

Emily Gass  
Parkside High School CTE  
Salisbury, MD.  
India, Factor 9: Water and Sanitation

### **India, Water and Sanitation: Realities and Solutions**

Water touches every aspect of life. A lack of sanitized and useable clean water has dramatic negative effects on people's everyday health and potential. In the world an estimated one in every ten people do not have access to clean water and one in three do not have improved sanitation. These issues pose a huge threat in particular for developing countries. Without the proper necessities of water and sanitation, human suffering will continue. In India uncertainty over access to and the availability of water is reaching crisis levels. India's population is nearing one and a half billion. "The World Health Organization estimates that ninety seven million Indians lack access to safe water" (Luthra) "Urban slum areas are home to more than forty million Indians or twenty two per cent of India's urban population." (Some) In these cities lack of clean water and runoff of raw sewage is a major contributor to communicable diseases and death. "It is estimated that only eighteen percent of the total rural population of over eight hundred million have access to treated water" (Ten).

Sixty percent of India's land goes toward agriculture. About two thirds of Indian men are in the agriculture business. Typical families in India are large and consist of several generations working together. The males tend to have control over finances, land, and businesses. The eldest man in an Indian family is the key provider and rules the household. In India, women cover themselves veiling their bodies. A key aspect in every Indian family is marriage. In northern and central India, marriages are usually arranged so that the two people may have never met.

Most Indians reside in villages, where caste and class affiliations overlap. Large landholders are more often upper caste, the small scale farmer the middle caste, while landless laborers typically belong to the lower ranking classes. In rural areas these groups tend to form a three level class system. "In cities, class lines adhere less obviously to caste affiliations, as vested interests strongly crosscut caste boundaries"(Indian). The upper classes include about one percent of the population. The upper class are wealthy property owners, industrialists, top executives, and prosperous entrepreneurs. Below them are the many millions of the upper middle class. At the other end of the scale is half of India's population including low level workers of many kinds. This lower class includes of millions of poor people, who have inadequate housing and education and many other economic hardships.

With India having such a high population there are many people without jobs. Recent numbers put the unemployment rate at five percent. Recent studies show that only sixty five percent of the over billion people are of legal age to work. "Data from WDI2013 reveal that in 1999 only sixty three percent of male students and sixty percent of female students who began grade one reached grade five" (Jha). Recruitment and training programs have been instituted to try to help India improve the employment rate and provide nonagricultural jobs for those in need. Urbanization is transforming Indian society. The cities are the great hubs of commerce, education, science, politics, and government. The largest cities are densely populated, congested, noisy, polluted, and deficient in clean water, electricity, sanitation, and decent housing. Slums stand next to luxury apartment buildings, with the roads overrun with pedestrians, cattle, refuse, and vehicles spewing diesel fumes.

Lack of access to safe water takes a toll on the health and economic wellbeing of India's population, and is especially devastating to the people in rural areas. Annually, diseases in water effect about forty million people and have caused about eighty thousand deaths. Only about one-third of eight hundred million rural households are reached by piped water supplies, and more than half of these deliver untreated water. Even

improved water sources may be contaminated by fluoride, nitrate, arsenic, and iron. It is estimated that ninety seven million people, lack access to safe drinking water. Household access to piped water in India is insufficient and in many cases doesn't mean access to treated water. Drinking water from hand pumps, tube wells, and bore wells is typically considered safe by the public as it is extracted from underground sources. Studies show that the groundwater in India is mostly contaminated by iron, arsenic, fluoride, nitrate, and salinity. "The World Health Organization (WHO) reports that India accounts for twenty one percent of the world's global burden of disease." (Community). The most common waterborne diseases in the country are diarrhea, enteric fever, and cholera. Acute Diarrheal Disease (ADD) is the most common waterborne disease across India in children under five years old with around twelve million affected children and two thousand deaths attributed to it annually.

