



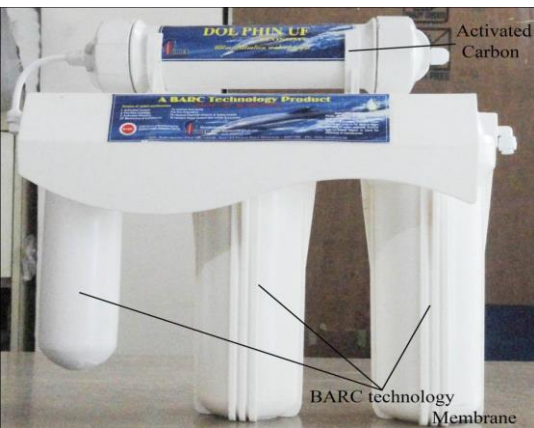
# SWACHH BHARAT ABHIYAN



## REPORT ON NATIONAL WORKSHOP ON INDIGENOUS WATER, WASTEWATER AND SOLID WASTE TREATMENT TECHNOLOGIES

JANUARY 19, 2015

GTU CHANDKHEDA CAMPUS, AHMEDABAD.



**Organized By**  
**The Department of Atomic Energy**  
**Government of India**



**Knowledge Partner**  
**Gujarat Technological University (GTU)**  
**Ahmedabad**



## Acknowledgement



I would like to express my deepest appreciation to Ms. Nisha Singh, IAS, Joint Secretary, the Department of Atomic Energy, Government of India, New Delhi for giving GTU this challenging opportunity. A special thanks, I extend, to Prof. Saswat Bandyopadhyay, Program Advisor, whose contribution was the base of everything.

I would like to express my gratitude to the visionary and forward looking Vice Chancellor of Gujarat Technological University, Hon'ble Dr. Akshai Aggarwal, who always encouraged us and guided our team with passion. Furthermore I would also like to acknowledge with much appreciation the crucial role of the workshop Management team. A special thanks goes to the team working at the core, Naresh Jadeja, Vikrant Vala, Vimal Sharma, Darshana Chauhan, Sarika Srivatsava, Gopal Bhatt, Jignasha Acharya, and Reema Parekh, who helped in assembling all the parts together to a very successful end.

My thanks and appreciation also goes to the learned speakers at the workshop. The workshop would not have been so enlightening and informative to the participants without the excellent presentations and speeches of the distinguished speakers. Last but not least, many thanks to the participants for their keen interest in the workshop.

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## Background

India's Urban Awakening report, a report by McKinsey to HPEC, highlights the glaring infrastructure lacunas in our cities. As per census 2011, less than 30% of the municipal waste water is treated. Water supply and sanitation have emerged as one of the most underperforming sectors in the country. The demand for clean water and sanitation can be evident from the investments from JnNURM, where 38% of funds dedicated to water supply and 26% of funds to sewerage.

These are also one of the most crucial to the citizen's wellbeing since their inadequacy affects the health as well as economic productivity equally. The challenges of water sanitation are even more pronounced in the old, historic and heritage cities and cities with a strong environmental receptor like a river, wetland or forested areas.

Through JnNURM and other multi-lateral funding agencies, some Indian cities are also experimenting with international technologies of waste management. However they have proved not only very expensive to be replicated and up scaled, but also often cumbersome to operate, retrofit and manage in the Indian circumstances. The need for indigenous technologies tailored to India is often felt by the city managers.

BARC (Department of Atomic Energy) has done research and development of some indigenous water and sanitation technologies such as, Technological solutions for purification of water bodies including the river Ganga through effective wastewater treatment; Technological solutions for water purification and its portability; and Technological Solutions for Solid waste management solutions as an end-to-end concept: NISARGRUNA .

Recently, the new Government, spearheaded by Hon'ble Prime Minister Shri Narendra Modi has unfurled several development missions such as 100 Smart Cities, New Urban Development for 400 Class I town, HRIDAY for Historic Cities in India, Clean India and Clean Ganga. Majority of these missions are intended to focus on treatment of surface and ground water resources, waste water management amongst others.

In this context, this national workshop was arranged which was intended to bridge the gap between research and practical application. This will foster symbiotic relations between demand and supply of technologies, allowing not only refined and customized technological solutions but also better urban living in our cities.

