Water Pasteurization as a Means of Providing Clean Drinking Water

Dale Andreatta, Ph.D., P.E.

The purpose of this talk is to stimulate your thinking.

Lack of clean drinking water is a big problem.

- About 1.5 million deaths per year, mostly children.
- Much malnutrition, debilitation, and lost productivity.
- Great suffering.

Many ways to provide clean water

- Wells.
- Chlorination, large or small scale.
- Filtration, sand or ceramic filters.
- UV sterilization, small or large scale.
- Distillation (not needed if water is only biologically contaminated).

Pasteurization

- Heat water to 65º C for 6 minutes.
- NOT necessary to boil water.
- Hepatitis A virus is most heat-resistant pathogen.
- Can be very low cost.

From UNICEF publication, Jan. 2008

While the WHO and others recommend bringing water to a rolling boil for 1 minute, this is mainly intended as a visual indication that a high temperature has been achieved; even heating to pasteurization temperatures (60º C) for a few minutes will kill or deactivate most pathogens.

Water PAsteurization Indicator (the WAPI)

- Designed in 1992 by Andreatta and others.
- Mass produced and available to be purchased.
- Reusable.
- About $2.
- Continues to indicate after the water has cooled.

Pasteurization indicator

Two ways to pasteurize-1
Batch processes

- A vessel of water is heated all at once, with a pasteurization indicator in the coolest part of the vessel (usually the bottom).

Types of Solar Batch Pasteurizers

- The Aquapak personal pasteurizer. (4 liters per day).
- The solar puddle (25 liters or more per day).
- Solar cookers (4-8 liters per day)
- Clever arrangements of plastic sheets.
- Super small pasteurizers using glass bottles (less than 1 liter-probably not practical).

