Trip Report: Tamale, Ghana October 2009
Steve Hubbs (Final October 27, 2009)

The purpose of this trip was to define the Gates Foundation project(s) and make contacts between SCI-Accra office (Tom Connolly) and Tamale.

Thursday Oct 15-morning
Met at the Tamale airfield by Jehanfo and Fati from the SC-Tamale. We met in the morning with staff from TTH regarding a dedicated line to the hospital. It was reveled that a contract for hospital renovation (39 million euros) had been let to SIMED. This was apparently a re-work of the project previously defaulted on. The hospital staff indicated that the size of the proposed hospital water line project had significantly decreased…but no details were available, and no one appeared to know exactly where the water was to come from. (Later conversations with BiWater staff indicated that their conclusion was that the hospital line had be re-introduced into the revised renovation contract with SIMED. This was not confirmed in a later conversation with Edward from Ghana Water.

Hospital staff indicated that approximately $3000 is spent each month for hauled water (2 to 3 trucks per day…but this may have been in reference to the dry season only). During the dry season, it is difficult to get enough water due to the shortage of tanker trucks. (This implies ~ 100 truckload per month, or 200,000 gallons (@ 2000 gallons per truck…which should be verified…but the billing goes directly to Accra, so the details weren't know in Tamale). Wells in the Tamale area were reported to be low-capacity, and less than 50% of boreholes produce any water, and are thus constructing a well for the hospital is not considered a feasible alternative water supply.

The hospital was constructed in 1974. An inspection of the hospital water/sewer system revealed the following:

1. Water enters the hospital grounds and discharges into a below-grade reservoir. A leak in the supply line immediately in front of the reservoir was observed. This tank was full and no water was flowing in from the inlet line at the time of inspection. A second smaller below grade tank was receiving water from the supply line and pumping out (two pumps, alternated) to the elevated tank (5 stories from ground level). An intermediate pump station (two pumps) was capable of moving water from the first (at rest) ground tank to the second, for reserve supply. There was an apparent leak in the inlet valve box leading to the second ground storage tank. All pumps appeared to be in working order. The leaks in the water lines leading to the below-ground tanks may be the result of "water hammer" caused when valves close too quickly. These valves that shut off flow to the below-ground reservoirs when full were referred to as "ball valves", which may imply that they are hydraulically designed to close slowly…but this should be verified.
2. The elevated tank on the hospital roof was inspected (appeared relatively clean). Total volume was reported to be 75 cubic meters. It was reported that under normal operating conditions, this tank would drain in 48 hours if no water was pumped to it,

indicating a typical average daily consumption of 75/2 = 37 cubic meters/day (use 40 as a rounded estimate).

3. The tank is opened to the system at 7:00 am and closed at 7:00 pm (confirm close time). During the night, any needed water come from "polytanks" that are filled during the day (one in each ward). Water has to be carried to the point of use, and in one location a third storage vessel was observed. No water is available for flushing toilets during the night (unless flushed by carried water).
4. We were at the surgery ward mid-day and it appeared that the instruments were being washed with water carried from one of the poly-tanks.
5. SUMMARY- The water supply system at the hospital is taken from ground storage, pumped to the elevated tank, used and/or stored during daytime, and carried to the ultimate point of use. This process provides several points of potential contamination:
    a. The line leading to the hospital (at times at zero pressure)
    b. The ground storage tanks (dirt fell in the one inspected when the lid was opened)
    c. The elevated tank (it was tight and secure)
    d. The Poly-Tanks
    e. The vessels used to carry water to the point of use.
6. The interior plumbing was reported to be galvanized, and in need of replacement. This was not verified.
7. WASTE SYTEM
    a. The waste system was inspected and found to be in poor repair. The system included two domed anaerobic digesters with methane capture (disabled), three enclosed filters, and discharged into a closed sewer along the roadway. One top of one of the three filters had a collapsed and sewage was open to the atmosphere. Some standing liquid was observed one low area near the back wall.
    b. The system was discharging at a very low rate. It was estimated that the 4 inch discharge pipe was flowing at less than 2 gallons/minute. It is possible that the relatively large area of the treatment system was acting as a large evapo-transpiration bed, and that most of the sewage flow was being lost to the atmosphere in the dry climate. No other discharge or seepage from the facility was observed.
    c. The water supply line ran adjacent to the wastewater system, and likely through saturated soil.
    d. The street sewer eventually discharged to surface water downgradient (estimated by sight at about 1 mile).
    e. Hospital staff was encouraged to keep track (visually) of how much water was flowing in the discharge, before and after any improvements that would result in higher amounts of water usage (and wastewater generation).
8. GENERAL OBSERVATIONS AND COMMENTS
    a. The system as operated is subject to contamination from multiple sources. The chlorine level at a routine point of use should be checked regularly (daily) to verify chlorine levels in the water (an inexpensive indication of sanitary condition of the water).

b. If the system is upgraded, it would be optimum to eliminate the below-ground storage vessels (or remand them to emergency supply only). A better system would include an above-ground storage tank (at ground level OK), from which water is lifted to the elevated tank on the hospital roof. This would reduce the risk of contamination of the water supply. The system pressure at the hospital is not adequate to fill the tank without booster pumping.
c. All internal storage (polytanks) should be isolated from the system (and be eliminated or perhaps remanded to emergency storage).

