Government of India
Ministries of Urban Development & Human Resource Development

National School Sanitation Manual

NUSP
NATIONAL URBAN SANITATION POLICY
TOWARDS CITY WIDE SANITATION

NATIONAL SCHOOL SANITATION INITIATIVE

सत्यमेव जयते
Government of India

Ministries of Urban Development & Human Resource Development

National School Sanitation Manual

GOVERNMENT OF INDIA
NUSP
NATIONAL URBAN SANITATION POLICY
TOWARDS CITY WIDE SANITATION

gtz

COOPERATION

NATIONAL SCHOOL SANITATION INITIATIVE

Advisory Group on National School Sanitation Initiative

1. **Mr. S. C. Khuntia**
   Joint Secretary,
   Ministry of Human Resource Development
2. **Mr. A K Mehta**
   Joint Secretary,
   Ministry of Urban Development
3. **Mr. J. S. Mathur**
   Joint Secretary,
   Ministry of Rural Development
4. **Mr. Vineet Joshi**
   Chairman and Secretary, CBSE
5. **Ms. E.P. Nivedita**
   Director,
   Ministry of Urban Development
6. **Dr. Sadhana Parashar**
   Education Officer, CBSE
7. **Dr. J Bischoff**
   Principal Advisor, GTZ
8. **Mr. Sanjay Kumar Srivastava**
   Sr. Advisor, GTZ
9. **Mr. Y. D. Mathur**
   Advisor, Sulabh International
10. **Mr. Dayanand Panse**
    Director, Ecosan Services Foundation
11. **Mr. Vinod Tihara**
    Administrator, Vidya Jain Public School & DDCA,
    New Delhi

School Sanitation Manual Drafting Committee

1. **Mr. Vineet Joshi**
   Chairman and Secretary,
   CBSE
2. **Ms. E. P. Nivedita**
   Director, Ministry of Urban Development
3. **Dr. Sadhana Parashar**
   Education Officer,
   CBSE
4. **Mr. R. R. Okhandiar**
   CCF, Madhya Pradesh Forest Department
5. **Mr. Sanjay Kumar Srivastava**
   Sr. Advisor, GTZ
6. **Mr. Y. D. Mathur**
   Advisor, Sulabh International
7. **Mr. Vinod Tihara**
   Administrator, Vidya Jain Public School & DDCA,
   New Delhi
8. **Mr. R. S. Arun Kumar**
   CEO, Ecosan Services Foundation
9. **Ms. Kalpana Kapoor**
   Principal, Delhi Public School,
   Vasundhara, Ghaziabad

Disclaimer

Unless otherwise specifically stated, the information contained in this Manual is made available to all urban schools by the Ministry of Urban Development, Ministry of Human Resource Development, CBSE and GTZ for use of content information and implementing green practices in their schools, thus fulfilling the objective of "safe sanitation for all" ideology. The intent of the Manual is to assist the school authorities in creating a new environment, which is hygienic and thus encourages a behavioural change among the students.

While sincere efforts have been put forth by the Members of the Sanitation Manual Drafting Committee, neither MoUD, MoHRD, CBSE or GTZ assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, product or process disclosed in this Manual.

The views and opinions of the Members expressed therein do not necessarily state or reflect those of MoUD, MoHRD, CBSE, GTZ or any agency or entities thereof.

We are grateful to Ms. Kalpana Kapoor, Principal, DPS Vasundhara, Ghaziabad for providing photographs for the manual.

एस. जयपाल रेड्डी
S. Jaipal Reddy

सत्यमेव जयते
Government of India

मंत्री
शहरी विकास
भारत सरकार

Minister of
Urban Development
Government of India

MESSAGE

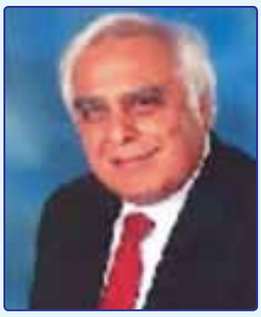
I am pleased to know that my Ministry's pioneering effort has finally borne fruits and a focused movement for Sanitised India has begun with the involvement of the country's children, the real "Agents of Change". The vision of our National Urban Sanitation Policy is that "All Indian cities and towns become totally sanitized, healthy and liveable 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".

I hope the Sanitation Manual painstakingly produced by the team comprising of experts and officials of my Ministry, Ministry of Human Resource Development, Ministry of Rural Development, CBSE and GTZ, will be useful for teachers and students in understanding sanitation in its proper perspective leading to safe hygienic practices. The manual is part of our initiative to generate desired awareness so that a change of mindset towards sanitation can occur and a community driven transformation can begin.

I am sure the large number of schools under urban local bodies would also benefit from the Manual. I appeal to all the City Mayors to initiate Sanitation Drives through our young school going citizens.

I wish the National School Sanitation Initiative all success.

(S. Jaipal Reddy)



कपिल सिब्बल
Kapil Sibal

सत्यमेव जयते
Government of India

मानव संसाधन विकास मंत्री
भारत सरकार
नई दिल्ली

Minister of
Human Resource Development
Government of India
New Delhi-110 115

MESSAGE

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. 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 collaborative effort of my Ministry, Ministry of Urban Development, CBSE and the GTZ 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.

(Kapil Sibal)

सुभाष चन्द्र खुंतिा
S.C. Khuntia

सत्यमेव जयते
Government of India

Joint Secretary
Ministry of Human Resource
Development
Government of India

FOREWORD

In India, 30.66 million households forming 35.5 % of the total households in the urban area 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 GTZ. A Baseline Survey on National School Sanitation, which was conducted by GTZ, 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 GTZ, 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 web-site has been launched on school sanitation to spread awareness and for exchange of information on good practices in the field. I would like to acknowledge the initiative taken and significant contribution made by Shri A.K. Mehta, Joint Secretary, Ministry of Urban Development, Shri Vineet Joshi, Chairman, CBSE, and Shri Sanjay Srivastava and Dr. J.Bischoff of GTZ in this important endeavour having a tremendous impact on the future of environment and health in this country.

I am confident that the School Sanitation Manual would help all the schools in the country to look at sanitation aspects in a new light and to bring about necessary behavioural and attitudinal changes amongst the children leading to a clean India of the future.

(S.C. Khuntia)

Table of Contents

Section 1 - Theme of the National School Sanitation Initiative

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

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 check-ups 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.

The National School Sanitation Manual: The Baseline Survey and Study by GTZ

The baseline survey noted that sanitation and waste management issues need to be given more emphasis in the Manuals and the aims and objectives of the School Health and Wellness clubs need to be reoriented toward sanitation, waste segregation and safe hygiene practices besides other factors related to sanitation like waste water recycling etc.

On the behest of MoUD, MoHRD, and CBSE, GTZ, in collaboration with the Ecosan Services Foundation, Pune, conducted a baseline survey on the existing health and sanitation scenario in schools. This baseline survey is the first step of action towards improvements of the water, sanitation and hygiene/ health situation of the school and

community. Baseline surveys need to be conducted at the very initial stage of the programme to assess the existing situation of water, sanitation, health and hygiene status, to understand the practices, traditional beliefs, and to identify the appropriate measures that can be considered for future plans. As desired by MoUD and MoHRD, on behalf of GTZ, Ecosan Services Foundation, Pune, carried out the baseline survey in three cities – Bangalore, Pune and New Delhi– spanning 41 schools and over 32,000 students.

The findings from the baseline survey are incorporated as the basis for developing the National School Sanitation Manual. It addresses key issues related to water, sanitation and hygiene, so as to provide schools a detailed document for implementing water and sanitation practices in their institutions in an efficient, effective and environmentally friendly way.

Objectives of the Baseline Survey

The objectives of the baseline survey were to

1. Collect information on awareness about sanitation, health and hygiene and also ascertain the extent of its practice
2. Collect information on the current state of water availability and usage , and the sanitation and health/hygiene status of the school in terms of adequacy, maintenance, availability and limitations
3. Prepare an appropriate plan of action based on the baseline information to improve the sanitary and health/ hygiene practices of students and use the information to enrich the National School Sanitation Manual
4. Use the information as the baseline index to measure the progress made in sanitation, health and hygiene improvement.

Some of the outcomes from the baseline survey for the future course of action are provided below:

- Build and promote awareness raising programmes and capacity building programs at the management levels.
- Build and promote regional leadership opportunities in schools that express an interest in leading this initiative, thus developing nodal centres for capacity building and hand-holding for other surrounding schools.
- Develop technological options in line with the current status and future expansion, both in terms of their strength as well as the potential to optimize the reuse and recycling concepts of waste management.
- Ensure that rainwater harvesting is made an integral part of the overall sanitation scenario.
- Develop skill based learning approaches in line with the capacities of the schools to take them up as part of the regular curriculum.

Continuous support and hand-holding will be required during the initial months of the upgrading process, after which monitoring and evaluation should be regularized.

1. Urban School Sanitation – Confronting the Challenges

Today in India 30.66 million urban households or 35.49 percent 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, this practice results in the unsafe disposal of human excreta which has a severe impact on environmental and health outcomes. The inadequate and unsanitary disposal of excreta leads to contamination of ground and surface water. The loss due to diseases arising out of poor sanitation for children under 14 years of age in urban areas alone is estimated at Rs. 500 crores at 2001 prices. A related concern is that of manual scavenging which has not been eliminated in our country even 60 years after Independence. **The National Urban Sanitation Policy** (NUSP) was formulated by the Ministry of Urban Development, Government of India and was launched in the year 2008 which was declared the International Year of Sanitation by the United Nations.

The vision for Urban Sanitation in India is, "All Indian 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".

One of the key policy issues is to improve awareness regarding the linkage of sanitation with public health through community driven initiatives, and achieve the overall policy goal of transforming urban India into totally sanitized, healthy and livable cities and towns.

The specific goals which need to be met are:

- Awareness generation and behavioural change
- Open defecation free cities
- Focus on sanitation and waste management

Total Sanitation Campaign (TSC)

Total Sanitation Campaign is a comprehensive programme to ensure sanitation facilities in rural areas with broader goal to eradicate the practice of open defecation. TSC as a part of reform principles was initiated in 1999 when Central Rural Sanitation Programme was restructured making it demand driven and people centered. It follows a principle of "low to no subsidy" where a nominal subsidy in the form of incentive is given to rural poor households for construction of toilets. TSC gives strong emphasis on Information, Education and Communication (IEC), Capacity Building and Hygiene Education for effective behaviour change with involvement of PRIs, CBOs, and NGOs etc. The key intervention areas are Individual household latrines (IHHL), School Sanitation and Hygiene Education (SSHE), Community Sanitary Complex, Anganwadi toilets supported by Rural Sanitary Marts (RSMs) and Production Centers (PCs). The main goal of the GOI is to eradicate the practice of open defecation by 2010. To give fillip to this endeavor, GOI has launched Nirmal Gram Puraskar to recognize the efforts in terms of cash awards for fully covered PRIs and those individuals and institutions who have contributed significantly in ensuring full sanitation coverage in their area of operation. The project is being implemented in rural areas taking district as a unit of implementation.

The Ministry of Urban Development (MoUD), Ministry of Human Resource Development (MoHRD), Central Board of Secondary Education (CBSE), and GTZ have now joined hands again to launch a unique National School Sanitation Initiative covering the entire country.

The National Urban Sanitation Policy envisions that, "All Indian 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."

"Educating them young" is one theme which has every chance of success in this endeavour.

Schools and students can play a very vital role in attaining the goals under the NUSP and thus making its vision a reality. Schools are considered to be the most important and basic links which have a definite reach to 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 paucity of safe hygienic facilities in schools which often lack safe drinking water provisions and toilets and urinals. Separate toilet facilities for girls do not even exist in many schools. Where they do exist they are so poorly maintained or so few in number, that most children do not use them. Instead they relieve themselves in inappropriate places 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 being absent after recess when they go home and do not return to school.

Sanitation facilities have a direct bearing on enrolment and retention of girls in schools. Lack of separate and safe sanitary facilities for girls has been a factor in discouraging parents from sending girls to school and contributes to their dropping out of school, especially adolescent girls. Growing girls find it difficult to attend schools that have no or a few badly maintained facilities. Thus it is critical to have separate toilet facilities for girl students.

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

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 laid out in the National School Sanitation Manual.

The main objective of the Initiative is the effective awareness generation among the school children leading to behavioural change as envisaged in the National Urban Sanitation Policy through hygiene education towards the issues pertaining to improved sanitation, including personal and environmental hygiene, waste segregation and recycling through the concept of the 3 Rs (Reduce, Reuse and Recycle).

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 process for needs assessment studies as the first requirement. Thus the initiative goes beyond earlier efforts in terms of scope, aims and implementation, and this makes this a unique and ground breaking initiative.

2. National School Sanitation Initiative

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 met are:

a. **Awareness Generation and Behavioural Change:** In order to achieve the goal of behavioural change among children it is important that general awareness about sanitation issues is improved. It is important for children to understand the vital link between sanitation and their health and immune systems. The idea is to promote a mechanism which will bring about and sustain behavioural changes aimed at adoption of healthy sanitation practices.

   In a nutshell, the main objective of the Initiative is the effective awareness generation among 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 the three 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 this which include adequate availability and the complete upkeep and management of public sanitation facilities in all urban areas.

c. **Focus on Sanitation and Waste Segregation:** This Initiative focuses on sanitation and waste segregation and relies on real time technological interventions and support, besides data gathering which is a part of the process for needs assessment and is the first requirement.

Safe sanitation is the main component of the Initiative. Here, it will be important to ensure that the sanitation systems already existing in schools are improved/created and brought to a level where it becomes totally hygienic to use them. The waste generated should be disposed off/recycled safely with efficient water use and without any kind of

contamination to any natural resources or endangering the health of the school children in any manner, and without compromising on the aesthetics. The MoUD, MoHRD, CBSE and GTZ would take necessary steps to ensure the success of this venture.

It is expected that through these measures the Initiative would also lead to appropriate interventions in sanitation management so as to achieve ecological sanitation which is socially acceptable, economically feasible, environmentally sound, and technically appropriate in an context. Ecological sanitation ensures that human excreta and waste water are seen as resources 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 schools first and turn the school campus into eco-centres where the 3 Rs concept of Reduce, Reuse and Recycle can effectively be used and demonstrated particularly organic waste management (for example wastes from hostels) and waste water recycling, so that they become a role model for the schools in the semi urban and other areas.

Simple measures like rain water harvesting and energy efficiency can ultimately turn the schools into eco-sensitive schools comprising of hundreds of young eco-managers. This can be emulated by other schools that can afford to do so, mostly in the private sector and under the umbrella of the Government, both Central and State, so that a self sustaining system can be evolved to meet the expenses in the proposed endeavor. The point which needs to be emphasized and publicized is that safe and hygienic sanitation is not a costly affair. It is a low cost proposition the success of which depends on the attitude and mind set of the community at large.

Waste segregation measures will be undertaken across all schools and a special awareness campaign will be launched to induce behavioural change at a receptive age by targeting young 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 is considered essential for a protected, sheltered and healthy environment for children to learn better and face the challenges of future life.

