The Village Well Project

The Need for a Reliable, Inexpensive, and Sanitary Mechanism to Raise Water from a Village Well to Replace Handpumps that Break Down, Which Would Be a Mechanism that Would Help the United Nations and the United States Achieve Their Goals of Increasing Access to Safe Drinking Water for People in Developing Countries

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Introduction

As noted in the Senator Paul Simon Water for the Poor Act of 2005, and as noted by the United Nations, nearly 5 million people die annually in developing countries from water-related diseases caused by drinking water contaminated by human waste.[1] The number of people who die every year from drinking dirty water exceeds the 2.1 million who die from AIDS, the 1.7 million who die from tuberculosis (TB), and the 1 million who die from malaria.[2]

Many of the deaths that dirty water causes could be prevented by the development of a simple mechanism to raise water from a village well that does not break down after extensive use (as most handpumps do) or contaminate the water in the well (as the rope and bucket mechanism does). This report discusses the problems with village wells and proposes a project to solve those problems.

The UN's Millennium Development Goals and the Senator Paul Simon Legislation on Safe Drinking Water

The United Nations in 2000 adopted the Millennium Declaration that included goals and targets that have become known as the Millennium Development Goals.[3] Among the Millennium Development Goals is Goal 7, Target 10 of reducing by half the proportion of people without sustainable access to safe drinking water and basic sanitation by the year 2015.[4]

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1 *Senator Paul Simon Water for the Poor Act of 2005*, Public Law 109-121, Sec. 2(1), 119 Stat. 2533;* UN Millennium Project, *Fast Facts: The Faces of Poverty, Water*, 2006.* (Matters marked in this present report with an * in the footnotes indicate that the URL address for said matter is provided at the end of this report.) There are other estimates of the deaths caused by drinking dirty water. The Gates Foundation has noted that 2.4 million people die every year from water-related diseases caused by drinking such contaminated water. Bill and Melinda Gates Foundation, *Water, Sanitation, & Hygiene*.* Pending legislation states that more than 2 million people die every year from such diseases. *See infra* note 16. Other estimates of the deaths caused by water-related diseases also generally range between 2 million to 5 million people per year. Peter H. Gleick, Pacific Institute for Studies in Development, Environment, and Security, *Dirty Water: Estimated Deaths from Water-Related Diseases 2000-2020*, August 15, 2002, pages 2-4.* The terms waterborne diseases and water-related diseases are almost interchangeable and generally refer to various diseases caused by drinking water contaminated by human waste. *See Id.*

2 The above figures are estimates that are available for recent years. *See* William J. Clinton Foundation, Clinton HIV/AIDS Initiative, *Why HIV/AIDS?*;* The Global Fund to Fight AIDS, Tuberculosis and Malaria, *HIV/AIDS Background*,* *Tuberculosis Introduction*,* *Malaria Background*.*

3 United Nations, *Indicators for Monitoring the Millennium Development Goals*, 2003, page iii.*

4 *Id.*, page 3 (Goal 7, Target 10).

The UN Millennium Project Task Force on Water and Sanitation (UN Task Force), which is the UN advisory task force for the above Millennium Development Goal, has stated:

> The importance of safe drinking water and basic sanitation to the preservation of human health, particularly among children, cannot be overstated. Water-related diseases are the most common cause of illness and death among the poor of developing countries….
>
> At any given time, close to half of the people in the developing world are suffering from one or more of the main diseases associated with inadequate provision of water supply and sanitation services: diarrhea, ascaris, dracunculiasis (guinea worm), hookworm, schistosomiasis (bilharzias, or snail fever), and trachoma. More than half the hospital beds in the world are filled with people suffering from water-related diseases.[5]

The above diseases are widespread due to the fact that *billions* of people in the developing world lack access to safe drinking water and basic sanitation. The UN Task Force stated: "Four of every ten people in the world [2.6 billion of the world's 6.2 billion people] do not have access to [basic sanitation such as] even a simple pit latrine; and nearly two in ten [1.1 billion people] have no source of safe drinking water."[6]

Thus it appears that the UN hopes that reducing by half the proportion of people without sustainable access to safe drinking water and basic sanitation will reduce by half the number of such deaths and illnesses caused by drinking contaminated water.

The UN has other Millennium Development Goals, which include eradicating extreme poverty and hunger, reducing child mortality, improving maternal health, and combating AIDS, malaria and other major diseases.[7] Concerning the other Millennium Development Goals, the UN Task Force observed that "it is difficult to imagine how significant progress can be made [toward achieving these

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[5] Roberto Lenton, Albert M. Wright, Kristen Lewis, UN Millennium Project, Task Force on Water and Sanitation, *Health, Dignity, and Development: What Will It Take?*, 2005 (hereinafter referred to as UN Task Force, *Health, Dignity, and Development*), pages 19-20.* Infectious diarrhea, ascaris, dracunculiasis, hookworm, and schistosomiasis are diseases caused by drinking water contaminated by human feces containing bacteria, viruses, helminths (parasitic worms), or parasites. Gleick, *Dirty Water, supra*, note 1, pages 2-3.

[6] UN Task Force, *Health, Dignity, and Development*, *supra* note 5, pages 1, 40, 16 (Box 2.1), iii.

[7] *Id.*, pages xviii-xix.

other goals] without first ensuring that poor households have a safe, reliable water supply and adequate sanitation facilities."[8]

Subsequent to the UN's Millennium Declaration, the United States Congress in 2005 enacted the Senator Paul Simon Water for the Poor Act of 2005, which as stated above, notes that nearly five million people die every year from water-related diseases due to the lack of access to safe drinking water and basic sanitation.[9] Concerning the causes for those five million deaths, the Act repeats some of the UN's statistics and states:

> At any given time, half of all people in the developing world are suffering from one or more of the main diseases associated with inadequate provision of water supply and sanitation services…. Over 1.1 billion people, one in every six people in the world [of 6.2 billion people], lack access to safe drinking water…. Nearly 2.6 billion, two in every five people in the world, lack access to basic sanitation services [such as a simple latrine]…. Half of all schools in the world do not have access to safe drinking water and basic sanitation.[10]

The above Act notes that "Target 10 of the United Nations Millennium Development Goals is to reduce by half by the proportion of people without sustainable access to safe drinking water by 2015."[11] That Act follows the UN's lead by stating that the Act "seek[s] to reduce by one-half … the proportion of people who are unable to reach or afford safe drinking water and the proportion of people without access to basic sanitation by 2015."[12]

The Act's preamble states that the Act's intent is: "To make access to safe water and sanitation for developing countries a *specific policy objective of the United States foreign assistance programs*."[13] That Act states that it "is the *policy of the United States …. to increase the percentage of water and sanitation assistance*" to developing countries.[14] This foreign policy not only has an obvious

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8 *Id*., page 17.
9 *Senator Paul Simon Water for the Poor Act of 2005*, *supra* note 1, Public Law 109-121, Sec. 2(1), 119 Stat. 2533.
10 *Id*., Public Law 109-121, Sec. 2(5)-(8), 119 Stat. 2533.
11 *Id*., Public Law 109-121, Sec. 2(21), 119 Stat. 2534.
12 *Id*., Public Law 109-121, Sec. 5(a) (Sec. 135(a)(2)), 119 Stat. 2536.
13 *Id*., Public Law 109-121, preamble, 119 Stat. 2533 (emphasis added).
14 *Id*., Public Law 109-121, Sec. 3(1), 119 Stat. 2535 (emphasis added).

humanitarian motive, but the Act also notes an economic motive, stating that "[e]very $1 invested in safe water and sanitation would yield an economic return of between $3 and $34, depending on the region."[15] Thus investing in safe drinking water and sanitation is a type of economic stimulus.