Thursday Oct 15 afternoon
Visited and took pictures of the two sites where water catchment tanks had been constructed. The tanks looked great, and the spitot at the tank at the Primary school was opened and flowed freely.

The system at the Islamic school was in stalled at the girls dormitory. It was the second tank on site (draining the "back half" of the roof). The other tank was a Polytank 1000 that was situated in the front of the building. A third elevated tank (Polytank 350) was used as an elevated tank for water to two-story dormitory.

Thursday Oct 15 Evening
Met and had dinner with Jim Niquette, and "Joe and Dave" from BiWater. Joe provided a pressure chart taken from the line feeding the hospital, and the "ring" line that would be the supply to a direct feed line to the hospital. These charts indicate that the pressure at the hospital varied between 0 and 15 meters above grade of 166 m amsl, with peaks at midnight. Most of the time, pressure was less than 2 meters above grade, and pressure dropped below grade at least 4 times during the week. (This zero pressure condition leaves the line susceptible to infiltration and siphonage when system pressure and flow resume.)

A monthly recording of system pressure on the ring near the hospital indicated that the supply dropped to zero on 3 or 4 occasions during July 2009. A subsequent weekly chart indicated that the pressure dropped to zero twice during the week of September 24, 2009. These data indicate that while system pressure and water availability has improved significantly since the construction of the "ring" water main, the system is vulnerable to occasional outages lasting several hours.

The group discussed the water supply issues at Tamale in general at length. Joe and Dave indicated that they had fielded several inquiries from SIMED referring to the hospital supply line, and questioned if it had been or was being considered in the current hospital renovation project.

Friday October 16, 2009 – morning
Met with Regional Administrator and Chief of Tamale. Both were highly aware of and supportive of the Gates Foundation project. The Chief spoke specifically of the hospital project, and referred to it as the highest priority to be dealt with for the project.

Friday October 16, 2009 – late morning
Met with the municipal officer in charge of sanitation xxx xxx. When asked of an appropriate sanitation project for the Gates Foundation project, he suggested that we tour the Salamba area near center-city (Just north and east of city center, to the west of the main drainage sewer...located and marked on Google Earth). Pictures are available. By comparison to poorly sewered areas in Accra, the Tamale Salamba area is relatively clean. Drainage from houses was clearly visible between houses (no paved streets in this area), but the sloping ground and proximity to the main sewer eliminated the large areas of standing water. One VIP was inspected in the area. Xxx.xxx suggested that an appropriate project for poverty alleviation would be to add drainage between houses to the main sewer. The area to be covered was about 5 hectares (verify) and would impact about 4000 people living there. Upon leaving, we were introduced to the "opinion leader" in the community that would need to be consulted for any project we might attempt there. He was open to anything that "encouraged development in the area".

The public toilet serving the area was also inspected. It was typical of public facilities in Ghana, and had no running water inside (nor outside). The inside sink had been removed. Dumpsters for garbage disposal were provided, and except for drainage from the houses, the area was relatively clean and residents were inquisitive and good-natured. Tom suggested that a rain-catchment tank at the public toilets might also be a good project in this area. I would like to find out what the schedule is for water in Salamba (it was indicated to be for two days per week…question is how long during that two weeks?) A public tap was seen between houses. Xxx xxx indicated that fewer than half of the residents had interior water supply.

Friday afternoon – Mosque time, wrote up report, did a little shopping at the craft area. Watched the soccer game in the restaurant.

Saturday Oct 17
Met early morning with Tom and Barnabas to discuss progress to date. I met with Edward by phone and discussed the direct connection to the hospital, and if it was included in the SIMED contrat. He indicated that it was not. He described the system, and connected me with the Tamale Water Director Al Hassan (goes by Hassan). (Note that phone conversations are not nearly as effective as direct conversations…while it was informative, it was difficult to communicate effectively…the direct meeting with Hassan was very informative.)

Hassan (and his lovely 2-year old daughter) provided a tour of the Tamale distribution system as it affects water pressure and availability at the hospital. The Tamale distribution system is divided into three distinct "pressure zones". Pressure zones are defined by closing valves in pipes in the distribution system, and isolating portions of the system to specific tanks and pump stations that control the pressure in that zone. The teaching hospital is currently in the lowest pressure zone (zone C), but is quite close to the line feeding the highest zone located on Second Ring Road. Also note that Second Ring Road isn't a complete ring, and nor is the water line. The section of the piping ring

not yet completed is in open field, as is the path that would connect the back of the hospital directly to the high pressure zone.

However, the high pressure zone continues from Second Ring Road towards the city center and hospital along the Highway. The high pressure zone is separated from the low pressure zone by a closed valve in the 8 inch PVC line along the highway within a few hundred feet of the line that feeds the hospital. An alternative method to connect the hospital to the high pressure zone would involve "shifting" the high pressure zone to include the hospital supply line, which can be accomplished by opening the closed valve, and closing one closer to the city. To do this effectively, it might be necessary to install (cut in) an additional "line valve" in the 8 inch PVC line just north of the current hospital water line connection. This will have two impacts: it will place the hospital in the high pressure zone, and remove a major consumer from the low pressure zone (thus improving service in the low pressure zone for the other consumers).