Urban areas of the country fare better than their rural counterparts on water access. However, a larger and denser population, coupled with dwindling natural sources of freshwater pose challenges. In cities like Delhi, Bangalore, and Hyderabad, their water supply lasts for about four hours or less a day, while in places like Kolkata it lasts for nine hours. In India, survey says that households consume about ninety liters of water a day, which is less than the World Health Organization believes people should consume. Nearly sixty million people in urban areas lack access to improved sanitation and more than two thirds of wastewater is let out untreated into the environment polluting land and water bodies. The lack of wastewater treatment capacity in cities like Delhi and Kolkata threatens public health and the safety of already scarce freshwater resources. "Sewerage networks, where they exist, are badly maintained: there are frequent blockages, siltation, missing manhole covers, and gully pits. There is hardly any preventive maintenance and repairs are made only in case of crises." (Water). Storm water enters sewers, which are not designed for, leading to overflow onto the surrounding areas. Improper disposal of solid waste also tends to block sewer lines.

India's water crisis has many causes. The first is insufficient water per person as a result of population growth. "The total amount of usable water has been estimated to be between seven hundred to twelve hundred billion cubic meters (bcm). With a population of 1.2 billion according to the 2011 census, India has only one thousand cubic meters of water per person, even using the higher estimate. A country is considered water-stressed if it has less than seventeen hundred meters per person per year. For comparison, India had between three thousand and four thousand cubic meters per person in 1951, whereas the United States has nearly eight thousand cubic meters per person today." (Luthra) The second cause is poor water quality resulting from insufficient and delayed investment in urban water-treatment facilities. Water in most rivers in India are not fit for drinking, and in many not even fit for bathing. There have been many action plans in the last twenty five years yet most of the rivers remain polluted with a high contamination. Water facilities created are not properly maintained because adequate fees are not charged or paid for. Additionally, industrial waste water standards are not enforced because the state pollution control boards have inadequate technical and human resources. The third problem is dwindling groundwater supplies due to over-extraction by farmers. This is because groundwater is an open accessed and anyone can pump water from under his or her own land. With millions of farmers and an average farm size of less than two hectares, demand outstrips supply. In 2010, India took 251 billion cubic meters of groundwater out while the U.S. only took 112 billion cubic meters. Since 1980, India has rapidly been increasing their extraction rate.

Access to water and sanitation also involves issues of gender and caste. In India, only half of the population had water and 12% of people spend more than thirty minutes daily to get water. In households that don't get water, females are usually assume that responsibility. Among children below fifteen years of age, girls are four times more likely than boys to be responsible for collecting water. Indian society has history with caste discrimination, as lower castes have been traditionally promoted with occupations such as collecting human/livestock waste. Additional analysis of the sanitation data by income quintiles reveals that the poorest forty per cent in India have hardly benefitted from improvements in sanitation. The poorest groups are more likely than their richest counterpart to practice open defecation.

Through education India must work to correct and improve upon cultural practices. Studies of India's population show how since the 1960s child mortality rates have consistently been higher in Hindu families than Muslim ones though Muslims typically are poorer, less educated and have less access to clean water. Out of one hundred children, two more Muslim children than Hindu children survive to five years old. A 2005 government survey found that sixty seven percent of all Hindu households, rural and urban, practiced open defecation, compared with just forty two percent of Muslim ones. In places where there is more open defecation among Muslims than Hindus, the mortality gap is reversed. A recent survey found that even among households with a working latrine, more than forty reported that at least one family member preferred to defecate in the open. Those with a government built toilet were especially likely to choose a bush instead. In many surveys latrines were considered impure and open defecation as wholesome, healthy and social. Men often described latrines for use only by women, the sick and the elderly. These studies suggest that the mere availability of latrines will not end open defecation immediately. Another study found that only a quarter of rural householders understood that washing hands helps prevent diarrhea. What is needed are public campaigns, in schools and in the media, to explain the health and economic benefits of using toilets and of better hygiene.

The Indian government has various types of programs and investments in water and sanitation. The first type centrally sponsored programs are for improving urban water and sanitation. These programs are directed to water supply, sewage networks and sewage treatment plants. Other program are directed toward river cleaning and sewage treatment facilities near rivers. Additionally, programs have been promoted that target and provide individuals and communities with toilets, either pit latrines or septic tanks. There is an emphasis throughout the country on watershed development. This involves leveling land and tapping rainwater in small ponds created by building small dams in streams. This water increases soil moisture, recharges groundwater, and permits a second crop to be planted. For example, a city in Maharashtra has been transformed into the perfect, model village due to water harvesting and cooperation.