3. Concept of Sanitation

Sanitation is one of the basic determinants of the quality of life and human development index. The concept of sanitation was earlier limited to disposal of human excreta and construction of lavatories. Today it includes personal hygiene, safe water, human excreta disposal, waste water disposal, solid waste disposal, food hygiene and environmental sanitation (in and around the school). The components of sanitation are as follows:

a. Personal Hygiene

Besides general aspects of cleanliness for children the key issue is hand washing before handling food and after using the toilet. This can result in a substantial reduction in the incidence of diseases like diarrhoea etc.

b. Safe Drinking Water

Drinking water for children should always be taken from a safe water source. The water should be collected, stored and used hygienically eliminating any chance of contamination.

c. Human Excreta Disposal /Toilets

As human excreta is responsible for the transmission of several diseases, a sanitation barrier by way of an appropriate toilet and a safe disposal system is necessary to break the chain of transmission of disease.

d. Disposal of Waste Water

Waste water accumulation in the school campus leads to the breeding of vectors which are responsible for transmission of diseases. The management of waste water (for recycling and reuse) is necessary to eliminate this threat. It also educates children about the importance of water.

e. Waterless Urinals

These urinals need to be popularized as not only do they save precious water but also serve as an excellent example and illustrate alternative methods of effective water conservation.

f. Solid Waste Management

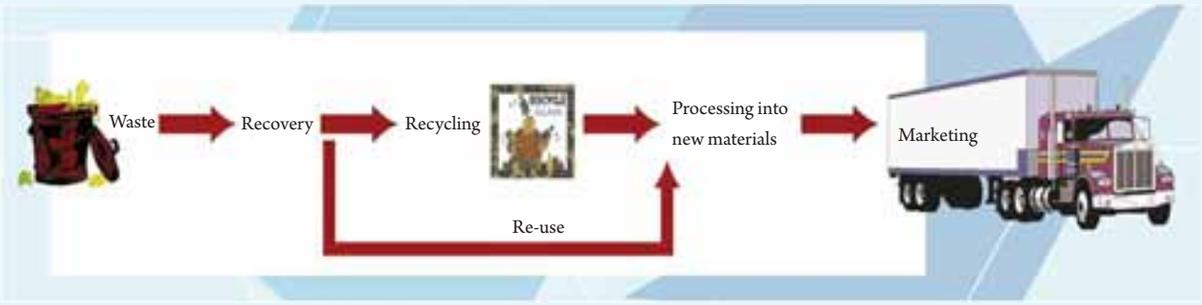
Waste segregation and disposal is important for the school. Accumulation of waste particularly organic waste is not only unaesthetic but leads to the breading of insects such as flies etc. which help in disease transmission. Measures such as vermi-composting, traditional-anaerobic composting or bio-dynamic quick composting are quite popular.

g. Food Hygiene

Food which is cooked, stored, or served to children in schools should be done under hygienic conditions in order to minimize the chances of contamination and disease transmission.

h. Environmental Sanitation

Proper cleanliness should be maintained within the school buildings (classrooms corridors etc.) as well as within the school campus.



4. Norms for Water and Sanitation Facilities in Schools

Determining the Need

a. School Toilets

To begin any school toilet design exercise, it is first important to establish the need and then follow the norms for provision of facilities. The norms for school toilets, urinals and washing facilities have been defined in the National Building Code (NBC). However, it should be noted that the norms must be simple, pragmatic and based on:

- Field experience of the ground situation(s)
- Observed pattern of usage of these facilities
- Methods that connect directly with planning of school classrooms and other infrastructure provisions (planned for multiples of 40 children)

For example, in most day-schools the frequency of use of urinals is much higher than toilets as compared to residential schools. Most norm based calculations are envisaged for 'peak' load situations of usage. If such peak times can be offset by creative planning of the time table, the provision of infrastructure may be optimized without compromising on quality. For example, if in larger schools, the lunch break is staggered for primary and middle schools, the number of urinals and toilets to be provided may be reduced without causing any inconvenience and ensuring better utilization of available resources. Hence, one toilet for every 80 children has been suggested.

It is also noticed that school toilets are being constructed across the country without following any clearly defined norms. Certain criteria need to be kept in mind while deciding on the number of and provisions provided to a structure. There are studies on queuing time for toilets is schools and how many toilets and urinals should be made available according to the number of students (both boys and girls). The following norms have been developed for school sanitation keeping the above criteria in mind. Separate tables have been prepared for non-residential schools and residential schools since the patterns of usage differ in both the cases.

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 children as well as adults.
4.	Clothes hanging hook*	Hooks in each toilet	At least 2 hooks at different child accessible heights – suitable for a 5 year old 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 a 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.

Children With Special Needs.

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 old 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	Minimum of 2. One wash tap for every 20 children	Can be provided (toilet/urinal)* as common/separate for girls' and boys' toilet blocks.
22.	Hand wash MDM kitchen*	Minimum of 3. 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.

It may be noted that provisions mentioned in 26 and 27 will replace provision mentioned in 1 and 12

All marked with '*' are essential and mandatory.

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 a universal design approach for use by children, CWSN as well as adults.
- In the spirit of inclusive education, toilet designs must be developed with the assumption than 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) 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 and one urinal in the boys' and in the girls' toilet blocks must be accessible to CWSN.

b. 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 a force lift is desirable for lifting water. Potability of water to be tested for safety as per the prescribed schedule. Source to be located at least 10 metres 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 and found safe for drinking).

Table : Sanitary fittings for Schools (Extract from IS:8827 – 1978 published by Indian Standards Institute)

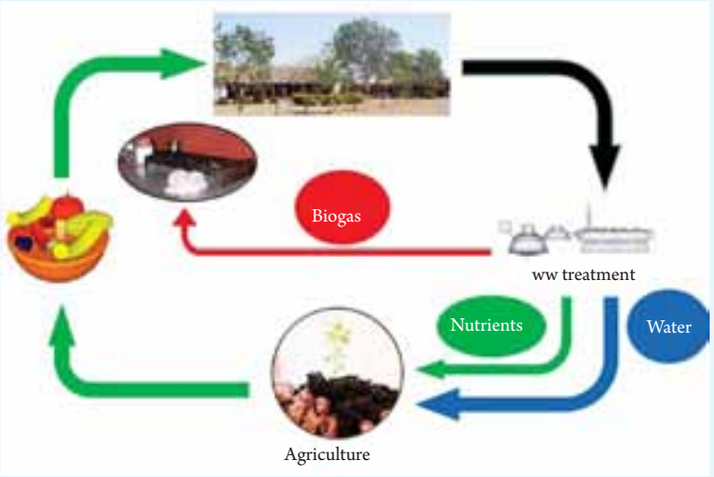
Fitments	Pre-schools	Primary & Secondary schools (Boys)	Primary & Secondary Schools (Girls)	Staff
Water closets	1 per 15 students or part thereof	1 per 40 students or part thereof	1 per 25 students or part thereof	1 per 30 members or part thereof
Urinals	Not specified	1 per 20 students or part thereof	Squatting plate urinals 1 per 20 students or part thereof	Not specified
Drinking water fountains	1 per every 50 students or part thereof	1 per every 50 students or part thereof	1 per every 50 students or part thereof	1 per every 50 or part thereof
Ablution taps	1 in each water closet and 1 water tap with draining arrangements shall be provided for every 50 students or part thereof in the vicinity of water closets and urinals.			

5. Focal Points and the Key Deliverables

The key deliverables based on the above stated concepts of sanitation are summarized below.

5.1 Hygiene Education

- Inculcation of basic and safe hygiene habits among school children through various educative and demonstrative means
- Safe hygiene practices in the schools
- Development of waste segregation habits among school children
- Capacity building and training of school teachers on sanitation and waste management practices
- Orientation of the school curriculum towards safe sanitation, health and hygiene strengthening using project assignments and effective marking and grinding .
- Focus on Waste Management and Safe Sanitation issues by Health and Wellness Clubs in and the schools
- Focus on Waste Management and Safe Sanitation issues in CBSE's "Lifestyle Management Training Programme
- Focus on Waste Management and Safe Sanitation in the MoUD's domain.



Sustainable Waste Water Management Concept for Boarding Schools

5.2 Waste Water Cobweb – The Zero Discharge Concept

- Waste water recycling measures in schools
- Spilled water management from wash basins and water closets
- Appropriate technological interventions for waste water recycling
- Use of grey waste water
- Conservation of green spaces

5.3 Sustainable Water Management

- Establishment of water harvesting structures at appropriate places within the school premises
- Water conservation and judicious use of water
- Awareness regarding safe drinking water and its up keep
- Initiation of innovative approaches in water conservation

5.4 Technological Interventions

- Technological interventions in the improvement of the existing sanitation/toilet systems in the needy schools in a region specific (geographical) manner
- Waterless toilets and urinals
- Separate and safe toilets for girl students
- Establishment of recycling oriented waste water management systems
- Establishment of facilities for vermi-composting and other methods of utilizing organic kitchen waste depending upon the specific situation
- Technological interventions for recycling oriented waste water management, waste segregation and bio-gas generation
- Rain water harvesting structures
- Ground water recharge methodologies
- Intervention towards the establishment of the decentralized waste water treatment system
- Proper bio-medical waste management in school clinics
- Elaboration of strategies for nation-wide dissemination of sustainable sanitation concepts.
- Bio Dynamic Waste Segregation
- Vermi-composting

5.5 Green Spaces Development

Benefits of the Green Spaces

In the quest for healthy, livable and sustainable cities, green spaces with trees as a major component has a vital role to play. It not only does provide a breathing space and an area for relaxing in leisure time, it freshens up air and provides a viable option for games and recreation as well.

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

- Linkages between ecological sanitation and green spaces
- Understanding the direct and indirect advantages of green spaces in the overall improvement of the school environment

5.6 Monitoring and Evaluation

- Periodic reviews at the Central Government level through the Advisory Committee on National School Sanitation
- Regular monitoring, reporting and assessment
- Establishment of online real time monitoring systems
- Health and Wellness Club quarterly reports
- Designing of road map and milestones
- Impact assessment
- Independent monitoring and evaluation by CBSE/ MoUD/ MoHRD/ GTZ

5.7 Interface with the Urban Local Bodies

- Several schools are run by urban local bodies (ULBs) and these ULBs will extend this initiative to them.
- The ULBs will make a special effort to be in direct touch with the schools and ensure that safe and efficient sewage disposal is being followed in and around the schools.

5.8 Institution Building through Participatory Approach

- Sustainable Sanitation: Establishment of Operation and Maintenance mechanism in a school and region specific manner.
- Exposure visits to appropriate places like Jungle Lodges, EcoSan centers, etc. for learning experiences in eco-sanitation in nature and cultural heritage.

- Active and sustained participation of parents and guardians in the endeavor.
- Workshops and seminars for teachers, knowledge dissemination and sharing of information as well as technical know-how
- Sustained nationwide awareness campaign for ecological sanitation, waste and water management through print, electronic and visual media
- Establishment of the National level Awards and Prizes for the performing schools

…. Recognizing Excellence in School Sanitation Management

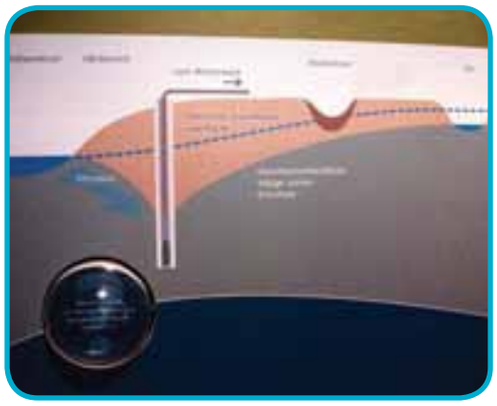
5.9 National School Sanitation Awards: Theme

One of the most effective ways of meeting the aims of the National Urban Sanitation Policy of the Government of India is to inculcate good sanitation habits amongst the children and the best way to start this is from the schools. The Ministry of Urban Development, Ministry of Human Resource Development, Central Board of Secondary Education (CBSE) and GTZ have joined hands in this unique National Initiative on School Sanitation and an annual National School Sanitation Award (NSSA) has been instituted by Ministry of Urban Development (MoUD), and Ministry of Human Resource Development (MoHRD), Government of India, in collaboration with the Central Board of Secondary Education (CBSE) and German Technical Cooperation (GTZ) to inspire and acquaint, and celebrate excellence in school sanitation.

These Awards are instituted with the purpose of honouring schools, education boards and institutions up to the Secondary level, and also to recognize and appreciate the partners-in-change for example the corporate sector, institutions and non-governmental organizations (NGOs) etc., that assist them in taking significant steps towards effective sanitation and improvement in service delivery leading to behavioural change.

"I consider the School Sanitation Initiative highly significant and different because it recognizes and attempts to do something about the human and behavioural aspects of sanitation which are as important as the engineering issues. The battle for safe sanitation, as in the case of many other issues has also to be fought in the minds of people by bringing about awareness generation and behavioural change and there can be no better option for doing so other than instilling the right values in our children who will be tomorrow's citizens."

---- M. Ramachandran
Secretary (Urban Development), Ministry of Urban Development,
Government of India



Urban Schools Lead the Way to Safe Sanitation

At the start of the new Millennium, despite all the progress reported in recent decades, people still live without access to sanitation facilities and are unable to practice basic hygiene. Diseases related to poor sanitation and water availability cause many people to fall ill or even die. Children are the most vulnerable to health hazards and consequently are affected the most. While the impact of poor sanitation and hygiene is known to be disastrous for small children, it also has an impact on the health of school-age children including adolescents.

The lack of sanitation and hygiene is a public disaster that deserves the highest priority. The problem needs to be tackled by making improvements to sanitation facilities. However such improvements must go hand-in-hand with hygiene behavior change, if the transmission of diseases is to be prevented. Access to sanitation facilities is a fundamental right that safeguards health and human dignity. Providing such facilities in schools not only help to meet that right, it also provides the most favorable setting to encourage behavioural change in the school and in the community

Schools are the key institutions for the cognitive, creative and social development of children. 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. There is a dire need for reorienting these first steps which have been taken in this direction by the Central Board for Secondary Education (CBSE) and several other schools and organizations so that this becomes a national effort to induce behavioural change among children. To attain the goals set by the National Urban Sanitation Policy and to make this vision a reality, schools and students have a vital role to play. The schools are important links with a definite reach to the parents, individual families, and consequently the community.

The sanitation systems already existing in schools need to be reassessed for improvement so as to bring them to a level where they becomes totally hygienic to use and the waste generated is disposed off/recycled safely with efficient water usage and without any kind of contamination to any natural resources or endangering the health of the school children and without compromising on the aesthetics.

Technological interventions are necessary wherever needed. This would include corrective infrastructural measures for improving the sanitation facilities within schools and also calls for improvements in service delivery by establishing direct contact with the concerned Municipal Corporation/urban local body which has the responsibility for the safe disposal of waste and sewerage. Schools can have direct interaction with the concerned ULBs in order to effectuate speedy grievance redress. Through the website www.schoolsanitation.com the schools can directly interact with the partners MoUD, MoHRD, CBSE and GTZ for assistance.

For all this MoUD, MoHRD, CBSE and GTZ would act as the catalysts for change in order to ensure its success. Thus, it is clear that by and large, the ultimate objective is to bring about awareness and positive behavioural modifications among students and through them in society at large.

The efforts of performing schools are recognized and encouraged through the National School Sanitation Awards.

Partners in the Awards

- Ministry of Urban Development, Government of India
- Ministry of Human Resource Development, Government of India
- Central Board for Secondary Education (CBSE), Ministry of Human Resource Development, Government of India
- German Technical Cooperation (GTZ)

Who is eligible for the Awards

The awards are open to:

1. Categories of Schools :

⊙ Schools under Central Government

- Kendriya Vidyalayas
- Jawahar Navodaya Vidyalayas
- Others

⊙ Schools under State Government

⊙ Private UnaidedSchools

⊙ Private AidedSchools

2. Urban local bodies (ULBs) for their work on sanitation improvement in the Municipal Schools

3. Non-governmental Organizations, Community Based Organizations, corporate sector, institutions, bilateral and multilateral agencies in combination with ULBs/ water utilities/boards who help/collaborate with the performing schools in this endeavor

Catergories for the Award

⊙ Awareness Generation leading to Behavioural Change through Students and Community Mobilization

⊙ Technical Innovation and Interventions

⊙ Creation and Conservation of Green Spaces

⊙ Public Private Partnership

Schools should inform the mechanism used in achieveing the Best Practices. Eg: Health and Wellness Clubs, NSS, NCC, etc.

