



सत्यमेव जयते

Ministry of Human Resource Development
Ministry of Urban Development

giz



Best Options for School Sanitation: Meeting the Challenge



TOWARDS CITY WIDE SANITATION



NATIONAL SCHOOL
SANITATION INITIATIVE



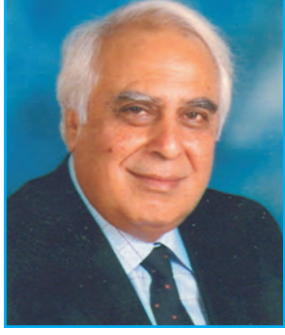
सत्यमेव जयते

Ministry of Human Resource Development
Ministry of Urban Development

Best Options for School Sanitation: Meeting the Challenge







कपिल सिबल
KAPIL SIBAL



मंत्री
मानव संसाधन विकास,
संचार एवं सूचना प्रौद्योगिकी
भारत सरकार, नई दिल्ली -110 115
MINISTER OF
HUMAN RESOURCE DEVELOPMENT,
COMMUNICATIONS AND INFORMATION TECHNOLOGY
GOVERNMENT OF INDIA
NEW DELHI - 110 115

MESSAGE

It gives me great pleasure to know that the CBSE, GIZ and the Ministry of HRD are collaborating to launch a website to disseminate information on school sanitation and provide a status of the conditions prevailing in CBSE schools.

A healthy mind needs a health body to flourish. Education cannot be limited to the knowledge contained in books but should also enable a child to understand concepts like health, hygiene, nutrition and physical fitness. A holistic development of the child would be found wanting if we do not inculcate such learning both in person and through the school environment. The future of the country and society are shaped in the schools of the day and we would be failing in our task if we do not endeavour to reach out to our children through the education system on sanitation and hygiene.

I commend the joint endeavour of CBSE, GIZ and the schools of India in participating in the National School Sanitation Initiative and hope that the message carried in the Initiative reaches every child.

(KAPIL SIBAL)



National School Sanitation Initiative

Vigyan Bhawan, 27 April 2010



A. K. Mehta



सत्यमेव जयते

Ministry of Human Resource Development
Ministry of Urban Development

Joint Secretary
Ministry of Urban Development
Government of India

FOREWORD

The CBSE in collaboration with the Ministry of Human Resource Development (MoHRD), Ministry of Urban Development (MoUD) and GIZ (formerly known as GTZ) has introduced the 'National School Sanitation Initiative' and the aim is to inculcate good sanitation habits among the school children in order to inspire, acquaint and celebrate excellence towards School Sanitation at the National Level.

To facilitate best sanitation practices in the schools, a National School Sanitation Manual was released last year by Hon'ble Human Resource Development Minister Sri Kapil Sibal which was later adopted by all the CBSE schools and approved in the Education Minister's Conference held on 09.06.10.

Now as a furtherance to the effort, an Online National School Sanitation Ratings has been instituted in order to make a realistic assessment of the state of school sanitation in India and also to give a due recognition to those schools who are really committed to the cause of better sanitation for the children.

This book will also help the students to prepare project reports on sanitation and hygiene and could prove an important tool in the in moving towards National School Sanitation Awards which has been instituted on annual basis for those schools who have been rated online for sanitation and taken noteworthy steps towards betterment of the sanitation scenario in their schools in varied ways.

The Sanitation Ratings are expected to infuse the required dynamism in the schools towards sanitation management. In order to assist the schools for taking up noteworthy steps towards effective sanitation and enhancement in such facilities at low cost and with the minimum use of resources leading to the desired behavioural and attitudinal changes towards hygiene & sanitation, this book has been prepared by a team of experts consisting of the following :-

1. Mr. A.K. Mehta,
2. Mr. Arne Panesar , GIZ, Germany
3. Mr. Sanjay Kumar Srivastava, Senior Advisor, GIZ India
4. Ms. E. P Nivedita, Director, Ministry Of Urban Development, Government of India
5. Mr. Dayanand Panse, Eco San Services Foundation, Pune
6. Ms. Sree Vidya Satish, Eco San Services Foundation, Pune
7. Mr. Y.D. Mathur, Expert and Advisor, Sulabh International, Lucknow,
8. Dr. Kalpana Kapoor, Principal, DPS International, Vasundhara
9. Mr. R.S. Arun, Eco San Services Foundation, Bangalore
10. Mr. Vinod Tihara, Administrator, Vidya Jain Public School, Delhi
11. Mr. R.R. Okhandiyar, CCF, Government of Madhya Pradesh, Bhopal
12. Mr. Dirk Walthers, Sr. Advisor, GIZ, India
13. Mr. Stefan Weyler, Intern GIZ, India

My special thanks goes to Mr. Girish Kapoor, GIZ, Ms. Sanchita Deb Roy, GIZ, Ms. Neeta Sinha, Dr. Amita Sinha, Ms. Smita Netra and Ms. Pradnaya Thakur of ESF, Pune who have toil hard in giving the desired shape to this by going through each and every page and also provided valuable inputs.

I am sure this book will go a long way in infusing attitudinal and behavioural changes among school children as envisaged in the National Urban Sanitation Policy leading to a clean India in future.

(A.K. Mehta)

Table of Contents

1. National School Sanitation Initiative	1
2. Sustainable Sanitation in Schools An Introduction	4
3. State of Sanitation in India	5
4. Comprehensive School Health Manuals : Issued by CBSE	8
• A Summary of the Health Manuals issued by CBSE	8
5. National School Sanitation Manual	10
6. The National School Sanitation Ratings	10
• Guidelines for Toilets and Sanitation Setup	11
• Norms for provisioning of SSHE Facilities	12
• Drinking Water Provisions & Norms	16
• Purpose of National School Sanitation Ratings	17
7. National School Sanitation Awards	18
• Parameters for Selection	19
• Mechanism & Procedures	20
8. The Role of Health & Wellness Clubs	20
• List of Activities pertaining to health, eco sanitation & wellness	22
• Facilities : Options in the Schools	25
9. Waterless Urinals	26
• Hygiene Benefits	28
• Installations	28
• Comparison between Different kinds of Waterless Urinals	32
10. Best options on dry-compost toilets, eco-urinals and hand-washing facilities, rainwater harvesting and groundwater recharging	36
11. Conservation Measures : Rain Water Harvesting	37
12. Understanding Waste management Terminology	38
13. Creation, Conservation & Eco-Sustainable Use of Green Space in Urban Schools	39
• Benefits of Green Spaces	41
• The Green Space Economics	41
14. Water Management : The Scenario & Prospects	45
15. Water Security	47
16. Options for Conservation in schools	48
• Rain Water Harvesting	52
• Storage Tanks	55
• Roof Top Water Harvesting	57
17. More Options for Innovations in Schools	63
• Zero Discharge Concept	63

● Water Saving Urinals	67
● Sanitation Initiatives by Kirorimal College, Delhi University	70
● Urban Agriculture : City Gardening	71
● The Revered School Garden and the Hanging Food Gardens in Urban Dry lands	72
18. Students' Activities : Capture Good Examples for Documentation	74
19. Integrating Sanitation & Hygiene Education	76
● Sustainable Sanitation Exchange Programme	78
● Certificate Course on School Sanitation	79
● Environment Education in the Tolkappiyar Poonga – A showcase from Chennai	81
● Eco Activities in the Schools in Germany	84
● Documentation of German School Gardens on the web	85
● Institutional Framework	86
● Sanitation and Hygiene in Primary Schools in Uganda	86
● Sanitation Scenario in Primary Schools of Bangladesh	87
20. Introduction to Sanitation Systems and Technologies	88
● Technical Options Suitable for Schools : Appropriate Systems & Technologies	91
● Sulabh Flush Compost Toilet	92
● Septic Tanks	94
● Anaerobic Sanitary Systems	99
● Community / School Toilet Linked Bio-gas Plants	101
● Baffle Reactor	103
21. Approaches for waste management at school	104
● Liquid Waste Management	105
● Sludge Tanks	110
● Rain water harvesting system in a school	111
● Incinerator for Girls toilets in schools	112
● Construction and Maintenance of school facilities SuSan Experience	114
● Technology review of constructed wetlands - Subsurface flow constructed wetlands for grey water and domestic wastewater treatment	115
22. The Way Forward	119
Appendix ● Water, Environment & hygiene	120
● UNICEF Action	123
Annexures	125
I ● CBSE Circular : NSSR – National School Sanitation Ratings	126
II ● Creating Better Cities : The Bremen Initiative	129
● Kitakyushu Initiative for A Clean Environment	137
III ● Dewats	141
IV ● Hazardous Waste Management Handling Rules, 1989	165
V ● Municipal Solid Waste Rules 2000	173



National School Sanitation Initiative

Vigyan Bhawan, 27 April 2010

PHOTO CREDITS

1. Mr. Sanjay Kumar Srivastava
2. Mr. Arne Panesar
3. Ms. Sree Vidya Satish
4. Ms. Smita Netra
5. Dr. Kalpana Kapoor
6. Mr. R.S. Arun
7. Mr. Shelly Shaurya
8. Mr. Stefan Weyler
9. Ms. Sanchita Deb Roy

National School Sanitation Initiative

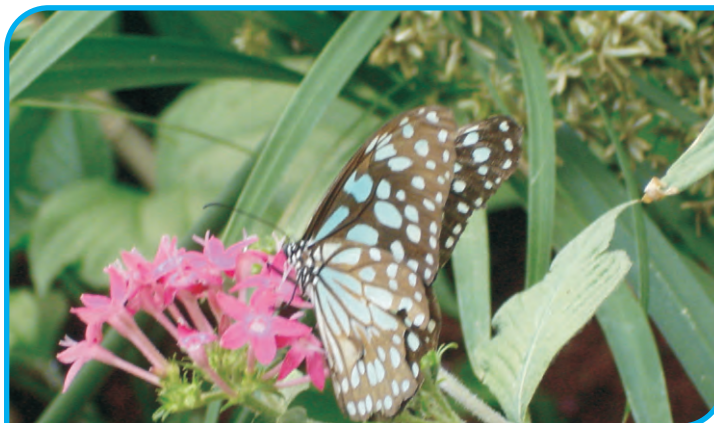
National School Sanitation Initiative is a joint effort spear-headed by the Ministry of Human Resource Development (MoHRD) and the Ministry of Urban Development (MoUD) with the support of GIZ-India (GIZ : German International Cooperation) and CBSE (Central Board of Secondary Education). The initiative is aimed at involving “Children as Agents of Change” philosophy and addressing the water, sanitation and hygiene issues in schools to trigger positive behavioural change among children, who can potentially take back the lessons home and trigger a change.

The National School Sanitation Manual along with a Kids Sanitation Manual would help all the schools in the country to look at sanitation aspect in a new light and to bring about necessary behavioural and attitudinal changes amongst the children leading to a clean India of the future. In India, 30.66 million households forming 35.5 % of the total households in the urban areas do not have adequate access to sanitation facilities at home. Besides loss of human dignity, this state of affairs has a severe impact on the environmental and health outcomes. Lack of sanitation and unscientific disposal of waste lead to contamination of surface and ground water. Diseases arising out of poor sanitation take their toll not only in terms of human suffering but in economic loss to the family and the society. The problem is also acute in schools, many of which lack hygiene facilities and safe drinking water. Separate toilets are not available for girls. Even when these exist, many are poorly maintained or are inadequate in number. As a result girls absent themselves from classes for spells of time or in extreme cases they drop out. Thus, the adequacy of sanitation facilities has a direct bearing on the enrollment and retention of girls in schools.

There is another important reason for focusing on school sanitation. In the school-going age, the human mind is impressionable. Those who grow up in a satisfactory sanitary environment will form good hygienic habits and behavior in the adult stage. The National Urban Sanitation Policy was launched in 2008 with the objective to achieve 100% sanitation coverage in the urban areas through awareness generation and behavioural change. Educating the young is the key to behavioural change. So it was realized that the ideal target group for achieving their national goal is to focus on the school children. The success of “no tobacco” and “no crackers” campaigns in schools gives us hope in this regard.

Children of our nation would be a potent instrument in achieving the desired sanitation goal. So, keeping the faith on the strength of the younger generation, the ‘National Urban Schools Sanitation Initiative’ was launched by Dr. M. Ramachandran, Secretary, Ministry of Urban Development, Government of India, on 26th of February 2009 in New Delhi. More than 100 schools affiliated to the Central Board of Secondary Education (CBSE) from all over India participated. There was a very encouraging response, and hence it was decided to widen the

scope of the initiative and rechristen it as the National School Sanitation Initiative. The Advisory Group for the Initiative endorsed the idea to bring out a comprehensive National School Sanitation Manual and to institute National School Sanitation Awards besides taking up several other measures. In this effort, Ministry of Urban Development and Ministry of



Human Resource Development put up a united effort in collaboration with Central Board of Secondary Education and GIZ. A Baseline Survey on National School Sanitation, which was conducted by GIZ, was made use of while preparing the manual. Detailed studies done by UNICEF and other organizations also provided inputs. Organizations like Sulabh International, Ecosan Services Foundation, Pune and SEECON International, Switzerland also contributed. After a year of hard work and a series of meetings, workshops and training cum exposure visits organized by GIZ, the Advisory Committee endorsed the School Sanitation Manual as well as the structure of the National School Sanitation Awards in December 2009. The initiative intends to create awareness generation leading to behavioural change by focusing on proper sanitation and segregation of waste and its disposal so as to achieve zero open defecation for all school children during school hours. Once the students are used to better sanitation in the school premises, hopefully they would spread the message amongst their families and community, and would act as advocates for change. Under the National School Sanitation Initiative, it will be incumbent on the schools to lay emphasis on personal hygiene, proper sanitation, clean toilet habits, safe drinking water, and separate toilets for the girls and the boys, proper disposal including recycling of waste water, waste segregation and composting, food hygiene and creation and conservation of green spaces. Schools and their students and teachers are thus expected to play a vital role to attain the goals of the National Urban Sanitation Policy (NUSP) to become better citizens of the future. CBSE has already issued guidelines to all its affiliated schools on the National Urban School Sanitation Awards. It has also made adequate sanitation facilities in schools a requisite for all affiliated schools. A website has been launched on school sanitation to spread awareness and for exchange of information on good practices in the field.

Based on the outcomes of the baseline survey and the deliberations of the Members of the Manual Drafting Committee, the specific goals which need to be focused upon are:-

A. Awareness Generation and behavioural Change:

In order to achieve the goal of behavioural change among children, it is important that the general awareness about sanitation issues is improved *viz.* about sanitation and how vitally it is linked to their health & immune systems. The idea is to promote a mechanism which could bring about and sustain behavioural changes aimed at adoption of healthy sanitation practices. In a nut shell, the main objective of the Initiative is Effective Awareness Generation among urban school children leading to behavioural change as envisaged in the National Urban Sanitation Policy through education towards the issues pertaining to safe sanitation, personal and social hygiene and waste segregation and recycling through the concept of 3 Rs (Reduce, Reuse and Recycle).

B. Open Defecation Free Cities:

One of the major aims of the policy is to achieve open defecation free cities and a number of measures have been prescribed for that. These include adequate availability and 100% upkeep and management of public sanitation facilities in all urban areas, to get rid of open defecation and consequent environmental hazards.

C. Focus on Sanitation and Waste Segregation:

This Initiative focuses on Sanitation and waste segregation mainly and believes in real time technological interventions and support, besides data gathering which of course is a part of the process for needs assessment and definitely is the first requirement. Safe sanitation is the main component of this Initiative. Here, it would be ensured that the sanitation systems already existing in schools are improved/created and brought to a level where they become totally hygienic to use and the waste generated is disposed off/recycled safely with efficient water use and without any kind of contamination of any natural resources or endangering the health of the school children in any manner, without compromising on the aesthetics. For this MoUD, MoHRD, CBSE and GIZ would take necessary steps to ensure its success. It is expected that through these



Best Options for School Sanitation: Meeting the Challenge

measures the Initiative would also lead to appropriate interventions in sanitation management so as to achieve a sort of ecological sanitation which is socially acceptable, economically feasible, environmentally sound, and technically appropriate in an urban context. Ecological Sanitation, in fact ensures that the human excreta and school wastewater are treated as a resource which can be recovered, treated where necessary and safely reused. It aims at establishing zero discharging systems.

For this there is a need to sanitize our urban schools first and turn the urban school campus into urban eco-centres wherein 3 Rs concept of Reduce, Reuse and Recycle can effectively be used & demonstrated particularly for organic waste management (for example wastes from hostels) and waste water recycling, so that they become a role model for the schools in semi urban and other areas.

The simple measures like rain water harvesting and energy efficiency can turn the schools ultimately into eco-sensitive schools comprising of a hundreds of young eco-managers. This can be emulated by the other schools who can afford to do so, mostly in the private sector and under the umbrella of Government, both central and the states, so that a self sustaining system could be evolved to meet the expenses in the proposed endeavour. The point which needs to be hammered and well publicised is the fact that safe & hygienic sanitation is not a costly affair. It is a low cost proposition whose success depends upon the attitude and mind set.

Waste segregation measures would be undertaken in all these schools and a special awareness campaign is to be launched to induce the behavioural change at receptive tender and young age of the school children so that they can inculcate the habit of safe and hygienic sanitation practices and waste disposal through proper waste segregation.

School is the key tool for cognitive, creative and social development of children. So School Sanitation and Hygiene Education are considered essential for a protected, sheltered and healthy environment for children to learn better and face the challenges of future life.

Sustainable Sanitation in Schools An Introduction

Schools are important for cognitive, creative and social development of children. Schools after the family are the best demonstration centres to bring about positive behavioural changes on a sustained basis. Teacher-Child-Parent-Community is a proven route to spread the message of good and accepted hygiene & sanitary practices. Children are perhaps the best change agents and can play an effective role in creating a healthy and clean environment in schools as well as homes. They have already proven themselves as “Champions of Change” through successful “No Tobacco and No Crackers” Campaign. The provision of safe water and sanitation facilities in schools is a vital step towards an healthy & learning environment. Focusing on hygiene, sanitation and safe drinking water in schools is in essence an investment in our future.



The salient features of such healthy scenario leads to the following :

- ⊙ **Effective learning:** Children perform better if provided with a hygienic and clean environment.
- ⊙ **Enrolment of girls:** The lack of private sanitary facilities with due privacy for girls can discourage parents from sending girls to school and contribute to the drop-out of girls.
- ⊙ **Reduced disease and worm infestation:** If school sanitation and hygiene facilities are absent, or are badly maintained, schools become health hazards.
- ⊙ **Environmental cleanliness:** Proper facilities will prevent pollution of the environment and limit health hazards for the community at large.
- ⊙ **Implementing children rights:** Children have the right to be healthy and cheerful. Good health and sanitation contribute to a happy & satisfactory childhood.
- ⊙ **Creation & conservation of green spaces:** Constant creation, conservation and maintenance of green spaces in the schools and around it begets a better learning environment.

It is of utmost importance that the concept of sustainability is considered when looking at school sanitation. Technologies adopted should not result in negative environmental effects. A paradigm shift that leads from the FLUSH & FORGET systems to RECYCLE in consonance with WASTE TO WEALTH approach is therefore to be favoured. Innovative, decentralized solutions that are cost effective and environmental friendly need to be promoted among the school students.

State of Sanitation in India

In India the incidence of morbidity and mortality, particularly among children, is largely attributed to unsafe water supply, poor personal hygiene practices and poor sanitation. According to the World Health Organization (WHO) 80% of all the sickness and disease is largely attributed to the lack of safe drinking water and proper sanitation. Today in India 30.66 million urban households or 35.49 % of all urban households suffer



inadequate access to sanitation facilities and either defecate in the open or use shared community lavatories. Besides being an issue of human dignity, these practices result in the unsafe disposal of human excreta which adversely affects the environmental health. The inadequate and unsanitary disposal of excreta leads to contamination of ground and surface water. The losses due to diseases arising out of poor sanitation for children under 14 years of age in urban areas alone have been estimated to the Rs. 500 crores at 2001 prices. A related concern is that of manual scavenging which has not been eliminated completely in our country even more that 60 years after Independence. Keeping these issues in view, the Ministry of Urban Development, Government of India formulated and adopted the National Urban Sanitation Policy (NUSP) in the year 2008 which was also declared as the International Year of Sanitation by the United Nations. The vision for Urban Sanitation in India is All India cities and towns become totally sanitized, healthy and livable and ensure and sustain good public health and environmental outcomes for all their citizens with a special focus on hygienic and affordable sanitation facilities for the urban poor and women.

India has one of the largest numbers of school going children, specially in the rural areas. The primary education system is one of the largest in the world with over 766 thousand primary & upper primary schools, over 3 million teachers and a student strength exceeding 100 million children however, only 76.9% of the schools have water supply facility, 35.5% have urinals and 29.5% have lavatory facilities. Only 35% have separate urinals and 28.9% lavatory facilities for girls. Even the schools which have water and sanitation facilities often suffer from:

- ⊙ Non-existent or insufficient water supply & hand washing facilities.
- ⊙ Toilets are not adapted to the needs of the children in particular girls.
- ⊙ Broken, unsafe water supply, sanitation and hand washing facilities.
- ⊙ Children with poor hygiene and hand washing practices.
- ⊙ Non-existent and irrelevant hygiene education for children.
- ⊙ Unhealthy and dirty class rooms and school compounds.
- ⊙ Improper operation and maintenance of existing facilities.

Under these conditions schools and the community environment tend to become unsafe places where diseases are transmitted. Poor health of children affects their ability to learn and is detrimental to their physical and emotional growth.

The Ministry of Urban Development (MoUD), Ministry of Human Resource Development (MoHRD), Central Board of Secondary Education (CBSE), and GIZ have now joined hands again to launch a unique Online National School Sanitation Ratings covering all the schools in

Schools and students can play a very vital role in attaining the goals under the NUSP and making its vision a reality. Schools are considered as the most important and basic link for reaching the parents, individual families and consequently the community. It is a universal fact that children are far more receptive to new ideas and are definitely at an age when they can be influenced to cultivate good hygienic habits. The promotion of personal hygiene and environmental sanitation within schools can help the children to adopt good habits during the formative years of their childhood and adolescence. The need of this Initiative is highlighted by the existing scenario of a general deprivation of safe hygienic facilities in schools which many a times lack safe drinking water provisions and often do not have any kind of toilet or urinal. Separate facilities for girls may not even exist at many urban schools. And Where they do exist they are so poorly maintained or so few in number, that most children do not use them. Instead they find a place to relieve themselves in some other place which could be a stinking corner of the school compound or even outside the school. In this scenario, the growing girls normally have to endure this hardship, and this often results in them dropping out of school or absenting themselves after recess when they go home and do not return to school.

We must realize that today's children born in the post- liberalization era in India and are mostly unaware of what India was like in the pre-liberalization era. The urban children today are the ones who live, see, realize and go through the stark contrasts in the urban life, especially in the municipal and sanitation services. If we analyze the real time situation, it is seen that most of the urban children are not yet affluent enough to go to those urban schools which have better sanitation facilities. Moreover it is also seen that most of the schools including the schools having best of the buildings and facilities do not necessarily practice safe sanitation, waste segregation and their safe disposal. So the learning curve is missed by the children of this new era as well.

Many schools are yet to follow the Health Manual prescriptions which the CBSE has issued. There is a need to recharge and rejuvenate the School Health & Wellness clubs.

In fact, in implementing the National School Sanitation Initiative, apart from teachers and students, the school's "Health and Wellness Clubs" are to play a very vital role. There is a need to provide a guiding force to get them going and activate them which would come by way of the provisions of the National School Sanitation Manual.

Thus, the Initiative mainly focuses on sanitation, waste segregation and hygiene education and aims at real time technological interventions and support, besides basic data gathering which forms the part of the processes for needs assessment studies as the first requirement. Thus the initiative goes beyond both in scope, aims and implementation than any of the other similar efforts made earlier and this makes this initiative unique and the most trustworthy in history.

Sanitation facilities have a direct bearing on enrolment and retention of girls in the schools. Lack of separate and safe sanitary facilities for girls has been a factor discouraging parents from sending girls to schools and contributes to the drop-out of girls, especially adolescents. Growing girls find it difficult to attend schools that have no or few badly maintained facilities. So it is very much essential to have separate toilet facilities for the girl students.

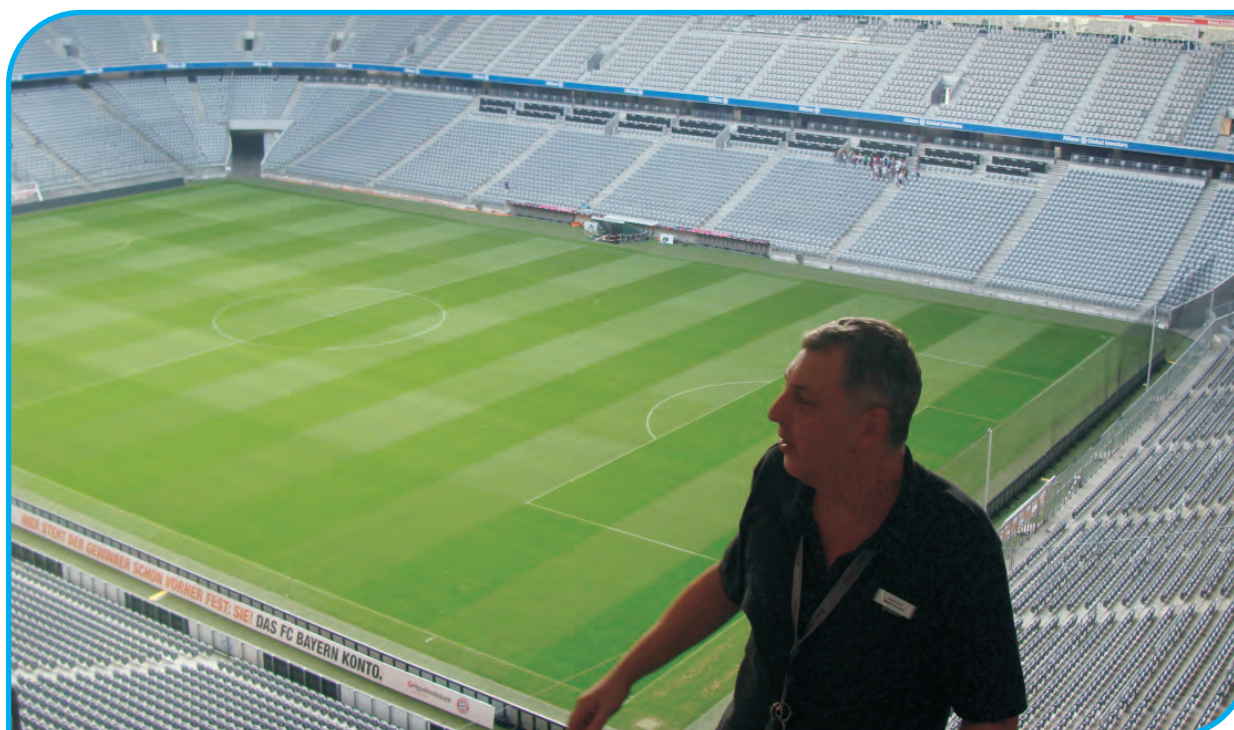
Comprehensive School Health Manuals : Issued by Central Board for Secondary Education

The Comprehensive School Health Manuals address a basic gap in schooling that has crept in over the years. This is largely due to the fact that school health tends to be narrowly defined and is relegated to sporadic health checkups or in some cases a few hours of health instruction in the curriculum. It is imperative that something is done urgently to take up the issue of holistic health in school curriculums which includes physical, mental, emotional and psychological health. The School Health Policy and the Manuals, propose to view health in schools in a holistic and integrated manner by utilizing all possible educational opportunities for health promotion including formal and informal approaches in curriculum pedagogy. Providing a safe school environment, an activity oriented health education curriculum to avoid health-related risk behaviour, ensuring physical fitness activities and sports, providing nutritious snacks in the school canteen, ensuring access to primary health care services, integrated family and community activities and a staff health promotion policy are some of the expectations that a school should fulfill as was advised earlier in a circular issued to all schools regarding the setting up of Health Clubs. Besides this, the safe and appropriate disposal of waste and conservation of green spaces are the main objectives of this Manual.



A Summary of the Health Manuals that have been issued by CBSE

A Health Promoting School strives to provide a healthy environment conducive to School Health Education and School Health Services along with School/community projects and outreach opportunities for physical education and recreation, and safe hygienic practices. School Health and Wellness Clubs can become the focal point of the School Health Promotion Campaign which would encompass the entire school environment and become a school campus activity. A checklist for a Health Promoting School is included so that schools can



monitor their own School Health Plans. The responsibilities of the administrators, principals, teachers, counselors and community leaders are also delineated. Monitoring, evaluation and sustainability of the Health Plan in each school is extremely essential. Fact sheets regarding a Health Promoting School, focusing resources on effective school health and improving school performance through health promotion are other important areas that have been dealt with in this Manual.

Personal and Environmental Hygiene Activities in schools emphasize the need to ensure that children follow clean and regular habits regarding bathing, bowel movements, sleeping, oral hygiene, nails and hair. Once personal hygiene becomes a part of the regular system the child will look forward to having a cleaner and healthier environment.

The Behaviour and Life Skills Section focuses on bringing about awareness and an in-depth understanding of behavioural issues and focuses on how teachers can influence a child's academic performance and social development. The Manual attempts to forge clarity about sanitation among the teachers to facilitate the child's learning progress. The objective of the activities is to improve the self-management and coping skills of a child which could help him or her emerge as an individual well equipped to handle sanitation issues.

The Manuals issued by CBSE so far are holistic in their approach as they deal not only with physical health but also mental, social, emotional and spiritual thought processes.

Their uniqueness lies in their participative and interactive approach. The activities mentioned can be easily incorporated in the classroom transaction keeping in mind that hands-on learning is internalized faster than conventional learning. It is also recommended that teachers modify or customize the activities according to their social, cultural and demographic needs.

The CBSE has also undertaken a Global School Health Survey across different types of schools in various parts of the country. This has been done to collect data on health behavior and protective factors that affect the immediate and long-term health status of young children. The results from the survey will help in policy formulation at the local and national levels. The feedback once analyzed will also help to further enhance understanding of protective health factors.

National School Sanitation Manual (NSSM)

In order to provide proper guidance to the Indian schools in achieving good sanitation levels, a National School Sanitation Manual was launched on 27.04.10 by Mr. Kapil Sibal, Union Minister for Human Resource Development in presence of Mr. S. Jaipal Reddy, Union Minister for Urban Development, Ms. D. Purandeswari, Union Minister of State for Human Resource Development and the Brand Ambassador for School Sanitation Mr. Aamir Khan.

The NSSM published as a collaborative effort of the Ministry of Human Resource Development, Ministry of Urban Development, CBSE and GIZ.

The Manual covers the following main areas :

Theme of the National School Sanitation Initiative explaining the concept of sanitation and highlighting the Norms for the water and sanitation facilities in the schools with special reference to the main focal areas and the key deliverables and also on the technological options. The Section 2 of the Manual deals with the Activities for Schools covering Hygiene Education, Waste Water Discharge Management, Water Management, Green Spaces Creation and Conservation, monitoring & evaluation with appropriate technological interventions. Section 3 of the National School Sanitation Manual contains several interesting chapters like “Challenges faced in Sanitation, Guidelines for Toilets & Sanitation set up, National Urban Sanitation Policy (NUSP) and other relevant details.

The NSSM was supported by all the Education Ministers for its sheer usefulness on 09.06.11.

The National School Sanitation Ratings

In the National School Sanitation Manual, there are parameters and certain norms which are to be followed by the school. These norms act as a guide for achieving satisfactory sanitation in the schools both for the male and female students.

Guidelines for Toilets and Sanitation Set-up

In the context of the schools, ecological and safe sanitation in fact, ensures that the human excreta and school waste water as resources are recovered, treated where necessary and safely reused.

While planning/designing school toilets the internal rules of the establishment have to be considered:

- ⊙ *Build separate toilet rooms for girls and boys.*
- ⊙ *A closed container for the disposal of sanitary napkins has to be provided within each cubicle for girls and women teachers.*
- ⊙ *Urinals and toilets for boys, and toilets for girls to be installed as per the ISI norms.*
- ⊙ *Hand washing facility must respect children height and size.*
- ⊙ *A toilet cleaning and maintenance service has to be activated within the school.*
- ⊙ *In Muslim schools (as in Muslim homes): separate toilet buildings for girls and boys; sitting and facing direction must respect the religious norms.*

General Guidelines

- a) *For sanitation to be sustainable, affordable and environmentally safe it is essential that the selected treatment technology and process are appropriate to the local conditions.*
- b) *Technologies for the treatment of human excreta and urine should be considered as technologies recovering valuable nutrients and useful by-products for agriculture, forestry, gardening, and greenery, avoiding pollution of ground and surface water and contamination of soil.*
- c) *The ecological and economic impact of treatment technologies should be calculated for 20 years of utility.*
- d) *Final products from treatment installations (sludge) have to be hygienically safe with out any hazardous impact on public health and the environment. Therefore open defecation fields, trench latrines, conventional deep pit latrines and Ventilated Improved Deep Pit (VIP) latrines are not considered as components of sustainable and environmentally sound sanitation systems.*
- e) *Results of treatment technologies and processes (treated waste water as effluent) must fulfil the State Pollution Control Boards permissible limits.*
- f) *An overall assessment of related criteria has to be carried out when planning the implementation of a sanitation system.*
- g) *Operation instructions for any treatment technology have to be respected in order to ensure and maintain the successful implementation of the treatment processes.*
- h) *Maintenance must be carried out for all treatment technologies referring to the specific requirements of each process in order to keep the systems well operating*

These Norms are as follows :

**Norms for provisioning of SSHE facilities
(for day schools without residential facility)**

Sr. No.	Provision head*	Numbers to be provided	Remarks
Girls Toilet			
1.	Girls toilet squatting pan*	1 unit for every 40 girls + lady teacher	Day school without residential facility
2.	Girls toilet for CWSN	At least 1 unit in a Girls toilet block	In case only 1 Girls toilet is needed in a school, this single toilet must be designed for CWSN. In case more toilets are needed, the others need not cater to CWSN.
3.	Wash tap in Girls toilet*	1 tap in each toilet	Located conveniently for use by the child as well as adult.
4.	Clothes hanging hook*	Hooks in each toilet	At least 2 hooks at different child accessible heights – suitable for a 5 year child to an adult.
5.	Niche in wall*	1 niche in each toilet	Recessed in the wall to keep sanitary napkins.
6.	Ventilation arrangement*	1 opening for ventilation in each toilet	Size 450x450mm at a height and location that allows sunlight to penetrate for few hours in a day for self drying.
7.	Door*	1 door in each WC	Door to be 2100mm high with child accessible latching arrangement.
Girls Urinal			
8.	Girls Urinal*	1 urinal for every 20 girls	With partitions. Two minutes waiting/queuing time for using the facility at peak hours.
9.	Self cleaning system	1 flushing system in each urinal	Any flushing system that washes the soiled surface with minimal water is acceptable. Use of recycled water is desirable. Use of standard urinal or toilet flush is not compulsory.
10.	Ventilation arrangement*	1 opening for ventilation in each urinal	Height and location that allows sunlight to reach the floor for few hours in a day for self drying.
11.	Screen door	1 door for each urinal	Screen door to be 1500mm high with child-accessible latching arrangement.

Boys Toilet			
12.	Boys toilet squatting pan*	1 unit for every 80 boys + male teacher	Day school, without residential facility
13.	Boys toilet for CWSN	At least 1 unit in a Boys toilet block	In case only 1 Boys toilet is needed in a school, this single toilet must be designed for CWSN. In case more toilets are needed, the others need not cater to CWSN.
14.	Wash tap in Boys WC*	1 tap in each WC	Located conveniently for child as well as adult use.
15.	Clothes-hanging hook*	2 hooks in each WC	Hooks at different child-accessible heights-from 5-year-child to adult.
16.	Ventilation arrangement*	1 opening for ventilation in each toilet	Size 450x450mm at a height and location that allows sunlight to penetrate for few hours in a day for self drying.
17.	Door*	1 door in each WC	Door to be 2100mm high with child accessible latching arrangement.
Boys Urinal			
18.	Boys Urinal*	1 urinal for every 20 boys + male teacher	With partitions
19.	Self cleaning system	1 flushing system in each urinal	Any flushing system that washes the soiled surface and works with minimal water is acceptable. Use of recycled water is desirable. Use of standard urinal or toilet flush is not compulsory.
20.	Ventilation arrangement*	1 opening for ventilation in each urinal	Height and location that allows sunlight to penetrate to the wet wall/urinal pan and floor for a few hours in a day for self drying.
Hand Wash			
21.	Hand wash (toilet/urinal)*	Minimum of 2. One wash tap for every 20 children	Can be provided as common/separate for Girls and Boys toilet blocks.
22.	Hand wash MDM kitchen*	Minimum of three. One wash tap for every 20 children thereafter	To be provided near MDM kitchen. Preferably, should be segregated and separate from toilet hand wash for hygiene purposes.
23.	Soap tray with soap*	1 with every two wash taps	Soap type can be according to feasibility.
24.	Mirror	1 in each hand wash unit	
25.	Wash water storage tank*	Minimum 500 litres for a school of up to 100 children. Subsequent calculation @5 litres per child.	The tank capacity does not include a buffer storage reserve in case of emergency.

Norms for provisioning of SSHE facilities
(for residential schools with boarding facility)

Sr. No.	Provision head*	Numbers to be provided	Remarks
Girls Toilet			
26.	Girls toilet squatting pan*	1 unit for every 20 girls + lady teacher/supervisor	Residential school with boarding facility
Boys Toilet			
27.	Boys toilet squatting pan*	1 unit for every 20 boys + gent teacher/supervisor	Residential school with boarding facility
<i>It may be noted that provisions mentioned in 26 and 27 will replace provision mentioned in 1 and 12</i>			



The following must be noted :

- ⊙ It is mandatory to make separate toilets for girls in the school. Special and exclusive provisions for girls and ladies must be made in these toilets.
- ⊙ Exclusive toilets must be avoided altogether for teachers or head Masters/mistresses. Toilets should have an universal design approach for use by children, CWSN (Children With Special Needs) as well as adults.
- ⊙ In the spirit of inclusive education, toilet designs must be developed with the assumption that CWSN are attending and will attend the schools in larger numbers in times to come. Under the act Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation act 1996) enacted by the Government of India in January 1996 and passed by the Indian Parliament, it is mandatory that amenities in school are accessible to each CWSN. The design must address the needs of the types of CWSN attending school and at least one toilet + urinal in the Boys and one in the Girls toilet block must be accessible to CWSN.



Drinking Water Provision

In a school, provision of drinking water must be made as per the following norms. The actual requirement may vary according to the climatic conditions, physiological needs and other factors.

Norms for Drinking Water

Drinking Water			
1.	Safe Drinking Water Source	At least 1 source inside the school premises, irrespective of whether there is another one outside or near the school campus	A dedicated safe drinking water source for a school is a must. Hand pump with force lift is desirable for lifting water. Portability of water to be tested for safety as per prescribed schedule. Source to be located atleast 10 m away from toilet soak pit.
2.	Water Storage Tank	Minimum 500-litre tank for every 100 children including buffer reserve. At least 5 litres per child to be provided	The tank capacity assumes a buffer storage reserve in case of emergency or maintenance work, etc. for two days.

● All marked with '*' are essential and mandatory.

Drinking water may be provided through any of the following modes :

1. Tested hand pump, bore well or any other traditional water structure.
2. Piped drinking water supply based on ground or surface water.
3. Rain harvested water (after it has been treated or found safe for drinking).

Various studies & experiences have shown that it is easier to put forth norms which are seldom followed not by design but due to different prioritization by the schools. Obviously, sanitation improvement was always on a low priority and always neglected even by best of the schools. Keeping all the factors in mind, a software has been prepared by CBSE, MoHRD, MoUD in collaboration with GIZ (formerly GTZ) wherein certain fields have been developed based on the parameters and norms for the schools for safe sanitation based on the National School Sanitation Manual. All the schools are supposed to obtain a Sanitation Ratings Certificate which can be generated online. The schools have to logon to the website www.schoolsanitation.com and simply follow the instructions by filling up the desired details pertaining to the school and its sanitation facilities. Once the process is complete, the participating school will be given an online generated Unique Identity Number (UIN) and also a sanitation rating certificate. The certificate, however, would be generated within 3 days after verification of the authenticity of the details logged in by a school in order to avoid mischief. A-team of software experts associated with the website and sanitation ratings would assist & provide all the guidance required. The team would work on No Profit No Loss basis & for the school sanitation rating, a nominal fee would be charged from each participating school. The Sanitation Rating Certificate can be improved once school improves its sanitation facilities and can again log in after a gap of three months and generate an improvement certificate.

The schools are supposed to display their ratings in their letterheads etc. and also in their prospectus and brochure.

The Checks & Balances : To verify the sanitation ratings obtained by the schools a few checks & balances have been devised which include random verification by the monitoring committee or team & blogs by parents and students and also by the teachers.

The blogs would be maintained and monitored by the website team in order to dispel unwarranted comments & offensive language.

Purpose of the National School Sanitation Ratings :

The CBSE in collaboration with the Ministry of Human Resource Development (MoHRD), Ministry of Urban Development (MoUD) and GIZ (formerly known as GTZ) has introduced the `National School Sanitation Initiative and the aim is to inculcate good sanitation habits among the school children in order to inspire, acquaint and celebrate excellence towards School Sanitation at the National Level.

To facilitate best sanitation practices in the schools, CBSE in collaboration with MoHRD & GIZ has adapted the National School Sanitation Manual. Accordingly, Online School Sanitation Ratings have been instituted with the purpose of recognizing those schools who are taking significant steps towards effective sanitation and improvement in service delivery leading to the desired behavioural and attitudinal changes towards hygiene & sanitation.

As furtherance to the National School Sanitation Initiative, it has been decided that all the CBSE schools will be rated according to their sanitation status in five color categories which are as follows :

Categories:	Rating	Remarks:
		Sanitary Provisions and Conditions are in the state of:
91% - 100% of the Norms	Green	Excellent Keep it up!!
75%- 90% adherence to the Norms	Blue	Very Good, but there is a scope for improvement
50%-74% adherence to the Norms	Yellow	Fair: Can Improve
34%- 49% adherence to the Norms	Black	Poor: Needs considerable Improvement
Below 33% adherence to the Norms	Red	Grim: Needs Immediate attention

Best Options for School Sanitation: Meeting the Challenge

In order to ease out the School Sanitation Ratings, the entire process has been made online and the schools are expected to register themselves and obtain a sanitation rating for them by following the due process. After getting an online sanitation rating, if later on a school improves its sanitation situation by appropriate means it can obtain a fresh sanitation rating certificate after a gap of three months from the date of issue of the earlier rating certificate.

All the schools are also directed to display their current sanitation ratings in the form of a colored circle (like ●) as per their Online School Sanitation Certificate at the right hand corner of all their correspondence.

For Online School Sanitation Ratings and also for more information about the National School Sanitation Initiative visit: www.schoolsanitation.com

The various formats for registration and sanitation ratings are enclosed in PDF format. They are also available at www.schoolsanitation.com

National School Sanitation Awards

As we have seen that the CBSE in collaboration with the Ministry of Human Resource Development (MoHRD), Ministry of Urban Development (MoUD) and GIZ (formerly known as GTZ) has introduced the `National School Sanitation Initiative and the aim is to inculcate good sanitation habits among the school children in order to inspire, acquaint and celebrate excellence towards School Sanitation at the National Level.

To facilitate best sanitation practices in the schools, CBSE in collaboration with Ministry of Human Resource Development , GOI, Ministry of Urban Development, GOI & GIZ has already adopted National School Sanitation Manual. Accordingly, Online School Sanitation Ratings have been instituted with the purpose of recognizing those schools who are taking significant steps towards effective sanitation and improvement in service delivery leading to the desired behavioural and attitudinal changes towards hygiene & sanitation. The Sanitation Ratings are expected to infuse the required dynamism in the schools towards sanitation management.

As furtherance to the National School Sanitation Ratings it has been decided by the Ministry of Human Resource Development, Government of India to institute National School Sanitation



Best Options for School Sanitation: Meeting the Challenge

Awards on annual basis for those schools who have been rated online for sanitation and taken noteworthy steps towards betterment of the sanitation scenario in their schools in varied ways.

