

DEVELOPING A NATIONAL ACTION PLAN FOR HOUSEHOLD WATER TREATMENT AND SAFE STORAGE IN THE REPUBLIC OF VIET NAM

*Thomas F. Clasen, JD, PhD
London School of Hygiene & Tropical Medicine*

1. BACKGROUND

1.1 Legal Context

The *National Rural Clean Water Supply and Sanitation Strategy Up to the Year 2020* (NRWSS Strategy) seeks to improve the health and living conditions of the rural population by setting targets of 60L of clean water per person per day for 2010 (85%) and 2020 (100%) as well as sanitation. It establishes an immediate priority for water quality for populations affected by droughts and floods and those living in remote areas. Priority is also given to nurseries, schools, hospitals, clinics and other institutions. It advocates a demand-response approach, with users deciding on technologies and paying the costs, and using IEC programmes to guide user understanding. It allocates responsibilities for implementation to the Ministry of Agriculture and Rural Development (MARD) for coordinating implementation of RWSS programmes and projects, overall coordination of IEC, pilot implementation and technical guidance. The Ministry of Health (MoH) is responsible, among other things, for setting water quality standards and monitoring water quality.

The *National Target Program for Rural Water Supply and Sanitation (2006-2010)* (NTP II) confirms the targets established under the NRWSS Strategy and establishes specific objectives, guidelines, principles and program activities. NTP II recognizes the role of IEC to establish the links between water, sanitation and health, generate demand for clean water, provide users with informed decisions about technologies, and encourage users to contribute financially to water and sanitation. It also recognizes the need to identify and pilot appropriate technological solutions to improve water quality, with a particular emphasis on challenging regions: “High attention to different water treatment technologies to improve water quality will be paid, especially in difficult areas such as mountainous areas, alum contamination areas, salinity intrusion areas, flooded and drought-stricken areas.”

Two separate decisions by the MoH govern water quality standards and monitoring. Decision No. 1329/QD-BYT of April 18, 2002 sets standards for drinking water (“water used for eating, drinking, food processing, personal hygiene, and water from supply plants in urban areas”) and contains parameters both for human health and acceptability. Decision No. 09/2005/QD-BYT of March 11, 2005 applies to clean water (“used for persons and families in daily living and not for direct drinking water”). Consistent with WHO Guidelines for drinking water quality, the microbiological standards for drinking water are zero *E. coli* or thermotolerant coliforms (TTC); for clean water the standard is zero *E. coli* or TTC, and not more than 50 total coliforms per 100/ml sample. The maximum limits for arsenic are 0.01mg/l for drinking water and 0.05mg/l for clean water.

Decision No. 45/2008/QD-BNN of March 11, 2008 of the MARD establishes the functions, tasks and organizational structure of the National Center for Rural Water Supply and Environmental Sanitation (NCERWAS) as an administrative centre under MARD, with authority to implement and manage rural

water supply and environmental sanitation (RWSS) nationwide. Among other things, the duties of NCERWAS include participation in establishing national strategies, plans, norms and technical standards concerning RWSS; provide guidelines, training and capacity building for local Centres for Clean Water and Rural Environmental Sanitation; to perform scientific research and technology transfer for clean water supply and treatment; and to coordinate with national and international organizations operating in RWSS. . The Standing Office (SO) in MARD is responsible for the management of the RWSS NTP II.

1.2 Water and Health

Unsafe drinking water, along with poor sanitation and hygiene, are the main contributors to an estimated 4 billion cases of diarrhoeal disease annually, causing 1.8 million deaths, mostly among children under 5 years of age (WHO 2005). Among children under 5 in developing countries, diarrhoea accounts for an estimated 21% of deaths. Because diarrhoeal diseases inhibit normal ingestion of foods and adsorption of nutrients, continued high morbidity also contributes to malnutrition, a separate cause of significant mortality; it also leads to impaired physical growth and cognitive function, reduced resistance to infection, and potentially long-term gastrointestinal disorders. Faecally-contaminated drinking water is also a major source of hepatitis, typhoid, and cholera as well as opportunistic infections that attack the immuno-compromised.

Diarrhoeal diseases are the third leading cause of death (after neonatal causes and pneumonia) in children under 5 years of age in Viet Nam, representing 10% of all such deaths (WHO 2006). Among all ages, diarrhoea is among the top ten killers in Viet Nam, with an estimated 9400 deaths annually (WHO 2008). The country also has a comparatively high incidence of shigellosis and typhoid fever, and experiences frequent outbreaks of cholera (Kelly-Hope 2007). While Viet Nam has a comparatively high national coverage of improved water (97% urban, 85% rural), only 10% rural homes have piped water while 51% rely on dug wells (51%). Even these improved sources, however, are subject to frequent and extensive faecal contamination. In a recent large water quality assessment by the Viet Nam Ministry of Health, only 29.9% of all samples from improved water supplies met the WHO guideline value for thermotolerant coliforms, the indicator for faecal contamination. As a result, the people of Viet Nam take charge of their own water quality by treating it at the household level, mainly by boiling.

Among chemical contaminants, arsenic and excess fluoride are the primary risks to health. However, unlike microbial pathogens, which cause acute disease and mainly attack the children and others without competent immune systems, these chemical agents cause disease after extended exposure. The long-term ingestion of drinking water can cause arsenicosis, or chronic arsenic poisoning, as well as cancer. While there is no treatment, symptoms can often be reversed by eliminating or reducing exposure, mainly by changing to water supplies that meet or exceed maximum limits, or if impractical, by treating the water to reduce arsenic levels. The Viet Nam National Institute of Occupational and Environmental Health first reported cases of arsenicosis in 2004 (Dang 2004). Between 0.5 and 1.0 million Vietnamese people are expected to be at chronic risk from arsenic exposure, mainly in Ha Nam province (Red River delta in the north), Dong Thap province (Mekong river delta in the south) (Berg 2007).

1.3 Water Supplies and Water Quality

As noted above, the Government of Viet Nam has made improved water supplies a major priority. According to the 2006 Demographic and Health Survey (DHS) data used by the Joint Monitoring Committee on Water and Sanitation (JMP), 97% of urban populations and 85% of rural dwellers have access to “improved water supplies”. However, while 61% of urbanites have household connections (and 29.4% use private wells), only 10% of rural populations have household connections.

The main water supplies for rural populations are private wells (56.4%), rainwater collection systems (14.0%), springs (7.4%) and rivers or streams (7.3%). Coverage varies considerably by region. According to the Multi-Indicator Cluster Survey (MICS) for Viet Nam in 2006, in the mountainous and comparatively poor North West only 72.6% of the population using improved supplies. In the Mekong Delta region, which is often affected by floods, improved water coverage is 78.9%.

Despite comparatively high levels of improved water supplies, water quality monitoring suggests that water supplies in Viet Nam rarely meet national standards for drinking water quality. A MoH report found only 26.7% of water sources used by rural populations satisfied the TTC standard of zero/100ml. However, in the Northern, Red River and Coastal regions, the average was less than 10%. Tap water (72.1%) was most likely to be free of TTC, while rainwater (36.4%), tub well water (32.4%) were considerably lower; dug wells (16.0%) were actually more likely to be contaminated with TTC than surface water (16.6%). These results also suggest that some of the sampling was done at the household level with water that has already been treated.

2. Household Water Treatment and Safe Storage

2.1 Background

Providing safe, reliable, piped in water to every household is an essential goal, yielding optimal health gains while contributing to the MDG targets for poverty reduction, nutrition, childhood survival, school attendance, gender equity and environmental sustainability. Initiatives such as increasing piped-in supplies and harvesting rainwater are critical for achieving water security. While committed strongly to this goal, and to incremental improvements in water supplies wherever possible, the WHO and others have called for interim approaches that will accelerate the health gains associated with safe drinking water for those whose water supplies are unsafe (WHO 2007).

