

A Case for Dry Sanitation

Where It's Needed Most

Emma Scott

6/8/2009

This paper suggests that dry sanitation, or dry composting toilets, are a sustainable way of increasing access to proper sanitation. It then describes what issues must be addressed in introducing this technology in traditional societies where the toilets are in highest demand.

Barking dogs greeted our footsteps as we walked up to the small building. Even Dan beheld the new home for the first time. In his previous trip here with Engineer Without Borders they had only completed the first construction phase. He informed me the engineers designed the home to maximize coolness, ideal for the hot humid summers of Isan. Before Engineers Without Borders arrived the family, mother, father, and son, basically lived in a shack. The new structure seemed fairly modern against the backdrop of overgrown fields and makeshift wooden houses. Unlike the others, this home's walls appear purposeful, the dimensions strategically calculated with both comfort and air flow in mind. We entered the house by crossing an imaginary threshold; in such an open community little demand exists for a front door. We rounded the corner of the bedroom and discovered a short staircase leading to the bathroom. I knew from my reading the room was elevated for access to the chambers beneath. Sure enough looking round the back I found two open chambers. To my disappointment they appeared to be storage space, housing bags and boxes of who knows what, but definitely not fecal remains. Back around the other side we climbed the steps and approached the door, knocking to avoid intrusion, though the silence of the venue assured us we were alone. Upon opening the door we discovered that the bathroom had been transformed into a bedroom. A bamboo mat covered the floor, with books and papers (including a sketch of the Chelsea football team's emblem) decorating the concrete floor. We observed one exposed hole in the floor on the right, and underneath the mat found the rest of the "toilet". Clearly unused there lay two large holes intended for defecation, missing their lids, and a canal running between them leading to a smaller hole. This small hole directs urine through a hose out into the garden where it waters

and nurtures the garden. Users experience minimal odors by adding water to the urine and ash to the fecal matter. In my research I've learnt the odors we associate with "port-a-potties" and latrines come mostly from the combination of urine and fecal matter; once the two are separated, odor control is fairly easy. Sprinkling some ash and taking several other simple steps (which I will go into a bit later) to create usable compost from fecal remains all sound easy enough to me, so why had this room drifted so far from its purpose? As if beckoned from my musing, the wife and mother of the family returned home and greeted us. Fortunately she remembered Dan and didn't seem to mind our intrusion. While the family was very happy with the house, they had no desire to use the bathroom, it just didn't appeal to them. With my pitiful Thai, limited to very few phrases mostly about food and shopping, I was able to ask where or what they used as a toilet. To our dismay, they have been using the woods out back behind their home. We returned to the factory and reported our discovery to Geoffrey. The family, he told us, had wanted a room for their son and this took priority over the bathroom. Despite this, it is unlikely they would have used it anyways because they met the idea with a fair amount of disinterest, seen especially with the father.

Here we have a dilemma. A rural family is given the appropriate technology for a fairly simple, ecological, environmentally friendly composting toilet, but they fail to use it. This family's case is not an isolated one and unfortunately many plans to introduce dry sanitation have a substantial rate of failure. Often in designing these interventions planners consider technological challenges but sometimes fail to consider the cultural barrier which ultimately determines whether or not the end product will be used. As the

world confronts issues of poverty reduction and raising standards of living, a successful intervention scheme must be developed.

As issues of poverty permeate the discussions of our world leaders, we also realize that our planet's resources cannot possibly support the exponential population growth experienced since the medical revolution. This combined with global development, or more appropriately "Westernization," makes a recipe for disaster. It is impossible to bring developing countries up to the standard in place for Western society, the resources do not exist. For progression to continue, we must reject Westernization and embrace sustainability. Quoting from the United Nations in Republic of Moldova, "A decisive aspect of sustainable development is preserving and regenerating natural resources, promoting environmentally friendly economic and social policies" (Barbarosie, p 47). Development therefore involves redesigning technologies with this imperative in mind. Technologies which most immediately require attention involve key aspects of human livelihood, including (and especially) health.