Pressure charts have been secured from Joe at Biwater, which indicate that a substantial increase in availability and pressure to the hospital will result from this change in pressure zone boundary. This alternative is very similar to providing a direct line to the hospital from the Second Ring Road water main, assuming the 8 inch PVC line is in good condition (which it appeared to be, and I was told by Hassan that it was). I will meet with Hassan and Joe again on Monday to review maps and discuss project costs.

We toured the remainder of the city pipe system, noting points of connection to the treatment plant source. It is unfortunate that the hospital is located at the very most distant section of the distribution system, and that as the system becomes taxed in the future, by design the hospital will vulnerable to future pressure and supply problems. However, for the time being, connection to the Second Ring Road water main should provide a significant increase in both pressure and availability at the hospital.

If the water pressure to the hospital is increased, the problems with leaks in the line immediately leading to the below-ground storage tanks will likely become more pronounced…thus the control valves (ball valves) between the water supply line and the tanks should be considered as a vulnerable part of the supply system to the hospital, as a broken line will result in no water to the hospital.

The location of the hospital at the end of either the high or low pressure zones makes it the most vulnerable portion of the system to "water hammer". Simple and relatively inexpensive modifications to the intake lines to the hospital can greatly reduce the vulnerability of these lines to leaks caused by "water hammer" due to flow and pressure changes in the distribution system.

Saturday Evening

We met with Jehanfo and introduced Tom and Barnabas to Haroon. We discussed the process for managing the project, and Tom outlined next steps (meeting with SCT committee and Louisville contingent in November). We then discussed the potential projects that we had identified for the SCI grant (in no particular order):

1. Improved water supply to the Tamale Teaching Hospital (TTH).
2. Rainwater catchment and latrines in selected schools, including consideration for Poly-Tank installations.
3. Improvements in drainage in the Salamba community, and consideration for rainwater catchment systems there for hand-washing and facility cleaning. This area might be targeted for community involvement.
4. Health topics to be suggested by the SCL medical team during their visit in November.
5. Improvements at smaller community hospitals (West and North Hospitals, as relayed by Susan Herlin).
6. Innovative rain-catchment systems for round thatch-roof villages similar to Tugu. Rain catchment and guttering is the challenge.
7. Consideration for irrigation rain-catchment systems in peri-urban and rural areas.

Had dinner at Haroon's and mashed some of those potatoe-things with the big stick.

Sunday am
I prepared conceptual design drawings and estimated elevations for the hospital supply system and pressure plane boundary adjustment. Current usage patterns were estimated by assuming the 100 cubic meter tank provided a 2 day supply (as provided by hospital staff), or approximately 15,000 gallons per day usage or about 10 gallons per minute. This compares reasonably with their statement of needing 3 tankers per day, each being about 2000 gallons (or 6000 gallons total), when little or no water is available from the system. This also feeds back into the estimate of wastewater flow out of the plant at ~2 gallons per minute, indicating that about 20% of the hospital water consumption is reaching the street sewer (implying that 80% is lost to evapotranspiration). If this is accurate, then it can be assumed that any increase in water usage will result in an equivalent increase in wastewater discharge (in other words, the evapotranspiration is maxed-out, and any additional flow into the sewage system will result in an equal amount flowing to the street sewer.

Dinner at Haroon's. Girls address for pen-pals:

- Salma Haroon 8 y/o, Dahin Sheli Primary School, PO Box 1054, West Africa, Ghana
- Kisura Haroon, 12 y/o, Dahin Sheli Junior High School, PO Box 1054, West Africa, Ghana

Monday October 19, 2009

Met with Samuel Mensah (Ghana Water, Edward's boss, General Mgr Operations Area 4, email northern.region@ghanawater.info, tele 233 71 22796), Al Hassan, and TTH Plant Engineer today and gave each the same pitch, as follows:

1. I provided an overview of what was proposed by Ghana Water for the water supply project to the hospital.
2. I provided an alternative project that would cost far less money.

3. I explained that the Tamale/Louisville Committees would decide which projects would be done, and that could include:
    a. Funding to complete the alternate proposal (for $30k to $50k)
    b. Providing partial funding for the Ghana Water proposal
    c. Providing no funding to the THH water supply project.
    d. I am only providing the role of a technical person identifying possible solutions to the water reliability issues at THH.
4. I provided a copy of my design for use in further discussions.

Samuel referred me to Hassan for technical details, but was generally supportive of whatever we decided. Samuel indicated that any project involving the water mains would be contracted out, with Ghana Water acting as the consultant. Hassan provided a detailed description of what Ghana Water was proposing, as follows: Ghana Water would provide a complete new water supply system for the hospital complex, which includes both the hospital and housing for staff. They discussed a new elevated storage tank (but that was not in the proposal provided to us). With a new line to the hospital and a properly designed water supply, the hospital would see greatly improved water supply and pressure. The proposal includes no internal plumbing changes, but with the proposed system it is likely that the existing system could be completely abandoned, and no internal water supply storage would be needed…the system would tie directly into the hospital distribution system. This would require a new water tank. This system would benefit both Ghana Water and the hospital, and would be a preferred solution if water supply in Second Ring Road is highly reliable.