Pending before Congress is the Senator Paul Simon Water for the World Act of 2009, which states that the previous Paul Simon Act "codifies Target 10" of the UN's Millennium Development Goals concerning access to safe drinking water and basic sanitation.[16] The pending Act's preamble states that the Act's intent is: "To provide *100,000,000 people with first-time access to safe drinking water and sanitation* on a sustainable basis by 2015 by improving the capacity of the United States Government to fully implement the Senator Paul Simon Water for the Poor Act of 2005."[17] The pending Act states that it is necessary for the United States to "*expand foreign assistance capacity to address the challenges*" caused by the lack of safe drinking water and basic sanitation.[18]

The Village Well and Its Problems

Fighting AIDS, TB, and malaria requires scientists, doctors, health workers, and great sums of money but a key to reducing the deaths and illnesses from dirty water, and thereby achieve the goals of the UN and Congress, is to simply improve the devices for lifting water from a well so that such devices are not only dependable for lifting water but also for shielding the well itself from contamination by the human waste that causes water-related diseases. Since sustainable access to safe drinking water is an obvious key to solving many global health problems then there must be a *focus* on how to actually provide sustainable access to safe drinking water.

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15 *Id*., Public Law 109-121, Sec. 2(16), 119 Stat. 2534.

16 *Senator Paul Simon Water for the World Act of 2009*, Senate Bill 624, 111th Cong. (2009) (hereinafter Senate Bill 624), Sec. 2(1)(C);* *Senator Paul Simon Water for the World Act of 2009*, House Bill 2030, 111th Cong. (2009) (hereinafter House Bill 2030), Sec. 2(1)(C).* The pending legislation states that more than 884,000,000 people throughout the world lack access to safe drinking water and that more than 2 million deaths occur as a consequence of unsafe drinking water and poor sanitation. Senate Bill 624, Sec. 2(4)(A), (5)(B); House Bill 2030, Sec. 2(4)(A), (5)(B).

17 Senate Bill 624, *supra* note 16, preamble (emphasis added); House Bill 2030, *supra* note 16, preamble (emphasis added).

18 Senate Bill 624, *supra* note 16, Sec. 2(11) (emphasis added); House Bill 2030, *supra* note 16, Sec. 2(11) (emphasis added).

The lack of safe drinking water is primarily due to fecal contamination of water sources. As noted above, 2.6 billion people lack access to basic sanitation such as a simple pit latrine and 1.1 billion people lack access to safe drinking water. The UN Task Force has stated:

> Adequate water supply and sanitation, coupled with hygienic behaviors … are fundamental to health because the *main culprit in the transmission of water-related disease is the "fecal-oral" cycle…. Drinking contaminated water transmits waterborne fecal-oral diseases* such as cholera, typhoid, diarrhea, viral hepatitis A, dysentery, and dracunculiasis (guinea worm disease)…. Sanitation facilities interrupt the transmission of much fecal-oral disease by preventing human fecal contamination of water and soil.[19]

Most (70%) of the poor people in the world live in rural areas,[20] and the source for obtaining water in rural areas is typically an *open well*.[21] Such wells can be easily contaminated by human excreta on buckets, ropes, and other objects that enter the wells, such contamination usually being due to open defecation and the lack of basic sanitation such as a latrine.

The organization WaterAid has observed:

> *The majority of people in the developing world gain access to groundwater either by means of a bucket and rope*, or by using a handpump. Using a bucket and rope can be made easier if the well is provided with a windlass to help lift the bucket. However, although easy to operate and repair, the bucket and windlass arrangement has *serious disadvantages: it does not allow the well to have a cover slab which can be sealed to prevent ingress of polluted water or other contaminants, and the bucket and rope themselves are continually being polluted by mud and dirty hands*.[22]

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[19] UN Task Force, *Health, Dignity, and Development*, *supra* note 5, page 22 (emphasis added).

[20] The World Bank, *Water, Rural WSS*, 2009.* Definitions of poverty include lack of safe drinking water and basic sanitation. UN Task Force, *Health, Dignity, and Development*, *supra* note 5, page 17.

[21] For pictures of such open wells, *see* Prof. Richard Carter, Water and Sanitation Program of The World Bank, and Rural Water Supply Network, *Investigating Options for Self-Help Water Supply*, 2006.*

[22] WaterAid, *Technology Notes*, 2007, page 21 (emphasis added).*

Although the UN did not specifically define the term safe drinking water, the UN measures progress towards its safe drinking water goal by determining the proportion of the population with sustainable access to an *improved water source*, such as piped water, a public tap, rainwater, a borehole (which requires a handpump), a pump, or a *protected well*. UN Task Force, *Health, Dignity, and Development*, *supra* note 5, pages 28-29; United Nations, *Indicators for Monitoring the Millennium Development Goals*, supra note 3, page 64. Thus the UN considers a protected well to be an improved water source and thus such wells count toward achieving the UN's goal on increasing access to safe drinking water. However, it appears that the definition of a protected well *includes* an open well that has a rope and bucket system that is only protected on the side by a circular wall (casing) extending above ground and that is obviously not sealed on the top (although it might have a temporary cover over the well opening that the users must remove before dropping the bucket into the water and then replace after each use). *See* Jeff Conant, Hesperian Foundation, and the United Nations Development Programme, *Water for Life, Community Water Security*, 2005, pages 24-27;* Francois Brikke and Maarten

Thus if the water to be raised from a well is for people to drink, it seems preferable to install on the top of the well a handpump that allows the well to be covered and sealed. WaterAid has stated: "In every respect, the hand pump has been accepted as the best tool for protecting well water in many countries. It provides the opportunity to cover and seal the well to prevent all foreign materials from entering the water."[23]

However, the handpumps break down to a great extent. The UN Task Force observed that the technology for removing water from wells was mostly handpumps, but the handpumps in dispersed settlements (villages) often fall into disrepair due to inadequate maintenance, the unavailability of spare parts, or the lack of technical skills to repair the handpumps.[24] The UN Task Force noted as a common example one country in Africa where 60% of the handpumps and piped systems were nonfunctional in the 1990s due to the communities' lack of training and the human capacity to maintain the handpumps and piped systems in good working order.[25]

Bredero, World Health Organization and IRC Water and Sanitation Centre, *Linking Technology Choice with Operation and Maintenance in the Context of Community Water Supply and Sanitation, A Reference Document for Planners and Project Staff*, 2003, page 29.* Such wells surely provide safety for the users but do not really provide safe drinking water to the users since an open well can be easily contaminated. Thus increasing the number of such 'protected' but actually open wells does not achieve much in providing greater sustainable access to safe drinking water.

The UN only made an assumption that such improved water sources, such as protected but open wells, provide safe drinking water. As noted by the UN Task Force the UN in setting its goals "did not specifically define" the term safe drinking water and "*assumed* that those technologies that can be categorized as improved are inherently safer … than others that are considered not improved." UN Task Force, *Health, Dignity, and Development*, *supra* note 5, page 28 (emphasis added). "The indicator [for safe drinking water] monitors access to improved water sources based on the *assumption* that improved sources are *more likely to provide safe water*." United Nations, *Indicators for Monitoring the Millennium Development Goals*, *supra* note 3, page 64 (emphasis added).