The issue of health brings us to the focus of our discussion: sanitation. One of the Millennium Development Goals is halving the proportion of people without access to safe water and sanitation. According to the World Bank Development Report in 2006 to reach this goal means providing 2 billion more people with basic sanitation facilities between the years 2000 and 2015. Only one fifth of countries are on track toward this goal. The Millennium Development Goal Report for 2008 cites improved sanitation facilities for 53% of developing regions, far from the goal of 71% set for 2015 (especially considering the figure has only gone up 4% since the year 2000). A heavy percentage of those without access, over 70%, live in rural areas. Many of these people practice

open defecation. According to the same report from 2008 half the population of Southern Asia and a quarter of the population in Sub Saharan Africa continue this practice. Lack of adequate sanitation facilities aids in the spread of diseases such as diarrhea. First, open defecation increases chances of contact with excrement. Second, with open defecation and unimproved facilities (such as pit latrines) we find excreta contaminating the ground water and surrounding environment. Even with water involved in the defecation routine, we find that “90 % of wastewater and excreta worldwide is either only poorly treated or not treated at all at discharge” (Werner, p 24). In the World Health Report in 2002 it was determined that “approximately 3.1% of deaths (1.7 million) and 3.7%of DALYs (54.2 million) worldwide are attributable to unsafe water, sanitation and hygiene” (p 68). Nearly all of these deaths are in developing countries and the majority is children. Another table in this report lists the ten leading risk factors as percentage causes of disease burden in developing countries. In the high mortality countries unsafe water, sanitation, and hygiene rank third at 5.5% and in the low mortality countries tenth with 1.7% (The World Health Organization, p 232). Clearly in creating equity and improving the standard of living in developing countries around the globe water and sanitation are at the forefront.

Going back to the issue of sustainability, it is impossible to give everyone access to a flush toilet system. The infrastructure for such a system is costly itself and requires extensive regional planning and government support, often lacking in the areas where the systems are in highest demand. With the right approach, improved sanitation could in fact save money. For example, in a report titled Economic Impact of Sanitation in Cambodia, one of the impoverished countries we’re concerned with, we find that a lack

of sanitation leads to losses of \$448 million a year, about 7.2% of the country's GDP in 2005 (p 7). The damage is accounted for primarily through healthcare expenses, clean water losses, and negative impacts on tourism. In addition to the monetary cost, flush toilets come at a huge environmental cost. Clean water is a scarce, non-renewable resource; it is predicted that half the world's population will live in conditions of water stress or scarcity by 2025 (Huq). Environmental experts stress that manipulating our water sources is gradually eating away at our precious supply. Flush toilets and sewage systems contribute heavily to this exploitation. To sustain our supply and our environment we must seek a more appropriate technology.

A solution to this problem is found in dry-sanitation with reuse, also known as dry composting toilets and falling under the Ecological Sanitation movement or EcoSan. The literature on EcoSan published through GTZ and IWA (International Water Association) calls for a paradigm shift, in which we view the material flow cycle as a closed loop rather than a linear demise (GTZ-ecosan-project). With such an outlook human excreta becomes a resource which can be fed back into the system rather than an end product to be discarded. The goals of this system, paraphrased from the literature, are to reduce health risks, pollution, soil degradation, and "optimize the management of nutrients and water resources" (GTZ-ecosan-project). This system dramatically improves upon the technology in place. It reduces water dependency and reclassifies our "waste" a valuable resource. It does not demand funding or construction of a large infrastructure for support. Its design prevents groundwater contamination, hindering pollution and spread of disease. If properly planned for, it can even render an economical benefit; the composted waste and urine can be used in agriculture, saving

money on fertilizers. These ideas brought about toilet designs of varying complexity, but I will describe the basic form next.

The dry composting toilet functions best when the urine and feces are separated through urine diversion. On its own, urine works great as a fertilizer for watering plants. A slab sits above two chambers, each with a hole for defecation. One chamber is used at a time, the switch being made when the first reaches capacity. When this one is full the feces is left to compost for six months to a year, during which the pathogens die off. This system requires the user add ash or lime down the hole after using it to soak up excess moisture and prevent odors. Sometimes stirring the fecal matter periodically is also required. The end product is compost that can be used safely in agriculture, bearing no resemblance to human excrement.

