



The Second Anil Agarwal Dialogues: Excreta Does Matter was held in Delhi on March 4-5. On World Water Day, we bring you the report on the meeting where we attempted to make the connection between poor sewage collection and treatment and India's growing water emergency.

The meeting brought out problems of urban water supply and sewage management, and the reasons for demise of lakes and wetlands in India. It also looked at possible solutions to provide water, restore lakes and wetlands and non-conventional sewage treatment. The meeting brought together providers of non-conventional sewage treatment and instances where sewage is being used as a resource by agriculture and industry. About 550 people from NGO, academia, private sector and government attended the Dialogue at which 57 people made presentations. The presentations and report are available at <http://www.cseindia.org/node/4837>.

Setting the tone for the meeting Sunita Narain from the Centre of Science and Environment said the 7<sup>th</sup> State of India's Environment Report called Excreta Matters

'All cities are losing the battle to treat sewage': Sunita Narain

details the challenges faced by cities as they source water from further and further away; increased distribution losses and cost of supply; increased disparity within the city and; most importantly, paucity of funds for sewage systems to be set up and maintained. Today, all cities are losing the battle to treat sewage. As a result, we are killing our rivers and water bodies, which have become receptacles of sewage and garbage. Cities are impinging on the rural areas, resulting in increased tension and conflicts over sourcing. The meeting would deliberate on these issues to look for answers. The water and waste and pollution sector is extremely truncated and disparate, and one of the objectives was to bring the community together. [Please see presentation at [http://www.cseindia.org/userfiles/aad\\_sn.pdf](http://www.cseindia.org/userfiles/aad_sn.pdf)].

### **Session 1: Urban Waterscapes-Urban Water Catchments and Commands**

This session sought to define where cities get their water from and intra-city issues on distribution and equity. It also brought out conflicts in the urban waterscape, and how wise management of local water resources can head off these conflicts. Chairperson Santha Sheela Nair said urban water commands need to be created through holistic programmes including water supply, sewage and rain water harvesting (RWH).

India is heavily dependent on groundwater, while as much as 75% people depend on informal water networks. Water quality deteriorates as incomes rise, said Tushaar Shah from the International Water Management Institute. [Presentation link <http://www.cseindia.org/userfiles/tushaar.pdf>]

A host of new cities are coming up across the country. Gurgaon is a glittering example of urban planning run amok. The Delhi-Mumbai Industrial Corridor is another mega-infrastructure project that envisages 'development' of many more. Amitabh Kant, the project's chief executive officer, underlined the importance of planning to manage their waste water. The Corridor project plans

'The Delhi-Mumbai Industrial Corridor could be an opportunity to create model cities': Amitabh Kant

to integrate diversified water sources, enhance aquifer storage and identify and restore existing water bodies. This could be an opportunity to create model cities.

[Presentation link:

<http://www.cseindia.org/userfiles/DMIC-amitabh.pdf>]

India's rapid urbanization and industrialization have created new flashpoints, said K J Joy from the Society for Promoting Participative Ecosystem Management. These concern sourcing of water, allocation, access, pollution, water sector 'reforms' and institutional issues. They can be resolved by rebalancing demand, addressing equity concerns, sensible allocations and safeguarding rural livelihoods. [Presentation link:

<http://www.cseindia.org/userfiles/k%20j%20joy.pdf>].

Intra-city conflicts are due to the institutional and organizational issues that prevent access to water. Women and children are especially vulnerable to these restrictions, said Marie-Helene Zerah from the Institut de Recherche Pour Le Developpement. This can be addressed through decentralization and participatory policy formulation rather than capacity building. [Presentation link: [http://www.cseindia.org/userfiles/marie\\_20130319.pdf](http://www.cseindia.org/userfiles/marie_20130319.pdf)].

Cities ignore the environment but emphasize the creation of physical and economic infrastructure, said S Janakarajan, of the Madras Institute of Development Studies. In Chennai, there are 1,400 tanks that if properly restored integrated can store a substantial quantity of water, help the city cope with floods and ameliorate its groundwater crisis. [Presentation link: <http://www.cseindia.org/userfiles/Janakarajan.pdf>]

Chennai, Santha Nair said, is of the first cities that made rooftop RWH mandatory, and 90% households have these systems. On pricing, she said the aim should be resource conservation rather than cost recovery.