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: Activity points scored by participation in various activities as organized from time to time through the website; www.schoolsanitation.com

5. Networking

6. Cost effectiveness of the interventions

6 The Technological Options in Sanitation

Sanitation Management focuses on the safe management of human excreta, including its safe confinement, treatment, disposal and associated hygiene related practices. While this policy pertains to management of human excreta and associated public health and environmental impacts, it is recognized that integral solutions need to take account of other elements of environmental sanitation, i.e. solid waste management, generation of industrial and other specialized/hazardous wastes, drainage, and also the management of the drinking water supply. This makes the canvas of sanitation management very wide covering all the important and sundry issues.

There are many arguments about the methodology and mechanism pertaining to the collection, transportation and disposal of waste and there is serious debate about the conventional system of sewage disposal and the new technological innovations of using less water and propagating the use of dry toilets. Modern day technological options have triggered this debate and there have been many successful demonstrations of the new thinking and eco-friendly technologies.

This concept has become popular as "eco-sanitation". Ecological sanitation (eco-san) or sustainable sanitation means keeping our surroundings (the environment) clean and safe and preventing pollution. It includes waste water treatment disposal and recycling, effective vector control and other disease-prevention activities. Eco-san, is based on recycling principles. It means keeping the eco-cycle in the sanitation process closed. This is what is often termed as "closing the loop". It is also a low-energy approach that uses natural processes.

Eco-san pays particular attention to the health aspects, and emphasizes the following:

1. The destruction of pathogens through flow-stream management, specific confinement and treatment.
2. Resource conservation through reduced use of potable water as a medium to transport human waste, and recovering waste water for irrigation.
3. Elimination/minimization of waste water discharges to the environment.
4. Closes the loop through productive use of nutrients contained in the wastes.

The modern eco-san concept thus represents the culmination of the paradigm shift initiated in response to satisfying the health needs of unserved population groups, like schools in this context.

Ecosan Services Foundation is among one such organization which has made serious efforts to popularize this concept and has done many pilot projects successfully. The main argument given for eco-sanitation practices is that it saves a lot of water which is a scarce commodity in many parts of India and also the fact that the water based conventional sewage disposal system has not able to treat the ever increasing bulk of human waste in most of our cities.

It is argued that:

1. The existing system is not sufficient to treat the sewage being produced in the cities and a large percentage of it flows into rivers, untreated.
2. Most of the sewage lines are choked and silted. As a result, some of the sewage treatment plants do not get enough sewage to treat due to the non-functioning of certain lines. The sewage generated is often diverted to functioning lines and thus some of the treatment plants get sewage which is beyond their capacity to treat. This again results in untreated sewage flowing into rivers.
3. In many places where sewer lines are jammed, residents and other users divert their sewage into storm water or waste water drainage lines thus leading to the free flow of sewage into rivers and other water bodies. Though illegal, this is a common practice.
4. The present water based technology consumes lots of water which is a scarce commodity and is not always available. This results in stinking public toilets and blocked sewer lines.
5. The cost of sewage treatment is very high and is increasing day-by-day. The cost of water cannot be increased such that it affects the local populace. The resulting water subsidies thus become an economic burden and for an efficient economy, a way out has to be found.
6. Contamination of rivers and other water bodies, ground water and other sources lead to water borne diseases, pollution, and affects agricultural produce and destroys aquatic life. This is leading to an ecological disaster and environmental "hara-kiri".
7. The "flush toilets" have served their purpose and we should adopt new ways. There is a need for a paradigm shift and we must change our age old habits.
8. The new technological shift should be for the "rich" as well, and just not for the "poor" alone. One should remember that the flush system is mostly used by well off people and is one of the biggest eco-threats at the moment.
9. In eco- san technology urine is collected from the boys' toilet using waterless urinals. The black and grey water is 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 through 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. The collected urine from the waterless urinals is stored and is used for agriculture/gardening purposes within the school campus.
10. The biogas that is generated is used either for cooking purpose or lighting purposes.
11. The faecal sludge is used as compost in campus agriculture/gardening purposes.

With new insights and the interest and success stories reported in the development and usage of eco-san technologies it is expected that with the passage of time this concept will be accepted and internalized by the people and thus some of the sewage burden will be taken off from the system and consequently from our rivers and water bodies.

It needs to be stressed that in the present National School Sanitation Initiative, the idea is not to trigger a debate to finalize which approach is better from the ecological point of view and from the practical position of implementation. This aspect is being touched upon and dealt with so that one can weigh all the options and alternatives and then decide on the best way forward for sanitation management in the Indian context. At the moment, the focus of the initiative is on raising awareness and inducing behavioural change. On the technological side, we need to address these issues without compromising on the immediate and efficient service delivery by removing the impediments in the best possible manner first and if during this course of action we also introduce the concept of eco-sanitation greater acceptability will follow. In fact technological intervention is a matter of using appropriate technology for the day and introducing simultaneously, suitable technologies for the future which can withstand the changing pressures and demands dynamics. Such efforts could also be region specific and resource availability based e.g. how much water is available for use and at what frequency?

Besides sewage waste disposal and waste water recycling mechanisms adopted by the schools also need to be examined and analyzed in order to attain the best practices.

It is expected that through the measures and action indicators mentioned so far, the Initiative would be able to evolve appropriate interventions and activities so as to achieve ecological sanitation in a socially acceptable, economically feasible, environmentally viable, and technically appropriate manner in an urban context.

See Annexure 1 for all the technological options for implementation.

Mahatma Gandhi raised the issue of the horrible working and social conditions of scavengers more than 100 years ago in 1901 at a Congress meeting in Bengal. Yet it took about 90 years for the country to enact a uniform law abolishing manual scavenging. The Employment of Manual Scavengers and Construction of Dry Latrines (Prohibition) Act, 1993 punishes the employment of scavengers or the construction of dry (non-flush) latrines with imprisonment for up to one year and/or a fine of Rs 2,000. Offenders are also liable to prosecution under the Scheduled Castes and Scheduled Tribes (Prevention of Atrocities) Act, 1989. This Act to eradicate a pernicious practice that only dalits were subjected to, aims at restoring the dignity of the individual as enshrined in the Preamble to the Constitution.

Total Sanitation Campaign

"Sanitation is more important than independence."

"The day every one of us gets a toilet to use, I shall know our country has reached the pinnacle of progress."

"Let us all take that one extra step to ensure that we live in clean and healthy surroundings."

Section 2 – Activities for Schools

Activities pertaining to education cannot be confined to a set pattern. The horizons of such activities are unlimited and a vast range of activities on varied themes converging on hygiene and sanitation can easily be developed.

Only a few activities have been mentioned here for students of different age groups.. These could act as triggers to initiate further activities among students as well as the teachers.

Based on the key deliverables outlined in the previous section, activities for children in school have been designed and built around six key topics:

1. Hygiene Education
2. Waste Water Cobweb – The Zero Discharge Concept
3. Sustainable Water Management
4. Technological Interventions
5. Green Spaces Development
6. Monitoring and Evaluation

1. Hygiene Education

Hygiene Education focuses on three core activity areas, each targeted at students of different classes:

- Hygiene practices: For Classes III-V
- Healthy food eating practices: For Classes III-V
- My school – A clean environment: For Classes VI-VIII

1.1. Hygiene Practices: For Classes III-V

Background

Activities related to Hygiene Practices will encourage students to understand:

- The importance of self hygiene,
- The need for maintaining hygienic conditions in school, and
- The various hygienic conditions that prevent water borne and sanitation related diseases.

Washbasin - 1860

Concept

- Awareness amongst children for maintaining self hygiene
- Washing hands at regular intervals helps in preventing communicable diseases

Objective

Highlight the importance of adopting hygienic practices and conditions for preventing the spread of water borne and sanitation related diseases.

Materials Required

- Chart paper and colouring material
- Computer and Internet facility
- LCD enabled room for presentations

Mode

Group surveys to study hygiene in specific areas of the school like the water facility area, classroom hygiene, toilets, etc.

Time Required

Two periods (once a week)

Methodology

Students will be divided into three groups: A, B and C , and each group will be given a survey topic.

Group A

Children of this group will be required to work at home and use the Internet to perform the following: Understand the importance of sanitation hygiene and maintenance of hygienic conditions in school, etc. Group A will prepare a power point presentation on their findings for later presentation in class.

Group B

Children of this group will be required to conduct a survey in school highlighting the hygienic conditions in various areas of the school. Group B will document their findings by making a power point presentation on hygienic conditions in school.

Group C

Children in this group will be required to study various communicable diseases (water borne and sanitation related) and ways to prevent them. Group C will prepare charts and posters showing the spread of communicable diseases (water borne and sanitation related). The best chart and presentation will be rewarded in the class.

All of the above groups can also consider working on an activity related to water supply storage, water uses and waste water disposal in the school.

This activity could make them understand that how much water is being efficiently utilized and how much water is available for irrigation etc. in the school.

Evaluation

Students will be evaluated on individual/ group presentations.

List of groups	Content	Power point	Presentation	Individual /team
Group A				
Group B				
Group C				

Key Message

- Creating awareness on maintaining good hygiene practices and conditions at school.
- Ways to prevent communicable diseases like cholera, swine flu, common cold, dysentery etc.
- Creating awareness about water management practices.

Suggested Activities

1. Interviewing neighbourhood doctors and listing the major causes for the spread of communicable diseases.

2. Brainstorming sessions in class on diseases caused by lack of sanitation.
3. Students can make a daily checklist record for maintaining hygienic conditions in school.
4. Placards on different aspects of sanitation and important instructions about it could be placed at appropriate places in the school.
5. Theatre - skits etc. could be developed.

Independent Practice: From school to home

Hygiene education

Survey in your homes

1. How many times does your water tank get cleaned? (Weekly / Monthly / Bi-monthly / Quarterly / Six-monthly / Annually)
2. How many times or at what frequency do members of your home wash their hands and when?
3. Mention specific areas in your home which are absolutely clean.
4. Participate in cleanliness drives.

1.2 Healthy Food Eating Practices: For Classes III-V

Background

Activities related to Healthy Food Eating Practices will encourage students to understand:

- The importance of healthy eating habits,
- The need for maintaining food hygiene, and
- The various hygienic conditions that decrease the development of chronic diseases.

Concept

- Awareness amongst children for maintaining food hygiene
- Healthy hygienic conditions are essential to achieve full mental and physical growth.

Objective

Sensitize children on adopting measures for maintaining essential food hygiene and overall health.

Materials Required

- Chart paper and colouring material
- Computer and Internet facility
- LCD enabled room for presentations

Mode

Individual surveys at home.

Group surveys in particular areas of the school like water facility area, classroom hygiene, canteen area, etc.

Time Required

Two periods (once a week)

Methodology

Students will be divided into two groups, A and B, and each group will be given a survey.

Group A

Children of this group have to conduct an individual survey at home on the following:

i. Adequate water supply in kitchen.

ii. Maintenance of food hygienic conditions, etc.

Group A will document their findings by making a chart on the dos and don'ts for maintaining food hygiene at home.

Group B

- Children of this group will conduct a group survey in school highlighting the hygienic conditions in various areas of the school.
- Group B will document their findings by making a power point presentation on hygienic conditions in school.
- The best chart and presentation will be applauded in the class.

Evaluation

Students will be evaluated on individual/group presentations.

List of groups	Content	Power point presentation /chart	Presentation in the class	Individual /team work
Group A				
Group B				

Key Message

- To enable children to become aware of maintaining hygienic conditions at home as well as in school.
- To develop in children the habit of maintaining food hygiene in order to achieve full academic potential, physical and mental growth, and a body that is free from disease.

Suggested Activities

1. Brainstorming sessions can be taken up in a class for maintaining food hygiene.
2. Students can make a daily check list record on the dos and don'ts for maintaining hygienic conditions.
3. Making placards (to spread awareness about food hygiene) and placing them in significant places in the school.
4. Theatre - street play or one-act play.
5. Mention any four health problems that may occur later in life due to unhygienic food conditions.

Independent Practice: From school to home

Food hygiene

1. Do an individual survey at home on your weekly menu card. List out what you eat at breakfast, lunch and dinner and what is the nutritive component in each.
2. Discuss within your family and prepare a comparative chart to study the advantages and disadvantages of nutritious food and junk food.

1.3 My School - A Clean Environment: For Classes VI - VIII

Background

Activities related to My School – A Clean Environment will encourage students to analyze:

- The need for a clean school environment.
- The areas which help to make the school environment clean.
- Student role and responsibility in keeping the school environment clean.

Concept

Encouraging a clean school environment

Objective

Children will identify areas which they can take care of in making the school environment clean and to internalize the concept of healthy living

Materials Required

Some waste material available at home or school to be utilized for making props.

Mode

Group Activity

Time Required

Three theatre periods (once a week)

Methodology

1. Students will be apprised about the topic, areas of evaluation, and the dos and don'ts of the presentation by the theatre teacher
2. Role Play : Students will be given different topics for role play (such as how to keep your classroom clean, how to maintain clean toilets, importance of washing of hands before eating food, keeping the surrounding clean etc.)
3. Students will be divided into four groups.

- In the first theatre period students in each group will brainstorm on the topic and note down the points to be covered in the presentation.
- They will plan the sequence and roles in the days before the next period and get it approved by the teacher.
- Each group will practice in the next theatre period.
- Presentations will be made in the final theatre period assigned for this activity.
- The best two groups will perform during assembly.

Evaluation

Students will be evaluated on their group presentations.

List of groups	Content (areas covered)	Following deadlines	Effectiveness of the dialogues/ script	Team Work	Presentation Time
Group 1					
Group 2					
Group 3					
Group 4					

Key Message

To enable young students to analyze:

- The areas and people who make the school look clean.
- Understand their responsibility in keeping the school clean.

Suggested Activities

1. Shramdaan – cleaning the classroom after every lunch break with duties being assigned to different groups/ houses
2. Surveys - the things/ items that make a classroom dirty
3. Making of posters/slogans
4. Organizing campaigns and rallies

Independent Practice: From school to home

School environment

Carefully observe the following in your school:

1. Proper lighting and ventilation arrangements.
2. White washing and cleaning in your school.
3. Any slogans based on hygiene displayed in school.
4. Shramdaan duties in school.
5. Prepare a check-list for all the above and follow it up regularly at home too.

2. Waste Water Cobweb – The Zero Discharge Concept

The Waste Water Cobweb topic focuses on the following core activity areas, targeted at students as well as at teachers:

- Water conservation: For Class VII
- Water conservation: For Class XI
- Clean toilet habits: For staff members

2.1. Water Conservation: For Class - VII

Background

Water conservation activities will for students of Class VII will encourage them to understand simple ways which help in saving water

Concept

- Water is scarce so should be used judiciously.
- A lot of water can be saved if we are careful about the way we use it at school.

Objective

- Developing awareness about the simple actions which reduce wastage of water.
- Responsibility in using water without wastage everywhere.

Materials Required

- Survey sheet
- A4 sheets

Mode

Group Activity (four to five children in a group)

Time Required

- Two periods (once a week)
- Ten minutes of assembly time

Methodology

1. Students will be divided into four groups of four students each.
2. Each group will brainstorm and list down ways/methods in which water wastage can be reduced.
3. The groups will present share their lists in class.
4. Ten such ways and methods will be listed in the survey sheet.

6. Before the next class the students present the information collected, in the form of a graph and draw conclusions.
7. In the next class the children will present their surveys along with graphical presentations and the conclusions they drew from their activity.
8. A selected group of five students will list down the findings of the class and present these findings at assembly through a presentation which will also include ways in which water wastage can be reduced.

