

**Preliminary Report 30. 07. 2007**

**Disinfection of Jerry Cans in Okidi Camp and a Preliminary Assessment of the Water Supply System at Patongo Camp, Northern Uganda, July 2007**



**Centre for Environmental Health Engineering  
University of Surrey  
Guildford GU2 7XH**

**Tel: +44 (0)1483 689530  
Fax: +44 (0)1483 686681  
Email: [b.clarke@surrey.ac.uk](mailto:b.clarke@surrey.ac.uk)**



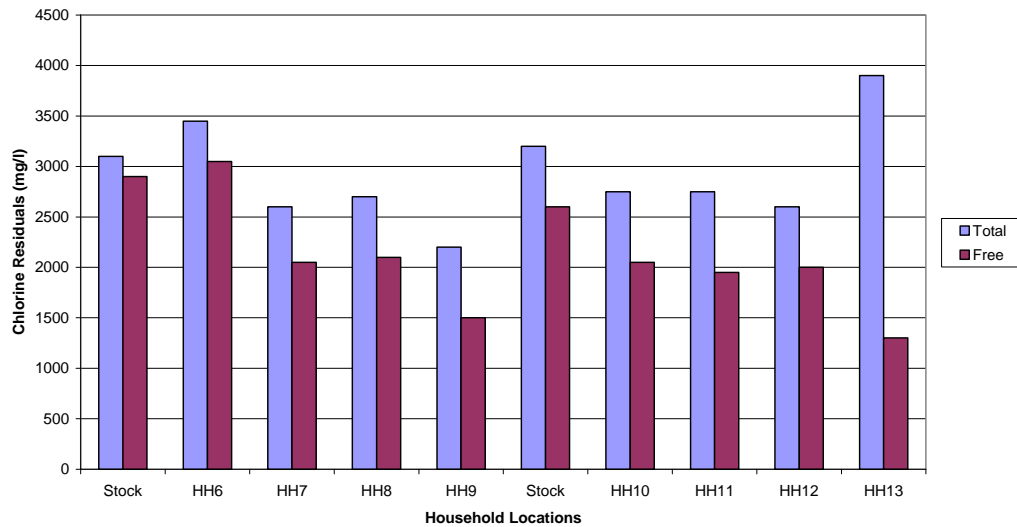
*Plate 1 ~ Okidi Camp July 2007*

1. A CEHE team comprising Brian Clarke, Andre Steele and Owen Watkins travelled to Oxfam Kitgum in July 2007 to deliver a 2 day Water Treatment & Supply Workshop and field test an innovative Aquaclor Solar unit which can generate high strength sodium hypochlorite disinfectant levels from salt and water.
2. The Aquaclor Solar experimental unit proved itself capable of producing 600-700ml/hour of sodium hypochlorite at 3000+ mg/l with the quality of salt used in Kitgum, and given the hours & intensity of sunlight prevailing at the time.
3. CEHE has returned the experimental unit to the UK and will carry out a forensic evaluation with Italian collaborator Dr Giovanni del Signore with a view to optimising what is a very small and conveniently transported system. Particularly as the production rates achieved, though impressive enough, contrasted with the 1.5 litres/hour production rate described in the Aquaclor Solar briefing sheet and there is therefore a possibility that the unit was damaged in transit?



Plate 2 ~ CEHE Postgraduate Researcher Andre Steele and the Aquaclor Solar

Figure 1 – Total & Free Chlorine Concentrations during Jerry Can Disinfection  
Households HH6-9 and HH10-13 Okidi Camp July 2007



4. The levels of total and free chlorine levels recorded in two separate jerry can disinfection trials (Figure 1) indicated that:
  - a. Concentrated sodium hypochlorite can conveniently be used to disinfect jerry cans by being poured from can to can, losing some of its effectiveness in the process but still requiring only a very short swill operation to maintain an appropriate disinfection contact time.  
{ Disinfection =  $C^n t$  }
  - b. Existing levels of contamination or calcium carbonate deposition in some cans was relatively high. The former suggested that the prevailing levels of hygiene in the camps is relatively low, although there were handpump features that inevitably contributed to levels of contamination.

- c. The groundwater was unexpectedly hard and the calcium bicarbonate had converted to the insoluble calcium carbonate within some jerry cans. The strong sodium hypochlorite caused these jerry cans to foam, as the calcium carbonate reacted with the hypochlorite. There is absolutely no health risk associated with the chemical reaction but it is speculated that this level of solids deposition in jerry cans could provide a reservoir for pathogens?



*Plate 3 ~ Jerry Can Disinfection in the Okidi Community*

5. Disinfection tests were carried out with the enthusiastic support of the community in the Okidi Camp, thanks mainly to the PHE team and Community Supporters from Oxfam Kitgum who are clearly accepted as a very positive presence.
6. Bearing in mind that a "1% and a pebble" level of calcium hypochlorite in a jerry can would exceed levels shown on Figure 1, the results indicate that the same initial stock solution of sodium hypochlorite can be utilised to successfully clean an appreciable number of jerry cans if the progressive decline in free chlorine levels is taken into account.