Interventions to treat and maintain the microbial quality of water at the household level are among the most promising of these approaches. This is particularly true in settings, like much of the Viet Nam, where populations have access to sufficient quantities of water, but where the water is microbiologically unsafe. Even harvested rainwater and other supplies that are relatively safe at the point of collection benefit from household water treatment and safe storage by addressing recontamination of water during collection, storage and use in the home. Effective point-of-use interventions—if used correctly and consistently—can significantly improve the microbiological and chemical integrity of the water at the point of ingestion, and thus deliver some of the health benefits of safe, reliable piped-in water. The WHO-sponsored International Network to Promote Household Water Treatment and Safe Storage (HWTS) coordinates the efforts of all stakeholders to advance HWTS (www.who.int/household_water).

2.2 Selected Approaches

A study commissioned by the WHO identified 37 different products, technologies and approaches used in the microbiological treatment of drinking water in the home (Sobsey 2002). Only a few of these approaches have been rigorously assessed for the microbiological performance and health impact and have been shown to be cost-effective. These proven approaches are summarized below.

a. Boiling. Boiling or heat treatment of water with fuel is effective against the full range of microbial pathogens and can be employed regardless of the turbidity or dissolved constituents of water. It is by far the most common means of treating water at the household level, and is practiced by more 500

million people in low- and middle-income countries (Rosa 2008). As noted below, it is widely practiced in Viet Nam. While different sources recommend boiling water for 5, 10 or even 25 minutes, the WHO and others recommend bringing water to a rolling boil for just one minute (WHO 2004). This is mainly intended as a visual indication that a high temperature has been achieved; even heating to pasteurization temperatures (60° C) for a few minutes will kill or deactivate most microbial pathogens. However, in other countries, the inconvenience of boiling, the cost and time used in procuring fuel, the potential aggravation of indoor air quality and associated respiratory infections, the increased risk of burns, and questions about the environmental sustainability of boiling have led to other alternatives.

b. Chemical Disinfection. Chemical disinfection is the most widely-practised means of treating water at the community level; apart from boiling, it is also the method used most widely in the home (Rosa 2008). While a wide range of oxidants are used in treating water, most household-based interventions employ hypochlorous acid derived from liquid sodium hypochlorite, solid calcium hypochlorite or high test hypochlorite (HTH) which are frequently available and affordable. Tablets formed from dichloroisocyanurate (e.g., NaDCC), a leading emergency treatment of drinking water, and novel systems for on-site generation of oxidants such as chlorine dioxide, also have a role in household water treatment. At doses of a few mg/l and contact time of about 30 minutes, free chlorine inactivates more than 99.99% of enteric pathogens, the notable exceptions being *Cryptosporidium* and *Mycobacterium* species. Its impact in reducing diarrhoeal diseases has been documented (Arnold 2006). The “Safe Water System (SWS)” is a programmatic chlorination intervention developed by the US Centers for Disease Control and Prevention in response to a cholera outbreak in Latin America. It combines bottles of dilute sodium hypochlorite with safe storage and behaviour change techniques (www.cdc.gov/safewater). Dichloro-isocyanurate (NaDCC) tablets, another source of chlorine for treating drinking water, have been used by UNICEF and others for emergency response, and have recently been approved for routine water treatment (Clasen 2006).

c. Microbiological Filtration. Household filters potentially present certain advantages over other technologies. They operate under a variety of conditions (temperature, pH, turbidity), introduce no chemicals into the water that may affect use due to objections about taste and odour, are easy to use, and improve the water aesthetically, thus potentially encouraging routine use without extensive intervention to promote behavioural change. At the same time, they have a higher up-front cost. Higher quality ceramic filters treated with bacteriostatic silver have been shown effective in the lab at reducing waterborne protozoa by more than 99.9% and bacteria by more than 99.9999%, and their potential usefulness as a public health intervention has been shown in development and emergency settings (Clasen 2004; 2006). The improving quality of locally-fabricated silver coated ceramics is particularly promising as a sustainable and low-cost alternative (Brown 2007). Slow-sand filters, which remove suspended solids and microbes by means of a slime layer (schmutzdecke) that develops within the top few centimetres of sand, are capable of removing 99% or more of enteric pathogens if properly constructed, operated and maintained (Hijnen 2004). A simpler but more advanced version, known as the “biosand” filter, was specifically designed for intermittent use and is more suitable for household applications. It has been tested both in the laboratory and the field (Stauber 2006) and is being deployed widely in development settings by the Centre for Affordable Water and Sanitation Technology (www.cawst.org). The Kanchan Arsenic Filter combines the microbiological performance of the biosand filter with iron-based sorption to reduce levels of waterborne arsenic.

d. Solar Disinfection. Solar disinfection, which combines thermal and UV radiation, has been repeatedly shown to be effective for eliminating microbial pathogens and reducing diarrhoeal morbidity (Hobbins 2004) including epidemic cholera (Conroy 2001). Among the most practical and economical is the “Sodis” system, developed and promoted by the Swiss Federal Institute for Environmental Science and Technology (<http://www.sodis.ch>). It consists of placing lower turbidity (<30NTU) water in clear plastic bottles (normally 1.5-2.0L PET beverage bottles) after aerating it to increase oxygenation and

exposing the bottles to the sun, usually by placing them on roofs. Exposure times vary from 6 to 48 hours depending on the intensity of sunlight. Like filters, thermal and solar disinfection do not provide residual protection against recontamination. Accordingly, householders must have a sufficient number of bottles to allow them to cool and maintain treated water in the bottles until it is actually consumed.

e. Combination Flocculation and Disinfection. A particular challenge for most household-based water treatment technologies is high turbidity (suspended solids). Such solids can use up free chlorine and other chemical disinfectants, cause premature clogging of filters, and block UV radiation essential in solar disinfection. While turbidity can often be managed by pre-treatment or even simple sedimentation, flocculation/coagulation using common substances such as alum can be an effective and relatively low-cost option. Such forms of assisted sedimentation have been shown to reduce the levels of certain microbial pathogens, especially protozoa that may otherwise present a challenge to chemical disinfectants. However, disinfection is still required in most cases for complete microbial protection. Certain manufacturers have combined flocculation and time-released disinfection in a single product that is sold in sachets for household use. Tests of one product have shown that it reduces waterborne cysts by more than 99.9%, viruses by more than 99.99% and bacteria by more than 99.99999% (Souter 2003). Unlike the other methods of household water treatment discussed above, it has also been shown effective in reducing arsenic, an important non-microbial contaminant in certain settings. Field studies have shown such flocculation-disinfection products to be effective in preventing diarrhoeal diseases (Reller 2003). While these products are relatively expensive on a per litre treated basis, they may have application in certain emergency and other settings with high or unpredictable turbidity.

f. Safe storage. Once water has been collected or treated, it is immediately vulnerable to recontamination from microbial pathogens unless protected by the presence of a residual disinfectant (such as chlorine) or protected by safe storage. Research has shown that stored water supplies in the home frequently contain higher levels of bacteria than water at the source (Wright 2003). Harvested rainwater, for example, is often safe at the point of collection but subsequently contaminated in the home. This is principally due to contact with hands during collection, transport or use in the home. In the case of boiled water, recontamination also arises from adding contaminated cold water to the boiled water in order to cool it (Clasen 2008). Recontamination can be minimized by changes in behaviour that discourage contact with hands. However, a more effective solution is a storage vessel that prevents hand contact by employing a narrow mouth for filling with tight fitting cap and a tap or spout for drawing or pouring water from the vessel rather than dipping into it.

g. Arsenic remediation. A variety of household-based interventions have been used to decrease the level of arsenic in water used for drinking and cooking, with various levels of success. Many of these technologies were developed and tested in Bangladesh where the presence of elevated levels of arsenic in groundwater was first widely recognized. In Viet Nam, Berg and colleagues (2006) have shown that rapid sand filter currently used at the household level to remove iron, are 80% effective against arsenic. Recognizing the need for affordable, reliable, low-maintenance, electricity-free technologies for reducing arsenic in drinking water to an acceptable level for human consumption, the Grainger Foundation in cooperation with the US National Academy of Engineering (NAE) established a competition to identify the most promising solutions in low-income settings. In February 2006, NAE announced three winners. The SONO filtration system, which is based on a composite-iron matrix (CIM), has been extensively tested and used in Bangladesh, and meets or exceeds local government guidelines for arsenic removal. NAE recognized this innovative technology for its affordability, reliability, ease of maintenance, social acceptability, and environmental friendliness. The second-place award was given to a community water-treatment system based on activated alumina. The third-place award was given to Procter & Gamble for its PUR technology, which uses calcium hypochlorite (bleach) to kill a wide range of microbial pathogens and ferric sulfate to remove arsenic through flocculation-

precipitation. The addition of broken bricks and rusted nails to a BSF (Kanchan filter) has shown some capacity for arsenic, thus offering the benefits of microbial and chemical reductions.