The most significant government program underway in India is the Jawaharlal Nehru National Urban Renewal Mission (JNNURM). Recognizing the huge infrastructure deficits in Indian cities, the government of India launched JNNURM in late 2005. The program is meant to infuse capital for infrastructure into select Indian cities as well as initiating a set of urban reforms. "The mission is focused on sixty five selected cities (mostly million-plus), and included two sub-missions: Urban Infrastructure and Governance (UIG), which focused on infrastructure; and Basic Services for the Urban Poor (BSUP), with a focus on shelter for the urban poor." (Water) JNNURM was designed to enable cities to develop their own priorities on the basis of city-wide planning, and the mission cities were required to submit a City Development Plan before they could access funds. Much progress has been developed in sewage systems. The National Urban Sanitation Policy (NUSP) was launched in 2008. The NUSP has several features, most of which point to new directions for urban sanitation in India. It recognizes the importance of the entire waste cycle, as well as open defecation free cities, and one hundred percent collection and treatment of waste. It also underlines the importance of operation and maintenance of all sanitary installations and facilities. Realizing the vast differences in the cities, it recommends that each state in India prepare a state sanitation strategy, and each city prepare a city sanitation plan. (NUSP) calls for the urban poor to be provided with sanitation facilities, irrespective of legal status or tenure. There are hundreds of community safe water non-governmental organizations working in India. These companies focus on a range of water quality challenges using various treatment technologies. The challenges of providing sustainable service and with scaling these services remains. There are many different operating and ownership models with some being owned by government and operated by independent companies, some working independently and some being turned over to communities after startup phase.

Healthpoint Services India is a profit company established to provide a broad assortment of health care benefits to rural communities. Healthpoint services include not only safe water, but also a range of healthcare services. Healthpoint Services operates in one hundred and forty villages in Punjab and thirty villages in Andhra Pradesh, and charges INR 80 (US\$1.30) per household per month for safe water provision. Villages are selected based on certain needs such as water quality, water sourcing practices, community size, disease prevalence, and availability of alternative drinking water sources. An operating team and a service team oversee operations. Healthpoint has at least one operator who is responsible for operations and day to day maintenance, and one or more promoters during the first year of operations. Promoters engage in promotion, customer engagement and enrollment, organizing campaigns on the health benefits of treated water. Service teams comprised of engineers and technicians provide maintenance. Each technician services thirty plants. Healthpoint has established a training and certification program for members of the service team, as well as a telephone support line. Most Healthpoint community locations include a water distribution program.

Safe Water Network India is a not for profit that is committed toward developing and expanding sustainable solutions aimed at delivering safe, affordable drinking water to the underserved in rural India. Safe Water Network has commissioned forty four water kiosks providing nearly two hundred thousand people with reliable safe-water access. They have also introduced a microfinance based rainwater harvesting program in over fifty five communities. The company involves seeking community grants to install these community owned and operated water kiosks. Consumer activation programs are conducted in each project village to drive safe water demand and promote good health in the community. The kiosks use a reverse osmosis system to treat water contamination. Regular water quality tests are conducted through accredited laboratories on both raw source water (every six months) and treated water (every three months). Station operators also track PH and total dissolved solids daily on-site to ensure that the treatment system is operating efficiently. The company provides to community computer tablets to provide a cost-effective way to develop the education, adoption and utilization, a cost-effective rural messaging mechanism, was developed to accelerate the adoption and utilization of safe water.

Tarun Bharat Sangh (TBS) is an NGO working in the Rajasthan state of India. The organization is situated in the semi-arid region of Rajasthan. (TBS) has been constructing rain water harvesting structures and mobilizing village communities to work for natural resource conservation. “The effects are visible in terms of recharging of wells and aquifers, renewed flow of rivulets which had been dry for many years, increased bio-mass productivity, and significant increase in agriculture production, reversal of out-migration and reduction in women’s drudgery.” (Water) TBS focuses on integrated water resource management based on traditional and indigenous skills, knowledge, and cultural values. Additionally, TBS has an awareness campaign among riparian and agrarian communities about the impacts of climate change and its adaptive measures. TBS does workshops, camps, seminars and school based activities. These awareness activities promote green technologies like smokeless stoves, solar lights, and wind power.