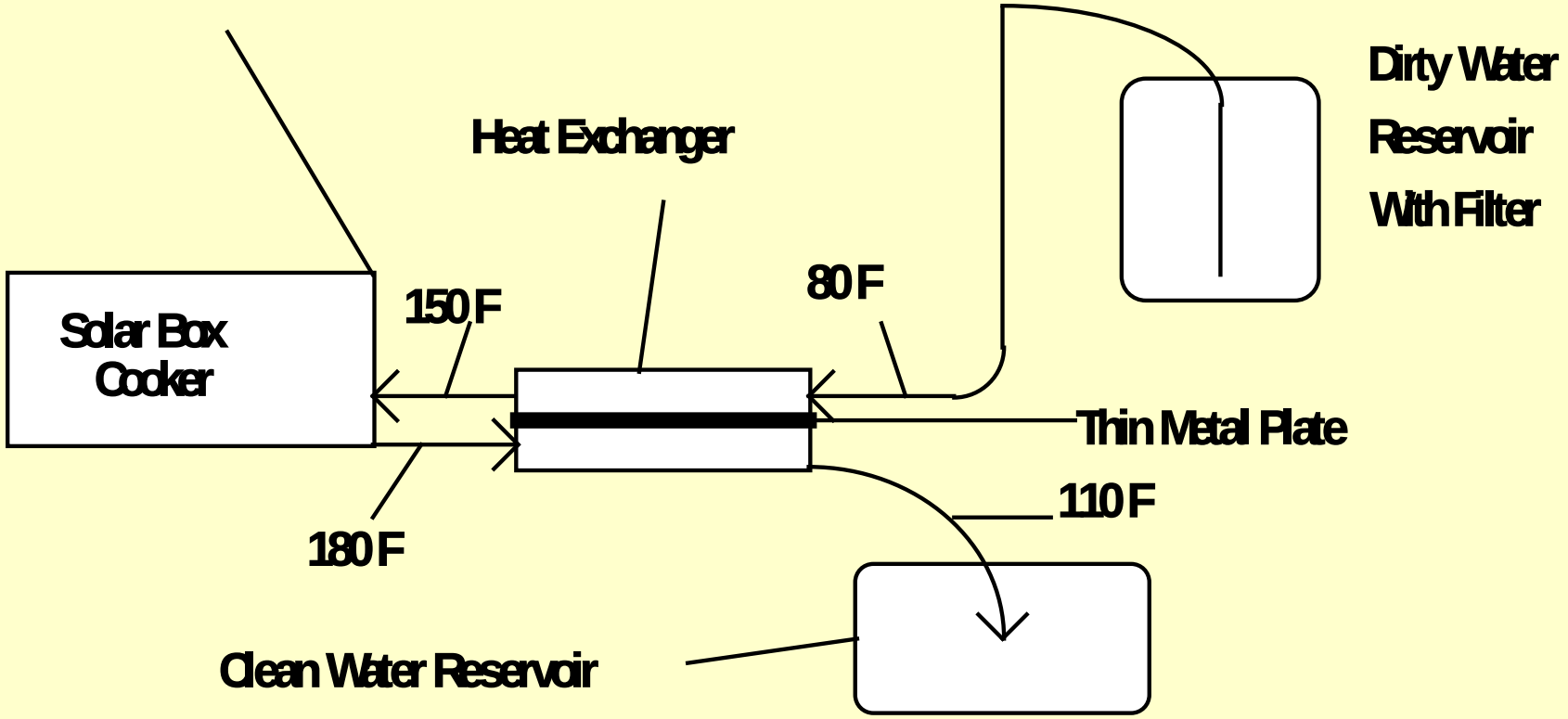
The Aquapak, a small solar pasteurizer

The solar puddle, a family-size solar pasteurizer

Two ways to pasteurize-2 Flow-through systems

- A continuous flow is established using a thermostatic valve.
- Typically 72º C for 15 seconds.
- Automatic.
- Can recycle the heat of the outgoing water, typically increasing water output about 4-fold per unit of heat input.

Schematic diagram of flow-through systems



A commercial flow-through unit

What does this have to do with stoves?

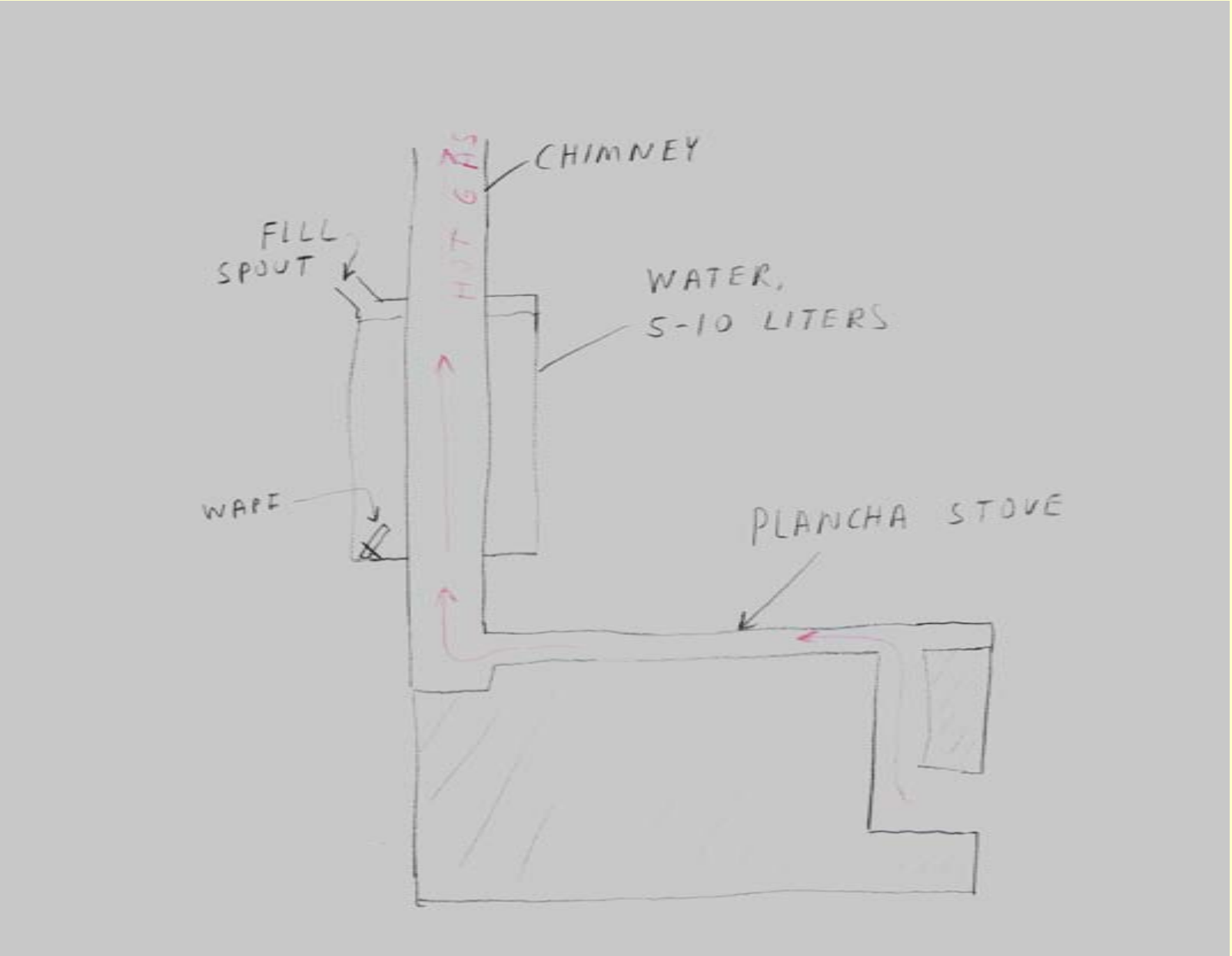
- Pasteurization works no matter what the source of heat.
- Stoves are heat generators that work in any weather at any time.