Thus an increase in the number of wells that are protected on the side but not on the top (and therefore easily contaminated) should not count as increasing access to safe drinking water, and progress should be measured only by the increase in the number of wells that are fully enclosed with sealed covers or covers that need not be removed to use the well.

Another improved water source is rainwater. UN Task Force, *Health, Dignity, and Development*, *supra* note 5, pages 28-29; United Nations, *Indicators for Monitoring the Millennium Development Goals*, *supra* note 3, page 64. Since the rainwater is apparently collected from roofs then it could be easily contaminated from animal excreta on a dirty roof, or later become contaminated if it is stored during the dry season in open containers or it could become stagnant.

In addition to efforts to improve the means of removing water from the ground so that the water does not become contaminated at the point of removal, there are efforts to provide technologies that purify the water at the point of use, which is an approach known as household water treatment and safe storage. *See* World Health Organization, *Household Water Treatment and Safe Storage*, 2009;* World Health Organization, *Treatment Technologies*, 2009.*

[23] WaterAid, *Piloting the Rope Pump in Ghana*, 2004, page 2.*

[24] UN Task Force, *Health, Dignity, and Development*, *supra* note 5, pages 94 (Table 7.1), 48-49.

[25] *Id*., page 49.

Another organization, FairWater, has observed that "*about 90% of most handpumps breakdown within 3 years due to worn out or broken parts.*"[26] A report by the World Bank's Water and Sanitation Program (WSP) published in 2006 states that "at any given moment an average of 30 percent of all potentially functional handpumps in Africa are not working …. [and in] some areas 50 percent or more are non-functional, due in part to difficulties in obtaining spare parts."[27] In some areas of Niger as "few as 20 percent of the hand pumps are functional."[28]

Although not specifically mentioning handpumps, the Senator Paul Simon Water for the Poor Act of 2005 states: "Between 20 percent and 50 percent of existing water systems in developing countries are not operating or are operating poorly."[29] These percentages are not the percentages of water systems that break down and are soon fixed but are the percentages regarding water systems working on an average day.

The organization Water For People has noted that "broken pumps exist throughout the developing world because the financial and technical capacity to operate, maintain, repair and replace water systems is fragile.[30] That organization more recently stated that the conventional indicators for measuring success in water and sanitation programs – merely counting the number of people who benefit from a new water or sanitation system the day it is installed – are misleading.[31] That organization stated to change that it would monitor the systems it installs and issue reports on whether those systems are still functional 3, 6, and 10 years after installation. That organization will only count as beneficiaries of their installed systems the number of people using those systems at the later times rather than at the time of installation.

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[26] FairWater, *About Us*, page 1 (emphasis added).*

[27] Anthony Oyo, Water and Sanitation Program of The World Bank, and Rural Water Supply Network, *Spare Part Supplies for Handpumps in Africa,* 2006, page 2.*

[28] Dr. Kerstin Danert, Water and Sanitation Program of The World Bank, and Rural Water Supply Network, *A Brief History of Hand Drilled Wells in Niger,* 2006, page 3.*

[29] *Senator Paul Simon Water for the Poor Act of 2005*, *supra* note 1, Public Law 109-121, Sec. 2(14), 119 Stat. 2534.

[30] Water For People, *Major Announcement from Water For People CEO*, October 27, 2009.*

[31] Water For People, *Demonstrating Impact Over Time*, December 27. 2009.*

Thus the main options for retrieving underground water in rural areas are cheap but unsanitary open wells, or covered wells that have costly handpumps that eventually break down.

This basic problem has not received enough attention. Although the UN Task Force has stated, as noted above, that handpumps often break down, that Task Force has also stated that "most experts agree that a full complement of technologies is now available for safe, reliable water supply in almost any setting."[32] The Task Force stated that the available technology for abstracting water from wells was mostly hand pumps, and that "[h]and pumps … [and] improved wells … are examples of 'lower-tech' approaches that may be particularly relevant and cost-effective for many rural … areas."[33]

The UN Task Force also stated that "[e]xpanding water and sanitation coverage is not rocket-science … [and] requires neither colossal sums of money nor breakthrough scientific discoveries or dramatic technological advances."[34] Although the UN Task Force stated that dramatic technological advances were not needed, it did say that "*innovation* should be pursued" in water supply technology to speed progress toward meeting the Millennium Development Goal of reducing by half the proportion of people without sustainable access to safe drinking water.[35]

However, innovation is needed not only to speed progress but to make any significant progress toward reaching the UN's goal. The organization FairWater has noted that the Millennium Development Goal of reducing by half the proportion of people without sustainable access to safe drinking water "*will never be possible*" in rural areas due to the way water projects have been organized, which has basically been to rely on donated handpumps that break down after a few years and are abandoned.[36] Issuing subsequent reports on broken handpumps obviously won't fix them.

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[32] UN Task Force, *Health, Dignity, and Development*, *supra* note 5, pages 48-49, 172.
[33] *Id*., pages 94 (Table 7.1), 171.
[34] *Id*., page 163.
[35] *Id*., pages 100-101 (emphasis added).
[36] FairWater, *The Millennium Development Goals and the WatSan Sector*, page 4 (emphasis added).*

The Senator Paul Simon Water for the Poor Act of 2005 recognizes the problem by stating that between 20 percent and 50 percent of existing water systems in developing countries are not operating or are operating poorly.[37] The pending Senator Paul Simon Water for the World Act of 2009 also recognizes the problem by advocating research and technology development to address safe drinking water and sanitation issues, and by providing grants to foster the development and dissemination of low cost and sustainable technologies for safe drinking water and sanitation, particularly in places with limited resources and infrastructure.[38] That Act also seeks to promote research on the effectiveness of programs that provide safe drinking water and sanitation.[39]

To make any significant progress toward providing people in the developing world with safe drinking water, the world needs to focus like a laser on the village well. Designing a reliable, inexpensive, and sanitary mechanism to raise water from a village well that requires little if any maintenance and repair, and no maintenance or repair by people outside the village, would be a giant step toward achieving the goals regarding increasing access to safe drinking water as set forth in the UN's Millennium Declaration and the Senator Paul Simon legislation.

Afripump, Rope Pump, and Elephant Pump

Attempts have been made to solve the problem. The organization FairWater, which has noted the problems with typical handpumps, promotes a handpump (Afripump) that requires no spare parts and only limited maintenance.[40] Although the Afripump addresses the problems of spare parts and maintenance, its cost of 1,500 euros (about $2,100.00 depending on the exchange rate) is a problem and appears to be more within the price range of charities and NGOs rather than most villages.[41]

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[37] *Senator Paul Simon Water for the Poor Act of 2005*, *supra* note 1, Public Law 109-121, Sec. 2(14), 119 Stat. 2534.

[38] Senate Bill 624, *supra* note 16, Sec. 8 (Sec. 135 (c)(3)); House Bill 2030, *supra* note 16, Sec. 8 (Sec. 135 (c)(3)).

[39] Senate Bill 624, *supra* note 16, Sec. 8 (Sec. 135 (c)(3)); House Bill 2030, *supra* note 16, Sec. 8 (Sec. 135 (c)(3)).

[40] FairWater, *Afri-pump*, pages 3-4.*

[41] *See* Fairwater, *FairWater Projects* (costs).* The cost of the Afripump makes it suitable for purchase by an NGO or a business such as a commercial water service. FairWater, *Afri-pump*, supra note 40, pages 3, 5-6.