## Objective of the workshop

- Dissemination of Indigenous Technologies of Water, Wastewater & Solid Waste Treatment developed by the Bhabha Atomic Research Centre (BARC) under "Swachh Bharat Abhiyan".
- Bridging the GAP between research and practical application



## Speakers and Participants

**Speakers** at the workshop were senior officials from the prominent government institutions such as Department of Atomic Energy, Bhabha Atomic Research Center, Gujarat Technological University, Gujarat Energy Research & Management Institute, CEPT University, Institute of Plasma Research and Gujarat Pollution Control Board as well as private organization such as SSB Infrastructure, Embarq and M/s Sondhka. Please refer [Annexure II](#) for detailed profile of all speakers.

**Participants** from various institutions and locations took part in the workshop. The participants were Administrators, Managers and Engineers from Urban Local Bodies; Academicians and Researchers in the fields of Water, Waste Treatment, Environmental Technologies and Industrial Pollution; Professionals from relevant Industry; Leading consultants in the field of Water, Wastewater and Solid Waste Treatment Technologies; Technology Providers; Researchers in the fields of Water and Waste Treatment; NGOs; Environmentalist and Officials from Pollution Control Boards and Water related Government Organization.



Figure 1: Participants of the workshop

The percentage of turnout of participants was 65% of total registration. Female participation was 37%, which is fairly good amount.



Figure 2: Participants applauding the presentation of speakers



Figure 3: Participants keenly listening to the speakers

The participants were from various categories and designations. 46% of the participants were the Faculty Members of GTU and other institutions from civil engineering and environment engineering. As the topic was relevant to the government agencies, the second highest participations was observed from Government agencies i.e. 17%. There is a need to increase participation of consultants, industry personals and researchers in such kind of workshops. Participants from all over Gujarat have benefitted from this workshop.

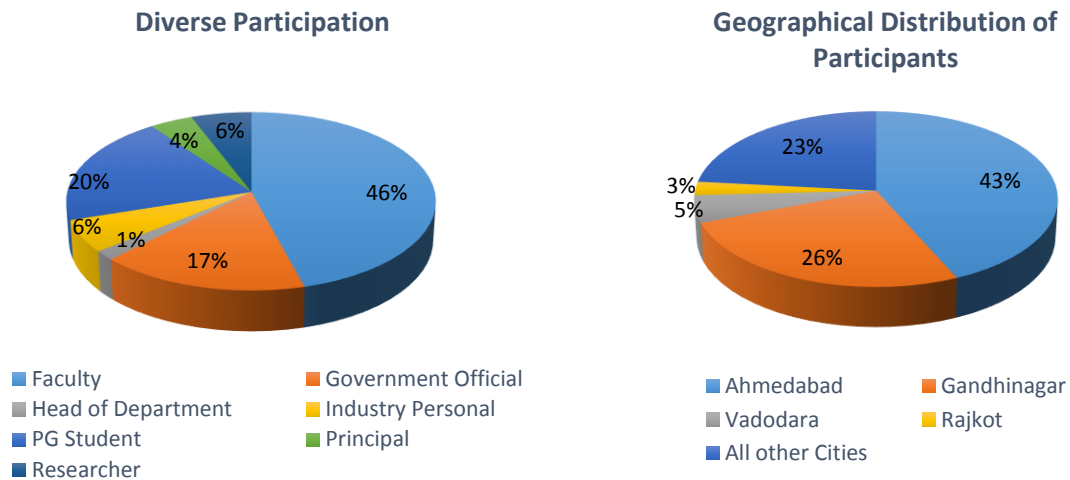


Figure 4: Participants Profile

## Inaugural Session

The workshop was inaugurated by lighting the lamp with Saraswati Pujan by all the dignitaries followed by a welcome speech by Shri J C Lilani, Registrar of Gujarat Technological University.



Figure 5: Inaugural Ceremony

Dr. Akshai Aggarwal, Hon'ble Vice Chancellor, Gujarat Technological University in his inaugural remarks explained the importance of relevance in research and its dissemination and also mentioned that if the research work doesn't reach the end users at the local level, then it would never become of global importance.