## Session 2, Sponging off Urban Lakes

Lakes are critical to a city's survival as they store excess water from heavy rainfall events, help retain groundwater levels, are biodiversity hotspots and moderate the climate. However, they have lost their importance as cities have started sourcing water from further and further away and high land prices have encouraged city 'development' agencies to value the land instead of the water. These were the main points from this session.

Anjal Prakash of SACIWaters said another reason for the decline of urban lakes was the tanker mafia. In Hyderabad, about 3245 hectares of lakes have disappeared between 2001 and 2012 because of these reasons. The city had 684 lakes interconnected in cascading system but only a few survive, and even these are under threat. However, with a judicious blend of technology

and legal action, they can be saved. [Presentation link:

[http://www.cseindia.org/userfiles/anjali\\_prakash\\_hydlakes.pdf](http://www.cseindia.org/userfiles/anjali_prakash_hydlakes.pdf)]

In Bangalore, the situation is as bad, said Bhargavi Rao of Environment Support Group. It was entirely dependent on its lakes and the Arkavathy river for water till a few decades ago, but now draws water from the Kaveri river that is 100 km away and 500 m below the city level. The city 'development' authorities are responsible for much of the lakes' demise. Concretization is another cause for the city's water emergency as it has reduced groundwater recharge. The city's lake development authority has handed over three lakes to private companies for maintenance, affecting traditional livelihoods. The city depends heavily on groundwater, extracting three times the recharge. Even though rainwater is mandated, just 44,700 houses out of about a million in the city have any sort of rainwater harvesting system. [Presentation link: [http://www.cseindia.org/userfiles/Bangalores\\_Lakes\\_Bhargavi.pdf](http://www.cseindia.org/userfiles/Bangalores_Lakes_Bhargavi.pdf)]

Srinagar has dealt with the problem of Dal Lake's pollution on several fronts, said Irfan Yasin of the Lakes and Waterways Development Authority. It was receiving silt and sewage from houses and boats on the periphery was polluting it. The Authority is setting up a sewage treatment plant to reduce pollution. It has divided the catchment into 12 micro-watersheds and planted trees to reduce siltation. Buffers have been set up between the catchment and the lake to clean the water runoff before it enters the lake, and 60,000 people living around the lake have been resettled.

The Vembanad Lake in Kerala is a Ramsar site but has shrunk to a third of its original area over the past century. N C Narayanan from the Centre for Technology Alternatives for Rural Areas at IIT Bombay said bunds built to keep out sea water and improve paddy cultivation around the lake have altered its ecology and polluted the backwaters connected to the lake. Tourism has also affected the lake, and an estimated 2,500 million litres a day (MLD) of sewage enters the lake. To tackle this, panchayats need more regulatory powers, and a campaign involving NGOs, teachers and students is needed. [Presentation link: [http://www.cseindia.org/userfiles/nc\\_narayanan.pdf](http://www.cseindia.org/userfiles/nc_narayanan.pdf)]

Mansagar Lake in Jaipur is one model of restoration of an urban water body by a private company. Rajeev Lunkad, a Delhi-based architect and urban planner said it was a joint effort between the Jaipur municipality, the Jaipur Development Authority, Ministry of Environment and Forests and the pollution control board. Through this approach, the sewage has been diverted to a constructed wetland with a 7 MLD capacity before it enters the lake. The depth has been increased to 2.5 m. Using a novel approach, storm water is being treated in a sedimentation basin, location in the lake itself. [Presentation link: [http://www.cseindia.org/userfiles/mansagar\\_lake.pdf](http://www.cseindia.org/userfiles/mansagar_lake.pdf)]

'Mansagar Lake in Jaipur is one model of restoration of an urban water body by a private company': Rajeev Lunkad

The session chairperson M Ramachandran said a listing of water bodies is a prerequisite to any revival and restoration work. It should be monitored by prominent citizens. A model law drafted with inputs from the public is another necessity. Urban planning has to incorporate protection of water bodies.

### Session 3, Ground Water – What Lies Beneath

More than half of India's urban population depends on groundwater for its needs. However, this critical resource is neglected and abused. Its use is never properly accounted for by individual users and water utilities, and therefore, it is not protected or used sustainably. The session considered ways to estimate the role of groundwater in urban water budgets, improving data collection, ways to use it more sustainably and how to make the regime governing groundwater more effective.