The parameters and categories for the Awards are given in the National School Sanitation Manual. The Awards are open to all schools affiliated to CBSE which include Kendriya Vidyalayas, Jawahar Navodaya Vidyalayas, Government Schools, Private Independent Schools, DAV Schools, CTSA Schools, Army Schools etc.

Awards will be given in the following categories which schools can take up as part of Health & Wellness Clubs as well as the Eco-Clubs (If a school desires so it can merge its Health & Wellness Club and Eco-Club into one entity) :-

- ⊙ Awareness generation leading to behavioural change through students and community mobilization
- ⊙ Technical innovation and Interventions
- ⊙ Creation & conservation of green spaces
- ⊙ Public - Private partnership



Parameters for the Selection

1. **Sustainability** -: Demonstrated success geared towards long term hygiene and safe sanitation.
2. **Replicability** -: Potential for replication of practices and models that have resulted in better service delivery.
3. **Innovation** -: Demonstrated Innovation, Uniqueness and Originality in the use of Ideas, Technology and Resources
4. **Dynamism** -: Online Sanitation Ratings of the School plus Activity Points scored by taking up appreciable initiatives in the following areas :
 - ⊙ Improving Sanitation facilities for the Girl Child
 - ⊙ Best performing Health and Wellness Clubs
 - ⊙ Sustainability of the Effort
 - ⊙ Waste Management and Disposal
 - ⊙ Water conservation and Waste Water Recycling and its Utilization
 - ⊙ Safe Hygiene Practices
 - ⊙ Waste Segregation and Waste Management
 - ⊙ Awareness Generation Efforts and impact leading to behavioural Change

- ⊙ Water and Sanitation: Tangible Improvements in Service Delivery
- ⊙ Efforts towards Water Management

Mechanism and Procedures

- ⊙ MORDD, CBSE and GTZ have constituted an Advisory Group for deciding on Awards.
- ⊙ Initial scrutiny will be done by Committee and then the short-listed entries will be submitted for critical examination and final selection for the Awards by the Advisory Group.

The Awards will be in the form of certificates of excellence, mementos, citations, participation in a school sanitation exchange programme, joint development of pilot projects on zero waste producing concepts with the schools and also special certificates to Principals, Teachers and Students associated with **Health & Wellness Clubs and Eco Clubs**.

The call for entries would be published sometime in the month of November every year and requisite entries could be submitted at that time. For more information about the National School Sanitation Awards visit: www.schoolsanitation.com and also National School Sanitation Manual.

The Role of Health & Wellness Clubs

Healthy living in case of school children is the prime concern of all stakeholders including principals, parents, teachers and the community. To achieve this objective collective responsibility needs to be assumed. An important dimension is that of experience and development of health skills and physique through practical engagements with play, exercise, sports and practice of personal and community hygiene.

Health & Wellness Clubs in schools focus on the overall well being comprising emotional, social and mental health of the child. It acts as the enabling and organizational point for conducting activities related to various dimensions of health and wellness. A health card needs to be created for students which would form a continuous part of their growth and development. This could form an effective monitoring and feedback system for the overall health of child during schooling.

Responsibilities of the Health Club

- ⊙ As an organizer of all health relevant activities (at least 8-10 activities in the year at each level.)
- ⊙ As a Resource Centre for the overall well being of students.
- ⊙ To screen, diagnose and impart health counseling services to the students.

Objectives of the Health Club

- ⊙ To create health cards for each student.
- ⊙ To create health newspaper at least twice a year/poster competition related to health issues.
- ⊙ To conduct surveys on health related concerns.
- ⊙ To organize health walks as part of social campaigns.
- ⊙ To organize health fairs and immunization projects.
- ⊙ To tap the local resources in the community to arrange health talks.
- ⊙ To render service in any area affected by a disaster or a calamity.
- ⊙ To create health help line within the school to de-stress, cope with emotional and social behaviour and to clarify misconceptions regarding sexual and reproductive health.

There is a school of thought getting stronger in all the schools and within CBSE itself that Health & Wellness Clubs in the schools are to be merged with Eco-clubs as most of the aims and objectives are overlapping and cross cutting. Moreover such mergers would help in saving time of students & teachers from participating in activities of multiple institutions with similar purpose.

Online Form

Have health & wellness clubs been constituted? y/n

Are these constituted clubs in compliance with the CBSE or Board guidelines? (y/n)

Have coordinators been appointed? Staff (y/n) / student (y/n)

How many activities were realised in the last 12 months? (0 to 5)

How many ongoing activities are there? (0 to 5)

Self-evaluation of school sanitation system in place (y/n)

Is a self-evaluation system in place, that allows the pupils (girls and boys separately)

(a) *to evaluate how happy they are with the cleanliness and with the economical and ecological sustainability of the facilities they use (y/n)* (b) *what improvements they suggest (y/n)*

--> *if yes, please submit results and suggestions*

**List of Activities for implementation of Eco sanitation and health and Wellness For
Details one can refer to the following :-**

1. National School Sanitation Manual
2. School Health Manuals of CBSE
- 3 Besides the following inter curricular links can be thought of :

SAMPLE 1

WHAT : Awareness on Eco-Sanitation and Health and Wellness

WHEN : During Assembly, class activities, inter section, inter house activities, CCE activities, exhibition, class function, annual function, visual and performing arts periods, clubs, zero periods, PEC periods, Physical Education periods, ICT class, PEP (Peer Educator Program) activity, SEP (Student Empowerment Program) group, subject periods, any other as per individual schools etc

Sample of inter-curricular links (Could be taken as theme for the month)

APRIL

I CARE-Wellness (Me and Myself)

Components-Importance of food and nutrition, physical fitness, hygiene, self awareness, coping with emotions, body imaging, any other

English and Hindi-Comprehension passages, panchtantra stories, autobiographies of sportspersons (India or abroad) who overcame disabilities, debate on changing lifestyles, articles, slogans, headers, report writing, cartoon strips, dialogue writing, newsletter, magazine, any other

Math-Statistics on diseases like diabetes, hypertension, lifestyles etc, (in and around the world) presentation of the data through bar graphs, pie charts, positive statistics on healthy people who overcame obesity etc, any other ideas, display & dissemination of relevant posters prepared by CBSE, MoHRD, MoUD and GIZ.

Science-Food Pyramid, balanced diet, ingredients of fast foods, food chain, respiration, breathing, oxygen intake through exercise, blood circulation, importance of the body organs and systems etc, any other like poster display.

Social Science-healthy crops, vegetation, soil, relation of eating habits to demographic changes etc, any other like poster display.

SHP/Life Skills-Personal Hygiene, self awareness, coping with emotions, positive strokes etc, any other.

Art-integration of the topics mentioned earlier using a specific medium

Music/Dance/Theatre- curriculum related. The dance should be especially focussed upon as an alternative to gym & other fitness exercise. Classical Indian dances as well as western classical dances and modern form of dances like contemporary, hip-hop etc. all provide very good anaerobic & aerobic exercises. The exercising through dance becomes engrossing & not boring.

PEC/Sports- Warm up routine and physical exercises, being proud of owning a fit body; each school can have inter section/inter class sports tournaments renowned as sanitation or Hygiene Cup. Technology presentation on above topics

SEPTEMBER

ICARE- the earth

Components- beauty and appreciation of the diversity on Earth-India and around, focus on flora (flowers), fauna (animals), geographical features, climate, seasons, vegetation, rivers, oceans, life on earth, water, land, planets etc, positive ways of enhancing the beauty of the earth by man, management of waste, mans intervention at destroying the beauty of the earth-global warming, ozone layer, radiations, oil spills etc

English and Hindi- Comprehension passages on the above components, panchtantra stories related to earth and care, positive stories on mans intervention at saving the earth, writing skills related to above-autobiography of fish, debate on climatic changes etc, scripting a card, writing experiences related to the above topic, designing posters, slogan writing, letter writing, article writing, cartoon strips, etc, any other

Math- Statistics on dying forests, extinct, endangered species (in and around the world) presentation of the data through bar graphs, pie charts etc, any positive statistics on the above

Science- positive ways of managing waste-3 Rs etc

Social Science- positive ideas on diversity of the earth and its beauty (lakes, rivers, oceans, plants, animals) etc, any other

SHP/Life Skills- Environmental sensitivity, campaigns, slogans, Decision making. Problem solving, negotiation skills, any other

Art-integration of the above topics using a specific medium

Music/Dance/Theatre- Above curriculum related

PEC/Sports- Diversity in sports in and around the world and its appreciation

Technology- PPT on above topics, video films (clips on save water, electricity etc), photography etc

At the Nadukuppam Govt. High School, close to Auroville, Tamil Nadu, an Environment Educational Center has been constructed. With it, many ecoclub activities have been started through the last 7 years that are a great example of what a school can achieve.



As in this school unexceptionally all students

are enrolled in the Ecoclub of the school, several groups have been established, that rotate in their activities on a regular basis. These activities involve gardening (picture 1) or the work in a



tree nursery (picture 2 and 3) etc. leading to creation and conservation of Green Spaces and utilization of waste water.

The Nadukuppam Environment Educational Center is not only used by the Nadukuppam Govt. High School but also from surrounding schools of the area.

On a regular basis schools meet here for exchange and to present their own school's projects and activities.

In the picture shown, a student tells the other students about the differences of energy saving bulbs to regular ones. Other ecology-relevant topics are also given attention, like the functioning of solar panels etc.



The topic of ecology is also carried to and incorporated into education by i.e. initiating a school-wide drawing contest on climate change.

Further Reading:

Fit for School - Inter-sectoral Collaboration for Child Health

Technical Report

School Gardens and Ecological Sanitation Component in Selected Philippine Schools in Northern Mindanao

(http://www.fitforschool.ph/resources/reports/doc_download/46-icch-technical-report.html)

Facility-options in schools

The schools should follow the manual to establish a good, cost effective, infrastructural system for sanitation management. A simple online form has been created in the website for Online Sanitation Ratings which carry a simple questionnaire on the facilities available. This includes a squatting pan which is fast being overtaken by English style of commode. The squatting pan is popular as Indian style of Pan while the other is known as English pan.



Indian Pan



English Pan

There is an unending debate on the use of these two kinds of toilet pans, while the Indian style pan conserve water by using comparatively less water. The English pan has off late come into much criticism for its high water consumption by design but on the other hand it is becoming the most favoured one because of its better ergonomic design which puts very little strain on knees & thighs. It is more comfortable to use and greatly favoured by middle & old age people. Otherwise also, it is better rated.

The schools need to carefully ponder over these options before deciding to go for a one.

Innovation in Cisterns : Now a days double chamber cisterns are available and if the requirement is for a quantity of water, then the water from the smaller chamber can be used. For cisterns with large chambers, one can place one or two litre plastic mineral water bottles

filled with sand inside the cisterns so that at least that much of water is saved. Many large cisterns have been made without giving any thought about wastage. Such measures can save water & turn wasteful use of cistern into good use. Moreover such measures need to be highlighted by the schools in order to educate the school children & teachers. Such innovations also carry good marks in sanitation rating of a school.

There should be good sanitation facilities for the Children with Special Needs (CWSN) so that they do not feel isolated at any point of time. The special toilet facilities for them is specially being noted for the purpose of sanitation rating of a school. Other simple details being sought for sanitation ratings are i) whether taps have been installed and if water flows from them ii) about waste disposal especially that of sanitary napkins etc.



Accessibility factor in the traditional urinals

Often we tend to place the urinal for boys so high that only tall boys can use the urinal pot. The growing children & young students often find it difficult to use.

Waterless Urinals

The Energy Efficient Urinals: Waterless, but Odourless too . The market today responds to environmental concerns with hygienic waterless urinals!

If you think that the subject of waterless urinals sounds repulsive, given the fact that water is the primordial factor to make closets bacteria and germ free, think again!

Research and technology have advanced to incredible parameters and the Waterless Urinal Systems not only save water but also eliminate urinal odour due to the proprietary cartridge installed at the base.

The cartridge acts as a funnel, filters sediments, and allows urine to flow through the sealant liquid, thus preventing odours from being carried. Right now, only mens urinals are being installed in several cities in India. PVR Cinema Complexes have installed these and it saves lots of water for them.

Urinals generally provided at roadsides, schools or public places need water for manual or automatic flushing at regular intervals. Otherwise, after a few days, the stink becomes unbearable. Waterless urinals need no such flushing. One does not need water to transport water. Urine is 96 percent water that travels through the drain without residue build-up on the non-porous surface of the water-free device. Due to the lighter-than-water specific gravity, the sealant liquid allows passage of the liquid in an odourless closure that makes it bacteria-free too. The absence of water on top prevents the chemical reaction between urine and water (ammonia oxide) which is the reason other urinals have the typical odours.

Maintenance: A urinal used for 175 times a day is said to be under heavy use. Such a urinal will need a cartridge replacement after 2-3 months or so. After 8,000 to 10,000 uses, the flow of urine into the cartridge slows down. This is an indication that the membrane needs to be replaced. The membrane gets locked in the seat and there can't be any leakage.

Maintenance expenses are reduced as there are no mechanical components such as flush valves and sensors. The membrane, which costs around Rs.100, needs to be replaced only after approximately 10,000 uses. How long a membrane lasts would depend on the traffic and usage. There is almost zero installation cost as no plumbing for water supply is required. Just a connection to the drainpipe is enough to

install a waterless urinal. Thus no time is lost in installing these urinals and inserting the membrane. These urinals are therefore ideally suited for airports, hotels, hospitals, theatres, multiplexes, schools, colleges and other such public places.

No use of water or energy, no odour, and no operating or installation costs make these urinals worth a consideration. The inlet pipe of these urinals is small thus preventing cigarette butts



from blocking the urinal drain opening. Above all, no touching of handles, which people are so reluctant to do at public places, is involved. But the biggest advantage is that water expenses are non-existent, maintenance is reduced to a janitorial clean-up. Above all, it saves an average of 40,000 gallons (151,000 litres) of water per urinal each year. Now this is energy saved too.

Hygiene Benefits

The University of California at Los Angeles (UCLA) has compared the number of organisms (bacteria) present on the interior surfaces of traditional flush urinals and waterless urinals. The organism count per square inch has been found to be lower in waterless urinals.



The University of California at Los Angeles (UCLA) Dept. of Civil and Environmental Engineering performed an extensive research study where the team counted organisms from the interior porcelain surfaces of both traditional flush urinals and waterless urinals.

The data indicated that the cell count per sq. inch was lower for water-free devices because water-free urinals prevent harbouring and growth of bacteria.

Installations

Such systems are commercially available and also have a LEED# Certification. What has made the technology enter Bangalore, Chennai and Hyderabad is the waterless systems high performance rates in about a hundred places in the country including Parliament House, Rashtrapati Bhavan, Delhi Metro Railways, AIIMS, PVR Cinemas, Gateway of India, and the Taj Mahal complex. Each such urinal is capable of saving 1.5 lakh litres of water every year. The biggest advantage of waterless urinals is that these can be installed at places where there is no water available to keep a urinal running.

Water Conservation through Waterless Urinals

- One use of normal urinal : water consumed four litres.
- Assuming even an average of 300 students in a school and 200 students using the urinals two times a day : makes 400 liters per day per school.
- CBSE's 10000 schools saving water in a day would be $400 \times 10000 = 4000000$ i.e. 40 lakh litre per day.
- Assuming schools' year of 250 days, the total water saved in the schools $4000000 \times 250 = 1000000000$ litres i.e. 100 crore litres of water i.e. one billion litres per year!!

Installation of these urinals will also help in maintaining better hygienic conditions and our country may get rid of the unhygienic practice of frequent roadside urination against the walls. The schools can also consider installing these systems as it would reduce their expenditure on frequent toilet cleaning and in the process help them in saving water as well. This technology is especially useful in Gujarat, Rajasthan, Madhya Pradesh & Chhattisgarh which are geographically water deficient States. Then in most of the Indian cities & states water is not available 24x7 and situation is worst for public conveniences & schools. Therefore the installation of waterless urinals has a universal need in India.

The conversion of a water consuming urinal to a waterless urinal is carried out by a simple membrane fixture, which can be attached to any existing urinal, and using water only once or twice a day to clean the bowls. Given below are pictures of such a fixture, which costs about Rs. 100. The water free system consists of a vitreous china fixture and a replaceable



membrane that locks at the base. It can be installed in a housing that connects to the drain line. So, there is no need for a flush valve assembly or a water supply hook-up. The membrane acts as a drain trap, with a design and use of non-porous materials, which ensures that urine passes through the membrane. The membrane provides an airtight barrier between the drain and the rest room to prevent odours from escaping. So virtually there is no requirement of water and thus the wastage of water is simply stopped.

Any existing made urinal can be converted into a waterless urinal at a cost of approximately Rs. 700-800.

HINDWARE/ FALCON

Cartridge based technology:

- ⊙ Firstly, it acts as a funnel, allowing liquid from the bowl to flow into the cartridge.
- ⊙ Secondly, the cartridge holds the sealant liquid that creates a barrier between urine and open air, thereby eliminating odors.
- ⊙ Thirdly, the cartridge acts as a trap for uric sediment. Much of the sediment that can cause drainage pipe corrosion is



trapped at the bottom of the cartridge.

- ⊙ Lastly, the cartridge allows the remaining urine to be freely disposed down the drain.

Recurring Expense - Cartridge replacement. Cost per cartridge - Rs. 2500

Installation – Can be installed in place of existing urinals, no special arrangement required.

PARRYWARE WATERLESS

- ⊙ Urine flows down into the Eco trap due to gravity (water waste being lighter than the blue liquid). And because of GEL Resin, Urine does not stick to the surface of the Urinal.
- ⊙ Passes through the Blue seal liquid in the Eco trap to the drain.
- ⊙ Urine is pushed to the drain pipe through the centre hole provided in the Eco trap.
- ⊙ Blue seal acts as a barrier preventing sewer vapors escaping to the rest room.



Recurring Costs

- ⊙ Blue seal liquid: Rs 1700/bottle
- ⊙ Eco trap: Rs 775/unit

COMMANDER

- ⊙ The patented exchangeable odor seal element used in the COMMANDER URIMAT collects the urine and discharges it (without using water) into the drainage system. The float seal (without a sealing liquid) prevents any odor developing.
- ⊙ The patented drain trap guarantees the smooth operation without sealing liquid. It is inserted into the respective opening in the urinal.
- ⊙ The urine reaches the internal piece of the drain trap. After arriving at the overflow height, it is transferred to overflow area through the corresponding openings and diverted into the sewage system.
- ⊙ **Recurring Expenses** - Electricity costs for the sensors. Need to refill special liquid.
- ⊙ **Installation** - Need to provide electricity connection for units with sensors .

KOHLER

- ⊙ Liquid waste passes into the fully glazed trap-way through the debris-catching strainer.



- ⊙ The design of the trap-way slows the flow of liquid waste as it passes through the sealing liquid, ensuring that the sealing liquid isn't washed out of the trap-way.
- ⊙ Being less dense than liquid waste, the sealing liquid maintains its position at the top of the trap-way, thus providing a barrier to block trap-way odors.
- ⊙ Through simple displacement, the liquid waste then makes its way into the waste pipe.

REFILLING LIQUID: Rs. 13,000/- for 4 Ltrs Pack, Refill every 15 days

SUNMING

- ⊙ Works on the principle of gravitational force and air pressure technology.
- ⊙ The nano silver is an anti bacterial glaze that doesn't let urine to stay on the body and the patented trap technology has a membrane sheath that opens with the urine flow and closes once its passed through
- ⊙ No Stain or Odor.
- ⊙ Plastic Trap installed inside the steel case needs to be replaced once in 5 years



ZERO recurring cost : No cartridge /No chemicals

Installation: Can be installed in place of existing urinals without any special arrangements



Comparison between different Waterless Urinals

Manufacturer Attribute	Hindware (Cartridge Based)	Parryware (Sealant Liquid Based)	Sunming (Nano technology Glaze & Air Seal Trap Technology Based)
Odor Control	Average (Cartridges require replacement periodically)	Average (Periodic refilling of sealant liquid is necessary)	Excellent (no replacement or refilling)
Cost of system	New Urinal Pan with Membrane has to be Procured and cartridges worth Rs. 2500/- to be replaced after every 3 months.	New Urinal Pan with ecotrap has to be Procured and the refilling liquid also needs to be refilled frequently which comes about 1200/- per 1 Liter.	New Urinal Pan with Trap has to be Procured, which comes with a very special nanotech coating on it. No further purchase of anything is required, 1 odor trap free with each unit, which might be required after 5 years.
Replacement of parts	Cartridges need to be replaced	Replacement of Sealant Liquid frequently.	No replacement Needed
Clogging frequency	High	Medium	Low
Maintenance of pan & trap	High	Medium	Low
Flow of Urine particles through trap	Particles accumulate in trap cartridge	Particles accumulate in Eco trap	No accumulation
Dependence on Suppliers	Supply of sealant liquid	Supply of cartridge	No Dependence
Bacterial and Fungal Concentration	High	High	Anti bacterial and anti fungal coating kills those pathogens and does not let infections spread.
Stains	High	High	NIL
Urine accumulation on urinal surface	yes	yes	No, due to hydrophobic property of the nano silver coating which repels water.

A brief study on the benefits of installing Sunming Waterless Urinals

WATER CONSERVATION:

Each Flush based urinal uses at least 2.5 Liters of Water on each flush. Assuming a facility, comprising 100 males, with average urinating frequency of 4 times in a day, total water usage:

Total Water Usage per Day = $100 \times 4 \times 2.5$ Liters = 1000 Liters per day

Hence, the total water saving in an year = $1000 \times 365 = 3,65,000$ Liters.

The More The Number Of People, The More The Water Saving.

ENERGY CONSERVATION:

Electricity is used to pump up water to overhead tanks and batteries for sensors.

A medium capacity electric pump has wattage of about 3.7 KW. If that motor runs even for 1 hour, that consumes 3.7 units of electricity.

To pump up 1000 Liters of water on a three story building, approximately 1.96 units electricity is used.

The Less The Water Required, The More The Electricity Savings.

SAVING MAN-HOURS:

As Sunming Waterless Urinals are completely maintenance free, and it uses no consumables at all, thus it reduces the requirement of manpower to look after these urinals up to 80%, compared to Flush Based Urinals.

SAVING ECOLOGICAL FOOTPRINTS:

By not using water, these urinals are already contributing towards a reduced water footprint and as these urinals do not require any Cartridge/ Chemical, or any other Consumables to operate in its entire lifespan, they contribute towards reducing carbon footprints also.

SAVING COST:

- ⊙ **Water Charges:** Water cost can be up to Rs. 40/KL, i.e. 100 men can cost Rs. 14,600 per year
- ⊙ **Electricity Charges:** 1.96 units of electricity is required to pump up 1000 liters of water (Approx). Each unit costs at least Rs. 6, even for domestic purpose.
- ⊙ **Maintenance Charges:** As these urinals are completely maintenance free, so no chemicals need to be used, which can save the chemical cost as well as the manpower charges, up to 80% compared to flush based urinals.

An example of the Online Form to be filled up for sanitation ratings : -

Online form

Girls toilets (same with boys toilet if applicable)

- Total number of Girls toilet squatting pan (no.)
- Total number of Girls toilet squatting pan in proper working condition (no.)
- Girls toilet for CWSN (children with special needs) (no.)
- Girls toilet for CWSN in proper working condition (no.)
- Total number of taps in girls toilet (no.)
- Total number of taps in girls toilets in proper working condition (no.)
- Girls toilet taps are located conveniently to be used by children as well as adults? (y/n)

- *Clothes hanging hooks*
- *Are there clothes hanging hooks in each toilet? (y/n)*

Napkins / Niche in wall

- *Is there at least 1 niche in each toilet or alternative to keep sanity napkins?*
- *Are napkins disposed in an appropriate way? (y/n)*

Ventilation arrangement

- *Total number of ventilators in toilets (no.)*
- *Size of ventilator is (length & width in cm)*
- *Ventilator allows sunlight to penetrate for a few hours in a day for self drying (y/n)*

Door

- *Total number of doors in WC (no.)*
- *Total number of doors in WC in proper condition (no.)*
- *Height of door is (cm)*
- *Latching arrangement are child accessible (y/n)*
- *Girls urinals*
- *Total number of girls urinals (no.)*
- *Total number of girls urinals in proper working condition (no.)*

Self cleaning system

- *Urinals used in the school are waterless (y/n)*
- *System that washes the soiled surface use minimal water (y/n)*
- *Screen door*
- *There is at least one door in each urinal (y/n)*
- *Are these doors in proper working condition? (y/n)*
- *Height of door is (cm)*
- *Latching arrangement are child accessible (y/n)*

Hand wash taps

- *Total number of hand-wash taps (no.)*
- *Total number of hand-wash taps in proper working condition (no.)*
- *Number of hand wash tap for MDM kitchen (no.)*
- *Number of hand wash tap für MDM kitchen in proper working condition (no.)*
- *Is hand wash tap for MDM kitchen segregated and separated from toilet hand wash (y/n)*
- *How many of the wash taps are associated with one soap tray? (no.)*
- *How many wash units are associated with one mirror? (no.)*
- *Is there a wash water storage tank (y/n)*

Safe drinking water source

- *Is there a safe drinking water source? (y/n)*

Best options on dry-compost toilets, eco-urinals and hand-washing facilities, as well as rain-water harvesting and groundwater recharging - An example from Mahabalipuram, Tamil Nadu.

In Mahabalipuram (Mamallapuram), south of Chennai, an ecological anganvadi (nursery school) has been established in 2008. It features a great combination of toilet and waste- and water-management facilities as well as gives excellent innovative examples of raising awareness among (pre-) school students.

Toilet facilities:

The nursery school is equipped with dry-compost toilets (called ecopan). These allow for minimal use of water on one hand and protection of ground- and surface water on the other. The use of the dried faeces offers farmers improvement in soil quality and biomass & better food production. With the help of eco-pans grey- and blackwater gets separated.



The "eco-pan" toilets have closable doors and get sunlight through several small vents. These small vents for sunlight and air circulation are important for little children.

"ACTUALLY THE DOOR IS KEPT OPEN WHEN SMALL CHILDREN USE ECO-PAN THE LITTLE WINDOW VENTS GIVE THEM THE FEEL OF NOT BEING BOXED-IN AND AFRAID"



The school also provides the students with eco-urinals. These are separated for boys and girls and allow a urine-alone storage. This is later used, in a 1:10 mixture with water, for fertilising plants. Both the dry-composting toilets and the eco-urinals are kept very clean and are nicely painted in bright colors and also provide graphics on the functioning of the facilities.



Another feature, the school is rigged with low-cost and leakage-free hand-washing facilities. Here old plastic bottles serve as water-storage by opening the screw cap, a small water jet is released through a hole at the bottom of the bottle.

Conservation measures:

The nursery school **harvests rain-water**. The water tank is normally covered, so that the first minutes during a shower, when water carries dirt from the roof with it, the water can't get into the tank. After some minutes it is then opened and the now clean water stored.



Water from other parts of the roof is not stored in a tank but directly piped down to the ground to **recharge the groundwater**.

The direct **loss of pumped groundwater** or water from the water tank is thus **avoided** by channeling water to the plants in the garden.



The purpose and functioning of different systems is well labeled on the systems itself or on adjoining walls of the school building.



What is Solid Waste Management?

Solid waste management is a polite term for garbage management. As long as humans have been living in settled communities, solid waste, or garbage, has been an issue, and modern societies generate far more solid waste than early humans ever did. Daily life in industrialized nations can generate several pounds of solid waste per consumer, not only directly in the home, but indirectly in factories that manufacture goods purchased by consumers. Solid waste management is a system for handling all of this garbage; municipal waste collection is solid waste management, as are recycling programs, dumps, and incinerators.



What is Municipal Waste?

"Municipal Solid Waste" includes commercial and residential wastes generated in a municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes;



What is recycling of waste water?

Creation, Conservation & Eco-Sustainable Use of Green Space in Urban Schools :-

India is entering into the World's First Urban Century wherein in the next 20 years 40 percent of its population will live in urban areas. The greatest challenge of this era definitely lies in achieving sustainable and ecologically viable urban habitats. It is clear that if unrestrained, the concrete blocks would gobble up the natural open spaces at a faster rate and the already not so pristine air would further strive for staying breathable. The trees would go to give way to roads,

What is Organic Waste?

Organic waste is a major component of municipal solid waste. Most originates from household waste but commercial, institutional and industrial waste can also contain significant proportions of organic waste e.g. market waste. Organic waste is biodegradable and can be processed in the presence of oxygen by composting or in the absence of oxygen using anaerobic digestion.

What is Composting?

"Composting" means a controlled process involving microbial decomposition of organic matter;

What is Waste Water Management?

Decentralized wastewater management implies managing wastewater as close as practical to where it is generated and to where its potential beneficial reuse is located. The wastewater management system for a community may comprise several smaller subsystems for collection, treatment and reuse.

What is recycling of waste water?

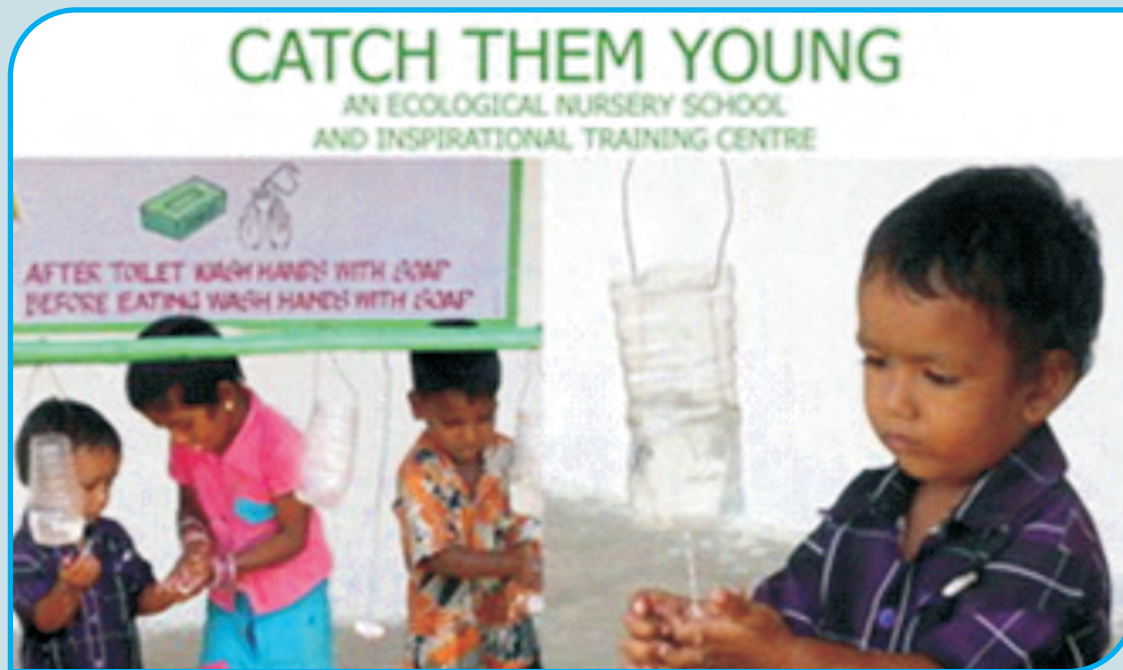
Creation, Conservation & Eco-Sustainable Use of Green Space in Urban Schools :-

India is entering into the World's First Urban Century wherein in the next 20 years 40 percent of its population will live in urban areas. The greatest challenge of this era definitely lies in achieving sustainable and ecologically viable urban habitats. It is clear that if unrestrained, the concrete blocks would gobble up the natural open spaces at a faster rate and the already not so pristine air would further strive for staying breathable. The trees would go to give way to roads,



The ecological anganvadi also serves as an inspirational training centre for . schools and teachers, as well as senior government officials, enquiring citizens and NGOs.

More information can be found on www.eco-solutions.org. An informative further reading on this specific school project is Paul Calvert's book "Catch them Young".



Online form

Have any measures been taken on solid and/or liquid waste management? y/n

Solid waste

Is the solid waste collected?(y/n)
Is the solid waste segregated?(y/n)
Is the solid waste disposed?
Composting (y/n)
Reuse (of waste fractions)(y/n)

Liquid waste

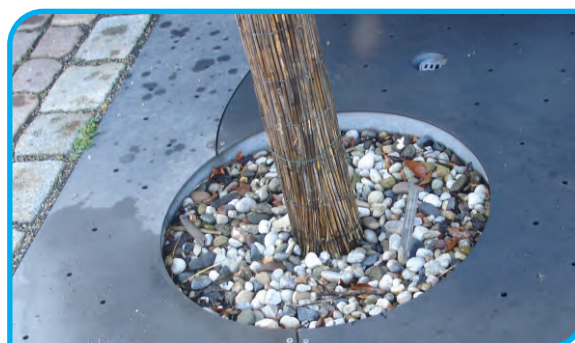
Is the liquid waste collected? (y/n)
Do grey- and blackwater get separated? (y/n)
Is liquid waste disposed environmentally safe?(y(how?)/n)

the chirping birds would find their habitat gone and the lesser primates would further retreat to nowhere. The school would feel the pinch of development. Already they are losing the green space which they have, following in the foot steps of the ultra urbanizing cities and this is happening despite everybody willing to conserve and preserve the areas under green patch so passionately. What would happen in such crunching situations in the future? The FUTURE SHOCK is waiting to happen, a time bomb ticking every second waiting for its day! It is the schools who can prepare the future citizens of prominence to take up the challenges of evolving a New Urban Ecosystem and discarding the anti-green overwhelming urban dystopia.



Benefits of Green Spaces

In the quest for healthy, livable and sustainable cities, urban green spaces with trees as a major component have a vital role to play. These not only provide a breathing space and an area for relaxing in leisure time, but freshen up air and provide a viable option for games and recreation as well.



School Green Spaces provide many contributions to health, hygiene and ecological system. They promote ecological literacy and environmental stewardship among students, teachers, parents and the surrounding community. Green Spaces in maintaining a healthy school environment by providing clean air, water and soil.

The Green Space Economics

There are always complaints from the general public that in the capitalist and laissez faire ball game the profit oriented schools often shun the green spaces for constructing buildings for school expansion or hostels, etc. The loss is always justified by the school authorities and decried by the users comprising mainly of the parents and the students.

The question arises how to make them financially attractive for the schools? If we don't try to optimize financially viable models, no school would take the ecological bait to suffer financially. Ecological measures must contribute to financial sustainability and prosperity.

The solutions are not difficult to find. The green spaces can be allocated to private entrepreneurs for developing world class sports facilities, gymnasiums, swimming pools, etc. which could be made available to the schools at a nominal cost. The Ministry of Human Resource Development is taking up the matter with the Ministry of Urban Development to

facilitate this process without any legal hitch, especially for the Government Schools which have appreciable Green Spaces lying in poor condition.

facilitate this process without any legal hitch, especially for the Government Schools which have appreciable Green Spaces lying in poor condition.

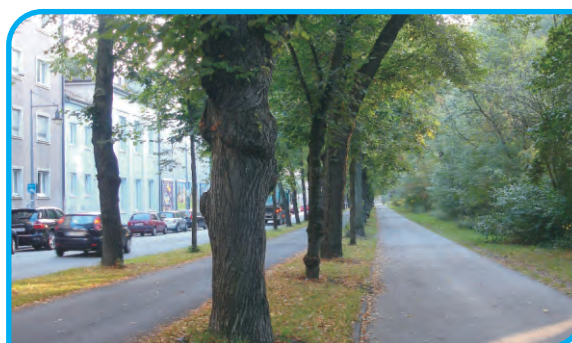


(A) Herbal School Gardens

- (i) Herbal Plantation in school supported by State Medicinal Plant Board under the guidance of social forestry wing of Kerala Forest Department.
- (ii) Army Welfare Education Society has issued a directive to all the Army Schools in the country stating that students must know the importance of medicinal plants on a practical basis and for this, they should create a herbal garden in their campuses
- (iii) The Karnataka Education Department has come up with a home-grown plan to enhance the nutritional content of the midday meals being served in government and aided schools across the State. It is encouraging government and aided schools to develop Bio-intensive gardens and around their buildings wherever there is availability of space and water. High-yielding varieties of vegetables such as brinjal, drumstick and curry leaves can grow here, which may go straight into the midday meals cooked to feed the children. Children, staff and the community regularly participate in maintaining the garden.

(B) The Gujarat Experience

- (i) We can easily establish Kitchen Garden in the Schools having Mid Day Meal Program with the help of NGOs in Gujrat.
- (ii) One of its major activity is to provide nutritious food to the students of the school having Mid Day Meal programme with long term planning and supporting nutrition and better health to the children and promoting awareness towards the benefit of green environment.
- (iii) Panchmahals District; Kadana and Lunawada Talukas; has already taken up 100 Schools for a cause.



- (iv) Implementing agency: Bochasanvasi Akshar Purushottam Swaminarayan Sanstha (BAPS)

UNICEF SWASTHH Plus Initiative

- (i) Bio-intensive vegetable garden development under UNICEF SWASTHH Plus (School Water and Sanitation towards Health and Hygiene) Programme.
- (ii) Launched by UNICEF in 2005 in 120 schools of Gulbarga, 200 schools of Raichur and 80 schools in Tumkur districts of Karnataka. Students have found a new reason to come to school.



(D) AYUSH Intervention

- (i) Project launched to sensitize the students about conservation of the rich biodiversity and in particular the role of medicinal plants in providing a holistic healthcare both in traditional and modern systems of medicine.
- (ii) Initially 1000 schools are proposed to be covered in 50 districts in different states
- (iii) The central assistance available for raising herbal gardens
- ⊙ Rs. 1.00 lakh per hectare for setting up herbal garden.
 - ⊙ Rs. 0.40 lakh for maintenance/hectare/year.
- (iv) The State medicinal Plants Boards (SMPBs) to arrange and provide technical support with the help of state forest/horticulture/agriculture department of Agriculture Universities/Research Institute.

(E) Vidya Van-GoMP Initiative

- (i) MPFD in association with education department launched Vidya Van project in 2007-08
- (ii) Prime objective : To impart practical knowledge about Tree plantation, its maintenance and creation of green space in school backyard.
- (iii) Priority to schools having campus, fencing and irrigation facility
- (iv) Plantation of minimum 100 saplings for meaningful development of green space.
- (v) Provision of quality seedlings through MPFD. Regular monitoring and provision for awarding the best schools.
- (vi) 690 schools selected in first year and 96817 plants planted.

(F) The Government of Bihar Initiative

- (i) An ambitious and bold scheme of Students Plantation launched by Bihar Government in 2007.
- (ii) Students of all recognized govt. and private schools eligible.
- (iii) One student can plant minimum one plant of his own choice.
- (iv) No binding on place of planting (Own house, School or Public place).
- (v) Responsibility of maintenance for three years.
- (vi) Rs 300 in three annual installment to student.
- (vii) Simple monitoring system. No hassle in payment.
- (viii) Verification by school or village panchayat.
- (ix) Collaboration of Forest and Education department.
- (x) Chief Minister commitment

(G) Some Recommendations

- (i) Integration of schemes of various ministries and department.
- (ii) Database of existing school green spaces.
- (iii) Arrangement of financial resource in the form of aid or grant.
- (iv) Private or corporate houses to be invited to join and provide necessary funding for this scheme.
- (v) In urban Schools if space is not available then public places, part of municipality park and other community land may be earmarked for green space development by school.
- (vi) Incorporate Green space development into standards-based school curriculum.
- (vii) Organization of training to the staffs and resource persons.
- (viii) Demo visit by students to selected eco-tourist sites.
- (ix) Raising and tending plants, Water harvesting, Vermiculture and compost preparation to be made a part of SUPW.
- (x) Involvement of NGOs
- (xi) There should be awareness in school planners that it is not only necessary to maintain as much as open space as possible but it has to be green free of asphalt concrete and other impervious surfaces.

- (xii) School administration should receive training in how to care for the trees, garden planting, and other landscape features that enhance the schoolyard green space.
- (xiii) Butterfly gardens, vegetable gardens, peace gardens, nature retreats, outdoor learning labs, rainbow gardens may be developed as outdoor extensions of the classroom and school building.

(H) Conclusion

- (i) Get your School Growing.
- (ii) The educational, health and ecological benefits are endless.

Water Management : The Scenario and the Prospects

Water is one of nature's greatest gifts and has been providing substance to life on Earth for millions of years.

India is one of the most well endowed countries in terms of primary source of water. There is no natural reason why any single village in any part of India should remain short of water.

National annual av. Rainfall is 554 mm with 25% annual with 25 % less rain, drought occurs in over 80% of area.

According to a study by the Water Resources Group, India will have a 50% gap in demand and supply of water (754 billion m³) by 2030. 80% of this demand is projected to be for agriculture considering the fact that India has poor agricultural water productivity, produces water intensive crops, has an ageing and inadequate water supply infrastructure and increasing domestic food requirements. Due to rapid urbanization, India will see rapid increase in municipal and domestic water demand also (108 billion m³) by 2030. India has poor water storage capacity (200 m³ per person) compared to China's 2200 m³ per person and 6000 m³ per person in the US. India's three major river basins (Ganga, Indus and Cauvery) are projected to face shortages.

Therefore the most prudent thing to do first is to improve our water uses. The efficiency of utilisation in all the diverse uses of water needs to be optimised and the awareness of Water as a scarce resource should be fostered. Conservation consciousness requires to be promoted through education, regulation, incentives and disincentives.

Current Scenario :

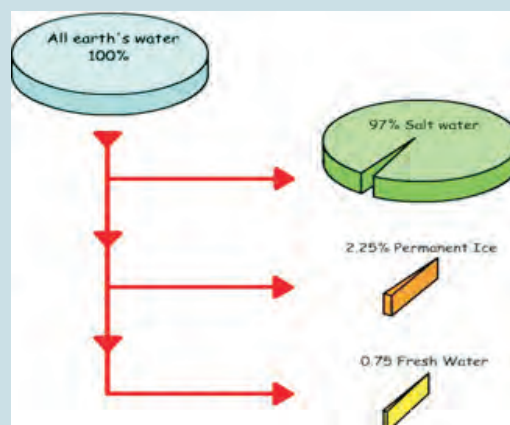
India is a home of 1.8 billion people, approximately 1/6th of world's population. Such high population combined with a high rate of urbanization has led to an increase in the demand for basic amenities i.e. safe drinking water and sanitation system. This leads to inadequate sanitation and water supply system has turned small rivers into virtual sewers and have

Best Options for School Sanitation: Meeting the Challenge

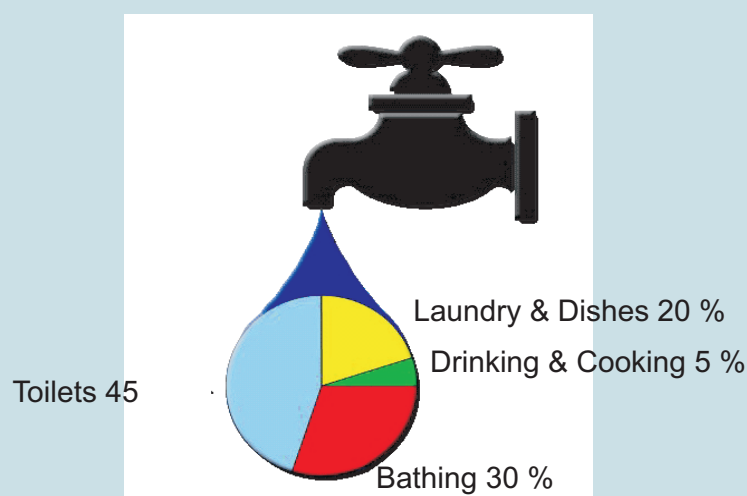
affected ground water supplies. All these have led to a rise in water born diseases like gastroenteritis, dysentery, diarrhoea and hepatitis. Water logging due to poor drainage breeds mosquitoes and often leads to malaria, dengue and chickengunia. The per capita fresh water availability in India is on the decline, from 3450 m³ /cap in 1951 to 1967m³ today, and it is estimated that it might fall drastically to 1500 m³ to 1800 m³ by 2025, even though annual precipitation would remain around 4000 billion cubic meters. It is the contamination of fresh water that is increasing the stress on availability of water.

availability in India is on the decline, from 3450 m³ /cap in 1951 to 1967m³ today, and it is estimated that it might fall drastically to 1500 m³ to 1800 m³ by 2025, even though annual precipitation would remain around 4000 billion cubic meters. It is the contamination of fresh water that is increasing the stress on availability of water.