Evaluation

Students will be evaluated on their individual work.

List of students	Completion of survey	Graphic Presentation	Conclusions Drawn	Neatness
Student 1				
Student 2				
Student 3				
Student 4				

Key Message

1. To enable young students to become aware of simple ways in which water wastage can be reduced.
2. To shoulder responsibility in promoting simple water conserving behaviours in their school and home environments.

Independent Practice: From school to home

Waste water cobweb

1. Students will conduct a survey in their homes and localities on how much water is used for bathing, washing hands and face, brushing teeth, gardening, cleaning and other daily chores in each house.
2. The survey conducted can then be brought back to school and a comparative chart can be made based on locality usage and conservation of water.

2.2. Water Conservation: For Class - XI

Background

Water conservation activities for students of class XI will inculcate in them the habit of preserving water as a valuable gift of nature.

Concept

To conserve water

Objective

To raise awareness of water conservation and water management issues amongst the school community

Materials Required

Chart paper, colouring material, computer, Internet facility, LCD enabled rooms for presentations

Mode

Group Activity

Time Required

Two periods in a week .

Methodology

Students will be divided into seven groups to list various issues on waste water management.

They will collect information on different topics and will make power point presentations of their work. They have to submit their project and survey reports.

Group-I

Students of Group –I will study about definitions of black, yellow, brown and grey water and sources of waste water in various school locations.

Group-II

Students of Group –II will collect information on waste water treatment.

Group-III

Group-III will work on the sewage treatment procedure followed in a sewage treatment plant. They will also make a working model of a sewage treatment plant.

Group-IV

Students of this group will collect information on waste water management.

Group-V

Students will try to find out whether waste water treatment is effective.

Group-VI

Students of this group will study the future directions given by scientists and researchers on improving the quality of waste water treatment.

Group-VII

Students will study the remedies to reduce the quantity of waste water like waste water recycling and management of spilled water.

Observations

Students will be able to understand that the unnecessary and excessive use of water can be costly and should be avoided to reduce overall environmental costs.

Evaluation

Students will be evaluated using the following parameters on a scale of 1 to 3 (1: Good, 2: Very good, 3: Excellent).

Groups	Presentation	Team work	Models/charts	Quality work	Content	Project report
I						
II						
III						
IV						
V						
VI						
VII						

Key Message

Schools can reduce their water consumption by assessing how much they use every day and by noting the readings on their water meters, identifying leaks and drips, adjusting the flow rate on taps and reducing the amount of water used in toilets.

Suggested Activities

- Water quality testing
- Report writing
- Development of water education website
- Water audits: Water experiments, educational games, crosswords and puzzles showing how the water cycle works

Independent Practice: From school to home

Waste water management

1. Students will be asked to list some ways of re-using grey water like water dripping from coolers, air conditioners, R.O (reverse osmosis) systems.

2.3. Clean Toilet Habits: For Staff Members

Background

Activities related to clean toilet habits will help staff to providing need- and age-appropriate toilet facilities for children.

Concept

Develop awareness among all members of the community about clean toilet habits, considering the individual needs of the different members.

Objective

Children will be provided with toilet facilities that are environmentally friendly and age- and need-specific. Children will also be trained to develop clean toilet habits.

Materials required for the survey

Staff members will need to collect information for their surveys from books, the Internet, magazine articles etc.

Mode

Staff Activity.

Time Required

About 15 days

Methodology

1. Staff members will be divided into four groups depending on the interests of the members and their individual strengths (some may be tech-savvy, some regular newspaper readers etc.).
2. Group 1 will survey the designs and dimensions of toilets and washbasins which are age- appropriate (for example, lower urinals for young children, separate toilets for boys and girls).
3. Group 2 will survey the requirements of separate toilet conditions for boys and girls (for example, arrangements for disposal bags/newspapers in senior girls' toilets and dustbins in each toilet).
4. Group 3 will conduct a survey to identify the types of toilets that need to be designed for disabled children in schools (for example, special seats, rods etc.).
5. Group 4 will conduct a survey on environmentally friendly ways of disposal of toilet wastes(urine, excreta, napkins etc.).
6. Each group will collect the information and give their report to the management.
7. Each group must take care that their reports present practical solutions.

Observations

The staff members will be able to understand the needs of different students so that toilets are kept clean.

Evaluation

Evaluation of the various groups will depend on the practicality of the suggestions made by each group.

Key Message

To provide healthy and age-appropriate toilet conditions to the students in the school.

Suggested Activities

- Surveys on methods of waste water disposal.
- Role plays can be enacted showing the harmful effects of unsafe disposal of toilet waste.

Independent Practice: From school to home Toilets

1 Prepare a checklist at your home for the regular cleaning of your toilets.

2. Conduct a survey in your own locality for the kind of toilet systems (Western/Indian) for their comfort whether they are age-appropriate (suitable young and old) etc. and the cleaning materials used.

3. Sustainable Water Management

3.1. Safe Drinking Water: For Class – VIII

Background

Activities related to Safe Drinking Water will encourage students to understand:

- the sources of safe drinking water
- the need for safe drinking water
- the various water borne diseases
- the different ways of purifying water

Concept

- Water for drinking should be clean and from a safe source.
- Judicious use of drinking water to avoid scarcity.

Objective

Developing awareness about the judicious use of water.

Materials Required

- Computers
- Internet facility
- LCD enabled room for presentations

Mode

Group Activity (four to five children in a group)

Time Required

- Two periods (once a week)
- Assembly

Methodology

1. Students will be divided into eight groups and given two topics:

A. The sources and need for safe drinking water

B. The process of purification before water reaches our home and some ways of purifying water at home.

2. Four groups will study topic A and the other four topic B.

3. Each group will document their findings in a power point presentation (Ten minutes long with a maximum of 15 slides)5.
4. The presentations will be made group wise in the class
5. The best presentation of each will be presented in the assembly

Evaluation

Students will be evaluated on their group presentations.

List of groups	Content	Power point presentation	Presentation in the class	Team work
Group 1				
Group 2				
Group 3				
Group 4				

Key Message

To enable young students to become aware of issues relating to their health and growth.

Suggested Activities

1. A holiday project in the form of a file presentation.
2. Surveys (in the school, neighbourhood).
3. Making of posters to spread awareness about the judicious use of drinking water.
4. Making placards (to spread awareness about the judicious use of drinking water) and placing them in significant places in the school.
5. Theatre - Street play or one-act play.

Independent Practice: From school to home

Water management

1. Find out how many neighbours in your neighbourhood treat water before drinking (boil/use aqua guard/use R.O. systems).
2. Collect pH paper from your teacher from school and find out the pH of water being used in your respective homes (acidity/alkalinity).

4. Technological Interventions

4.1. Vermi-composting: For Classes IX -XII

Background

Encouraging and spreading awareness among students about the concept of vermi-composting i.e., recycling wastes into valuable organic fertilizer.

Concept

Developing an organic waste management policy.

Objective

Children will learn nature's way of recycling, basic composting, vermi -composting and important principles of waste reduction.

Materials Required

Vegetable and fruit scraps, fallen leaves, tea leaves and tea bags, coffee grounds, vacuum cleaner dust, soft stems, dead flowers, used vegetable cooking oil, egg shells, old newspapers, lawn clippings, sawdust (not from treated timber e.g. treated pine), wood ash.

What NOT to add to a compost heap/bin

Meat and dairy products, diseased plants, metals, plastic, glass, fat, magazines, large branches, weeds that have seeds, bulbs or underground stems, bread or cake (may attract mice), bones animal manures, especially the droppings of cats and dogs. sawdust from treated timber e.g. treated pine.

Mode

Group Activity

Time Required

Two periods in a week

Methodology

1. Students will be divided into four groups, where different groups will study about the benefits of composting, troubleshooting, bin types and methods, biology of the compost pile, compost and plant health, vermi-composting

2. Students of Group 1 will investigate: What green waste is produced? How it is produced?, Where does it go after identifying suitable sites for environmental action? Students will find out about composting and worm farming processes and the management issues associated with them. They may refer to the Internet, encyclopaedias or other reference material for information.

3. Students of Group 2 will investigate on worm species suitable for green and organic waste management and dimensions of pits.

4. Students of Group 3 will research on the by-products of green and organic waste processing.

5. Students of Group 4 will investigate how the school can reduce its green and organic waste levels by setting up a composting programme and investigating the amount, types and sources of waste in the school.

6. Each of the groups will be observed at regular intervals by the teacher in charge to see the individual participation in each group as well as the group dynamics and team work. Each group will be assessed regularly for team work.

7. Each group will be asked to make a technology based presentation to be presented before the school community.

Observations

Students will learn about the following benefits of vermi-composting:

- can replace chemical fertilizers
- saves valuable landfill space
- compost can be used as fertilizers
- compost improves the condition of soil

Evaluation

Students will be evaluated on their group presentations.

List of groups	Content	Technology	Presentation	Team work
Group 1				
Group 2				
Group 3				
Group 4				

Key Message

To enable young students to investigate and broaden their understanding about green and organic matter available in the natural environment and the shared needs of living things. This will also make them aware of the need for sanitation in their immediate environment.

Suggested Activities

1. Practical activity on vermi-composting
2. Disseminating the idea of vermi-composting in rural and urban areas
3. Surveys
4. Making of posters for comparison of organic and green waste
5. Mulching
6. Auditing of school waste
7. Identifying organic and other waste in pictures

Independent Practice: From school to home

Solid waste management

1. Ask students to create three bins at home separately for biodegradable, non-biodegradable and toxic waste.
2. Label the bins.

5. Green Spaces Development

5.1. Eco Club/Nature Club/Green Spaces Club – Classes VI to IX

Aim

Associating students with green spaces.

Objectives

To help students understand the importance of green spaces in the overall improvement of the local environment and analyze the intricate relationship between ecological sanitation and the green space concept.

Materials required

i. Gardening implements

ii. Earthen and/or cemented pots

iii. Poly-pots, seeds, seedlings

Space required

i. At least 100 sq.mt of open space

ii. Available roof top

iii. Corridors, prayer rooms, playgrounds, campus periphery

Mode

i. Survey the of availability of green space in school/home/colony as an individual activity

ii. Development of school garden

iii. School nursery development and sale of plants

iv. Preparation and maintenance of ornamental potted plants for school

v. "Each one plant and maintain one" – collaboration with local civic authorities

vi. Resource mobilization from various Government/non-Government schemes

vii. Eco-tourism

Time required

i. Two hours every month

ii. 15 min every day for maintenance

Activity

Individual as well as group.

Methodology

Part A

i. The school will provide basic tools and implements.

ii. Identification of space/area for green space development activities within school campus.

iii. Allotment of park/green space area from civic administration.

Part B

i. Groups of 10 – 15 students to be made in each class from classes VI to IX.

ii. Each group to be allotted a nursery bed of 5 metres by 1 metre.

iii. All activities related with plant (fruit bearing/flowers/vegetables) preparation in poly-pots to be carried out by the group. Each group may be allotted a different plant species, and the plant seedlings can be procured from forest department/horticulture department/markets.

iv. Daily watering and fortnightly weeding and adding of manure.

v. Selling of the plants through different means and the earnings from sales to be given to the students.

vi. On a similar pattern, few groups can be allotted the job of preparing and taking care of pots with decorative plants in the school campus and corridors.

vii. Two or three groups could be assigned the activity of planting trees (for shade and flowers) along the school campus boundary, car-parking areas, etc. Regular maintenance of these trees to be carried out by the group members.

viii. Compost/vermin-compost generated in house, to be used for soil conditioning.

ix. Treated waste water to be channelized and used for school gardens.

Evaluation

Group activities will be monitored and evaluated by the teacher or the senior students of class IX. Monitoring can be carried out on a monthly basis.

Group No	Total student	No. of active students	Total plants planted planted	Survival %	Grade

Other suggested activities

i. Weekly oral presentations on the importance of plants having medicinal properties and use (one species per week)

ii. Guest lecture from experts from the forest department/horticulture/civil administration

iii. Touring to places of ecological importance

iv. Film shows

Essential activities for school administration

i. Collaboration with Forest department

ii. Resource mobilization and benefitting from various Government schemes

iii. Creation of a eco-brand/green brand of school

Essential activities for individuals

i. Listing the number and species of trees in their neighbourhoods

ii. Herbarium collection

iii. Listing all small and big parks of the city

iv. Photography of subjects related with green space

v. What not to do for green-space development

6. Monitoring and Evaluation

6.1. Regular Monitoring and Assessment: Wellness Club: For Classes VI- XII

Background

Encouraging students to analyze:

1. The need for a clean school environment and the need for periodic checks/reviews.
2. Student role and responsibility in regular monitoring, reporting and assessing.

Concept

Developing a clean school environment

Objective

Children will identify areas which they can take care of and help in sustaining a clean school environment by reporting and assessing areas of concern.

Materials Required

Chart sheets, A-4 sheets, crayons, colouring material.

Mode

Group Activity

Time Required

One period a day

Methodology

1. Children in groups (four groups of five children each) will move around the school to observe specific areas for cleanliness, conservation practices, operating and maintenance procedures and sustainability parameters.
2. They will form a check-list and put up a daily log of areas of concern.
3. This will have to be immediately reported to authorities.
4. The authorities will have to have a separate check-list and observation patterns so that no negligence talks place.

5. Members of each of the Wellness Clubs and members of other groups can be responsible for specific areas for on-line real time monitoring systems.

Evaluation

Students will be evaluated on their group presentations.

List of groups	Content (areas covered)	Following deadlines	Effectiveness of the team observations	Team Work	Presentation time
Group 1					
Group 2					
Group 3					
Group 4					

Key Message

To enable young students to analyze:

- The areas and people who make the school look neat and clean.
- Understand their responsibility in sustaining the operating and maintenance system of the school.
- To establish on-line real time monitoring systems.
- To assess the impact of their assessment systems and follow-up process.

Suggested Activities

1. Following the TQC (Total Quality Control) story to monitor and evaluate environmental hygiene, personal hygiene.
2. Prepare rubrics/checklists for different groups.
3. Periodical assessments and graphical presentations on the winners and their achievements.

Independent Practice: From school to home

Monitoring and Evaluation

Carefully observe the above in your home/school and ask the senior members of your house to give you guidelines for:

1. Setting up cleanliness-drive programmes in your locality.
2. Monitor and evaluate the cleanliness-drive process and help the local authorities to learn about the impact and role of proper sewage/drainage systems.
3. Setting up of blue and green dustbins in your locality. Monitoring and evaluating whether citizens are able to help local authorities in their drive for a clean and green city.

Health and Wellness Clubs will be required to do the following :

1. Make a water audit team (How to do a water audit)
2. Other tasks which have been identified earlier in the "Water" topic/section.

Water Audit

1. Check the water meter and its average consumption per month.
2. Check if school is paying the water bill regularly and identify the "high useage months" (these are likely to be the summer months but still, please check).
3. What are the sources of water that the school has?
4. Test the water quality.
5. Check the capacity of cisterns, if any in the bathroom
6. What are the facilities in the girls' bathroom?
7. What kind of urinal system is in the bathrooms?
8. If there is a water pump, find out the total water drawn by it.
9. Then calculate per capita water consumption.
10. Calculate the total water usage in the bathroom.
11. A similar exercise can be done for the hostels.

Section 3 – Annexures

1. Urban Sanitation – The Challenge and the Solutions

The challenges of urban sanitation as outlined in the report 'The Challenges of Urban Sanitation as recognized by the Government of India', fall in the following four categories:

- Low infrastructure coverage;
- Limited access to services;
- Low service usage; and
- Weak institutional arrangements.