GTU has a total of 17000 faculties in affiliated institutions. Many of them are from prominent and reputed institutes. The objective of Research and Consultancy Services Cell (RCSC) at GTU is to use the knowledge, which GTU system possesses through its Faculty Members and researchers, for solving the problems of the society, industry and governments.

### Innovative Technologies available for Urban India for Water & Solid Waste Treatment by DAE - By Ms. Nisha Singh, Joint Secretary, Department of Atomic Energy

Ms. Nisha Singh brought attention to the concern of urbanization and poor service level in Indian cities. She talked on the role of DAE in water purification and the Innovative Technologies available for Urban India for Water Treatment & Solid Waste Treatment. She emphasized the importance of complete water cycle and solid waste reuse/recycle.



Figure 6: Context setting of workshop by Ms. Nisha Singh



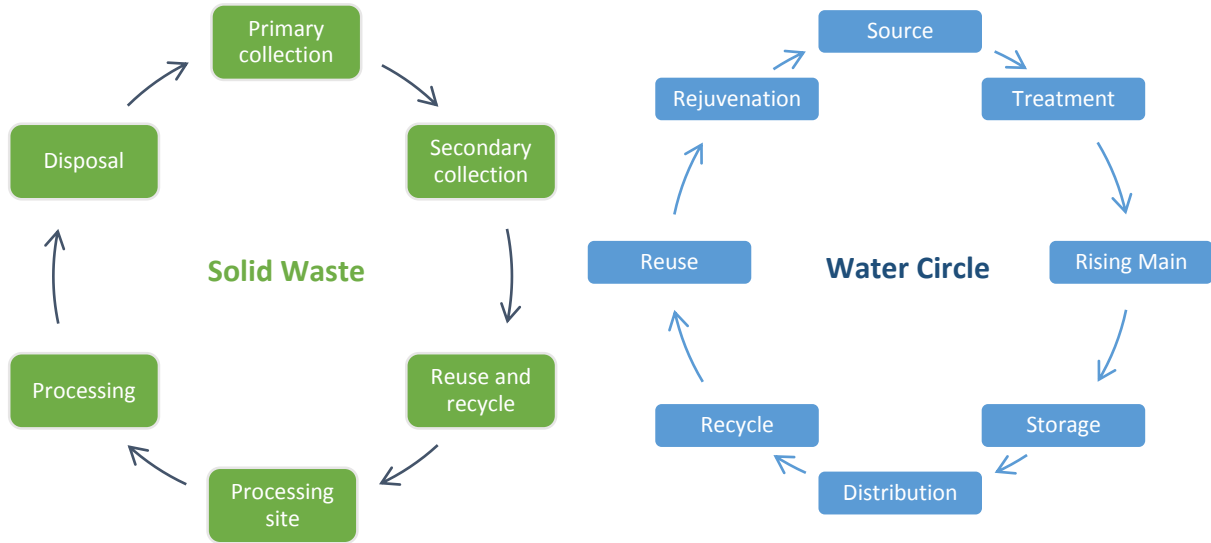


Figure 7: "Unless the circle is complete end to end our initiatives are not fruitful"

### Complete the circle

#### Indigenous Water Purification Technologies - By Dr. PK Tewari, Professor, HBNI & Associate Director Chemical Engineering Group, BARC, DAE

Dr. Tewari in his presentation covered information about the water quality issue and demonstrated various indigenous water purification technologies which can improve the drinking water quality from smaller villages to larger cities.

Dr. Tewari explained the process of Pressure Driven Membrane.