At the macro level, 1.5 billion people and 48% of Indians live off groundwater. The main reasons are the reduced reliability of supply from surface water, ease of access and lax regulation. Therefore, groundwater levels are falling rapidly in all urban areas, said Himanshu Kulkarni from the Advanced Centre for Water Resources Development and Management.

'Little thought is paid to recharge and cities are drilling deeper into fossil aquifers in their search for water': Himanshu Kulkarni

Little thought is paid to recharge and cities are drilling deeper into fossil aquifers in their search for water. To understand urban groundwater, an aquifer-based approach coupled with capacity

building is needed, and groundwater has to be protected from pollution by sewage.

[Presentation link: [http://www.cseindia.org/userfiles/himanshu\\_kulkarni.pdf](http://www.cseindia.org/userfiles/himanshu_kulkarni.pdf)]

Sushil Gupta, Chairman of the Central Ground Water Board, put it more bluntly. Cities and groundwater have an unsustainable relationship, leading to salinity intrusion in coastal areas, leaching of pesticides and industrial wastes, and blockage of recharge zones. In Chennai, overuse of groundwater has caused land subsidence and saline intrusion as average water tables have fallen from 2-3 m below ground level (BGL) to 16 m now. In Ahmedabad and Gandhinagar, the decline is 2.3 m a year due to over-extraction. Deep aquifers in Chandigarh are fast depleting and the city has switched to shallow aquifers. The solutions are to augment water storage, reduce, reuse and recycle and use treated water in industries. [Presentation link: [http://www.cseindia.org/userfiles/urban\\_groundwater\\_sushilgupta.pdf](http://www.cseindia.org/userfiles/urban_groundwater_sushilgupta.pdf)]

Making the connect between lakes and groundwater, Rakesh Kumar from the National Environment Engineering Research Institute lakes said can be lifesavers for urban areas. However, their quality is degrading owing to pollution and encroachment. Dredging and aeration have to be done carefully. An alternative is to improve lake water quality is to use a process developed by the Institute called Phytroid, as has been done in the Kalina-Kurla complex in Mumbai to treat sewage and Lunar Lake in Maharashtra. [Presentation link: [http://www.cseindia.org/userfiles/20130319\\_rejuvenation.pdf](http://www.cseindia.org/userfiles/20130319_rejuvenation.pdf)]

Talking about the legal framework of groundwater, Archana Vaidya from the Indian Environment Law Offices said groundwater under Indian law is an easement connected to the owner of the land. There is no federal law dealing with its management and regulation though 16 states have laws to regulate its use. The Government of India introduced groundwater bills in 1970, 1992, 1996 and 2005, but regulation takes place only in notified areas. There is nothing about augmentation. To implement the acts, institutional issues and technical aspects need to be addressed. [Presentation link: [http://www.cseindia.org/userfiles/20130319\\_frameworkgw.pdf](http://www.cseindia.org/userfiles/20130319_frameworkgw.pdf)]

To understand groundwater use in urban areas, it is first essential to map aquifers and groundwater. Giving the example of Bhuj, Yogesh Jadeja from Arid Communities and Technologies said they have done a well-inventory around the city's Hamirsar Lake and identified potential recharge zones. Storm water management is also critical for preserving and reviving urban lakes, and thereby improving the groundwater regime. [Presentation link: [http://www.cseindia.org/userfiles/bhuj\\_aquifer\\_mapping\\_yogesh.pdf](http://www.cseindia.org/userfiles/bhuj_aquifer_mapping_yogesh.pdf)]

Summarizing, the session chairperson G Mohan Kumar from the Ministry of Water Resources said India was the largest groundwater user in the world. The Government of India has launched a program to map and manage aquifers. Urbanization presents new challenges of over-use, reduced recharge potential and pollution.

#### **Session 4: Fouled – Urban Sewage Mismanagement**

This session examined the various aspects of sewage and waste water. Chairperson Anil Baijal said sewage and water are strongly hyphenated and increasing urbanization has put pressure on civic services and structures. The objective of projects sanctioned under JNNURM is to handle urban services on a sustainable basis. The urban sewage challenge includes inequity, exclusion, river pollution, loss of traditional sources, problem of environmental degradation and declining groundwater table. Efforts to scale up the sewerage network are often financially unviable and technically unfeasible.