The details from the Report are reproduced below

Low Infrastructure Coverage

In India it is estimated that 17 percent of the urban population currently has no access to any sanitary facilities at all, while 50-80 percent of waste water is disposed of without any treatment (National Urban Sanitation Policy, 2008).

It may take several decades for sewerage and other sanitation services to become available to all of urban India. In the meantime, the great majority of urban residents will remain dependent on on-site sanitation facilities such as pour flush toilets discharging to leach pits or septic tanks. Municipal sanitation plans should therefore include measures to improve on-site sanitation, otherwise they will meet the needs of just a small portion of the city.

Municipal planners should also recognize that the worst sanitary conditions tend to be found in poor areas. Construction of a toilet is generally regarded as the householder's responsibility but, for poor households, investments in sanitation are often constrained by issues relating to:

- Affordability, including the cost of connection to sewer networks;
- Uncertainty over land tenure (fear of eviction);
- Space constraints; and
- The low priority given to sanitation (people may not appreciate its importance)

Limited Access to Services

Official coverage figures do not, on their own, give the full picture regarding access to sanitation services. Existing arrangements can in fact be deficient in a number of ways:

- There may be a complete lack of facilities. For example, there may be settlements with no toilets at all, while facilities for the safe emptying of septic tanks, and the treatment of seepage, may be lacking across the entire town.
- Sanitation facilities may be available but could be inconvenient, unpleasant, or unhygienic. This may be the result of inappropriate design or construction, or inadequate management arrangements. Poor management is often a problem with community toilet blocks.
- Sanitation facilities may be available, but some people have limited access to them. For example, people may not be able to afford to connect to an existing public sewer.
- Sanitation facilities may be in place but are not operated or maintained properly. Poor operation and maintenance of a facility shortens its useful life and could, at worst, result in rapid total failure.
- There may be no provision for the treatment of wastewater or excreta. Local drains and sewers may simply relocate waste to another part of town where it causes local pollution. Households are primarily concerned about the cleanliness of their immediate surroundings and much less worried about the wider impact on the environment.

Low Service Usage

Even where toilets are available, some are not used or are under used, with family members defecating outside most of the time. This might be because the facilities are unacceptable in some way (for example, poor people may not be willing to share toilets), or because there is a long-held preference for open defecation. Alternately, people may under use their toilets because of misunderstandings about their functioning and maintenance. In the case of twin-pit pour flush toilet, for example, some people fear that the pits will fill rapidly if the toilet is used too often; and they may not know that the contents of a full pit can safely be removed manually once they have been given time to degrade.

Such problems indicate the need for effective communication in sanitation programmes, so that community awareness, preferences and behaviour are properly understood and then addressed through information, advice, and hygiene promotion.

Weak Institutional Arrangements

State agencies and municipalities sometimes make very large investments in sanitation infrastructure, but these do not always deliver their intended benefits. There can be several reasons for this, for example:

- The investments are made on an ad hoc basis when funds become available, without reference to an over-arching strategy or plan.
- Within the state government and municipalities, sanitation has no 'institutional home', meaning that no single department or agency is accountable for it. Responsibilities for different aspects of sanitation are often assigned to a number of agencies, and coordination between them is not always good. There have been cases, for example, where a state agency has developed a sewage treatment plant even when there are no sewers in the town, then handed it over to a municipality that does not have the technical capacity or financial resources to operate and maintain it.
- Large capital investments are rarely matched with detailed arrangements - both practical and financial - for future operation and maintenance.
- Improvements are often implemented on a norms basis, meaning that technologies are selected without reference to local conditions or to the preferences of users. Therefore, the new facilities may not function properly, or may not be used as intended.
- Especially in smaller towns, municipal and line agency staff tend to have limited technical expertise or awareness of the range of non-technical factors that affect the outcome of sanitation investments.
- Sustainability.

Some of the technological interventions are described in the following pages to assist the school to undertake and implement. These technological interventions are simple, and can help the schools in achieving the objectives of this initiative successfully.

2. 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's 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 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 without 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 Board's 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.

3. Technological Options

3.1. 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 men's 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 doesn't 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 1.5 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 the 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 system's 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. 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 by the. 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.

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

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 X 10000 = 4000000 i.e. 40 lakh litre per day
- Assuming schools year of 250 days, the total water saved in the schools 4000000 x 250 = 1000000000 litres i.e. 100 crore litres of water i.e. one billion litres per year!!

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 there is no requirement or wastage of water.

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

(# Leadership in energy Environmental Design)

3.2. 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 waste water. 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	Challenges
Health	- no fly or insect breeding - immediate isolation of wastewater from humans	- requires service provision for sludge removal & treatment by community/ municipality - tank location must be chosen to ensure access by truck
Environment	- high retention time, good pre-treatment - no surface or groundwater pollution (if constructed water-tight and with appropriate subsequent treatment) - no smell - possible nutrient recovery with appropriate subsequent system	- requires service provision for sludge removal and treatment (see above)
Economic		- high long-term maintenance costs (gully sucker)
Social	- water sealed, well-known toilet system - widely used pre-treatment of domestic wastewater	- users must refrain from using chemical cleaners
Technical	- can be constructed from local materials - pre-fabricated models are available - low everyday maintenance requirements	- in areas of high ground water table or rocky underground, toilet must be elevated to maintain the pipe slope towards the septic tank - installation of concrete tanks

Essential Design Information

Structural

A septic tanks 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 (m^2) = working capacity of tank (m^3) / 3.
- The working capacity of a single tank shall always be greater than $1m^3$ and less than 12 m^3.
- Where the required working capacity exceeds 12 m^3, parallel sets of tanks shall be used such that the working capacity of each is less than 12 m^3.
- 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 the 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 be vented separately.

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 have been satisfied prior to commissioning the system. Pre-commissioning tests to ensure water-tightness 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 in 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

rodding 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:

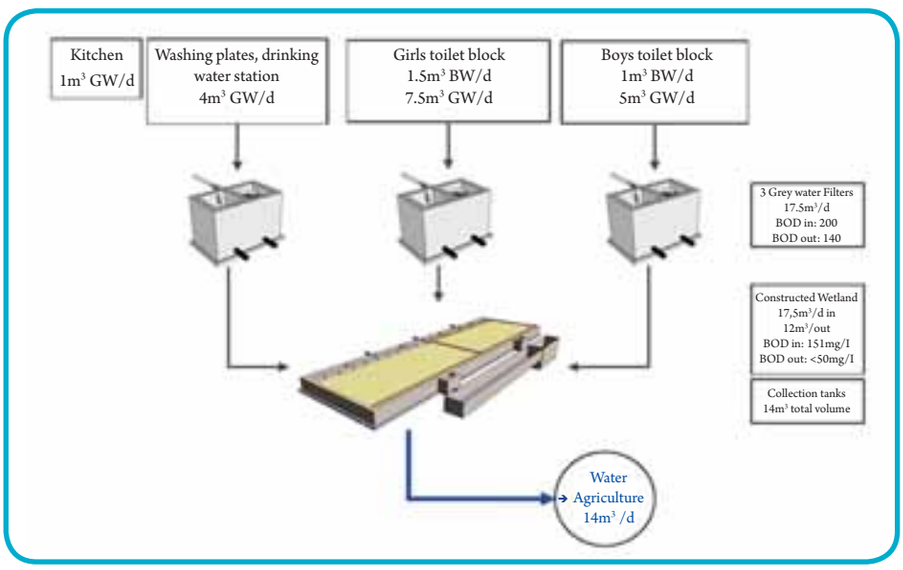
- No space for on-site septic tank installation
- Great water scarcity (lack of flush water)
- Rocky underground (difficult installation)
- High groundwater table, appropriate secondary treatment cannot be provided
- Site is not accessible by gully sucker
- Gully suckers and sludge treatment facility 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", ARTI bio-gas digesters are an effective option for both bio-gas generation and also composting. The ARTI system has been awarded the prestigious "Ashden" award.

Grey Water Generation and Treatment at each Source



3.3. Anaerobic Sanitary Systems – Bio-gas System

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 wetlands 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. Floating 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 underground. 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.

Advantages and Challenges

	Advantages	Challenges
Health	- no fly or insect breeding - hand washing facilities could be installed in the same toilet room, to use water for toilet flushing	- requires post-treatment of effluent if no agricultural, gardening or landscaping use is considered
Environment	- high retention time (treatment) of the waste water - no smell - treatment of all domestic waste water, including solid organic waste; no stagnant waste water in the community - no surface or groundwater pollution - no greenhouse gas emissions produced from organic waste and waste water when treated - in sanitary bio-gas systems and bio-gas is used	- requires post-treatment of effluent if no agricultural, gardening or landscaping use is considered - Clean Development Mechanism strategies could be added as financing source for dissemination programmes with cluster implementation (www.unfccc.org)
Economic	- comparatively low investment cost, due to material savings of multi-household treatment - recovering costs by water saving and fertilizer use	- investment costs in land - covering operation and maintenance costs
Social	- recovering costs by bio-gas energy use - all kinds of toilets could be connected - understanding of link between sanitation and community development	- users/cleaning personnel must be taught to refrain from applying bio-toxic chemical cleaners
Technical	- can be constructed from local materials - qualified work for responsible and dedicated masons and plumbers	- space requirements for facility, decision over land use - bio-gas facility requires training of construction and plumbing workers

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 (1m^3 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.

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 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.

3.4. 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. Floating of the facility during construction must be prevented in areas of high groundwater. The system is not suitable in extremely water scare areas without secured water supply (lack of flush water) or rocky underground.
- 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.

3.5. 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.

Advantages and Challenges

	Advantages	Challenges
Health	- Sub-surface flow prevents fly and insect breeding	
Environment	- high retention time (treatment) of the wastewater - no smell - treatment of all domestic waste water, therefore no stagnant waste water in the community - no surface or groundwater pollution	
Economic	- recovering of costs by water saving	- investment costs in land - covering operation and maintenance costs
Social	- water sealed toilet system - understanding of link between sanitation and community development - can be constructed from local materials	- users/cleaning personnel must be taught to refrain from applying chemical cleaners
Technical	- can be constructed above ground - no movable parts - no permanent operational control - no maintenance, if well designed and constructed	- space requirements for facility, decision over land use

Essential Design Information

The distribution chamber must be wide enough to ensure homogeneous flow across the full width of the filter. Trenches filled with rocks of 50 to 100 mm diameter are provided at both ends of the filter to ensure equally distributed supply of water at the inlet and equally distributed reception at the outlet side. A perforated pipe that is connected to the outlet pipe lies below the strip of rocks for effluent collection.

The filter must have water-tight sides and a waste-tight base. The bed should be large and shallow (30 to 60 cm), filled with preferably uniform, round gravel. Fine soil should be removed from the gravel filter material by washing before installation. The size of the gravel depends on the quality of the waste water. While large grain size with a high percentage of voids prevents clogging, it also reduces treatment performance. Round, uniform gravel of 6 - 12 mm or 8 - 16 mm is recommended. If only mixed grain sizes are available, it might be advisable to screen the gravel with the help of a coarse sieve to use the larger grains in the front and the smaller grains to the rear of the filter, as additional precaution against clogging. Care is to be taken when changing from a larger grain size to the smaller, because blockage happens predominantly at the point of change. A rather flat slope (< 45°) should join sections of one-grain size to another in order to obtain a larger connecting area. If grain diameters differ considerably, an intermediate zone consisting of intermediate size should be considered.

Hydro-botanical plants, with deep reaching and widely spreading roots, are planted on top of the gravel bed. Although the principle of the system appears quite simple, the processes involved are a complex combination of aerobic, anoxic and anaerobic bio-chemical reactions, combined with nutrient adsorption and evapo-transpiration processes of the plants on the filter.

The horizontal filter functions continuously with a permanent water level in the filter. The implementing agency should complete the design, supervise the construction until completion and guarantee the proper functioning of the system for a time period of one year.

Operation and Maintenance

Maintenance must be carried out by trained personnel, who should be trained during the construction process. Since clogging is the biggest problem of constructed wetlands, one of the most important maintenance steps is to guarantee the proper operation of prior treatment steps to effectively remove suspended solids. Verification of adequate inflow quality can be tested with an Imhoff cone; after 60 minutes the sediment should not be more than 1 ml/l.

Toilet users must be advised not to apply chemical disinfectants for toilet bowl cleaning.

Weekly inspection of inflow and outflow structures ensures even distribution across the filter.

Flow should be regulated so that the water level in the filter remains below the filter surface.

clogged gravel filter, indicated by surface flow, can become useful again after a resting periods of several months, due to bacteria being left without feed.

Fallen leaves should be removed from the filter to prevent sealing of the filter surface. Plants are normally not harvested.

3.6. Rainwater Harvesting

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.

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 practised 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 perfected 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 community's

dependence on groundwater for domestic uses. 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 city's requirement, it 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 showering or bathing. It may require treatment prior to use for drinking.

In New Zealand many houses away from the larger towns and cities routinely rely on 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 metres.
2. G**utters and down-take pipes:** lead the water from the catchment surface to the storage tank
3. **Filters and first flush devices:** remove 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 counterparts

It is advisable to use IS 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 on 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.

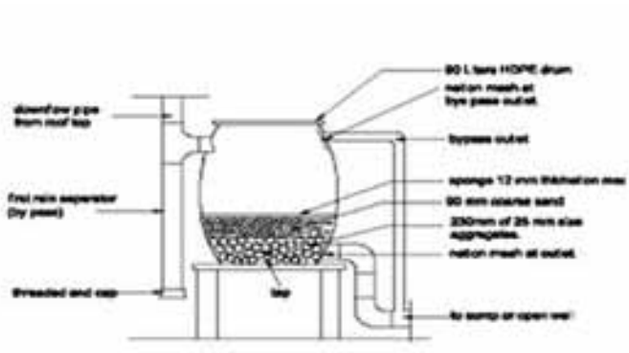
Maintenance: The top layer of sand (or sponge if used) needs to be cleaned periodically to a depth of about 3 centimeters. The sand or sponge can be removed and soaked /cleaned in a bucket of water and replaced. There could be fungal growth on the sponge if prescribed maintenance is not followed. If 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 metre 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)

Figure 1: Slow Sand Filter



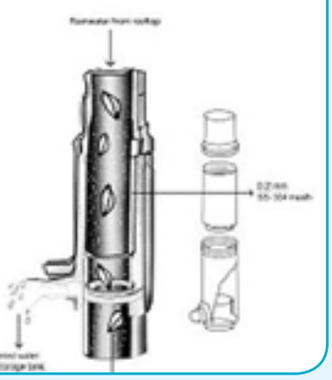
- Mesh filters: These filters use a fine mesh to filter out suspended particles. They are usually wall mounted and take much less space than the sand filters. Each filter is also able to service a larger rooftop area than the sand filter. Product designs are varied and maintenance depends on the design. 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 apart from 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 metre of catchment area, 0.5 litres of water is flushed out. This is equivalent to the first ten minutes of average intensity rainfall.

Figure: Mesh filter



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.

#High-density Poly Ethylene

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 metres 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.

Source: *Rainwater Harvesting - Trainers' Manual published by Karnataka Urban Infrastructure Development and Finance Corporation, Bangalore*

3.7. Composting Technologies

Composting, as defined for the purposes of this study, is the actively managed process of decomposition of organic residuals in the municipal solid waste stream. A range of composting systems is designed to manage this decomposition process to yield a high quality compost product without creating a public nuisance or a negative environmental impact. The process of complex organic matter breaking down into its simpler elements is called decomposition; which results in a dark, earthy, sweet smelling, and nutrient rich humus called compost. The rich substance can be made from our kitchen and garden waste that we normally throw away as garbage into roadside dust bins where it accumulates and causes an unhygienic stinking mess. Composting takes time - anywhere between three-six months.

