sticker that can be provided with or on the buckets.

Education around chlorine taste and odor. PUR-treated water will have a chlorine taste similar to municipal water in developed countries. In many circumstances PUR will be distributed to people who have never been served by an improved water supply and who are not accustomed to chlorine taste and odor. Experience has shown us, however, that consumers will come to accept chlorine taste if they understand the importance of chlorine in removing microbial pathogens. Disaster survivors must be told during the product demonstration that the water will have a chlorine odor and taste that will diminish over a few hours, and that these odors and tastes are indicators of water safety. If people find the taste objectionable, they can be advised to prepare the water at night so that much of the chlorine taste will dissipate by the following morning.

Explaining the color change. A PUR demonstration must highlight the fact that a color change or darkening of even clear water will occur when the PUR powder is added to the water. This is an indication that the product is working properly. The color might be orange or brown depending on the nature of the source waters. The final drinking water should be clear.

Adequate supplies of containers and cloth. Under certain emergency conditions, containers such as buckets and jerry cans may not be available. In these cases, these supplies will need to be provided with PUR. It is important that beneficiaries possess the tools necessary to conduct the PUR procedure.

Acceptance by govement officials and community leaders. It is important to engage govement officials and community leaders so that they understand that PUR is a quality product, safe for their communities, and will provide an effective and practical solution to providing emergency drinking water. The emergency response needs to be coordinated with the local government recommendations so that there are not conflicting messages. For example, the community may not understand that there is no need to both boil water and use PUR.

When *not* to Use PUR

In addition to pathogenic microbes and suspended matter, PUR also has been shown to significantly reduce concentrations of pesticides like DDT as well as other high molecular-weight organic chemicals and particulate-fraction (undissolved) heavy metals. Arsenic levels, for example, are significantly reduced by PUR.

There are, however, some water contaminants *not* removed by PuR. These include:

- salinity,
- nitrate and fluoride,
- low molecular-weight organic chemicals (such as industrial solvents like TCE, PCE, and vinyl chloride), and
- dissolved heavy metals in high concentrations, such as would be found in mine tailings.

The above are not common contaminants in disaster response settings, but it is important to know when they are a problem, and not to deploy PUR when those contaminants are a major concern.

Finally, provision of household water treatment approaches such as PUR should be considered as part of a coordinated response to an emergency situation. For example, in some emergency relief situations it may be easier to distribute tankered or bottled water.

Additional Resources

http://www.pghsi.com/safewater/ - P&G Health Sciences Institute

http://www.who.int/household_water/en/ - WHO International Network for the Promotion of Household Water Treatment and Safe Storage

http://www.who.int/water_sanitation_health/dwq/wsh0207/en/index.html - *Managing Water in the Home: accelerated health gains from safe water supply*. Mark Sobsey, PhD., University of North Carolina, for WHO.