Deepak Kantawala, a leading environment engineer, said sewage is drinking water polluted by waste water. It needs to be cleaned since it is a resource instead of being dumped in drains to pollute rivers and the seas. The best way is not to use drinking water to carry away excreta by

promoting dry toilets. There is no dearth of technology, only application of mind. Reuse is the best way to reduce wastage of this resource, and in 1964 high rise buildings in Mumbai were required to put water treatment plants and use the water for air-conditioning; reuse of domestic sewage is cheap and easy. India's cities need to ensure their existing infrastructure works before building new plants. [Presentation link: [http://www.cseindia.org/userfiles/d\\_kantawala.pdf](http://www.cseindia.org/userfiles/d_kantawala.pdf)]

'Sewage needs to be cleaned since it is a resource instead of being dumped in drains to pollute rivers and the seas': Deepak Kantawala

Head of Bangalore's Waste Supply and Sewerage Board Gaurav Gupta said Bangalore is unique as it does not have a nearby river. Therefore, it gets water from the Kaveri that is 100 km and 1000 feet below the city. The city has a major plan to collect and treat sewage and is expanding the network. The cost of treating sewage to make available more water is less (about Rs 10 per kiloliter, Kl) than desalinization (about Rs 35 per Kl). It is important to charge for water, but differences in tariffs should not lead to high-tariff users stealing water from low tariff users.

The conventional approach to sewage treatment, to treat it to regulatory standards and dispose in water bodies, is like turning the pyramid upside down, said Shyam Asolekar from the Indian Institute of Technology, Mumbai. The new paradigm is to use treated effluent and keep it out of

streams, lakes and seas. For this, new solutions are needed since the installation and operation of conventional sewage treatment systems is very expensive. The new solutions have to be low-cost and simple. There is a market for recycled water but its opponents argue it is impractical, while its proponents say this water can be used for specific purposes. To expand the market, recycling should be made mandatory by heavy users. [Presentation link: [http://www.cseindia.org/userfiles/prof\\_ashlekar.pdf](http://www.cseindia.org/userfiles/prof_ashlekar.pdf)]

City sanitation plans (CSP) prepared under the National Urban Sanitation Programme (NUSP) have a direct bearing on urban sewage management. Bringing out this nexus, Srinivasa Chary from the Administrative Staff College of India said 130 CSPs have been prepared since 2008. They propose different systems such as sewers and plants, and on-site sanitation systems such as septic tanks. Sanitation is linked to health and good sanitation depends on a good sewage system. Conventional sewage systems are expensive and therefore, a hindrance in improving public health. The solution is on-site sanitation through septic tanks and many countries have design guidelines for them. In India, septic tank design, septage handling is unregulated and there is no institutional mechanism for on-site sanitation. [Presentation link: <http://www.cseindia.org/userfiles/CHARY.pdf>]

To improve sewage treatment, STPs need to be monitored, their staff trained and utilities need to have the money to pay salaries and running costs, said Anurabha Majumdar, professor emeritus with Jadavpur University. Several treatment options have emerged and need to be chosen appropriately. STPs should work like factories and need to generate income from the sale of products and services. The operation and maintenance of STPs is usually outsourced since water utilities lack the competence to run them. [Presentation link: <http://www.cseindia.org/userfiles/arunabha.pdf>]

About 80% of the urban water supply goes for domestic use, while large water consumers such as industries fall outside city limits, said Abhay Kantak from Crisil. Thus, there is a limited potential for cross-subsidisation and recycling of waste-water for supply to industrial consumers cannot substitute. However, recycling can save on costs of developing additional water sources. In Visakhapatnam the municipality is building a 40 MLD waste water treatment under the PPP model to supply treated water to industry and will then divert potable water from industry to households. The company will charge a maximum tariff of Rs 32.96 by KI and pay the municipality a royalty of Rs 2.25 per KI. [Presentation link: <http://www.cseindia.org/userfiles/abhay.pdf>]