India has many challenges toward improving clean water access and sanitation. Innovative approaches are required to ensure the availability of low cost, simple, and locally acceptable water and sanitation interventions. To support the growing population Indian agriculture must expand as well. For Indian agriculture to grow it needs to increase the area of land irrigated, introduce new high yield technologies and work toward water conservation practices and storage capability. The government needs to strengthen pollution controls and waste standards. Adequate sewage treatment facilities must be constructed. Many cities treat only a part, and some no more than half of their waste.

A system being studied and trialed in Senegal seems a perfect candidate for trials in India. The project is called the Omniprocessor, and it was designed and built by Janaki Bioenergy, an engineering firm based in Seattle. The Omniprocessor is a new generation of Micro Sewage Treatment facilities. Today, in many

places like India without modern sewage systems, truckers take the waste from latrines and dump it into the nearest river or the ocean—or at a treatment facility that doesn't actually treat the sewage. Either way, it often ends up in the water supply. If they took it to the Omniprocessor instead, it would be burned safely. The machine runs at such a high temperature (1000 degrees Celsius) that there's no nasty smell; in fact it meets all the emissions standards set by the U.S. government. Through the use of a steam engine, it produces more than enough energy to burn waste and power itself. Within time, these processors may be able to handle 100,000 people's waste and produce at least 86,000 liters of drinkable water a day. "These next-generation processors eventually could handle waste from 100,000 people, producing up to 86,000 liters of potable water a day and a net 250 kW of electricity" (Gates). Initial trials in Senegal have shown promise yet there are problems finding enough engineers and people with expertise to run the system. Investment in these new technologies will have to include training and education programs to secure adoption of these new methods of sanitation.

In Namibia they have been piloting a community integrated implementation of the Otji Toilet system. This program has been highly successful. The construction is conducted primarily by the recipient, though members of neighboring communities are heavily involved. The recipient incorporates personal variations into the system design demonstrating their investment in the pilot. The Otji toilet is a dry system that separates liquid from solids. The Otji Toilet not only improves community hygiene but will also prevent contaminants from entering the groundwater. The rapid adoption of the Otji toilet system has progressed as towns are saving on water use that was previously used for flushing. As the system has few moving parts maintenance issues are not at issue. Additionally, there is no connection needed for electricity as solar panels are used for ventilation needs. Case studies conducted in the Namibian towns of Havana and Aranos have demonstrated that these toilets are effective sanitation methods. Additionally, "the DRFN has begun to organize implementation of ion exchange filters, chlorine treatment, and more dry sanitation systems in the rural communities" (Valerie Boutin) Programs that rely on concerted community involvement integrating new technologies with educational support could help India move toward a more sustainable future.

In India moving toward water use efficiency in both agriculture and industrial processes would have obvious advantages. In Mexico, the Nestle Dairy Factory uses recycled water from its dairy operations and removes the need to extract water from ground resources. The Cero Agua dairy factory takes fresh cow's milk, typically about eighty eight percent water, and heats it at low pressure to remove some of its water content. The resulting steam is then condensed and treated and used to clean the evaporating machines themselves. Once the machines have been flushed out, the water is then collected once more, purified and recycled a second time. The water can then be reused for watering gardens or cleaning. "The amount of groundwater that the Cero Agua dairy saves each day, around 1.6 million liters, will amount to roughly fifteen percent of the total water used by Nestle in Mexico each year in its factories, operations and offices, according to the company." (Valerie Boutin)

Essential water supply and sanitation services should become available to all Indians, and should be accessible at a cost which is affordable to everyone. The equitable improvement of water and sanitation services should be achieved by the combined efforts and cooperation of the government and the people. India must engage the people as stakeholders in the efforts to improve sanitation and clean water access in order to be successful.

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