2.3 Evidence on Health and Economic Impact

This section summarizes research on the health and economic implications of household water treatment. That research suggests that (i) household-based water treatment can deliver significant health gains over conventional source-based interventions, (ii) the up-front cost of providing low-cost household water treatment is about half that of conventional source-based interventions, (iii) most or all of that cost can be borne directly by the beneficiary, not the public sector, and (iv) the public sector will nevertheless recover more than the full cost of implementation from reduced health costs for disease treatment.

a. Effectiveness against diarrhoeal diseases. Because it prevents recontamination of water in the home, treating water at the household level is more effective than conventional improvements in water supplies in ensuring the microbiological quality of drinking water at the point of consumption (Sobsey 2002). This translates into improved health outcomes. In a systematic review of 15 intervention studies for the World Bank, Fewtrell and colleagues (2005) reported that household-based water treatment and safe storage was associated with a 35% reduction in diarrhoeal disease compared to a statistically insignificant 11% for conventional source-based interventions. A more recent and comprehensive Cochrane review covering 38 randomized, controlled trials and 53,000 people in 19 countries found that household-based interventions were about twice as effective in preventing diarrhoeal disease (47% reduction) as improved wells, boreholes and communal stand pipes (27%) (Clasen 2006).

b. Cost. The cost of implementing water quality interventions varies, from a low of US\$0.63 per person per year (solar disinfection) and US\$0.66 (chlorination) to US\$3.03 (ceramic filters) and US\$4.95 (combined flocculation/disinfection). This compares to an average US\$2.61 per person per year for installing and maintaining wells, boreholes and communal tap stands in Asia (Clasen 2007). The cost of treating water by boiling has not been rigorously investigated in Viet Nam, but has been calculated in other settings in Asia using a variety of fuels. The estimated cost of fuel for boiling water in Viet Nam (where most people collect or purchase wood for cooking) is \$0.272/household/month for wood collectors and US\$1.68/household/month for wood purchasers (Clasen 2008). Cost estimates include estimates for the value of the time required to practice the method, but do not fully reflect the relative convenience or burden of one method over the other since these have not been rigorously measured and may depend on local factors and traditions.

c. Cost-Effectiveness and Cost-Benefit Analyses. The combination of lower cost and higher effectiveness renders household-based chlorination the most cost-effective of water quality interventions to prevent diarrhoea, with a cost effectiveness ratio in Wpr-B (the WHO epidemiological sub-region that includes Viet Nam) of US\$521 per disability-adjusted life year (DALY) averted, compared to US\$1077 for conventional source-based interventions (Clasen 2007). When health cost savings are included in the analysis, implementing low-cost HWTS interventions such as home-based chlorination and solar disinfection actually results in net savings to the public sector; in other words, the intervention more than pays for itself. A recent WHO-sponsored analysis also concluded that household-based chlorination was among the most cost-beneficial of the various options for pursuing the MDG water and sanitation targets, yielding high returns on every dollar invested mainly from lower health care costs but also increased productivity and the value of school attendance (Hutton 2007).

d. Willingness to Pay. Finally, there is considerable evidence that the target population is willing and able to pay for some or all of the cost of household-based water treatment products, leveraging public sector and donor funding and allowing it to be more focused on the base of the economic pyramid (Ashraf 2006). As described more fully below, more than ninety percent of the

national population reports that they usually boil their water before drinking it. Even 86% of the lowest income quintile claim to boil their drinking water. Thus, there is compelling evidence that the Viet Nameese people recognize the need for treating their water and are willing to cover the cost of boiling. Since the cost of fuel for boiling exceeds the cost of solar disinfection and chlorination with sodium hypochlorite (US\$0.63 and US\$0.66 per person per year, respectively (hardware and programmatic costs), it can be assumed that they might be willing to pay for those interventions if they deemed them to be more attractive than boiling. It is not clear what portion of the population would be willing or able to pay higher costs for filtration and flocculation options. As noted previously, the National Strategy expressly contemplates that householders demonstrate their demand by contributing to the cost of water treatment solutions.

2.4. Epidemics and Emergencies

Outbreaks of infectious diseases and other emergencies occasioned by flooding and drought impose a heavy health burden in Viet Nam and divert scarce health and economic resources away from continued national and regional development strategies. Because of its potential for rapid and targeted deployment, household-based water treatment can be an effective intervention in response to such epidemics and emergencies. Point-of-use chlorination, solar disinfection and sachets combining flocculation/disinfection have been shown effective in reducing transmission of cholera and other diarrhoeal disease in outbreaks and emergencies (Conroy 2001; Doocy 2006). There is also evidence that such epidemics and emergencies provide an opportunity for increased adoption and long-term use by the target population (Ram 2007; Clasen 2006).

While boiling is promoted in Viet Nam and elsewhere in response to outbreaks of suspected water borne diseases and other emergencies involving interruption of water supplies, there is evidence that it may not be completely protective in actual practice. In random sampling of 400 households in Indonesia following the 2005 tsunami where people were encourage to boil, 47.5% of samples from the households were positive for *E. coli*, with 13.3% >101 CFU/100ml (high risk) and 18.0% <10>100 CFU/100ml (intermediate risk) (Handzel 2005). Another study of water samples from 1027 households in post-tsunami Indonesia found that neither adequate boiling (maintaining a rolling boil for at least one minute) nor adequate boiling combined with water storage in a narrow mouthed container were associated with a decreased risk of stored water contamination (Gupta 2005). This contrasts with results in Viet Nam where, in a 12-week longitudinal study not involving an emergency or displaced population, boiling was associated with a 97% reduction in faecal contamination of stored drinking water in the home compared to source water (Clasen 2008).

Chloramine-B and PUR sachets have also been used in emergency response in Viet Nam. These are discussed in Section 3 below in the sections on chlorination and flocculation/disinfection.

3. Household Water Treatment in Viet Nam

3.1 Boiling

Microbiological water treatment is already widely practiced at the household level in Viet Nam. According to the 2006 MICS survey (a nationally representative study based on a sample of 36,573 persons in 8,355 households), 90.1% of the population reports that they usually boil their water at home to make it safe for drinking. This is an extraordinarily high number; in a comparison of 58 low- and medium-income countries, only Mongolia and Kazakhstan have a higher prevalence of boiling, and in most countries, fewer than a third of the population boils their water (Rosa 2008). By comparison, few Viet Nameese practice methods that the JMP characterizes as “microbiologically adequate”: 13.6% report usually using a filter, 5.9% report using chlorination (bleach), and 0.5% use solar disinfection (Sodis).

Another 10.0% report letting their water stand and settle and 2.9% report straining their water through a cloth, both methods that are microbiologically inadequate.

There is geographic and demographic differences in the prevalence of HWTS practices. Boiling is almost universal in the North Central (99.7%) and Red River Delta (99.5%), Highlands regions (93.2%), and slightly less common in the North West (77.3%), and Mekong River Delta regions (78.4%). Households headed by one who completed upper secondary (95.3%) or lower secondary (92.8%) are more likely to boil than those headed by one who had no formal education (83.9%). Significantly, an adequate method of treating water at home was more likely practiced by populations relying on unimproved water sources (93.4%) than those relying on improved water sources (81.6%), suggesting that the population may well appreciate the risk of waterborne microbes and the benefits of boiling. However, boiling in Viet Nam is widely practiced by both urban (92.2%) and rural populations (89.4%), by the richest (90.9%) and poorest wealth quintiles (86.0%), and by both Kinh/Chinese (90.6%) and other ethnicities (87.1%).