Composting is a biological process that is optimized when the starting carbon to nitrogen ratio is in the range of 30:1 and the moisture and oxygen levels and temperatures are closely managed and monitored. When processing household organics, it is of critical importance to have the right starting mix of feed-stocks, and to manage moisture, oxygen and temperatures closely in order to minimize the risk of nuisance factors and environmental impacts.

Advantages of Composting

- Compost increases organic matter in soils
- Compost builds sound root structure
- Compost makes clay soils airy so they drain
- Compost gives sandy soils body to hold moisture
- Compost attracts and feeds earthworms
- Compost balances pH (acidity/alkalinity) of soil
- Compost reduces water demands of plants and trees
- Compost helps control soil erosion
- Compost reduces plant stress from drought and freezes
- Compost can extend the growing season
- Compost improves vitamin and mineral content in food grown in compost-rich soils
- Compost generously applied replaces reliance upon petrochemical fertilizers

We should keep in mind the following basic facts while managing the piles:

Air: Composting microbes are aerobic - they can't do their work well unless they are provided with air. Without air, anaerobic (non-air needing) microbes take over the pile. They do cause slow decomposition, but the pile tends to smell like putrefying garbage! For this reason, it's important to regularly stir your pile.

Water: Ideally, your pile should be as moist as a wrung-out sponge to fit the needs of compost microbes. This means that there is a thin film of water coating every particle in the pile, making it very easy for microbes to disperse themselves. If your pile is drier than this, it won't be a very good microbial habitat and composting will be significantly slower. If your pile is wetter than required, the sodden ingredients will be so heavy that they will tend to mat down and exclude air from the pile, again slowing down the composting process.

Food: In broad terms, there are two major kinds of food that composting microbes need:

1. 'Browns' are dry and dead plant materials such as straw, dry brown weeds, leaves and twigs. These materials are primarily composed of chemicals that are long chains of sugar molecules linked together. Browns are a source of carbon and energy for compost microbes.
2. 'Greens' are fresh plant materials such as green leaves and garden clippings, kitchen, fruit and vegetable scraps, coffee grounds, tea bags, etc. Compared to browns, greens contain more nitrogen which is a critical element in amino acids and proteins. So greens can be thought of as a protein source for the billions of multiplying microbes.

Here are a few composting methodologies that are being used to manage the source separated organic fraction of the solid waste stream. Historically, windrow composting and static pile composting have been viewed as the most simplistic and least costly approaches to processing municipal organics.

Simple Problems and the Solutions

Not Adding Equal Amounts of Dried Leaves/Sawdust/or Paper.

This makes the pile too wet and smelly and attracts a lot of flies. You need the carbon of the leaves etc. to offset the nitrogen rich kitchen waste. You have to put the same volume of leaves every day as that of your kitchen waste.

Leaving the pile to become compacted, wet and slimy and therefore smelly.

Alternating kitchen waste with dried leaves etc. is one way of avoiding compaction of the pile, and also stirring the pile once in four days helps.

Not Adding Enough Red Chilli Powder so the Pile gets too many Maggots and the User Feels Repulsed.

No customer can factor in the maggots, the soldier fly maggots can be quite prolific and the best thing to do is to add three tablespoons of red chilli powder in all containers every week.

Not covering the pile with adequate leaves/paper/sawdust so too many fruit flies - which also find their way into the kitchen and dining area.

Customers underestimate the term "cover". By cover we mean fully cover the surface of the waste so that the flies have no place to settle on.

Not Adding Enough Dried leaves in the Bottom Container to Absorb the Leachate (Liquid Released during Composting).

Because the last container is not seen, most customers do not look at it and sometimes the leachate is a lot and the bed of leaves at the bottom is inadequate to absorb it. Once in two weeks it's wise to inspect all three containers in case you are using the three tiered products.

Not Mixing Half done Compost with Fresh Kitchen Waste.

Most customers don't think that this will help reduce problems of smell and flies. We find this is a simple and sure way of reducing the problems. Mixing different vintages of composting matter helps accelerate the decomposition time of all the piles.

Windrows

General Description: Outdoor composting in piles that rely on mechanical aeration, typically with a compost windrow turner, to optimize the composting process. Windrow facilities with straddle turners (a turner which goes over the top of the pile) are limited in pile height by the height of the turner. Other turner technologies, e.g., elevating face, perform the turning function from the side and therefore pile height is less of a constraint. Generally speaking, to optimize the windrow composting process, pile height typically is limited to three to four metres.

Organics to be composted are either premixed prior to being formed into a windrow, or are layered (e.g., typically on a bed of ground yard trimmings, wood chips or sawdust) and then mixed with the turner. To control the release of odours when the food scraps in the organics are "fresh," some windrow facility managers create the windrows and then wait for a few days or a week before the first pile turning. In some cases, the windrows are covered with a layer of ground yard trimmings, which acts as a bio-filter during this initial stage.

Kambha

The Kambha manages medium volumes of kitchen and garden waste and fits into small spaces conveniently. The three tiered kambha comes in two sizes and requires shifting of contents between the three modular units. All the terra-cotta composters are outdoor products.

Every day one needs to dump the daily kitchen waste and also add an equal quantity of dried leaves or saw dust or shredded newspaper. This is important to avoid smell and flies.

Drum Composter

A combination of vegetable waste, food waste and garden litter is utilized for high rate composting in a rotary drum composter. It was found that the temperature remained above 55°C. The following steps describe how a simple drum composter can be designed in-house by the schools.

1. **Buy a plastic drum,** between 75-200 litres, and a 48 inch (1.25 meter) length of 2 inch (5 cm) schedule 80 PVC pipe, or a 48 inch length of 1.5 to 2 to 2 inch (3.8-5 cm) galvanized steel pipe.
2. **Drill holes in the center** at the top and bottom of your drum, large enough for the pipe you are going to use for an axle.
3. **Pass the pipe or post through the center holes.**
4. **Build a wooden saw buck to support the compost barrel.** Nail two sets of 2x4s (pieces of wood that are 1.5″ × 3.5″ or 38×89 mm in terms of height and width, respectively) in an x-frame, and nail two 2x4s across the feet at the bottom for support.
5. **Set the barrel with the pipe** in the wooden 2x4 saw buck.
6. **Drill holes in the body of the barrel** with a 1-inch (2.5 cm) drill for aeration.
7. **Rotate the barrel** in the sawhorse frame using the pipe or post as an axle.
8. **Cut a 10" square opening in the side** of the barrel/drum.

   Cut a hole in the side and add simple hinges and a hasp to create a door with the piece you cut from the side of your drum. Or, you can simply use scrap wire to create three hinges, and use the same material and an old cabinet knob to effect a way to close the hatch.
9. **Create a mixing fin inside the barrel to help turn** the compost when the drum is rotated. A long spare piece of galvanized sheet metal bent into an L shape and bolted to the interior wall of the barrel will do this nicely. (Put the fin opposite from the hatch, so as to weight balance the empty container.)

10. **Fill your drum composter with leaves** or other compostable material, and allow your new "garden helper" to do its job. You will want to rotate the drum a few times every day or so, depending on the outdoor temperature. (See tips below for ideas on how to add a handle.)
11. **Check the contents occasionally,** and when they are broken down by the bacteria in the drum, remove them to use for soil amending, mulch, and other purposes around your lawn and garden.

Source: *http://www.wikihow.com/Build-a-Tumbling-Composter*

3.8 Vermi-composting

Vermi-composting is a simple biotechnological process of composting, in which certain species of earthworms are used to enhance the process of waste conversion and produce a better end-product. Vermi-composting differs from composting in several ways. It is a mesophilic process, utilizing microorganisms and earthworms that are active at 10–32°C (not ambient temperature but temperature within the pile of moist organic material). The process is faster than composting; because the material passes through the earthworm gut, a significant but not yet fully understood transformation takes place, whereby the resulting earthworm castings (worm manure) are rich in microbial activity and plant growth regulators, and fortified with pest repellence attributes as well! In short, earthworms, through a type of biological alchemy, are capable of transforming garbage into 'gold'.

Earthworms consume various organic waste and reduce the volume by 40–60 percent. Each earthworm weighs about 0.5 to 0.6 g, eats waste equivalent to its body weight and produces cast equivalent to about 50 percent of the waste it consumes in a day. These worm castings have been analyzed for chemical and biological properties. The moisture content of castings ranges between 32 and 66 percent and the pH is around 7.0. The worm castings contain a higher percentage (nearly twofold) of both macro and micronutrients than regular compost.

Types of Earthworms

Earthworms are invertebrates. There are nearly 3600 types of earthworms in the world and they are mainly divided into two types: (1) burrowing; and (2) non-burrowing. The burrowing types Pertima elongata and Pertima asiatica live deep in the soil. On the other hand, the non-burrowing types Eisenia fetida and Eudrilus eugenae live in the upper layer of the soil surface. The burrowing types are pale, 20 to 30 cm long and live for 15 years. The non-burrowing types are red or purple and 10 to 15 cm long but their life span is only 28 months.

The non-burrowing earthworms eat 10percent soil and 90percent organic waste materials; these convert the organic waste into vermi-compost faster than the burrowing earthworms. They can tolerate temperatures ranging from 0 to 40°C but the regeneration capacity is more at 25 to 30°C and 40–45percent moisture level in the pile. The burrowing types of earthworms come onto the soil surface only at night. These make holes in the soil up to a depth of 3.5 m and produce 5.6 kg casts by ingesting 90 percent soil and 10percent organic waste.

Methods of Vermi-composting

Pits below the ground: Pits made for vermi-composting are 1 m deep and 1.5 m wide. The length varies as required.

Heaping above the ground: The waste material is spread on a polythene sheet placed on the ground and then covered with cattle dung. Considering the biodegradation of wastes as the criterion, the heap method of preparing

vermi-compost was better than the pit method. Earthworm population was high in the heap method, with a 21-fold increase in Eudrilus eugenae as compared to 17-fold increase in the pit method. Biomass production was also higher in the heap method (46-fold increase) than in the pit method (31-fold).

Tanks above the ground: Tanks made up of different materials such as normal bricks, hollow bricks, shabaz stones, asbestos sheets and locally available rocks were evaluated for vermi-compost preparation. Tanks can be constructed with the dimensions suitable for operations. The commercial bio-digester contains a partition wall with small holes to facilitate easy movement of earthworms from one tank to the other.

Cement rings: Vermi-compost can also be prepared above the ground by using cement rings. The size of the cement ring should be 90 cm in diameter and 30 cm in height.

Materials Required for Vermi-composting

A range of agricultural residues, all dry waste, for example, sorghum straw and rice straw (after feeding cattle), dry leaves of crops and trees, pigeonpea (Cajanus cajan) stalks, groundnut (Arachis hypogaea) husk, soybean residues, vegetable wastes, weed (Parthenium) plants before flowering, fiber from coconut (Cocos nucifera) trees and sugarcane (Saccharum officinarum) trash can be converted into vermi-compost. In addition, animal manures, dairy and poultry wastes, food industry wastes, municipal solid wastes, bio-gas sludge and bagasse from sugarcane factories also serve as good raw materials for vermi-composting.

The quantity of raw materials required using a cement ring of 90 cm in diameter and 30 cm in height or a pit or tank measuring 1.5 m × 1 m × 1 m is given below:

- Dry organic wastes (DOW) 50 kg
- Dung slurry (DS) 15 kg
- Rock phosphate (RP) 2 kg
- Earthworms (EW) 500–700
- Water (W) 5 litres every three days

Making Vermi-compost

The following 13 steps describe the process of making vermi-compost at all scales. Please note that the same procedure can be followed using any container or place.

Step 1: Cover the bottom of the cement ring with a polythene sheet. (Or use the sheet to cover the ground of the area you're using).

Step 2: Spread a layer (15-20 cms) of organic waste on top of the sheet.

Step 3: Sprinkle rock phosphate on top of the organic material (2kgs).

Step 4: Prepare cowdung slurry (15kgs) and add the slurry as a layer on top of the mixture.

Step 5: Fill the ring completely and evenly with the layered material.

Step 6: Paste cowdung or soil over the top of the material.

Step 7: Allow the material to decompose for 20 days.

After 20 days, put the earthworms on top. They will find the cracks and enter the material.

Step 8: Cover the ring with wire mesh or gunny bags to prevent birds from eating the worms.

Step 9: Sprinkle water over the whole mixture at three-day intervals for two months, to maintain adequate moisture and body temperature of the worms. Note: when the compost is ready, it is black, quite lightweight and has a pleasant, earthy smell.

Step 10: After two months, (or when the compost is ready), remove the ring and heap the material in a cone shape on the floor. Leave the heap undisturbed for two to three hours, to let the worms move slowly to the bottom.

Step 11: Separate the upper portion of the heap.

Step 12: Sieve the lower portion of the heap to separate the worms. They can be used again for preparation of more vermicompost.

Step 13: Pack the compost in bags and store them in a cool place.

Application of Vermi-compost

Vermi-compost can be used for all crops (agricultural, horticultural, ornamental and vegetable) at any stage of the crop development. For agricultural crops, it can be applied by broadcasting when the seedlings are 12-15 cm in height. The fields should be irrigated. For flowers, vegetables and fruit trees, apply vermi-compost around the base of the plant, at any stage of development, and cover with soil and water the plants regularly.

Conclusion

The production of degradable organic waste and its safe disposal is a current global problem. Meanwhile the rejuvenation of degraded soils by protecting the topsoil and sustainability of productive soils is a major concern at the international level. The provision of a sustainable environment in the soil by amending it with good quality organic soil additives enhances the water holding capacity and nutrient supplying capacity of the soil and also the development of resistance in plants to pests and diseases. By reducing the time of the humification and by evolving methods to minimize the loss of nutrients during the course of decomposition, the fantasy becomes fact. Earthworms can serve as tools to facilitate these functions. They serve as “nature’s plowman” and form nature’s gift to produce good humus, which is the most precious material to fulfill the nutritional needs of crops. The utilization of vermi-compost results in several benefits to the environment and the overall economy.

4. Vision and Key Policy Issues of National Urban Sanitation Policy

Vision

The vision for urban sanitation in India is: All Indian cities and towns become totally sanitized, healthy and liveable 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.

Key Sanitation Policy Issues

In order to achieve the above vision, the following key policy issues must be addressed:

- **Poor Awareness:** Sanitation has been accorded low priority and there is poor awareness about its inherent linkages with public health.
- **Social and Occupational Aspects of Sanitation:** Despite the appropriate legal framework, progress towards the elimination of manual scavenging has shown limited success, little or no attention has been paid to the occupational hazards faced by sanitation workers daily.
- **Fragmented Institutional Roles and Responsibilities:** There are considerable gaps and overlaps in institutional roles and responsibilities at the national, state, and city levels.
- **Lack of an Integrated City-wide Approach:** Sanitation investments are currently planned in a piece-meal manner and do not take into account the full cycle of safe confinement, treatment and safe disposal.
- **Limited Technology Choices:** Technologies have been focussed on limited options that have not been cost-effective, and sustainability of investments has been in question.
- **Reaching the Un-served and Poor:** Urban poor communities as well as other residents of informal settlements have been constrained by lack of tenure, space or economic constraints, in obtaining affordable access to safe sanitation. In this context, the issues of whether services to the poor should be individualised and whether community services should be provided in non-notified slums should be addressed. However provision of individual toilets should be prioritised. In relation to "Pay and Use" toilets, the issue of subsidies inadvertently reaching the non-poor should be addressed by identifying different categories of urban poor.

- **Lack of Demand Responsiveness:** Sanitation has been provided by public agencies in a supply-driven manner, with little regard for the demands and preferences of households as customers of sanitation services.

Policy Goals

The overall goal of this policy is to transform urban India into community driven, totally sanitized, healthy and liveable cities and towns.