The solution described has received a great deal of attention from the global community, from local governments to Non-Governmental Organizations. We should aspire to implement such a system globally, but we have found the highest demand for such facilities in the developing world and should focus attention there first. Inadequate sanitation has a strong correlation with absolute poverty (The World Health Organization) and we find poverty concentrated in rural communities. Accordingly, the rural population represents over 70% of people without improved sanitation (MDG Report 2008). In an ideal world, the technology would easily solve the problem and the Millennium Development Goals would be attainable. Environmental factors such as climate would need to be accounted for, but engineers and environmental scientists should be able to identify suitable adjustments so the technology could take form in any setting. Unfortunately the solution is not this simple. While the most disadvantaged, rural

communities are also the most traditional. This means that new technology will not take off without consideration of cultural and social factors present within the society in question. Many intervention attempts have failed due to a lack of reflection on this aspect. The remainder of this paper will focus on potential pitfalls in introducing dry-composting toilets and what must be considered in implementing such a program.

Human regard toward excrement predates the science exposing the harmful effects of contamination. Taboos about contact with excrement and correct disposal procedures exist in most societies. We find written evidence for this in religious texts such as the Bible and the Koran. Muslims have some of the most stringent practices with strict rules on where to go, which way to face, and how to cleanse oneself afterwards. The practice of water-based cleansing has been extremely difficult to drift away from especially for the Muslim population. Feelings of disgust toward excreta as an impure substance pervade the depths of their spirituality. Water, as an opposing and chaste substance, must be involved in cleansing order to once again achieve purity. Devotion to these rituals is apparent in local and national laws, such as in Malaysia where it's mandated that all public facilities be designed with these procedures in consideration (Warner). Likewise, Hinduism stipulates stringent cleansing with a superimposition of caste divisions to further bolster sentiments. Upper-caste Hindus concern themselves more with maintaining purity, consuming the most water for such purposes, while the lowest castes historically held occupations managing the waste (Warner). Interaction with waste therefore becomes demeaning and sanitation facilities become a matter of social status. In Machaki, a small Muslim village in Pakistan, villagers view dry sanitation as an obstacle toward Westernization and regard flush

toilets as the prestigious and desirable option (Nawab). We can describe these cultures as faecophobic. Conversely, faecophilic cultures exist, such as some Asian regions where human excrement has traditionally been used as fertilizer. Buddhism discourages waste and views the world and lifecycle as a circular system, so the seeds of reuse and tolerance of waste products have been planted. Christianity is more of a neutral ground, as the bible does not require water for relieving oneself. Religion reflects the traditional beliefs and practices of society members and therefore should be taken into consideration when designing a dry sanitation program.

Religion is merely one aspect of one's social conditioning toward excrement. In Western society, we learn from a young age to find the odors offensive and the topic distasteful. Comprising one's attitude toward anything are perceptions, cognitions and behaviors. To aid in research on attitude toward human waste specifically, Professor Templer of the California School of Professional Psychology developed the Body Elimination Attitude Scale (Warner). The scale reveals varying levels of disgust and tolerance toward human waste. It's determined that people with more exposure to excrement are likely to have a higher tolerance toward it, a predictable result from their conditioning (Warner). Furthermore, people differ in how willing and comfortable they are discussing excrement in the first place. In Machaki, Pakistan, researchers found that villagers would not talk about excreta as this was a personal, private matter not to be discussed outside the home. However the topic of sanitation and wastewater was an acceptable one (Nawab) Even in the most advanced societies, excrement is hardly considered an appropriate topic of conversation and is regarded as immature bathroom

talk. So there's a dilemma in discovering the root of the disgust within society with this itself preventing open discussion and investigation.