A recent knowledge, attitudes, practices (KAP) survey commissioned by UNICEF among H'mong and Gia Rai populations, however, found that only 3% of Gia Lai households boil their drinking water, while 100% of Lao Cai follow the practice (IRL 2007). The differences were not explained by gender, education and income level. The report notes, however, that Lao Cai generally being a cold climate, residents drink mostly boiled water to keep warm. It also ascribes the difference to a long history of educational campaigns to promote clean water and create awareness and reinforcing the behaviour. In Gia Rai, on the other hand, there was a perception that boiling spoils the taste of water. The report concludes that IEC and behaviour change communication (BCC) are effective and should be implemented immediately to reach vulnerable populations where boiling is under-represented.

As actually practiced in a rural community in Viet Nam, boiling has been shown to be reasonably effective in treating water for microbial pathogens and to be economically affordable (Clasen 2008). The study in Pac Nam, a remote and mountainous district of Bac Kan province, assessed the microbiological effectiveness and cost of boiling among a vulnerable population relying on unimproved water sources and commonly practicing boiling as a mean of disinfecting water. Paired water samples (source and stored drinking water) were compared for TTC levels in five rounds of sampling from 50 households who claimed to always or almost always boil their water before drinking it. The practice was associated with a 97% reduction in geometric mean TTCs ($p < 0.001$). Despite high levels of faecal contamination in source water (mean 141 TTC/100ml), 37% of stored water samples from self-reported boilers met the WHO standard for safe drinking water (0 TTC/100ml), and 38.3% fell within the low risk category (1-10 TTC/100ml). Nevertheless, 60.5% of stored water samples were positive for TTC, with 22.2% falling into medium risk (11-100 TTC/100ml), presumably due to post-treatment contamination due to unsafe storage. The estimated cost of wood used to boil water was US\$0.272 per month for wood collectors and US\$1.68 per month for wood purchasers, representing approximately 0.48% to 1.04%, respectively, of the average monthly income of participating households.

3.2 Chlorination. Chlorination is not widely practiced at the household level, except in emergency response. The 2006 MICS survey suggest that only 5.9% of the national population add bleach or another source of chlorine to their drinking water (UNICEF 2006). However, chlorination was significantly more popular in the Mekong River Delta region (26.2%) where flooding is common. Notably, use of chlorine is inversely related to household income; householders in the lowest (10.9%) and second lowest (10.7%) income quintiles are more likely to report using chlorine to treat their water than those in the richest (1.3%). PSI has promoted the use of sodium hypochlorite in accordance with the SWS since 2005. In 2007, they reported selling 113 million bottles and having 155,000 users, about the same as the previous year. In emergency response, the government distributes and promotes the use of chloramine-B, another source of hypochlorous acid. However, research has shown that this is less

effective than other chlorine donors (sodium hypochlorite, calcium hypochlorite, NaDCC) (Donnermair 2003), and choramines are no longer recommended for treating drinking water in the United States and other countries.

3.3 Sodis. Sodis has been actively promoted in Viet Nam since 2004 by Helvatas, a Swiss-based NGO in partnership with NCERWASS. The project extends to communities in four provinces, and uses a demand-driven approach that targets rural households with little immediate prospect for improved water supplies. As Sodis is primarily a behaviour change intervention, it relies extensively on promotion (here by the Women's Union and the Center for Health Information –Education-Communication); extensive IEC materials were developed by NCERWASS, and have been used extensively in the promotion of the An interim assessment was completed in late 2006; the NGO's annual report also provides extensive information on Sodis. To date, the project has reached nearly 10,000 households and around 3,000 school pupils. The 2008 assessment reports that SODIS is frequently applied by 50-60% of targeted households. Uptake has been less than optimal due primarily to challenges in procuring and supplying PET bottles to remote areas. Where bottles are provided free, householders resist purchasing new ones; suppliers also resist stocking empty PET bottles, as there is little profit compared to the volume of space required for storage. The programme will be independently evaluated in December 2008, after which a decision will be taken on whether it will be extended.

3.4 Microbiological Filtration. A variety of commercial water filters are available in urban centres throughout the country. These consist mainly of ceramic candle filters. Prices range from VND150,000-300,000, with replacement candles costing approximately VND50,000. None of these filters have claims concerning their microbiological performance, and no test results are available. It is believed that most consumers use these devices simply to remove suspended solids before boiling their water. Hindustan Unilever Limited is considering importing its Pureit filter from India. It is currently undertaking market and consumer research. However, at an estimated retail price of US\$60 (which reflects the US\$40 price in India plus transportation and a reported 30% tariff), it is unclear whether there would be a market for even this microbiologically proven product, since consumers may not be able to judge or pay for its superior performance. Higher-end ultra-violet and reverse osmosis filters are also available commercially at prices from VND800,000 to 1,200,000 or more. CAWST has collaborated with UN Habitat, a partner in bringing BSF technology to Laos and other countries, and has conducted some local testing of the Kanchan arsenic version of the BSF. However, no projects are currently underway. In October 2008, the University of North Carolina-Chapel Hill received a 5-year \$8.5 million Global Development Alliance grant from the USAID Regional Development Mission-Asia to facilitate marketing and characterize the performance of financially sustainable water, sanitation and hygiene manufacture and distribution programs in Viet Nam, Laos and Cambodia. Among other things, it will plans to produce ceramic pot-style and siphon filters in Viet Nam, working through East Meets West Foundation (EMWF), Lien Aid, World Toilet Organization, IDE and EntrepriseWorks/VITA.

3.5 Flocculation/Disinfection. Alum is widely used in Viet Nam as a flocculant for all household water supplies. It is frequently combined with boiling for drinking water. Two combined flocculation/disinfection products have been used in Viet Nam. The Procter & Gamble PUR sachets, described above, were donated to UNICEF and used in response to floods. The Viet Nam Preventative Medicine Department of the MoH and the Institute of Hygiene and Public Health conducted an assessment in 2006 of the deployment among four communes affected by flooding in the Mekong Delta region. The assessment followed 240 household for four months; a detailed report is available from UNICEF. Results showed that as actually used by the target population, the product was highly effective in removing faecal indicator bacteria from raw water while also removing turbidity. Results also suggest that the product was highly acceptable to the target population, that they used it correctly and consistently—with higher rates of use over the three month follow-up period—and that users would be willing to pay for the product (though at a price of VND200-500 (US\$0.01-0.02), compared to its

production cost of US\$0.035 and its retail price of US\$0.10). Procter & Gamble advises that it is currently seeking a distribution partner for PUR product in Viet Nam, since a proposed social marketing programme has not materialized due to lack of funding. In addition to PUR, a locally-produced flocculation/disinfection product that combines polyaluminium chloride with calcium hypochlorite is manufactured by a small factory in Vinh Long province and sold there under the name “Thanh Mai”. Each sachet sells for VND550 and is designed to treat 200L; accordingly, it is considerably cheaper than the PUR product. Household users use the product to treat not only drinking water but all the water used for household purpose; thus they typically make a stock solution and add it to the large ceramic jars that are common in rural areas for storing water. According to PATH, which is exploring a possible collaboration with the company, demand vastly exceeds production capacity; thus it is not available elsewhere in the country. No test results are available on the microbiological performance of the product. It should be noted that the flocculant used in Thanh Mai is not iron-based (as is PUR) and thus may not be effective in reducing arsenic.

3.6 Safe Storage. While the results from the boiling study suggest that the treated water frequently is subject to recontamination, there is comparatively little information in Viet Nam on water storage practices in the home, which is the main intervention against such post-boiling contamination. In Bac Kam province, where the study was undertaken, most householders boiled their water in a tea kettle and transferred it directly to thermal bottles; however, it was unclear in whether this practice was followed beyond the winter season (when the study was conducted) or in the south where higher temperatures make it unlikely that people drink hot water except as tea. There was some evidence that recontamination occurred when other cool water was added to recently boiled water in order to make it more palatable (Clasen 2008). According to the KAP study among H’mong and Gia Rai groups, respondents typically stored drinking water in a covered (66%) or uncovered (17%) vessel, or in a tank/jar/barrel with cap (9%); only 9% of respondents reported that they do not store drinking water. In addition to water used for drinking, rural and other populations without household connections typically stored larger volumes of water in clay jars, ferro-concrete tanks, plastic tanks, barrels and other containers. Safe storage is a particular challenge for harvested rainwater, and requires higher volume solutions that have not been fully evaluated for their capacity to minimize recontamination. The presence of uncovered and unsealed water storage vessels in the home has been shown to increase the householders’ risk of dengue as they create a breeding site for the mosquito vector (Phuanukoonnon 2006).