Speaking about the need to maximize reuse of water, Uday Kelkar from NJS Consultants said this can reduce gap between potable supply and demand, bring down the cost of transporting water over long distances, mitigate conflicts and reduce groundwater over-use. It is, therefore, central to making water supply sustainable. Nagpur and Bangalore have major plans to treat and recycle sewage for domestic and industrial use. Increasing reuse will need changes in institutional structures, a reuse guidance document, education and awareness to make recycled water acceptable, funding sources and incentives for those who reuse recycled water. [Presentation link: [http://www.cseindia.org/userfiles/uday\\_kelkar.pdf](http://www.cseindia.org/userfiles/uday_kelkar.pdf)]

While NUSP has tried to translate plans into action, several concerns remain such as identifying suitable champions from municipal corporations, para-stats and the private sector. Dirk Walther from the Indo-German Environment Programme (GIZ) said there are challenges of operating decentralized systems such as septic tanks. It is not the shortage of money but a process as few cities have institutional or financial mechanisms or have planned for these systems. [Presentation link: <http://www.cseindia.org/userfiles/DIRK.pdf>]

The waste water treatment industry is constantly searching for new technology driven by shortage of land, increasingly stringent standards and the need to treat sewage as a resource. Mukesh Grover from Degremont. There have been innovations at level of treatment that make sludge available as manure and treated water that can be reused for a wide range of applications. For example, in secondary treatment, new technologies include the suspended growth process, activated sludge process, sequential batch reactor, immobilized media process, biological filtration oxygenated reactor, the micro-ultra filtration process and the membrane biological reactor. [Presentation link; [http://www.cseindia.org/userfiles/mukesh\\_grover.pdf](http://www.cseindia.org/userfiles/mukesh_grover.pdf)]

## **Session 6: Meeting of River and Lake Warriors**

CSE organized a late evening gathering on the first day of the Dialogue, bringing together more than 50 people, including lawyers and activists, from several states who have worked on protection of urban lakes and rivers. The agenda was to share experiences and debate the causes for their rapid demise, and develop a roadmap for the future. Please visit <http://www.downtoearth.org.in/content/world-water-day> for profiles of some warriors.

Many expressed their disappointment with projects funded by the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) and National Lake Conservation Plan of the Environment Ministry, both of which have failed to curb encroachments and pollution loads in the water bodies. These projects serve primarily to fund civil engineering works, such as peripheral roads, promenades and sewage treatment plants, without any thought given to the operations and maintenances of these facilities, nor the ecology of a particular lake or river ecosystem. The various speakers highlighted the unabashed encroachment by the builder-bureaucrat-politician nexus, as well as failure on the part of urban water service providers, who are responsible for the sewage generated in their command areas.

Sunita Narain concluded the session after hearing from more than 15 activists who have been working to save lakes and rivers in their respective regions. While there was agreement that it is difficult to bring all these voices in to one room, the question she raised was where this community goes from here. She expressed enthusiasm for the fact that the other side (government and industry) is beginning to talk our language. "Each battle has to be fought and won, but sometimes lost. How do we move ahead? Urban water bodies are the most vulnerable of all water bodies in the country today. Only Guwahati has passed a law to protect the catchments of lakes. Rest of the cases, at best, provides for a buffer zone, all of which depend from case to case, judge to different bench," she said. There is a need to look at the issue of ecological flows and the water balance of our water bodies. We need to revisit the positioning of

industry based on water availability and receptor of pollution. "There is more happening in the country that we are able to report, which is why it is important that we share our experiences, good or bad," she added.

### Session 7: Killing Rivers, Revival Strategies

Rajendra Singh of Tarun Bharat Sangh led a mass movement near Alwar to revive the Arvari River. This session looked at strategies for reviving rivers. He said this approach shows that local solutions are needed to save rivers that need to be defined. Along with rivers, sub-surface aquifers need to be recharged so they can feed rivers. TBS used an approach called community-led soil and moisture conservation to revive the river. Simultaneously, it set up a village parliament to take up basin-level issues. [Presentation link: <http://cseindia.org/userfiles/rajendra.pdf>]

Bangalore is well-endowed with watersheds and lakes. The city can survive as long as it protects these, said Leo Saldanha of the Environment Support Group. However, Bangalore has systematically destroyed its surface water sources and is now heavily dependent on groundwater, which has fallen to 1000 feet below ground level in many places. Paradoxically, when it rains the city gets flooded. Cities have no alternative if they wish to afford to manage their water demands but to protect their local inter-connected hydrogeological systems.