We also find gender differences in respect to excrement, most leaving women in an unfavorable position. Attitudes concerning the propriety of women cause a differentiation in the way society views their defecation as opposed to men. Often women learn to feel embarrassed when it comes to their natural bodily functions. This embarrassment coupled with a much more intrusive defecation process (women must always squat, while men can urinate easily just about anywhere) force women to seek optimal privacy when answering the call of nature. In some societies, such strong sentiments exist that women will wait until nighttime to relieve themselves. Additionally, women use toilet facilities for purposes beyond the scope of just defecation, such as when they are menstruating or pregnant. Sometimes these factors make women an ideal target for marketing sanitation systems, as they would appreciate toilets at home. However in some societies, women have little say in this level of decision making. This was the case in Machaki, that Pakistani village, where strict adherence to Islam gave women virtually no voice in the matter of sanitation facilities though they suffered the most from traditional methods (Nawab). They found the privacy of the toilets appealing rather than the health benefits and desired the relief of having home unit rather than hiding to defecate or removing their excrement from their homes themselves (ibid). Fortunately in many households, women can influence decisions on sanitation facilities because they wield more control in home economic issues. The fact that maintenance responsibilities will usually fall upon them should be considered in designing an intervention scheme.

To have a successful intervention one must consider all of the aforementioned elements in the execution process. We find this verified upon investigating project failures.

At the 2nd International Symposium on Ecological Sanitation several projects were discussed which were not completely successful. One of these attempts was in South Africa where dry sanitation toilets were installed at a high school serving the local low-income communities. The facilities they had were unkempt and hardly used due to their repulsive state. Fortunately the local government was committed to improving sanitation facilities and decided to fund the construction of ecosan toilets that would accommodate half the students, while expecting the school to contribute the rest (Austin). Introducing dry sanitation toilets in the school seems initially to be a sound approach. Children pick up new technology more aptly than adults and have been the focus of several dry sanitation campaigns. Well-established (since 1994) NGO EcoSolutions of India has tapped into this phenomenon with creation of “Catch Them Young” ecological nursery school and publications such as picture books and posters as key factors in technology promotion (Catch Them Young). To implement the technology at the high school, teachers attended workshops and received training in proper facility maintenance and program benefits. Supplemented with books and posters, they were then expected to educate their students in these areas to ensure proper use and understanding of the technology. A visit several weeks after the program commenced revealed that the facilities were not being properly used (Austin). This was brought to the attention of the principal and the program was reiterated to the teachers once more. However, a subsequent visit the following school year showed

even less progress. Upon analysis, several conclusions were drawn in explaining the programs failure for consideration in future programs. First, the teachers in the region face pressure to reach particular academic standards while lacking funding and adequate support (Austin). Teachers were not motivated or committed to ensuring proper use of these facilities as other topics took precedence. In this case, the designers failed to identify the appropriate channel of influence in implementing the program. Second, use of dry toilets in the domestic realm has found more success largely due to a sense of ownership and personal responsibility. At home, the family takes responsibility for their own unit and waste where as in school users must adhere to procedures without feeling personally responsible for the facility. The disconnection breeds negligence. Furthermore there is no feeling of ownership. The facilities were constructed at the expense of the government; there was no prevailing commitment to the technology without sacrifices on part of the school. This phenomenon has been cited in other failed programs where government subsidized toilet construction.

The same symposium featured a lecture on an EcoSan project on the shore of Lake Victoria in Uganda. In the preliminary phase researchers held informal interviews to assess need and held a “barazas” to “sensitize” the community to their sanitation needs (Kaggwa).” Community members recognized toilets as their greatest necessity and government subsidized construction was undertaken (ibid). In a check up a few months later the toilets were in bad shape. Reasons cited were inadequate training, no sense of ownership (as previously discussed), lack of support, and cultural factors unaccounted for. Several steps were then taken to alleviate these issues. First sessions were held to sufficiently educate community members of the toilets’ benefits and leaders

were taken to see a successful project. Second, researchers suggest that to feel ownership community members involve themselves not only by contributing funds (in this case 10% of the price) but also by playing a role in the design and construction phase (ibid). Third, support and technical assistance after construction must be factored into the project scheme to ensure continued use and to evaluate shortcomings in design. Finally, and importantly, program designers failed to address cultural issues present in the community. After implementation they found the community quite faecophobic and aversive to the concept of reuse. Some community members practiced anal cleansing while others held onto taboos and false conceptions of sanitary defecation (ibid). After identifying these issues, more informative and involved educational sessions were held as well as formation of a committee to oversee the sanitation improvement. These measures increased usage and proper maintenance of the facilities. The lesson learned from this program is that no shortcuts can be taken in educating users and ensuring their involvement in project implementation.