$4.10 water heater for tea, etc.

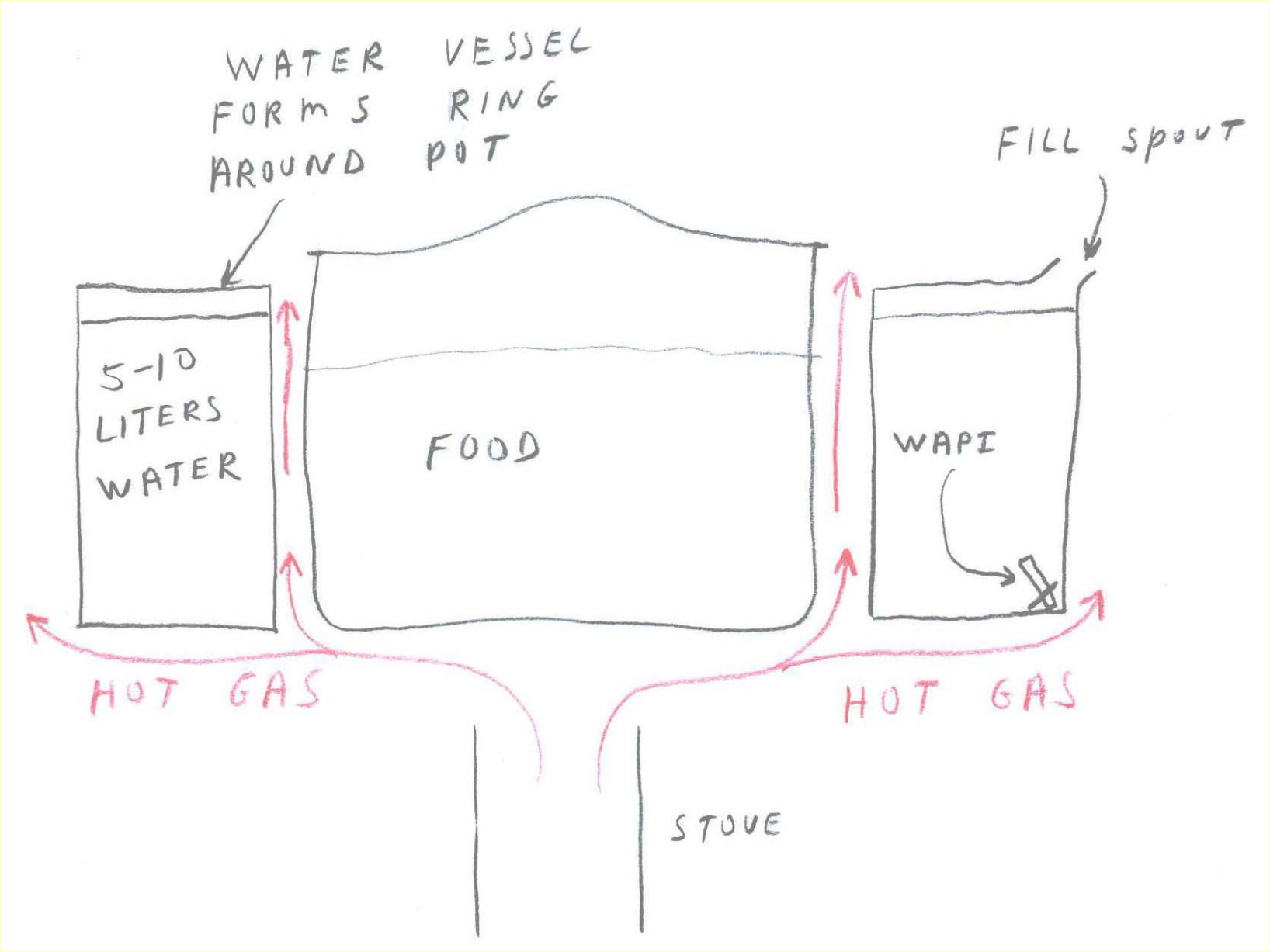
Batch processes

- Combine cooking with water pasteurizing.
- Use heat that would normally be wasted or poorly utilized.
- Pasteurize 5-10 liters per meal on a small stove.
- In mass production, such a device could be inexpensive.