Out of the available water resource on earth 97%is saline water and only 2.25% is in permanent ice caps and 0.75% only is available fresh water.



Out of this freshwater almost 45% of water is used for toilet flushing, 30% for bathing, 20% for washing and only 5% is used for drinking and cooking which is a basic need of the person



Water Security :

Water Security means water which is physically available, with appropriate quality for drinking agriculture & industries, accessible, when required and in necessary quantity.

It is necessary to see the path of water reaching our tap. Huge dams are constructed, lot of money is invested not only in construction of dams but in transportation of water to our door step out of which almost 90 % water is used in generation of waste water which pollutes natural resources and contributes to more investments in water treatment systems. Considering this it is necessary to take more steps towards water conservation by Indian level measures or community level measures.

resources and contributes to more investments in water treatment systems. Considering this it is necessary to take more steps towards water conservation by Indian level measures or community level measures.

Potential of water conservation at individual capacity:

It is expected that the optimal utilisation of water and reduction in generation of waste at individual as well as at community level.

It necessary to see that in our day to day life how much water do we use and actually the potential to conserve it.

1. Water requirement for brushing:

- a) If using Mug: 1-2 lit
- b) If using Tap water in wash basin: 4-5 lit

2. Water requirement for Shaving:

- a) If using Mug: 2 lit
- b) If using Tap water in wash basin: 16lit

3. Water Requirement for Bathing:

- a) If Bucket is used: 20 lit
- b) If Shower is used: 80 lit
- c) For Tub bath : 110 lit
- d) While applying soap if the shower tap is closed we can save up to 60 lit of water.

4. Water Requirement for Washing cloths:

- a) If using bucket: 40 lit
- b) Washing Machine : 260 lit

5. Water wastage through leakage

Water leakage through tap	Duration	Quantity of water wastage (lit)
	One day	5.2
One drop per second	One week	36.4
	One year	1891
	One day	109
Drop wise continuous flow	One week	754.6
	One year	39792

6. Water Usage during flushing:

- a) Single flush toilet : 0.1 l/flush of water to rinse the urine bowl.
- b) The double flush toilet has two flushing systems:
- c) Urine bowl : 0.1-0.5 liters of water
- d) Faecal bowl: 2-4 liters to flush the fecal bowl.

Case Study - Dual Flush System in a typical small office

Options for Conservation in schools

Rainwater harvesting is the process of capturing and storing rainfall for its efficient utilization and conservation to control its run-off, evaporation and seepage. Some of the benefits of rainwater harvesting are:

- ⊙ It increases water availability,
- ⊙ It checks the declining water table,
- ⊙ It is environmentally friendly,
- ⊙ It improves the quality of groundwater through dilution, mainly of fluoride, nitrate, and salinity, and
- ⊙ It prevents soil erosion and flooding, especially in the urban areas.



Number of female users	Use of toilets/ person /day	Water discharged/flush of the dual flush system	Water flushed before installing dual flush system	Total wastewater generated/day after installing dual flush system	Water conserved/day after installing dual flush system
8	3	3L	8 users * 3 times/day * 12L/use = 288L	8 users * 3 times/day * 3L/use = 72L	288L – 72L = 216 L

Even in ancient days, people were familiar with the methods of conservation of rainwater and had practiced them with success. Different methods of rainwater harvesting were developed to suit the geographical and meteorological conditions of the region in various parts of the country. Traditional rainwater harvesting, which is still prevalent in rural areas, is done by using surface storage bodies like lakes, ponds, irrigation tanks, temple tanks, etc. For example, Kul (diversion channels) irrigation system which carries water from glaciers to villages is practiced in the Spiti area of Himachal Pradesh. In the arid regions of Rajasthan, rainwater harvesting structures locally known as Kund (a covered underground tank), are constructed near the house or a village to tackle the drinking water problem. In Meghalaya, bamboo rainwater harvesting for tapping of stream and spring water through bamboo pipes to irrigate plantations is widely prevalent. The system is so perfect that about 18-20 litres of water entering the bamboo pipe system per minute is transported over several hundred meters. There is a need to recharge aquifers and conserve rainwater through water harvesting structures. In urban areas, rainwater will have to be harvested using rooftops and open spaces. Harvesting rainwater not only reduces the possibility of flooding, but also decreases the communities dependence on groundwater for domestic use. Apart from bridging the demand-supply gap, recharging improves the quality of the groundwater, raises the water table in wells/bore-wells and prevents flooding and choking of drains. One can also save energy to pump groundwater as the water table rises. These days rainwater harvesting is being taken up on a massive scale in many states in India. Substantial benefits of rainwater harvesting exist in urban areas as water demand has already outstripped supply in most of the cities.

Demand for water is growing in most cities as every urban citizen requires almost double the amount of water that a rural citizen requires. Moreover, India is rapidly urbanizing. The urban population in India has grown almost five times in five decades from 1951 (62.44 million) to 2001 (286.08 million). Not long ago, most of our cities were self sufficient in meeting their water needs from the extensive urban water bodies to supply water to citizens. Today these water bodies have completely disappeared. Municipalities have been stretched to their limit to find water for the growing urban population. Groundwater is being extracted by the government as well as private parties. Traditionally, rainwater harvesting has been practiced in arid and semi-arid areas, and has provided drinking water, domestic water, water for livestock, water for small irrigation projects and a way to increase the ground water level.

Systems

There are many types of systems to harvest rainwater. Notable systems are systems for run-off rainwater (e.g. hillside run-off) and rooftop rainwater harvesting systems. The type used depends greatly on the purpose (domestic or industrial use) and to some extent also on economics and physical and human considerations. Generally speaking, rooftop rainwater systems are most common as they are the most economical.

Advantages in Urban Areas

Rainwater harvesting in urban areas can have manifold reasons. To provide supplemental water for the cities requirement, to increase soil moisture levels for urban greenery to increase the ground water table through artificial recharge, to mitigate urban flooding and to improve the quality of groundwater are some of the reasons why rainwater harvesting can be adopted in cities. In urban areas of the developed world, at a household level, harvested rainwater can be used for flushing toilets and washing laundry. Indeed in hard water areas it is superior to water from the main supply pipes. It can also be used for bathing. It may require treatment prior to use for drinking. In New Zealand many houses away from the larger towns and cities routinely rely upon rainwater collected from roofs as the only source of water for all household activities.

Components of a Rainwater Harvesting System

Irrespective of the complexity, rainwater harvesting systems will have the following five basic components:

1. **Catchment:** the surface from which rainwater is collected for storage. This could be a rooftop, a paved flooring surface or a landscaped area. Catchment area is the area of that surface, usually calculated in square meters.
2. **Gutters and down-take pipes:** lead the water from the catchment surface to the storage tank
3. **Filters and first flush devices:** removes grit, leaves and dirt that the rainwater may transport from the catchment, before the water enters the storage tank. When it rains after a long gap, the rooftops are usually very dirty and the rainwater also carries with it a lot of dissolved air pollutants. A first flush device diverts the water from the first rain so that it does not enter the storage tank.
4. **Storage tanks:** These can be above the ground or below the ground.
5. **Delivery systems:** Piping systems that convey the stored rainwater till the point of end-use.

It is not recommended to use harvested rainwater for drinking, cooking and dish washing unless water quality issues are verified and necessary treatment or purification systems installed.

Types of Catchment

Roof catchments: The rooftop is usually the most common catchment surface and can be flat or sloping.

- ⊙ Smooth, hard and dense roofs are preferred since they are easier to clean and are less likely to be damaged and release materials/fibres into the water.
- ⊙ The catchment surface should slope slightly towards the down-take pipes so that water does not stagnate on the roof.
- ⊙ A catchment that slopes towards a single direction, preferably in the direction of the sump/bore well will reduce piping costs.

Ground level catchments: If the storage tank is below the ground level, paved flooring surfaces and open grounds can also serve as catchments.

Run-off Coefficient

Rainwater yield and quality varies with the size and texture of the catchment area, climatic conditions, cleanliness of the catchment and the surrounding environment. A smoother, cleaner, and more impervious catchment contributes to better quality and greater rainwater collection. Regardless of catchment material, there will be certain losses due to absorption, evaporation and inefficiencies in the collection process. Run-off coefficient is a factor that accounts for these losses and indicates the fraction of the rainwater that actually leaves the catchment to enter the collection pipes. For example, a run-off coefficient of 1 indicates that there are no losses and all the rainfall that falls on the catchment reaches the down-take pipes and a coefficient of 0.8 indicates that only 80 percent of the incident rainfall reaches the down-take pipes. The run-off coefficients for different catchment materials are given in the table below. Run-off coefficients for various catchment surfaces.

Type of Catchment	Coefficients
Roof catchments	
Tiles	0.8-0.9
Corrugated metal sheets	0.7-0.9
Ground surface coverings	
Concrete	0.6-0.8
Brick pavement	0.5-0.6
Untreated ground catchments	
Soil on slopes less than 10 %	0.1-0.3
Rocky natural catchments	0.2-0.5

Gutters

Gutters are pipes around the edge of the roof (usually sloped roofs) that collect and transport rainwater from the roof. Down-take pipes are cylindrical pipes that transport the water down, directly from the roof or from the gutters, until the storage tank.

Common material for down-take pipes are ultra-violet treated poly vinyl chloride (PVC), galvanized iron (GI), cast iron and asbestos cement. Down-take pipes will be present in most buildings, leading rainwater to the ground. Older constructions would have asbestos cement pipes but more recent ones would have PVC, and in a few cases GI down-take pipes.

PVC pipes are preferred since they are:

- ⊙ lightweight
- ⊙ cost effective
- ⊙ do not rust
- ⊙ are easy to procure, install and repair and
- ⊙ allow for increased flow rates because they are smoother than their metal counter parts

It is advisable to use ISI Quality pipes.

Sizing of Rainwater Down-take Pipes for Roof Drainage

The diameter of the down-take pipes varies depending on the roof area to be drained and the peak intensity of rainfall. A bell mouth inlet at the roof surface is found to give a better drainage effect.

Gutters should preferably be smaller or of the same size as the down-take pipes, depending on the number of gutters that lead into one down-take pipe.



Filters

It is preferable to filter the rainwater before storing it. If leaves and other organic material enter the storage tank, they decompose and support bacterial growth in the tank. Dirt and other debris, if not filtered out, can cause blocks in the plumbing system when the stored rainwater is used. Different filters exist: some are commercially available while others can be put together at home.

Care should be taken to maintain the cleanliness of the roof. It is advisable to cut tree branches that overhang the roof. This would not only reduce the leaves, flowers, fruits and bird droppings

that fall on the roof but would also reduce access to squirrels and rodents.

Filters introduce some losses into the rainwater collection system and the filter efficiency can either be calculated for simple systems or will be stated by the manufacturer.

Primary Filters/Leaf Guards

The first level of filtration could be a grating at the outlet of the catchment or the inlet of the gutters or down-take pipes to prevent large coarse debris like leaves from entering the rainwater transportation and storage network. For open gutters, leaf guards which are usually mesh screens in wire frames may be installed along the length of the gutter. The rooftop must be regularly cleaned for the leaf screens to be effective, or else the piled up leaves will clog the screen and prevent rainwater from entering the gutters or down-take pipes. This can even result in leakage of water from the roof. If wire meshes or gratings are not used at the outlet of the catchment, the filtration system installed should be able to segregate such debris from the collected rainwater.

Secondary Filters

The second level of filtration is required to remove finer particles and even bacteria, so that the collected rainwater is free from suspended solids and organic contaminants. Some filtering technologies are described and compared below. The final choice of a filtration system depends on the cost of the device and maintenance needs. Off-the-shelf availability is also a deciding factor since not many people will make their own filtration systems.

Sand - Gravel

This is a do-it-yourself filter consisting of three layers of gravel, sand and gravel, separated by meshes. The filter can be made in a ferro-cement tank or in a HDPE# drum. The gravel layer on top filters out the larger particles and since it has larger voids, it also acts as a store for the water as it slowly seeps through the layer of sand. The sand filters out the smaller suspended particles.

Variations to the sand -gravel filters include using a sponge layer on top to filter out coarse debris or adding a layer of charcoal or activated carbon to improve the odour.

Maintenance: The top layer of sand (or sponge if used) needs to be cleaned periodically to a depth of about 3 centimeters. The sand or sponge can be removed and soaked /cleaned in a bucket of water and replaced. There could be fungal growth on the sponge if prescribed maintenance is not followed. If charcoal is used, it needs to be changed every year. It is also advised to clean the meshes and the top layer of gravel.

VARUN: is a slow-sand filter constructed in a 90 litre (HDPE) drum. The lid is turned over and holes are punched in it. This is the first sieve which keeps out large leaves, twigs etc. Rainwater

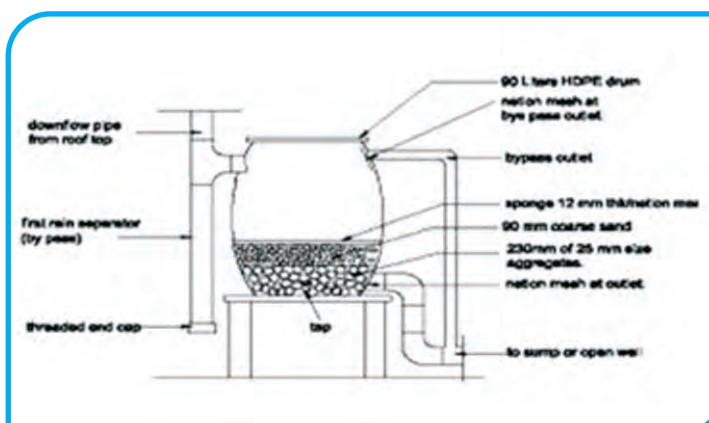
coming out of the lid sieve then passes through three layers of sponge and a 150 mm thick layer of coarse sand. The filter removes suspended solids from the harvested rainwater. It has been developed by S Vishwanath, a Bangalore based water harvesting expert. According to him, from a reasonably clean roof 'VARUN' can handle a 50 mm per hour intensity rainfall from a 50 square meter roof area. Based on these calculations, when a rainwater harvesting system is being designed for a new house, the optimal number of filters can be recommended.



Maintenance: The sponge needs to be cleaned periodically and the top layer of sand to a depth of about 3 cms needs to be cleaned at the end of a rainy season.

Cost: A filter that can service a rooftop area of 100 square metres costs Rs 4500/- (Price in 2006)

- ⊙ Mesh filters: These filters use a fine mesh to filter out suspended particles. They are usually wall mounted and take much less space than the sand filters. Each filter is also able to service a larger rooftop area than the sand filter. Product designs are varied and maintenance depends on the design. These filters are more cost effective than sand filters but need to be purchased and cannot be made by the installer.



The cost of mesh filters depends on the design and many other factors.

First Flush Diverters

The first rain that falls after a long dry spell usually carries with it a lot of dirt, dust and debris that would have collected over the roof. It also dissolves many air pollutants on its way down. It is therefore a safe practice to divert the first run-off away from the storage tank. A first-flush diverter is used for this purpose. After the 'first-flush', water that is collected is much cleaner. The volume of water that needs to be flushed out is a function of the number of dry days, the season, the catchment surface cleanliness and the surrounding environment. Though there are no specified standards and different studies have stated inconsistent results, a thumb rule that can be used is that for every square meter of catchment area, 0.5 litres of water is flushed

out. This is equivalent to the first ten minutes of average intensity rainfall.

Ease of operation and maintenance are key characteristics of effective first-flush devices. Without requisite attention, these diverters may get blocked and may even pollute the water in the tank.

Though there are a number of first-flush diverter designs, one that is relatively easy to build and maintain is the standpipe that is detailed below.

The standpipe consists of a vertical PVC pipe that is inserted perpendicularly into the pipe that leads into the storage tank as shown in the figure. It has a threaded plug at the bottom. Water from the down-take pipe fills up the standpipe and when full, water is allowed to go into the storage tank. The threaded portion at the bottom must be removed after each rainfall event to drain out the water in the standpipe and keep it empty for the next rainfall. Alternately a small drip hole in the standpipe cap allows the water to leak out of the standpipe slowly. A floating ball valve arrangement can also be made. As the first-flush water enters the standpipe, the ball valve rises and blocks the standpipe inlet, allowing the water to flow into the storage tank.

Storage Tanks

Storage tanks are the most expensive part of a rainwater harvesting systems, so due consideration must be given to this design and construction. The size of the storage tank depends on the amount of rainfall that can be harvested, the demand, aesthetics and budget. The availability of labour and materials/off-the-shelf products, cost, time, and other external factors are important in selecting the tank material and type. A tank can be:

1. at or just below a roof slab level,
2. on the ground, or
3. completely or partially below the ground (sump).

General Characteristics of Storage Tanks

All storage tanks must be:

- ⊙ Durable and water-tight.
- ⊙ Built/placed on a strong and stable substrate which can support a tank filled with water.
- ⊙ Opaque, so that light cannot enter the tank. The presence of light can cause algal growth in the stored water.
- ⊙ Have a strong, secure and impervious cover which is kept shut at all times, unless being cleaned. Manholes must be present to allow access for cleaning but these too must be secured properly to ensure that nothing can fall into the tank. The cover and manhole

should not allow dust, insects or light to enter the tank. Some RWH projects have reported that small animals have fallen into storage tanks and died, increasing the risk of bacteriological contamination. Care should be taken to prevent such occurrences.

- ⊙ Have all vents, including the overflow pipe, covered with an insect proof mesh to keep out mosquitoes and other insects as well as stray dirt. Care must be taken to ensure that mosquitoes cannot breed in the storage tank, since they are the source of many diseases.
- ⊙ Located as close as possible to demand and supply points, so that plumbing is reduced.
- ⊙ Situated as high as possible (but at least a couple of feet below the catchment discharge points) to reduce pumping loads.
- ⊙ The overflow pipe should be just below the tank/sump cover so that there is no 'dead space' and the tank can be used to its maximum capacity. The overflow pipe should divert the excess water away from the sump and the foundations of other buildings and structures. This water should be directed to gardens or into the storm water drain and should not create slushy areas. A reverse U bend should be installed at the end of the overflow pipe so that light and other impurities do not enter the tank.
- ⊙ Water should be extracted from the tank/sump only by means of a tap or pump. Taps or draw-off pipes should not be very close to the bottom of the tank, since there is likelihood of sedimentation and the dirt that may have settled at the bottom, entering the water supply. Sedimentation and dirt should be allowed to settle and remain in the tank until it is cleaned. If the dirt enters the water outlet pipe and the plumbing network it can cause blockages.

When going in for underground sumps, some important factors need to be considered. Firstly the ground should not be rocky as this can hinder the digging and construction process. Secondly the groundwater table in the area should not be very high and should ideally be several meters below the bottom of the tank. Underground sump tanks must not be built very close to:

- ⊙ underground sewerage chambers or lines
- ⊙ trees like the coconut which have strong roots that spread widely
- ⊙ existing foundations, especially those that may not be very deep
- ⊙ waste water treatment systems

Sumps could have level indicators, so that the pumps don't run dry. Level indicators can be as simple as a dip-stick or can be electronic. Dip-stick systems have the disadvantage of being a conduit for light and impurities to enter the storage tank.

Storage Tank Materials

Storage tanks are commonly constructed with the following materials:

- ⊙ Brickwork with cement plastering
- ⊙ Reinforced cement concrete (RCC)
- ⊙ Ferro cement
- ⊙ Plastic or polypropylene

Tanks made of galvanized iron are not advised since they are more prone to rusting or paint peel-off. These would be causes for concern, especially in coastal areas where the durability is further reduced. Recycled oil drums are used for water storage in poor communities but these are also not advised since they are prone to contamination. The cost of construction of storage tanks can vary from Rs. 3.50 per litre of storage to Rs. 5.00 per litre of storage depending on the material and the size of the tank

Online form

Have any measures been taken on water conservation? y/n

Is rainwater harvested in your school?

Is the use of water minimised at your school?

Have any measures been taken on leakage prevention?

Number of activities / measures on water conservation?

Which ones? (explanation)

Have measures been taken on the conservation of green spaces?

Roof top Water Harvesting:

A natural resource presently wasted due to paved areas and buildings. Therefore roof top rain water harvesting helps recharging ground resources, to prevent ground water depletion. It can also be stored as a good supplement to piped water. This helps to prove positive cost benefit ratio which is relatively pollution free, and also gives aspect of water conservation & self-dependence

Who can harvest rooftop rainwater?

- ⊙ Any person planning to build a house
- ⊙ An independent plot owner.
- ⊙ Persons in apartments
- ⊙ Industries and factories
- ⊙ Large Marketing Complexes, Malls, Airports.
- ⊙ Institutions like schools, colleges



- ⊙ People who are purchasing water for domestic use
- ⊙ RWAs (Resident Welfare Association) at appropriate places

How much Rainwater can be harvested?

For example: A School of rooftop area 200 sq. meter wants to harvest rainwater and the annual rainfall in that area is 500 mm with evaporation loss 0.8%.

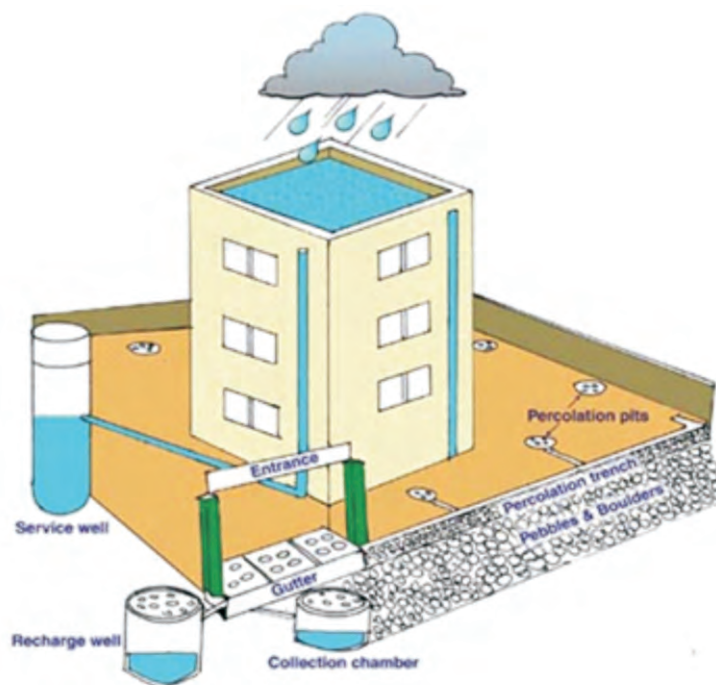
The potential of harvesting of rainwater = Area X Rainfall X Run off coefficient

The school can harvest 8000 lit water per year.

Method of Rooftop Rainwater Harvesting:

Following are main features:

1. Collection
2. Filtration
3. Storage
4. Recharge

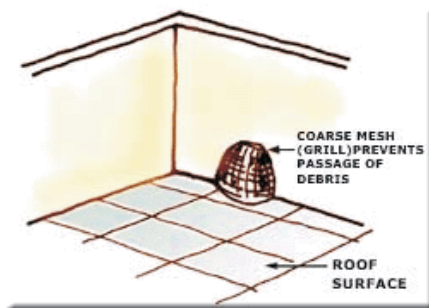


1. Collection

Rooftops are the best among them because of the large coefficient of runoff generated from them and there are less chances of contamination of water.

Best Options for School Sanitation: Meeting the Challenge

Collect water from the rooftop.

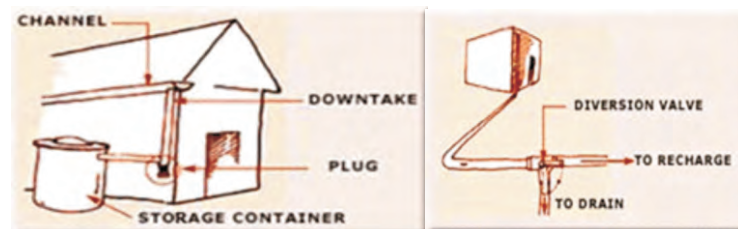


Draw it down from pipes



⊙ **First Flush device:**

A first flush device is a valve that ensures that runoff from the first spell of rain is flushed out and does not enter the system. This needs to be done since the first spell of rain carries a relatively larger amount of pollutants from the air and catchment surface.



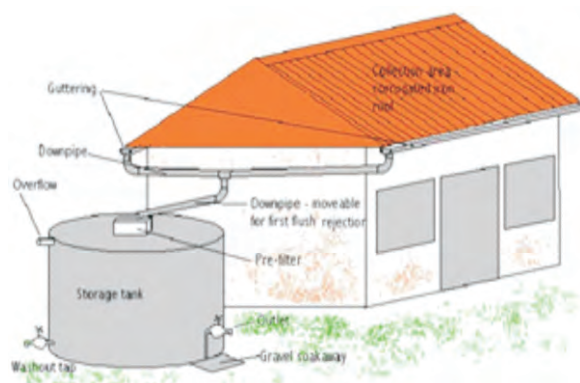
2. Filtration:

The filter is made up of Gravel and sand layers. These filters can be employed to remove turbidity (suspended particles like silt and clay), colour and microorganisms.. A filter unit is a chamber filled with filtering media such as fiber, coarse sand and gravel layers to remove debris and dirt. Charcoal can be added for additional filtration and removal of colored impurities.



3. Storage:

The most important part of the rain water harvesting is the storage system. The storage system is designed according to the amount of water that is to be stored. The design and site (location) of the storage or the recharge system should be properly chosen. The areas which receive the rainfall frequently, there a simple storage system could be constructed, to meet the daily water requirements. Otherwise the areas which receive lesser rainfall, there the storage systems are quite essential. Rain barrels, underground or open slumps are mostly used to collect rain water. Make sure that the storage system is properly sealed and does not leak. Use Chlorine from time to time to keep the water clean & germs free. It should also be used to purify the water from suspended particle impurities.

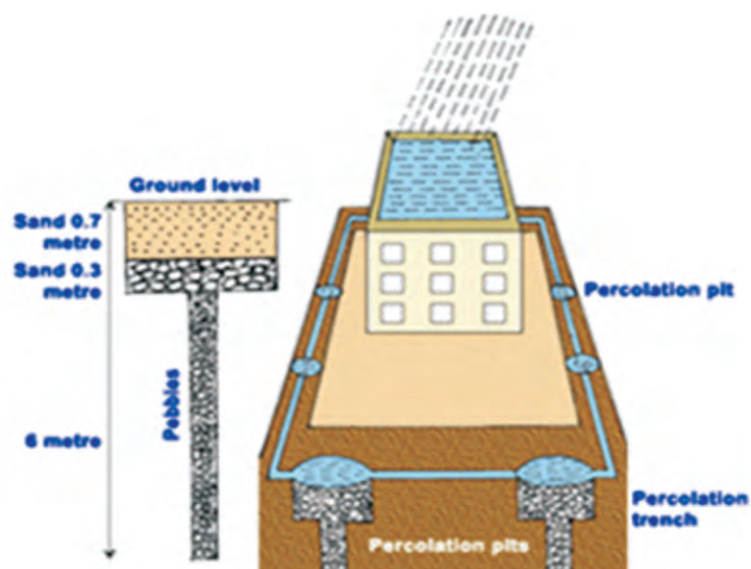


4. Groundwater Recharge through percolation pit:

Due to Increased population, urbanization, pavement of surface, and reduction the consumption of ground water is increasing day by day resulting in depletion of ground water level. It is our duty to assist in the recharge of the aquifers through various means. It consists a filter media such as river sand, coarse aggregate, river pebbles in successive layers. At the



bottom of the recharge pit a perforated pipe is inserted from which the water gets percolated into the soil. The pit is surrounded with brick construction in order to avoid intrusion of surface water inside the pit. Top area of pit is covered with grill or suitable media.



Tank Culture in India

The study of Indian civilization depicts the advances it had made in land and water resource management. The ancient Indian texts are full of such details and we find the remains of this lost art of management scattered in historical ruins in this subcontinent.

Early Period

The earliest record of water management by manipulating the natural water regime in India is found in Inamgaon near Pune. Here, man made water reservoir with an embankment wall measuring 240 meters in length and 2.2 meters in width was built with rubble set in mud mortar. An irrigation channel connected it to an adjacent river. This reservoir dates back to approximately 1500 BC (Chalcolithic Period). Excavations of Harappan sites have shown that river waters were channelized through dams

to the vicinity of the city. Cities like Dholavira and Lothal had such efficient systems of water management.

During the rule of the Mauryan Dynasty (320 BC) the construction of water harvesting structures (WHS) and sustainable irrigated agriculture in semi arid regions attained a high level of perfection. This is exemplified by Sudershana Lake at Junagadh in Saurashtra which was constructed by Pushya Gupta, the Governor under Chandra Gupta Maurya. Many of these lakes have lasted for more than 500 years. Much of the water harvesting technology of Karnataka was derived from the Mauryan period. Subsequently rulers of the Satavagaba, Chola, Kadamba, Ganga, Chalukya and Rastrakuta dynasties continued the tradition of building water conservation structures and improvng agriculture in the Karnataka region.

The golden age of tank construction in the Deccan Plateau was during the reign of the Chalukyas of Kalyan (973 to 1336 AD). The foremost tank builders are considered to be the Hoyasala rulers of Karnataka(12th to 14th Century AD). Gigantic tanks and irrigation schemes were also taken up by the Vijayanagara empire (1336 to 1556 AD). Several tanks and reservoirs, like Medag-Masur, Kumbum and Vysa Samudra, built during that period still continue to serve the people. In addition, dams were also built across the Tungabhadra and Kaveri rivers in a number of places in Bellary, Raichur and Mysore districts, some of which are still working.

Similar systems of water resource development were found in other semi-arid terrains like the Ahara of southern Bihar and Bhandaras of Maharashtra. A variety of rainwater systems, called khadins, were developed in the arid tracts of Rajasthan. These were often initiated by large Zamindars (Land owners) and rulers as relief measures during the recurrent droughts and famines.

Some precautionary steps to be taken before implementation of rain water harvesting projects:

- ⊙ Convenient “first flush” device must be integrated with the project.
- ⊙ A good fitting, light-proof cover will prevent debris, animals or humans from entering the tank and prevent light from causing algae growth
- ⊙ Good sanitary conditions around a tank will prevent any water-borne or water induced disease from spreading.
- ⊙ Water extraction should be such that the water is not contaminated while being drawn.
- ⊙ Poorly managed water harvesting systems may cause soil erosion and soil instability
Therefore, water-harvesting catchments require prudent maintenance to keep them in good condition.

Lessons Learnt:

Rainwater harvesting is a social responsibility involving the whole community. The social duties include:

Best Options for School Sanitation: Meeting the Challenge

- ⊙ Conservation of water by construction of contour bunds and trenches, check dams and storage tanks,
- ⊙ Using water more efficiently,
- ⊙ Reclamation, recycle and gainful utilization of waste water,
- ⊙ Identification of proper hydro-geological conditions,
- ⊙ Strict implementation of water legislation, and

Educating the students about the role of the hydrological environment and dissemination of knowledge gained over the years..

More Options for Innovation in schools

Submission of Online Queries :

The following is generally implied :

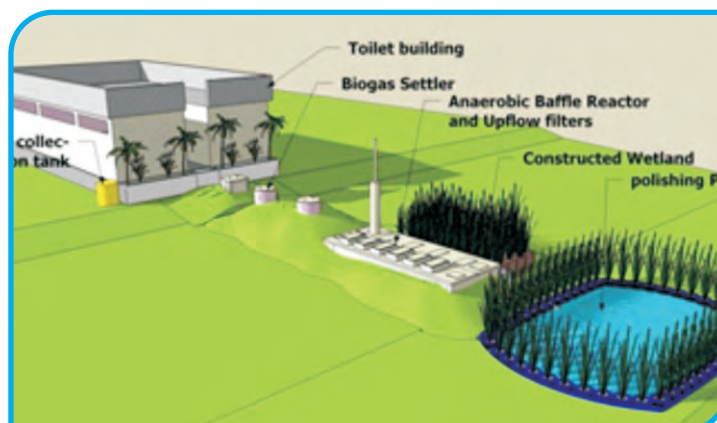
*Have any innovative measures been taken by your school? y/n
(if yes, then 5 open spaces to write)*

(i) Zero Discharge Concept for Sustainable School Sanitation

Introduction

According to the World Bank, “The greatest challenge in the water and sanitation sector over the next two decades will be the implementation of low cost sewage treatment that at the same time will permit selective reuse of treated effluents for agricultural and industrial purposes”. Promoting the development of domestic on-site wastewater treatment and recovery technologies that are linked with small scale gardening systems, at the community level have been found to be the most sustainable approach to solving the human and environmental health tight-spots that result from ill-managed domestic wastewater.

Decentralized small scale systems must be considered in planning and upgrading school environments. These systems would be based on the topography of the local water shed, and would result in small-scale facilities equally dispersed through environment. Pathogenic reduction and nutrient recovery would occur through the use of integrated



biological processes, which are generally low cost systems. This approach allows for independent, self maintained, and self sustained facilities that are capable of recovering wastewater resources and immediately reusing them in decentralized gardens and organic farms. The recycled wastewater can be used in the industries, bus stations



& depots, railway yard and also by car service centres. Wastewater recycled through STP (Sewerage Treatment Plants), Ultra filtration and Reverse Osmosis (RO) can be used for drinking water.

During the early 1980s, the Tokyo branch of the United Nations University conducted a special study on ecological engineering and integrated farming systems in China (Chan, 1993). Interest in these systems has been renewed. Recently, the “Integrated Bio-Systems Conference”, jointly organised by the Institute of Advanced Studies (IAS) of the United Nations University (UNU-Tokyo) and the UNESCO Microbial Resource Centre at Stockholm, as an activity of the UNU/Project Zero Emissions Research Initiative, focused on the recovery and reuse of biological waste.



The development of zero-discharge wastewater management strategies will contribute to a significant reduction in the pathogenic contamination of surface and groundwater and aid in protecting the vitality of school children. Organic waste recovery can result in production inputs for small-scale agri-practices, thus resulting in closing the loop at the source of generation. Thus, decentralized, organic waste recovery systems that integrate the best available low-technology in the recovery of domestic wastewater flows are essential and appropriate components for the promotion of a comprehensive sustainable school sanitation strategy.

The Zero Discharge Wastewater Treatment System is a multi-dimensional and comprehensive approach to upgrading the quality of school environment and protecting the environmental resources and aesthetic amenities of the surrounding in and around schools.

Objectives of Zero-Discharge Wastewater Management Strategies for Schools

Zero-Discharge Concept aims to focus mainly on approaches or treatment technologies capable of three end goals:

- i. To reduce the pathogenic risk inherent to wastewater;
- ii. To facilitate the recovery of nutrients and water resources for reuse in agricultural production, the irrigation of municipal greenbelts, parks and maintenance of other landscape amenities, and;
- iii. To reduce the overall user-demand for water resources.

Thus, the technologies for zero-discharge wastewater treatment systems have one or more of the following characteristics:



- 1. Achieving acceptable levels of treatment;
- 2. Requiring low capital investment;
- 3. Requiring low ongoing operation and maintenance costs;
- 4. Requiring less skilled operator knowledge than many conventional technologies;
- 5. Able to reuse all the treated components from the implemented systems; and,
- 6. Potentially having longer life-cycles than conventional / electro-mechanical technology.

Criteria for sustainability

Some of the important criterion for sustainability in the “Zero-Discharge Wastewater Management Systems” are:

- i) No / minimal dilution of high strength wastes.
- ii) Maximum recovery and re-use of treated water and by-products obtained from the polluting substances. for irrigation, fertilization etc.
- iii) Application of efficient, robust and reliable treatment/conversion technologies, which are low cost (in construction, operation, and maintenance), have a long life and are simpler in operation and maintenance.
- iv) Large scale applicability.



- v) Leading to a high self-sufficiency in all respects.
- vi) Acceptable by the school authorities and appropriate in local context.

Institutional and social dimensions should not be overlooked in the implementation of zero discharge wastewater technologies. The adoption of an alternative technology corresponds directly to the level of acceptance it gains from both the user and the institutional framework from which the technology is supported and developed.



Conclusion and Way forward

Integrated water resource management needs a holistic long-term approach. This must be supported by legislation, agreed quality standards and finance to enable projects to be realized. The only solutions to water shortage are to maximize the efficiency of water management and reclaim and



reuse wastewater. The increasing global experience in small and large high efficiency systems is continually reducing the production costs. The operation of Zero Discharge Wastewater systems that include wastewater reuse for irrigation and aquifer recharge provide long-term drought proofing and robust water resource solutions as the weather patterns continue to shift. These innovative solutions enable schools to move towards Zero Discharge Concept as part of an integrated water resource management strategy.

Further, it is felt that “Zero-Discharge Wastewater Management Systems” should be adopted by all the schools. In view of the critical problem of increasing contamination of surface and groundwater and of the solid-mantle due to untreated or



inadequately treated waste waters and the unsatisfactory performance of the municipalities in handling the problems of wastewater, schools should consider providing for appropriate treatment, recycling and reuse of the wastewater generated by them.

Water Saving Urinals

Natural resources are limited and considering industrialization and global warming we should start focusing on preservation and optimum utilisation of natural resources.

A step to secure the future is to conserve water. The most essential among all the natural resources on earth is water. A drop of water is worth more than a sack of gold for the thirsty man. If each one of us makes an effort to save water today , it will secure our future. Water conservation is the most effective and environmentally sound method to fight global warming. Water conservation can reduce the scarcity of water and improve efficient use of water, and reduce losses and waste.

Benefits of water Conservation:

- ⊙ Reduction in interior water use cuts waste water flows, especially overflowing of gutters which contaminates the environment.
- ⊙ Environment benefits include eco system and habitat protection.
- ⊙ Water conservation helps in improving the quality of your drinking water.

One of the steps to conserve water is by the use of a Water Saving urinal, which this chapter is going to explain in detail. A brief description has already been given in earlier chapters

In general, a urinal is a specialized toilet/makeshift container for urination by men and boys. However female urinals are also being piloted /demonstrated in some of the European/US cities but these have not taken off due to various reasons. More recently models that use specialized funnels have been introduced, with some success, at outdoor festivals to reduce cycle times and alleviate long lines.

Most of the modern urinals consist of a flushing system to wash the urine from the bowl to prevent odour and foul smell. The flushing can be activated by several methods which mainly include:

1. Manual flushing
2. Voice activated flushing
3. Timed flush
4. Automatic flush
5. Door regulated flush

In the normal urinals, the urine-effluent is led out through the common discharge with human faeces as sewerage. Also, as urine is flushed away using fresh water, large quantities of water is wasted in the process. Therefore the water based urinals need huge amount of water to run properly and in most cities freshwater is being used for the flushing. Considering the wastage of precious water in flushing the urine, Water Saving urinal (without water) has come to the fore in 1990s.

As -urine contains 80% of the nutrients being released by human bodies, there is good potential for (i) enriching the soil and plants using the nutrients available in it, (ii) protect the environment from the un-safe waste disposal practices largely followed in India and (iii) save enormous amount of precious water otherwise being wasted in the conventional systems. The concept of employing the “Water Saving Urinal”, which is already being adopted in some of the western countries, is proposed to overcome the shortcomings in the current approach of managing urinals. Also, the experiences gained in implementing the pilot can be widely utilized to create awareness among professionals and to prescribe some of the technical approaches that can be successfully employed by professionals and institutions.

Water Saving urinals do not require water for flushing urine. Urine, which has high NPK content, is diverted to a storage tank and used as fertilizer for crops. Water Saving urinals are increasingly being used in many countries due to the advantages offered such as saving of water, reuse of urine as fertilizer and reduced load on waste water treatment plants.

The conventional urinals consist of a flushing system to wash the urine from the bowl to prevent odour and foul smell. Therefore the water based urinals need huge amounts of water to run properly and in most cities freshwater is being used for the flushing. As Water Saving urinals do not use water at all thus save considerable amount of water. The system approximately saves between 56,800 litres to 170,000 litres of water per urinal per year. For the purpose of controlling the smell, the urinal pipes of the Water Saving urinals are fitted with stench barriers which prevent the emission of gases and odours from urine pipes apart from regular cleaning processes as adopted in the normal urinals. The Water Saving urinals can be installed in all high traffic urban/ rural facilities and in situations where providing a water supply may be difficult or where water conservation and urine reuse is desired to be practiced with benefits realised locally.

Advantages of Water Saving Urinals

The advantages of Water Saving urinals are:

1. Reduce water consumption (conventional urinals use 4-6 litres per flush for flushing 250-300 ml. Urine, a saving of 16-24 litres of Water per day per person, assuming four visits for flushing 1-1.2 liter of urine).

2. Considerable reduction in required carrying capacity of sewer lines.
3. Excellent nutrient recovery by recycling urine as liquid fertilizer in gardens, fields etc.
4. Reduced nutrient pollution of aquatic environment by recycling the urine.
5. Economical in comparison to flushed urinals.
6. Simple and easy to maintain.
7. Easy to construct design can be used in villages.
8. Social acceptance is generally very high since many men hardly notice the difference.
9. Odours should be the same or less than the conventional urinals.
10. Retrofitting/up gradation in water flushed urinals

Functionality

The development of Water Saving urinals was mainly driven by the needs of arid areas, water conservation, nutrient recycling and above all long term economy for sustainability in highly frequented places. The motivation for the invention was to conserve water and save costs.

Water Saving urinals collect simply undiluted urine, which can then be easily treated and used. Water Saving urinals come in many shapes and materials: squatting slabs or wall mounted bowls are available, while materials range from cheap plastic to high quality plastics, porcelain or stainless steel. Prefabricated urinals are available both as high quality products and as low-cost options. Self-construction of inexpensive Water Saving urinals is also possible and easy and these can be successfully piloted / demonstrated in rural areas.

From a functional point of view the main distinguishing feature of Water Saving urinals is the type of stench barrier that prevents the emission of gases and odours from urine pipes. Simple and low cost urinals often have no stench barrier. Odour problems therefore may occur. Four types of stench barriers are available:

1. Membrane barriers
2. Liquid barriers
3. Electromagnetic barriers
4. Hydrostatic float barriers



From the practical implementation perspective, we discuss only the membrane barrier type Water Saving urinals.

Sanitation Initiative by Kirori Mal College, Delhi University

Kirori Mal College Delhi University is going to convert all their existing Urinals into Waterless Urinals in collaboration with GIZ and Ecosan Services Foundation, Pune.

Dr. Sudipta Ghosh, Associate Prof. (Chemistry) is leading the initiative. He has also planned a model for demonstrating “Zero Discharge Sewerage Systems”. Mr. Ghosh appreciated the low cost of conversion of traditional urinals into waterless urinals and has calculated that each such Waterless Urinals can save upto 65000 litres of water per year.



Membrane Barrier Type Water Saving Urinals

With the Membrane Valve for Water Saving urinals (for men's urinal only up to this point) you get a well running solution for saving lots of water for flushing and odour free urinals. The Membrane Valve can get easily fixed at common urinal bowls available in the market. Inside the tube a membrane is placed. The stream of liquid (urine) will open the valve which will close again as soon as the stream stops – hence the valve acts as an odour trap.

Cleaning of the urinals:

You can clean the urinal as normal periodically (e.g. once a day) with water and detergent (if necessary), to prevent odour from urine residues in the bowl. Another possibility is to use a Bacterial Detergent, which can be sprayed into the bowl for building up a bacteria culture which breaks down any organic residues from the urine in the bowl hence no flushing water is required any more.



Membrane Valve for Water Saving urinals



Common urinal pot for boys



Structure of the Membrane Valve:



Easy fixing of Membrane Valve at the urinal bowl



Strengths and weaknesses

Health impact

Water Saving urinals are more hygienic than most water flushed systems. The urinals enable a hygienic collection of urine with no risk of faecal cross contamination.

Environmental impact

Cleaning is simple and requires minimal effort. No adverse environmental impacts.

Costs and benefits

A simple and very inexpensive urinal can be self-built. Not only water can be conserved, but also costs of water and wastewater can be saved. The collected urine, if it is going to be used as a fertilizer, can be sold to farmers, or used at household level to increase harvests from gardens. Urine from public toilet can be used for forestry, public garden/parks and future research work to explore the medicinal properties of urine and also for extraction of potassium or production of crystalline urine fertilizer. Modern Water Saving urinals are sometimes more expensive than waterbased systems, but the reduced water costs allow rapid recovery of extra costs.

Technical suitability

The variety from high tech to low technologies allows adequate solutions for every situation. Even the urinals without stench traps are useful, if it isn't connected to the sewer and no water is disposed in the collection container. In this case the formation of odour would be negligible. Urine can be directly used in agriculture with dilution.