I advised that the questions that will be put to Ghana Water is how much would each solution cost (a new system, and the alternative), and how quickly each could be done. Based on this information, SCL/SCT would decide whether to provide partial, full, or no funding for this project.

While at the hospital I also collected elevation data for the alternative design. Specific details from Tamale Teaching Hospital are:

- height from ground to overflow: 25.8m + 166m ground elevation ~ 192m amsl
- volume of THH elevated tank: 6.45x5.9x2.85 deep ~ 108 cubic meters ~32000 g
- Bottom tank elevation ~ 25.8-2.85 ~ 189m amsl
- Average pressure in 2nd Ring Road ~ 183m amsl
- Max pressure in 2nd Ring Road mail ~ 200m amsl
- Max pressure current source ~ 183m amsl
- Average pressure current system ~ 170m amsl
- Estimated daily flow current ~ 15,000 gpd
- Unrestricted usage estimate ~ 30,000 to 45,000 gpd

If I can get the pressure data in table form, I can make the predictions as to whether booster pumping would routinely be required for the hospital if all flow restrictions were lifted from hospital staff.

Central Hospital

I visited Central Hospital to inquire about their needs regarding water or other issues. My contact was Damasus Ayamgba (ayamgba76@hotmail.com). He indicated that while he could use more water storage on site (to augment the Polytank 1000's he has), his greater need is for a back up generator (estimated cost of ~ 10,000 cedi). This was likely heightened by the fact that the city was without power most of yesterday and through the night). He stated that in general, the water supply issues have been improving, but the power supply issues were getting worse.

The facilities were very well maintained, and the one ward I visited was about half-full. There was a very long line waiting to see administration (mostly women with children), but the overall impression was very good. Damasus indicated that this hospital was closed in 1974 when THH was opened, but then re-opened (~2002??) and has been getting increasing numbers of patients ever since. I advised that the next group to come from Louisville would likely want to see some statistics on patients, and he said he had an annual report that provided all of that.

Western Hospital

I visited the Western Hospital with Haroon and met with the administrator (Sam??) and his assistant. I posed the questions similarly to staff at both Central and West hospital. Regarding water supply at the hospital, a contractor built one of the hospital buildings directly over one of the water mains near Kaladan, where Ghana water has two large elevated storage reservoirs (to the due east of the hospital, to make it easier to find on Google Earth). Because this line has a leak in it very near the building foundation, the line has been shut off, starving the hospital for water. Thus, the hospital buys about 2,000 cedis worth of water each month. This problem was mentioned to me by Hassan, when I told him I would be visiting the Western Hospital (he said they have a big problem, with a water main under a building). Getting this water main back into service is the biggest water priority for this hospital, with a second priority being to get more storage (which may not be a priority when the water main is fixed). Pictures provide insight into this problem. It may be that the structure itself can be modified (the area where the drain is located is a covered open area between two buildings). Saeed will get with Hassan and see if there is an easy solution to this problem.

When asked for priorities other than water-related items (I called it his wish list), Sam provided the next list, roughly in order of priority:

1. A new children's ward. Currently children are in the women's ward, occupying the outer corridors and one inner room. The desire is to have a separate childrens' ward. There is plenty of space on the grounds for this. Pictures available.
2. A surgical theatre and equipment. There is currently none. I assume anyone coming to the hospital needing surgery will be sent to TTH…the medical team should investigate this.
3. Complete the fencing around the hospital to keep goats and livestock off the property, and bushes/etc to keep dust down.
4. Sterilization unit (autoclave??)
5. Conference hall where staff can meet.

6. Routine hospital equipment: beds (childen, delivery, adjustable), trollies, and anything a hospital needs to operate.
7. Accommodations for staff
8. Vehicle for transporting materials (small pick-up).

Evening: dinner with the Tamale Committee.

Tuesday October 20, 2009
Water Forum (Accra)

The opening session included statements by various ministers and leaders. The best statement was by the chair Madame, who said (paraphrased): *"We have been talking about water since I was a little child, and the good news is that as long as we are talking, we are not fighting. But the time for action is now. Let's get out in the field and get things done."* That's pretty much what we are doing with this grant!

At lunch, I met and discussed the hospital project with Jim Niquette and "*tall guy* xxxx xxxx" with Ghana Water. We briefly discussed the project, and the need to work out a business relationship between SCI and Ghana Water where our projects involve their facilities. He said I should meet with Ghana Water staffer xxx xxx to discuss this issue (this meeting did not occur). I also met Adam (from Wisconsin) with the Carter Center, who indicated that he had also heard of a plan to relocate TTH to a new location (on Kumasi Road). This was only hearsay and not confirmed.

After lunch, the crowd thinned down to about 50 people in the audience. There were four presentations that did a great job of documenting the current state of water, sanitation, and water resources in Ghana (I got a copy of all 4). The first addressed "Rights to Water", noting that the right to water is subject to realistic goals, and citizens should distinguish between the inability and unwillingness of government to take action (sounds like a frustrated public servant). Right to water does not mean it's free. In Ghana, the right to water is recognized in the Water Policy, but this needs to be added to the constitution. NGOs and government need to increase awareness of right to water, increase financial resources, guarantee access to information, and develop metrics.