The World Bank and its Development Marketplace program has also recognized the problem and in 2006 issued grants for the development of simpler technologies such as the following rope pump and Elephant Pump.[42]

Various organizations have promoted the rope pump, and provide pictures of it on their websites.[43] The rope pump raises water when the user turns the handle on a pulley wheel that rotates a single rope that has small pistons/washers attached to it every meter, and that rope goes down to the bottom of the well and through a guide box, and the rope then goes back up through a tube where the water that is above the pistons/washers is released through an outlet in the tube at the top of the well.

However, the rope pump has no complete cover and thus can be contaminated. The PRACTICA Foundation has noted: "The rope pump is not 100% closed. At the discharge and return tube, the pump is open to the air and contamination of the rope is possible via contact by hand."[44] Since the rope pump is not completely covered, then according to a World Health Organization (WHO) publication: "Hygiene is more important than with many other types of pump, particularly when the pump is used communally. In such cases, it is important that the users organize effective measures for ensuring good hygiene practices."[45]

Also, the rope must be regularly checked for tension and adjusted when needed,[46] and such inspection by hand can obviously lead to contamination. It must be remembered that billions of people in the world lack basic sanitation facilities such as latrines. Although most rope pumps stay in

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[42] The World Bank, *From Open Wells to Rope Pumps*;* The World Bank, *Pump Aid and the Elephant Pump*.*

[43] *See* PRACTICA Foundation, *Rope Pump Manual, Ethiopia*, 2006, cover, pages 9-10, 13;* Bombas de Mecate, *The Rope Pump*, *The Technology*;* WaterAid, *Piloting the Rope Pump in Ghana*, *supra* note 23, cover; Ideas at Work, *The 'Rovai' Pump*;* Demotech, *Rope Pump*.* The rope pump is also mentioned in a World Health Organization (WHO) publication. *See* Brikke and Bredero, *Linking Technology Choice with Operation and Maintenance*, *supra* note 22, pages 47-49.

[44] PRACTICA Foundation, *Rope Pump Manual, Ethiopia*, *supra* note 43, page 8.

[45] Brikke and Bredero, *Linking Technology Choice with Operation and Maintenance*, *supra* note 22, page 48.

[46] PRACTICA Foundation, *Rope Pump Manual, Ethiopia*, *supra* note 43, page 39.

use for extended periods of time,[47] there appears to be no surveys that indicate whether the rope pumps stay sanitary over extended periods of time. It is probably merely assumed that they stay sanitary.

The rope pump also has other problems. The PRACTICA Foundation has stated:

> Although the Rope pump technology seems (and is) simple, there are still many details in production, installation and use which need … attention especially in the first years of production and introduction….
>
> Therefore quality control is crucial in the phase of introduction when the Rope pump still has to build up a name as an accepted, reliable and sustainable pump by manufactures, users, government[s], NGO's and donors.
>
> If the quality of the pumps, produced in the first years, is bad and results in broken or rusted parts, the Rope pump will build up a negative name amongst users in an almost irreversible way! As a result the rope pump will be rejected. Unfortunately this is a hard lesson learned in a number of countries.[48]

The rope pump has many parts, and takes several steps to make and also to install.[49] The rope pump not only requires high precision in making it and high quality parts but transferring the technology for making it can take time.[50]

Regarding the operation of the rope pump, the rope can slip on the pulley wheel.[51] The person using it must insert a brake or pump lock after using it or else the metal handle goes backwards with force due to the weight of the water that was still in the tube.[52] According to the PRACTICA Foundation very small children should not be allowed to operate the rope pump because if "the handle slips out of their fingers, the pump will turn in [a] backwards direction and the handle could hurt the

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47 *Id*., page 8.

48 *Id*., page 11 (emphasis deleted).

49 *Id*., pages 13-35.

An organization that produces the rope pump, Bombas de Mecate, states that the rope pump requires a specialized production process including a plastic injection machine to make the pistons, an electric or gas kiln for the glazing of the ceramic piece in the guide box, and a mechanical process to make the pulley wheel. Bombas de Mecate, *The Rope Pump*, *The Production Process.** To make the rope pump includes making pieces that require high precision and high quality, such as the pistons that are attached to the rope and that must fit precisely within the tube or else water is lost. Bombas de Mecate, *The Rope Pump*, *The Technology*, *supra* note 43; *Warning*;* *Pistons.** The guide box that is made of concrete and a ceramic piece inside must be made in such a way that the rope only touches the smooth ceramic and not the concrete or else the rope wears out. *Id*, *The Guide*.*

50 *See supra* note 49; Bombas de Mecate, *The Rope Pump*, *Technology Transfer Program*.*

51 Bombas de Mecate, *The Rope Pump*, *Operation, Maintenance and Repair*.*

52 *Id*.; PRACTICA Foundation, *Rope Pump Manual, Ethiopia*, *supra* note 43, pages 19, 39.

children."[53] The rope pump must be rotated clockwise and never turned in the opposite direction, and more than 10 households should not use the rope pump because operation and maintenance cannot be carefully carried out when large groups use it.[54]

Replacing a broken rope appears to be a difficult task that requires training and many villagers might not feel qualified to do it and would wait for a trained person.[55]

The cost of the rope pump from Bombas de Mecate is $70.00 to $150.00.[56] The cost of the rope pump from Ideas at Work is $99.00.[57] Introducing the rope pump technology can be expensive.[58]

The contamination problem was addressed by the design of a rope pump that is completely enclosed in a concrete casing with a cover, and which is known as the Elephant Pump.[59] The organization Pump Aid that promotes the Elephant Pump on its website has pictures and a video on the Elephant Pump.[60] Due to the enclosure of the Elephant Pump, the technology for it is more complex than the rope pump.

The cost of the Elephant Pump for materials and to install is 500 pounds (about $800.00 depending on the exchange rate),[61] and thus out of the price range of most villages. To obtain an Elephant Pump requires first filing an application with Pump Aid, which then conducts a thorough investigation at the proposed site.[62]

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53 PRACTICA Foundation, *Rope Pump Manual, Ethiopia*, *supra* note 43, page 39.

54 *Id.*

55 *See* V. Whitehead, Ideas at Work *The 'Rovai' Handpump – RP6*, *Operation & Maintenance Manual*, October 2008, pages 8-11.*

56 Bombas de Mecate, *The Rope Pump*, *Costs*.*

57 Ideas at Work, *DM 2006 Completion Report, 7/1/2008* (Project Number DM1297), page 2.*

58 *See* Netherlands Water Partnership, *Smart Water Solutions*, 2006, pages 18-19 (introducing the technology and building 20 rope pumps could cost $10,000-$20,000, and for 1,000 pumps the costs could be $60,000-$100,000).*

59 Pump Aid, *The Elephant Pump*.*

60 Pump Aid, *How to Build an Elephant Pump* (pictures);* Pump Aid, *How Does It Work?* (video).*

61 Pump Aid, *The Elephant Pump*, *supra* note 59.

62 Pump Aid, *Our Approach*.*

101 Well

Nearly 40 years ago the author as a Peace Corps volunteer in northeast Thailand saw a village well that could not be used because it had a broken handpump that needed to be replaced, which took time. He tried to solve the problem not by working on a better handpump but by going backwards to the original rope and bucket, and designing a mechanism where the rope and bucket with a windlass were enclosed in a well casing and thus would be sanitary. He named it the 101 Well after the province of Roi Et where he was stationed, which translated means 101.