The Specific Goals are:

1. Awareness Generation and Behaviour Change

(a) Generating awareness about sanitation and its linkages with public and environmental health amongst communities and institutions.

(b) Promoting mechanisms to bring about and sustain behavioural changes aimed at adoption of healthy sanitation practices.

2. Open Defecation Free Cities

All urban dwellers will have access to and use of safe and hygienic sanitation facilities and arrangements so that no one defecates in the open. In order to achieve this goal, the following activities shall be undertaken:

(a) Providing households with access to safe sanitation facilities (including proper disposal arrangements).

(b) Promoting community-planned and managed toilets wherever necessary, for groups of households who have constraints of space, tenure or economic constraints in gaining access to individual facilities.

(c) Adequate availability and complete upkeep and management of public sanitation facilities in all urban areas, to rid them of open defecation and environmental hazards.

3. Integrated City wide Sanitation

(a) Mainstream thinking, planning and implementing measures related to sanitation in all sectors and departmental domains as a cross-cutting issue, especially in all urban management endeavours.

(b) Strengthening national, state, city and local institutions (public, private and community) to accord priority to sanitation provision, including planning, implementation and operation and maintenance management.

(c) Extending access to proper sanitation facilities for poor communities and other un-served settlements.

(d) Sanitary and safe disposal of waste.

Hundred percent of human excreta and liquid wastes from all sanitation facilities including toilets must be disposed of safely. In order to achieve this goal, the following activities shall be undertaken:

(a) Promoting proper functioning of network-based sewerage systems and ensuring households are connected to these systems wherever possible.

(b) Promoting recycle and reuse of treated waste water for non potable applications wherever possible will be encouraged.

(c) Promoting proper disposal and treatment of sludge from on-site installations (septic tanks, pit latrines, etc.).

(d) Ensuring that all the human waste is collected safely, confined and disposed of after treatment so as not to cause any hazard to public health or the environment.

(e) Proper operation and maintenance of all sanitary installations:

- Promoting proper usage, regular upkeep and maintenance of household, community and public sanitation facilities.
- Strengthening ULBs to provide sustainable sanitation service delivery.

Implementation of Support Strategy

The Government of India recognizes that sanitation is a State subject and on-ground implementation and support of public health and environmental outcomes requires strong city level institutions and stakeholders. Although there are some common elements across urban areas of India, there are a number of factors, constraints and opportunities that are peculiar to specific situation of states and cities with respect to sanitation, climate, physiographic factors, economic, social and political parameters, and institutional variables, etc. Therefore each state and city needs to formulate its own sanitation strategy, and their respective city sanitation plans in overall conformity to the National Policy.

5. Government Schemes for Green Space Development

5.1 National Green Corps Programme

1. Overview

Introduction

We all know that we are part of the environment we live in and the solution to many environmental problems lie in our attitude towards environment. Be it awareness to keep our surroundings clean or the realisation to conserve natural resources by re-using and recycling wherever possible, they all are attitudinal. On the surface it looks simple. But changing the attitudes of 100 crore people is not going to happen overnight. The best way to attempt to bring about a change in the attitudes in the society is through children. They have no vested interests. They are impressionable. They are our future. They are the single most important influence in any family. With this realisation the Ministry of Environment & Forests, Government of India has decided to launch the National Green Corps Programme (NGC) in all Districts of our vast country.

Objectives

- To make children understand environment and environmental problems.
- To provide environmental education opportunities for school children.
- To utilise the unique position of school children as conduits for awareness of the society at large.
- To facilitate children's participation in decision making in areas related to environment & development.
- To bring children into direct contact with the environmental problems facing the society they live in and make them think of solutions.
- To involve children in action based programmes related to environment in their surroundings.

Coverage

The NGC programme will be implemented in all the States and Union Territories in the country.

Membership

- About 100 schools in every district in the country.
- This will include all the Kendriya Vidyalayas, Navodaya Vidyalayas and all other schools under CBSE and ICSE.

Methodology

- The scheme will be operated through Eco-clubs to be formed in member schools.
- Each such club will have 30-50 children, who show interest in environment related issues.
- Each Eco-club will be supervised by a Teacher In-charge, who is selected from among the teachers of the member school on the basis of his/her interest in environment related issues.
- Each Eco-club will be provided with a kit of resource material in the language of their preference apart from a token monetary grant of Rs. 1000/- per annum for organising different activities (Please see the suggested list of activities)
- There will be District Implementation and Monitoring Committee to supervise, organise training for In-charge teachers, and monitor periodically the implementation of scheme at the District level.
- There will be a State Steering Committee to oversee the implementation of the scheme.
- The State Nodal Agency will coordinate the implementation of the scheme in the State and organize related activities like training to Master Trainers.
- The National Steering Committee will give overall direction to the programme and ensure linkages at all levels.

Selection of Participants

Criterion for Selection of Schools

All Kendriya Vidyalayas, Navodaya Vidyalayas and all other schools under CBSE and ICSE. About 100 schools in each district under the respective State/UT boards. The schools must be preferably of secondary and senior secondary level. In the districts, where it is difficult to find 100 secondary and senior secondary level schools, upper primary schools can be selected. Those schools who have prior experience in running Eco-clubs or other environmental related programmes would be given preference.

Selection of Master Trainers

From each district, the District Implementation and Monitoring Committee would select one or two Master Trainers. They can be from among the In-charge teachers of selected schools. They would be first trained at the State Capital. They in turn would train In-charge teachers in the District.

Finance

Financial Implications

(a) Financial Assistance

i. Each school with an Eco-club would be given an annual financial assistance of Rs. 1000k. The student members of the Eco-club and In-charge teacher would decide on using the sum for their activities in consultation with the Principal/Head Master.

ii. The State Nodal Agency would be given 5% of total annual expenditure on the scheme in that State towards administrative expenses. The money could be used towards stationary, postage and other expenses.

iii. For selection, printing and distribution of locally relevant resource material, the Nodal Agency would be given a financial assistance at the rate of Rs. 50 per Eco-club.

iv. For organising the training of Master Trainers, the Nodal Agency would be given a financial assistance at the rate of Rs. 990/- per master-trainer. (It would be calculated at the rate of 1.6 Master Trainers per district.)

v. For organising the training of In-charge teachers, the Nodal Agency would be given a financial assistance at the rate of Rs. 335/- per In-charge teacher.

vi. The State Resource Agency would be given 3% of total annual expenditure on the scheme in the State as their honorarium. The sum includes travel expenses and other administrative expenditure. No other financial assistance would be given to the Resource Agency for their assistance in the implementation of the scheme.

(b) Fund-flow Mechanism

i Except for the funds meant for Resource Agency where the money would be directly released, all other funds would be routed through the State Nodal Agency.

ii First installment of financial assistance released to the State Nodal Agency would consist of :

- 100% funds meant for selection, printing and distribution of locally relevant resource material.
- 100% funds meant for training of Master Trainers.
- 100% funds meant for training of In-charge teachers.
- 50% of funds meant for financial assistance to Ecoclubs.

iii Second installment would be released after the training for In-charge teachers is completed and resource material is distributed to Eco-clubs. After adjusting the first installment against actual expenditure, up to 30% of funds meant for financial assistance to Eco-clubs would be released. Final installment would be released subsequently.

iv The funds meant for State Resource Agency would be released directly to the agency.

Activities

List of Suggested Activities for Eco-Clubs

- Organise seminars, debates, lectures and popular talks on environmental issues in the school.
- Field visits to environmentally important sites including polluted and degraded sites, wildlife parks etc.
- Organise rallies, marches, human chains, and street theater at public places with a view to spread environmental awareness.
- Action based activities like tree plantation, cleanliness drives both within and out side the school campus.
- Grow kitchen gardens, maintain vermi-composting pits, construct water-harvesting structures in school, practice paper re-cycling etc.

- Prepare inventories of polluting sources and forward it to enforcement agencies.
- Organise awareness programmes against defeacation in public places, pasting posters in public places and to propagate personal hygiene habits like washing hands before meals etc.
- Maintenance of public places like parks, gardens both within and outside the school campus.
- Mobilise action against environmentally unsound practices like garbage disposal in unauthorised places, unsafe disposal of hospital waste, etc.

Role of Implementers

Role of State Nodal Agency

a. To nominate a Nodal Officer.

b. To ensure identification of member schools by the District Committee in consultation with the Resource Agency.

c. To select locally relevant resource material in consultation with the Resource Agency and get it printed.

d. To ensure identification of Master Trainers by District Committees and organise training for them with the help of Resource Agency.

e. To ensure training programme for In-charge Teachers in Districts.

f. To ensure distribution of grants and resource material to Ecoclubs.

g. To receive quarterly reports from District Committees and compile them in the form of reports and send them to Central Nodal Officer in the given format.

h. To organise State Level activities and coordinate them.

i. To organise publicity to the programme to encourage more schools and students to join Eco-clubs.

Role of Resource Agency

Each State/UT is being provided with the services of one Resource Agency for the better implementation of the scheme. The main role of the Resource Agency is that of a consultant and a facilitator. The Agency is expected to perform the following functions :

i. Assist the State Nodal Agency/District Committees in the identification of schools in each district.

ii. Help the Nodal Agency in selecting locally relevant resource material.

iii. Help the Nodal Agency in organising training programme for Master Trainers by providing technical inputs and resource persons.

iv. Assist District Committees in drawing up action plans and in organising District level training programmes for In-charge teachers by providing resource persons as well as in drawing up training schedule.

v. To advise the State Nodal Agency in all the aspects of implementation of the Scheme.

Composition & Role of State Steering Committee

(a) Composition

1	Principal Secretary, Environment & Forests (Or an Officer of equivalent rank)	Chairman
2.	Secretaries or their representatives from State Departments of Education, Health and other concerned departments	Members
3.	Representative of Resource Agency	Member
4.	Head of the Nodal Agency	Member
5.	Two eminent NGOs working on environmental issues	Member
6.	State Nodal Officer	Secretary

State Government can nominate other officers and individuals considered relevant to this committee.

(b) Role

a. To coordinate implementation of the scheme.

b. To encourage different government departments to actively help the Eco-clubs.

c. To review periodically the implementation of the scheme and suggest activities to be taken up at District Level.

d. To select the best district, best Eco-club and give publicity to their activities so that other districts and Eco-clubs can adopt them.

Composition & Role of District Implementation and Monitoring Committee

(a) Composition

1	PDistrict Collector/DM	Chairman
2.	Conservator of Forests/DFO	Member
3.	District level officials of Department of Environment/State Pollution Control Board and Department of Health	Members
4.	Two eminent NGOs working on Environmental issues	Members
5.	Heads of five schools from among the selected schools	Member
6.	Representative of the Resource Agency	Member
7.	District Education officer/District Scientific Officer	Member Secretary

The State Government can nominate any individual who is relevant to the Committee

(b) Role

a. To identify the Member schools in consultation with State Nodal Agency and Resource Agency.

b. To motivate Heads of schools to initiate participation in the scheme.

c. To select Master Trainers and send them for training organised by the State Nodal Agency.

d. To identify In-charge Teachers in consultation with School Principals and organise training for In-charge Teachers.

e. To distribute Resource Material to In-charge Teachers at the time of their training.

f. To identify the activities to be taken up at the District level and organise them.

g. Coordinate, supervise and monitor the implementation of the activities by all the Eco-clubs in the district.

h. To keep the State Nodal Agency informed of the activities undertaken by the individual schools and at the district level in the given format.

i. To appoint the individual members as supervisors for a group of 10-15 schools and review their reports.

j. To send the monitoring report to the State Nodal Agency as per the schedule.

Role of Teacher In-charge of Eco-Club

The Teacher In-charge of Eco-club plays a key role in the implementation of the scheme. He/She should encourage more and more students to join the club. He/She should take up imaginative steps to implement the activities suggested in the scheme, which are relevant to that region. Main functions of In-charge Teacher are :

- To assemble the eco-club members every week for one hour at-least and take up some activity.
- To encourage the students to suggest activities for the following weeks and make a list of it. Make necessary preparations for their execution in consultation with the Headmaster/ Principal.
- Send monthly activity report to the District Committee.
- Coordinate with the District Committee for taking up district level common programmes.

Monitoring

(A) Proforma for Schools

National Green Corps

Monitoring Proforma-A (For Schools)

(To be submitted every month to the District Implementation & Monitoring Committee)

Report for the Month of ....., 2001/2

About the School

1. Name of the School:
2. Total Student Strength:
3. Boys/Girls/Co-Education:
4. Do you Have Nursery/Primary/ Secondary Sections:
5. Medium of Instruction :
6. E-Mail Address (If Any):

About the Scheme

1. Have you Appointed the Teacher Incharge: (If Yes, give name)
2. Has He/she attended the Orientation Programme:

3. How many Students are taking part in the Scheme:
4. Break up of Girls & Boys (For Co-ed Schools)
5. Break up of Primary/Secondary Students:
5. Have you received Resource Material:
7. Any suggestions for Resource Material:
8. Have you received Grant:
9. Have you received Caps etc:

Activities

Activity	No.of Students ParticipatedDate/	Duration
1. Seminar/Talk/Debate		
2. Camp/Field Visit		
3. Plantation/Cleanliness Drive		
4. Awareness by Rallies etc.		
5. Others (Specify)		

Date:

Signature of Head Master/Principal with Stamp

(B) Proforma for District Implementation&Monitoring Committee

National Green Corps

Monitoring Proforma-B-1 (District Level)

Activity Report

(To be submitted to the State Nodal Agency for each quarter ending in September/ December/ March/ June by the 15th of following month)

1. Name of the District:
2. Number of Participating Schools:
3. Number of Participating Students

I. Activities by Individual Schools

Activity	Number of Schools which conducted	No. of Students Participated
1. Seminar/Talk/Debate		
2. Camp/Field Visit		
3. Plantation/Cleanliness Drive		
4. Awareness by Rallies etc.		
5. Others (Specify)		

II. Activities Conducted by District Committee

Activity	Number of Schools which conducted	No. of Students Participated

III. Monitoring Status

1. Has the Monitoring Committee met during this quarter: Yes/No
2. Have the Committee members inspected the working of Eco-clubs in Schools: Yes/No
3. If Yes, No. of Schools Visited:
4. Remarks:

Date:

Signature of DEO/Member Secretary with Seal

(C) Proforma for State Nodal Agency

National Green Corps

Monitoring Proforma-C-1 (State Level) Activity Report

(To be submitted to Central Nodal Officer half-yearly in the 1st week of May & November)

1. Name of the State:
2. Number of Districts covered under the Scheme:
3. Number of participating Schools:
4. Number of participating Students:

I. Activities by Individual Schools

Activity	Number of Schools which conducted	No. of Students who Participated
1. Seminar/Talk/Debate		
2. Camp/Field Visit		
3. Plantation/Cleanliness Drive		
4. Awareness by Rallies etc.		
5. Others (Specify)		

II. Activities Conducted By District Committee

Activity	No. of Districts	Number of Schools which conducted	No. of Students who Participated

III. Monitoring Status

5. Has the Monitoring Committee met during this Quarter: Yes/No
6. Have the Committee members inspected the working of Ecoclubs in Districts/ Schools: Yes/No
7. If Yes, Number of Districts/Schools Visited:
8. Remarks:

Date:

Signature of Nodal Officer With Seal

5.2 Setting-up of Herbal Gardens in Schools under the Promotional Scheme of National Medicinal Plants Board (NMPB), Government of India

1. Background

Realizing the resurgence of traditional Indian medicines across the world and the corresponding increase in demand for medicinal plants, the Department of AYUSH , Ministry of Health and Family Welfare set up a Medicinal Plants Board in November 2000, under the Chairmanship of the Union Health and Family Welfare Minister for the overall development of this sector. The Board is responsible for the coordination of all matters relating to medicinal plants, including the drawing up of policies and strategies for in-situ cultivation or cultivation of plants in their natural habitat.