The lessons learnt from failed attempts are reiterated by strategies that have led to success in project implementation. Recall the village Machaki in Pakistan where it seemed infeasible that a system of reuse might be accepted in such a traditional Muslim community. Owing to education from the researchers and open discussions, community members concluded on their own that a toilet system that employed greywater reuse was their best sanitation option (Nawab). Though this is not a dry-sanitation system, it does break from traditional beliefs against reuse of excrement. The tendency of impoverished communities to also be traditional pairs contact taboos with further ignorance and low prioritization of sanitation. These barriers can be overcome if

enough time is devoted to education and awareness campaigns. Such campaigns can only be administered after researchers have a firm grasp on local ideology so as to tailor education toward the particular community. For example, in South Africa a marketing strategy was adopted focusing on social factors rather than the benefits of reuse (Graham-Harrison). Sometimes, especially in poorer communities, focusing on the economic benefits of the compost is the best strategy. Motivations (such as health, smell, safety, privacy, environment, etc) appealing to the specific community must be particularly emphasized.

Another important component of the education process is seeing the end results. Most apathy toward reuse can be absolved once people witness the end result of the composting process. An example of this occurred in Tanzania where excreta reuse was rejected due to local taboos but accepted once community members saw the innocuous compost (Graham-Harrison). Surveys done in the project community Lichinga in Mozambique found that those who had not yet switched over to one of the dry sanitation toilet models were waiting to see the results of the installations in place (Breslin). Installing an EcoSan toilet in the home of the town leader, in addition to broadcasted radio interviews, also aided dissemination in this small town. Revelation of the finished compost from the first EcoSolutions pilot toilet in India, after months of anticipation, triggered demand from women in the community to have one installed in their own home (Calvert). In communities such as these word of mouth travels fast and the best advertising is satisfied users (Graham-Harrison).

Because acceptance and diffusion of this technology relies so heavily upon result observations, it is imperative that adequate training, materials and support be

administered to project attempts. This means project funds must be allocated for technology redesign and follow-up support for participants. Lack of such provisions will lead to project failure, as was found with some projects in Mexico where the government provided construction materials but no training or further support (Peasey). Richard Abbott of Public Health Sanitation, in describing his project in the City of Syracuse, emphasized that all troubleshooting should take place in the pilot project. Once this phase has met success it will be easier to propagate the toilets and commence an official program. To ensure understanding of the technology and increase feelings of ownership, communities should participate in some level of the project's development. This could be by contributing funds, but is more effective when they participate in construction. My favorite example of participation was described by Paul Calvert (working on behalf of EcoSolutions in India) when he had women aid in prototype design by drawing chalk circles of the dimensions they preferred for the separate holes to catch urine and feces (Calvert). Another way to ensure a sense of ownership is to distribute installations on a demand basis rather than coerced selection. Ideally, with proper education of the technology and its benefits such a demand will exist.

Before concluding this paper, I would like to look at some methods employed in the development phase of dry sanitation programs which help researchers design successful interventions.