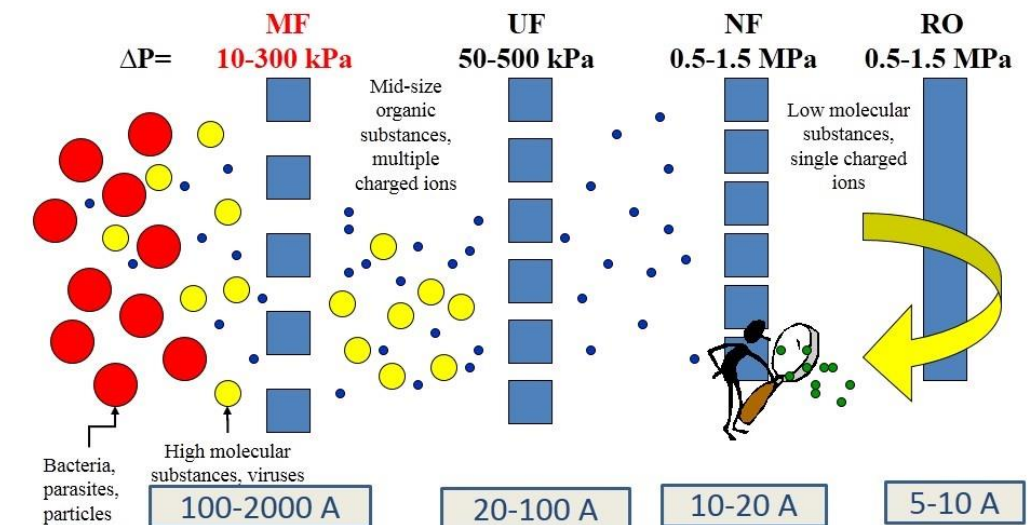


Figure 8: Pressure Driven Membrane Processes by Dr. P. K. Tewari

Dr. Tewari presented water purification technologies which were suitable for all capacity for example the technologies were adaptable from household level unit or community level unit to large scale unit. He also demonstrated water purification by using nuclear energy and solar energy.

**“Declining Cities in Emerging Economy”: Role of Technologies in City Management - By Professor Saswat Bandyopadhyay, CEPT University**

Prof. Saswat gave an overview of demand of indigenous technologies and emphasized on sensitizing people about the indigenous technologies.

Prof. Bandyopadhyay explained in his presentation explained the contribution of urban areas in the GDP of the country. He showed concern about the deficient level of services in the urban areas, which are much below the standards setup by Government of India.

Professor Saswat highlighted the under-use of technology for urban areas in policies and urban management. He mentioned the lack of targeted incentives for technological innovations in urban infrastructure. He enlisted the urban areas with urbanization and pollution issues which need attention for the clean Ganga mission.



Figure 9: “Declining Cities in Emerging Economy” by Prof. Saswat Bandyopadhyay

**Vote of Thanks - By Prof. Shri Rajnikant Patel, RCSC Advisor, GTU**

At the end of the inaugural session, the vote of thanks was delivered by Prof. Shri Rajnikant Patel, Advisor for Research and Consultancy Services Cell at GTU. Professor Patel thanked the Department of Atomic Energy for organizing the workshop. He thanked all the speakers for sparing their valuable time for sharing their vast experience in the respective field. The Professor also thanked the GTU staff individually for their efforts in making the workshop successful.



Figure 10: Glimpse of the Inaugural Session

## Technical Sessions

### Decentralized waste resource management: Nisargruna experience – By Dr. Sharad P. Kale, Head, Technology Transfer and Collaboration Division, BARC

Dr. Kale demonstrated the Nisargruna Technology which is based on the concept of “Paying back Nature’s loan”. Over a period of last six years, Nisargruna has been found to be a sustainable and viable option for solid biodegradable waste management. He emphasized on the cost of oxygen we are using every day which we get freely from the nature and stressed upon putting things back into the nature and complete the nature’s cycle. He also explained the perspective for looking the solid waste not as waste but as a wealth bank and how to achieve the maximum benefit from the waste Segregation is the key.



Figure 11: Nisargruna Technology by Dr. Sharad Kale

Nisargruna Technology based plants are functioning at 150 location all over India. Few prominent plants operating on Nisargruna Technologies are located in Baroda(Carcass Plant); Anushaktinagar, Mumbai; Ankaleshwar, Gujarat; TCS, Thane; Symbiosis, Pune; Kalameshwar Municipal Council; Anjangaon, Amravati; Katol, Nagpur; Hiranandani Estate, Thane; Tata Institute of Social Sciences, Deonar; Kurudampalayam, Coimbatore; and Tihar Jail, New Delhi.

He summarized by mentioning the need to develop an independent platform to launch waste to energy concept with incorporating decentralization, waste reduction and recycling, value addition by optimization of processing, increasing scope of the technology, and regions wise suitable processes.