Although the rope pump is based on old technology, the 101 Well is based on the even older rope and bucket system, and is simpler. The 101 Well raises water when the user turns the handle on a windlass that has two ropes that are tied on the other ends to the two sides of a bucket that has the shape of a bucket on a backhoe, and that bucket is raised from the bottom of the well to the top of the well where it releases its water into a trough that has an outlet pipe.[63] The entire mechanism, excluding the windlass handle and trough outlet pipe, is fully enclosed within a standard round concrete well casing (120 cm wide, 60 cm high) with a cover, and thus the mechanism is protected

[63] When the bucket, which is in the shape of a bucket on a backhoe, is lowered and hits the water it immediately sinks and when it is raised to the top of the well it quickly empties the water when the lip of the bucket in a metal frame touches the guide rods by the trough at the top. The bucket body from the side is approximately 41 cm long on top, 15 cm long on the bottom, 22 cm high, and 20 cm wide. The bucket frame is designed so that it not only immediately sinks when it hits the water but when raised the bucket is balanced and does not lose water, and when it reaches the top it easily tilts and empties the water into the trough when the lip of the bucket hits the guide rods. *See* attached diagram. The metal bucket frame has extensions on both sides of the frame where the two ropes are attached, which allows the bucket to be raised in a steady manner without swinging, which facilitates the bucket releasing the water once it touches the guide rods near the trough. There is a counterweight of concrete on a rope that goes through a pulley at the back of the trough, which makes it easier to raise the bucket full of water and so that when the bucket is emptied it stays at the top rather than falling back into the water with the windlass handle swinging.

The well is initially left open for people to familiarize themselves with its mechanics, which are the same as the traditional rope and bucket on a windlass system requiring turning the handle one way to raise the bucket and then the other way to lower it. Even when the well is later covered, knowing when the bucket reaches the top is easy because the user hears the bucket emptying, there is less pressure on the handle, and a guide rod stops the bucket from being raised further. Knowing when the bucket reaches the water at the bottom is also easy because the bucket immediately sinks and there is different pressure on the handle. Even without the different pressure on the handle the user would not keep turning the windlass to lower the bucket because lowering the bucket raises the counterweight that stops at a guide rod if it ever reaches the top of the well. The rope lengths are such that if the counterweight reaches the top of the well the bucket is only near the very bottom of the well. After a few weeks of use, the well is then sanitized with chlorine and covered. The cover does not need to be removed to use the well but can be removed to observe the mechanism or fix it.

from outside contamination. *See* attached diagram. The top of the mechanism is shoulder high and the windlass handle is waist high, similar to the usual rope and bucket on a windlass system.

The bucket held approximately 1.5 gallons (6 liters) of water, and the yield was better than the traditional rope and bucket on a windlass system because the 101 Well is a faster system and the bucket is larger than the usual bucket used to raise water from a well. Once the first bucket of water is emptied into the trough, the yield would probably be the same as the rope pump. The 101 Well is suitable for wells with depths that the traditional rope and bucket system would be suitable.

The author spent nearly two years working on the 101 Well. The design worked but there were problems with the durability of the materials, mainly the bucket that required a specific shape and which was made of bamboo or welded sheet metal.[64] The obvious solution would be to mold a plastic bucket that could easily fit inside a metal frame but that technology was not available in northeast Thailand in 1970. Today that would be an easy task.[65]

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[64] The bucket, which had a specific shape like that of a bucket on a backhoe, was first made of bamboo (with wax) and then later sheet metal. Although the bamboo was inside a metal frame and thus protected from wear when it touched the guide rods at the top, the entire bamboo body was subject to wear when it hit the water at the bottom of the well. In an average village well that bucket might hit the water 100 times per day. Sheet metal was then used for the bucket body but welding sheet metal was a difficult task and it was also foreseeable that the welds or the thin sheet metal around the welds might weaken and the bucket would fall apart.

[65] Another foreseeable but probably minor problem was the wear and tear on the pulleys that the two ropes would go through just before reaching the windlass. It is necessary to keep the bucket from swinging when it is being raised and therefore there is a rope on each side of the bucket frame and the ropes go through pulleys 60 cm apart attached to a bar at the top of the well near the windlass. *See* attached diagram. There would be a great deal of stress on the small pulley pins over a period of time and it should be assumed that the pulleys would fail. Replacing the entire bar holding the two pulleys that went through the well casing would be a difficult task. Perhaps placing the pulleys on a shorter bar that could be attached to the top of the longer permanent bar and therefore easily replaced would be the answer. The means to attach the shorter bar to the longer permanent bar would have to be not only simple but also stable and not become loosened over time.

The rope holding the counterweight comes up through another pulley welded to the middle of the back brace for the trough and then the rope is tied to the middle of the windlass. This pulley is in a difficult location at the bottom of the top well casing and thus would be difficult to replace if it wears out. However putting that pulley on another bar at the top of the casing where it could be replaced as easily as the two other pulleys could be the solution.

Another problem was the bushings in the well casing through which the axle of the windlass rotates. The bushings were merely pipes placed inside the concrete casing. Better bushings should be used. Also the bushings should be in a frame that is outside the well casing similar to the Elephant Pump. *See* Pump Aid, *How to Build an Elephant Pump* (pictures), *supra* note 60.

The parts to the 101 Well consisted of metal rods, pipes, rope, concrete, and a bucket that now should be made of plastic. Other than the plastic bucket, the parts to the 101 Well are available in most large rural towns. If a town has electricity it probably has the parts to make a 101 Well other than the plastic bucket. Construction requires precision but mostly measuring pieces of metal and welding parts. Private entities or health workers at provincial health offices could make the 101 Well.

Including the new plastic bucket, the windlass, trough, ropes and other parts, and the additional top concrete casing containing the mechanism, the cost of the 101 Well might be as low as $35.00.[66] Thus villages can afford the 101 Well and do not need charity or grants from NGOs.

When the author finished his service in the Peace Corps in 1970 he wrote a 23-page report on how to build the 101 Well, and he noted in that report the problems with the bucket body and the desire for a plastic bucket (that was not available at that time).

The Village Well Project

WorldView magazine, which the National Peace Corps Association publishes, dedicated an issue in 2005 to the water crisis in the developing world, and an article in that issue stated that the Peace Corps had shifted away from well digging projects because the handpumps on the wells would break down and not be repaired.[67] While some have given up on trying to solve the problems with village well technology, others such as the Clinton Global Initiative believe that "the technology exists" to solve the problem of a billion people's lack of access to safe drinking water.[68]

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[66] The major initial cost for a modified 101 Well would be the cost for a plastic injection machine to mass-produce the plastic bucket. The production of the rope pump also requires a plastic injection machine to make the pistons. Bombas de Mecate, *The Rope Pump, The Production Process*, *supra* note 49. Obviously a prototype of the bucket should first be made and tested before any major expense is incurred. The actual cost of the plastic bucket for the 101 Well would be similar to the cost of any other mass-produced plastic bucket.

[67] David A. Taylor, *Beyond Wells, Peace Corps Has Switched to Education and Bigger Roles for Counterparts in Ghana*, WorldView Magazine, Vol. 18, No. 4, Winter 2005, pages 47-48.

[68] William J. Clinton Foundation, Clinton Global Initiative, *Global Health, Safe Drinking Water and Sanitation*, 2008 (Schedule for Working Session for the Global Health Working Group on September 26, 2008 at the Clinton Global Initiative Annual Meeting).* As mentioned earlier, the UN has similar views. *See supra* page 8.