Urban Agriculture / City Gardening

Urban agriculture is the practice of cultivating, processing and distributing food in, or around, a village, town or city.

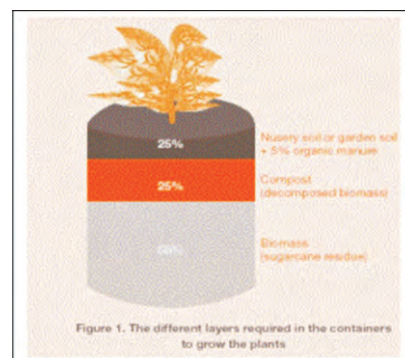
It contributes to food security and food safety in two ways: first, it increases the amount of food available to people living in cities, and, second, it allows fresh vegetables and fruits and meat products to be made available to urban consumers. Because urban agriculture promotes energy-saving local food production, they are seen as sustainable practices.



The recognition of environmental degradation within cities through the relocation of resources to serve urban population has inspired the implementation of different schemes of urban agriculture across the developed and developing world.

Conservation of Green Spaces : The Revered School Garden and the Hanging Food Gardens in Urban Drylands & Multi Stories

An interesting approach towards creation and conservation of Green Spaces in the school premises and also hanging food gardens in urban drylands & multistoried buildings has been developed by Dr. R. T. Doshi of Mumbai. His innovative approach aims at enabling city dwellers (which includes urban students, teachers & parents too) to grow their own food on every available square inch of urban space, including terraces and balconies, if they so desire. The methodology is cost effective and quite suitable for the schools as well. The farming techniques do not require long hours of work.



Every member of the family or if it is a school, the students could be involved in the creation, development and maintenance of the food garden. It provides the school students with ample nutrition from plant sources, eliminating the need for purchasing many kinds of vegetables and a few types of food from the market (http://undp.org/uploads/media/city_farming.pdf).

The farming is organic and his gardening materials include sugarcane wastes from sugarcane juice vendors and discarded polythene bags used to pack cement or fertilizers. The only item for which some payment may be necessary is soil.

The use of water in this system is also considerably less than in conventional farming. Since the plants grow in sealed bags or tyres or other cylindrical bags or containers, considerably less water needs be given compared to if the plants were receiving water while growing on soil in open fields where most of the water would leach underground or even evaporate since the area of evaporation would be extremely large and unconfined.

What Dr.Doshi has done is to put into practice the ideas propagated by the Prayog Parivar, an institution set up by Shripal Achyut Dabholkar from Kolhapur, Maharashtra. Such kind of socially useful innovations promoting successful urban or city farming are simple enough to be promoted among schools in different countries. (Source: <http://www.iwmi.cgiar.org/southasia/ruaf/CD/ho1.html>)

Further Reading:

-find more information on the innovation of city farming under: http://ssc.undp.org/uploads/media/City_farming.pdf

Plan to Develop a City Farm at Rosary High School Dockyard Road, Mumbai

Introduction: "Dockyard" is an historical quarter of the port city of Mumbai. The arterial road running through this area connecting north and south Mumbai on the eastern most side is P. D'mello road, ridden with slums whose occupants are primarily workers at the docks and fishing wharfs. This road bears heavy truckers traffic during most hours during the day with slum children dashing carelessly in front of colossal transport vehicles belching black smoke into the sea-kissed air.

Our main character Preeti had been witness to this sight of shanties and life in it for twelve years. This scene of poverty evoked in her at first feelings of repulsion, followed by compassion and then anger at being mere spectators to this environment. She noticed that life in ghettos continues despite all adversity. Having learnt the survival skills at a tender age, the children live a daring life willing to face challenges. She was drawn by idea of doing something creative for the children who had lot of potential in improving their lives given some opportunities.

Preeti had learnt an organic farming technique that required little material and manpower resources to grow plants successfully in the year 2000. Using this technique she went on to developing a terrace farm at her workplace at the Mumbai Port Trust, Central Kitchen that won accolades from horticultural authorities as well as impressed everyone who came to see it. The gardening activity turned out to be a great source of joy, a stress buster and a team builder. Then one day, while passing the often-traversed route of P.D'mello road the idea struck her of teaching this technique to the slum children to better their environment. The picture drawn in her mind's eye of an idyllic city, with people's resources used to green the otherwise gray and black hues of Dockyard Road, was extremely motivating. Her dream turned into a reality when she discovered piece by piece all the elements she needed to start a city farm project for the underprivileged children. Amongst the first building blocks of her project was the discovery of the NGO Vimla Vikas Kendra situated in the Rosary School compound right in the heart of Dockyard Road.

The salient features of the project are as follows :

1. Ensuing eco-friendly disposal of organic waste that is the need of the hour in this city.
2. Bringing awareness about organic farming techniques in slum dwellers and making them realize that organic farming does not require much investment, gives good nutritious food and gives higher returns.
3. The activity of urban farming not only nourishes the body but also the soul. Watching the plants grow responding to one's care and yielding fruits vegetables could be a very empowering experience enhancing one's self-esteem.
4. Increases the green cover, beautifies the surroundings, in the concretized jungles.
(Source: <http://www.iwmi.cgiar.org/southasia/ruaf/CD/ho1.html>)

Further reading:

Workshop reports from Rosary School Mumbai can be found here:

- <http://homepage.mac.com/cityfarmer/ROSARYWORKSMar05.pdf>
- <http://homepage.mac.com/cityfarmer/ROSARYWORKSFeb05.pdf>

Students Activity : Capture Good examples for documentation

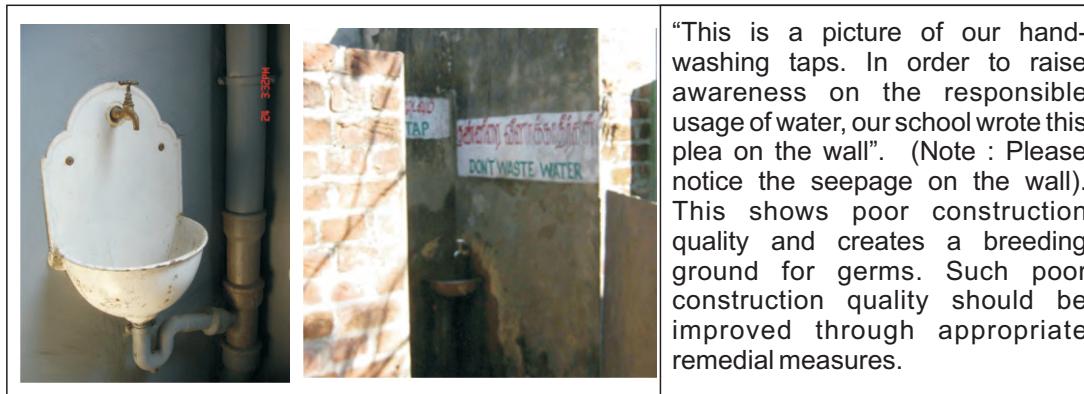
Please find the two following pictures as an example for such documentation of Eco-club activities as well as awareness raising at toilet facilities:



Members of the Eco-club plant seedlings for the new school garden-project."

The school students are encouraged to document real life sanitation situations along with photographs and send it to the website www.schoolsanitation.com for publishing on the web portal and e-Newsletter "The School Sparrow". Similarly, steps taken by the schools to improve sanitation facilities functioning of "Health & Wellness-/Eco-club", as well as information provided on toilet or other relevant facilities, like the school garden or green spaces should be documented and used for the betterment of the sanitation ratings of the school and also for submitting nominations for the National School Sanitation Awards.





Reports:

Provide us with written reports about different activities of the schools.

The students could include information (if applicable) on

- ⊙ The objective of the project / activity
- ⊙ The project history (If this activity has a certain history at one’s school and / or is already an ongoing activity for some years one can note that here).
- ⊙ Practical experiences made
- ⊙ Impacts expected and / or observed
- ⊙ Capacities and materials needed; costs

Please furnish as detailed information as possible, in order to give other schools a chance to evaluate if a similar improvement is possible for them and to give your school the chance of becoming a best-practice example in future NSSI-publications or uploading of the report at the web portal www.schoolsanitation.com.

- ⊙ Contact details of the people involved in the project

This should also include a description of their roles and responsibilities within the project
If a school decides to inform us about improvements made by it, information may preferably include the following:

- ⊙ Technologies applied

Description of applied technologies and implemented infrastructure with emphasis on collection and treatment facilities, application requirements, transportation distances, and justification of technologies (why the technologies have been chosen). Also: how were future users involved in the process.

- ⊙ Design
Design information that has been used in planning for the project
- ⊙ Operation and maintenance
Describe how the maintenance is carried out and by whom
- ⊙ Type and level of reuse
Description of the type and level of reuse applied in the project

A good example for such a report is to be found in Box x.x (see chapter on examples from Germany). Here it is the documentation of a German School Garden and consists of relevant information, i.e.:

- *school name*
- *contact person & author of the report*
- *who's participating (no. and age of kids) activities undertaken etc.*

*(literature used in this chapter: SuSanA - Case study template
(<http://www.susana.org/images/documents/06-case-studies/en-susana-cs-template-2011.doc>)*

Integrating Sanitation & Hygiene in Education

Sanitation is as much about human dignity as it is about hygiene and disease. The four important components of sanitation are safety, accessibility, affordability and cultural sensitivity. The centrality of sanitation to development though widely acknowledged, appears to be a distant reality, given the fact that 2.5 billion people lack access to basic sanitation. The impact of deficient sanitation on health, education and economic development is profound. Sanitation situation in India with more than 35% of its population having deficient sanitation facilities leaves much to be desired. As important as technological innovation and financial inputs is the need for an attitudinal change to bring about revolutionary change on our sanitation front.

Sanitation and hygiene needs to be integrated in school education in order to effect improvement in sanitary facilities as well as inducement of attitudinal change among the students.

School Sanitation and Hygiene Education, widely known as SSHE, is a comprehensive programme to ensure child friendly water supply, toilet and hand washing facilities in the

schools and promote behavioral change by hygiene education. SSHE not only ensures child's right to have healthy and clean environment but also leads to an effective learning and enrolment of girls in particular, and reduce diseases and worm infestation. SSHE was introduced in the RCRSP programme in 1999 both in TSC as well as in allocation based component. At present, SSHE is implemented under Total Sanitation Campaign (TSC) and given special thrust by following the proven route of teacher-children-family-community where child is a change-agent playing an effective role on sustained basis to spread the message of improved sanitary and healthy practices. TSC has made provision for toilet facility and hygiene education in all types of Government Rural Schools i.e. Primary, Upper Primary, Secondary and Higher Secondary schools with emphasis on toilets for girls. Central Government, State Government and Parent Teachers/GP share the cost in the ratio of 60:30:10. Govt. is committed to cover all uncovered rural schools with water and sanitation facility and also imparting hygiene education by 2005-2006.

SSHE Components

SSHE component of TSC aims to promote sanitation and hygiene in and through schools to bring about behavioral change that will have a lasting impact. The strategies are developed in tune with local needs which are adaptable and acceptable among target groups. These are involvement of child as a change agent to spread the sanitary practices in the proven route of Teacher - Children - Family - Community, emphasis on attitude and behavioral change



through hygiene education using life skill approach, Child friendly, especially girl child and disabled friendly, water and sanitation design options, inter-sectoral coordination through alliance building with concerned Ministries and Departments, and involvement of community and PTA as an equal partner. These strategies have been operationalised through two components. They are physical and software components. Physical Component that includes:

1. Construction of water supply points and storage facilities
2. Construction of toilet complexes with hand washing facilities
3. Construction of drainage system for waste water and urinals
4. Garbage pit Sulabh Technologies: Key to Improved Sanitation

Sanitation is a broad term that includes disposal of human excreta, waste water, solid wastes,

domestic, personal hygiene, etc. Human excreta is the cause of many enteric diseases such as cholera, diarrhoea, dysentery, typhoid, infectious hepatitis, hookworm etc. Studies reveal that over 50 kinds of infections can be transmitted from diseased persons to healthy ones by various direct and indirect routes from human excreta that cause nearly 80 percent of the diseases in developing countries.

In India out of a total population of 1027 million, according to 2001 census, 736 million people lack basic sanitation facilities resulting in high mortality and morbidity. Low sanitation coverage in India is primarily due to insufficient motivation, lack of awareness and lack of affordable sanitation technology. People (mostly from the lower economic strata) are generally not aware of the health and environmental benefits of sanitation and it is still not a "felt need" for them, resulting in the absence of people's participation in sanitation programmes. Non-availability of a choice of toilet designs, area specific technologies, inadequate supporting delivery systems and the absence of trained masons, skilled workers and technical manpower are also reasons for low coverage. By tradition, Indian society and culture values personal hygiene, but gives little importance to a clean and healthy community environment. Human excreta is regarded as the most hated object and anything connected with the latrine is considered so defiling that one is supposed to take a bath immediately after coming out of the toilet and before going into the kitchen - due to psychological and religious taboos. Sanitation is, therefore, regarded as a matter of individual initiative and not a collective obligation of the community. In this socio-cultural background, environmental sanitation has sadly been given the lowest priority.

A practical effort to integrate Sanitation & Hygiene is Sustainable School Sanitation Exchange Programme in collaboration with MoHRD, GIZ, CBSE, ESF (Ecosan Foundation), Pune and SEECON International, Switzerland.

Sustainable Sanitation Exchange Program

MoUD, MoHRD, CBSE, ESF and GIZ are coming up with National Sustainable Sanitation Exchange programme (NSSEP) followed by International exchange programs for school children in the coming academic year. This program aims at reaching out target groups who are the decision makers of tomorrow, educated youth in the age of 13 to 15 attending higher secondary schools. The whole programme will be executed in 3 stages; where Country is divided into four zones and school children from cities within zone will interact on internet platform regarding sanitation issues in the respective towns, Selected and best performers of the Zone will interact with the other best performers of the zones, and finally selected winner school will have exchange programme with students from International schools (Switzerland and Germany). We want our children to become the agents of change in our attitudes to sanitation. Against this background, the School Sanitation Manual, published as a

Best Options for School Sanitation: Meeting the Challenge

collaborative effort of my Ministry, Ministry of Urban Development, CBSE and the GIZ is an extremely laudable and timely initiative. I am sure, this Manual shall go a long way to realize our dream of "Sanitation for All" most expeditiously through our schools.



Certificate course on school sanitation:

CBSE in consultation with GIZ, MoHRD, SEECON, ESF and University of Norway will be starting a three months e learning programme on sustainable school sanitation. Certification course is designed to help teachers and school administrators tap into sector-specific knowledge of practices and approaches that are likely to yield positive results as they coordinate multi-sector efforts to improve sanitation and hygiene in schools. The e learning concentrates on the school environment, with focus on sanitation facilities and hygiene education in the education programs. Target groups will be teachers, Principal and Administrative staffs of schools. Upon successful completion of the course, participants will receive a Course Certificate.



Hand Washing



session on water aspects

Environment Education in the Tolkappiyar Poonga – A showcase from Chennai

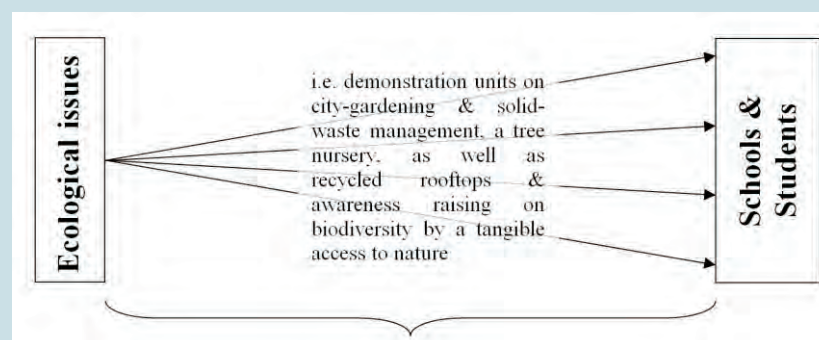
The Tolkappiyar Poonga (earlier called Adyar Poonga) is in the center of Chennai. Within the last 2 1/2 years, the former garbage dump has been turned into a 58 acre wetland ecopark that has already been visited by over 100,000 students since then. The park, which is open to school classes, today features around 200 species of indigenous trees and plants and is the natural habitat for over 140 species of fish, birds, reptiles, amphibians and mammals.

Effective conservation education simultaneously attempts to provide experiential adventure, transmit information, develop skills and promote values. This complex and difficult job is carried out by volunteers in the Poonga, who guide the students through the park and give them an understanding of the importance of a responsible and sustainable way of dealing with our eco-system.

The Tolkappiyar Poonga ecopark bridges the gap between ecological issues and the school students and thereby has an very important role as the interface between them.



The ecopark conveys knowledge in many fields to the students in several ways, of which some are presented in the following.



Best Options for School Sanitation: Meeting the Challenge



Also Organic farming, city gardening- and composting techniques find their place in the park and are explained and shown to the students.

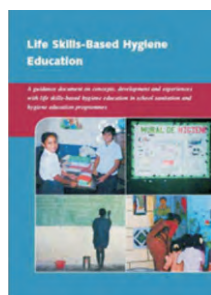
To show the opportunities of recycling, some roofs in the park are made of recycled Tetra Paks. Also traditional roofs from natural materials have been obstructed in many cases and show, besides others, options for eco-friendly building materials.



An almost countless number of information boards gives the students the chance to learn about flora, fauna, the eco-system and others. This picture shows some of these boards in one of the so called interpretation huts, that can be found at several locations in the park and that invite the students to stay for a little while. The park also holds exhibits of different plants and animals, and offers class room facilities for different activities.



<p>Sourabh Phadke: Alternative ways of raising awareness</p> <p>Sourabh Phadke, a teacher and architect from Pune, Maharashtra developed his own way to raise awareness among children. He gives presentations and publishes these as well as brochures and short books, that are first and foremost child-friendly.</p>	
	<p>All of his materials are published free of charge on his website (www.sourabh.tk) and are thereby easy accesible for all schools. Besides sanitation he also features other ecological important topics where children can „meet“ and learn about the importance of the earthworm.</p>



Life Skills-Based Hygiene Education

published by International Water and Sanitation Centre (IRC) and Unicef

A guidance document on concepts, development and experiences with skill-based hygiene education in school sanitation and hygiene education programmes.

(http://www.irc.nl/content/download/11504/168690/file/life_skills.pdf)

Eco-activities at Schools in Germany

School gardens in Germany have a long history of more than 300 years and are an often to be found institution in German schools. Mr. August Hermann Francke is known as the first person to have created a School garden in the German city of Halle in 1695.

In the German state of Baden-Württemberg for example more than 40 % of the schools are equipped with a school garden or a close to nature surrounding.

The objectives of German School Gardens are educating the students on:

- ⊙ planning, creating and maintaining a vegetable patch,
- ⊙ gardening without poison,
- ⊙ composting,
- ⊙ animal welfare,
- ⊙ conservation measures such as the construction of nest boxes for birds, insects and bats, and
- ⊙ healthy diet.

Instructions and examples for different composting techniques, i.e. vermi-composting, can be found in the National School Sanitation Manual (2010) on pages 80 to 86.

Documentation of German School Gardens on the web

The federal state of Baden-Württemberg maintains a website only about school gardens. Many school gardens have been well documented by the schools and are now presented to the public. It is a great example on how school gardens and other activities can be documented and how they can provide ideas and inputs for other schools (<http://www.schulgaerten-bw.de/cms/index.php?id=15>).



The screenshot shows a website page for 'Bodelschwingh Reutlingen'. At the top, there is a navigation bar with links: 'About Us', 'Information', 'School gardens', 'Schedules', 'Search', and 'Sitemap'. Below the navigation bar, the page title is 'Bodelschwingh Reutlingen'. To the left of the main content, there is a box with the text 'To Login imprint'. The main content area includes the following text:

Address:
Bodelschwingstraße 25
72762 Reutlingen

Contact: Christine Dehlinger-Prax
E-mail: Bodelschwingh-Schule@Reutlingen.de

The school garden work on the Bodelschwingh Reutlingen
(Reporting by Christine Dehlinger-Prax (Sonderschullehrerin) as of July 2007)

The Bodelschwingh school on their school premises a large school garden with many vegetable and flower beds, a large herb bed, a pond with stream, hedges, fruit and ornamental trees and a larger garden house (straw bale house).

The school is the school garden work, a small group room is available, which is set up as greenhouse cultivation and gardening space.

For many years, the school garden work in the context of the work-teaching (intermediate) and AG in the form of offerings for all levels is well established in the timetable. Also during the annual project week, usually a garden project is available.

The garden is visible from many classrooms, a school board in the lower garden staircase up to date information about the changes, observation opportunities and latest developments there.

The preparation and organization of regularly scheduled sales deals during the breaks (Fall: pumpkins, nuts, lantern flowers, Christmas and Valentine's Day: hyacinths, indoor plants, early summer: vegetable and flower seedlings) are additional actions with and for the pupils at the gardening in the School Year has its place.

The children of the **lower level** are within their class instruction and one hour by AG-offers to the school garden work-out approach. The two Montessori classes (Class 1-3A, Class 1-3b) process with the help of gardeners from the Middle School each held their own bed, to which they have direct access from their classrooms. To grow rhubarb, strawberries, raspberries, tomatoes, beans, peas, ... and flowers that were brought forward some of the children in the

On the right side of the page, there are two photographs. The top one shows two children working in a garden bed. The bottom one shows a small, yellow, single-story building with a dark roof, likely the garden house mentioned in the text.

A nice example of proper documentation can be found for the School Garden of Bodelschwingh-School in Reutlingen, Germany (Source: <http://www.schulgaerten-bw.de/cms/index.php?id=138>)

Source:http://www.schulgaerten-bw.de/cms/uploads/pics/startseite_4.jpg



Institutional Framework:

To support the nationwide work in School Gardens the „Federal Working Group School Garden“ (Bundesarbeitsgemeinschaft Schulgarten – BAGS) was founded in the year 2002, under the umbrella of the German Gardening-Society from 1822. It develops training opportunities and educational concepts.



Source: http://www.schulgaerten-bw.de/cms/uploads/pics/startseite_3.jpg



<http://www.stuttgart.de/img/mdb/item/354082/44187.jpg>

Sanitation and Hygiene in Primary Schools in Uganda

Child Health and Development Centre, Makerere University

A Study

The introduction of Universal Primary Education resulted in a rapid increase in the number of children in the primary schools from 5.3 million in 1997 to 7.3 million in 2002.

Almost all schools did not meet the minimum sanitation and hygiene school standards. Government efforts have focused on construction of toilet facilities in government-aided schools only. As such, emphasis has been on facility development with less focus on changing practices in sanitation and hygiene in schools. Functional sanitation facilities were mostly pit latrines in rural schools and VIP latrines in urban schools. Water closet and newer technologies such as ECOSAN and Mobilets were being explored for economising on space and addressing poor soil textures.

Although there has been a steady improvement in pupil-stance ratio from 150:1 (1997) to 60:1 (2004), the average pupil-stance ratio for primary schools was still much higher than set standard (40:1). Only 72% provided separate facilities for boys and girls. Physical discomfort and pain was reported to be the main hindrance for girls to attend school during menstruation as well as lack of sanitary materials for 1 in

10 girls. Lack of privacy (16%), fear of soiling toilets (31%), and poor toilet hygiene (51%) greatly contributed to discomfort of girls using toilet facilities during their menses.

Close to 80% did not allocate separate toilet facility for specific classes; the very young shared facilities with older pupils. In a third of primary (37%) and a higher proportion (52%) of secondary schools, teachers shared facilities with pupils/students. Floors in most primary schools (80%) and secondary schools (79%) were wet and dirty while walls were smeared with faeces in 1/3 primary and 1/4 secondary schools visited. Toilet surroundings were littered with faeces/urine in 2/5 primary and 1/5 of secondary schools. Toilet facilities were within standard distance from classrooms but poor hygiene led to pupils complaining of close proximity to classrooms. Almost 1 in 6 of primary school toilet facilities had no doors and two thirds (64%) of those with doors could not lock from inside. Toilet papers were present in only a quarter (23%) of primary schools. Urinals for boys were present in 84% of primary schools and 77% of secondary schools. Only a quarter of schools with disabled children reported to offer separate toilet facilities for these children.

Hand washing facilities were present in about four in ten primary schools (39%), thus schools failed to provide an enabling environment to students for hand washing. Less than 1 in 5 primary schools met recommended standard of 5 litres per day per pupil in day schools and 25 litres per pupil per day in boarding schools.

Sanitation has not been taken as a priority; as a result some schools have failed to take sanitation and hygiene seriously. Construction costs were high, with a 5-stance VIP costing between 4-6 million Uganda shillings, a formidable barrier to scaling up sanitation improvement in schools. A multi-sectoral approach and collaboration, policies and guidelines should be actively translated into real action and backed by resources for their implementation so as to improve the sanitation and hygiene situation in schools.

Sanitation Scenario in Primary Schools of Bangladesh

There are approximately 78,000 primary schools in the country (almost every village has at least one primary school) and about 20 million students are enrolled. There is at the moment, no national information on the state of sanitation facilities in these schools. This may be an indication of the lack of attention on this crucial issue in the past.

With just one latrine in a school, the experience is that this sole latrine tends to be locked and reserved for the exclusive use of the teachers only. Where there are two latrines, one is locked and reserved for use by the teachers and the other is used by both boys and girls. In such cases girls, especially, during their menstrual period are often unwilling to use the latrines and make their own (often unhygienic) arrangements or simply skip school.

The average number of students in each primary school in Bangladesh is 226, it varies from below 100 to 1000 or more in some cases. In general, the number of boys & girls is the same in primary schools. Most of the schools run two shifts which implies that the average number of students per shift is 113 and the ratio of boys to girls is one to one.

At present there are no readily available figures on the state of water supply and sanitation facilities in all primary schools in the country. A recent study done by UNICEF (An Assessment of School Sanitation

Best Options for School Sanitation: Meeting the Challenge

and Hygiene Education (SSHE) strategy with particular focus on Technology design, the needs of adolescent girls and adequate water and sanitation facilities in schools, DPHE & UNICEF, BCO,) with data collected from 4,388 primary schools, showed the following key statistics:-

- Average of 246 students and 4 teacher per school 19% school have no water source, 28% have non-functional water source, 53% have functional water source
- 6% have no latrine, 13% have a non-functional latrine, 25% have one latrine, 44% have two latrines, 12% have three or more latrines
- 46% have separate latrines for girls
- On average there is one latrine for 152 pupils.

(Addressing Special Needs of Girls : Challenges in School by Qumrun Nahar ,Project Officer ,WES Section, UNICEF, Bangladesh & Rokeya Ahmed , Poverty and Equity Advisor , WaterAid, Bangladesh)



Introduction to Sanitation Systems and Technologies

The main objective of a sanitation system is to protect and promote human health by providing a clean environment and breaking the cycle of disease. In order to be sustainable, a sanitation system has to be not only economically viable, socially acceptable, and technically and institutionally appropriate, it should also protect the environment and the natural resources.



The basic concept of collecting domestic liquid waste in waste-water sewer systems, treating the wastewater in centralized treatment plants and discharging the effluent to surface water bodies became the accepted, conventional approach to sanitation in urban areas in Europe in the last century. Although these conventional sewer systems have significantly improved the public health situation in those countries that can afford to install and operate them properly, there are alternative treatment methods besides the conventional ones. The conventional sewer systems were developed at a timewhen the existing environmental conditions and available technologies made it an appropriate solution for removing liquid from cities. Today with increased population pressure, changes in consumer habits, rapid urbanization, changing technologies and increasing pressure on freshwater and other resources, the conventional human waste disposal system alone is no longer able to meet the

pressing global needs and definitely is not the only solution for waste disposal, though it no doubt still is a very good technological solution.

Therefore, the focus of waste management has shifted to :

- ⊙ Identify appropriate simple, affordable decentralized sanitation systems and promote their adoption.
- ⊙ Implement appropriate technologies with the participation of the communities to be served and
- ⊙ Focus on health and hygiene education so that physical facilities would be properly used and maintained, and that hygienic behaviour would support the improvements brought about by the infrastructure.

Over the years, it became clear that this health and hygiene driven paradigm shift was still incomplete and in practice the faecal sludge management problems were often overlooked as were negative downstream effects of effluents from sewer systems. Protection of the environment, resource conservation and waste reuse remained secondary concerns at the best or were neglected in totality. The recurrent operational problems complicated the matters further and the desired level of public health was seldom achieved in developed countries.

The Sustainable Sanitation Alliance's calls for a paradigm shift from disposal towards reuse oriented sanitation systems, so that all the dimensions of sustainability in waste management could be taken into account.

Further, in addition to paying particular attention to the health aspects at household level, a holistic and reuse-oriented sanitation approach must emphasize the following:

- ⊙ *The destruction of pathogens through flow stream separation, containment and specific treatment.*
- ⊙ *Resource conservation through a reduced use of potable water as a transport medium for human waste and by recovering wastewater for irrigation.*
- ⊙ *The elimination or minimization of wastewater discharges to the environment*
- ⊙ *The need to close the resource loops through the productive use of nutrients and energy (biogas) contained in excreta.*

Thus ideas of recycling of waste emerged & technologies for waste water recycling & solid waste recycling emerged. This eco-compatible concept is the best outcome of the paradigm shift initiated in response to satisfying the health needs of unserved, mostly poor population groups.



A sanitation system consists of a multi-step process in which human excreta and domestic sewage are managed by a sequence of technologies from the point of generation to the point of reuse, recycling or safe disposal. There are a range of sanitation systems with different types of technologies. Some sewerage system templates can be studied in order to understand the flow streams for different sanitation systems, including “wet” and “dry” technologies. These are illustrated by case studies taken from different parts of the world. An idea of such different systems is considered to be essential for the school students in order to enhance their knowledge about the waste disposal technologies.

To address the sanitation challenges under Millennium Development Goal, numerous technological innovations have been developed. But with such a wide range of technologies that may be appropriate in different settings, difficulties with communication and knowledge dissemination hinder informed decision making and the integration of all sanitation elements. The different sanitation systems could be categorized according to the related processes and the resulting products. Different systems are presented diagrammatically using a “flow-stream” concept in which technologies are grouped and used to construct seven different systems.

A sanitation system - contrary to a sanitation technology - considers all components required for the adequate management of human wastes. Each system represents a configuration of different technologies that carry out different functions on specific waste inputs or waste products. The sequence of function-specific technologies through which a product passes is called a flowstream. Each system is therefore a combination of product and function-specific technologies designed to address each flowstream from origin to reuse, recycling or safe disposal. Technology components exist at different spatial levels, each with specific management, operation and maintenance conditions as well as potential implications for a range of stakeholders. Starting at the household level with waste generation, a system can include storage and potential treatment and reuse of all products such as urine, excreta, greywater, rainwater, organic solid waste from the household and agricultural activities or manure from cattle, at or near, the source of waste generation. However, problems can often not be solved at the household level alone. The household “exports” waste to the neighbourhood, town, or downstream population. In such cases, it is crucial that the sanitation system boundary is extended to include these larger spatial sections; those that take into account technology components for storage, collection, transport, treatment, discharge or reuse at these levels.

Sanitation systems can be distinguished by being water-reliant or non-water reliant with regard to the transport of excreta. This systematic distinction is used in characterizing sanitation systems. One such system is popular in Philippines and has been covered in the Philippines Sanitation Source book and also in the NETSSAF coordination action project.

Besides water-reliant or non-water reliant, another distinction can be made through classification of the various degrees of separation of incoming wastes. Urine diverting sanitation systems, as the name says, keep urine separate from faeces from the very beginning. On the other hand sewer based sanitation systems mix faeces, urine, flushing water, greywater as well as wet or dry anal cleansing materials resulting in a waste product classically called wastewater. It is important to note that, depending on the degree of waste mixing or separation, various “flowstreams” can be distinguished which consequently must be accounted for in the subsequent functions of the sanitation system.

“Wet” and “Dry” indicate the presence of flushing water for the transport of excreta. This however only gives a certain indication of how wet or dry the collected waste materials will be. Although flushing water might not be used (and would not therefore qualify as a “Dry system”) a system may nevertheless contain anal cleansing water or even greywater. Also, Wet systems are characterised by the production of a parallel product: faecal sludge. In wet systems then, the faecal sludge flowstream must be taken into account and treated accordingly with its own set of process- and product-specific technologies until the point of reuse or ultimate disposal. As an example for a set of sanitation systems, the following system categorisation is given, which is based on the findings from NETSSAF (Network for the development of Sustainable Approaches of large-scale implementation of Sanitation in Africa) (NETSSAF, 2007).

Technical Options Suitable for Schools- Appropriate Systems & Technologies:

It is very important to select appropriate and child friendly technical options specially for girls and children with special needs.

Norms for child, gender and special needs friendly toilet

- ⊙ Access to toilet must be open and clear without any hindrance.
- ⊙ If the toilet for boys and girls are in one complex, they should have separate entrances preferably on opposite sides to avoid inconvenience and ensure privacy.
- ⊙ There should be hooks for hanging clothes.
- ⊙ Factors like lighting, ventilation, provision of doors with system of latching, etc also need to be taken into account.



Best Options for School Sanitation: Meeting the Challenge

- ⊙ The superstructure should be such that students feel safe and comfortable using toilets.
- ⊙ Hand washing space should be located at the most convenient place.
- ⊙ Availability of water and other cleaning material such as brush, phenyl, mug, soap must be secured.
- ⊙ Toilet designs should also cater to the needs of children with special needs having simple adaptations such as :

Low level of hand rail in toilet.

Ramps, in case the toilet is at higher level or raised stool in case of Indian pan. Steps should be avoided as far as possible.

A pipe to be attached to the tap for self-cleanings (as the child will be holding the bar/ hand -rail for balance).

Furthermore, it must be recognized that children of different ages have also different physical strength and motor skills, requiring sometimes-special solutions. Following aspects must also be considered and measured:

- ⊙ Height of doorknobs and locks.
- ⊙ Height of steps and handrails of stairs.
- ⊙ Weight of the doors.
- ⊙ Strength needed to open taps, fetch water, etc.
- ⊙ Diameter of the squatting hole (needs oftentimes also psychological considerations because of fear of falling through)

Sulabh Flush Compost Toilet

Due to financial constraints and exorbitant maintenance and operational costs, sewerage is not the answer at present to solve the problem of human waste management in India. Sewerage was first introduced in London in 1850, followed by New York in 1860. Calcutta in India was the next city in the world to have this privilege in 1870, yet out of over 4,800 towns and cities in India only 232 have sewerage system and that too partially. In the developing countries neither the government nor the local authorities, or the beneficiaries can bear the total capital expenditure and the operation and maintenance costs of a sewerage system.

These days Ministry of Urban Development, Government of India is running a programme called "Jawaharlal Nehru National Urban Renewal Mission" (JNNURM) under which infrastructure & technological systems for sanitation management in development.

62 major cities are being taken up through the concerned State Governments.

Moreover, it requires skilled persons and good management for operation and maintenance. It requires over two gallons of water to clean human excreta. Do we build huge dams and irrigation systems to bring in water only to flush it down into an expensive sewage system, all ending up polluting our rivers and ponds? Most of the rivers are heavily polluted due to untreated domestic sewage load from the cities flowing into them. This has led to a deterioration of groundwater aquifers and community health.

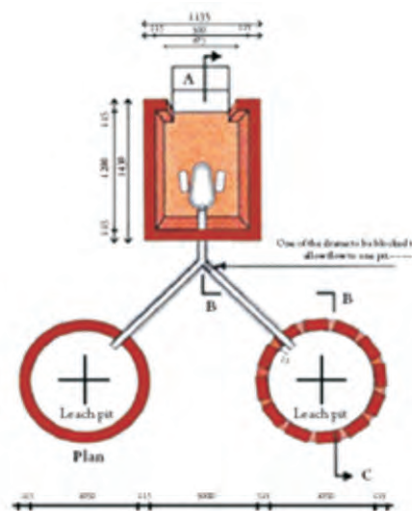
The septic tank system also requires a large volume of water for flushing. There is a shortage of drinking water in almost all the urban areas; hence water has to be conserved. Septic tanks have other problems like periodic cleaning and the disposal of sludge. Inadequate effluent disposal is a cause of foul smell, mosquito breeding and health hazards. An efficient septage management becomes vital in this system.

Sulabh flush compost toilet is eco-friendly, technically appropriate, socio-culturally acceptable and economically affordable. It is an indigenous technology and the toilet can easily be constructed using local labour and materials. It provides health benefits by safe disposal of human excreta on-site. It consists of a pan with a steep slope of 250-280 degrees and a specially designed trap with a 20mm water seal requiring only 1.5 to 2 litres of water for flushing, thus helping conserve water. It does not need scavengers to clean the pits. There are two pits of a size and capacity depending on the number of users. The capacity of each pit is normally designed for three years usage. Both pits are used alternately. When one pit is full, the incoming excreta is diverted into the second pit. In about two years, the sludge gets digested and is almost dry and pathogen free, thus safe for handling as manure. Digested sludge is odourless and is a good manure and soil-conditioner. It can be dug out easily and used for agricultural purposes. The cost of emptying the pit can be met partially from the cost of manure made available. Sulabh toilets can also be constructed on the upper floors of buildings. It has a high potential for upgrading, and can later be easily connected to sewers when introduced in the area. Sulabh has so far constructed over a million individual



household toilets in different parts of the country.

The Sulabh flush compost toilet does not cause water pollution. When constructed in homogeneous soil, horizontally bacteria do not travel more than 3 meters, and vertically the seepage is not more than 1 meter. To this is to be added the precaution that the toilet is built at a safe distance from the source of water, keeping the above points in mind. If there is a tube-well or a sunk hand pump, the first joint should be lower than the limit of the vertical seepage. No vent pipe is needed since the gas gets absorbed in the soil facing the chamber, as the brick lining inside is in lattice formation. The parameters change depending upon the coarseness of the soil and the type of terrain where the toilet is being constructed. Depending on the availability of space, the shape of pits may be designed. It may be rectangular, circular or linear in shape. It fulfills all the seven conditions of a sanitary latrine laid down by the WHO. (Excreta Disposal for Rural Areas and Small Communities by E.G. Wagner and J. N. Lanoix, WHO, 1958, pp. 39). These conditions are:



- a) The surface soil should not be contaminated.
- b) There should be no contamination of ground water that may enter springs or wells.
- c) There should be no contamination of surface water.
- d) Excreta should not be accessible to flies or animals.
- e) There should be no handling of fresh excreta, or when this is indispensable, it should be kept to a strict minimum.
- f) There should be freedom from odours or unsightly conditions.
- g) The method used should be simple, inexpensive in construction and operation.

Septic Tank

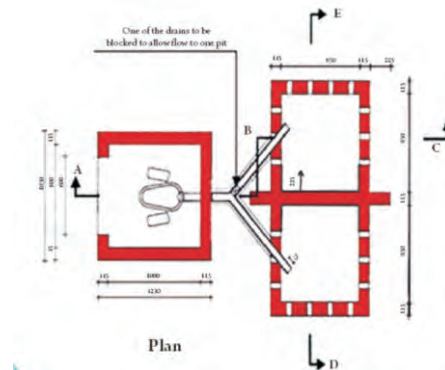
Description :- **Plastic and Concrete Septic Tanks**

Septic tanks are water-tight containers, which provide primary treatment by separating, retaining and partially digesting settleable and floatable solids in wastewater. They can be used in combination with any type of water seal toilet (preferably pour- or low- flush). Septic tank effluent must receive proper secondary treatment before being discharged to the groundwater or surface water bodies. Directly ensuing soakage pits may not be applied, if the vertical

distance from the bottom of the soakage pit to the highest seasonal groundwater is less than 1.5 meters. In these cases, septic tanks must be combined with French drain filters, constructed wetlands, baffled reactors or equivalent treatment. Septic tanks accumulate sludge, which must be emptied after approximately five years and treated separately.

The use of Septic Tanks Systems is Feasible under the Following Conditions:

Suitable if flush water is available, space requirements are met, and underground septic tank installation is feasible. Suitable in densely populated locations with high ground water table - if secondary treatment can be provided, gully sucker access is possible, and gully suckers and sludge treatment facility is available or can be anticipated.



Required before small-bore sewer systems

Not advisable in areas of great water scarcity (lack of flush water) or rocky underground.

Advantages and Challenges

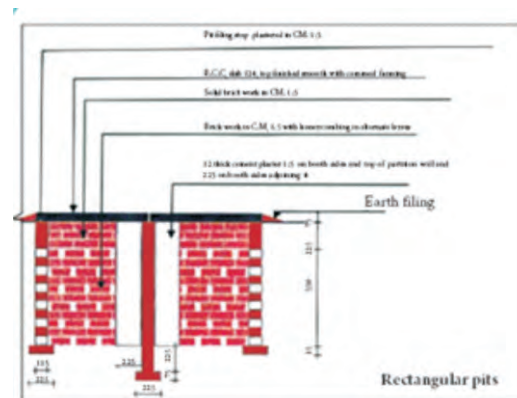
Advantages, etc.

----> Table ---> Advantages, etc.

Essential Design Information

Structural

A septic tank must be water-tight and must provide sufficient structural strength and integrity to withstand external soil pressures, internal and external water pressures and any likely imposed loading. Septic tanks situated under driveways and parking areas shall be designed to carry the appropriate vehicle loads.



In areas of high groundwater table, the tank should be filled with water immediately after or during installation to prevent flotation.

Capacity

A septic tank should consist of at least two chambers (the first one should be twice the size of the second).

The preferred geometry of a septic tank is rectangular, with length between two to four times the width. Tanks of other shapes such as circular section (with axis either horizontal or vertical) may be used, provided the area of the water surface in the tank during normal operation is sufficient to ensure the proper separation of solids.



In the absence of detailed analysis, the minimum surface area requirement may be estimated empirically as follows:

- ⊙ Minimum surface area (m²) = working capacity of tank (m³)/3.
- ⊙ The working capacity of a single tank shall always be greater than 1 m³ & less than 12 m³.
- ⊙ Where the required working capacity exceeds 12 m³, parallel sets of tanks shall be used such that the working capacity of each is less than 12 m³,
- ⊙ The minimum internal width of a tank shall be 750 mm.
- ⊙ The minimum depth below liquid level shall be 1 m.
- ⊙ The working capacity of a septic tank must be selected appropriately to allow for adequate separation and retention of settleable and floatable solids.



Inlet and Outlet Arrangements

In case of elevated toilet rooms, exposed pipes should be secured so as to prevent people, especially children from climbing these pipes. Tee fittings (allowing access through maintenance openings for cleaning) shall be provided at the inlet and outlet. The inlet fitting shall extend below the water level in the tank by at least 20 percent of the liquid depth. Ideally, it should extend down to 20 cm above the floor of the tank. The outlet fitting shall extend a minimum of 300 mm below the liquid level of the tank. The invert of the outlet pipe shall be at least 50 mm below the invert of the inlet pipe.

Access Openings

One or more access openings shall be provided for inspection and de-sludging. Openings may be circular, square or rectangular. Circular access openings shall be at least 500 mm in diameter. Square or rectangular openings shall have a minimum minor dimension of 500 mm. Septic tank maintenance lids should be secured with concrete slabs or a water tight weak mortar mix to prevent misuse or rainwater and groundwater infiltration.

Freeboard

A minimum of 200 mm freeboard shall be provided between the liquid level and the highest point of the tank ceiling. The air space thus provided shall have a volume equivalent to at least 10 per cent of the total tank volume.

Chamber Partitions

Septic tanks should have multiple compartment tanks. Chamber partitions shall have one or more openings of a total area greater than the area of the inlet to the tank, at a height between 30 - 70 percent of liquid depth from the bottom of the tank. The minimum dimension of an opening shall be 100 mm.

Vent Pipe

A vent pipe of minimum 25 mm diameter shall be provided extending outside the tank to above the toilet house roof. A single vent pipe is sufficient, provided the air space in each chamber of the tank is interconnected with another through an opening of minimum 25 mm diameter. If not, each chamber must have a separate vent. The pipe shall be covered with a suitable mosquito proof mesh at the top.

Sludge Minimisation

Several simple measures can greatly reduce the amount of sludge accumulation within the septic tank:

- ⊙ Make sure the septic tank is air-tight (providing anaerobic conditions within the tank).
- ⊙ Extend the inflow pipe to 20cm below the floor of the first chamber (to ensure mixing of new with old sludge).
- ⊙ Provide a ventilation pipe, which extends above the roof of the toilet house.