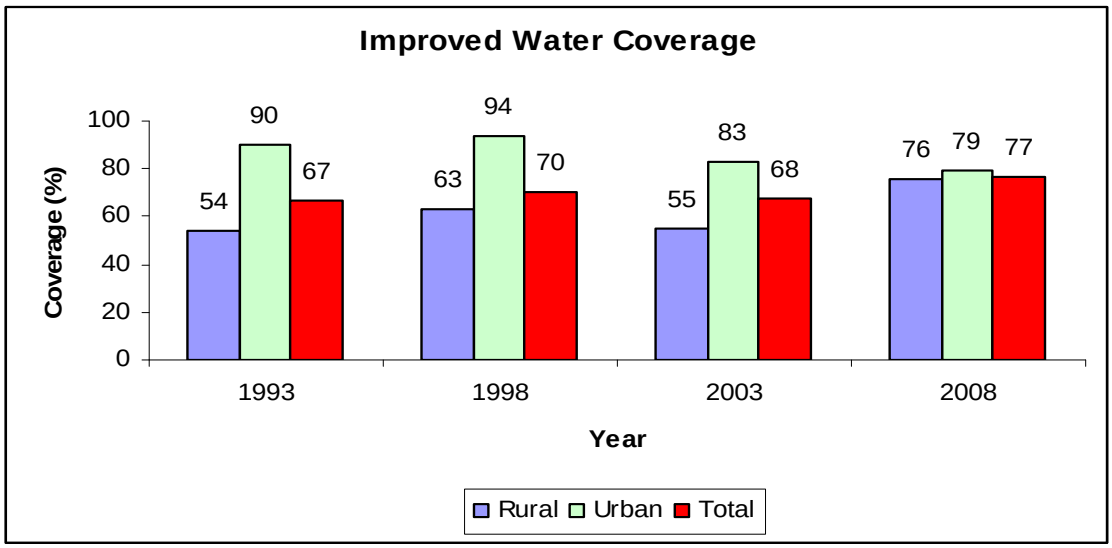
The next presenter directly addressed the MGDs with regard to water and sanitation, citing the number of people with access to water and improved sanitation (toilets). The assessment was that Ghana was on-target to make the goals for water, but lagged very badly behind in sanitation. The moderator commented that the goal for water should be 100% (target was ~ 78%). One person from the audience asked if there were any health statistics for waterborne disease that tied the improvements to public health measures (this strikes at the heart of what is needed for effective Monitoring and Evaluation). The presenter said no, and that they would take that as a recommendation. We need to get these specific statistics for Tamale (current and historical). They must exist, because data were presented for the northern district. (yes…contact is Emmanuel Gaze, Director, C.E Secretariat. Email emmatsegaze@yahoo.com).

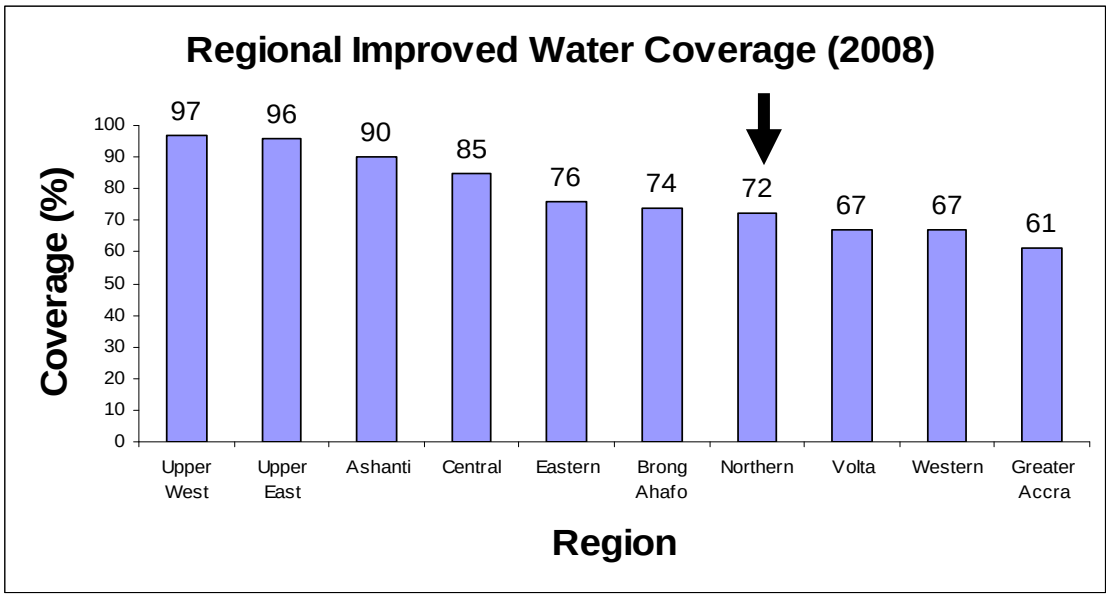
The speaker on the MGDs listed the following as key measures for M&E:

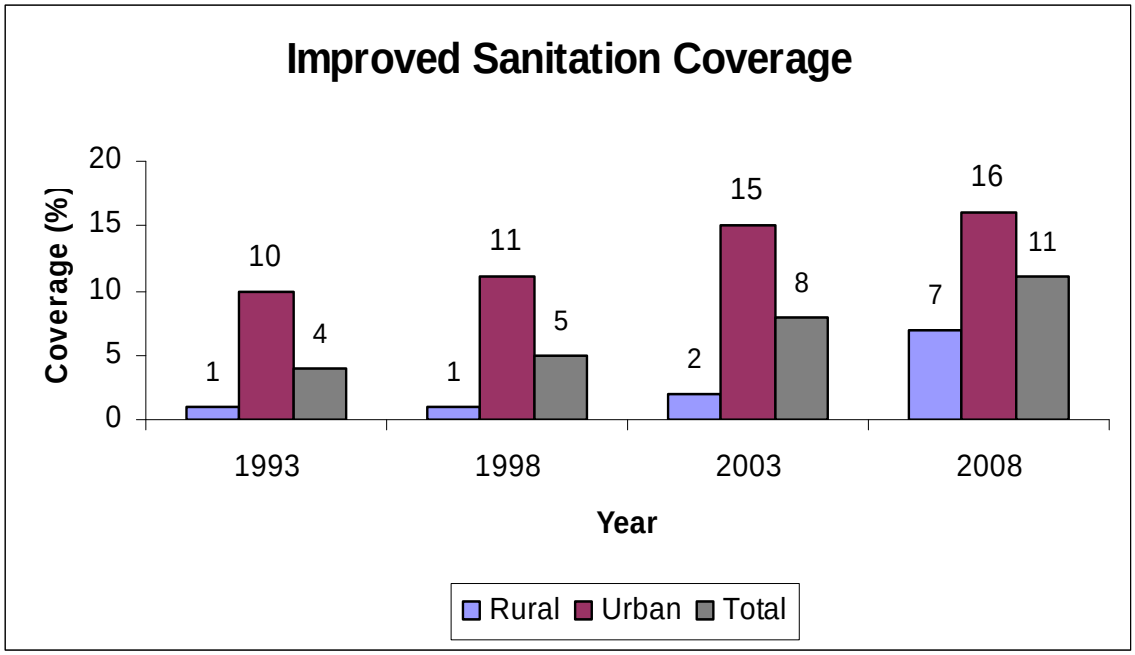
- Structural indicators (policies and regulations) *(I would have guessed this one wrong!)*
- Process indicators (what facilities need to be in place…like for 78% with access to potable water), and
- outcome indicators (like mortality rates and waterborne disease rates)

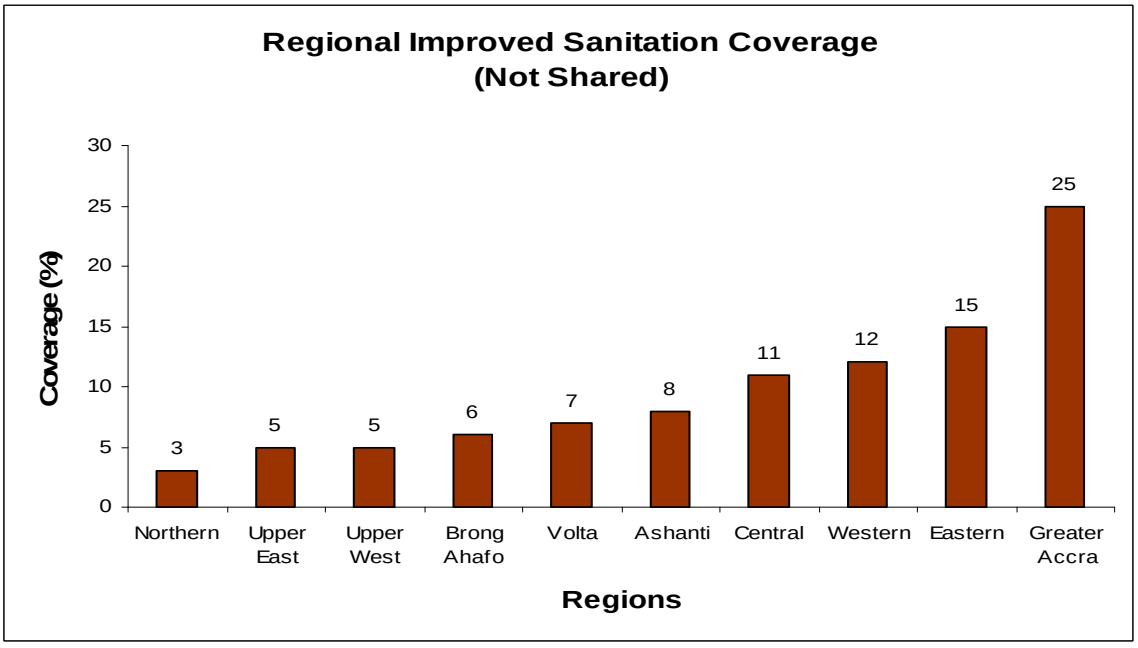
He stated that WASH data (Water, Sanitation, and Hygiene) were used to determine compliance with the goals (data available in handout). MGD indicators specify that "sanitary facilities" specifically mean toilets, and not landfill-bound solid waste. Unimproved water supply includes tanker waters, and unimproved sanitary facilities include pour/flush toilets that do not discharge to a proper facility (pipe, pit, latrine or treatment plant, etc). I think most of Tamale qualifies as water going to a pipe, but the pipe runs into a sewer and the sewer directly into a stream. Thus the house drains that discharge into the street sewer are considered "improved".