The standard technology for lifting water from a village well and which is supposed to actually provide clean water, is the handpump and although it exists it does not really work. There will not be any real progress in providing safe drinking water to the billion people without it unless there is a *focus* on designing and promoting a village well technology that is reliable, inexpensive, and sanitary, and that requires little if any maintenance and repair. That focus should equal the focus on trying to find vaccines for AIDS, TB, and malaria. As recently as 2006, the World Bank was still issuing grants trying to solve the village well crisis. There should be not just a few grants but a project towards that goal, which might appropriately be called the Village Well Project, which although not as expansive as the UN's Millennium Development Goals or the Global Fund to Fight AIDS, Tuberculosis and Malaria could by its focus actually improve the lives of millions of people.

There has been criticism of the world's emphasis on fighting AIDS while it ignores more pervasive diseases such as water-related diseases. In early 2008, Daniel Halperin, a scientist at the Harvard School of Public Health, criticized the world's emphasis on fighting AIDS while it neglects other health problems such as diarrhea caused by the lack of safe drinking water.[69] Halperin noted that the United States in 2007 spent almost $3 billion on AIDS programs in Africa but "invested only about $30 million in traditional safe-water projects." He stated that this "nearly 100-to-1 imbalance is disastrously inequitable." He criticized the fact that while there is a Global Fund to Fight AIDS, Tuberculosis and Malaria, "there isn't a 'global fund' for safe water ..." He concluded:

> [I]t is … important, especially for the United States, the world's largest donor, to reexamine the epidemiological and moral foundations of its global health priorities. With 10 million children and a half million mothers in developing countries dying annually of largely preventable conditions, should we multiply AIDS spending while giving only a pittance for initiatives like *safe-water projects*? (Emphasis added.)

More recently, an article in *The New York Times* states that there is a debate over whether the United States and other rich countries spend too much money on fighting AIDS, which requires

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[69] Daniel Halperin, *Putting a Plague in Perspective*, Op-Ed, New York Times, January 1, 2008.*

lifelong medications, and not enough money on fighting other diseases such as diarrhea and pneumonia, which can be treated inexpensively.[70] The article notes that about 1.5 million children in developing countries die every year from diarrhea. The article states that White House official Dr. Ezekiel J. Emanuel has contended that international aid for health is limited and that the aid that is available would save more lives if increases in aid focused on maternal health and the mundane diseases that cause the deaths of young children.

However, such a focus need not involve spending more money on fighting such mundane diseases and less money on AIDS. Unlike AIDS, billions of dollars are not needed to solve the problems with village wells that cause so many water-related mundane diseases. Not even millions of dollars are needed but rather a focus is needed. A reliable, inexpensive, and sanitary technology to lift water from a village well would allow a very effective use of the financial resources available to provide more access to clean drinking water.

Furthermore, Doctor Sally Sutton, a rural water supply expert, has stated that the UN's Millennium Development Goal of reducing by half the proportion of people without sustainable access to safe drinking water is jeopardized by the advocacy of expensive technology to achieve that goal, and she stresses that simple and inexpensive technology should be considered because such technology is more acceptable to the users and can reach a greater range of users because they can afford that technology.[71] There should be a focus on developing such simple technology.

Various actions could be taken to start the Village Well Project. Random site checks could be made of rope pumps in use for at least six months to determine if most rope pumps still provide clean water or have become contaminated because they are not completely covered. If most rope

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[70] Celia W. Dugger, *As Donors Focus on AIDS, Child Illnesses Languish,* New York Times, October 29, 2009.*

[71] *See* Dr. Sally Sutton, *The Risks of a Technology-Based MDG Indicator for Rural Water Supply*, 2008, pages 1-5;* Dr. Sally Sutton, Rural Water Supply Network, *An Introduction to Self Supply*, 2007;* Dr. Sally Sutton, Water and Sanitation Program of The World Bank, and Rural Water Supply Network, *Self Supply: A Fresh Approach to Water for Rural Populations*, 2004;* *see also* Carter, *Investigating Options for Self-Help Water Supply*, *supra* note 21.

pumps still provide clean water after months of use, then organizations involved in providing clean water in the developing world's rural areas should stress the rope pump as a partial solution to the problem and usually a better option than the handpump. (The author contends that the cost of the Afripump, which is 1,500 euros or about $2,100.00, and the cost of the Elephant Pump, which is 500 pounds or about $800.00, make those pumps impractical as a solution to the village well problem.)

Also prototypes of the 101 Well should be made, tested and modified to determine if that type of technology is as good or better than the rope pump, and if so there should a similar effort to promote the 101 Well as a solution to the village well problem, especially since it is simpler and cheaper than the rope pump and unlike the rope pump it is covered and thus more likely to provide clean water over an extended period of time than the rope pump.

Obviously in addition to the rope pump and 101 Well other solutions and options should be researched and considered.

Many entities are capable of focusing on and solving the problems with village wells.

For example, many colleges have research centers that could focus on the problem. The WaTER (Water Technologies for Emerging Regions) Center at the University of Oklahoma seeks to solve drinking water and sanitation challenges in developing countries through innovative research initiatives and projects.[72] The Center for Global Safe Water at Emory University's Rollins School of Public Health conducts research on and promotes innovative solutions to the problem of the lack of safe drinking water.[73] The Dickey Center at Dartmouth College and the HELP program at Dartmouth's Thayer School of Engineering are starting several water and sanitation projects in Tanzania.[74] The Mortenson Center in Engineering for Developing Communities at the University of Colorado conducts research and development to help developing communities meet the Millennium

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72 WaTER Center, University of Oklahoma, *About the WaTER Center*.*

73 Center for Global Safe Water, Emory University, *Center for Global Safe Water*.*

74 HELP, Dartmouth College, *Tanzania Global Health Initiatives Project*.*

Development Goals.[75] The Blum Center for Developing Economies at the University of California designs sustainable technologies for developing countries, and has an initiative on safe water and sanitation.[76] The D-Lab at the Massachusetts Institute of Technology develops low cost technologies for developing countries.[77] The Earth Institute at Columbia University has a Millennium Villages project that focuses on 79 villages in Africa and seeks to achieve the Millennium Development Goals by applying new advances in technology and simple solutions to various problems.[78]

Other colleges could also establish such research centers.

Engineers Without Borders, which has chapters at many engineering schools and has many professional chapters, designs and implements engineering projects with developing communities.[79]

Various organizations in Europe are involved in designing or promoting water supply technology to serve developing countries. Such organizations include the Rural Water Supply Network (RWSN),[80] the PRACTICA Foundation,[81] the IRC International Water and Sanitation Centre,[82] WaterAid,[83] and Demotech.[84]

The organization the Global Water Challenge is a coalition of leading organizations that find and provide creative and sustainable solutions to the lack of safe drinking water and basic sanitation in developing countries, and its mission is to provide an open forum for leaders to connect, communicate, and be catalysts for change and to invest in projects that are sustainable, scalable, and replicable.[85]

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75 Mortenson Center in Engineering for Developing Communities, University of Colorado, *About EDC*.*

76 The Blum Center for Developing Economies, University of California, *About Us**

77 D-Lab, Massachusetts Institute of Technology, *About D-Lab.**

78 The Earth Institute, Columbia University, *Millennium Villages*.*

79 Engineers Without Borders USA, *EWB-USA: Building a Better World*;* EWB-International, *About EWBI*.*

80 Rural Water Supply Network (RWSN) (Switzerland), *RWSN Mission Statement*.*

81 PRACTICA Foundation (The Netherlands), *Homepage*.*

82 IRC International Water and Sanitation Centre (The Netherlands), *About IRC.**

83 WaterAid (England), *What We Do*.*

84 Demotech (The Netherlands), *About Demotech*.*

85 Global Water Challenge, *About Us, Mission*.*

The organization Water For People has noted the problems of broken handpumps and the limited technology options that are available to provide safe drinking water in developing countries, and uses mobile mechanics, known as 'circuit riders', to repair those broken technologies for a fee that villages pay.[86]

Other organizations, such as Water.org[87] and the Water & Sanitation Rotarian Action Group,[88] are more generally involved in providing safe drinking water in developing countries.