### Environment Friendly Plasma Technologies: Developments at Institute for Plasma Research – By Prof. S Mukherjee, Head, FCIPT Division, Institute for Plasma Research, Gandhinagar

Solid waste dumping sites or landfill sites needs more amount of land which is not available in urban areas. Burning of solid waste in an open round pollute environment with toxic gases which dangerous to human being. Incineration of solid waste pollutes the environment if the incinerators are not designed or operated properly.

Prof Mukherjee presented the new concept of the use of plasma technology in waste treatment. Thermal Plasma Technology is ideally suited for waste treatment. By plasma technology Hazardous & toxic compounds are broken down to elemental constituents at high temperatures; Inorganic materials are converted to Vitrified Mass; and Organic materials are Pyrolysed or Gasified, Converted to flue gases (H<sub>2</sub> & CO) & Lower hydrocarbon gases when operated at low temperature (500 – 600OC).



Plasma Pyrolysis/Gasification technology is capable of disposing different waste streams such as biomedical waste, plastic waste, petroleum waste safely. Energy recovery from waste using plasma pyrolysis / gasification is economically attractive and is promising. Even for biodegradable waste – like floral waste in temple-towns needs to be disposed immediately; plasma pyrolysis can help and generated syn-gas can be used in community-kitchen. Disposal of carcass is also being thought of using plasma pyrolysis



Figure 12: Technical Session II

### Cleaning (Restoration) and Protection of Water Ways and Bodies: Ideas & Solutions - By Dr. B. Nagendra Kumar, Consultant Expert Engineer, Chennai

Dr. Nagendra depicted the nature as a family of earth, water and air. He mentioned that the nature is a perpetual cycle and it is imbalanced due to interferences of human being. Humans are missing green attitudes and are overexploiting and disrespecting the mother earth and fellow living systems.

Water Bodies' and Air spaces' natural behavior is to support life systems on the earth. Humans should not interfere it physically or chemically. We should devise suitable mechanisms to prevent damaging climate changes like floods. Dr. Nagendra explained this phenomena with the case studies of Chennai Waterways. Choking of water ways by garbage collection and encroachment of humans in the waterway eventually causes flood situations.

Human beings are part of the nature as our bodies consist both water and air to an extent more than 60% and let us respect the surrounding nature including our own fellow citizens with Green Attitude, Green Designs and Green Planning of Human Development and Waste around Water Ways and Bodies.

### Unique Multi Stage Biological Treatment Solution - By Maulik Joshi, Manager projects, SSB Infrastructure Pvt. Ltd., Ahmedabad

MSBT can be implemented on existing STP which are not able to process Sewage to optimum efficiency. MSBT can be implemented as a modular or container on the banks of rivers on Drains/Nalas which discharge waste water to the river. It can also be implanted in small urban societies and housing complex for better water management.



Container Based MSBT



Concrete structure



Pond System

Figure 13: MSBT technology is available in different capacities as per the requirement (Source: SSB Infrastructure Pvt. Ltd.)

Benefits of MSBT are No Surplus of Organic Sludge, No Odour problem, Drastic reduction of Electrical Power usage which minimizes operating costs, No need for return sludge pumping (minimizing electro mechanical component which ultimately reduces operating cost), No need for sludge treatment reduces operating costs, No primary and secondary settling is required, High effluent quality, High modularity, It can be applied on the existing STPs for increasing Plant efficiency.

### Role of environmental isotope techniques in the water resources development and management - By Dr. U.K. Sinha, Isotope Hydrology Section, Isotope Production & Applications Division, BARC

Dr. U K Sinha presented the use of isotope techniques in hydrology. There are two type of isotopes, stable isotopes and radioactive isotopes. Isotope techniques are used to find out the type of contamination in



Figure 14: Dr. U K Sinha answering the questions

surface water and ground water, the sources and origin of contamination, pollutant dispersion in surface water bodies, to assess the groundwater salinity, to assess the changes due to long-term exploitation of groundwater, for hydro-chemical investigation and to carry out geochemical evolution of groundwater. Dr. Sinha presented several case studies of use of isotope techniques in water resources management.

### The BARC UF Membrane Technology

#### for Domestic Water Purifiers - By Shri Pradip Lalla, Director, M/s Sonadka

Shri Pradip Lala presented water filters manufactured by Sonadhka based on membrane based water Purification Technology developed by BARC. Benefits of BARC Polysulfone Membrane are high tech 0.02 micron or 20nm, simple form factor, rugged (life of more than 1 year) and low maintenance (about Rs. 500 per year). It is very easy to use and very low cost solution for the water contamination.