One method used to evaluate community sanitation needs is called Rapid Assessment Procedures. The procedures, carried out by researchers consisted of informal dialogues, field notes, focus groups, semi structured interviews and

assemblies, each of which focused on particular aspects of the system (Cifuentes). Dialogues were held with community leaders focusing on major concerns and community issues (ibid). Field notes consisted of diagrams of the community and observations which helped researchers understand existing practices and relationships. Focus groups, interviews, and assemblies collected personal testimonies and facilitated community discussion to identify key concerns and common experiences (ibid). Although this method does not really include education, it is a good step toward comprehension of community attitudes. When this method was applied in Mexican communities receiving aid from Clean Water, it brought light to perceptions held by community members. They felt excluded from the development process and desired to participate in the process before implementation (Cifuentes). It also revealed that while women were the selected target group, in the community they were largely excluded from decision making (ibid). Applying Rapid Assessment Procedures in a community prior to program implementation will help researchers pick up on existing conditions that they should tailor the project around. Researchers in Machaki, though not using RAP exactly, used a very similar approach of collecting qualitative data through interviews, discussions, and observations which helped them understand and adapt planning to the concerns and preferences of the community (Nawab). Accounting for a community's unique characteristics ensures a greater chance of project success and demonstrates respect for its distinctive qualities.

Flourishing projects have utilized community participation early on in program development. In 2008 the Water Research Commission published "The Implementation Of Hygiene Education Programmes In Informal Settlements" describing several

successful education campaigns. Child to Child, Personal Hygiene and Sanitation Education, Nali Kali, and Human Values in Water, Hygiene, and Sanitation Education are each campaigns that have sprung up in different world regions which have targeted campaigns toward children and infiltrated the school system (Namai Consulting). While these efforts can be effective they should not stand alone. We have seen from the earlier example in South Africa that a school cannot be the sole medium for technology transmission. The report even cites that such campaigns work best when supported by the teachers, local community, and government (ibid). Therefore, a broader campaign encompassing all community members must take place.

Participatory Hygiene and Sanitation Transformation (PHAST) has emerged as a common and effective strategy in successful interventions. The official user guide describes it as a participatory approach that allows the community members to indicate problems, brainstorm solutions, plan execution, and devise ways to ensure sustainability (Wood). Program workers act as facilitators, providing information and tools to enhance discussion and impart knowledge, but not as salesmen trying to convince participants to adopt a particular technology. PHAST aims to:

“help communities improve hygiene behaviors, prevent diarrheal disease, and encourage community management of water and sanitation facilities. It does this by demonstrating the relationship between sanitation and health status, increasing the self-esteem of community members, and empowering the community to plan environmental improvements and to own and operate water and sanitation facilities” (ibid, p 4).

Educating community members helps them realize that they can make decisions that will affect their well-being and future. Putting the tools in their hands and creating the opportunity to participate in program development empowers them and begets a stronger relationship with the end product. The resulting sense of ownership makes

program success much more likely. A facilitator trained to use the PHAST method would use the guide and provided tools to administer the program with a selected group of community members. There are seven steps, and each step involves several activities which must be carried out before moving onto the next. For example, the first step is “Problem Identification” and the activities assigned are “Community Stories” and “Health Problems in Our Community” (ibid, p 7). The subsequent steps in order are problem analysis, planning for solutions, selecting options, planning for new facilities and behavior change, planning for and monitoring evaluation, and participatory evaluation (ibid). The PHAST method was used in Lichinga, Mozambique where EcoSan toilets were selected as an appropriate technology for a community where flush toilets were infeasible due to poor infrastructure (Breslin). Though quantitative data is lacking, the apparent widespread success of this method has encouraged program designers to employ participatory education and program design schemes to ensure favorable results.

In concluding this paper, it is important to remember that global sanitation is an issue which at some point in the future will affect all our livelihoods. The flush toilet of Western culture is an unsustainable model and should no longer be suggested as ideal. As the global community strives to reach the Millennium Development Goal of halving the number of people without access to basic sanitation, we must turn to more sustainable technologies such as EcoSan and dry composting toilets. Introducing this technology has been difficult as the topic of excrement is a personal and delicate one, with many cultures having preconceived notions and traditions regarding the process. The best way to overcome these biases is through education and participation.