3.7 Arsenic Remediation. The first option for those populations using groundwater contaminated with arsenic is to identify and use alternative sources of drinking water. Rainwater collection has been heavily promoted as an alternative supply in such cases. Alternatively, surface sources can be utilized, provided they are treated effectively for microbial contaminants—an important role for HWTS measures. As noted above, Berg and colleagues (2006) showed that household sand filters, which use locally available materials and operate without chemicals, can achieve average arsenic removal rates of 80% in groundwater with high iron and low phosphate concentrations; there is also evidence of that people consuming this sand-filtered water can significantly lower their arsenic body burden. Governmental agencies and others have been actively promoting the use of specially adopted sand filters for use by those populations that do not have alternative sources of supply. Other commercial filters are also available, but these are mainly not affordable or otherwise accessible in remote areas. Compared to microbiological water treatment, there are few examples of effective, affordable options for treating arsenic at the household level that have been widely deployed in Viet Nam.

4. Toward a National Action Plan for Household Water Treatment and Safe Water in Viet Nam

4.1 WHO Mission (2005). In March 2005, Dr. Robert Quick of the US Centers for Disease Control and Prevention visited Hanoi on behalf of the WHO and conducted a half-day workshop with the MoH, MARD, NGO's and others to explore options for advancing the HWTS initiatives. Dr. Quick noted while boiling, filtration, and other HWTS measures were being undertaken in the country, and a desire on the part of governmental authorities to pilot and evaluate projects, there was no coordinated effort to support the intervention and little rigorous assessments of its contribution to health and national developmental goals. He cited some of the challenges faced in water in Viet Nam including low rural water supply coverage, high rates of diarrhoeal disease, and the presence of arsenic in certain ground water. He also suggested some immediate actions (such as the need for more extensive testing for arsenic and the substitution of more effective disinfectants for Chloramine-B) and possible solutions that could be piloted using NGOs and other partners. Above all, he recommended that the government of Viet Nam organize a conference to review its past experience with HWTS technologies, assess impact evaluations, and develop a strategic plan to evaluate untested technologies and implement those interventions found effective.

4.2 HWTS Workshop (2007). In November 2007, the Viet Nam Preventive Medicine Association (VAPM) convened a workshop in Hanoi for the purpose of reviewing in-country experience with HWTS technologies and programmes and to consider the experience of Cambodia where HWTS technology evaluations have been supported by WHO, UNICEF, the World Banks Water and Sanitation Programme (WSP) and others. The workshop presentations and discussions revealed that Viet Nam has broad experience with a range of HWTS technologies and promotion strategies, but that initiatives were mainly ad hoc and donor-driven. There was no coherent national plan or organizing mechanism for scaling up successful programmes, and in fact, no rigorous assessments to identify which initiatives were effective. Participants concluded that there may be a need for a national plan and coordinating mechanism to promote scaling up effective HWTS interventions, and particularly the need for competent national authorities to verify the performance of HWTS technologies in the field.

4.3. HWTS Mission and Workshop (2008). Following the 2007 workshop, it was agreed that insofar a VAPM's main focus on HWTS was water quality and testing, MARD would assume the lead in developing a national action plan for HWTS in Viet Nam. With support from WPRO and coordination from WHO and UNICEF, Dr. Thomas Clasen from the London School of Hygiene & Tropical Medicine was invited to Hanoi to collaborate with local stakeholders in the preparation of a Framework for the National Action Plan for HWTS in Viet Nam. A working group, consisting of representatives from MARD, VAPM, UNICEF, and WHO, was organized to coordinate the effort. From 10-21 November 2008, Dr. Clasen worked with members of the working group, other stakeholders (including national and international organizations, NGO and other programme implementers, private sectors companies involved in HWTS products) to solicit their input for the National Action Plan. This included a National Workshop in Hanoi on 17 November 2008 in which these and other stakeholders from the national and provincial levels, contributed their ideas and suggestions on the Plan.

4.4. Framework for National Action Plan for HWTS. Annex A to this report contains the draft of the Framework for the National Action Plan for Household Water Treatment and Safe Storage for Viet Nam. It is designed to set forth the principal components of a national plan and capture the possible action items that have been suggested as priorities. As a framework, the document does not include specific targets, dates, duties and funding mechanisms to execution of these action items; these will need to be agreed by national participants and reflected in the final plan itself. Nevertheless, the framework should serve as the basic foundation for that plan, and thus as a roadmap for scaling up effective HWTS solutions in Viet Nam as part of long-term effort to improve the health and well being of the people of Viet Nam. Annex B contains some possible additional action items that were raised during the course of meetings or the workshop.

4.5 Need for Further Research. In addition to the immediate action steps, there is a need for further research to support HWTS initiatives in Viet Nam, and to assess the extent of its effectiveness. Research should include studies designed to specifically identify current gaps in coverage and practices, such as among ethnic and remote rural populations, which may benefit most from HWTS adoption. This would help target the intervention and yield optimal health returns. There is also a need to identify specific HWTS strategies for special challenges in Viet Nam, including arsenic remediation, effective storing of harvested rainwater and boiled water to prevent recontamination, and responding to floods and other emergencies. Recent data from household-based surveys should be analyzed to profile and develop targeted IEC materials to increase adoption of effective HWTS practices. Training materials and strategies should be developed to help governmental and other HWTS implementers select the most appropriate HWTS solutions under different conditions, to apprise field mobilisers in the most effective ways of ensuring uptake and long-term adoption of effective HWTS approaches. Finally, steps should be taken to monitor and assess the effectiveness of initiatives in reaching vulnerable populations and securing their correct, consistent, and sustained use of HWTS solutions in order to optimize health and other gains.

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Appendix A

FRAMEWORK FOR A NATIONAL ACTION PLAN FOR HOUSEHOLD WATER TREATMENT AND SAFE STORAGE

1. Background and Rational

1.1 Unsafe drinking water, along with poor sanitation and hygiene, impose a heavy burden of disease in Viet Nam. Contaminated drinking water contributes to an estimated 10,000 deaths annually from diarrhoeal disease, the third largest killer of children under 5 years of age in Viet Nam. Unsafe drinking water also contributes to morbidity and mortality from malnutrition, enteric fevers, cholera and arsenic poisoning.

1.2 The government of Viet Nam recognizes the essential role of safe water and sanitation in promoting health and development, and is committed to increase access to safe water, especially among rural populations, those affected by floods and other emergencies, and those living in remote areas. This commitment is reflected in the *National Rural Clean Water Supply and Sanitation Strategy* the *National Target Program for Rural Water Supply and Sanitation*, both of which advocate a demand-response approach, with IEC used to establish the link between water and health and generate demand, and users deciding on technologies and paying the costs. The approach also recognizes the need to identify and pilot appropriate technological solutions to improve water quality, with a particular emphasis on challenging regions, and using IEC programmes to guide user understanding.

1.3 The Ministry of Agriculture and Rural Development (MARD) is designated as the lead ministry for coordinating the implementation of rural water supply and sanitation (RWSS) National Target Programme II (NTP II). The Standing Office at MARD has been established to manage the programme while the National Center for Rural Water Supply and Environmental Sanitation (NCERWAS) provides technical support. Among other things, the duties of NCERWAS include participation in establishing national strategies, plans, norms and technical standards concerning RWSS; provide guidelines, training and capacity building for local Centres for Clean Water and Rural Environmental Sanitation; perform scientific research and technology transfer for clean water supply and treatment; and to coordinate with national and international organizations operating in RWSS.