Regarding UN entities, the United Nations Development Programme is the UN's global development network that connects countries with knowledge, experience and resources to help them reach the Millennium Development Goals.[89] The World Health Organization (WHO), which is the UN's health authority, shapes the global health research agenda and provides technical support to countries.[90] UNICEF works at providing safe drinking water to the millions of children without it and has helped to develop simple, affordable, and innovative solutions to complicated problems.[91]

And there is always the Peace Corps.[92]

There are entities that could either start a project on village wells or fund such a project.

For example, the Clinton Hunter Development Initiative, which is a partnership of the William J. Clinton Foundation and the Hunter Foundation, is investing $100 million toward catalyzing sustainable economic growth in Africa by among other things increasing access to clean water in ways that can be locally sustainable.[93]

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[86] Water For People, *How We Help*,* *Water For People Announces Investment from Case Foundation to Expand Sustainable Safe Water Solutions in Africa,* October 27, 2009,* *Major Announcement from Water For People's CEO, supra,* note 30.

[87] Water.org, *About Us.**

[88] Water & Sanitation Rotarian Action Group, *Mission Statement, Goals.**

[89] United Nations Development Programme, *About UNDP*.*

[90] World Health Organization, *About WHO*.*

[91] UNICEF, *Water & Sanitation,** *Our Values*.*

[92] Peace Corps, *About the Peace Corps, What Do Volunteers Do?, Health*.*

[93] William J. Clinton Foundation, Clinton Hunter Development Initiative, *Creating Sustainable Development in Africa.**

President Jimmy Carter and The Carter Center have initiated several health programs that have prevented the suffering of millions of people in developing nations.[94]

The Conrad N. Hilton Foundation has since 1990 committed $62 million for programs to provide clean, sustainable sources of water in Africa.[95]

The Bill and Melinda Gates Foundation has a Global Health Program that includes a program on diarrhea and enteric diseases that are caused by drinking contaminated water, and has another program on neglected infectious diseases, such as diseases caused by drinking water containing parasitic worms (helminths).[96] The Gates Foundation also has an initiative on water and sanitation that works toward expanding access to safe water and sanitation by "funding research that tackles key questions and brings new insight to the field" of water and sanitation, and by "supporting innovations on a broad range of products and services."[97]

The Case Foundation has noted the limited technology options available for providing safe drinking water in developing countries, and has issued a grant to Water For People for its work in using mobile mechanics, known as 'circuit riders', to repair those technologies for a fee.[98] That foundation supports "big ideas" that have transformative potential.[99]

As mentioned earlier, the World Bank has given grants for the development of water lifting technologies such as the rope pump and the Elephant Pump.[100]

Also as mentioned earlier, the pending Senator Paul Simon Water for the World Act of 2009 calls for grants for the development and dissemination of low cost and sustainable technologies for providing safe drinking water and sanitation, particularly in places with limited resources and

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94 The Carter Center, *Health Programs.**

95 Conrad N. Hilton Foundation, *Safe Water Development*.*

96 Bill and Melinda Gates Foundation, *Diarrhea & Enteric Diseases Overview*,* *Neglected Diseases Overview*.*

97 Bill and Melinda Gates Foundation, *Our Approach: Water, Sanitation, & Hygiene*.*

98 The Case Foundation, *About Us,** *Water For People Announces Investment from Case Foundation to Expand Sustainable Safe Water Solutions in Africa*.*

99 The Case Foundation, *What's the Big Idea?*.*

100 *See supra* page 10.

infrastructure.[101] The United States Agency for International Development would issue those grants.[102]

Conclusion

Thailand is no longer a poor developing country but a middle income country,[103] which already has more than surpassed the UN's Millennium Development Goals concerning access to safe drinking water and basic sanitation.[104] Also, according to a UN report the world as a whole is on track for

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[101] Senate Bill 624, *supra* note 16, Sec. 8 (Sec. 135 (c)(3)); House Bill 2030, *supra* note 16, Sec. 8 (Sec. 135 (c)(3)).

[102] Senate Bill 624, *supra* note 16, Sec. 8 (Sec. 135 (c)(3)); House Bill 2030, *supra* note 16, Sec. 8 (Sec. 135 (c)(3)). *See* U.S. Agency for International Development, *About USAID*.*

[103] World Health Organization, *Country Cooperation Strategy for Thailand*, 2003, page 1.*

[104] In Thailand, 97% of the urban population and 91% of the rural population have sustainable access to safe drinking water as defined by the UN; and 97% of the population has access to basic sanitation, and thus Thailand has achieved the Millennium Development Goals concerning safe drinking water and basic sanitation. Department of Water Resources, Ministry of Natural Resources and Environment of the Royal Thai Government, United Nations World Water Assessment Programme, *National Water Development Report: Thailand*, 2006, pages xvi, 27-28, 40, 56, 57.*

However, the Thais have observed that even though they have far surpassed the UN's safe drinking water and sanitation goals, something is still wrong possibly because some of the UN standards are not effective. The Thais have noticed that acute diarrhea is still a crucial health problem and diarrhea is the leading cause of illness in Thailand. *Id.*, pages 58-59, 88. "The major health problems that related to water or food and *water borne diseases are helminthes* [parasitic worms], *diarrhea, dysentery, enteric fever (typhoid and paratyphoid fever)* and food poisoning. The main causes are poor sanitation and non-hygienic behaviors. *These diseases cause high morbidity and mortality among the Thai people and still represent the major health problems of the country*." *Id.*, page 87 (emphasis added).

The Thais have questioned whether having so much success in meeting the UN's goals has resulted in that much success in reducing disease. The Thais have noted that "[d]espite development of water supply and sanitation which aims to control food and waterborne diseases, *morbidity rates remain high due to high bacterial contamination of the water*." *Id.*, page 64 (emphasis added). "When comparing the sanitation indicators represented by the number of households with clean water and sanitary latrines, to the morbidity rate of acute diarrhea, food poisoning, dysentery, and enteric fever, *it was found that while the coverage of households with clean water and sanitary latrines has increased, the morbidity rate of acute diarrhea and food poisoning has also increased*. Morbidity rate of dysentery and enteric fevers however, have decreased since 1990." *Id.*, page 88 (emphasis added).

The statistics that the Thais compiled regarding their efforts to meet the UN's goals regarding access to safe drinking water provide some clues as to why Thailand still had so many cases of waterborne diseases. According to statistics from 2000, in rural areas 91% of the population had access to safe drinking water, but only 16% had access to piped water. *Id.*, page 56. The UN's goals were met partly because in rural areas 50% of the population had access to rainwater, and 14% had access to protected wells. *Id.* As mentioned earlier the UN considers rainwater to be an improved water source and thus it counts in meeting the Millennium Development Goal on safe drinking water; and the UN also considers an open unsealed well that is protected on the side to be a protected well that qualifies as an improved water source and thus it also counts in meeting the goal on safe drinking water. *See supra* note 22.