Adoption is possible even in the most traditional societies if enough energy is devoted to education campaigns. These campaigns are most effective when researchers investigate the community thoroughly to determine existing attitudes, cultural impediments, and societal needs. Participants can contribute to the program design early on in the education process and a high level of involvement should be continued throughout implementation to ensure a sense of ownership and responsibility over the technology. Following these procedures, success is almost guaranteed. Complete project execution and support for continued use cannot be underestimated in value, for only successful projects can ensure dissemination of this technology. When dry sanitation becomes more common it will become feasible to introduce it in the hardest to reach areas, as familiarity with the technology, funding, demand, and the scope of designs/prototypes all increase. Some of the most challenging areas will be squatter communities, where frequent mobilization and the absence of property rights create little motivation for sanitation systems. Another challenge will be convincing people of Western cultures to alter their habits and give up the technology they're accustomed to. If we target rural communities lacking access to sanitation facilities now, we can upgrade their standards of living and get the ball rolling on a global movement toward a more sensible waste management scheme.

Works Cited

- Abbott, R. (2003). Skaneateles Lake watershed composting toilet project. . 2nd *International Symposium on Ecological Sanitation*. Eschborn: GTZ.
- Austin, A. (2003). Ecosan: an unsuccessful sanitation scheme at a rural school: Lessons learned from the project failure. 2nd *International Symposium on Ecological Sanitation*. Eschborn: GTZ.
- Barbarosie, A. et al. (2004). *Report on Millennium Development Goals*. United Nations in the Republic of Moldova. Draft.
- Breslin, E. D. (2002). Introducing ecological sanitation: some lessons from a small town pilot project in Mozambique. *Water Science and Technology*, 45 (8), 217–224.
- Calvert, P. (2003) Bringing EcoSan to South Asia. 2nd *International Symposium on Ecological Sanitation*. Eschborn: GTZ.
- Catch Them Young*. Retrieved April 27, 2009 from Eco-solutions website: <http://www.eco-solutions.org/books.html>
- Cifuentes, E. et al (2006). Rapid Assessment Procedures in Environmental Sanitation Research. *Canadian Journal of Public Health*, 97(1), 24-28.
- Graham-Harrison, K. & Low, M. (2005). *A Review of Ecosan Experience in Eastern and Southern Africa*. Nairobi: Water and Sanitation Program- World Bank.
- GTZ-ecosan-project. (2003) *10 Recommendations for Action from the Luebeck Symposium on Ecological Sanitation*. Eschborn: GTZ.
- Huq, S. et al. (2003) *Water and the Least Developed Countries*. International Institute for Environment and Development.
- Kaggwa, R. et al (2003). Experiences in Setting Up Ecosan Toilets in Shoreline Settlements in Uganda. 2nd *International Symposium on Ecological Sanitation*. Eschborn: GTZ.
- Namai Consulting. (2008). *The Implementation of Hygiene Education Programmes in Informal Settlements*. Gezina: Water Research Commission.
- Nawab, B. et al. (2006) *Cultural preferences in designing ecological sanitation systems in North West Frontier Province, Pakistan*. *Journal of Environmental Psychology*, 26(3), 236-246. doi:10.1016/j.jenvp.2006.07.005
- Peasey, A. (2000). *Health Aspects of Dry Sanitation with Waste Reuse*. London: WELL.

United Nations. (2008) The Millennium Development Goals Report 2008. New York: United Nations Department of Economic and Social Affairs.

Warner, W. (no date). *Cultural Influences that Affect the Acceptance of Compost Toilets: Psychology, Religion, and Gender*. Jordforsk: Center for Soil and Environmental Research.

Water and Sanitation Program- East Asia and the Pacific. (2008). *Economic Impacts of Sanitation in Cambodia*. World Bank.

Werner, C. et al. (2003) *Reasons for and Principles of Ecological Sanitation*. 2nd International Symposium on Ecological Sanitation. Eschborn: GTZ.

Wood S, Sawyer R, Simpson-Herbert M. (1998) *PHAST Step-by-step guide: a participatory approach for the prevention of diarrheal disease*. Geneva: World Health Organization (unpublished document WHO/EOS/98.3).

The World Bank. (2006). *World Development Report 2006: Equity and Development*. New York: Oxford University Press.

The World Health Organization. (2002). *The World Health Report: 2002: Reducing Risks, Promoting Healthy Life*. Geneva: World Health Organization.