1.4 Other key ministries in the RWSS NTP II include the Ministry of Health (MoH) was assigned a key function in IEC activities, raising awareness about hygiene and health, and setting standards and the Ministry of Education and Training (MoET) responsible for water supply and sanitation in schools. Water quality and monitoring standards are reflected in its Decision No. 1329/QD-BYT of April 18, 2002 and Decision No. 09/2005/QD-BYT of March 11, 2005.

1.5 Viet Nam has made significant progress in extending the coverage of improved water sources, with an estimated 97% of urban populations and 85% of rural dwellers having access to “improved water supplies”. However, while most urban dwellers of urbanites have household connections, the main water supply for rural populations are private wells, rainwater collection systems, springs and surface sources (rivers or streams). Coverage varies considerably by region, ethnicity and income level. Water quality monitoring suggests that water supplies in Viet Nam rarely meet national standards for drinking water quality, especially for sources used predominantly by rural populations.

1.6 Providing safe, reliable, piped in water to every household is an essential goal, yielding optimal health gains while contributing to the MDG targets for poverty reduction, nutrition, childhood survival, school attendance, gender equity and environmental sustainability. While committed strongly to this goal, and to incremental improvements in water supplies wherever possible, the WHO and others have called for interim approaches that will accelerate the health gains associated with safe drinking water for those whose water supplies are unsafe.

1.7 Interventions to treat and maintain the microbial quality of water at the household level are among the most promising of these approaches. This is particularly true in settings, like much of the Viet Nam, where populations have access to sufficient quantities of water, but where the water is microbiologically unsafe. Effective household water treatment and safe storage (HWTS) interventions—if used correctly and consistently—can significantly improve the microbiological and chemical integrity of the water at the point of ingestion, and thus deliver significant health benefits for those without access to safe, reliable piped-in water supplies. Some HWTS options are also suitable for remote populations and those affected by emergencies.

1.8 As a result of governmental campaigns and other efforts in the past, HWTS is already widely practiced in Viet Nam. The 2006 Multi-Cluster Indicator Survey of Viet Nam estimates that 90.1% of the national population reports usually boiling their water before drinking it; smaller percentages filter, strain or chlorinate their drinking water. It is noted that this survey only addresses reported water treatment, which may vary from actual practices. As practiced in Viet Nam, boiling has also been shown to be largely effective, though the drinking water of some reported boilers is still contaminated with microbial pathogens, probably due to inconsistent boiling or recontamination due to poor handling and storage. Boiling is also affordable in Viet Nam. Nevertheless, large portions of certain ethnic and other populations do not boil their drinking water, apparently due to personal and cultural objections. While other HWTS methods have been introduced in Viet Nam, there is little rigorous evidence of their effectiveness and uptake except in emergencies.

1.9 Sand filters and other interventions have been shown in Viet Nam to reduce the level of arsenic in ground water. Many of these approaches also reduce the level of other heavy metals and suspended solids that represent health and aesthetic concerns. Many of these options present challenge in terms of performance, portability, affordability and maintenance. To date, there are only limited efforts to develop, assess and scale up the implementation of effective, affordable, acceptable arsenic remediation technologies, so that householders are faced with identifying other water sources such as rainwater harvesting or microbiologically inferior surface supplies.

1.10 There is also the need to improve the storage of household water in Viet Nam. Improved storage is particularly important for drinking water, since water that is treated by methods such as boiling that do not provide residual disinfection (like chlorine), is immediately susceptible to recontamination, mainly through contact with hands and utensils during use in the home. There is also a need in water-scarce regions for increased capacity of stored water, both for drinking/cooking and for personal and domestic hygiene.

2. Purpose, Goal and Guiding Principles

2.1 Purpose. In furtherance of national strategies for health and development, the National Action Plan for Household Water Treatment and Safe Storage (hereinafter, the “NAP-HWTS”) will contribute to a measurable reduction in waterborne disease by encouraging the adoption and long-term use of effective HWTS, especially by those populations at greatest risk.

2.2 Goal. By ____, 100% of the population of Viet Nam who do not yet have access to safe piped-in other supplies will be consistently practicing effective HWTS methods in a manner that renders the water they use in compliance with national standards.

2.3 Guiding Principles. The actions taken under the NAP-HWTS will be governed by the following principles:

2.3.1 Health is the primary driver of all HWTS initiatives undertaken within the framework of the NAP-HWTS. Any programme or project involving HWTS will be considered and evaluated on the basis of its contribution to health.

2.3.2 As a matter of priority, HWTS initiatives should target those populations that do not have access to safe water and do not currently practice effective HWTS on a correct and consistent basis.

2.3.3 HWTS products and technologies should be introduced in Viet Nam only after they have been shown to be safe and effective. Wherever possible, householders should also be given choices in HWTS options, and sufficient information on which to make informed choices.

2.3.4 Consistent with national strategies and target programmes, HWTS initiatives should follow a demand-response approach, with users deciding from a range of proven methods, products and technologies, with users paying the cost.

2.3.5 While government has a special role in prioritizing HWTS initiatives, regulating HWTS products, securing necessary support, and monitoring progress, all stakeholders—including international organizations, non-governmental organization, donors, the private sector, and users—should be encouraged to participate in providing HWTS solutions.

2.3.6 For government and civil society initiatives, culturally-appropriate IEC programmes can help guide user understanding. Commercially-marketed products should be accompanied by accurate claims so that informed consumers can judge their performance capabilities, and use them safely and correctly. Governmental standards and certification procedures would also help ensure product quality and performance.

2.3.7 Optimal benefits from HWTS require correct, consistent use over the long term. HWTS initiatives should adopt a long-term strategy, and include follow-up assessments to demonstrate sustained compliance.

2.3.8 While boiling, a common practice for treating water in Viet Nam, is microbiologically effective under most circumstances when accompanied by safe storage, it presents certain disadvantages in terms of cost, environmental impact, and inability to address chemical contaminants. Householders should thus be encouraged to explore other options that may provide a more complete solution provided they are as effective against microbial contaminates that represent the most immediate threat to health.

2.3.9 Safe drinking water is a necessary but not sufficient condition to human health. HWTS initiatives should be undertaken as part of a comprehensive strategy to ensure access to adequate quantities of water, good personal hygiene practices, and environmental sanitation.

3. Strategies and Action Items

The following **strategies** and action items will be pursued as a matter of priority. Responsibility and a time frame for execution are described in Section 4 of this NAP-HWTS.

3.1. Position effective HWTS as a policy priority

3.1.1 Bring HWTS more clearly within the scope of the National Rural Clean Water Supply and Sanitation Strategy and the National Target Programme in order to establish its priority, gain necessary governmental support at all levels, and secure necessary funding.

3.1.2 Undertake legal formalities and instructions to clarify the role of HWTS as an acceptable strategy to address deficiencies in water quality.

3.1.3 Establish the policy support for developing IEC materials on HWTS technology options and delivery models, launching pilot projects, monitoring and assessing results, and scaling up successful initiatives.

3.1.4 Develop and recommend policies that will encourage more stakeholder participation in HWTS initiatives, including donor funding, private sector investment and commercialization, and socialization among potential beneficiaries.

3.1.5 Confirm the priority that HWTS initiatives should attach to populations that do not currently practice effective HWTS, that are impacted by emergencies or that are otherwise especially vulnerable to waterborne disease, including those whose water sources contain high levels of arsenic or other chemical pathogens

3.2 Review and enhance regulatory framework for HWTS

3.2.1 Develop national level standards for the safety and performance of HWTS products.

3.2.2 Create a certification and product labelling system so that consumers can understand and trust the performance of new HWTS products.

3.2.1 Explore the potential for reducing the tariffs, taxes and other costs on imported HWTS products in order to encourage the entry of appropriate technologies not currently present in Viet Nam and to improve their affordability by the target population.