Apparently realizing that rainwater and open wells were not really providing safe drinking water even though such sources satisfied UN criteria for improved water sources, the Thais started an ambitious program to provide apparently expensive piped water systems to *all* villages by the end of 2008. Department of Water Resources, *National Water Development Report: Thailand*, *supra* note 104, pages 27, 40-41, 57, 64.

As mentioned earlier, this author has similar questions about the UN criteria for improved water sources and he contends that progress concerning water provided by wells should be measured only by the increase in the number of wells that are fully enclosed with sealed covers or covers that need not be removed to use the well, and any increase in the number

meeting the Millennium Development Goal of reducing by 50% the proportion of people without sustainable access to safe drinking water.[105]

However, that UN report also states that "55 countries are off track, and the target [of a 50% reduction in those countries] will be missed by about 234.5 million people, with a total of 800 million people still lacking access to [safe drinking] water."[106] These figures take into account the fact that by the year 2015 the population in developing countries will increase by 830 million people.[107] It must be remembered that the UN goal is not universal access to safe drinking water but only a 50% reduction in the proportion of people without access to it.[108]

Unless there is a *focus* on the village well then there will be no real progress towards providing those 800 million people with sustainable access to safe drinking water. Nor will there be any real progress in providing safe drinking water to even 100 million people, which is the goal of the pending Senator Paul Simon Water for the World Act of 2009.[109] A simple solution to the village well problem would not only relieve the suffering of millions of people but also probably could accomplish such a reduction in suffering without requiring any significant increase in foreign aid. Solving the problems with village wells would have more of an impact on public health than the mosquito net.

The world has developed the technology to land a man safely on the moon but has shown little interest in developing a reliable, inexpensive, and sanitary technology to lift water from a village well, leaving hundreds of millions of people stranded in this world without safe drinking water.

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of 'protected' wells that are only protected on the side but open on the top should not be considered as counting towards increasing access to safe drinking water. *See supra* note 22.

[105] Kevin Watkins, United Nations Development Programme, *Human Development Report 2006, Beyond Scarcity: Power, Poverty and the Global Water Crisis*, 2006, page 56.*

[106] *Id*., page 57.

[107] *Id*., page 55.

[108] Furthermore even achieving statistical success in meeting the UN's goals does not mean that significantly more people actually will have safe drinking water. As mentioned earlier the UN goals only involve an increase in access to improved water sources but the definition of such improved sources include sources that are easily contaminated such as open wells. *See supra* notes 22, 104.

[109] Senate Bill 624, *supra* note 16, preamble; House Bill 2030, *supra* note 16, preamble.

URL Addresses

The following are the URL addresses for the matters in the corresponding footnotes.

1. Senator Paul Simon Water for the Poor Act of 2005, Public Law 109-121, 119 Stat. 2533, http://thomas.loc.gov/cgi-bin/bdquery/z?d109:HR01973:|TOM:/bss/d109query.html (at Latest Major Action, click on PDF, then click on Continue: to GPO Site)

UN Millennium Project, *Fast Facts: The Faces of Poverty, Water,* http://www.unmillenniumproject.org/resources/fastfacts_e.htm

Bill and Melinda Gates Foundation, *Water, Sanitation, & Hygiene*, http://www.gatesfoundation.org/topics/Pages/water-sanitation-hygiene.aspx

Peter H. Gleick, *Dirty Water: Estimated Deaths from Water-Related Diseases 2000-2020*, http://www.pacinst.org/reports/water_related_deaths/water_related_deaths_report.pdf

2. William J. Clinton Foundation, Clinton HIV/AIDS Initiative, *Why HIV/AIDS?*, http://clintonfoundation.org/what-we-do/clinton-hiv-aids-initiative/why-hiv-aids-

The Global Fund to Fight AIDS, Tuberculosis and Malaria, *HIV/AIDS Background*, http://www.theglobalfund.org/en/hivaids/background/?lang=en

The Global Fund to Fight AIDS, Tuberculosis and Malaria, *Tuberculosis Introduction*, http://www.theglobalfund.org/en/tuberculosis/background/?lang=en

The Global Fund to Fight AIDS, Tuberculosis and Malaria, *Malaria Background*, http://www.theglobalfund.org/en/malaria/background/?lang=en

3. United Nations, *Indicators for Monitoring the Millennium Development Goals*, http://mdgs.un.org/unsd/mdg/Resources/Attach/Indicators/HandbookEnglish.pdf

5. Roberto Lenton, *Health, Dignity, and Development: What Will It Take?* (referred to as UN Task Force, *Health, Dignity, and Development*), http://www.unmillenniumproject.org/documents/WaterComplete-lowres.pdf

16. Senator Paul Simon Water for the World Act of 2009, Senate Bill 624, 111th Cong. (2009), http://thomas.loc.gov/cgi-bin/bdquery/z?d111:SN00624:|TOM:/bss/111search.html (click on Text of Legislation)

Senator Paul Simon Water for the World Act of 2009, House Bill 2030, 111th Cong. (2009), http://thomas.loc.gov/cgi-bin/bdquery/z?d111:HR02030:|TOM:/bss/111search.html (click on Text of Legislation)

20. The World Bank, *Water, Rural WSS*, http://www.worldbank.org/ (on the top, click on Topics, then go to the bottom and click on Water, then on the left click on Water Supply & Sanitation, and then again on the left under Water Supply & Sanitation click on Rural WSS)

21. Prof. Richard Carter, *Investigating Options for Self-Help Water Supply*, http://www.rwsn.ch/documentation/skatdocumentation.2007-06-04.5483737723/file

22. WaterAid, *Technology Notes*, http://www.wateraid.org/documents/plugin_documents/technology_notes_07_web_1.pdf

Jeff Conant, *Water for Life, Community Water Security*, http://www.hesperian.info/assets/environmental/Water_EN.pdf

Francois Brikke, *Linking Technology Choice with Operation and Maintenance in the Context of Community Water Supply and Sanitation, A Reference Document for Planners and Project Staff*, http://www.who.int/water_sanitation_health/hygiene/om/wsh9241562153.pdf

World Health Organization, *Household Water Treatment and Safe Storage*, http://www.who.int/household_water/en/

World Health Organization, *Treatment Technologies*, http://www.who.int/household_water/research/technologies_intro/en/index.html

23. WaterAid, *Piloting the Rope Pump in Ghana*, http://www.wateraid.org/documents/plugin_documents/pilotingtheropepump.pdf

26. FairWater, *About Us*, http://www.handpump.org/handpump.htm (on the left click on About us)

27. Anthony Oyo, *Spare Part Supplies for Handpumps in Africa*, http://www.rwsn.ch/documentation/skatdocumentation.2007-06-04.2775193546/file

28. Dr. Kerstin Danert, *A Brief History of Hand Drilled Wells in Niger*, http://www.rwsn.ch/documentation/skatdocumentation.2007-06-04.6706724248/file

30. Water For People, *Major Announcement from Water For People's CEO*, http://www.waterforpeople.org/site/News2?id=5813

31. Water For People, *Demonstrating Impact Over Time*, http://www.waterforpeople.org/site/News2?page=NewsArticle&id=5877&news_iv_ctrl=-1
36. FairWater, *The Millennium Development Goals and the WatSan Sector*, http://www.handpump.org/handpump.htm (on the left click on Millennium goals)
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