Conservation and ex-situ/in-situ cultivation, proper harvesting, research and development, processing and marketing of raw material etc. in order to protect, sustain and develop this sector are some of the other responsibilities of this Board. The Board has been implementing promotional and commercial schemes and providing Central Assistance for such purposes.

2. Objective

In order to sensitize students about conservation of the rich biodiversity, and in particular, the role of medicinal plants in providing holistic healthcare both in traditional and modern systems of medicine, it is proposed to provide financial assistance for setting up herbal gardens in schools under the promotional scheme of the Board on a pilot basis.

3. Coverage

The project seeks to cover schools up to the Senior Secondary/Intermediate/10+2 levels. Initially the project proposes to cover 1,000 schools in 50 districts in different States. Based on the response and experience of implementation the project will be further extended.

4. Pattern of Financial Assistance

Under the existing guidelines approved by the Board, herbal gardens can be set up as part of the promotional schemes. Assistance available from the Central Government for raising herbal gardens, as per the approved guidelines is:

i) Rs. 1.00 lakh per hectare for setting up herbal gardens

ii) Rs. 0.40 lakh for maintenance/hectare/year

Considering that schools may not have very large tracts of vacant land available, it is proposed that herbal gardens of about 1000 square metres (1/10 of a hectare) be raised in each school. The Central assistance for each herbal garden will be limited to Rs. 10,000for setting up and Rs. 4,000 for maintenance during the second year. The cost of setting up the herbal garden will include provisions for barbed wire fencing, land development, irrigation tools and implements, cost and transportation of plants and planting material, cost of organic manure etc. The entire amount of financial assistance from the Central Government of Rs. 14,000 per herbal garden will be released in a single installment to the State Medicinal Plants Board (SMPB) who will in return release it to the concerned school in consultation with the Director (Education) of the State/UT Government. Maintenance from the third year onwards will be the responsibility of the school authorities.

The state-wise allocation will be worked out based on the detailed proposals received from the State/UT Governments; the respective State Medicinal Plants Boards (SMPB) will send the proposals in the required proforma for the purpose.

5. Technical Support

The State Medicinal Plants Boards (SMPBs) will arrange to provide technical support with the help of the State Forest/Horticulture/Agriculture Departments, Agriculture Universities/Research Institutes near the schools being covered under the project. The State Medicinal Plants Board (SMPB) should also arrange to provide quality planting material.

Only organic manure/bio-fertilizers will be used and at no cost will chemical fertilizers be used. While some medicinal plants like Bael, Aonla may be used to provide food supplements to the students, marketing for other medicinal plants/plant products should be provided through a tie-up with manufactures and traders. The State Medicinal Plants Borads (SMPBs) should play a proactive role in this.

6. Awards/Prizes

The Board may consider instituting prizes for the schools depending upon their performance in the form of trophies and cash prizes at the State and National levels. The prizes at the State level would be Rs. 10,000 ; Rs. 5,000 and Rs. 2,500 for the first, second and third positions respectively. The prizes at the National level could be Rs. One lakh, Rs. 50,000, and Rs. 25,000 for the first second and third positions respectively.

List of Plants for Herbal Gardens:

The National Medicinal Plants Board has identified the following 32 medicinal plants for development on priority:

1.	Amla	Emblica officinalis Gaertn
2.	Ashok	Saraca asoca (Roxb.) de Wilde
3.	Ashwagandha	Withania somnifera (Linn.) Dunal
4.	Atees	Aconitum heterophyllum
5.	Bael	Aegle marmelos (Linn) Corr.
6.	Bhumi amlaki	Phyllanthus amarus Schum & Thonn.
7.	Brahmi	Bacopa monnieri (L.) Pennall
8.	Chandan	Santalum album Linn.
9.	Chirata	Swertial chirata Buch-Ham.
10.	Daruhaldi	Berberis aristat DC
11.	Giloe	Tinospora cordifolia Miers.
12.	Gudmar	Gymnema sylvestre R.Br.
13.	Guggal	Commiphora wighitii (Arn.) Bhandari
14.	Isabgol	Plantago ovata Forsk.
15.	Jatamansi	Nordostachys jatamansi DC.
16.	Kalihari	Gloriosa superba Linn.
17.	Kalmegh	Andrographis paniculata Wall ex. Nees
18.	Kesar	Crocus sativus Linn.
19.	Kokum	Garcinia indica Chois.
20.	Kuth	Saussurea costus C.B.Clarke (S.lappa)
21.	Kutki	Picorhiza kurroa Benth ex Royle
22.	Makoy	Solanum nigrum Linn.
23.	Mulethi	Glycyrrhiza glabra Linn.
24.	Safaid Musalo	Chlorophytum borivillianum Sant.
25.	Pather Chur	Coleus barbatus Benth.
26.	Pippali	Piper longum Linn.
27.	Sarpgandha	Rauwolfia –serpentina Benth. Ex kurz
28.	Senna	Cassia angustifila
29.	Shatavari	Asoaragys racenisus Willd
30.	Tulsi	Ocimum sanctu
31.	Vai Vidang	Embelia ribes Burm. F.
32.	Vatsnabh	Aconitum ferox Wall.

The schools may grow at least five to ten medicinal plants out of the suggested list of 32 medicinal plants identified by NMBP for cultivation and development depending upon the agro-climatic conditions. Other local plants of medicinal importance including tree species can also be grown.

The herbs/shrubs can be grown in the herbal garden and the medicinal trees should be planted at the boundary of the herbal garden/suitable locations in the schools. All these plants/trees would be labeled with the local name, English name, botanical name, family name and their medicinal uses. The State Medicinal Plants Boards (SMPBs) will arrange to provide printed literature to each school with details of the plants viz. scientific name, uses, method of cultivation, parts used etc.

7. Proforma for Application, etc:

Enclosed herewith are the following proformas:

(i) Proforma of application for submission of proposals (Annexure-A).

(ii) Proforma for submission of Utilization Certificate (Annexure-B).

Annexure -A

Proforma of Application for Submission of Proposals for Setting up of Herbal Gardens in Schools under Promotional Scheme of National Medicinal Plants Board (NMPB)

1. Name and address of the applicant's Institution:
2. Status of the institution (Government/Non-Government):
3. Organization or body responsible for the maintenance of the institution and its composition:

(Copy duly attested by a Gazetted Officer of the documents showing the constitution of the present governing or managing committee responsible for its maintenance along with the names and designations of two office bearers who are authorized to operate upon and bind its funds to be enclosed).

4. Present activities of the institution:
5. Details regarding existing infra-structure proposed to be utilized for the Herbal garden, if any:
6. Details of prior experience in growing of medicinal plants, if any:
7. Total land available with the institution area wise and where located:

   (Whether inside or outside the campus)

8. Details of medicinal plants proposed to be grown under the scheme: (Note: the school should grow at least 5-10 medicinal plants out of the suggested list of 32 medicinal plants identified by NMBP for cultivation and development. Other plants of local importance can also be grown.
9. Number of saplings/bed proposed to be planted of each plant:
10. Details of the sources for seed/plantation material:
11. Details of items/components for which the grant will be utilized:
12. Whether any grant has been sanctioned by any other Deptt. of Central

    or State/UT Govt. for the same purpose for which the financial assistance is now sought? If yes, details thereof?

13. Name of the scheduled bank where accounts of the institution are

    maintained and operated jointly by its authorized office bearers:

14. Name and designation of the authorized office bearer for issuing the grant DD/Cheque:

Signature of the authorized office bearer of the institution (along with Name, Designation and Office Seal)

Phone/FAX No.

Recommendation and comments, if any, of state /UT Medicinal Plants Board

Signature, Name and Designation of Office bearer of SMPB, Phone/FAX

Annexure -B

Proforma for Submission of Utilization Certificate-Cum-Performance Report

It is hereby certified that a grant of Rs._____ sanctioned by National Medicinal Plants Board vide Sanction Order No._____ dated _____ under the promotional scheme for the setting up of a Herbal Garden in this school has been utilized for the purpose for which it was sanctioned.

ii) The Grant was incurred for the following works:

(Details of works and the expenditure for each to be provided)

iii) Herbal Garden has been set up on _____ (area of land) _____ and the following species of medicinal plants have been grown:

(List of species of medicinal plants to be given)

Signature, Name and Designation of

Office bearer of SMPB.

6. School Sanitation & Hygiene Education

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 washed water and urinals
4. Garbage pitSulabh Technologies: Key to Improved Sanitation

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.

Sanitation Technologies

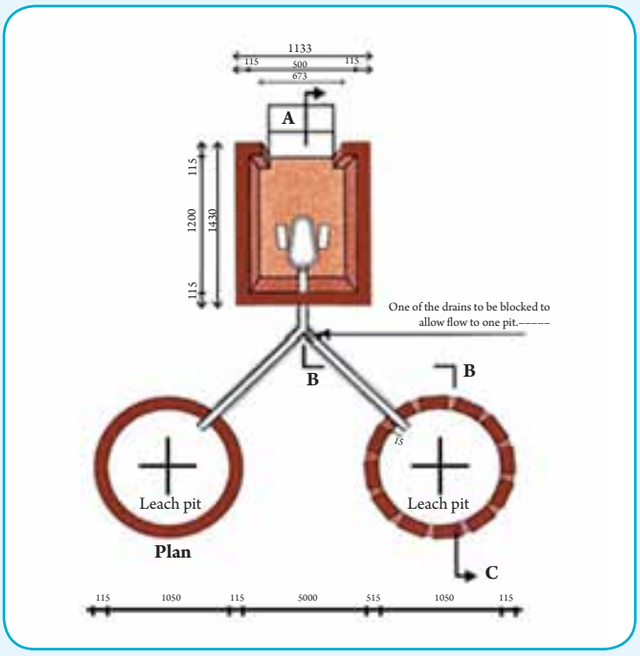
In the developed countries, the standard practice for the sanitary disposal of human waste is sewerage. Due to financial constraints and exorbitant maintenance and operational costs, sewerage is not the answer at present to solve the problem of human waste management in India. Sewerage was first introduced 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. 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 lead to a deterioration of groundwater aquifers and community health.

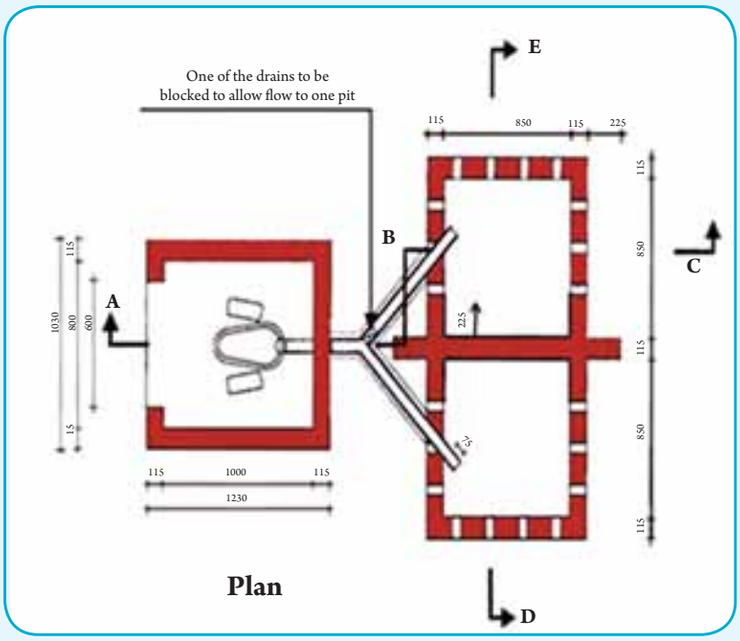
The septic tank system is also expensive and requires a large volume of water for flushing. There is a shortage of drinking water in almost all the urban areas; hence water has to be conserved. Septic tanks have other problems like periodic cleaning and the disposal of sludge. Inadequate effluent disposal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

Sulabh Flush Compost Toilet

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 20 mm 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 varying 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 metres, and vertically the seepage is not more than 1 metre. 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:

i. The surface soil should not be contaminated.

ii. There should be no contamination of ground water that may enter springs or wells.

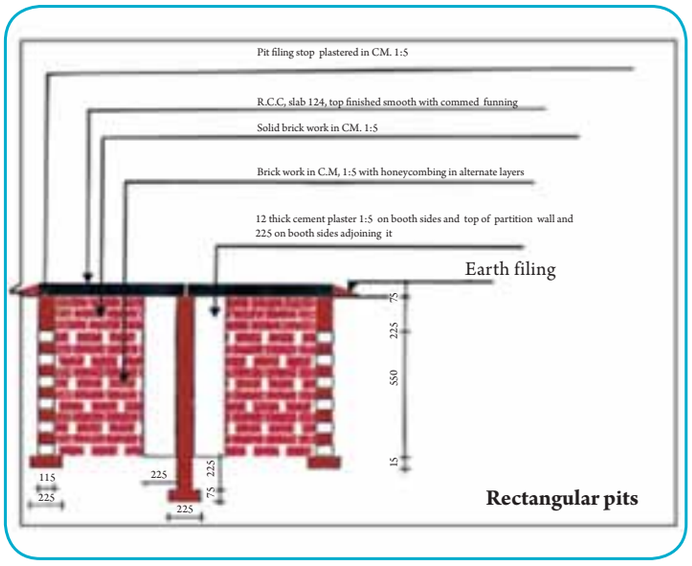
iii. There should be no contamination of surface water.

iv. Excreta should not be accessible to flies or animals.

v. There should be no handling of fresh excreta; or when this is indispensable, it should be kept to a strict minimum.

vi. There should be freedom from odours or unsightly conditions.

vii. The method used should be simple, inexpensive in construction and operation.



Solid Waste Management

Urban solid waste management has remained one of the neglected areas in urban management in India. Over the years there has been a progressive decline in the level of services in respect of collection and disposal of household, hospital, and industrial waste as well as measures for environmental sanitation and public hygiene. In most cities nearly one-half of the solid waste generated remains unattended and this gives rise to unsanitary conditions, especially in densely populated slums. This has also resulted in higher mortality and morbidity due to infections among the urban slumdwellers, handlers of wastes being the worst affected. It is therefore imperative that steps to improve solid waste management, environment health hygiene and sanitation be initiated immediately to minimize the health hazards arising from environmental consequences and rapid urbanisation.

The Sulabh International Academy of Environmental Sanitation has developed a new technology – Sulabh Thermophilic Aerobic Composter (STAC) which requires only eight to ten days to make compost from any biodegradable waste, without any manual handling during composting. It is based on the thermophilic aerobic method. The technology does not require recurring expenditure. The plant is fabricated from galvanized iron sheets, has double walls filled with glass wool, and partitioned with perforated sheets into three chambers. After biodegrading, the liquid is collected in the bottom chamber and can be removed and used for agricultural/horticultural purposes. Manure which contains 30-35 percent moisture, can be directly used for agriculture/land filling purposes or dried, granulated and stored until further use. The benefits of this technology are:

i. organic solid waste can be efficiently converted into manure and soil conditioner, giving economic returns,

ii. it can control diseases transmitted from waste; as at high temperature pathogens are eliminated from it,

iii. due to a reduction in volume, cartage costs of waste to disposal sites or for land filling will be greatly reduced, and

iv. the spread of weeds from waste will also be controlled.

The technology is suitable for rural areas as its byproducts (compost) can readily be used for agricultural purposes, and it reduces health hazards.

Community 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 metres 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 metres) 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 350°C, which is the self-ignition temperature of diesel. Biogas has a high (600°C) 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 metresof 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.

Towards Sustainable Sanitation, Health & Dignity For All

By: Star Communications • Photos: Sanjay Kumar Srivastava, IFS-87 & Dinodia