3.3 Build institutional capacity to support HWTS

3.3.1 Establish and equip NCERWAS to provide effective technical assistance to provinces and districts to optimize HWTS choices, performance and coverage

3.3.2 Provide comprehensive, professional training in HWTS technologies, selection criteria and strategies for optimizing uptake and use to NCERWAS and PCERWAS staff and support for them to train district, commune and village mobilizers

3.4 Improve coordination of efforts to promote HWTS

3.4.1 Establish a coordinating committee representing MARD, MoH, UN agencies, the, NGOs and other programme implementers, the private sector and users to coordinate HWTS activities in Viet Nam

3.4.2 Explore opportunities to coordinate HWTS strategies and activities in cooperation with the Viet Nam Rural Water Supply and Sanitation Partnership

3.4.3 Coordinate HWTS activities with other water, hygiene and sanitation strategies and initiatives, and encourage pursuit of synergistic opportunities with other interventions (mother and childhood health, immunizations, malaria control, etc.)

3.5 Encourage the development, testing, manufacture and introduction in Viet Nam of new HWTS technologies and delivery strategies

3.5.1 Identify technology gaps (e.g., low-cost filtration, coagulation, flocculation prior to boiling or other disinfection to improve water aesthetics or satisfy requirement for non-drinking water needs, effective and affordable arsenic remediation, options for populations that object to boiling due to taste or other reasons, safe storage vessels for both clean water for domestic use and drinking water) and encourage research and development to find solutions

3.5.2 Give priority to development of solutions that are simple, acceptable, affordable, appropriate for low-income and remote populations, and for products that are manufactured in Viet Nam

3.5.3 Collaborate with NGOs and the private sector to develop and test new technologies and delivery models in demonstration projects and in scaling them up nationally

3.5.4 Explore creative supply channels and distribution systems to ensure that effective HWTS reach the most vulnerable (and often remote) populations

3.5.5 Establish enabling environment that encourages the private sector to assume a key role in developing, promoting and distributing safe, effective and affordable HWTS solutions, especially among the most vulnerable populations

3.6 Increase understanding of the need for HWTS

3.6.1 Develop and implement a long-term campaign to increase awareness of risk of waterborne disease, and the potential for HWTS as a simple, effective and affordable solution especially suitable the conditions prevailing in Viet Nam

3.6.2 Identify populations in which HWTS practices are poor and conduct KAP and other studies that will determine the barriers to adoption; determine the technology, delivery, IEC and behaviour change communication strategies that will be most effective in reaching these populations with effective HWTS solutions

3.6.3 Increase the profile of HWTS as a cost-effective intervention among public leaders, health personnel, and other change agents; use schools, hospitals, clinics, women's union and other institutions and groups to promote awareness of HWTS

3.6.4 Establish a website to collect and make available research, assessments, technical reports, instructions, fact sheets, IEC materials, etc. on HWTS technologies, delivery models, projects and programmes

3.7 Use IEC to build awareness of and demand for effective HWTS

3.7.1 Develop and disseminate high-quality IEC materials that address the advantages and disadvantages of each technology option, and provide users with necessary information to make informed choices; materials should be specific and action-oriented

3.7.2 Ensure that IEC materials are culturally and linguistically appropriate and reflect local customs, especially for remote populations and ethnic minorities who may be at greatest risk of waterborne disease due to low levels of boiling or other HWTS practices

3.7.3 Explore opportunities to integrate IEC materials and strategies for HWTS with other health communication efforts (diarrhoeal disease, water supply and sanitation, dengue, maternal and child health, nutrition) but avoid over-complicating messages that may reduce effectiveness; explore potential for building on successful broadcast campaigns for hygiene and sanitation

3.7.4 Encourage the private sector to develop and use accurate and effective IEC materials as part of their marketing campaigns and accompanying products

3.7.5 Take steps to coordinate HWTS with other IEC materials to take advantage of synergies and avoid potential confusion caused by multiple messages

3.8 Encourage implementation of HWTS initiatives that warrant special priority

3.8.1 Take steps to extend boiling to populations not yet following the practice by identifying and mapping such populations, conducting KAP surveys to identify barriers to adoption, and developing IEC and other strategies that overcome those barriers;

3.8.2 Explore options to optimize the effectiveness of boiling as a means of treating water in the home by improving safe storage and water management practices

3.8.3 Scale up low-cost arsenic filters in regions known to have high levels of arsenic-contamination in ground water, particularly where alternative water supplies such as rainwater harvesting are not practical

3.9 Take steps to improve the use of HWTS in emergency response

3.9.1 Evaluate alternative HWTS products in response to floods, other disasters and disease outbreaks, and compare options on the basis of performance, cost, ease of delivery, acceptability, etc.

3.9.2 Re-examine the merits of Chloramine-B in view of recent research and its safety, efficacy, shelf-life and other key criteria in emergency response

3.9.3 Take advantage of opportunities to transition emergency users of HWTS products to routine, long-term use in the home

3.10 Undertake relevant, practical and rigorous research to improve the targeting, performance, delivery and adoption of HWTS

3.10.1 Compile existing research, distil lessons learned, identify research gaps, and develop a comprehensive research agenda that will yield results that can be translated into action to improve HWTS performance, adoption and long-term use

3.10.2 Encourage collaborations between national and international research institutions in health, engineering, economics, social sciences and other fields to take full advantage of research already undertaken in support of HWTS and address the special conditions prevailing in Viet Nam

3.10.3 Promote transparency and accountability in the implementation of HWTS projects and programmes by encouraging regular, rigorous and independent assessments of technology performance, adoption and sustained use—especially by the most vulnerable populations—and achievement of health benefits

3.11 Secure necessary financial support for implementation of NAP-HWTS

3.11.1 Develop near- and long-term budgets for implementing strategies and priority action items and secure support from governmental sources

3.11.2 Explore opportunities for funding through the Viet Nam Rural Water Supply and Sanitation Partnership

3.11.3 Secure specific funding for training and institutional capacity building, development of IEC strategies and materials, pilot and demonstration projects, HWTS products for emergency response, and research and monitoring/evaluation

3.11.4 Engage the private sector to invest in research, development and deployment of effective and appropriate HWTS solutions through collaborations and partnerships that identify and create market opportunities, reducing costs and risks of entry

4. Responsibilities and time frame

4.1 Responsibilities

4.1.1 The lead ministry for coordinating the implementation of the NAP-HWTS is MARD. Except as otherwise delegated to other ministries below, MARD shall be responsible for the timely execution of all of the strategies and action items contemplated by the NAP-HWTS.

4.1.2 In cooperation with MARD, the MoH will be responsible for (i) developing and implementing campaigns designed to build awareness of the risk of waterborne disease, the link between water and health and the value of effective HWTS strategies in preventing disease, (ii) to help position HWTS interventions as part of the national strategies for water, hygiene and sanitation, (iii) for reviewing health messages contained in IEC materials, (iv) to collaborate with other ministries on the regulation of HWTS products and claims, (v) to assess the effectiveness of HWTS solutions in achieving water quality guidelines.

4.1.3 Other ministries are encouraged to participate in the implementation of the NAP-HWTS. This includes the Ministry of Science and Technology and Environment (MOSTE) to assist with research and development of advanced technologies and the transfer of HWTS technology and the Ministry of Education and Training (MOET) to encourage the integration of research, implementation and training on HWTS in schools.

4.1.4 NCERWASS will be designated as the central agency within MARD to coordinate all national activities under the NAP-HWTS among rural populations where HWTS will be given priority, and will support the implementation of HWTS at the provincial, district and commune level. NCERWASS will establish a Centre of Excellence on HWTS technologies, IEC materials and implementation strategies. It will also establish a website to disseminate this and other information, including research, assessments of pilot projects, and international developments in HWTS.

4.1.5 MARD shall convene and chair a national coordinating committee or technical working group (TWG) to assist in and provide oversight over the implementation of the NAP-HWTS. The coordinating committee will include representatives from the MoH, UNICEF, WHO, the Viet Nam Rural Water Supply and Sanitation Partnership, funding agencies, donors, NGOs involved in implementing HWTS programmes and the private sector, and such other organizations as MARD shall deem appropriate. The national coordinating committee shall meet at least quarterly to review progress on action plan and make recommendations.

4.2 Timeframe

With input from the Coordinating Committee, MARD will establish a specific schedule for the implementation of the priority action items contemplated by this NAP-HWTS one-, three- and five-year periods commencing in 2009.