Important

Septic tanks only provide pre-treatment. If the distance from the bottom of the intended soakage pit to the highest seasonal groundwater is less than 1.5m, appropriate secondary treatment must be applied. The implementing agency should complete the design, supervise the construction until completion and guarantee the proper function of the system for a time period of one year.

Operation and Maintenance

All systems shall be inspected for structural defects, defects in construction and conformity with the design specifications prior to commissioning. All such defects detected shall be repaired and rectified such that the original requirements are satisfied prior to commissioning the system. Pre-commissioning tests to ensure watertight fitting shall be performed. Septic tanks must be filled up to the liquid level with water prior to commissioning. Since the biological processes within the septic tank require up to six to eight weeks to reach full functioning capacity, the tank may be 'seeded' to accelerate the start-up process. Seeding shall be done by adding a small quantity (up to one fifth the working capacity of the tank) of digesting sludge from a functioning septic tank, or fresh cow dung slurry or pig slurry. The 'seed' shall be added to the first chamber of the tank.

Depending on the size of the septic tank, waste water quality and the number of users, sludge must be removed from the system every three to five years. Every six months, users should monitor the sludge and scum levels within the septic tank using the 'white towel' test. When sludge accumulation has reached one third to half of the depth of the liquid tank volume, it should be removed. Adequate sludge removal and treatment services must be provided; service access to the septic tank must be guaranteed. Tanks should not be completely emptied during desludging. Between 100mm - 150 mm of sludge should be left: at the bottom of the tank as 'seed' for the next cycle of operation.

The most common form of blockage is due to solids blocking the inlet device in a septic tank. This may be cleared by prodding the inlet device from above(through an access opening or inspection port) with a suitably flexible rod. All access covers shall be properly replaced and sealed air-tight after each opening.

Broken and damaged access covers shall be promptly repaired or replaced. The mosquito-proof mesh cover over vent pipes shall be inspected monthly and replaced as required

Users should not apply chemical detergents for toilet bowl cleaning to ensure proper treatment and prevent fast sludge accumulation.

They should be trained in the required maintenance during construction

Approach and Tools

- ⊙ Hygiene promotion programmes.
- ⊙ Training users on water saving, toilet cleaning and the importance of proper septic tank sludge removal

Cross check - Septic tank system not to be applied under the following conditions.

- ⊙ No space for on-site septic tank installation
 - ⊙ Great water scarcity (lack of flush water)
 - ⊙ High groundwater table, appropriate secondary treatment cannot be provided
 - ⊙ Site is not accessible by gully sucker
 - ⊙ Rocky underground (difficult installation)
 - ⊙ Gully suckers and sludge treatment facility is not available and cannot be anticipated in the near future
- a) Grey Water Treatment Systems: Without combining with the overall waste water treatment systems, this separation will allow direct reuse for flushing purposes, for residential schools. Secondly, grey water treatment is simple as compared to mixed waste water treatment, and less expensive
- b) Wet Composting Bio Gas Systems: For wet garbage which is generated from day schools run by ULB's and where the mid-day meal programme is run by the Government under "Sarva Shiksha Abhiyan", ART! bio-gas digesters are an effective option for both bio-gas generation and composting. The ARTI system has been awarded the prestigious "Ashden" award

Anaerobic Sanitary Systems Description

Sanitary bio-gas systems are efficient, hygienic and ecologically sound waste water treatment units with the additional benefits of energy production and an effluent of high nutrient content. They can be combined with any type of (low-), flush toilet (including pour flush) and their

effluent can be used directly for fertiliser application and irrigation. Alternatively, they can be followed by constructed wet lands or other aerobic tertiary treatment to allow other forms of reuse of the effluent for car-washing, toilet flushing or outdoor cleaning purposes. The treatment of organic solid kitchen and garden waste can also be integrated into the concept to increase bio-gas production and reduce household waste. Unlike septic tank systems, sanitary bio-gas units do not require frequent sludge removal.



The system is applicable under the following conditions:

- ⊙ The system is suitable under most conditions. Flooding of the facility during construction must be prevented in areas of high groundwater. The system is not suitable in areas of great water scarcity or rocky terrain. Public buildings including schools with secured - even if limited - water supply, allowing reuse.
- ⊙ Newly constructed toilets attached via a small bore sewer, gravity sewer or vacuum network.
- ⊙ Sanitary bio-gas systems should compete with costs for septic tanks.
- ⊙ Depending on local conditions different designs may be appropriate and could be adapted with design support from bio-gas technology experts

Essential Design Information

A sanitary bio-gas unit must be constructed air-tight to guarantee the intended anaerobic microbiological processes. These processes minimize sludge accumulation (only 10 percent



removable sludge compared with aerobic treatment systems) through acidification, liquefaction, and fermentation of the settled solids and the production of bio-gas. Eighty percent of the organic matter is converted into bio-gas, while a residue of organic matter is pushed out in dissolved form as effluent. Subsequently, the rate of degradation equals that of formation - eliminating the need for sludge removal. Biological activity demands average soil temperatures above 15 degrees Celsius.

If bio-gas is to be utilized, it can be assumed that the toilet black water of approximately five households (maximum about 40 litres of bio-gas/(person x day) are produced without adding other organic waste) are needed to cover the basic cooking needs of one family (1m³ bio-gas per day). Lighting (heating) with bio-gas lamps is feasible, but recommended only as a secondary solution, due to increased maintenance issues and low energy use - only three-five percent of



the energy content is used for generating light, the rest is emitted as heat. One should try to attach multiple waste water producers to the unit, as the cost per capita decreases with the size of the treatment facility. Incurring costs are offset by the benefits from use of the gas for cooking or lighting. For volume consideration it must be considered, that it takes at least twenty days to eliminate 90 percent of UOD (ultimate oxygen demand) from black water. And pre-sanitization of black water takes at least 50 days at temperatures around 30 degrees Celsius. The implementing agency should complete the design, supervise the construction until completion and guarantee the proper function of the system for a time period of one year.

Community / School Toilet Linked Bio-gas Plant

Recycling and reuse of human excreta for biogas generation is an important way of getting rid of health hazards from human excreta. Sulabh is the pioneering organization in the field of biogas generation from public toilet complexes. After a series of experiments, the organization developed an efficient design for a biogas plant that has been approved by the Ministry of Non-conventional Energy Sources, Government of India. Biogas plants using this design will be introduced through the State nodal agencies. Human excreta contains a full spectrum of pathogens. Most of these pathogens are eliminated due to anaerobic condition inside the digester. Besides using biogas for different purposes, biogas plant effluent can also be used as manure or discharged safely into any river or water body without causing pollution. Thus biogas technology from human waste has multiple benefits; sanitation, bioenergy and manure. Based on the 'Sulabh Model' design, 190 biogas plants of 35 to 60 cubic meters capacity have been constructed by Sulabh in different states of the country so far. Human excreta based biogas technology remained unnoticed for long due to the fact that the available technology was not socially acceptable, as it required manual handling of human excreta, which contains a full spectrum of pathogens. The design developed by Sulabh does not require manual handling of human excreta and there is complete recycling and resource recovery from the waste. The digester is built underground into which excreta from public toilets flows under gravity. Inside

the digester biogas is produced due to anaerobic fermentation with the help of methanogenic bacteria. The biogas, thus produced, is stored in an inbuilt liquid displacement chamber. One cubic foot of biogas is produced from the human excreta per person per day. Human excreta based biogas contains 65-66 percent methane, 32-34 percent carbon dioxide and, rest is made up of hydrogen sulphide and other gases in traces. Methane is the only combustible constituent, which is utilized in different forms of energy. Its calorific value is 24 MJ / cum or about 5000 Kcal/ cum. One thousand cubic feet. (30 cubic meters) of biogas is equivalent to 600 cubic feet of natural gas, 6.4 gallons of butane, 5.2 gallons of gasoline or 4.6 gallons of diesel oil. Biogas is utilized for cooking, lighting through mantle lamps, electricity generation and heating during the winter. Cooking is the most efficient use of biogas. Biogas burners are available in a wide ranging capacity from eight cubic feet to 100 cubic feet biogas consumption per hour. It burns with a blue flame and without soot and odour. The biogas mantle lamp consumes two to three cubic feet per hour and has an illumination capacity equivalent to a 40 watts electric bulb at 220 volts.

Motive power can be generated by using biogas in a dual fuel internal combustion (IC) engine. Air mixed with biogas is aspirated into the engine and the mixture is then compressed, raising its temperature to about 3500C, which is the self-ignition temperature of diesel. Biogas has a high (6000C) ignition temperature. Therefore, in order to initiate combustion of the charge, a small quantity of diesel is injected into the cylinder just before the end of compression. The charge is thus ignited and the process is continued smoothly. At optimum conditions only 20 percent diesel is required, and the rest (80 percent) is substituted by biogas. Biogas consumption by the engine is 15 cubic feet/BHP /hour. A public convenience used by about 2,000 persons per day would produce approximately 60 cubic meters of biogas which can run a 10 KVA genset for eight hours a day, producing 65 units of power.

Sulabh has developed a novel technology to run a dual fuel genset on biogas alone i.e. without any diesel. Under the system, the ignition of compressed biogas takes place through a battery operated spark system. It is a new method to make biogas based electricity generation sustainable.

The human excreta based biogas system has multiple advantages: it improves sanitation, generates energy, can be converted to bio fertilizer, and reduces the green-house effect

Operation and Maintenance

Toilet users must be advised not to apply chemical detergents for toilet bowl cleaning, as their application kills the active bacteria in the digester (disabling the treatment process and

resulting in fast sludge accumulation, which must be removed from the digester) and can plug flow treatment units.

Maintenance must be carried out by trained personnel, who should be trained during the construction process. The trained personnel should check all control openings weekly and remove any obstructions to the regular flow. If bio-gas is utilized, storage, pipelines and appliances must be monitored regularly by trained personnel.

Baffle Reactor

Baffle reactors, also sometimes called baffled septic tanks, are efficient, hygienic and ecologically sound anaerobic treatment units for collected organic waste water. They can be combined with any type of (low-), flush toilet (including pour flush). Constructed out of local materials, the system provides easy maintenance, easily available spare parts and low operational costs; it does not have treatment process relevant movable parts and is not dependant on external energy inputs, like electricity. If the landscape is slightly sloped, water flow is caused by natural gravity, therefore no pumps are required. Effluent can be used for fertiliser irrigation or other forms of reuse for car-washing, toilet flushing or outdoor cleaning purposes, if followed by constructed wetlands or other aerobic tertiary treatment. If baffled reactors are constructed gas-tight, bio-gas can be collected and used.

The system is applicable under the following conditions:

- ⊙ Baffle reactors are suitable under most conditions. Flooding of the facility during construction must be prevented in areas of high groundwater. The system is not suitable in extremely water scarce areas without secured water supply (lack of flush water) or rocky terrain.
- ⊙ Public-buildings including schools with secured - even if limited - water supply, allowing reuse.
- ⊙ Newly constructed toilets attached via a small bore sewer, gravity sewer or vacuum network. Baffled reactor should compete with costs for septic tanks

Operation and Maintenance

Toilet users must be advised not to apply chemical detergents for toilet bowl cleaning, as their application kills the active bacteria in the baffled reactor - disabling the treatment process and resulting in fast sludge accumulation, which must be removed from the digester and can plug following treatment units. Maintenance must be carried out by trained personnel, who should be trained during the construction process. The trained personnel should check all control

openings weekly and remove any obstructions to the regular flow. If bio-gas is utilized, storage, pipelines and appliances must be monitored regularly by trained personnel.

Planted Gravel Filter Description

Horizontal gravel filters, also referred to as constructed wetlands, subsurface flow wetlands or root zone treatment plants, provide natural treatment for pre-settled wastewater of a maximum COD content of 500 mg/l. They are therefore ideal as tertiary treatment for waste water, which has already undergone secondary treatment in units, like baffled reactors, anaerobic filters or bio-gas digesters. Horizontal gravel filters have no movable parts, do not require operational control and deliver an effluent, which is suitable for irrigation, toilet flushing, car washing, etc.

The system is applicable under the following conditions:

- ⊙ Suitable if adequate space requirements can be met.
- ⊙ Public buildings including schools with secured - even if limited - water supply, allowing reuse.
- ⊙ Newly constructed toilets attached via a small bore sewer, gravity sewer or vacuum network.

Approaches for waste management at school

School authorities need to take steps for effective management of solid and liquid waste for hygienic environment and surroundings in the school. There are different ways of treating solid and liquid waste.

Solid Waste

- a. Sorting or segregation of waste at source level by keeping biodegradable and non-biodegradable waste in separate colour bins of 5-10 litres capacity each (e.g. green-coloured bin for biodegradable waste and blue bin for non-biodegradable waste).
- b. Treatment/management of biodegradable waste by adopting anyone of the following technologies and reuse of treated products:
 - ⊙ Composting
 - ⊙ Vermi-composting
- c. Treatment/management of non-biodegradable waste: Some of the sorted out non-biodegradable waste will be of recyclable type. Schools may be encouraged to keep such waste separately and sell it to rag pickers and kabadiwalas and keep the non-recyclable products separately for transportation for community-level waste management.

Liquid Waste

The grey water, in particular, can be recycled by using the technologies of piped root zone system, leach pit and soakage pit. Maintaining a herbal garden by using waste water is a good option if space is available. Technologies for solid waste management in schools

Composting: Composting is carried out in a simple manure pit or garbage pit (lined or unlined). In this process, aerobic micro-organisms oxidize organic compounds to carbon dioxide and oxides of nitrogen and carbon from organic compounds is used as a source of energy while nitrogen is recycled. As discussed above, in the composting process, due to exothermic reactions, temperature of mass rises. In areas/regions with higher rainfall, composting in over-ground heaps is advisable. The factors affecting the composting process are: (a) Micro-organisms; (b) Moisture, (c) Temperature and (d) Carbon/Nitrogen (C/N) ratio.

For school-level composting, a suitable site should be selected as compost yard for the school taking into consideration wind flow direction so that the inhabited areas do not get any foul odour. The site should be easily accessible for transportation of waste and manure. It should not be a low-lying area to avoid water logging. Once the site is chosen, the construction of a composting pit or heap should be initiated. The depth of the pit should not be more than 1 meter and its width should not exceed 1.5 meters. The length of the pit may go up to 3 meters. In the pit, waste takes about 4-6 months to compost. Hence, adequate number of pits will be required. Distance between two pits should be more than 1.5 meter. While digging pits, adequate care should be taken to ensure that there is adequate facility to transport the garbage and store the manure.

© Vermicomposting: This involves the stabilization of organic solid waste by earthworms which convert the material into worm castings. Vermicomposting is the result of combined activity of micro-organisms and earthworms. Therefore, its technology is a tripartite system which involves biomass, microbes and earthworms and is influenced by the abiotic factors such as temperature, moisture, aeration etc. Microbial ecology changes according to change of abiotic factors in the biomass but decomposition never ceases. Conditions unfavourable to aerobic decomposition result in mortality of earthworms and subsequently no vermicomposting occurs. **Hence, pre-processing of the waste as well as providing favourable environmental condition is necessary for vermicomposting.** Vermitank, used for vermicomposting, is a specialized unit constructed in brick masonry, capable of converting biodegradable solid waste into high quality organic manure in a short period. Operation and maintenance of vermitanks is a simple process.

Technologies for liquid Waste Management in Schools:

The analysis of the sources of waste water and its types has revealed that more than 90 percent of waste water generated is grey water. Therefore, grey water management is a major challenge in rural areas. In the schools also, enough grey water is generated which if managed properly can be used for kitchen / herbal garden or be diverted to a soakage pit or channel to avoid water logging.

There are a number of simple technologies which may be used at school level for this purpose. The details of some of them are given below.

- ⊙ Kitchen / Herbal Garden with piped root zone system
- ⊙ Kitchen / Herbal Garden without piped root zone system
- ⊙ Leach pit
- ⊙ Soakage pit
- ⊙ Soakaway Channel

Kitchen / Herbal garden with piped root zone system

With this methodology, treated grey water can be utilized to grow vegetables, flowers or fruits in the premises of the school. This is a simple drip irrigation kind of technology where the grey water will be routed through a pipe with perforations to enable watering of plants. The system has following components:

1. Digging of trench (150 mm to 200 mm depth and 200 mm width)
2. Filling of trench with gravel of size (20 to 25 mm size)
3. A grease trap to collect silt (450mm x 350 mm x 300 mm)
4. Laying of perforated pipe.
5. Perforated non pressure PVC pipe (50 mm diameter and length as per requirement)
6. Covering the trench with polythene sheet.
7. Putting the soil layer (50 mm thickness over the polythene sheet)
8. Construct a leach pit (900 mm diameter with honey comb masonry and water tight cover).
9. Put a layer of earth over (25 mm thickness) over the pit cover.
10. Plant suitable vegetable or flowers at both the sides of the trench.

Operation and maintenance (O&M)

1. Periodical cleaning of the grease trap (every week)
2. Cleaning of perforated pipes (once in a year)

Materials required

1. Bricks (150 bricks)
2. Fine Sand (15 gamlas)
3. Cement (1/3 bag)
4. 50 mm non-pressure PVC pipe and length as per requirement
5. Pit cover (1000 mm diameter and 50mm thickness 3 to 4 kg. in height)
6. Polythene sheet

Advantages

1. Simple and cost effective technology
2. Cent percent utilization of water to produce vegetables and fruits
3. Prevention of stagnation of water and
4. Prevention of vector breeding.

Kitchen / Herbal garden without piped root zone system

This is simply canalizing of grey water without any piped system. It is simply routing the grey water through channels by maintaining proper slope to facilitate even watering. The system has the following component:

1. A grease trap to collect silt (450mm x 350 mm x 300 mm)
2. A simple bed of appropriate size to absorb the available water;
3. Let the grey water flow into the bed;
4. Plant suitable vegetable or flowers at both the sides of the trench.

Operation and maintenance (O&M)

Periodical cleaning of the grease trap (every week) Materials Required

1. Bricks (50 bricks)
2. Fine Sand (5 gamlas)
3. Cement (1/2 gamlas)

Leach Pit

Leach Pit is a brick lined pit constructed in honeycomb masonry, the size of which can be made as per requirement. They are very useful where waste water discharge is relatively more, these prevent stagnation.

Description

1. Selection of site - the leach pit can be located at any convenient space near the house, keeping a safe distance between the wall and the pit as 1m.

2. Digging of the pit
3. Construct the pit in a circular fashion with honey combing in alternate layers. The pit can be constructed with single brick with a mortar in the ratio of 1:6.
4. Connect the drain pipe coming from the house to the leach pit via a grease trap.
5. A silt chamber is necessary between the pit and the outlet from the waste water source to avoid entrance of mosquito vectors into the leach pit.
6. The pit should be covered with RCC cover or flag stone slab. The diameter of the cover should be .100 mm more than that of the pit.

Operation and maintenance (O&M)

Periodical cleaning of the silt chamber
Periodical removal of the sludge from the pit.

Advantages

1. It can handle large volumes of water during peak period of water generation and is better suited than soak pits
2. Prevention of stagnation of grey water
3. Prevention of vector breeding

Limitations

Not suitable for rocky terrain

Soak Pit

Soak pit is a dug out pit filled with stones or preferably over burnt bricks. The large numbers of stones or bricks increase the surface area over which biological and chemical action takes place. The water seeps into the ground and reduces danger of polluting the ground water sources.

Description

An example of making a small soak pit is given below. This can be modified as per the requirements of the school.

Step No.1: Excavation of 1 m x 1 m x 1 m pit;

Step No.2: Filling of 1 m x 1 m x 1 m pit by boulders from bottom 250 mm by 125 mm to 150 mm boulders; 2nd 250 mm layer by 100 mm to 125 mm size boulders; 3rd 250 mm layer by 50 to 75 mm size boulders;

Step 3: Place the 225 mm earthen pot (or plastic container) over the last layer of the boulders;

Step 4: a). Lay twigs (25 mm thick) over the top 250 mm boulders of size 50 to 75 mm size. b). Take a gunny bag, tear it out to make it a bigger piece and layover the twig (25 mm thick)(Remember to make a hole in the gunny bag appropriately to place the earthen pot.) c). Give one more layer of twig (25mm thick) over the torn portion of the gunny bag;

Step 5: Put a layer of mud over the top twig layer; **Step 6:** Put some dry soil over the layer of mud; 225 mm to 250 mm;

Step 7: Make chamber of size 200 mm x 200 mm around the 225 mm earthen pot and plaster t the inner part of the chamber, 20 mm thickness (1 :4) and finish it with cement;

Step 8: Connect the bathroom (water) chamber with a 50 mm size diameter non- pressure PVC pipe;

Step 9: Cover the chamber with suitable lid (e.g. wooden plank or a tile).
Advantages

1. This is the cheapest technology for management of water at household level
2. Prevention of stagnation of grey water
3. Prevention of vector breeding

Soakaway Channel

Soak pits can be built in every house for wastewater disposal. But such small pits cannot be of much use near public wells where a large quantity of wastewater flows. In such places pits have to be built like big channels, which are called soakaway channels. Soakaway channel is built where more than 50-60 buckets of water is used. Sludge tanks have to be made to clean and filter the water before entering such channels. In soak pits a pot with holes is used for filtration of water. As large quantity of water flows into soakaway channels, a sludge tank is provided instead of a pot. Such an arrangement is called soakaway channel with sludge tank.

Advantage

1. Large quantities of community grey water can be absorbed without any open stagnation of grey water;
2. Vector breeding will be prevented;
3. Main water source will not be contaminated;

Description

The system has two major components: Sludge Tank and Soakaway Channel

Sludge Tank

Function of a sludge tank is the same as that of the filter pot in household level soak pit on a big scale. The sullage tank intercepts ash, mud and oily substances in the water and allows the cleaned water to flow to the soakaway channel. Soakaway channel is built near the well and the water allowed to flow into it through the sullage tank.

A sludge tank is generally constructed at a distance of 1.2 to 1.5m away from the well and waste water is taken to it by a drain. First a 93 x 53 x 45cm (deep) pit is excavated. A 15cm thick layer of cement concrete 1 :4:8 is laid on the bottom of the pit. A 11.5cm thick and 30cm high brick wall is constructed on the foundation on four sides of the pit. The height of the wall at the point where the drain meets the sludge tank is kept 22.5cm so that a notch is formed, from where wastewater enters the sludge-tank. The height of this wall should be 15cm towards the inlet of water and 12.5cm towards the outlet. This wall will divide the tank into two portions each measuring by 30cm x 29.25cm. The first chamber is called grit chamber and second is called grease chamber.

In the tank, other than the one in which water falls, leave a space of 6.25 to 7.5 from the bottom and make a groove of 2.5cm wide in both the walls at center up to the top. Fit in a 25mm thick stone slab in this groove. Fix a pipe 7.5 to 10cm above the bottom in the last chamber for the outlet of water into the soakaway channel. Before using the sludge tank a 10 to 12.5cm thick layer of grass and leaves should be placed in the grease chamber.

Water from the drain first enters the grit chamber of the sludge tank where ashes, mud and other grit material settles in the chamber and the water flows over the wall in the middle and goes to the other tank. Floating substances like charcoal, oil etc. are intercepted by grass and leaves at this place. Because of the stone slab, the water flows through the grass and leaves etc. and goes into the soakway channel through the pipe provided at the end of this chamber. This water is well cleaned.

Sketch of Sullage Tank

1. Channel for wastewater from the drain;
2. Cover of Sullage tank;
3. 11.5 cm wall;
4. Grass leaves etc.;
5. 25mm thick stone slab;
6. Pipe to convey water to the soakway channel;
- 7-8 Foundation

The mud, ash and gritty material collected in the grit chamber should be taken out by a spade. Grass and leaves, etc. should also be occasionally removed and fresh ones placed. Some times lime and hypochlorite should be sprinkled in the grit tanks so that insects do not breed. Do not use phenyl, dettol or DDT. A container with holes in the bottom can also be used in the grit

chamber so that if necessary it can be taken out, cleaned and replaced in the tank.

If large quantity of wastewater is coming, then an extra grease chamber should be built with a slab in it as described above for further cleaning of wastewater. The grit chamber can be built big or small according to the quantity of water used.

If drainage channel is long, smaller tanks may be constructed or colored containers be kept in the passage to intercept the sullage, mud etc. If the soakaway channel is far from the sullage tank then also a tank should be built in between.

Soakaway Channel

Dig a channel 4.5m long and 0.6m broad. It should be 0.6m deep in the beginning and 0.75m in the end. It should be divided into three portions of 1.5m each. The first portion should be filled with round pebbles of 7.5 to 10cm diameter leaving a space of 12.5cm at the top. In the second portion round pebbles of 10cm to 12.5 cm diameter and in the last those of 12.5cm to 15cm diameter should be placed. After this a 7.5cm thick layer of pebbles of 7.5cm to 10cm diameter should be laid on the top throughout. The outlet pipe from the sullage tank should be fixed into the first portion of the channel.

The soakaway channel is covered from above in the same way as the soakaway pit. A 2.5cm layer of non-decaying vegetable matter should be laid over the stones in the channel. Gunny cloth or plastic sheet should be used to cover it so that mud and refuse etc. may not get in. Again a similar layer of non decaying vegetation should be laid and coated with 2.5cm thick layer of mud. Then put dry earth over it, so that its level may be 15cm above ground level. Gradually this earth will get pressed and be level with the ground. Carts and trucks can pass over the soakaway channel without causing any damage to it.

Rain water harvesting system in a school

It is very important today to conserve water especially in a rain dependent country like India. If rain water is collected during monsoons and a system is developed to store it, then this water can be used during the lean / dry months. The technology by which rain water is collected, stored and then re-used after treatment is called rain water harvesting. This is being successfully implemented in different parts of the country at the household as well as community levels. Rainwater falling on the roof can be directed to fall at a few chosen spots, through open pipes of simple tin sheets placed at the edges of the roof. These chosen spots can be near the vines planted adjacent to the buildings (for example, along pillars/poles). Rooftop water can also be directed to rows of shrubs, small trees or trees in the vicinity of buildings. This is very exciting, for a large part of the water requirements of planted trees can be

met in this way. Other than what the trees draw, the rest of the water gradually percolates into the ground. If the roof sheets are coated on the top exterior surface with good quality turpentine-based enamel paint (of light reflective colour like white or yellow), simple water harvesting structures will enable water to percolate and replenish ground water.

With innovative (and not very elaborate) landscaping, it is possible that all the rainwater that falls in the school area (and not just roof water), percolates into the earth and does not run-off to drains. This water would make living greens like the ones that are planted and many self-occurring one's spring forth. This is very exciting for a school and it also drastically reduces the need for watering plants. It is like setting up (or rather helping nature evolve) a self-sufficient natural system. The rest of the rainwater will recharge the plummeting groundwater table. Interaction and adjustments of the landscape (contours and gradient) of the open spaces in the school area is required to help rainwater travel towards the existing and planned green spaces. Small trenching etc. in these spaces and improvement of soil conditions towards increasing percolation potential will ensure that the rainwater falling in the school area is utilised to the maximum. Another design (especially when all water cannot percolate in a spread out way as above, usually due to lack of soft soil space) is to make strategically placed rainwater harvesting or recharge structures. Other than the direct benefits, children will get a first hand experience of how water can be harvested and utilized.

Incinerator for Girls toilets in schools

Both biodegradable and non-biodegradable waste can prove hazardous for health, if proper and complete disposal is not done. In schools especially, disposal of sanitary cloth and sanitary napkins in Girls toilets is a big problem. The napkins affect the proper functioning of toilets when disposed in the toilet and serious health problems if thrown out in garbage dumps or in the open. There is, thus an imminent need to address this sanitary waste disposal effectively, especially in terms of developing cost-effective and simple technology for composite waste disposal for schools.

An innovative low-cost technology incinerator has been developed for proper disposal of sanitary waste. This design is simple, safe and cost effective. It has already been installed in many rural schools and women's sanitary complexes.

The incinerator comprises of two chambers, an emission control system along with a door for firing and removal of ash. In each incinerator, there is a spout/opening in the toilet wall for disposal of soiled napkins into the chamber. The soiled napkin drops on the wire gauze in the chamber on the other side of the toilet wall. This dropped napkin and other waste are fired on weekly basis through the door/firing inlet in the lower chamber. The entire incinerator is

attached to the outer wall of the toilet. A smoke vent is provided for the disposal of gaseous substances while firing the sanitary wastes.

This simple addition to the toilets is highly appreciated by girls and teachers. The use of the incinerator has removed inhibitions among girls on attending schools during menstruation and has made them comfortable attending school during those days. There are also no blockages of toilets due to sanitary waste disposal in the toilets.

In another suggested design, an existing drum can be modified to be used as an incinerator. For this, a simple drum used in households will be lined with a perforated fire bed, as shown, where used napkins will get collected coming through the chute made on top, like in letter

System Categories

This section discusses seven different categories for practically proven sanitation systems. The borders between the specific systems are flexible and combinations between the different systems are possible. Therefore sustainable sanitation systems can principally be assigned



boxes. At the bottom of the drum, there will be an opening / space to enable firing of these napkins. There will be a smoke vent / chimney for disposal of gases while firing.

to the seven system categories discussed in the subsequent sections. For each category one case study is presented to illustrate how the system approach has been translated to the design of real systems. The examples are presented only briefly without detailed data. References to detailed descriptions of the case studies are provided for each case. Figure 7.1 shows an exemplary template for sanitation systems describing how inputs enter a sanitation system via a specific user interface and how the specific flowstreams pass through the different functional groups in which they are transformed prior to final reuse, recycling or safe disposal.



Construction and Maintenance of school facilities

Operation and maintenance plans:

A well-designed hygiene and sanitation facility will lose its effect if it is not properly looked after. A good operation and maintenance plan will not only indicate who is responsible for cleaning, maintenance and the costs involved, it will also ensure involvement of children, teachers, parents and the community in the continuous process of monitoring and improving hygiene practices at school.



Assessment of successful school sanitation programmes has shown that the overall **situation** in the school and the condition of its hygiene and sanitation facilities are closely linked, rather than merely being the result of the economic situation of the community. When students, teachers, parents and the community are proud of their school and the other school facilities are well maintained and clean, a well thought out operation and maintenance plan involving all stakeholders has a better chance of being accepted and contributing to the overall situation.

Operation and maintenance plans: Project examples from SuSanA – An international meta network to support sustainable sanitation provision

The Sustainable Sanitation Alliance (SuSanA) network was initiated prior to the International Year of Sanitation in January 2007 by GIZ (former GTZ) and the Stockholm Environment Institute (SEI) in an attempt to promote concepts of sustainability for the sanitation sector. It is a loose network of over 140 organisations working together to promote sustainable sanitation solutions in different urban and rural contexts through knowledge sharing and joint publications. (SuSanA 2011, GTZ 2008)

The goals and objectives of SuSanA are to raise awareness about the need for sustainability within the sanitation sector and sanitation systems, to promote such systems at a large scale, to identify the key role that sanitation plays in human development and the MDGs, to emphasise the importance of stakeholder participation in sanitation and hygiene planning and programme execution and help change the general attitudes about sanitation from a disposal-oriented one to a more reuse-oriented one. (GTZ 2008)

**Technology review of constructed wetlands -
Subsurface flow constructed wetlands for greywater and domestic wastewater
treatment**

published by GIZ-programme "Sustainable Sanitation / ecosan"

This booklet focuses on treating domestic/municipal wastewater or greywater with subsurface flow constructed wetlands with coarse sand as a filter medium. The emphasis is on the application in developing countries and countries in transition. In the publication, an overview and basic guidance is provided on the design and maintenance of horizontal flow beds (HFBs), vertical flow beds (VFBs) and the "French System". A description of the most common pre-treatment systems is also included due to their vital importance for the proper functioning of CWs. The target audience are people with some basic technical background, who want to obtain an overview of subsurface flow constructed wetlands, their designs, performance and maintenance requirements.



(http://www.susana.org/docs_ccbk/susana_download/2-930-technology-review--constructed-wetlands.pdf)



Sustainable sanitation in cities: a framework for action

published by SuSanA

This book takes a look at some of the methods that have worked well in the past, to guide us in solving the problems of the future. By addressing sanitation as a key element of the urban metabolism, and by linking sanitation with urban planning and neighbouring sectors like solid waste management or waste recycling, it allows for a holistic approach. It is only through this comprehensive view that new solutions come to light and there are many opportunities. In the cities of tomorrow, we will need to focus more on recycling energy. A good example being biogas generation from wastewater and sludge. Water will also become an increasingly scarce commodity. Greywater (from showers and sinks) can be treated in urban constructed wetlands or used to water and fertilise urban green spaces. Such examples of productive sanitation systems will form an integral part of infrastructure in sustainable cities.



Best Options for School Sanitation: Meeting the Challenge

(http://www.eawag.ch/forschung/sandec/publikationen/sesp/dl/sustainable_san.pdf)
More resources can be found in the SuSanA-library: <http://www.susana.org/lang-en/library>

There are 10 working groups within the SuSanA, that are also at NSSI's command for assistance. They focus on a variety of issues and produce various reports and fact-sheets, which summarise the latest state of knowledge for their field of specialisation. These working groups are i.e. focusing on capacity development (WG 1) or on schools (WG 7). (GTZ 2008)



A range of Indian individuals and organisations (e.g. UNICEF-India, Cap-Net India, Ecosan Service Foundation Pune or Sulabh) are active partners of the SuSanA and thereby ensure that latest developments in the field of sustainable sanitation from SuSanA's thematic working groups are channeled into the sanitation sector in India. (GTZ 2008)

On its website, stakeholders have quick access to lots of relevant information. Especially the "Resources for Education"-section (<http://www.susana.org/lang-en/education>) can provide schools and teachers with useful material, from posters and visual aids from worldwide projects and awareness creation campaigns to resource materials and publications for educational purposes.

Many proven technical elements are available for sustainable sanitation system and the number of pilot demonstration and research projects, as well as large scale applications, is continuously increasing. They do showcase innovative solutions in a variety of climatic, social, cultural, economic and geo-morphological contexts and have helped in the development of a series of model solutions covering the whole range of sanitation needs. (GTZ 2008)

In the following, an insight into implemented projects for innovative sustainable sanitation systems in Indian schools is given.

Project 1: Sustainable sanitation system at the AVM-college in Badlapur (near Mumbai)

Adarsh Vidya Mandir is one of the most famous educational institutions within Kulgaon Badlapur Municipal Council accommodating 1300 students in morning and 1300 students in evening classes. In order to upgrade the sanitation situation in the school, the municipality came up with an idea to implement the complete ecological sanitation approach that not only meets the sanitation requirements of the pupils but also protects the environment



and raises awareness amongst the students educating them about the importance of water and sanitation in promoting health and hygiene.

The existing school toilets were in poor condition and new toilet blocks for male and female students were constructed. The new toilet buildings have pour flush toilets. Water from the toilets (black water) and water from hand washing and other purposes (grey water) are jointly connected to the biogas settler where the waste water is treated through anaerobic treatment for the production of biogas.

Urine is collected from the Boys toilet using waterless urinals. The black and grey water are initially drained to the ““Biogas settler“ where the waste water is subjected to anaerobic decomposition. The effluent is then drained to anaerobic baffle reactors for the further treatment of faecal sludge. The effluent from the anaerobic baffle reactors is then subjected to horizontal flow trough the constructed wetland in order to further decrease the BOD (biological oxygen demand) of the waste water. The final effluent from the horizontal flow through the wetland is stored at the polishing pond and re-used for landscaping.

Re-use:

- ⊙ *The collected urine from waterless urinals is stored and is used for gardening purpose within the school campus.*
- ⊙ *The produced biogas is used either for cooking or lighting purpose.*

Best Options for School Sanitation: Meeting the Challenge

- ⊙ *The faecal sludge is used as compost in campus gardening purpose.*
- ⊙ *The final effluent which is stored in the polishing pond is used for irrigation*

Project 2: Sanitation Improvements at Navsarjan Boarding Schools, Gujarat, India

Project / Introduction:

The “Navsarjan Trust”, which is dedicated to improving the living condition of Dalits, operates in over 1,000 villages in the state of Gujarat. Together with the BMZ-GIZ-escosan programme, closed-loop oriented concepts are being implemented in elementary schools and central vocational training institutes. The GIZ-escosan programme contributes to spread ecologically, economically and socially sustainable sanitation systems worldwide on behalf of the BMZ (German Federal Ministry for Economic Cooperation and Development). In collaboration with the biggest association for water works in India (IWWA) and local partners like the Navsarjan Trust, it supports the Indian Ministry for Rural Development (MoRD) with the elaboration of strategies for nation-wide dissemination of sustainable sanitation concepts.

Impacts:

In one of the GIZ-supported “Navsarjan Trust” schools pupils have received the “Young Scientists” prize in the Ahmedabad School Science Fair for the model built by them, which demonstrates the functional principles of their school's urine diversion toilets. After one year storage in the dry climate of Gujarat, the faeces are converted into harmless, hygienic nutrient-rich material. This material is excellent for improving the fertility of the region's barren soil.

The grey water from showers and wash basins contributes, after proper treatment, to irrigation of the school garden and green spaces. This is of high value for the schools, as they are located in water-scarce areas where water is expensive and precious.

By examining the hygienic conditions, water management and the potential of closed-loop sanitation project, the pupils became real ecosan experts; experts India will soon need in large numbers. (GTZ 2008)

Related publications & further reading:

A detailed report of this project can be found here:

http://www.susana.org/docs_ccbk/susana_download/2-45-en-susana-cs-india-gurajat-navsarjan-boarding-schools-2009.pdf.



Technology review "Urine-diversion dehydration toilets"

This, in parts, critical review doesn't show the functional principles and strengths only, but also weaknesses of UDDTs, that should be considered by the stakeholders before implementation.

(http://www.susana.org/docs_ccbk/susana_download/2-874-gtz2009-en-technology-review-udd-toilets.pdf)

SuSanA - Compilation of 31 case studies on sustainable sanitation projects

(http://www.susana.org/images/documents/06-case-studies/book/case_study_book_complete.pdf)



Sustainable Sanitation in India – Examples from Indo-German Development Cooperation.

*published by GIZ-programme "Sustainable Sanitation / ecosan"
(www.gtz.de/en/dokumente/en-ecosan-sustainable-sanitation-india-2008.pdf)*



A Manual on School Sanitation and Hygiene
published by UNICEF & International Water and Sanitation Centre (IRC)

*(www.unicef.org/wash/files/Sch_e.pdf)
http://www.susana.org/images/documents/06-case-studies/book/case_study_book_complete.pdf*



For more information about the alliance see the SuSanA website (www.susana.org).

*literature used in this chapter:
GTZ 2008: Sustainable Sanitation in India – Examples from Indo-German Development Cooperation
SuSanA 2011: Sustainable Sanitation in Cities – A framework for action.*

The Way Forward

Effectuating proper school sanitation and creating best hygienic conditions in Indian schools is

a very challenging and pristine task. The National School Sanitation Ratings would take the cause of National School Sanitation Initiative to new horizons leading to the consolidation of the efforts for ensuring safe sanitation, hygiene and waste segregation with a view to induce behavioural changes & awareness generation among school students. Municipal Bodies & other institutions are to provide support in this endeavour. Making National School Sanitation Ratings mandatory would bring the entire National School Sanitation Initiative (NSSI) to an unending dynamic mode wherein definite action towards institutionalization of the NSSI would take place leading to its consolidation. The Online National School Sanitation Ratings would give a national recognition to those schools who are taking significant steps towards effective sanitation and improvement in service delivery.

APPENDIX

Water, Environment and Sanitation

UNICEF's long standing support for improving water supply, sanitation and hygiene stems from a firm conviction and based on sound evidence that these are central to ensuring the rights of children. In fact, it is essential for children to survive, grow and develop into healthy and fulfilled citizens of the world. In the broader context, UNICEF's activities in Water, Sanitation and Hygiene (WASH) contribute to the achievement of the Millennium Development Goals.

Fast Facts

- ⊙ *Hand washing with soap, particularly after contact with excreta, can reduce diarrhoeal diseases by over 40 per cent and respiratory infections by 30 percent. Diarrhoea and respiratory infections are the number one cause for child deaths in India.*
- ⊙ *Hand washing with soap is among the most effective and inexpensive ways to prevent diarrhoeal diseases and pneumonia.*
- ⊙ *With 638 million people defecating in the open and 44 per cent mothers disposing their children's faeces in the open, there is a very high risk of microbial contamination (bacteria, viruses, amoeba) of water which causes diarrhoea in children.*



- ⊙ *Children weakened by frequent diarrhoea episodes are more vulnerable to malnutrition and opportunistic infections such as pneumonia. About 48 per cent of children in India are suffering from some degree of malnutrition. Diarrhoea and worm infection are two major health conditions that affect school age children impacting their learning abilities.*
- ⊙ *Adequate, well-maintained water supply and sanitation facilities in schools encourage children to attend school regularly and help them achieve their educational goals. Inadequate water supply and sanitation in schools are health hazards and affect school attendance, retention and educational performance.*
- ⊙ *Adolescent girls are especially vulnerable to dropping out, as many are reluctant to continue their schooling because toilet facilities are not private, not safe or simply not available.*
- ⊙ *Women and girls face shame and a loss of personal dignity and safety risk if there is no toilet at home. They have to wait for the night to relieve themselves to avoid being seen by others.*

Sanitation

It is estimated that

- ⊙ *Only 31 per cent of India's population uses improved sanitation (2008)*
- ⊙ *In rural India 21 per cent use improved sanitation facilities (2008)*
- ⊙ *One Hundred Forty Five million people in rural India gained access to improved sanitation between 1990-2008*
- ⊙ *Two hundred and Eleven Million people gained access to improved sanitation in whole of India between 1990-2008*
- ⊙ *India is home to 638 million people defecating in the open; over 50 per cent of the population.*
- ⊙ *In Bangladesh and Brazil, only seven per cent of the population defecates in the open. In China, only four per cent of the population defecates in the open.*



Water

- ⊙ 88 per cent of the population of 1.2 billion has access to drinking water from improved sources in 2008, as compared to 68 per cent in 1990.
- ⊙ Only a quarter the total population in India has drinking water on their premises.
- ⊙ Women, who have to collect the drinking water, are vulnerable to a number of unsafe practices. Only 13 per cent of adult males collect water.
- ⊙ Sixty seven per cent of Indian households do not treat their drinking water, even though it could be chemically or bacterially contaminated.



Hygiene

- ⊙ According to the Public Health Association, only 53 per cent of the population wash hands with soap after defecation, 38 per cent wash hands with soap before eating and only 30 per cent wash hands with soap before preparing food.
- ⊙ Only 11 per cent of the Indian rural families dispose child stools safely. 80 per cent children's stools are left in the open or thrown into the garbage.
- ⊙ Only 6 per cent of rural children less than five years of age use toilets.
- ⊙ WASH Interventions significantly reduce diarrhoeal morbidity;

statistically it has been shown that:

- ⊙ Handwashing with soap reduces it by 44 per cent
- ⊙ Household water treatment by 39 per cent
- ⊙ Sanitation by 36 per cent
- ⊙ Water supply by 23 per cent
- ⊙ Source water treatment by 11 per cent.

Key Issues

- ⊙ *Newborn Infants: Hand washing by birth attendants before delivery has been shown to reduce mortality rates by 19 per cent while a 4 per cent reduction in risk of death was found if mothers washed their hands prior to handling their newborns.*
- ⊙ *Children under five years: Poor WASH causes diarrhoea, which is the second biggest cause of death in children under five years. Diarrhoea is an immediate cause of undernutrition*
- ⊙ *School-aged children: Children prefer to attend schools having adequate and private WASH facilities. Schools provide an excellent opportunity for children to learn about hygiene practices.*
- ⊙ *Older Girls: Giving girls the knowledge and facilities necessary for good menstrual hygiene is key to their dignity, their privacy, their educational achievement and their health. Adolescent girls are empowered through improved menstrual hygiene management.*
- ⊙ *Mothers and Caregivers: Hand washing with soap at critical times is important for protecting the health of the whole family. By being a role model, mothers and caregivers can also help instill in their children the good hygiene practices which will serve them for life.*
- ⊙ *Children in emergencies: During emergencies, children are especially vulnerable to the effects of inadequate access to water and sanitation services. WASH is a key component of any emergency response.*
- ⊙ *Chemical contamination in water ensuring water quality at the source is crucial. In India, there is a widespread natural occurrence of arsenic and fluoride in the groundwater.*

UNICEF Action

UNICEF is supporting Government of India programs on arsenic and fluoride mitigation and identifying water quality testing technologies which are appropriate for use in field situations. All emergencies cause disruption to basic services. People are less likely to be able to drink safe water, use basic sanitation facilities and maintain improved hygiene practices.