[Presentation link:

<http://cseindia.org/userfiles/leo.pdf>]

'The pulp and paper industry is the largest polluter of the Ganga River, accounting for 40% of the total waste water': R M Bhardwaj

The pulp and paper industry is the largest single polluter of the Ganga River, accounting for 40% of the total volume of waste water. Domestic

sewage contributes about 6087 MLD and industries, 501 MLD, said R M Bhardwaj, senior scientist in the Central Pollution Control Board. The towns along the river have an installed capacity to treat only 50% of the sewage generated.

Faecal coliform levels are the highest downstream of Varanasi, but are a problem along the entire length of the river. This is true of most river stretches in the country. [Presentation link: [http://cseindia.org/userfiles/ganga\\_pollution\\_raj.pdf](http://cseindia.org/userfiles/ganga_pollution_raj.pdf)]

In Tamil Nadu, the Noyyal River has been severely polluted by textile dyeing units in Tirupur, and the downstream Orthupalayam Dam is also fouled. T Mohan, the High Court Commissioner in this case, said this has in turn adversely affected agriculture in large tracts along the river. Groundwater in many places have high TDS, fluoride and other pollutants. As the river is seasonal, there is no scope for dilution of sewage and industrial effluents. The High Court gave industries six months to set up reverse osmosis plants and stipulated that industry will be fined for every litre of pollutant discharged; this money would be used to clean the ponds and river. [Presentation link: [http://cseindia.org/userfiles/noyyal\\_river\\_pollution\\_tmohan.pdf](http://cseindia.org/userfiles/noyyal_river_pollution_tmohan.pdf)]

The Chite Lui is a river flows along Aizawl; it has been contaminated by sewage from the city and damaged by a road financed by the World Bank. Rochamlia from the Zoram Research Foundation has developed a strategy for river restoration. The river's catchments have been



built over. Even though Mizoram has a riverine reserve law, it is not properly enforced. The Foundation is propounding strengthening the legal framework for rivers and building a platform with like-minded NGOs. [Presentation link: <http://cseindia.org/userfiles/rochamlan.pdf>]

The Musi River, which flows through Hyderabad, is a pollution hotspot affected by domestic sewage and industrial effluents. Downstream of Hyderabad, its water is used for irrigation. Priyanie Amarsinghe from the International Water Management Institute, said studies have shown that vegetables grown with this water do not absorb heavy metals such as cadmium and lead present in the water. Sanitation is a problem in rural areas, but Hyderabad does not have enough sewage treatment plants to treat its waste. [Presentation link: <http://cseindia.org/userfiles/priyanie.pdf>]

## **Session 8: Decentralised Sewage Management as an Alternative to Pipes Pumps and Plants**

There are many alternative models for sewage treatment that do not require capital intensive solutions of pumps, pipes and plants. Based on natural processes, these can be viably used in conjunction with conventional sewage treatment systems, and this session brought out several such methods.

Sandeep Joshi from Shristi Eco-Research Institute said the Ujjani Basin is polluted by solid, liquid and industrial wastes. Another 3,000 micro watersheds are severely polluted. SERI's Green Surgeon/ Green Bridge system can be economic and ecologically viable option for reducing pollution levels. For example, 6 systems were installed on the Ahar River reducing BOD and COD by 50% and increasing dissolved oxygen by 1200%. However, community participation and efficient governance are key to success. Hence, proper designs are needed to treat the wastewater at a zero or low energy cost and include science, governance, finance, minds, hands and ecosystem. [Presentation link: <http://cseindia.org/userfiles/sandeep.pdf>]

Prof H.S. Shankar from IIT Mumbai presented the concept of Soil Bio-Technology (SBT) to treat liquid waste. This is based on the principle of carbon cycle that assumes soil has micro-organisms to consume dead organic matter. SBT uses a special media with plantation and the principle of the apex soil predator to process waste water. The culture media design is critical to get the desired quality of water. The Government of Maharashtra has decided to use SBT systems in 95 villages. An SBT system installed by the Brihanmumbai Municipal Corporation with a capacity of 3 MLD produces water with a BOD of 2. [Presentation link: <http://cseindia.org/userfiles/shankar.pdf>]