Graphics from the presentation are copied below. Data for the Northern District are indicated by the arrow.



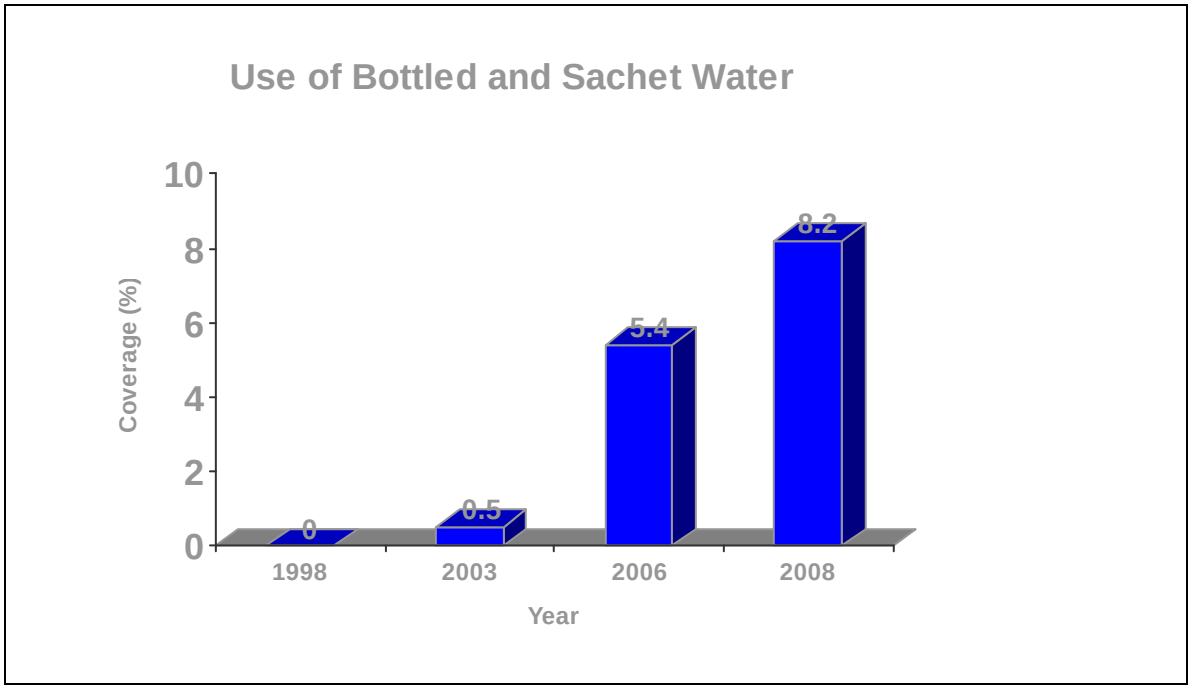

Regional Improved Water Coverage (2008)
Coverage (%)
100
90
80
70
60
50
40
30
20
10
0
97
96
90
85
76
74
72
67
67
61
Upper West
Upper East
Ashanti
Central
Eastern
Brong Ahafo
Northern
Volta
Western
Greater Accra
Region


Improved Sanitation Coverage
Coverage (%)
20
15
10
5
0
1
10
4
1
11
5
2
15
8
7
16
11
1993
1998
2003
2008
Year
Rural
Urban
Total


Regional Improved Sanitation Coverage
(Not Shared)
Coverage (%)
30
25
20
15
10
5
0
3
5
5
6
7
8
11
12
15
25
Northern
Upper East
Upper West
Brong Ahafo
Volta
Ashanti
Central
Western
Eastern
Greater Accra
Regions

MGD goals for Ghana based on the 1990 base year are 78% for water, 53% for sanitation (5 million do not have access to improved water and 19.5m do not have access to improved sanitation). Most of the water improvement occurred in the northern districts, while most sanitation improvement occurred in Accra. Therefore Ghana is on track to meet 2015 goals for water, but NOT for sanitation.

Bottled water and sachet water is NOT considered as improved water supply. This is based on affordability and the amount of water provided. From 1995 to 2008, the percent of people drinking bottled water has jumped from ~ 0 to 10%. This is cutting into gains for water supply goals.



Urban Sanitation Presentation

Why sanitation? Because it is the most important medical breakthrough in 150 years (British Medical Journal reference). He showed nasty picture of trash in a stream and dumps as an example of poor sanitation. For sanitation, less than 30% is properly handled, with the remaining 70% going to drains, open spaces, water bodies and beaches. Only 2.2m Ghanians have toilets, 11.2m share toilets with others, and in Africa Ghana ranks 51st out of 54 (not so good). Only 0.2% of GDP goes to sanitation…needs improvement. (The problem may be at least partially driven by availability of more water without proper sanitation, leading to a greater problem with sanitation. A later slide stated this). And…Thursday Nov 19 2009 is World Toilet Day…give a squat! (Quoted: *"Sanitation is an attitude, not a program…it is what people think."*)

Rural Water and Sanitation (Benedict)

Rural Water initiative started in 1948. In 1965 Ghana Water and Sewerage (GWAS) incorporated. In rural areas, 1600 boreholes, and 600 water supply systems have been constructed. For water, coverage ranges from 40% to 67%.
Regarding rural sanitation, the subsidy is being replaced with credit scheme (for latrines). The focus includes eliminating open defecation. For hygiene, the TV emphasis has been on hand washing. For the future, an emphasis needs to be made to incorporate education with sanitation projects.