Children, especially those under the age of five, are particularly vulnerable to the diseases which can result during emergencies.

Best Options for School Sanitation: Meeting the Challenge

These diseases include diarrhoea, cholera, typhoid, respiratory infections, skin and eye infections which are all likely to occur when water supplies and Sanitation services are disrupted. UNICEF has set out minimum standards of response for any emergency situation. These describe the life saving actions which UNICEF will take within the first six to eight weeks of an emergency, along with the longer term role in the subsequent weeks and months.

Are You One Of Them?

मौलाना आज़ाद रोड
MAULANA AZAD ROAD
मैलाना आज़ाद रोड
مولانا آزاد روڈ
Pin Code - 110011

Be A Good Citizen
Use public toilets. Not public places.

By: Star Communications • Photo: Sanjiv Kumar Srivastava, IFS, Govt. of India

gtz
COOPERATION
FEDERAL REPUBLIC OF GERMANY
Government of India
Ministry of Urban Development & Human Resource Development
NUSP
NATIONAL URBAN
SANITATION POLICY
TOWARDS CITY WIDE SANITATION

CBSE Circular - NSSR

Gram: CENBOSEC
Website: www.cbse.nic.in

Ph: 011-22509252-59
Fax: 011- 22515826



Central Board of Secondary Education

(An autonomous Organization under the Union Ministry of Human Resource Development, Govt. of India)

Shiksha Kendra, 2, Community Centre, Preet Vihar, Delhi-110092



CBSE/H(I&R)/NSSA/2011

29 June 2011

Circular No. 47/2011

All the Heads of Schools
affiliated to CBSE

Subject: Institution of Annual *National School Sanitation Awards* based on "*Online National School Sanitation Ratings*"

Dear Principal,

The CBSE in collaboration with the Ministry of Human Resource Development (MoHRD), Ministry of Urban Development (MoUD) and GIZ (formerly known as GTZ) has introduced the '**National School Sanitation Initiative**' with the aim is to inculcate good sanitation habits among the school children in order to inspire, acquaint and celebrate excellence towards School Sanitation at the National Level.

The CBSE's Comprehensive School Health Manuals also address the issue of Sanitation in Schools. Sanitation is one of the six areas and themes that have been identified for a school to improve its performance in its objective of becoming a **Health Promoting School**. These six themes are:

1. Food and Nutrition,
2. Knowing Your Body,
3. Personal, Environmental Hygiene and Sanitation,
4. Behaviour and Life Skills,
5. Physical Fitness and
6. Being Responsible and Safe.

Accordingly, *Online School Sanitation Ratings* have been instituted with the purpose of recognizing those schools who are taking significant steps towards effective sanitation and improvement in service delivery leading to the desired behavioural and attitudinal changes towards hygiene & sanitation. The Sanitation Ratings are expected to infuse the required dynamism in the schools towards sanitation management.

As furtherance to the *National School Sanitation Ratings* it has been decided by the Ministry of Human Resource Development, Government of India to institute **National School Sanitation Awards** on annual basis for those schools who have been rated online for sanitation and taken noteworthy steps towards betterment of the sanitation scenario in their schools in varied ways.

The parameters and categories for the Awards are given in the **National School Sanitation Manual**. These Awards are open to all school affiliated to CBSE which include Kendriya Vidyalayas, Jawahar Navodaya Vidyalayas, Government Schools, Private Independent Schools, DAV Schools, CTSA Schools, Army Schools etc.

Awards will be given in the following categories which the schools can take up as part of Health & Wellness Clubs as well as the Eco-Clubs:-

- Awareness Generation leading to Behavioural Change through Students and Community Mobilization
- Technical Innovation and Interventions
- Creation & Conservation of Green Spaces
- Public Private Partnership

Parameters for the Selection

- 1. Sustainability:** Demonstrated success geared towards long term hygiene and safe sanitation.
- 2. Replicability:** Potential for replication of practices and models that have resulted in better service delivery.
- 3. Innovation:** Demonstrated Innovation, Uniqueness and Originality in the use of Ideas, Technology and Resources
- 4. Dynamism: Online Sanitation Ratings of the School plus Activity Points** scored by taking up appreciable initiatives in the following areas :
 - Improving Sanitation facilities for the Girl Child
 - Best performing Health & Wellness Clubs
 - Sustainability of the Effort
 - Waste Management & Disposal
 - Water conservation and Waste Water Recycling and its Utilization
 - Safe Hygiene Practices
 - Waste Segregation & Waste Management
 - Awareness Generation Efforts and impact leading to Behavioural Change
 - Water & Sanitation: Tangible Improvements in Service Delivery
 - Efforts towards Water Management

Mechanism and Procedures

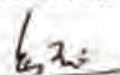
- MoUD, CBSE and GIZ have constituted an Advisory Group for deciding on the Awards.
- Initial scrutiny will be done by Committee and then the shortlisted entries will be submitted for critical examination and final selection for the Awards by the Advisory Group.

The Awards will be in the form of certificates of excellence, mementos, citations, participation in a school sanitation exchange programme, joint development of pilot projects on zero waste producing concepts with the schools and also special certificates to Principals, teachers and students associated with Health & Wellness Clubs and Eco Clubs.

The call for entries would be published in the month of November every year and at that time requisite entries could be submitted. The schools are expected to register themselves. The format for registration/membership is available online. For more information about the **National School Sanitation Initiative** visit www.schoolsanitation.com and/or the sanitation hyperlink on the CBSE website.

Looking forward to your whole hearted cooperation

Yours sincerely,



(VINEET JOSHI)
CHAIRMAN

Copy with a request to respective Heads of Directorates/KVS/NVS/CTSA as indicated below to also disseminate the information to all concerned schools under their jurisdiction:

1. The Commissioner, Kendriya Vidyalaya Sangathan, 18-Institutional Area, Shaheed Jeet Singh Marg, New Delhi-110 016.
2. The Commissioner, Navodaya Vidyalaya Samiti, A-28, Kailash Colony, New Delhi.
3. The Director of Education, Directorate of Education, Govt. of NCT of Delhi, Old Secretariat, Delhi-110 054.
4. The Director of Public Instructions (Schools), Union Territory Secretariat, Sector 9, Chandigarh-160 017.
5. The Director of Education, Govt. of Sikkim, Gangtok, Sikkim – 737 101.
6. The Director of School Education, Govt. of Arunachal Pradesh, Itanagar- 791 111
7. The Director of Education, Govt. of A&N Islands, Port Blair-744 101.
8. Director of Education, SIE, CBSE Cell, VIP Road, Junglee Ghat, PO 744103, A&N Island.
9. The Secretary, Central Tibetan School Administration, ESS ESS Plaza, Community Centre, Sector 3, Rohini, Delhi-110 085.
10. All the Regional Officers of CBSE with the request to send this circular to all the Heads of the schools affiliated with the Board in their respective regions.
11. The Education Officers/AEOs of the Academic Branch, CBSE.
12. The Joint Secretary (IT) with the request to publish this circular on the CBSE website.
13. The Library and Information Officer, CBSE
14. EO to Chairman, CBSE
15. PA to CE, CBSE
16. PA to Secretary, CBSE
17. PA to Director (ACAD.)
18. PA to HOD (AIEEE)
19. PA to HOD (EDUSAT)
20. PRO, CBSE



CHAIRMAN

Creating Better Cities The Bremen Initiative

CREATING BETTER CITIES

THE BREMEN INITIATIVE

“The environmental future of the planet is closely linked to how we manage human settlements and their demand for resources.”

The Bremen Initiative is a global platform for all local business-municipality partnership programmes and projects aiming at sustainable development. As a campaign, its goal is to affect awareness, influence legislation and be a catalyst in developing new solutions based on best practices.

GIZ-ASEM is carrying forward the spirit of the Bremen Initiative in India in collaboration with the Government of India .

BACKGROUND :

The Bremen Initiative has its origin in the decisions taken during the first Earth Summit at Rio in 1992. The UN Earth Summit in Rio de Janeiro in 1992 was the first giant leap forward by the humankind for environmental conservation. The 179 participating sovereign nations after careful deliberations for hours together gave the Summit its soul in the form of a future action plan for the nations, called Agenda 21. The Summit expressed its concern



over the excessive and indiscriminate damage to the environment and ecology being done by the mindless developmental activities and categorically stated that the global economy must not only satisfy the needs of the people, but also to ensure that its growth does not overstretch the earth's ecological limits.

Agenda 21 is the UN action programme for sustainable development through which they aim at taking definite actions. It is a comprehensive blueprint of action to be taken globally, nationally and locally by organisations of the UN, governments, and major groups in every area in which humans impact on the environment. The number 21 refers to the 21st century.

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

---Brundtland's Report

This international meet was the mother of all environmental conferences and was rightly called as THE EARTH SUMMIT. It focussed and established the direct relationship between the environmental changes which were occurring globally and the ever growing world population, its consumption pattern , technological

development and uses. Agenda 21, in fact, chalks out the Action Programme for the National governments , international organizations for minimizing the wasteful and inefficient consumerism practised by the developed countries of the world, while at the same time helping to promote a more intensive but sustainable development in the developing and underdeveloped countries of the world.

AGENDA 21: GUIDING FEATURES

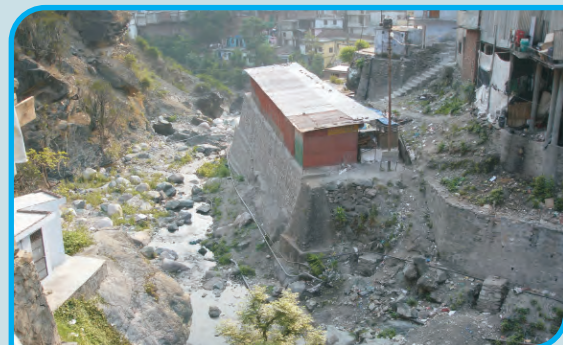
⊙ *Agenda 21 provides options for combating degradation of the land, air and water, conserving forests and the diversity of species of life. It deals with poverty and excessive consumption, health and education, cities and farmers. There are roles for everyone: governments, business people, trade unions, scientists, teachers, indigenous people, women, youth and children. Agenda 21 does not shun business. It says that sustainable development is the way to reverse both poverty and environmental destruction.*



⊙ *We currently gauge the success of economic development mainly by the amount of money it produces. Accounting systems that measure the wealth of nations also need to count the full value of natural resources and the full cost of environmental degradation. The polluter should, in principle, bear the costs of pollution. To reduce the risk of causing damage, environmental assessment should be carried out before starting projects that carry the risk of adverse impacts. Governments should reduce or eliminate subsidies that are not consistent with sustainable development.*

⊙ *A major theme of Agenda 21 is the need to eradicate poverty by giving poor people more access to the resources they need to live sustainably. By adopting Agenda 21, industrialized countries recognized that they have a greater role in cleaning up the environment than poor nations, who produce relatively less pollution. The richer nations also promised more funding to help other nations develop in ways that have lower environmental impacts. Beyond funding, nations need help in building the expertise—the capacity—to plan and carry out sustainable development decisions. This will require the transfer of information and skills.*

⊙ *Agenda 21 calls on governments to adopt national strategies for sustainable development. These should be developed with wide participation, including non-government organizations and the public. Agenda 21 puts most of the responsibility for leading change on national governments, but says they need to work in a broad series of partnerships with international organizations, business, regional, state, provincial and local governments, non-*



governmental and citizens' groups.

⊙ As Agenda 21 says, only a global partnership will ensure that all nations will have a safer and more prosperous future

The First International Conference : The Bremen Declaration:

As we know that businesses and municipalities play an important role in city sustainability and management and therefore to strike a balance between the developmental aspirations and environmental conservation concerns leading to the Sustainable Green Habitats, a Local Action Road Map was essential to be designed keeping these factors in view. The First International Conference on Business and Municipality in the City of Bremen took up the mantle of taking up next steps in this direction. Firstly by initiating the promotion of networking and collaborations and secondly, by seeking to beget new partnership initiatives between the willing actors who made significant contributions to the objectives agreed upon in Rio 1992, in order to create better cities and provide better municipal services.

So, this was the rationale behind the launching of '1st International Conference on Business and Municipality' in Bremen in March 1997.

The recommendations of this Conference came to be known as The Bremen Declaration. (see annexure I).

The "Bremen Declaration" is the foundation of Bremen Initiative.

The core idea of this declaration was the call for mutual action between municipalities and businesses on a local level. **The Bremen Declaration** was officially adopted as a guideline by the 33rd **International Union of Local Authorities** (IULA) World Congress in April 1997, and was circulated during the preparatory sessions of the United Nations Special Assembly Rio+5 in June 1997.

Encouraged by the commitment of Bremen's partners and the positive response to the outcome of the 1997 Conference, the second initiative was organised in order to enhance and strengthen the idea of partnership. The Bremen Initiative is pillared by political leaders of the Free Hanseatic City of Bremen.

Preparatory Events : Creating Better Cities

Before organising the 2nd International Conference "business and municipality - new partnerships for the 21st century in Bremen, Germany in April 2001, a series of preparatory events were organised in the form of regionally organised international workshops and conferences all over the world. The results of preparatory meetings in four continents, fed in together with varied presentations on solutions for achieving better cities, made this conference both a policy forum and a practical hands-on experience. The outcomes of these events help in securing a broad perspective for the 2nd Bremen Conference with objectives aimed at, ranging from, energy saving to employment and wealth creation. In this way this Conference was unique and that's why it holds a very important place in consolidating our varied views and in designing various action plans in a truly global perspective.

The Second International Conference at BREMEN

The Second International Conference on the theme of “Creating Better Cities, together” was organised in Bremen, Germany in April 2001 by Bremen Initiative Group to bring business and municipality together in order to foster new partnerships for the 21st century so as to start a global campaign through such business-municipality partnership towards a sustainable future for cities. After four days of brainstorming, the following recommendations were made:-



1. Partnership between business and municipality is key to sustainable urban development.
2. Well defined and inclusive governance and management structures based on clear roles and responsibilities are cornerstones of successful implementation of partnerships for sustainable urban development.
3. Good governance must be recognised as the foundation of good government in all sectors: this requires systems to be put in place which reveal and terminate corrupt activities, build integrity and generate public trust as a pre-condition of effective partnership.
4. Access to relevant information is an essential pre-requisite to raise awareness of the public and enable individual citizens and community stakeholders to build mutual trust, to guarantee transparency and to play a full part in decisions which affect their daily lives. Businesses and municipalities should utilise the opportunities presented by modern information and communications technology to enhance sustainability, participation and democracy.
5. Every effort should be made to facilitate the transfer of the principles and techniques of successful partnerships through appropriate training, financial resources, toolkits, strategic policy support and dissemination.
6. The international community should take steps, in partnership with local authority and business associations and networks, to facilitate effective and appropriate transfers of knowledge and technology between stakeholders in the developed countries and their partners in developing countries and countries with economies in transition. Similar steps should be taken to facilitate transfers between stakeholders in developing countries.
7. Sustaining and developing public-private partnerships at the local level requires supportive policy frameworks and longer term funding from governments and international agencies.
8. All opportunities should be taken to promote and popularise sustainability to all citizens and

consumers, in order to educate and raise awareness; thus, for example, the phrase "quality of life" should be used more widely to demystify the phrase "sustainable development".

9. The mainstreaming of sustainable development calls for the engagement of educational institutions at all levels with the business community and local authorities in building capacity and expanding skills at the local level according to the concept of life long learning.

10. Legislative and fiscal regimes at all levels should be designed and implemented to encourage eco-efficiency in all production processes and service delivery. Strategic partnerships should be established to assist in the creation of economies and markets which incorporate sustainability principles.

11. The massive need to develop and improve urban areas and facilitate mobility in developing countries must be met in a sustainable manner through partnerships between government at all levels, the private sector and all civil society stakeholders.

12. Urban and rural areas should recognise the mutual benefits of interdependence. Urban areas in particular should develop partnerships to create buffer zones and / or green belt areas for biodiversity, recreation, human wellbeing and quality of life. Networking between farmers, producers, trade and consumers can promote sustainable agriculture and support local and regional production and marketing.

13. Governments at all levels should join with business to reduce the need to travel through appropriate participatory urban and spatial planning, through their roles as employers, by seeking to source materials locally, and through the use of electronic communication.

14. Community-based design and planning initiatives which draw on social capital¹ lead to more culturally and regionally sensitive, sustainable solutions which in turn support longer term growth.

15. Health should be given equal priority with environmental, social and economic aspects of sustainable development. Businesses and municipalities should contribute to securing appropriate health services, particularly for the poor.

16. Securing clean water and decent access to potable water is a key responsibility of business municipality partnerships as well as their concern for preventing and terminating air pollution.

17. Businesses and local authorities should work with their communities in partnership, to devise integrated waste management strategies aimed at waste minimisation, energy recovery and recycling, including the development of new markets for recycled materials. These activities should include aspects of combating poverty and necessities of increasing demands in developing countries.

18. Partnerships between businesses and municipalities should aim at climate protection and minimising energy demand by introducing energy efficient technologies and service structures and redirecting supply towards renewable energy resources for the sake of long term urban sustainability and in coherence with needs to satisfy demands of cities in less developed parts of the world.

19. Local authorities, enterprises and financial institutions should work in partnership to define criteria for ethically, socially and environmentally sound investments which can properly be included in their pension fund portfolios. Encouragement should be given to fund managers to investigate the possibilities of investing in sustainable ventures.

Best Options for School Sanitation: Meeting the Challenge

20. International social, environmental and ethical management standards should be implemented by public authorities and businesses. Small and medium-sized enterprises and local authorities in many countries need professional and technical assistance to enable them to improve their environmental performance and address all aspects of sustainability.

21. The exchange of experience and good practice in the development of business municipality partnerships promoted by the Bremen Initiative and the Bremen Partnership Award is already making an important contribution to the achievement of the sustainable urban development objectives of Agenda 21 and the Habitat Agenda. Cities and business, and their national and international associations, are urged to develop this exchange further in partnership with the relevant national and international institutions, and devote the required resources.



The Message

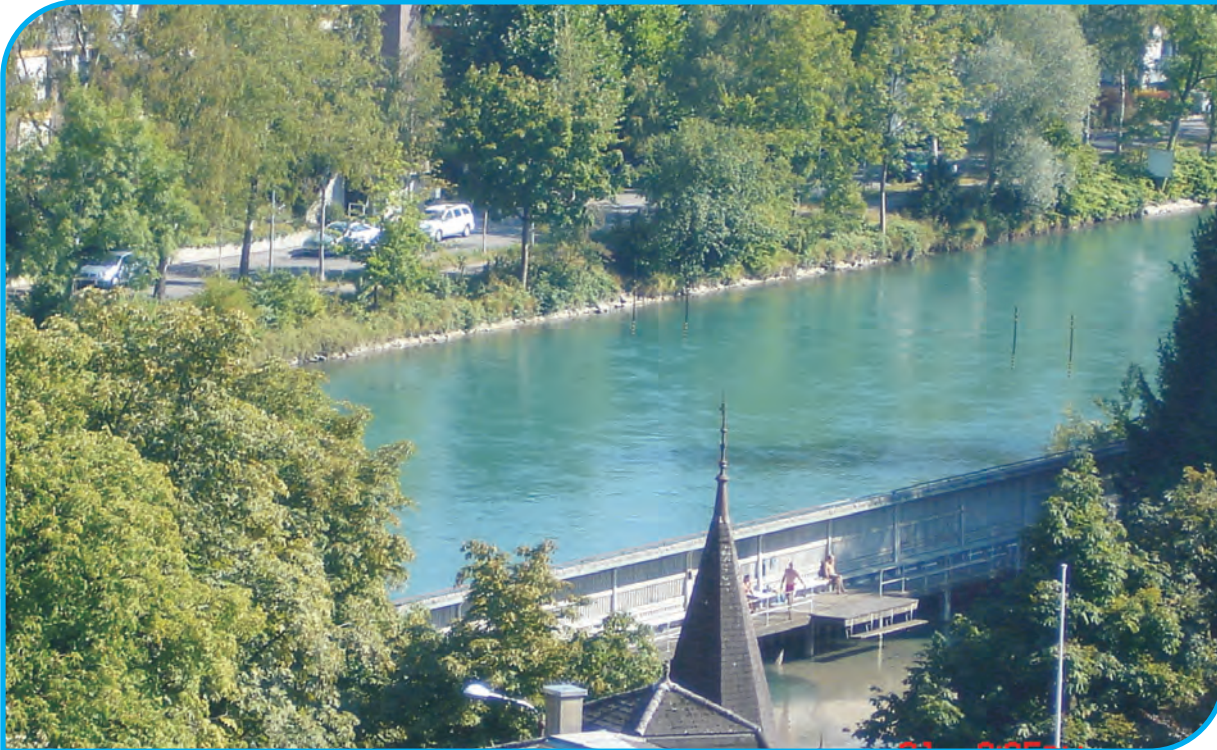
Bremen initiative is the only virtual community of cities, decision makers including businesses and political leaders working together to realise the goal of sustainable cities. It is considered as the driving force and its vision is that of an urban society which follows the concept of Green Urban Habitats where people can live comfortably without doing any damage to the ecology and environment. It emphasizes the fact that the cities will remain in the helm of the affairs if we have to achieve progressive sustainability. The world cities today are the critical factor for sustainability. They cover only 2% of the earth's surface yet they consume 75% of the world's resources. Thus, cities are not only the centre of environmental and social impact but of innovative solutions as well. Cities that connect well work well. The role of the city managers, local authority, municipalities and local economy managers are key to their sustainability and progress. A living city is in harmony with the nature and in dynamic equilibrium with developmental activities and progress providing better living and comfortable working locations thereby attracting vital enterprises.

Bremen initiative invites pro active stakeholders, - corporations and municipalities who care about their long-term future – to contribute in order to provide an information hub, learn from each other and identify best solutions world-wide.

Bremen Initiative aims at the transformation of all cities to such ones as the globalisation not only throw up the challenges but also provide the opportunities to excel.

Best Options for School Sanitation: Meeting the Challenge

To accomplish new solutions, one needs to break new grounds. The Bremen Initiative has been doing so since 1996. It aims at becoming the global campaign for business-municipality partnership, a forum for the exchange of knowledge, innovations, best practices, workable solutions that improve the quality of urban life.



The Other Initiative : Kitakyushu Initiative for a Clean Environment”

The “Kitakyushu Initiative for a Clean Environment” was adopted by the Environment ministers of the Asia-Pacific Region at the 4th Ministerial Conference on Environment and Development in Asia and the Pacific, organized by the United Nations Economic and Social Commission for Asia and the Pacific (UN/ESCAP), in September 2000.

The Kitakyushu initiative is a mechanism for the priority implementation of the Regional Action Programme for Environmentally Sound and Sustainable Development in Asia and the Pacific (RAP), 2001-2005, with special focus on environmental quality and human health.

. The Kitakyushu Initiative was included as a Type I initiative in the plan of implementation at the World Summit on Sustainable Development in September 2002. Currently in its second phase of implementation (2005-2010), the Kitakyushu Initiative Programme was again endorsed by the 5th Ministerial Conference on Environment and Development in Asia and the Pacific (MCED 2005) held in March 2005 in Seoul, Republic of Korea.

GIZ-ASEM

GIZ's Advisory Services in Environmental Management (ASEM) is carrying the spirit of the Bremen Initiative forward. With its six major thrust areas namely Environmental Planning, Hazardous Waste Management, Sustainable Consumption & Consumer Protection, Environmental Economics, Air Quality Management,

Best Options for School Sanitation: Meeting the Challenge

Human Resource Development, and of course, with all these efforts leading to various Public Private Partnerships, it has taken large strides towards achieving this goal.

GIZ-ASEM

GIZ's Advisory Services in Environmental Management (ASEM) programme is the umbrella organization for projects relating to industrial and urban environmental protection. It advises and supports the Ministry of Environment and Forests (MoEF) and the Ministry of Consumer Affairs (MoCA) in resolving current issues and implements projects with the aid of strategic alliances. ASEM coordinates a network of institutions and experts from Germany and India.

The approach of the ASEM programme is to shift from measures reacting to acute environmental damage to proactive strategies for action that will ensure sustainability. The aim is to achieve a structural change in ecological terms and to decouple growth and consumption of resources, while addressing the levels of consumption.

KITAKYUSHU INITIATIVE FOR A CLEAN ENVIRONMENT

A Programme of the United Nations Economic and Social Commission for Asia & the Pacific

The Kitakyushu Initiative for a Clean Environment (2000-2005) was adopted at the 4th. Ministerial Conference on Environment & Development in Asia & Pacific (MCED 2000), organized by the United Nations Economic & Social Commission for Asia & Pacific (UNESCAP) in September 2000 in the City of Kitakyushu, Japan to address the pressing Urban Environmental Issues.

The Kitakyushu Initiative, identified in the Plan of Implementation at the World Summit on Sustainable Development (WSSD) in 2002 as a relevant initiative to achieve sustainable development, is a mechanism for the priority implementation of the five-year Regional Action Programme, with specific focus on environmental quality and human health in urban areas. The Kitakyushu Initiative was included as a Type I initiative in the plan of implementation at the World Summit on Sustainable Development in September 2002.

Currently, in its second phase of implementation (2005-2010), the Kitakyushu Initiative Programme was again endorsed by the 5th Ministerial Conference on Environment and Development in Asia and the Pacific (MCED 2005) held in March 2005 in Seoul, Republic of Korea.

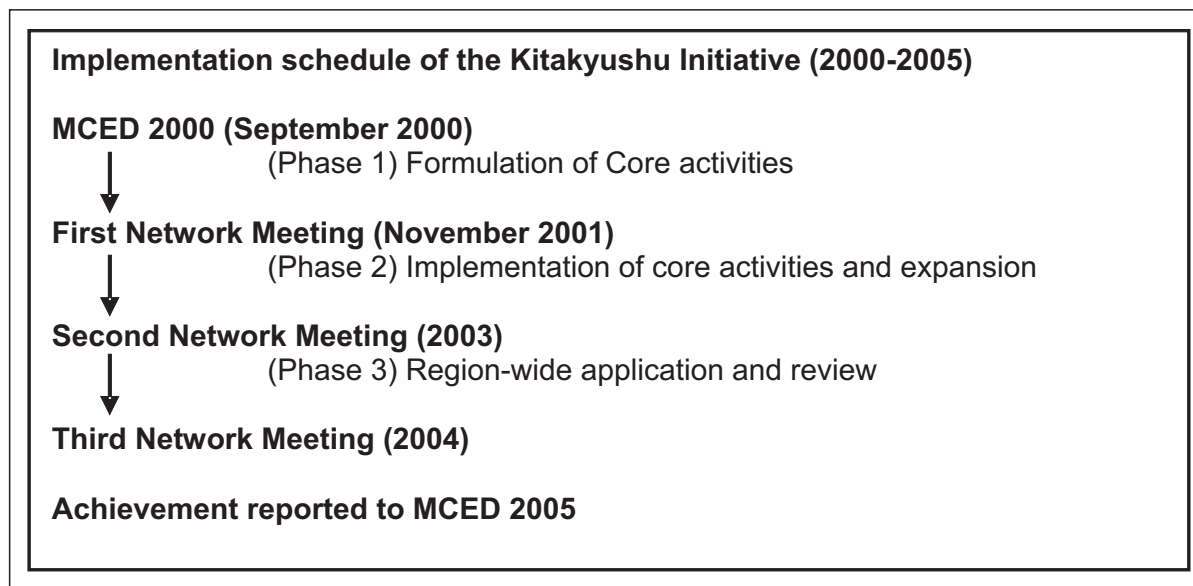
With a mandate to achieve measurable progress in improvement of the environment in major cities in the Asia-Pacific region, the Kitakyushu Initiative focuses on the sharing of experiences of cities that have overcome pollution and improved the urban environment, taking selected technical, institutional, regulatory, and participatory measures available.

Local governments play a vital role in mitigating pollution and taking remedial measures to improve the environment. Proposed in the Kitakyushu Initiative is the strengthening of local initiatives and enhancement of partnerships, creation of a network of local governments to strengthen environmental management

capacities at the local level, and support from national governments for those activities, as well as strengthening linkages with academia, and collaboration with existing international initiatives, among others. Target setting and monitoring of activities were also proposed making use of quantitative indicators in action areas such as enhanced integrated urban planning strategies, improvement in air and water quality, hygienic management and reduction of wastes, and capacity-building, awareness-raising and stakeholder participation.

The implementation of the Kitakyushu Initiative (2000-2005) was conducted in three stages : (1) Phase 1: formulation of core activities; (2) Phase 2 : Implementation of core activities and expansion; and (3) Phase 3 : Region-wide application and review. Three Network meetings were held in 2001, 2004 and 2005 to review overall Network activities.

Overall Activities of the Kitakyushu Initiative



The Kitakyushu Initiative Network was established as a forum to strengthen intercity cooperation in the implementation of the Kitakyushu Initiative. The eight functions proposed for the network are as follows :

- (i) Assistance in preparing and implementing integrated and sustainable urban developed plans and strategies with quantitative indicators;
- (ii) Periodical monitoring of the implementation status in terms of quantitative indicators;
- (iii) Promotion of information exchange and sharing of experience among participating local governments;
- (iv) Provision of a platform for the transfer of technology and know-how packages, good practices, and a successful municipal/regional model for sustainable development;
- (v) Linkages, catalysation and facilitation of internal and external financial support for international cooperation initiatives of local authorities;
- (vi) Facilitation of capacity-building activities for environmental administration staff

in participating local governments;

- (vii) Promotion of environmental education programmes in intercity cooperation, such as student exchanges;
- (viii) Encouragement of private enterprises to participate in infrastructure development and environmental quality enhancement programmes.

The first meeting of the Kitakyushu Initiative Network was held in Kitakyushu, Japan in November 2001, with the participation of 20 cities from 13 countries. The Kitakyushu Initiative Network was inaugurated at the meeting, with the cities that attended participating as core members of the Network. As of March 2005, the number of participating cities has reached 61 cities from 18 countries.

Activities carried out under the banner of the Kitakyushu Initiative include the : (a) Development of the Kitakyushu Initiative Network; (b) Collection and analysis of successful practices in urban environmental management; and (c) Implementation of pilot activities.

Organisation of network meetings

Between April 2001 and March 2005, the Kitakyushu Initiative Network organized three meetings to review and formulate activities of the network.

- First Meeting of the Kitakyushu Initiative Network (20-21 November 2001, Kitakyushu, Japan)
- Second Meeting of the Kitakyushu Initiative Network (15-17 October 2003, Weihai, China)
- Third Meeting of the Kitakyushu Initiative Network (2-4 August 2004, Kitakyushu, Japan)

.....

Annexure III-a

DEWATS

DEWATS - DECENTRALISED SUSTAINABLE APPROACH TO SEWAGE AND WASTE WATER TREATMENT FOR URBAN INDIA

Prepared by:

Inspiration – the eco-sensitive design group

(Member, CDD (Consortium for DEWATS Dissemination), India)

Opp.Bhavans Vidya Mandir, Eeroor (W)P.O, Tripunithura, Kochi-682306, Kerala, India.

Ph:91-484-2779470 / 73 Email: inspire@vsnl.com Web: www.inspire-india.com

Water – the most important factor which brings beauty to any place – the small ponds, the lakes, the rivers flowing into backwaters, the sea, the wells catching the abundant rain water enabling such vegetation and greenery all around.....

Best Options for School Sanitation: Meeting the Challenge



Water – also the factor which brings the biggest of problems to urban life –

- mosquitoes,
- bad stench from clogged dirty canals,
- floods and water logging especially in the monsoons,
- roads breaking up because of poor drainage,
- drinking water scarcity in many parts of the city,
- water borne diseases and health problems,

Mosquitoes



Clogged canals waste water problems



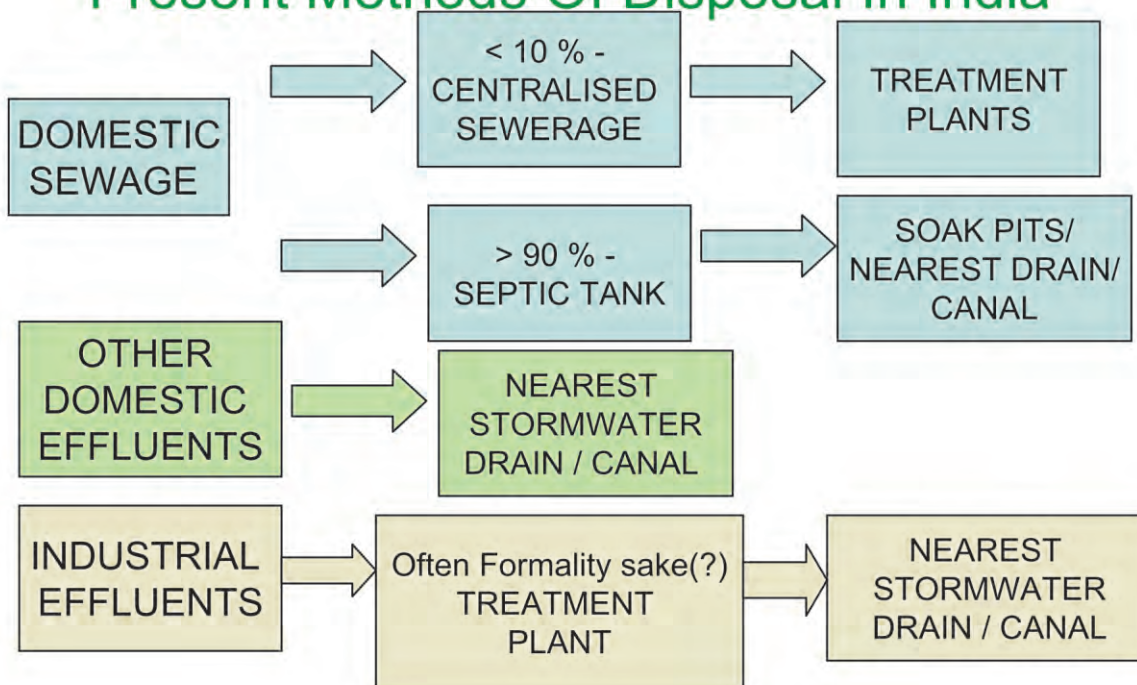
Health hazards and Diseases

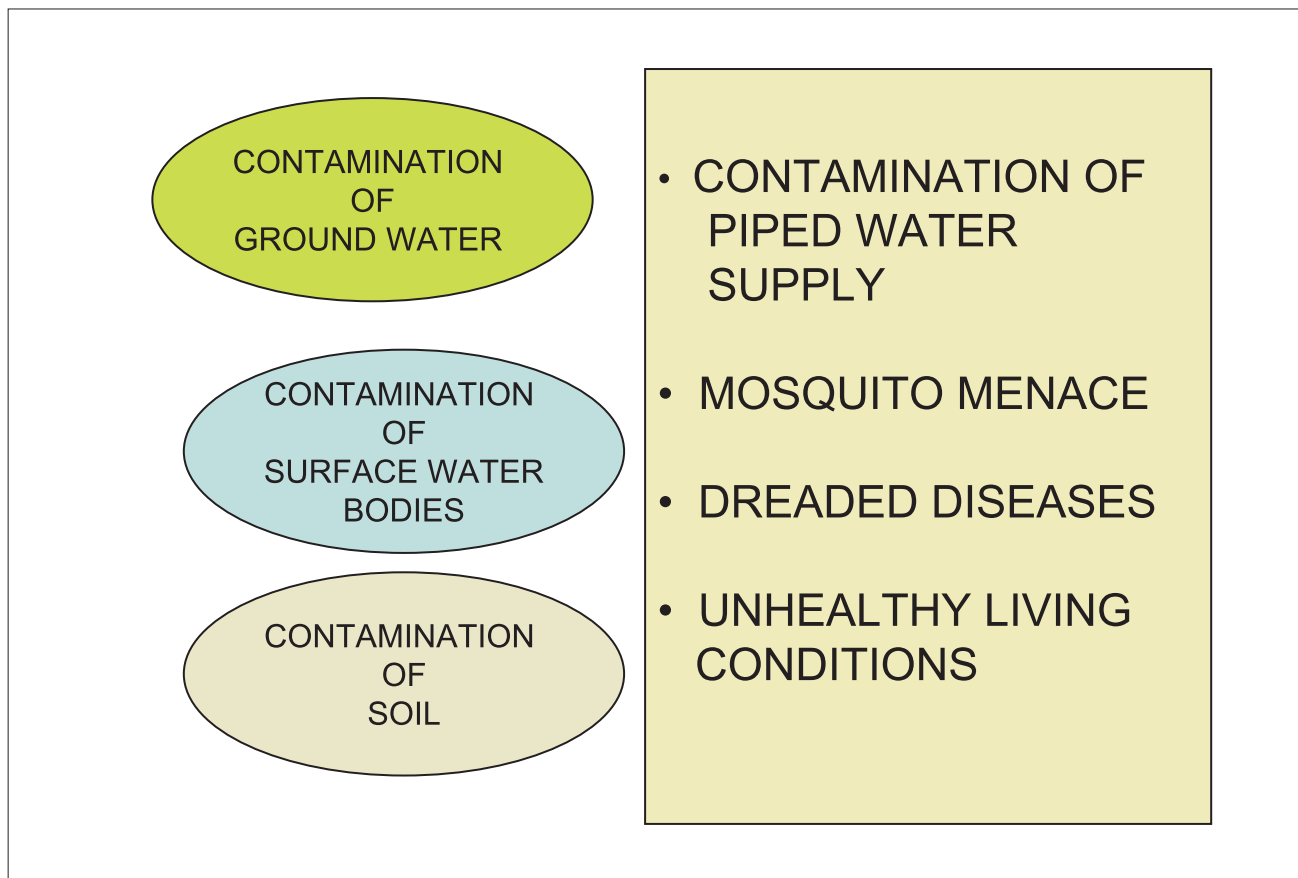


Sources of Waste water

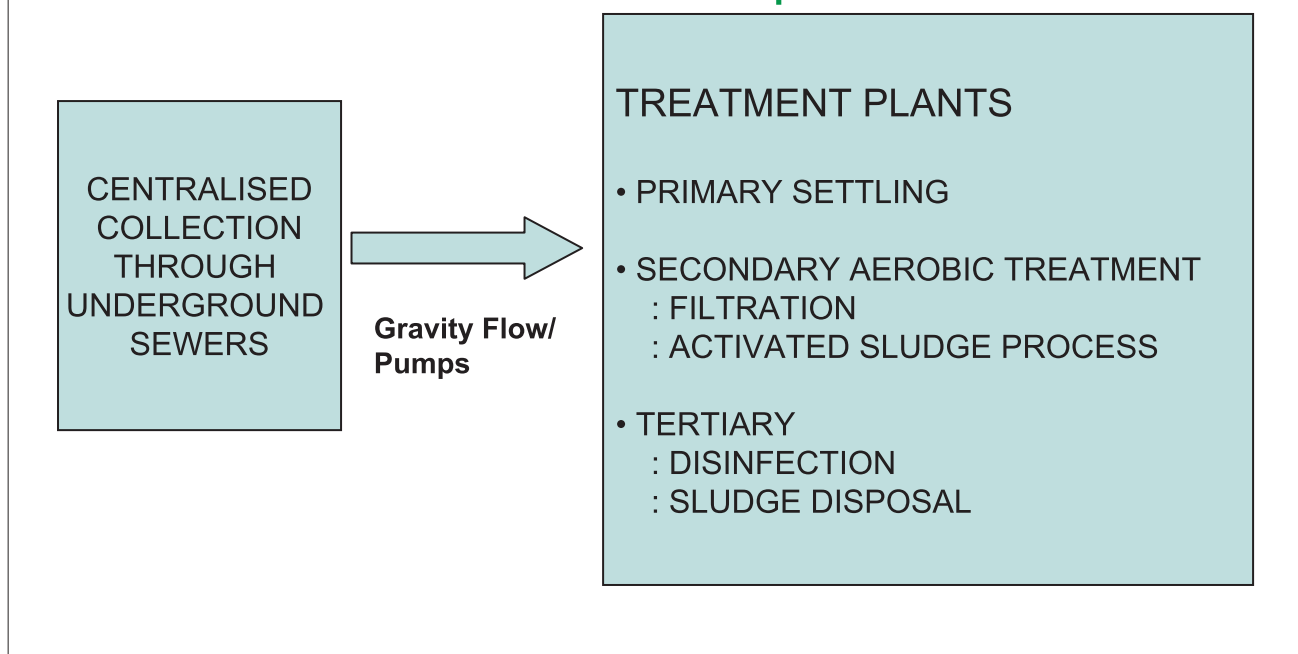
- Domestic Sewage - Waste Water From Kitchens of Houses, Hotels, Hospitals, Canteens, Schools Etc.
- Wastes from Butcheries and Market Places
- Wastes from Bus Stands, Railway Station Etc.
- Waste Water From Garages, Service Stations Etc.
- Waste Water From Peeling Yards & Other Processing Units.
- Effluents From Industries – Large & Small.

Present Methods Of Disposal In India





Conventional System Of Sewage / Waste Water Treatment And Disposal



Why Are Such Systems Often Impractical?

- Expense Involved In Laying Lines To Great Depths Often In Densely Populated Areas.
- Need For Heavy Pumping Machinery
- Very High Energy Costs For Aerobic Treatment – Aeration.
- Need For Skilled Manpower To Operate And Maintain.

Is an alternative approach possible?

In centralized treatment, all the waste water/ effluents generated from various sources such as houses, hotels, schools, markets, hospitals, industries etc are all collected and taken via open or covered drains to a centralized treatment plant.

Developed and designed by Western countries, such systems are mostly based on Aerobic treatment. Aerobic treatment procedures include stabilization ponds, trickling filters, activated sludge process, extended aeration ponds, rotating contact beds etc.

Centralized sewage networks needs high infra-structure investment. They require high maintenance cost, needs skilled technical man power and are highly energy consuming.