Annex B

Additional Action Items

1. Enhancing Governmental Policy, Regulation and Planning

a. Policy

- Maintain focus on improving water supplies (especially piped water and rainwater harvesting) that improve water quantity and access as well as quality
- Ensure that national policies and strategies of MARD and MoH recognize HWTS as an effective and cost-effective means of delivering the health gains associated with safe water in furtherance of national priorities and the MDGs
- Emphasize the economic and poverty reduction benefits of HWTS, and secure promotional/training funding as part of the larger water supply/water resource policy and budget
- Take steps to extend boiling and other effective HWTS practices to populations not yet following the practice
- Discourage promotion of any HWTS that has not yet been shown in independent laboratory and field testing to be safe and at least as microbiologically effective as boiling
- Avoid strategies that will encourage householders to adopt HWTS products or methods that are less effective or more costly than boiling
- Define role of HWTS in emergency response and promote the transition of emergency to routine use of appropriate HWTS technologies
- Forecast and stockpile supplies of effective HWTS products in order to improve emergency preparedness and prevention
- Encourage inclusion of boiling and other effective practices into school curriculum as part of the wider water, sanitation and hygiene programme
- Promote safe storage of harvested rainwater and whenever boiling and filtration are used for treating water
- Secure necessary international funding for implementation of National Action Plan for HWTS

b. Regulatory Matters

- Develop guidelines for national level standards for HWTS products
- Create a certification and product labelling system so that consumers can understand and trust the performance of new HWTS products
- Adopt guidelines for claims about HWTS products that will not confuse or encourage boilers to adopt technologies that are less effective
- Expedite registration of HWTS products that have been shown to be safe and effective
- Reduce duties, taxes and other costs on imported HWTS products in order to improve affordability
- Evaluate alternatives to chloramine tablets for safer, more effective and more practical use in emergency water treatment
- Require new HWTS products to monitor and report on safety and effectiveness in actual use by target population in comparison to boiling

c. Leadership, Advocacy and Administration

- Develop schedule and budget for implementation of National Action Plan for HWTS
- Establish and equip NCERWAS to provide effective technical assistance to provinces and zones to optimize HWTS choices performance and coverage
- Contract with NGOs and the private sector to transition pilot targeted HWTS interventions to the most vulnerable populations

- Coordinate the development of IEC materials that all stakeholders can use to promote HWTS at all levels
- Coordinate HWTS activities with other water, hygiene and sanitation strategies and initiatives, and encourage pursuit of synergistic opportunities with other interventions (mother and childhood health, immunizations, malaria control, etc.)
- Develop mechanism for assisting householders to purchase arsenic and other filtration devices on an instalment basis
- Work with NGOs, donors and other stakeholders to develop a comprehensive, multi-year proposal to demonstrate the feasibility of scaling up HWTS in 2-3 key provinces, including the cost and cost savings per person reached
- Create and fund capacity building in HWTS within PCERWAS

2. Encourage the development, testing, manufacture and introduction in Viet Nam of new HWTS technologies and delivery strategies

- Identify technology gaps (e.g., low-cost filtration, coagulation, flocculation to prior to boiling or other disinfection to improve water aesthetics or satisfy requirement for non-drinking water needs, effective and affordable arsenic remediation, options for populations that object to boiling due to taste or other reasons, safe storage vessels for both clean water for domestic use and drinking water)
- Encourage different household-based options for “clean water” (i.e., for domestic and personal hygiene) as well as drinking water
- Collaborate with NGOs and the private sector to develop and test new technologies in demonstration projects
- Explore creative supply channels and distribution systems to ensure that effective HWTS reach the most vulnerable (and often remote) populations
- Require new technologies to demonstrate correct use, consistent use, sustained use
- Encourage technology transfer and local value added in HWTS products but do not compromise product quality
- Join WHO-backed International Network to Promote Household Water Treatment and Safe Storage to stay apprised of developments in research, technology and product development

3. Increase understanding and awareness of, and demand for, HWTS

- Identify the awareness gaps (e.g., that diarrhoea is natural/inevitable, that improving and protecting water quality minimized disease) and make those first priority; this will require multi-focused strategy depending on the target audience
- Map districts and communities with low HWTS coverage and target campaigns to those areas
- Use KAP survey to develop effective messages to reach those that can benefit from effective HWTS and to optimize boiling with safe storage
- Engage the Ministry of Education for school-based programmes and MoH for hospitals and clinics
- Adopt a consumer-oriented strategy; use consumer research to find out what the target population wants, and try to meet their demands
- Consider a “national HWTS day” to coordinate governmental and non-governmental promotional campaigns
- Use sports figures and celebrities to promote HWTS
- Encourage targeted promotion of HWTS during rainy season when populations feel most vulnerable to waterborne diseases and are thus more willing to adopt protective measures
- Develop and disseminate effective, language- and culturally-appropriate IEC materials
- Develop specialized IEC materials for schools and clinics as there are for emergencies

- Emphasize community- and household-based communication and demonstrations in addition to mass media Use locally-produced video to promote HWTS in mobile “road shows”, schools, community gatherings
- Using donor support, develop and implement campaign to give away initial supply of HWTS products as an introductory measure
- Publicise success stories
- Create more visibility for HWTS at schools, clinics, health posts, etc.

4. Coordination among HWTS Implementers

- Establish partnerships with MARD, CERWAS, MoH, provincial and district governments optimize coverage and allocation of resources
- Develop coordinated advocacy strategy to develop support and funding to make HWTS a priority at provincial level by demonstrating not only health but also economic benefits (net savings) from investing in HWTS
- Conduct technology and stakeholder forums at provincial level
- Continue to map existing HWTS implementation efforts to improve awareness, monitor progress and optimize methods
- Introduce HWTS in emergencies and outbreak response as a long-term solution
- Provide training to in HWTS technology to provincial sanitary inspectors and BHWs
- Promote choice of different technologies and delivery strategies (public, social marketing, NGO, commercial)
- Provide training in various HWTS products and technologies to promote optimal solutions and sustained uptake through greater acceptability
- Encourage collaboration with International HWTS Network, WPRO and other international HWTS efforts
- Increase access to research and lessons learned
- Emphasize overall programme management in delivery of HWTS interventions

5. Improve access to HTWS by vulnerable populations

- Increase availability/access to commercial HWTS products by taking advantage of and improving supply chains, especially to remote rural and costal populations
- Use schools, clinics, emergency-response and other special settings to promote and deliver HWTS options
- Include HWTS options as part of preparedness for natural disasters, and take advantage of special funding reserved for emergency response
- Look for opportunities to achieve multiple goals (e.g., primary health care, safe water and AIDS project, school-based initiatives, child survival, survival kits)
- Employ micro-enterprise and micro-finance to enhance delivery and access
- Promote local production of effective HWTS options (e.g., ceramic filters, biosand filters, arsenic sand filters) and improve capacity of existing producers
- Improve project/process management capacity for producing, delivering and securing use (behaviour change) of HWTS products as part of the effort to ensure quality control and optimize results

6. Promote research, monitoring and evaluation

- Involve NCERWAS and other governmental agencies, laboratories and epidemiologists, WPRO, universities, reference libraries and other research institutions in HWTS research and M&E
- Map existing and planned HWTS activities in Viet Nam to improve coordination and ensure optimal delivery

- Confirm effectiveness and affordability of boiling by conducting assessments in multiple regions
- Validate performance of arsenic remediation measures
- Document and publicise the economic advantages of HWTS over bottled water sold in Viet Nam
- Evaluate multiple HWTS options in emergency response on the bases of cost, effectiveness, ease of deployment, uptake, and continued use following emergency
- Document and publicise the out-of-pocket savings to the public sector and householders from using HWTS (less diagnostic and treatment costs, medicines, lost productivity, etc. in Viet Nam
- Document other benefits associated with HWTS (reduced school absenteeism, increased productivity, possible reduction in co-morbidity with other infections/diseases)
- Emphasize strategies for achieving acceptability, correct/consistent use, sustained use
- Implement longitudinal studies to verify efficacy trials
- Develop and implement systems to monitor longer-term adoption