Figure 15: Water filters manufactured by Sonadka

### Deployment of BARC Domestic Water Purifier in Rural Area through AKRUTI Program By Shri Gajendra Kulkarni, Project Executive officer, RHRDF.

Rural Human & Resource Development Facility is disseminating BARC technologies, namely Nisargruna Biogas, Soil Organic Carbon Testing Kit, Seed Bank, Domestic Water Purifier, Weather Forecasting, LLL, RIA, FSD, VTD; under the AKRUTI( Advance Knowledge of Rural Technology Implementation) Program.

Activities carried out under the AKRUTI program are surveys for safe drinking water, Interaction with the villagers, Entrepreneurship development for domestic water purifier production and Awareness programs for benefits of use purified water. RHRDF has also launched a scheme for safe drinking water for village under CSR.



Figure 16: Domestic water purifier works without electricity disseminated by RHRDF

### Radiation Hygienization of Municipal Sewage Sludge - Process & Technology Adoption By Dr. Lalit Varshney, BARC

Dr Lalit explained that the Sewage is the waste water generated from domestic premises and consists mainly of human waste. It typically contains 99.9% water and about 0.1% solid. The solid waste in sewage is typically organic in nature and is broken down in the sewage treatment plants resulting in sewage sludge as a byproduct. Indian cities and towns together are generating an estimated sewage load of 38,254 million liters per day (MLD). Out of which 11,787 MLD is treated with a capacity gap of 26467 MLD. Considering 0.1 % solid content, the total potential of sludge generation from the sewage is 38254 tons per day (density of sludge approx. =1.0).



In Radiation Hygienization process dry sludge generated at STP's is hygienized using radiation technology using standard Gamma facility at a Dose of 10 kGs. Such radiation plants are operating in India for sterilizing medical products.