**RESEARCH AND DEVELOPMENT
OVER THE LAST 15-20 YEARS IN
DECENTRALISED ANAEROBIC
WASTE WATER TREATMENT SYSTEMS**

- It can be decentralized even to single household levels
- Water can be treated to CPCB discharge standards and recycled for irrigation
- Operable with semi skilled/ unskilled labour
- No mechanical parts
- Requires little space
- No smell
- Less expensive than comparable conventional treatment systems and
- Very low maintenance costs

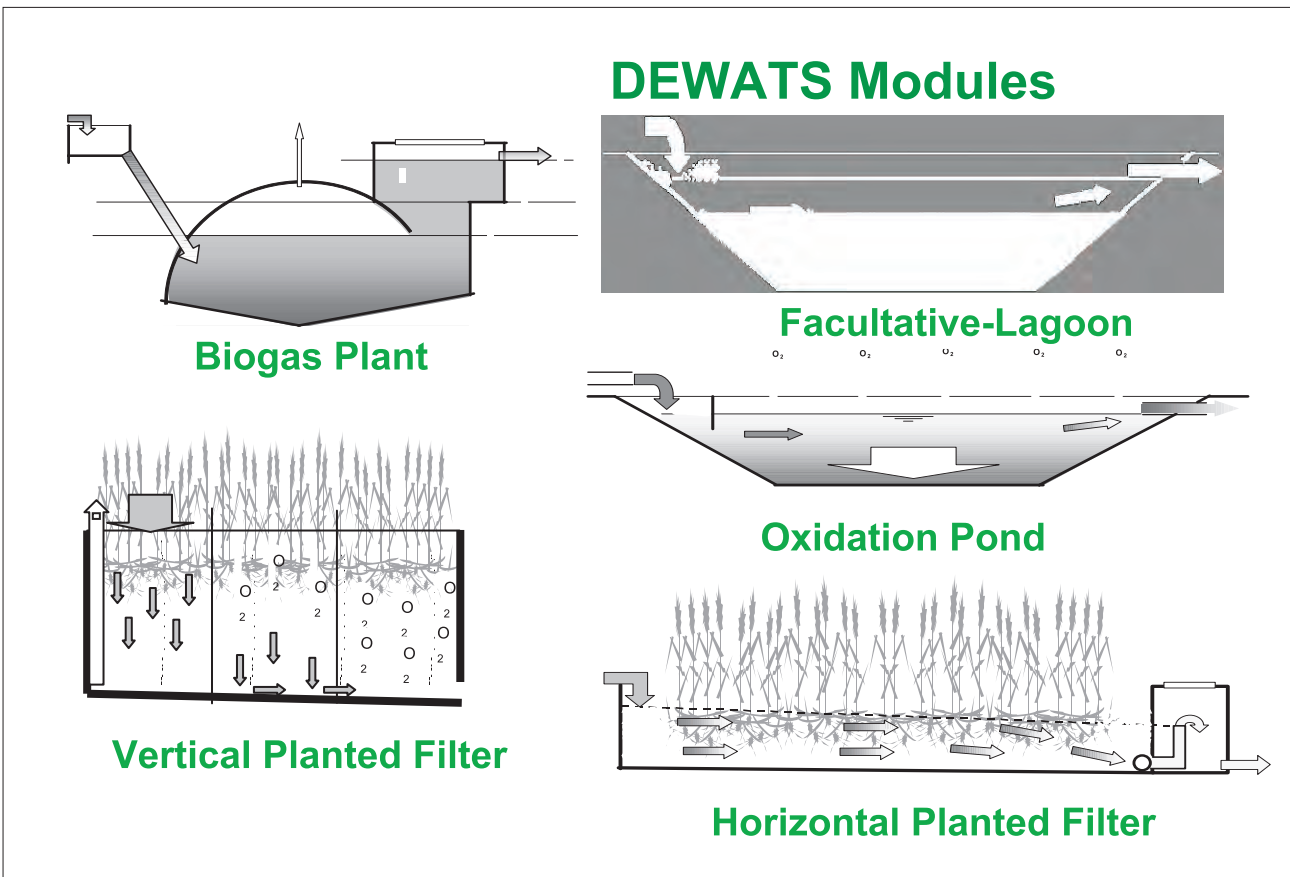
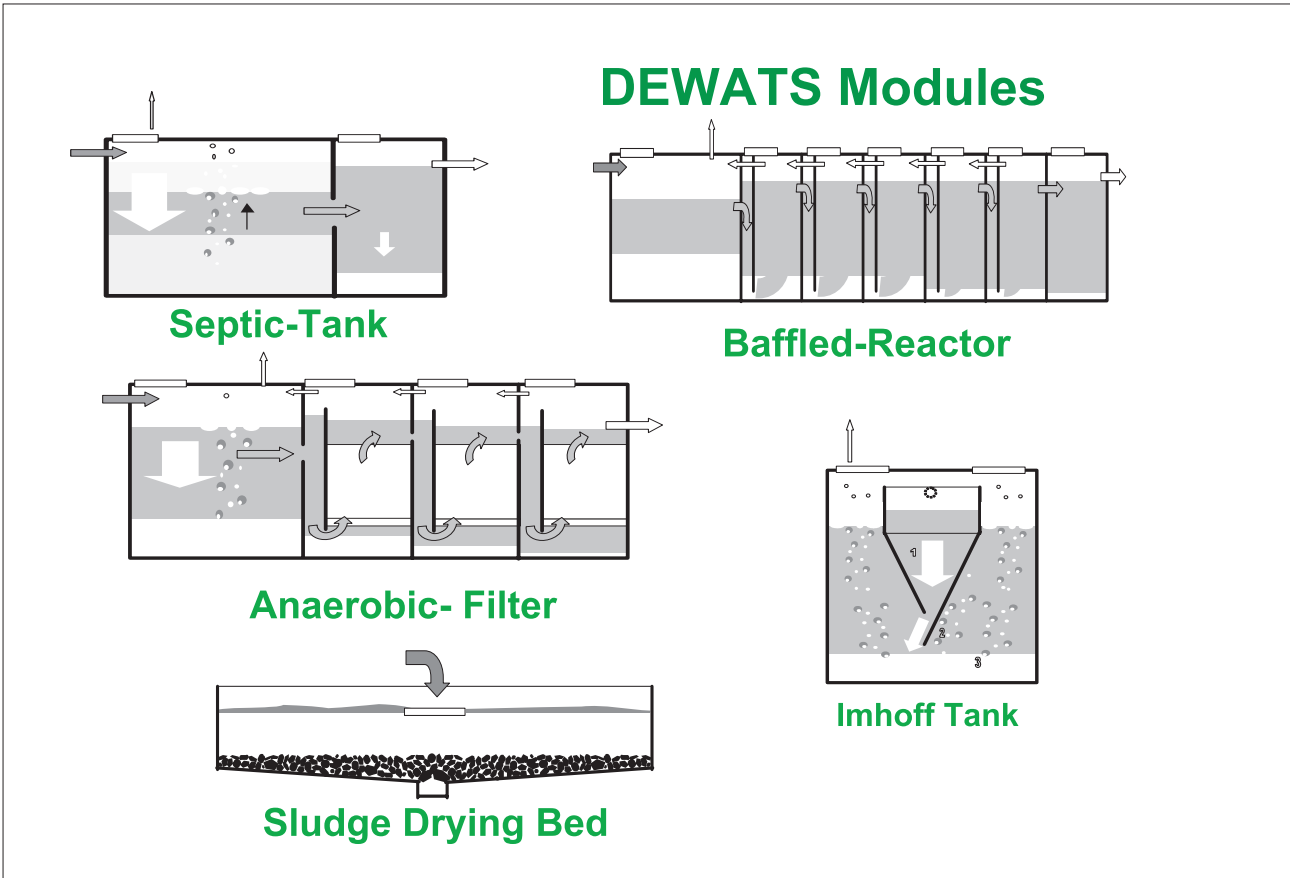
DEWATS is based on four treatment systems:

Sedimentation and primary treatment in settlers, septic tanks or Imhoff tanks.

Secondary Anaerobic Treatment in fixed bed filters or Baffled Reactors.

Secondary and tertiary aerobic/anaerobic treatment in Planted Gravel Filters.

Secondary and tertiary anaerobic /aerobic treatment in ponds.

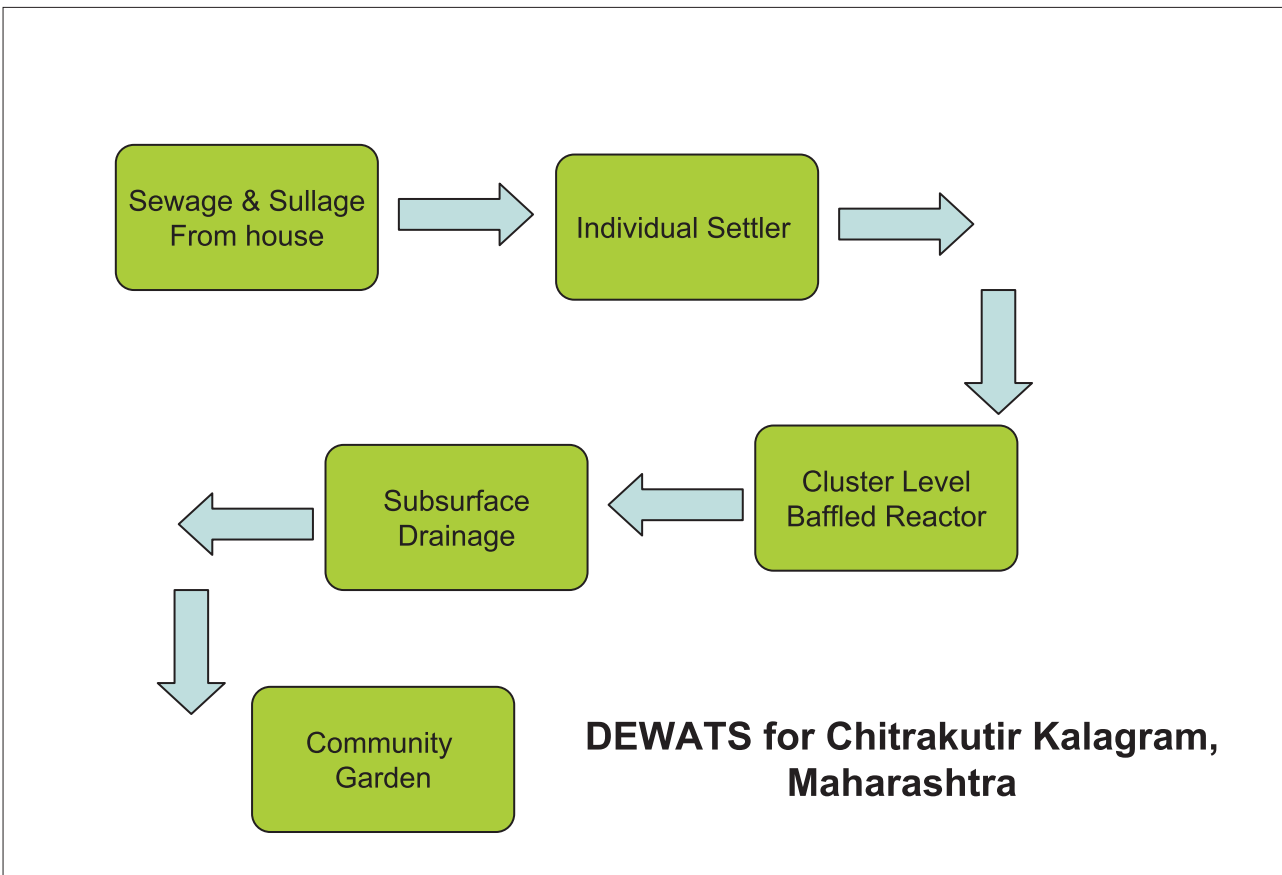
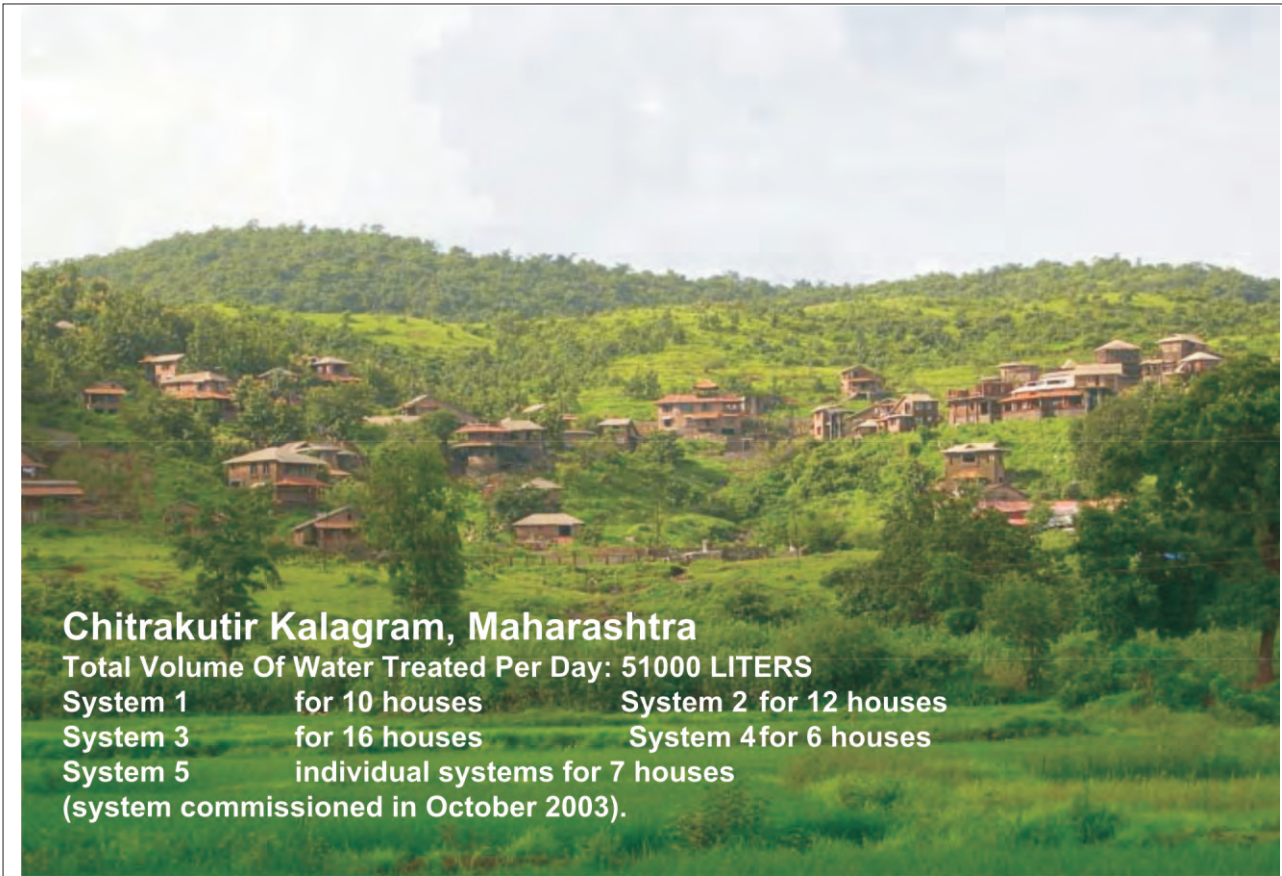


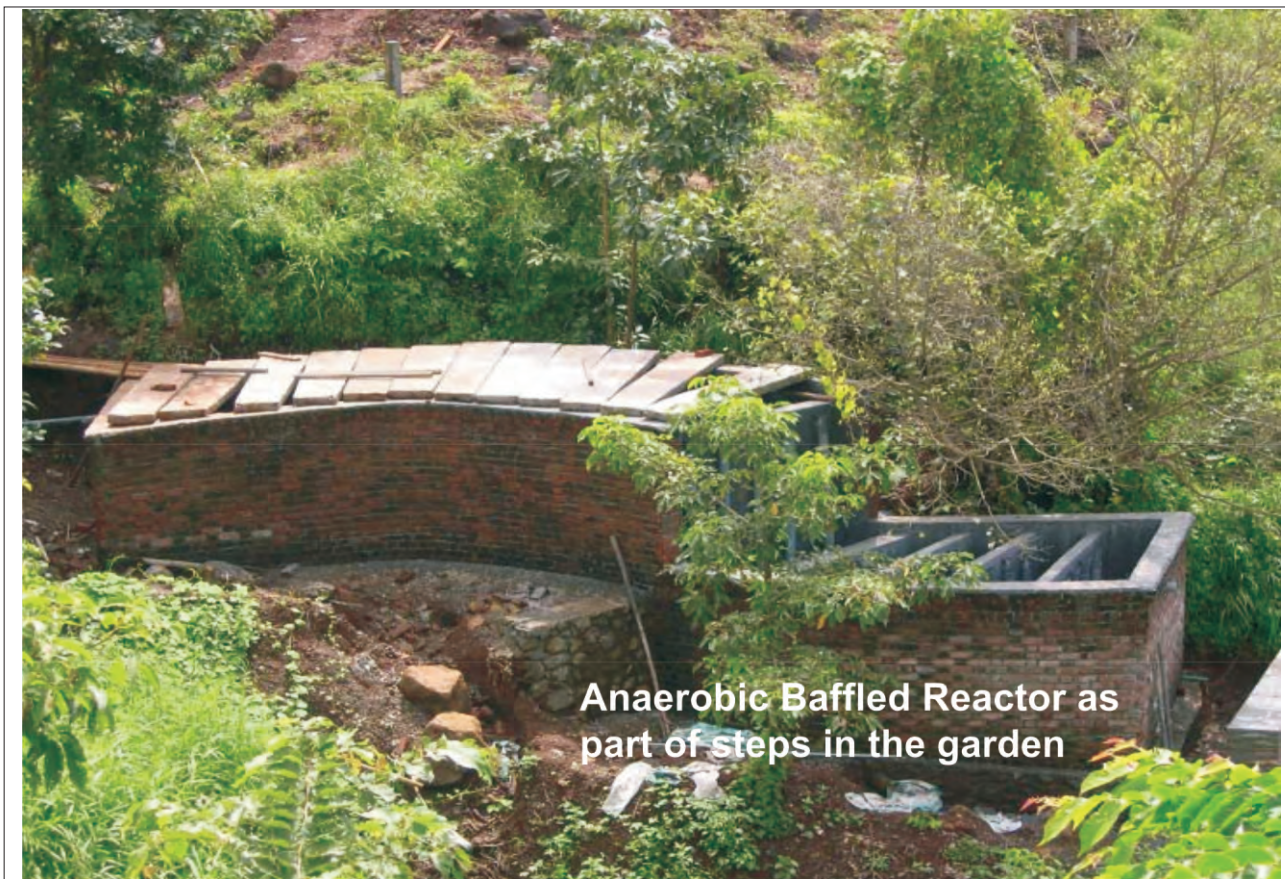
Apartments can opt for DEWATS

- **Minimum space requirement – does not eat up precious ground space**
- **Can be accommodated underground – below paved pathways / parking lots or even under service buildings etc.**
- **No need for skilled maintenance.**
- **Minimum operation costs.**
- **Civic responsibility to prevent soil and ground water contamination.**

Housing Colonies / Townships

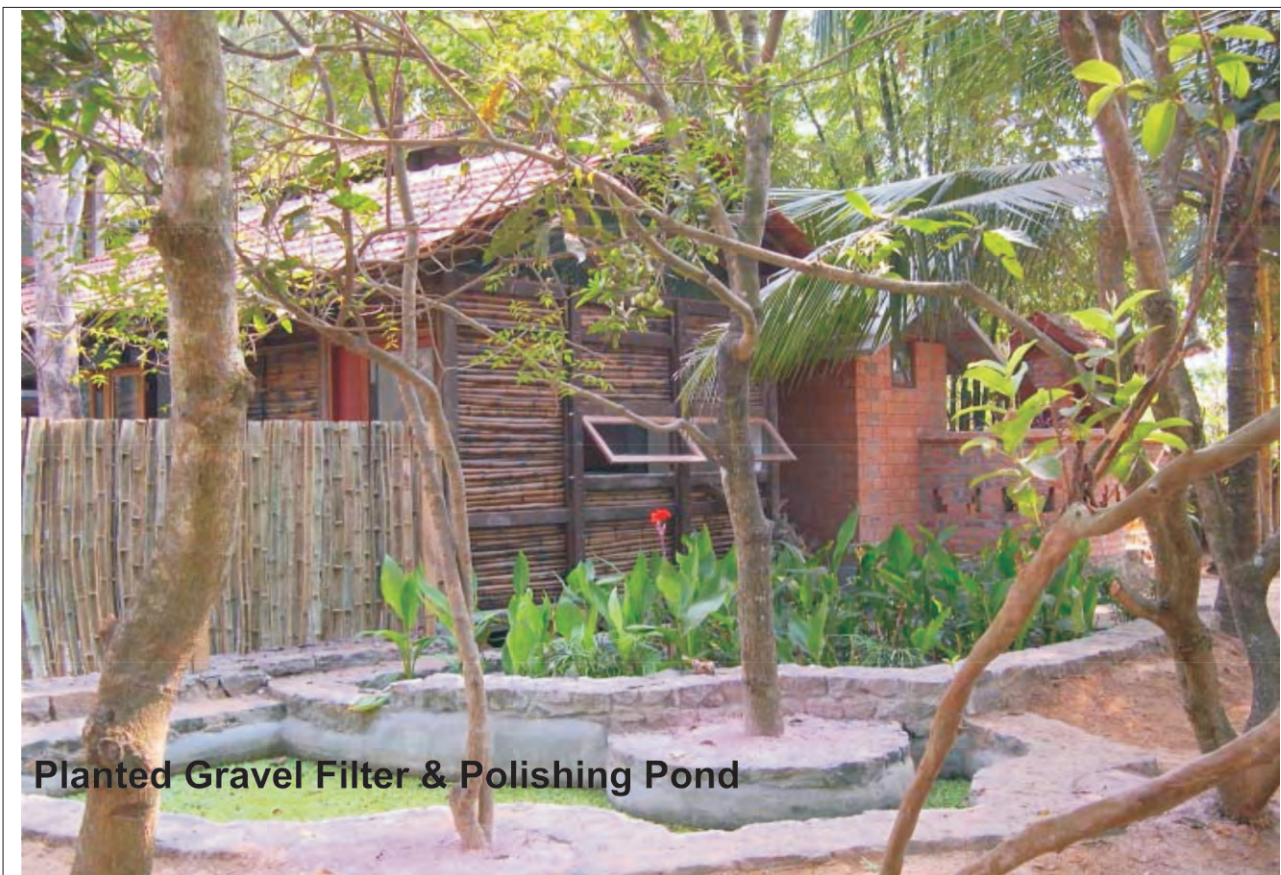
- **Can be decentralized thereby reducing plumbing and pumping costs.**
- **Possibility of safe reuse of water for gardening open spaces.**
- **Can be integrated as part of the landscape.**
- **Low energy & operation costs.**
- **Civic Responsibility.**





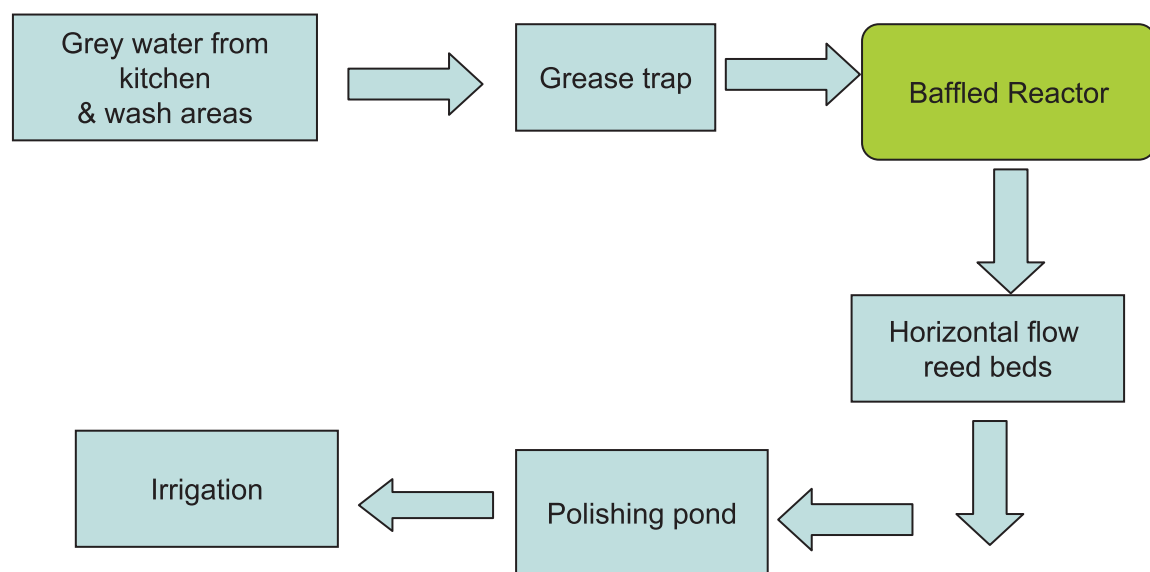
III. DEWATS for Commercial Establishments – Offices, Shops, Hotels, Resorts etc.

- Can be scaled to any size.
- Adaptability to varying load conditions.
- Adaptability to varying climatic conditions.
- Can treat waste water with high fat, suspended solids and BOD.
- Safe reuse of water for non potable end uses.
- System cannot be switched off – so ensures efficient working irrespective of external factors.





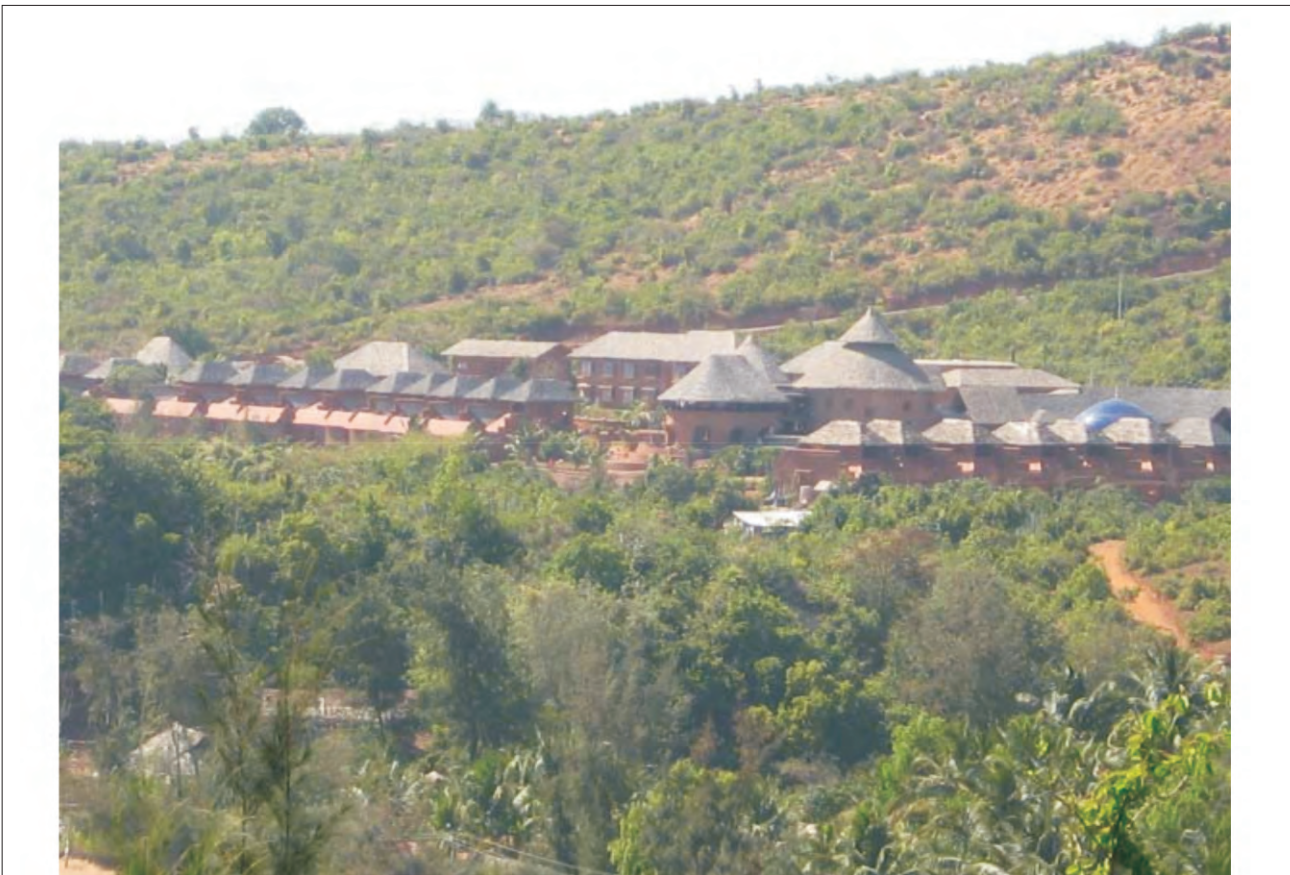
BTH Sarovaram, Cochin



Flow Chart Of DEWATS System at BTH Sarovaram



Best Options for School Sanitation: Meeting the Challenge



Best Options for School Sanitation: Meeting the Challenge





Expertise available:

Several such anaerobic treatment systems have been tried and tested successfully in various parts of India, China, Germany, Indonesia, Srilanka and Philippines among others. These include treatment systems ranging from individual houses to Hotels, Hospitals, small industries and small townships.

A national consortium (CDD) for dissemination of Decentralised Waste water Treatment Systems (DEWATS) has been formed with partners including BORDA (Bremen Overseas Research and Development Agency), Auroville, CES - Anna University, Exnora International, Sulabh International etc along with 'Inspiration' in Kochi to disseminate such treatment systems.

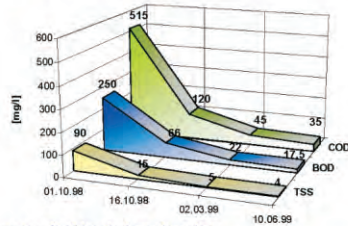
Annexure III-b

DEWATS

Best Options for School Sanitation: Meeting the Challenge

Effluent Laboratory Test Results

Effluent quality during first month of *dewats* operation



Laboratory result of treated wastewater

No	Parameter	Satuan	Kadar Maks.	Hasil Analisa		Reduksi
				Inlet	Outlet	
1	Suhu	C	<30	-	-	-
2	BOD	mg/l	30	57	28	50,88%
3	COD	mg/l	80	138	46	66,67%
4	TSS	mg/l	30	44	13	70,45%
5	NH ² bebas	mg/l	0,1	0,37	0,09	75,68%
6	PO ⁴	mg/l	2	5,7	2,42	57,54%
7	pH	6,0 - 9,0	-	7,48	7,45	-

Note: BOD: Biologiçal Oxygen Demand, COD: Kimiçal Oxygen Demand, TSS: Total Suspended Solid, NH²: Ammonia, PO⁴: Phosfat



German Federal Ministry
for Economic Cooperation
and Development

Freie
Hansestadt
Bremen



BORDA Bremen Overseas Research and Development Association

Industriestr. 20 · D28199 Bremen · Germany
Phone: +49 421 137 18 office@borda.de
Fax: +49 421 165 5323 www.borda.de

dewats

Decentralized Waste Water Treatment System



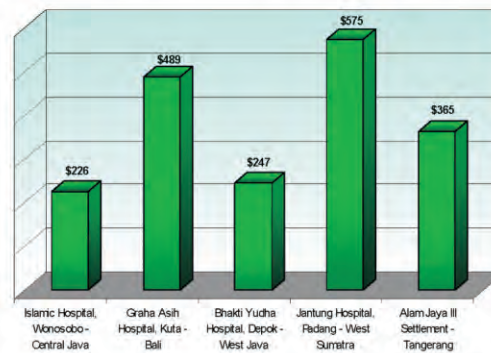
Bremen Overseas Research and
Development Association

Overview



Construction Costs (Approximately)

Examples of prices (\$ / m³) for *dewats* treatment volume



Typical *dewats* cost factors
for 100 m³ anaerobic filter reactor

Factors	%
Sand, Cement, Concrete, Iron, Stone, Pipes, Plats, Filter material	60
	40
	100

Implementation

dewats – implemented in four steps:



Seminar and workshop
Potential clients are encouraged and informed about the importance of wastewater treatment & *dewats* technology.



Feasibility study
On-site surveys by *dewats* experts: Collection of first hand information about all important aspects related to wastewater treatment, which then be transformed into project proposal.



Construction and supervising
Construction is the most important part in *dewats* technology. Wastewater discharged is treated appropriately in this section.



Monitoring
dewats project is responsible for monitoring and maintaining the wastewater treatment system for a generate period of 12 months.

Demand

Common wastewater problems within communities and small & medium enterprises



Communities, Small and Medium Enterprises are often not able to meet high investment and maintenance cost required for sophisticated wastewater treatment system.

Maintenance of sophisticated wastewater treatment system are found to be difficult due to low human resources.



Wastewater treated does not meet wastewater discharge standard regulation.



Low maintenance and operation of wastewater treatment system are required to avoid problems during operation.



A combination between wastewater treatment system and landscape is required to achieve environmental friendly communities, small and medium enterprises

dewats Technology Principles

A combination of low-maintenance based technology

Biogas digester



- Half-ball-shaped fixed dome plant
- Suitable for rather "thick" and homogenous substrate like sludge from aerobic treatment tanks, liquid animal excreta and excrements

Basic septic tank



- Basically principled on sedimentation tank in which settled sludge is stabilized by anaerobic digestion
- Mechanical treatment by sedimentation
- Biological treatment by contact between fresh water and active sludge compete with each other in the septic tank

Baffled up-flow reactor



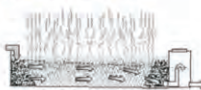
- Treatment by forcing incoming wastewater to pass through active bacteria sludge in each compartment. The settler in front prevents larger solids to enter the baffle section

Anaerobic filter reactor



- Treatment of non-settleable and dissolved solids by bringing them in close contact with a surplus of active bacterial mass

Horizontal sand filter



- Provides continuous oxygen supply to the upper layers
- Treatment by permanently soaked sand or gravel filter with water and operates partly aerobic, partly anoxic, and partly anaerobic

Construction

Wastewater discharged is treated to meet wastewater discharge standard



Sedimentation biogas digester

- Optionally constructed and integrated with 'Baffle Reactor'
- Brick construction, fully waterproof, and air-tight plastering
- Biogas produced as renewable energy source
- Functioned as settler for 'Black Water'



Baffle reactor and anaerobic filter

- Anaerobic degradation of suspended and dissolved solid based on up-flow principle
- Simple, durable, easy to maintain
- Underground construction, little permanent space required
- Effective, efficient, and low cost maintenance
- BOD reduction up to 90%



Horizontal sand filter

- Aerobic-facultative-anaerobic degradation of dissolved and fine suspended solids
- Pathogen removal
- No wastewater above ground
- No nuisance odor
- High treatment efficiency



Aerobic ponds

- Aerobic degradation
- High pathogen removal rate
- Simply constructed
- Naturally & environmentally reliable in performance
- Provide possibilities for pleasant landscaping

Hazardous Waste Management Handling Rules, 1989

Hazardous Waste (Management and Handling) Rules, 1989

In exercise of the powers conferred by sections 6, 8 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules, namely :

1. Short title and commencement

- (1) These rules may be called the Hazardous Wastes (Management and Handling) Rules, 1989.
- (2) They shall come into force on the date of their publication in the official Gazette.

2. Application

These rules shall apply to the handling of hazardous wastes as specified in Schedule and shall not apply to-

- (a) waste water and exhaust gases as covered under the provisions of the Water (Prevention and Control of Pollution) Act, 1974 (6 of 1974) and the Air (Prevention and Control of Pollution) Act, 1981 (14 of 1981) and rules made thereunder;
- (b) wastes arising out of the operation from ships beyond five kilometres as covered under the provisions of the Merchant Shipping Act, 1958 (44 of 1958) and the rules made thereunder,
- (c) radio-active wastes as covered under the provisions of the Atomic Energy Act, 1962 (33 of 1962) and rules made thereunder,

3. Definitions

In these rules, unless the context otherwise requires,-

- (a) "Act" means the Environment (Protection) Act, 1986 (29 of 1986);
- (b) "applicant" means a person or an organisation that applies, in Form 1, for granting of authorisation to perform specific activities connected with handling of hazardous wastes;
- (c) "authorisation" means permission for collection, reception, treatment, transport, storage and disposal of hazardous wastes granted by the competent authority in Form 2;
- (d) "authorised person" means a person or an organisation authorised by the competent authority to collect, treat, transport, store or dispose of hazardous wastes in accordance with the guidelines to be issued by the competent authority from time to time;
- (e) "export" with its grammatical variation and cognate expression means taking out of India to a place outside India;
- (f) "exporter" means any person under the jurisdiction of the exporting country who exports hazardous wastes and the exporting country itself, who exports hazardous wastes;
- (g) "facility" means any location wherein the processes, incidental to the waste generation collection, reception, treatment, storage and disposal are carried out;
- (h) "Form" means Form appended to these rules;
- (i) "hazardous wastes" means,
 - (a) Waste Substances which are generated in the process indicated in column-2 of Schedule-1 and consists of wholly or partly of the waste substances referred to in column - 3 of the same schedule;
 - (b) Waste substances which consists wholly or partly of substances indicated in Schedule-2, unless the concentration of the substances is less than the limit indicated in the same schedule: and
 - (c) Waste substances indicated in Part-A, List 'A' and 'B' of Schedule -3 applicable only to rule 12, 13 and 14 unless they do not possess any of the hazardous characteristics in Part-B of the same schedule.
- (j) "hazardous wastes site" means a place for collection, reception, treatment, storage and disposal of hazardous wastes which has been duly approved by the competent authority;
- (k) "import" with its grammatical variations and cognate expressions, means bringing into India from a place outside India;
- (l) "importer" means an occupier or any person who imports hazardous wastes;
- (m) "operator of a facility" means a person who owns or operates a facility for collection, reception, treatment, storage and disposal of hazardous wastes;
- (n) "Schedule" means Schedule appended to these rules;
- (o) "State Pollution Control Board" means the Board appointed under sub-section of the section 4 of the Water (Prevention and Control of Pollution) Act 1974 (6 of 1974); and under Section 4 of the Air (Prevention and Control of Pollution) Act, 1981 (14 of 1981);
- (p) "transboundary movement" means any movement of hazardous wastes or other wastes from an area under the national jurisdiction of one country to or through an area under the national jurisdiction of another country or to or through an area not under the national jurisdiction of any country, provided at least two countries are involved in the movement;
- (q) "disposal" means deposit, treatment, storage and recovery of any hazardous wastes;
- (r) "manifest" means transporting document originated and signed by the occupier in accordance with rule 7(4) and 7(5);
- (s) "State Government" means State Government and in relation to Union Territory the Administrator thereof appointed under Article 239 of the Constitution;
- (t) "storage" means keeping hazardous wastes for a temporary period, at the end of which the hazardous waste is treated and disposed off;
- (u) "transport" means movement of hazardous waste by air, rail, road or water;
- (v) "transporter" means a person engaged in the off-site transportation of hazardous waste by air, rail, road or water;
- (w) "treatment" means a method, technique or process, designed to change the physical, chemical

or biological characteristics or composition of any hazardous waste so as to render such wastes harmless;

- (x) "environmentally sound management of hazardous wastes" means taking all steps to ensure that the hazardous wastes are managed in a manner which will protect human health and the environment against the adverse effects which may result from such wastes;
- (y) "illegal traffic" means any transboundary movement of hazardous wastes as specified in rule 15;
- (z) the words and expressions used in these rules and not defined but defined in the Act, shall have the meanings respectively assigned to them in the Act.

4. Responsibility of the occupier and operator of facility for handling of wastes

- (1) The occupier and the operator of a facility shall be responsible for proper collection, reception, treatment, storage and disposal of hazardous wastes listed in Schedule 1,2 and 3.
- (2) The occupier or any other person acting on his behalf who intends to get his hazardous waste treated by the operator of a facility under sub-rule (1), shall give to the operator of a facility, such information as may be specified by the State Pollution Control Board.
- (3) It shall be the responsibility of the occupier and the operator of a facility, to take all steps to ensure that the wastes listed in schedules -1, 2 and 3 are properly handled, and disposed of without any adverse effects to the environment.

4A. Duties of the occupier and operator of a facility

It shall be the duty of the occupier and the operator of a facility to take adequate steps while handling hazardous waste to

- (i) Contain contaminants and prevent accidents and limit their consequences on human and the environment; and
- (ii) provide persons working on the site with information, training and equipment necessary to ensure their safety.

4B. Duties of the Authority

Subject to the provisions of these rules, the authority shall also perform duties as specified in Column 3 of Schedule 4.

5. Grant of authorisation for handling hazardous wastes

- (1) Hazardous wastes shall be collected, treated, stored and disposed of only in such facilities as may be authorised for this purpose.
- (2) Every occupier generating hazardous wastes and having a facility for collection, reception, treatment, transport storage and disposal of such wastes shall make an application in Form 1 along with a sum of rupees seven thousand five hundred only for processing application for authorization and analysis fee, if required, as prescribed under the Environment (Protection) Act, 1986 to the State Pollution Control Board for the grant of authorisation for any of the above activities:
Provided that the occupier not having a facility for the collection, reception, treatment, transport, storage and disposal of hazardous wastes shall make an application to the Member-Secretary, State Pollution Control Board or any officer designated by the Board in Form 1 for the grant of authorisation within a period of six months from the date of commencement of these rules.
- (3) Any person who intends to be an operator of a facility for the collection, reception, treatment, transport, storage and disposal of hazardous wastes, shall make an application in Form 1 along with a sum of rupees seven thousand five hundred only for processing application for authorization and analysis fee, if required, as prescribed under the Environment (Protection) Act, 1986 to the Member-Secretary, State Pollution Control Board or any officer designated by the Board for the grant of authorisation for any of the above activities:
Provided that the operator engaged in the business of the collection, reception, treatment, transport, storage and disposal of hazardous wastes shall make an application to the Member-Secretary, State Pollution Control Board or any officer designated by the Board in Form 1 for the grant of authorisation within a period of six months from the date of commencement of these rules.
- (4) The State Pollution Control Board shall not issue an authorisation unless it is satisfied that the operator of a facility or an occupier, as the case may be, possesses appropriate facilities, technical capabilities and equipment to handle hazardous wastes safely.
- (4A) the authorisation application complete in all respects shall be processed by the State Pollution Control Boards within ninety days of the receipt of such application
- (5) The authorisation to operate a facility shall be issued in Form 2 and shall be subject to conditions laid down therein.
- (6) (i) An authorisation granted under this rule shall unless sooner suspended or cancelled, be in force for a period of five years from the date of issue or from the date of renewal.
(ii) An application for the renewal of an authorisation shall be made in Form 1r before its expiry.
(iii) The authorisation shall continue to be in force until it is renewed or revoked.
- (7) The Member-Secretary, State Pollution Control Board or any officer designated by the Board, may, after giving reasonable opportunity of being heard to the applicant refuse to grant any authorisation.
- (8) The Member-Secretary, State Pollution Control Board or any officer designated by the Board

Best Options for School Sanitation: Meeting the Challenge

shall renew the authorisation granted under sub rule (6), after examining each case on merit, subject to the following:

- (i) on submission of annual returns by the occupier or operator of facility in Form 4;
- (ii) on steps taken, wherever feasible, for reduction in waste generated or recycled or reused;
- (iii) on fulfilment of conditions prescribed in the authorisation regarding management in an environmentally sound manner of wastes; and
- (iv) on remittance of a processing application fee and analysis fee, as the case may be.

6. Power to suspend or cancel an authorisation

- (1) The State Pollution Control Board or Committee may cancel an authorisation issued under these rules or suspend it for such period as it thinks fit, if in its opinion, the authorised person has failed to comply with any of the conditions of the authorisation or with any provisions of the Act or these rules, after giving the authorised person an opportunity to show cause and after recording reasons therefor.
- (2) Upon suspension or cancellation of the authorisation and during the pendency of an appeal under rule 12, the State Pollution Control Board or Committee may give directions to the persons whose authorisation has been suspended or cancelled for the safe storage of the hazardous wastes, and such person shall comply with such directions.

7. Packaging, labelling and transport of hazardous wastes

- (1) The occupier or operator of a facility shall ensure that the hazardous wastes are packaged, based on the composition in a manner suitable for handling, storage and transport and the labelling and packaging shall be easily visible and be able to withstand physical conditions and climatic factors.
- (2) Packaging, labelling and transport of hazardous wastes shall be in accordance with the provisions of the rules made by Central Government under the Motor Vehicles Act, 1988 and other guidelines issued from time to time.
- (3) All hazardous waste containers shall be provided with a general label as given in Form 8.
- (4) No transporter shall accept hazardous wastes from an occupier for disposal unless it is accompanied by five copies of the manifest (Form 9) as per the colour codes. The transporter shall give a copy of the manifest signed and dated to the occupier and retain the remaining four copies to be used as prescribed in sub- rule (5).
- (5) Occupier shall provide the transporter with six copies of the manifest as per the colour codes indicated below:

Copy 1(White)	forwarded to the Pollution Control Board by the occupier
Copy 2(Light Yellow)	signed by the transporter and retained by the occupier.
Copy 3 (Pink)	retained by the operator of a facility.
Copy 4(Orange)	returned to transporter by the operator of facility after accepting waste.
Copy 5 (green)	forward to Pollution Control Board by operator of facility after disposal.
Copy 6 (Blue)	returned to the occupier by the operator of the facility after disposal.
- (6) The occupier shall obtain necessary no-objection certificate from State Pollution Control Boards in the respective states involved in case of any inter and intra State transport of hazardous wastes;
- (7) The occupier shall provide the transporter with relevant information in Form 10, regarding the hazardous nature of the wastes and measures to be taken in case of an emergency.