Another biological process to treat sewage involves the use of diatoms. Sampath Kumar from Nualgi Technologies Private Limited said diatoms can treat the polluted water containing sewage and effluents. Nutrients in sewage cause the growth of blue-green algae and diatoms feed on this to fix carbon dioxide by photosynthesis. In addition oxygen generated through photosynthesis reduces BOD. Diatoms also act as a source of food for fish and can enhance local livelihoods. [Presentation link: <http://cseindia.org/userfiles/sampath.pdf>]

Stanzin Tsephal of Consortium for DEWATS Dissemination (CDD) Society in Bangalore introduced a low cost model of DEWATs that combines many treatment systems. There is no linear relationship between the size of a DEWATS treatment plant and its cost. The current technologies are very site-specific and hence their cost varies. [Presentation link: <http://cseindia.org/userfiles/staizin.pdf>]

Mamta Tomar from JM Enviro spoke about the restoration of Mithi River using anaerobic bioremediation. The river is polluted by both liquid and solid wastes from point and non-point sources that have a heavy load of oil and grease and organic matter that leads of an overload of nutrients and sludge accumulation. ABR decomposes the organic wastes in the absence of air using special bacteria strains. They first remove oil and grease, then odour and finally the organic matter. The product was applied in the Mithi River at the confluence of the Virar and Powai lakes. The total cost of the project was Rs. 303 crore. [Presentation link: [http://cseindia.org/userfiles/mamta\\_presentation.pdf](http://cseindia.org/userfiles/mamta_presentation.pdf)]

A similar process using bioremediation was discussed by Varun Arora from Greenway Technologies, and applied at the Kumbh nala in Allahabad. This process begins with making mud balls of clay, molasses and rice/wheat bran. After 1.5 weeks the mud balls develop a whitish layer due to fermentation and then they are put in the water to be treated.

Bio-remediation mimics nature by introducing microbes into sewage for treatment, said Sanjay Aggarwal from Clover Organics. All waste treatment systems work on capacities and the microbes need a suitable environment to survive. Using this, Proctor and Gamble have reduced their pollution by 90% and it has been used to attempt remediation of several lakes in Delhi. The system has limitations such as high running costs and a lack of bureaucratic will with the government, as well as industry fragmentation. [Presentation link: <http://cseindia.org/userfiles/sanjay.pdf>]

Manu Bhatnagar from INTACH discussed the threats to urban lakes due to encroachment, siltation, dumping of solid and liquid waste. He presented the case of Naini lake, Najafgarh

'Solutions must involve a combination of different innovations and should be context specific': Manu Bhatnagar

Jheel, Bhalsawa lake, Mangalavarnam bird sanctuary in Kochi and Hauz khas lake of Delhi, all of which are deteriorating because of urbanization and direct sewage discharge. Solutions must involve a combination of different innovations and should be context specific. [Presentation link: <http://cseindia.org/userfiles/manu.pdf>]

The session chairperson Ajay Shankar from the National Manufacturing Competitiveness Council said in the past six years several alternative technologies have been developed that can help overcome the problems of conventional sewage treatment methods. These should come into widespread use over the next few years. Promoters of these technologies need to determine how to mainstream them and get approvals from decision makers.

## Session 9: Brown Gold or Plain Excreta – Is Sewage a Resource?

Sewage is a resource rather than polluted water to be flushed away. Several municipalities as discussed in the previous sessions sell sewage to farmers, while others supply it to industry. However, while large cities are developing plans to handle sewage, small towns do not have the capacity, said Debashree Mukherjee of Delhi Jal Board at the session.

Small cities have low levels of infrastructure development, leading to low service levels of water supply and sewage management, said Ashish Mathur from Jamshedpur Utilities and Services Co. (Jusco), a 105 year old enterprise that manages water and sewage in the city. Small cities get pushed into a corner by larger ones in terms of funding and do not attract talented managers. Better governance is one point of entry to improve the situation, and Jamshedpur is being re-modeled to meet the needs of its expanding population. Jusco is flexible and creative in the use of new approaches and technology. [Presentation link:

<http://cseindia.org/userfiles/JUSCO.pdf>]