Pasteurizer using heat in chimney



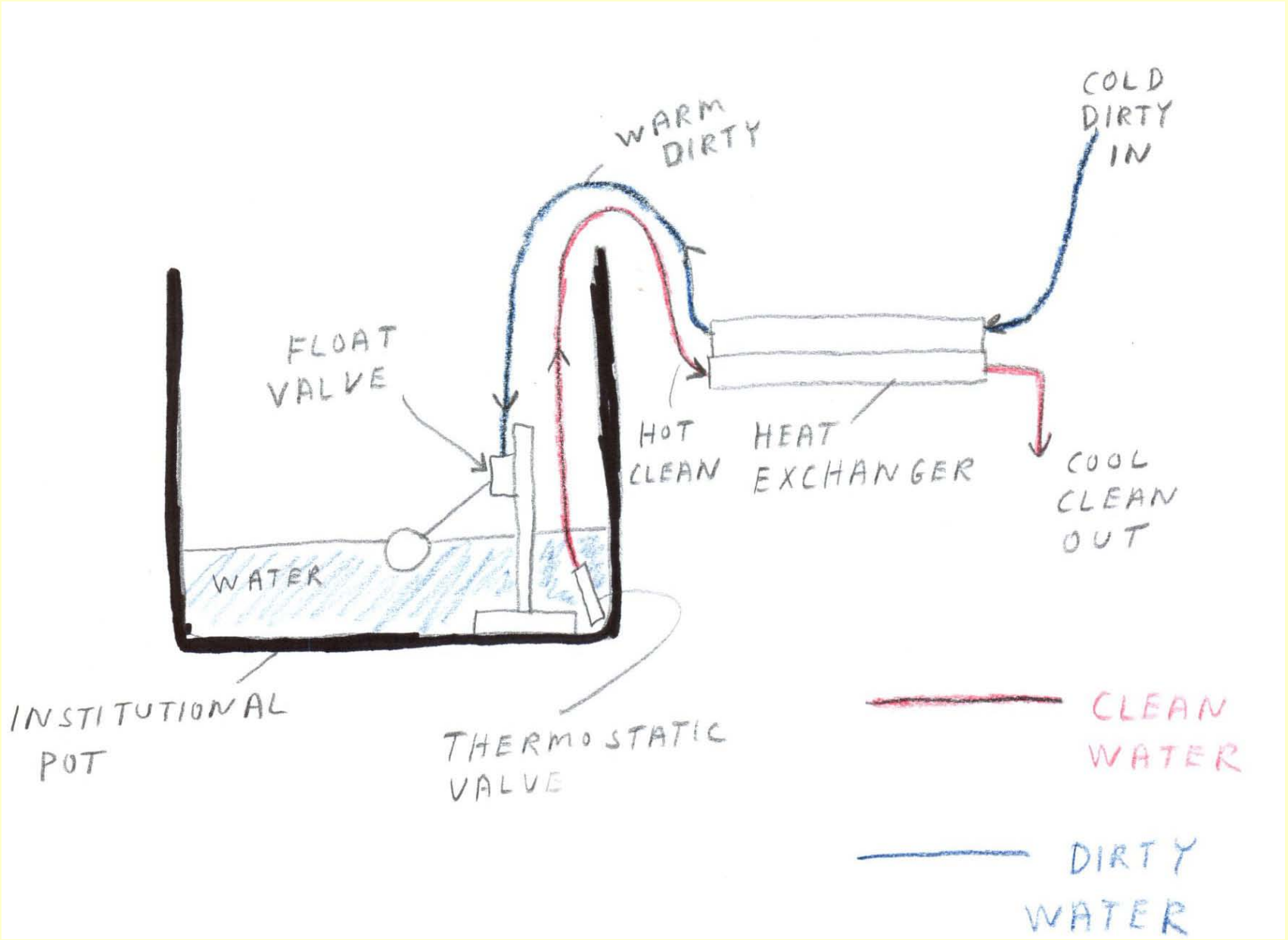
Pasteurizer using heat not normally used well



Flow-through system based on institutional stove and pot.

- Use thermostatic valve.
- Use heat exchanger.
- Don’t cook and pasteurize at the same time, but use the same equipment.

Flow-through pasteurizer based on institutional stove and pot



Further information

- http://images3.wikia.com/solarcooking/images/5/52/Summary_of_Water_Pasteurization.pdf
- Or search for Solar Water Pasteurization.
- Or search for Dale Andreatta.