8. Disposal Sites

1. The occupier or any operator of a facility shall be responsible for identifying sites for establishing hazardous wastes disposal facility;
2. The State Government, operator of a facility or any association of occupiers shall identify sites for common hazardous wastes disposal facility in the state;
3. The State Government, occupier or any association shall after preliminary impact assessment studies identify possible sites for disposal facility. They shall then undertake an Environmental Impact Assessment of these sites for selecting an appropriate site for hazardous waste disposal facility;
4. The occupier or any association after identification as prescribed in sub-rule (3) shall inform the State Government to take necessary action for notifying of the site;
5. The State Government shall after identification or on receipt of information regarding identification by such occupier or any such association shall cause a public notice inviting objections and suggestions within thirty days;
6. The state Government shall on receipt of any objection conduct a public hearing as per the procedure notified for Environmental Impact Assessment;
7. The state Government shall then, acquire or inform such occupier or any such association to acquire the site before notifying the same. It shall also undertake to compile and publish periodically an inventory of such disposal sites in the state;
- 8A. Design and setting up of disposal facility:
 1. The occupier, any association or operator of a facility, as the case may be shall design and set up disposal facility as per the guidelines issued by the Central Government or the State Government as the case may be;
 2. The occupier, any association or operator, shall before setting up a disposal facility get the design and the layout of the facility approved by the State Pollution Control Board;

3. The State Pollution Control Board shall monitor the setting up and operation of a facility regularly.
- 8B. Operation and closure of landfill site:
1. The occupier or the operator as the case may be, shall be responsible for safe and environmentally sound operation of the facility as per design approved under Rule 8A by the State Pollution Control Board;
 2. The occupier or the operator shall ensure that the closure of the landfill is as per the design approved under Rule 8A by the State Pollution Control Board.

9. Records and returns

- (1) The occupier generating hazardous waste and operator of a facility for collection, reception, treatment, transport, storage and disposal of hazardous waste shall maintain records of such operations in Form 3.
- (2) The occupier and operator of a facility shall send annual returns to the State Pollution Control Board or Committee in Form 4.

10. Accident reporting and follow-up

Where an accident occurs at the facility or on a hazardous waste site or during transportation of hazardous wastes, the occupier or operator of a facility shall report immediately to the State Pollution Control Board or Committee about the accident in Form 5.

11. Import and Export of Hazardous Wastes for dumping and disposal

- (1) Import of hazardous wastes from any country to India and export of hazardous wastes from India to any country for dumping or disposal shall not be permitted.
- (2) The exporting country or the exporter as the case may be, of hazardous wastes shall communicate in Form 6 to the Central Government (the Ministry of Environment and Forests) of the proposed trans-boundary movement of hazardous wastes.
- (3) The Central Government shall, after examining the communication received under sub-rule(2) and on being satisfied that the import of such hazardous wastes is to be used for processing or reuse as raw material grant permission for the import of such wastes subject to such conditions as the Central Government may specify in this behalf and if, however, the Central Government is not satisfied with the communication received under sub-rule (2), may refuse permission to import such hazardous wastes.
- (4) Any importer importing hazardous wastes shall provide necessary information as to the type of hazardous wastes he is to import, in Form 6, to the concerned State Pollution Control Board/the Central Pollution Control Board in the case of Union Territories.
- (5) The State-Pollution Control Board shall examine the information received under the sub-rule (4) and issue such instructions to the importers as it considers necessary.
- (6) The Central Government or the State Pollution Control Board, as the case may be, shall inform the concerned Port Authority to take appropriate steps regarding the safe handling of the hazardous wastes at the time of off-loading the same.
- (7) Any person importing hazardous wastes shall maintain the records of the hazardous wastes imported as specified in Form 7 and the records so maintained shall be open for inspection by the State Pollution Control Board/the Ministry of Environment and Forests/the Central Pollution Control Board in the case of Union Territories or an officer appointed by them in this behalf.

12. Import and Export of Hazardous Wastes for recycling and reuse

1. Import and/or export of hazardous wastes rule 3(i)(c) shall only be permitted as raw material for recycling or reuse;
2. The Ministry of Environment and Forests shall be the nodal Ministry to deal with transboundary movement of hazardous waste;
3. For regulation of export and import the authorities mentioned in Schedule 4 shall be responsible;
4. The decision of the Central Government in respect of grant of permission for import or export shall be final;
5. Any occupier importing or exporting hazardous waste shall provide detailed information in Form 7A to the Customs authorities.
6. Any occupier exporting or importing hazardous waste from or to India shall comply with the articles of the Basel Convention to which the Central Government is a signatory.

13. Import of Hazardous Waste

1. Every occupier importing hazardous waste shall apply to the State Pollution Control Board, one hundred twenty days in advance in Form-6 for permission to import along with a minimum fee of rupees thirty thousand payable to Ministry of Environment and Forests, Govt. of India for imports upto five hundred metric tonnes and for every additional five hundred metric tonnes or part thereof of waste imported an additional sum of rupees five thousand will be payable;
2. The State Pollution Control Board shall examine the application received from the occupier within thirty days and forward the application with recommendation and requisite stipulations for safe transport, storage and processing, to the Ministry of Environment and Forests;
3. The Ministry of Environment and Forests, Government of India will examine the application received from the State Pollution Control Board and after satisfying itself will grant permission for imports subject to the following;-

- a. environmentally friendly/ appropriate technology used for re-processing;
 - b. the capability of the importer to handle and reprocess hazardous wastes in an environmentally sound manner;
 - c. presence of adequate facility for treatment and disposal of wastes generated; and
 - d. approvals, no objection certificates and authorisations from all concerned authorities; and
 - e. remittance of a processing application fee;
4. The Ministry of Environment & Forests, Government of India, shall forward a copy of the permission granted, to the Central Pollution Control Board, the State Pollution Control Board and the concerned Port and Customs authorities for ensuring compliance of the conditions of imports and to take appropriate steps for safe handling of the waste at the time of off-loading;
 5. An application for licence to the Directorate General of Foreign Trade for import shall be accompanied with the permission granted by the Ministry of Environment and Forests, Government of India under sub-rule (3) to the importer and an authenticated copy of Form 7 of the Exporter under sub rule (3) of rule 14;
 6. The Port and Custom authorities shall ensure that the shipping document is accompanied with an authenticated copy of Form 7 and the test report from an accredited laboratory of analysis of the hazardous waste shipped;
 7. The occupier having valid permission to import shall inform the State and Central Pollution Control Board and the Port authorities of the arrival of the consignment of hazardous wastes ten days in advance;
 8. The occupier importing hazardous waste shall maintain the records of hazardous waste imports as specified in Form 6A and the record so maintained shall be available for inspection;

14. Export of Hazardous Waste

1. The exporting country or the exporter as the case may be, of hazardous waste shall apply ninety days in advance in Form 7 to the Ministry of Environment and Forests, Government of India, seeking permission for the proposed export and transboundary movement;
2. The Ministry of Environment and Forests, Government of India, on receipt of such Form 7 from an exporter or an exporting country shall examine the case on merit and grant or refuse permission for export to India;
3. The Ministry of Environment and Forests, shall communicate the grant of permission by authentication on Form 7 to the exporter and the exporting country and endorse a copy of the same to the Central Pollution Control Board and the State Pollution Control Board;
4. The exporter shall ensure that no consignment is shipped prior to the requisite authentication being received. The exporter shall also ensure that the shipping document is accompanied with Form 7A, an authenticated copy of Form 7 and an authenticated copy of the test report from an accredited laboratory of analysis of the hazardous waste;
5. The occupier, exporting hazardous waste to any other country shall seek permission from the competent authority of that country prior to any shipment;
6. Every occupier exporting hazardous waste shall inform the Central Government of the permission sought for exporting, permission granted for export and details of the export in Form 7.

15. Illegal Traffic

- (1) The movement of hazardous wastes from or to the country shall be considered illegal:
 - i. if it is without prior permission of the Central Government; or
 - ii. if the permission has been obtained through falsification, mis- representation or fraud; or
 - iii. it does not conform to the shipping details provided in the document;
- (2) In case of illegal movement, the hazardous wastes in question;
 - i. shall be shipped back within thirty days either to the exporter or to the exporting country;
 - ii. shall be disposed of within thirty days from the date of off-loading subject to inability to comply with Sub-rule 2(i) above.
- (3) In case of illegal transboundary movement of hazardous wastes, the occupier exporting hazardous waste from the country or the exporter exporting hazardous waste to the country and importer importing hazardous waste into the country shall ensure that the wastes in question is safely stored and shipped or disposed off in an environmentally sound manner within thirty days from the date of off-loading;
- (4) The exporting country shall bear the costs incurred for the disposal of such wastes.

16. Liability of the occupier, transporter and operator of a facility

1. The occupier, transporter and operator of a facility shall be liable for damages caused to the environment resulting due to improper handling and disposal of hazardous waste listed in schedule 1, 2 and 3;
2. The occupier and operator of a facility shall also be liable to reinstate or restore damaged or destroyed elements of the environment;
3. The occupier and operator of a facility shall be liable to pay a fine as levied by the State Pollution Control Board with the approval of the Central Pollution Control Board for any violation of the provisions under these rules.

17. Transitional provisions

where-

- a. On the date of coming into operation of these rules, an occupier handling hazardous

Best Options for School Sanitation: Meeting the Challenge

wastes who is required to comply with the provisions of these rules, it will be sufficient compliance if the occupier and the authorities do so within three months after the date of coming into force of these rules;

- b. State Pollution Control Boards and Pollution Control Committees are required to oversee the compliance.

18. Appeal

1. An appeal shall lie, against any order of grant or refusal of an authorisation by the Member-Secretary, State Pollution Control Board or any officer designated by the Board to the Secretary, Department of Environment of the State Government by whatever name called.
2. Every appeal shall be in writing and shall be accompanied by a copy of the order appealed against and shall be presented within thirty days of the receipt of the order passed.

MSWM rules 2000

Ministry of Environment and Forests

Notification

New Delhi, the 25th September, 2000

S.O. 908(E).- Whereas the draft of the Municipal Solid Wastes (Management and Handling) Rules, 1999 were published under the notification of the Government of India in the Ministry of Environment and Forests number S.O. 783(E), dated, the 27th September, 1999 in the Gazette of India, Part II, Section 3, Sub-section (ii) of the same date inviting objections and suggestions from the persons likely to be affected thereby, before the expiry of the period of sixty days from the date on which the copies of the Gazette containing the said notification are made available to the public;

And whereas copies of the said Gazette were made available to the public on the 5th October, 1999;

And whereas the objections and suggestions received from the public in respect of the said draft rules have been duly considered by the Central Government;

Now, therefore, in exercise of the powers conferred by section 3, 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules to regulate the management and handling of the municipal solid wastes, namely :-

1. Short title and commencement .--

1. These rules may be called the Municipal Solid Wastes (Management and Handling) Rules, 2000.
2. Save as otherwise provided in these rules, they shall come into force on the date of their publication in the Official Gazette.

2. Application .-- These rules shall apply to every municipal authority responsible for collection, segregation, storage, transportation,, processing and disposal of municipal solid wastes .

3. Definitions.-- In these rules, unless the context otherwise requires ,--

- i. **"anaerobic digestion"** means a controlled process involving microbial decomposition of organic matter in the absence of oxygen;
- ii. **"authorization"** means the consent given by the Board or Committee to the "operator of a facility" ;
- iii. **"biodegradable substance"** means a substance that can be degraded by micro-organisms;
- iv. **"biomethanation"** means a process which entails enzymatic decomposition of the organic matter by microbial action to produce methane rich biogas;

- v. **"collection"** means lifting and removal of solid wastes from collection points or any other location;
- vi. **"composting"** means a controlled process involving microbial decomposition of organic matter;
- vii. **"demolition and construction waste"** means wastes from building materials debris and rubble resulting from construction, re-modelling, repair and demolition operation;
- viii. **"disposal"** means final disposal of municipal solid wastes in terms of the specified measures to prevent contamination of ground-water, surface water and ambient air quality;
- ix. **"Form"** means a Form appended to these rules;
- x. **"generator of wastes"** means persons or establishments generating municipal solid wastes;
- xi. **"landfilling"** means disposal of residual solid wastes on land in a facility designed with protective measures against pollution of ground water, surface water and air fugitive dust, wind-blown litter, bad odour, fire hazard, bird menace, pests or rodents, greenhouse gas emissions, slope instability and erosion;
- xii. **"leachate"** means liquid that seeps through solid wastes or other medium and has extracts of dissolved or suspended material from it;
- xiii. **"lysimeter"** is a device used to measure rate of movement of water through or from a soil layer or is used to collect percolated water for quality analysis;
- xiv. **"municipal authority"** means Municipal Corporation, Municipality, Nagar Palika, Nagar Nigam, Nagar Panchayat, Municipal Council including notified area committee (NAC) or any other local body constituted under the relevant statutes and, where the management and handling of municipal solid waste is entrusted to such agency;
- xv. **"municipal solid waste"** includes commercial and residential wastes generated in a municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes;
- xvi. **"operator of a facility"** means a person who owns or operates a facility for collection, segregation, storage, transportation, processing and disposal of municipal solid wastes and also includes any other agency appointed as such by the municipal authority for the management and handling of municipal solid wastes in the respective areas;
- xvii. **"pelletisation"** means a process whereby pellets are prepared which are small cubes or cylindrical pieces made out of solid wastes and includes fuel pellets which are also referred as refuse derived fuel;
- xviii. **"processing"** means the process by which solid wastes are transformed into new or recycled products;
- xix. **"recycling"** means the process of transforming segregated solid wastes into raw materials for producing new products, which may or may not be similar to the original products;
- xx. **"Schedule"** means a Schedule appended to these rules;
- xxi. **"segregation"** means to separate the municipal solid wastes into the groups of organic, inorganic, recyclables and hazardous wastes;

- xxii. **"State Board or the Committee"** means the State Pollution Control Board of a State, or as the case may be, the Pollution Control Committee of a Union territory;
- xxiii. **"storage"** means the temporary containment of municipal solid wastes in a manner so as to prevent littering, attraction to vectors, stray animals and excessive foul odour;
- xxiv. **"transportation "** means conveyance of municipal solid wastes from place to place hygienically through specially designed transport system so as to prevent foul odour, littering, unsightly conditions and accessibility to vectors;
- xxv. **"vadose water"** water which occurs between the ground, surface and the water table that is the unsaturated zone;
- xxvi. **"vermicomposting"** is a process of using earthworms for conversion of bio-degradable wastes into compost.

4. Responsibility of municipal authority .-

1. Every municipal authority shall, within the territorial area of the municipality, be responsible for the implementation of the provisions of these rules, and for any infrastructure development for collection, storage, segregation, transportation, processing and disposal of municipal solid wastes.
2. The municipal authority or an operator of a facility shall make an application in **Form-I**, for grant of authorization for setting up waste processing and disposal facility including landfills from the State Board or the Committee in order to comply with the implementation programme laid down in **Schedule I**.
3. The municipal authority shall comply with these rules as per the implementation schedule laid down in **Schedule I**.

(4) The municipal authority shall furnish its annual report in **Form-II**,-

- a. to the Secretary-in-charge of the Department of Urban Development of the concerned State or as the case may be of the Union territory, in case of a metropolitan city; or
- b. to the District Magistrate or the Deputy Commissioner concerned in case of all other towns and cities,

with a copy to the State Board or the Committee on or before the 30th day of June every year.

5. Responsibility of the State Government and the Union territory Administrations .--

(1) The Secretary-in-charge of the Department of Urban Development of the concerned State or the Union territory, as the case may be, shall have the overall responsibility for the enforcement of the provisions of these rules in the metropolitan cities.

(2) The District Magistrate or the Deputy Commissioner of the concerned district shall have the overall responsibility for the enforcement of the provisions of these rules within the territorial limits of their jurisdiction.

6. Responsibility of the Central Pollution Control Board and the State Board or the Committees .—

1. The State Board or the Committee shall monitor the compliance of the standards regarding ground water, ambient air, leachate quality and the compost quality including incineration standards as specified under **Schedules II, III and IV**.
2. The State Board or the Committee, after the receipt of application from the municipal authority or the operator of a facility in **Form I**, for grant of authorization for setting up waste processing and disposal facility including landfills, shall examine the proposal taking into consideration the views of other agencies like the State Urban Development Department, the Town and Country Planning Department, Air Port or Air Base Authority, the Ground Water Board or any such other agency prior to issuing the authorization.
3. The State Board or the Committee shall issue the authorization in **Form-III** to the municipal authority or an operator of a facility within forty-five days stipulating compliance criteria and standards as specified in **Schedules II, III and IV** including such other conditions, as may be necessary.
4. The authorization shall be valid for a given period and after the validity is over, a fresh authorization shall be required.

(5) The Central Pollution Control Board shall co-ordinate with the State Boards and the Committees with particular reference to implementation and review of standards and guidelines and compilation of monitoring data.

7. Management of municipal solid wastes .--

1. Any municipal solid waste generated in a city or a town, shall be managed and handled in accordance with the compliance criteria and the procedure laid down in **Schedule-II**.

(2) The waste processing and disposal facilities to be set up by the municipal authority on their own or through an operator of a facility shall meet the specifications and standards as specified in **Schedules III and IV**.

8. Annual Reports .—

1. The State Boards and the Committees shall prepare and submit to the Central Pollution Control Board an annual report with regard to the implementation of these rules by the 15th of September every year in **Form-IV**.
2. The Central Pollution Control Board shall prepare the consolidated annual review report on management of municipal solid wastes and forward it to the Central

Government alongwith its recommendations before the 15th of December every year.

9. Accident Reporting .-- When an accident occurs at any municipal solid wastes collection, segregation, storage, processing, treatment and dispoosal facility or landfill site or during the transportation of such wastes, the municipal authority shall forthwith report the accident in **Form-V** to the Secretary in-charge of the Urban Development Department in metropolitan cities, and to District Collector or Deputy Commissioner in all other cases.

Schedule I

[see rules4(2) and (3)]

Implementation Schedule

Serial No.	Compliance Criteria	Schedule
1.	Setting up of waste processing and disposal facilities	By 31.12.2003 or earlier
2.	Monitoring the performance of waste processing and disposal facilities	Once in six months
3.	Improvement of existing landfill sites as per provisions of these rules	By 31.12.2001 or earlier
4.	Identification of landfill sites for future use and making site (s) ready for operation	By 31.12.2002 or earlier

Schedule -II

[see rules 6(1) and (3), 7(1)]

Management of Municipal Solid Wastes

S.no	Parameters	Compliance criteria
1.	Collection of municipal solid	1. Littering of municipal solid waste shall be prohibited in cities, towns and in urban areas notified by the State Governments To

	<p>wastes</p>	<p>prohibit littering and facilitate compliance, the following steps shall be taken by the municipal authority, namely :-</p> <ol style="list-style-type: none"> i. Organising house-to-house collection of municipal solid wastes through any of the methods, like community bin collection (central bin), house-to-house collection, collection on regular pre-informed timings and scheduling by using bell ringing of musical vehicle (without exceeding permissible noise levels); ii. Devising collection of waste from slums and squatter areas or localities including hotels, restaurants, office complexes and commercial areas; iii. Wastes from slaughter houses, meat and fish markets, fruits and vegetable markets, which are biodegradable in nature, shall be managed to make use of such wastes; iv. Bio-medical wastes and industrial wastes shall not be mixed with municipal solid wastes and such wastes shall follow the rules separately specified for the purpose; v. Collected waste from residential and other areas shall be transferred to community bin by hand-driven containerised carts or other small vehicles; vi. Horticultural and construction or demolition wastes or debris shall be separately collected and disposed off following proper norms. Similarly, wastes generated at dairies shall be regulated in accordance with the State laws; vii. Waste (garbage, dry leaves) shall not be burnt; viii. Stray animals shall not be allowed to move around waste storage facilities or at any other place in the city or town and shall be managed in accordance with the State laws. <p>2. The municipal authority shall notify waste collection schedule and the likely method to be adopted for public benefit in a city or town.</p> <p>3. It shall be the responsibility of generator of wastes to avoid littering and ensure delivery of wastes in accordance with the collection and segregation system to be notified by the municipal authority as per para 1(2) of this Schedule.</p>
<p>2.</p>	<p>Segregation of municipal solid wastes</p>	<p>In order to encourage the citizens, municipal authority shall organise awareness programmes for segregation of wastes and shall promote recycling or reuse of segregated materials.</p> <p>The municipal authority shall undertake phased programme to</p>

		ensure community participation in waste segregation. For this purpose, regular meetings at quarterly intervals shall be arranged by the municipal authorities with representatives of local resident welfare associations and non-governmental organizations.
3.	Storage of municipal solid wastes	<p>Municipal authorities shall establish and maintain storage facilities in such a manner as they do not create unhygienic and insanitary conditions around it. Following criteria shall be taken into account while establishing and maintaining storage facilities, namely :-</p> <ol style="list-style-type: none"> i. Storage facilities shall be created and established by taking into account quantities of waste generation in a given area and the population densities. A storage facility shall be so placed that it is accessible to users; ii. Storage facilities to be set up by municipal authorities or any other agency shall be so designed that wastes stored are not exposed to open atmosphere and shall be aesthetically acceptable and user-friendly; iii. Storage facilities or 'bins' shall have 'easy to operate' design for handling, transfer and transportation of waste. Bins for storage of bio-degradable wastes shall be painted green, those for storage of recyclable wastes shall be printed white and those for storage of other wastes shall be printed black; iv. Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers.
4.	Transportation of municipal solid wastes	<p>Vehicles used for transportation of wastes shall be covered. Waste should not be visible to public, nor exposed to open environment preventing their scattering. The following criteria shall be met, namely:-</p> <ol style="list-style-type: none"> i. The storage facilities set up by municipal authorities shall be daily attended for clearing of wastes. The bins or containers wherever placed shall be cleaned before they start overflowing; ii. Transportation vehicles shall be so designed that multiple handling of wastes, prior to final disposal, is avoided.
5.	Processing of municipal solid	Municipal authorities shall adopt suitable technology or combination of such technologies to make use of wastes so as to

	wastes	<p>minimize burden on landfill. Following criteria shall be adopted, namely:-</p> <p>(i) The biodegradable wastes shall be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of wastes. It shall be ensured that compost or any other end product shall comply with standards as specified in Schedule-IV;</p> <p>ii. Mixed waste containing recoverable resources shall follow the route of recycling. Incineration with or without energy recovery including pelletisation can also be used for processing wastes in specific cases. Municipal authority or the operator of a facility wishing to use other state-of-the-art technologies shall approach the Central Pollution Control Board to get the standards laid down before applying for grant of authorisation.</p>
6.	Disposal of municipal solid wastes	<p>Land filling shall be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing. Land filling shall also be carried out for residues of waste processing facilities as well as pre-processing rejects from waste processing facilities. Land filling of mixed waste shall be avoided unless the same is found unsuitable for waste processing. Under unavoidable circumstances or till installation of alternate facilities, land-filling shall be done following proper norms. Landfill sites shall meet the specifications as given in Schedule –III.</p>

Schedule III

[see rules 6(1) and (3), 7(2)]

Specifications for Landfill Sites

Site Selection

1. In areas falling under the jurisdiction of ‘Development Authorities’ it shall be the responsibility of such Development Authorities to identify the landfill sites and hand over the sites to the concerned municipal authority for development, operation and maintenance. Elsewhere, this responsibility shall lie with the concerned municipal authority.

2. Selection of landfill sites shall be based on examination of environmental issues. The Department of Urban Development of the State or the Union territory shall co-ordinate with the concerned organisations for obtaining the necessary approvals and clearances.
3. The landfill site shall be planned and designed with proper documentation of a phased construction plan as well as a closure plan.
4. The landfill sites shall be selected to make use of nearby wastes processing facility. Otherwise, wastes processing facility shall be planned as an integral part of the landfill site.
5. The existing landfill sites which continue to be used for more than five years, shall be improved in accordance of the specifications given in this Schedule.
6. Biomedical wastes shall be disposed off in accordance with the Bio-medical Wastes (Management and Handling) Rules, 1998 and hazardous wastes shall be managed in accordance with the Hazardous Wastes (Management and Handling) Rules, 1989, as amended from time to time.
7. The landfill site shall be large enough to last for 20-25 years.
8. The landfill site shall be away from habitation clusters, forest areas, water bodies monuments, National Parks, Wetlands and places of important cultural, historical or religious interest.
9. A buffer zone of no-development shall be maintained around landfill site and shall be incorporated in the Town Planning Department's land-use plans.
10. Landfill site shall be away from airport including airbase. Necessary approval of airport or airbase authorities prior to the setting up of the landfill site shall be obtained in cases where the site is to be located within 20 km of an airport or airbase..

Facilities at the Site

11. Landfill site shall be fenced or hedged and provided with proper gate to monitor incoming vehicles or other modes of transportation.
12. The landfill site shall be well protected to prevent entry of unauthorised persons and stray animals.
13. Approach and other internal roads for free movement of vehicles and other machinery shall exist at the landfill site.
14. The landfill site shall have wastes inspection facility to monitor wastes brought in for landfill, office facility for record keeping and shelter for keeping equipment and machinery including pollution monitoring equipments.
15. Provisions like weigh bridge to measure quantity of waste brought at landfill site, fire protection equipments and other facilities as may be required shall be provided.
16. Utilities such as drinking water (preferably bathing facilities for workers) and lighting arrangements for easy landfill operations when carried out in night hours shall be provided.
17. Safety provisions including health inspections of workers at landfill site shall be periodically made.

Specifications for land filling

18. Wastes subjected to land filling shall be compacted in thin layers using landfill compactors to achieve high density of the wastes. In high rainfall areas where heavy compactors cannot be used alternative measures shall be adopted.
19. Wastes shall be covered immediately or at the end of each working day with minimum 10 cm of soil, inert debris or construction material till such time waste processing facilities for composting or recycling or energy recovery are set up as per Schedule I.
20. Prior to the commencement of monsoon season, an intermediate cover of 40-65 cm thickness of soil shall be placed on the landfill with proper compaction and grading to prevent infiltration during monsoon. Proper drainage berms shall be constructed to divert run-off away from the active cell of the landfill.
21. After completion of landfill, a final cover shall be designed to minimize infiltration and erosion. The final cover shall meet the following specifications, namely :--
 - a. The final cover shall have a barrier soil layer comprising of 60 cms of clay or amended soil with permeability coefficient less than 1×10^{-7} cm/sec.
 - b. On top of the barrier soil layer there shall be a drainage layer of 15 cm.
 - c. On top of the drainage layer there shall be a vegetative layer of 45 cm to support natural plant growth and to minimize erosion.

Pollution prevention

22. In order to prevent pollution problems from landfill operations, the following provisions shall be made, namely :-
 - a. Diversion of storm water drains to minimize leachate generation and prevent pollution of surface water and also for avoiding flooding and creation of marshy conditions;
 - b. Construction of a non-permeable lining system at the base and walls of waste disposal area. For landfill receiving residues of waste processing facilities or mixed waste or waste having contamination of hazardous materials (such as aerosols, bleaches, polishes, batteries, waste oils, paint products and pesticides) minimum liner specifications shall be a composite barrier having 1.5 mm high density polyethylene (HDPE) geomembrane, or equivalent, overlying 90 cm of soil (clay or amended soil) having permeability coefficient not greater than 1×10^{-7} cm/sec. The highest level of water table shall be at least two meter below the base of clay or amended soil barrier layer;
 - c. Provisions for management of leachates collection and treatment shall be made. The treated leachates shall meet the standards specified in Schedule- IV;
 - d. Prevention of run-off from landfill area entering any stream, river, lake or pond.

Water Quality Monitoring

23. Before establishing any landfill site, baseline data of ground water quality in the area shall be collected and kept in record for future reference. The ground water quality within 50 metres of the periphery of landfill site shall be periodically monitored to ensure that the ground water is not contaminated beyond acceptable limit as decided by the Ground Water Board or the State Board or the Committee. Such monitoring shall be carried out to cover different seasons in a year that is, summer, monsoon and post-monsoon period.
24. Usage of groundwater in and around landfill sites for any purpose (including drinking and irrigation) is to be considered after ensuring its quality. The following specifications for drinking water quality shall apply for monitoring purpose, namely :-

S.No.	Parameters	IS 10500: 1991 Desirable limit (mg/l except for pH)
1.	Arsenic	0.05
2.	Cadmium	0.01
3	Chromium	0.05
4.	Copper	0.05
5.	Cyanide	0.05
6.	Lead	0.05
7.	Mercury	0.001
8.	Nickel	-
9.	Nitrate as NO ₃	45.0
10	PH	6.5-8.5
11.	Iron	0.3
12.	Total hardness (as CaCO ₃)	300.0
13.	Chlorides	250
14.	Dissolved solids	500
15.	Phenolic compounds (as C ₆ H ₅ OH)	0.001

16.	Zinc	5.0
17.	Sulphate (as SO ₄)	200

25. Ambient Air Quality Monitoring

26. Installation of landfill gas control system including gas collection system shall be made at landfill site to minimize odour generation, prevent off-site migration of gases and to protect vegetation planted on the rehabilitated landfill surface.
27. The concentration of methane gas generated at landfill site shall not exceed 25 per cent of the lower explosive limit (LEL).
28. The landfill gas from the collection facility at a landfill site shall be utilized for either direct thermal applications or power generation, as per viability. Otherwise, landfill gas shall be burnt (flared) and shall not be allowed to directly escape to the atmosphere or for illegal tapping. Passive venting shall be allowed if its utilization or flaring is not possible.
29. Ambient air quality at the landfill site and at the vicinity shall be monitored to meet the following specified standards, namely :-

S.No.	Parameters	Acceptable levels
(i)	Sulphur dioxide	120 µ γ/µ ³ (24 ηουρσ)
(ii)	Suspended Particulate Matter	500 µ γ/µ ³ (24 ηουρσ)
(iii)	Methane	Not to exceed 25 per cent of the lower explosive limit (equivalent to 650 mg/m ³)
(iv)	Ammonia daily average	
	(Sample duration 24 hrs)	0.4 mg/m ³ (400 µ γ/µ ³)
(v)	Carbon monoxide	1 hour average : 2 mg/m ³ 8 hour average : 1 mg/m ³

29. The ambient air quality monitoring shall be carried out by the concerned authority as per the following schedule, namely:-

- (a) Six times in a year for cities having population of more than fifty lakhs;
- (b) Four times in a year for cities having population between ten and fifty lakhs;

(c) Two times in a year for town or cities having population between one and ten lakhs.

Plantation at Landfill Site

30. A vegetative cover shall be provided over the completed site in accordance with the and following specifications, namely :-

- (a) Selection of locally adopted non-edible perennial plants that are resistant to drought and extreme temperatures shall be allowed to grow;
- (b) The plants grown be such that their roots do not penetrate more than 30 cms. This condition shall apply till the landfill is stabilised;
- (c) Selected plants shall have ability to thrive on low-nutrient soil with minimum nutrient addition;
- (d) Plantation to be made in sufficient density to minimize soil erosion.

Closure of Landfill Site and Post-care

31. The post-closure care of landfill site shall be conducted for at least fifteen years and long term monitoring or care plan shall consist of the following, namely :-

- (a) Maintaining the integrity and effectiveness of final cover, making repairs and preventing run-on and run-off from eroding or otherwise damaging the final cover;
- (b) Monitoring leachate collection system in accordance with the requirement;
- (c) Monitoring of ground water in accordance with requirements and maintaining ground water quality;
- (d) Maintaining and operating the landfill gas collection system to meet the standards.

32. Use of closed landfill sites after fifteen years of post-closure monitoring can be considered for human settlement or otherwise only after ensuring that gaseous and leachate analysis comply with the specified standards.

Special provisions for hilly areas

33. Cities and towns located on hills shall have location-specific methods evolved for final disposal of solid wastes by the municipal authority with the approval of the concerned State Board or the Committee. The municipal authority shall set up processing facilities for utilization of biodegradable organic wastes. The inert and non-biodegradable waste shall be used for building roads or filling-up of appropriate areas on hills. Because of constraints in finding adequate land in hilly areas, wastes not suitable for road-laying or filling up shall be disposed of in specially designed landfills.

Schedule IV

[see rules 6(1) and (3), 7(2)]

Standards for Composting, Treated Leachates and Incineration

1. The waste processing or disposal facilities shall include composting, incineration, pelletisation, energy recovery or any other facility based on state-of-the-art technology duly approved by the Central Pollution Control Board
 2. In case of engagement of private agency by the municipal authority, a specific agreement between the municipal authority and the private agency shall be made particularly, for supply of solid waste and other relevant terms and conditions.
 3. In order to prevent pollution problems from compost plant and other processing facilities, the following shall be complied with, namely :-
 - i. The incoming wastes at site shall be maintained prior to further processing. To the extent possible, the waste storage area should be covered. If, such storage is done in an open area, it shall be provided with impermeable base with facility for collection of leachate and surface water run-off into lined drains leading to a leachate treatment and disposal facility;
 - ii. Necessary precautions shall be taken to minimise nuisance of odour, flies, rodents, bird menace and fire hazard;
 - iii. In case of breakdown or maintenance of plant, waste intake shall be stopped and arrangements be worked out for diversion of wastes to the landfill site;
 - iv. Pre-process and post-process rejects shall be removed from the processing facility on regular basis and shall not be allowed to pile at the site. Recyclables shall be routed through appropriate vendors. The non-recyclables shall be sent for well designed landfill site(s).
 - v. In case of compost plant, the windrow area shall be provided with impermeable base. Such a base shall be made of concrete or compacted clay, 50 cm thick, having permeability coefficient less than 10^{-7} cm/sec. The base shall be provided with 1 to 2 per cent slope and circled by lined drains for collection of leachate or surface run-off;
 - vi. Ambient air quality monitoring shall be regularly carried out particularly for checking odour nuisance at down-wind direction on the boundary of processing plant.
- In order to ensure safe application of compost, the following specifications for compost quality shall be met, namely:-

Parameters	Concentration not to exceed * (mg/kg dry basis , except pH value and C/N ratio)

Best Options for School Sanitation: Meeting the Challenge

Arsenic	10.00
Cadmium	5.00
Chromium	50.00
Copper	300.00
Lead	100.00
Mercury	0.15
Nickel	50.00
Zinc	1000.00
C/N ratio	20-40
PH	5.5-8.5

* Compost (final product) exceeding the above stated concentration limits shall not be used for food crops. However, it may be utilized for purposes other than growing food crops.

4. The disposal of treated leachates shall follow the following standards, namely:-

S.No	Parameter	Standards (Mode of Disposal)		
		Inland surface water	Public sewers	Land disposal
1.	Suspended solids, mg/l, max	100	600	200
2.	Dissolved solids (inorganic) mg/l, max.	2100	2100	2100
3	PH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
4	Ammonical nitrogen (as N), mg/l, max.	50	50	-
5	Total Kjeldahl nitrogen (as N)	100	-	-

	mg/l, max.			
6	Biochemical oxygen demand (3 days at 27 ⁰ C) max.(mg/l)	30	350	100
7	Chemical oxygen demand, mg/l, max.	250	-	-
8	Arsenic (as As), mg/l, max	0.2	0.2	0.2
9	Mercury (as Hg), mg/l, max	0.01	0.01	-
10	Lead (as Pb), mg/l, max	0.1	1.0	-
11	Cadmium (as Cd), mg/l, max	2.0	1.0	-
12	Total Chromium (as Cr), mg/l, max.	2.0	2.0	-
13	Copper (as Cu), mg/l, max.	3.0	3.0	-
14	Zinc (as Zn), mg/l, max.	5.0	15	-
15	Nickel (as Ni), mg/l, max	3.0	3.0	-
16	Cyanide (as CN), mg/l, max.	0.2	2.0	0.2
17	Chloride (as Cl), mg/l, max.	1000	1000	600
18	Fluoride (as F), mg/l, max	2.0	1.5	-
19	Phenolic compounds (as C ₆ H ₅ OH) mg/l, max.	1.0	5.0	-

Note : While discharging treated leachates into inland surface waters, quantity of leachates being discharged and the quantity of dilution water available in the receiving water body shall be given due consideration.

The incinerators shall meet the following operating and emission standards, namely:-

A. Operating Standards

- (1) The combustion efficiency (CE) shall be at least 99.00%.
- (2) The combustion efficiency is computed as follows :

$$\%CO_2$$

$$\text{C.E.} = \frac{\text{-----}}{\% \text{CO}_2 + \% \text{CO}} \times 100$$

1. Emission Standards

<u>Parameters</u> <u>correction)</u>	<u>Concentration mg/Nm³ at (12% CO₂</u>
(1) Particulate matter	
(2) Nitrogen Oxides	
(3) HCl	
(4) Minimum stack height shall be 30 metres above ground.	
(5) Volatile organic compounds in ash shall not be more than 0.01%.	

450

Note :

1. Suitably designed pollution control devices shall be installed or retrofitted with the incinerator to achieve the above emission limits, if necessary.
2. wastes to be incinerated shall not be chemically treated with any chlorinated disinfectants
3. Chlorinated plastics shall not be incinerated.
4. Toxic metals in incineration ash shall be limited within the regulatory quantities as specified in the Hazardous Wastes (Management and Handling) Rules, 1989 as amended from time to time.
5. Only low sulphur fuel like l.d.o., l.s.h.s or Diesel shall be used as fuel in the incinerator.

Form –I

[see rules 4(2) & 6(2)]

Application for obtaining authorization

To,
The Member Secretary

1.	Name of the municipal authority/Name of the agency appointed by the municipal authority	:	
2.	Correspondence address Telephone No.	:	

Best Options for School Sanitation: Meeting the Challenge

	Fax No.		
3.	Nodal Officer & designation(Officer authorised by the municipal authority or agency responsible for operation of processing or disposal facility)	:	
4.	Authorization applied for (Please tick mark)	:	(a) Setting up & operation of waste rocessing facility (b)Setting up & operation of disposal facility
5.	Detailed proposal of waste processing/disposal facility (to be attached) to include	:	
5.1	<p>Processing of Waste</p> <ul style="list-style-type: none"> i. Location of site ii. Name of waste processing technology iii. Details of processing technology iv. Quantitty of waste to be processed per day v. Site clearance (from local authority) vi. Details of agreement between municipal authority and operating agency vii. Utilization programme for waste processed (Product utilization) viii. Methodology for disposal of waste processing rejects (quantity and quality) ix. Measures to be taken for prevention and control of environmental pollution x. Investment on Project and expected returns xi. Measures to be taken for safety of workers working in the plant 	:	
5.2	<p>Disposal of Waste</p> <ul style="list-style-type: none"> i. Number of sites indentified ii. Layout maps of site iii. Quantity of waste to be disposed per day iv. Nature and composition of waste v. Details of methodology or criteria followed for site selection vi. Details of existing site under operation vii. Methodology and operational details of landfilling 	:	

	viii. Measures taken to check environmental pollution	
Date		Signature of Nodal Officer

Form - II

[See rule 4(4)]

Format of Annual Report to be submitted by the Municipal Authority

- i. Name of City/Town:.....
- ii. Population
- iii. Name of municipal body:..... and Address

Telephone No. :

Fax :

- iv. Name of Incharge dealing with municipal solid wastes with designation

1. Quantity and composition of solid wastes

(i) Total quantity of wastes generated per day

(ii) Total quantity of wastes collected per day

(iii) Total quantity of wastes processed for :

- a. Composting:
- b. Vermiculture:
- c. Pellets:
- d. Others, if any, please specify

(iv) Total quantity of waste disposed by landfilling:

.....

a. no. of landfill sites used :

.....

b. Area used:

c. Whether Weigh bridge facilities available : Yes/No

a. Whether area is fenced : Yes/No

a. Lighting facility on site : Yes/No

(f) Whether equipment like Bulldozer, Compacters etc.available. (Please specify) :-----

a. Total Manpower available on site: -----

a. Whether covering is done on daily basis : Yes/No

i. Whether covering material is used and whether it is adequately available :

a. Provisions for gas venting provided : Available (Yes/No) /Not available

a. Provision for leachate collection : Provisions made/ Provisions not made

2. Storage facilities

(i) Area covered for collection of wastes : -----

(ii) no. of houses covered : -----

(iii)Whether house-to-house collection is practised (if yes, whether done by Municipality or through Private Agency or Non-Governmental Organisation) : -----

(iv) Bins : -----

Specifications Existing Proposed

(Shape & Size) Numbers for future

- a. RCC Bins (Capacity) :
- b. Trolleys (Capacity) :
- (c) Containers (Capacity) :
- d. Dumper Placers :
- e. Others, please specify :

- (v) Whether all bins/collection spots are attended for daily lifting of garbage : Yes/No
- (vi) Whether lifting of garbage from dustbins is manual or mechanical i.e. for example by using of front-end loaders (Please tick mark) : Manual/Loader/Others, please specify

3. Transportation

	Existing number	Actually Required/Proposed
(i) Truck :		
(ii) Truck-Tipper :		
(iii) Tractor-Trailer :		
(iv) Refuse-collector :		
(v) Dumper-placers :		
(vi) Animal Cart :		
(vii) Tricycle :		
(viii) Others (please specify) :		

4. Whether any proposal has been made to improve solid wastes management practices

4. Are any efforts made to call for private firms etc. to attempt for processing of waste utilising technologies like :

	Waste Utilisation Technology	Proposals	Steps taken (Quantity to be processed)
i. Composting :			
ii. Vermiculture :			
iii. Pelletisation :			
iv. Others if any, Please specify :			

6. What provisions are available and how these are implemented to check unhygienic operations of :

- i. Dairy related activities :
- ii. Slaughter houses and unauthorised slaughtering :
- iii. Malba (cnstruction debris) lifting :
- iv. Encroachment in Parks, Footpaths etc. :

7. How many slums are identified and whether these are provided with sanitation facilities :

8. Are municipal magistrates appointed for Taking penal action : Yes/No

[If yes, how many cases registered & settled during last three years (give year-wise details)]

9. Hospital waste management

- i. How many Hospitals/Clinics under the control of the Corporation:
- ii. What methods are followed for disposal of bio-medical wastes ?:

- iii. Do you have any proposal for setting up of common treatment facility for disposal of bio-medical wastes :
- iv. How many private Nursing Homes, Clinics etc. are operating in the city/town and what steps have been taken to check disposal of their wastes :

Signature of Municipal Commissioner

Dated :

Form -III

[See-rule 6(2)]

Format for Issue of Authorisation

File No.: _____

Date: _____

To,

Ref: Your application number _____ dt. _____

The _____ State Pollution Control Board/Pollution Control Committee after examining the proposal hereby authorises _____ having their administrative office at _____ to set up and operate waste processing/waste disposal facility at _____ on the terms and conditions (including the standards to comply) attached to this authorization letter.

1. The validity of this authorization is till _____. After the validity, renewal of authorization is to be sought.
2. The _____ State Pollution Control Board/Pollution Control Committees may, at any time, revoke any of the conditions applicable under the authorization and shall communicate the same in writing.
3. Any violation of the provision of the Municipal Solid Wastes (Management and Handling) Rules, 2000 will attract the penal provision of the Environment (Protection) Act, 1986 (29 of 1986).

(Member Secretary)

State Pollution Control Board/
Pollution Control Committee

Date :
Place :

Form - IV

[see rule 8(1)]

Format of Annual Review Report to be submitted by the State Pollution Control Board/Committees to the Central Pollution Control Board

To,
The Chairman,
Central Pollution Control Board,
(Ministry of Environment and Forests)
Government of India,
'Parivesh Bhawan', East Arjun Nagar,
DELHI- 110 0032.

1.	Name of the State/Union territory	:	
2.	Name & address of the State Pollution Control	:	
3.	Board/Pollution Control Committee Number of municipal authorities responsible for management of municipal solid wastes in the State/Union territory under these rules	:	
4.	A Summary Statement on progress made by municipal authorities in respect of implementation of Schedule I [rule 4(3)]	:	Please attach as Annexure-I
5.	A Summary Statement on progress made by municipal authorities in respect of implementation of Schedule II [rules 6(1) and (3), 7(1)]	:	Please attach as Annexure-II
6.	A Summary Statement on progress made by municipal authorities in respect of implementation of Schedule III [rules 6(1) and (3), 7(2)]	:	Please attach as Annexure-III
7.	A summary statement on progress made by municipal authorities in respect of implementation	:	Please attach as Annexure-IV

Best Options for School Sanitation: Meeting the Challenge

of Schedule IV [rules 6(1) and (3), 7(2)]	
Date: _____ Place : _____	Chairman or the Member Secretary State Pollution Control Board/ Pollution Control Committee

Form - V

[see rule 9]

Accident reporting

1.	Date and time of accident	:	
2.	Sequence of events leading to accident	:	
3.	The waste involved in accident	:	
4.	Assessment of the effects of the accidents on human health and the environment	:	
5.	Emergency measures taken	:	
6.	Steps taken to alleviate the effects of accidents	:	
7.	Steps taken to prevent the recurrence of such an accident	:	
Date :		Signature :	
Place :		Designation :	

V. Rajagopalan, Jt. Secy.
[F.No.17-2/95-HSMD]



Toward sustainable sanitation health & Dignity for all

www.schoolsanitation.com

Cover and back cover by Sanjay Kumar Srivastava (IFS-87)