Improper recycling of sewage in urban areas means leads to a growing demand and cost of fertilisers, declining yield due to nutrient deficient soil, pollution, said Rahul Bakare from Arghyam. The solution is to increase production of food, while controlling costs. Excreta must become fertiliser, according to research conducted by the University of Agricultural Science and Arghyam. The research examined the nutrient potential of human urine and worked out cost economics of using this for crop production. The nutrient potential depends on diet, age. They used urine for vegetable cultivation, and the results were a doubling of productivity. Pit latrines and septic tanks are emptied using suction machines that empty their load into sewage beds prepared by farmers. However, protocols for this disposal and the use of manure have to be developed. [Presentation link: [http://cseindia.org/userfiles/rahul\\_bakare.pdf](http://cseindia.org/userfiles/rahul_bakare.pdf)]

Several municipalities in Gujarat have been selling sewage to farmers' cooperatives for irrigation for decades, said Alka Palrecha from People in Centre. Rural areas provide water and receive waste water as municipalities do not have the capacity to treat sewage. For example, the Sabarmati River is dry for 80 km downstream of Ahmedabad. However, some 30,000 hectares of land are irrigated by the waste water from just three municipalities. There are attendant health risks, but the solution is to develop and enforce standards, instead of stopping the practice. In Bhavnagar, the first STP was installed in 1940 that stopped working in 1998. Some 135 farmers collect and use sewage. In Bhuj, sewage is disposed in the Khari River and farmers pump this out for irrigation; they plan their crops in tune with the city's water supply. Gandhinagar's sewage is conveyed directly to eight villages. In Patan, 35 share croppers buy primary-treated sewage from oxidation ponds for Rs 12,000 a year.

[http://cseindia.org/userfiles/alka\\_palrecha.pdf](http://cseindia.org/userfiles/alka_palrecha.pdf)]

The East Kolkata Wetlands (EKW) is a unique Ramsar wetland that handles the city's sewage and provides with fish and rice in return, said Dhrubajyoti Ghosh, former Chief Environment Officer of West Bengal. This is a stable urban fringe that keeps the city's groundwater levels up. Local communities have designed, made and maintain the intricate network of drainage canals in the wetlands. The system has not been replicated as engineers are averse to taking risks and

other cities are unaware of the wetlands. [Presentation link: [http://cseindia.org/userfiles/d\\_ghosh.pdf](http://cseindia.org/userfiles/d_ghosh.pdf)]

The Surat municipal corporation sells 50 MLD of sewage at Rs 17 per kilo litre to industries, as other sources of water are high in TDS, said Anand Madhavan from ICRA. This is one of the ways to head off an impending water shortage as the industrial estate is a major consumer of water. The concept of waste water reuse is appealing but costs need to be fixed to make it viable. [<http://cseindia.org/userfiles/Anand%20Madhavan.pdf>]

The reuse of sewage has health implications, pointed out Nandini Sharma from Maulana Azad College. These come from the bacteria, virus, protozoa, etc., and can lead to water-related diseases. Pathogens survive in soil long enough to be a risk to farm workers and the risk can extend to consumers as well. The lowest risk is from crops that are not directly eaten, such as rice and wheat. An emerging trend is the rise of Cysticercosis that affects 96% of vegetarians, caused by using sewage for irrigation. [Presentation link: <http://cseindia.org/userfiles/nandini.pdf>]

There are many examples where industry has promoted water efficiency, leading to a 30% reduction on average in water use by industry, said Ramani Iyer from the Standards Council, Confederation of Indian Industry. Some examples are savings of 200 cu m by ITC in Bangalore, 100% rainwater harvesting by TCS in Chennai, rainwater harvesting by several companies in Coimbatore that include Siruthuli, Sri Benari Amman, Pricol Ltd, Lakshmi Machines and Elgi. [Presentation link: [http://cseindia.org/userfiles/ramani\\_iyer.pdf](http://cseindia.org/userfiles/ramani_iyer.pdf)]

In her closing remarks, Sunita Narain said sewage is big news now. Over the last year, partly because of concern of pollution, partly because water bodies are dying and then health concern, there is greater realisation that we are drowning in our own excreta. Governments are waking up to the realisation that sewage has been neglected for far too long. The cost of building sewage and water supply networks at around Rs 1 lakh per kilometre are prohibitive, and therefore we need other options.