Conclusion for the day: With emphasis on help from donors, good progress has been made…and this should be demonstrated clearly to allow for continued support for MGD goals. MY CONCLUSION- this was an excellent overview of water supply and sanitation in Ghana.

QUESTION for later: has analysis (spatial) been done on successful and unsuccessful boreholes? Answer was yes, this has been initiated. I requested that any available information be provided, and that I would be willing to provide support. Contact for this is: Raymond Sumbo, email raysumbo@yahoo.com.

Q and A from audience to presenters.
Question: has there been a decrease in health statistics for waterborne diseases (diarrhea and death) that reflects improvements in water supply = reduction in waterborne disease? Answer is "don't know" \haven't done the stats yet, and will accept this as a recommendation.

Sanitation man also emphasized that if you do no include sanitation to water supply accessibility, then there may be no net health improvement.

Another point was made that water supply activities must include concerns for malaria, as these two are directly linked with regards to surface impoundments.

Wednesday October 20, 2009

This day was devoted to water sanitation. The presentations (copy obtained) painted a rather dismal state of sanitation in Ghana. Of the 47 WW plants constructed in Ghana, only 5 to 7 are currently operating at some level. The remainder are completely non-functional. The presentations were copied to my computer. The major message is that the complex plants are not maintained and quickly fall from service, the example being (paraphrased): ***"The $11 million plant for Accra that operated well during the two-year demonstration period (operated by the contractor), but is now totally non-functional one year later. A similar fate has befallen the Kumasi WW treatment plant ($10m). One was a grant (wasted) and the other was a loan (to be repaid by Ghana's children)".***

In my opinion, Tamale should start migrating towards wastewater treatment. This should be simple technology (like wetlands or lagoon treatment for the existing drains). These facilities should be constructed and operated by local Ghanians. While this type of waste

treatment may not be optimal, and may require some degree of by-pass during wet weather, the net effect will be a substantial improvement in sanitation for the region, and another positive step towards overall sanitation in the region.

A potential design might include wetlands coupled with rainwater storage capable of holding the first few hours of "flush" during a rainstorm. Such a system might be designed to catch the bulk of highly contaminated water from the "first flush" during a rainstorm event and allow the remaining less contaminated wastewater to bypass to the stream. Land requirements for this type of a system should be identified and set aside now, before any further land development occurs. This will allow Tamale far greater latitude in how to handle wastewater in the future.

Vendors

Three of the five vendors at the conference were selling poly-tanks, which indicates the prevalence of the need to store water (and thus the general inability for the water suppliers to maintain pressure 24/7). Contacts are:
PolyTank: Allen Dwamena, 223-21-811576 (no email)
Polystar: Karan Chimnani, Director, 233-22-1212599 nsppl@infinet.com.gh
Sintex: Accra: 233-244-335168 Tamale: 071-25073

Selected prices are provided below. An appropriate evaluative parameter might be the weight of the tank (implying an heavier tank has more PE and is thus stronger…but this isn't necessarily the case if the tank is designed or constructed poorly).

Size (gallons)	Sintex GH¢	Size (gallons)	Polystar GH¢	Size (gallons)	PolyTank GH¢		
1000	GHC 792	1111	GHC 840	1000	GHC 815		
2000	GHC 1,350	2000	GHC 1,350	2222	GHC 1,470		
3000	GHC 1,958	3333	GHC 2,175	3333	GHC 2,100		
4222	GHC 2,565	4444	GHC 2,600	4444	GHC 2,760		
		5555	GHC 3,310	5555	GHC 3,500		
				6666	GHC 3,970		

Email sent to Samuel Mensah : ***No response as of October 27, 2009***

We met today (Monday October 19, 2009) and discussed the water supply options for the Tamale Teaching Hospital. I left you with a computer file of what I had shown you…but this was the wrong file (only had partial inforation). I have since visited the hospital and gotten more accurate data on elevations. The file is attached.

Please pass this on to Hasson. I also gave Hasson the wrong file.

In addition, it would be most helpful if I knew the size and operating elevations (overflow to empty) for the new reservoir. If you could pass this on, I would be appreciative. I have estimated the daily flow into the hospital at 10,000 gallons per day, and project that this amount will double or triple when flow restrictions are revieved.

Thanks Steve

Specific details from Tamale Teaching Hospital are:
height from ground to overflow: 25.8m + 166m ground elevation ~ 192m amsl
volume of THH elevated tank: 6.45x5.9x2.85 deep ~ 108 cubic meters
Bottom tank elevation ~ 25.8-2.85 ~ 189m amsl
Average pressure in 2nd Ring Road ~ 183m amsl
Max pressure in 2nd Ring Road mail ~ 200m amsl
Max pressure current source ~ 183m amsl
Average pressure current system ~ 170m amsl
Estimated daily flow current ~ 10,000 gpd
Unrestricted usage estimate ~ 20,000 to 30,000 gpd