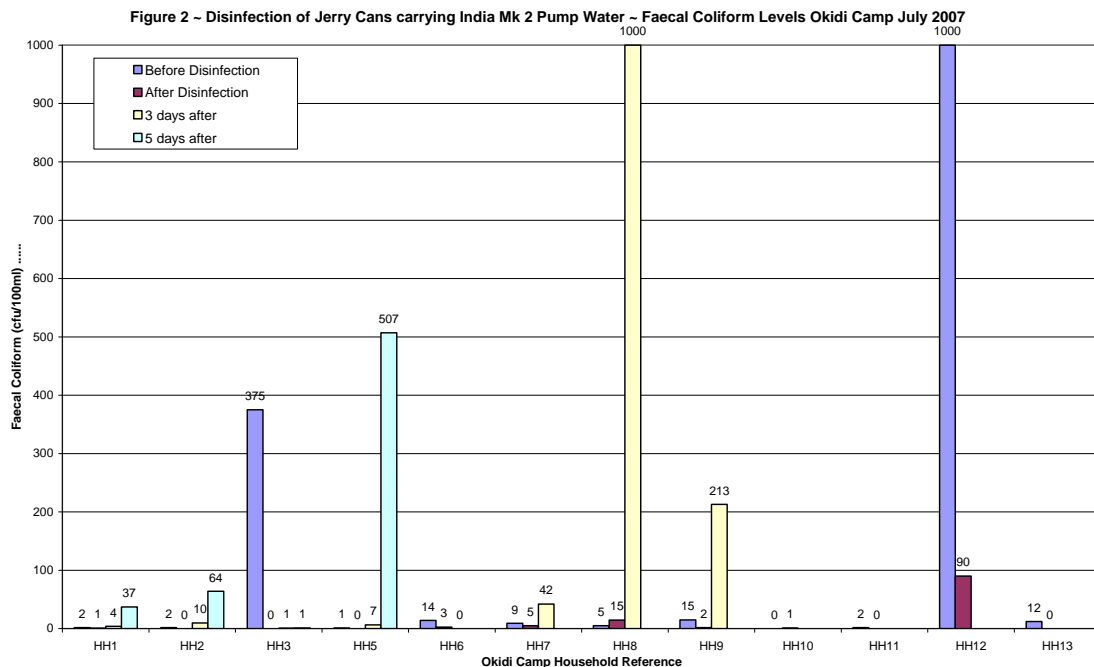


*Plate 4 ~ Foaming caused by Calcium Carbonate deposition within the Jerry Can*



*Plate 5 ~ The India Mark 2 delivery tube does not fit Jerry Cans, leading to the use of dirty plastic funnels and poor hygiene practice*

7. A limited "sanitary survey" approach was adopted to identify key risks once the somewhat rapid re-contamination levels of "previously disinfected" jerry cans was detected.
8. The first obvious hygiene risk was the habit of the community in throwing away jerry can stoppers, although difficult to understand, it was suggested that this is possibly related in some way to the fact that the India Mark 2 delivery tube does not fit jerry can spouts.
9. More obviously the informal funnels used to assist in filling jerry cans were an obvious area of risk, as were the hands used to hold them in place.
10. CEHE monitoring showed that the groundwater quality discharging from the main pump serving the Camp was of good quality and complied with the Sphere Standard Key Indicator for microbial water quality [ Zero faecal coliform / 100 ml ].



11. Results of progressive testing in the Okidi Camp (Figure 2) indicated that the sodium hypochlorite offered a means of disinfecting contaminated jerry cans [HH3 & HH12]. Although the poor state of jerry cans in Okidi Camp would require slightly longer swill contact times to be adopted if the total disinfection of all jerry cans was a required outcome.
12. It is speculated that the ability to produce such a strong sodium hypochlorite solution in such a convenient manner could be of considerable advantage both on a day to day basis and if a step change in disinfection operations was required during (say) a cholera outbreak. Sodium hypochlorite would be very easy to dose by syringe into jerry cans etc.
13. A marked feature of the tests in Okidi Camp was the very short period after disinfection when relatively high levels of contamination were again recorded in some disinfected jerry cans [HH5 & HH8], indicating that poor levels of hygiene were being maintained. Although this is not to be unexpected, given

the conditions in the camp, it points to the need for increased levels of hygiene promotion possibly supported by a disinfection programme?

14. At the request of Oxfam Kitgum Brian Clarke and Owen Watkins travelled to Patongo Camp to view the existing water supply system and assess the possibility for improving the supply to an area where existing tap stands are not able to maintain a supply at key periods of the day.



*Plate 6 ~ Tapstand in Patongo Camp*

15. In the larger Patongo Camp a pumped borehole provides water to plastic storage tanks and a distribution system, reportedly constructed mainly in 63mm pipe, connects to a network of 10-15 tapstands (precise number not known by CEHE).
16. CEHE was able to provide the Oxfam Kitgum PHE Team with a number of options for their consideration, but pointed out that a definite solution would be obtained by incorporating a "service reservoir" in the area where supplies were currently inadequate and which connected directly to the nearby borehole. A simple small diameter junction on the borehole head could achieve the desired result.



*Plate 7 ~ Borehole Head at Patongo Camp*

17. Water quality characteristics varied from Camp to Camp and a "random sample" approach was adopted to take advantage of Oxfam Kitgum PHE Team work patterns, thereby maximising work in what is a relatively large study area.
18. Turbidity and iron levels that exceeded WHO Guideline Values were recorded at a number of locations, but the nitrate levels recorded for a central tapstand in Patongo are viewed as a matter of concern [ 78.83 mg/l set against a WHO Guideline Value of 50 mg/l ]. It is recommended that further tests are carried out to determine if the reading was a limited local event or whether natural levels or contamination from the sizeable population in Patongo are presenting a clear and tangible health risk.
19. High nitrate levels can adversely impact on the health of children. In young children bacteria in the digestive tract can reduce nitrates to nitrites which convert the oxygen-carrying haemoglobin into methaemoglobin (hence methaemoglobinaemia). Infants have a high fluid intake relative to body weight and the proportionate reduction in the oxygen-carrying capacity of the blood has been known to make infants go blue (in essence they are asphyxiating), hence the conditions name in some industrialised countries "blue baby syndrome".