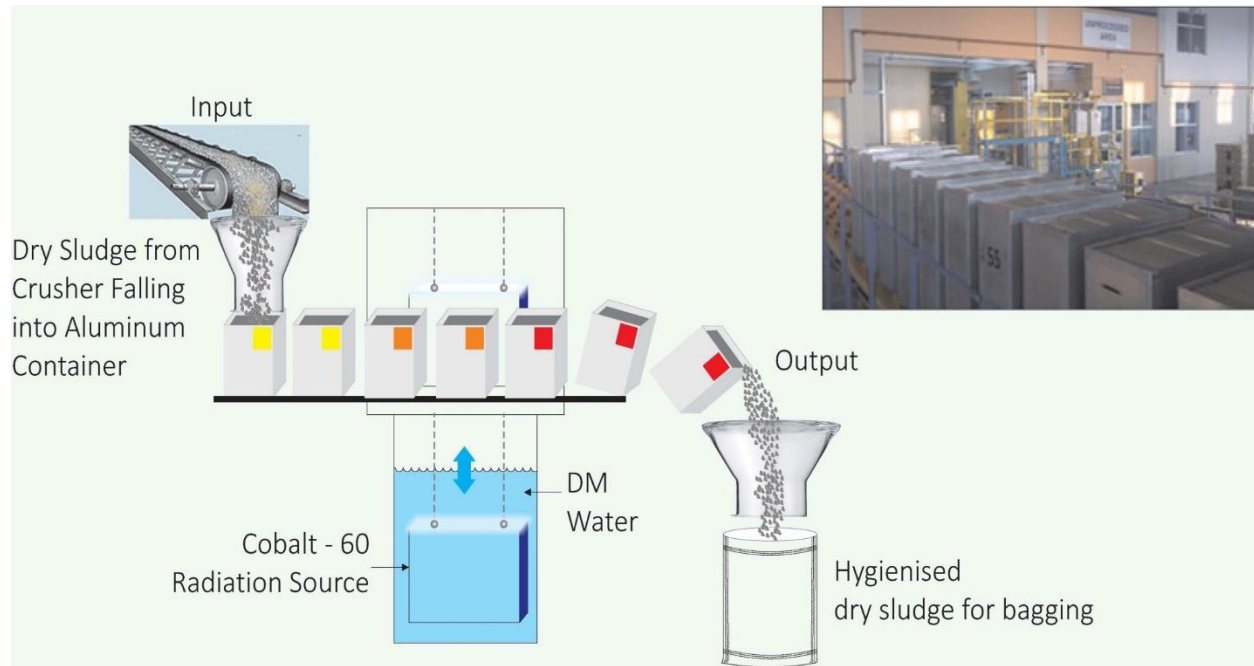


Figure 17: Flow sheet diagram of the Radiation Process by Dr. Lalit Varshney

#### Advantages of Radiation Hygienized Sewage Sludge

- Most of the live forms in the sewage are inactivated. Pathogens are inactivated with high degree of reliability.
- Foul smell in the sludge is significantly reduced.
- Toxic chemicals are partially degraded.
- Overall quality of sludge is significantly improved for use or safe disposal.

#### Refuse Derived Fuel: An Emerging Processing Technology in MSWM -By Prof Dr. K N Sheth, Dean of Inter-disciplinary Research, Gujarat Technological University & Director Sardar Patel College of Engineering

Dr. Sheth discussed about sustainable energy and its emerging demand. Refuse Derived Fuel (RDF) is a processed form of Municipal Solid Waste (MSW) and it can be a substitute to coal energy. The process of conversion of garbage into fuel pellets involves primarily Drying, Separation of incombustible, Size reduction and Pelletisation, which is explained in detail in the following figure.



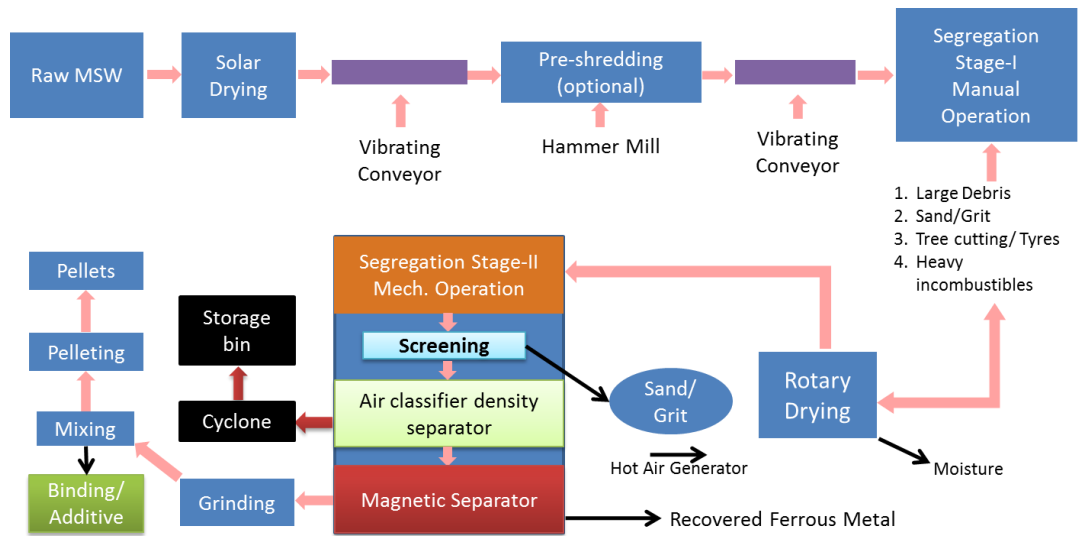


Figure 18: Process Flow Diagram of Refuse Derived Fuel by Prof Dr. K N Sheth

**Merits of RDF**

- Successfully established for MSW
- High calorific value of pellets 3500-4000 kcal/kg (this is equivalent to E class coal) against that of unprocessed garbage i.e 800-1000 kcal/kg
- Pellets can be conveniently stored and transported
- Pellets can be used as supplementary fuel for combustion processes and utility boiler
- Less generation of ash
- Clean fuel (free from stones and other incombustible material )
- Uniform size and regular supply
- Low Sulphur content (about 0.2-0.3%), lesser than coal (about 3-4%)

**Demerits of RDF**

- The processing unit cannot be operated during rainy season as the garbage will be too wet
- Consumes more energy than biological processes
- Uncontrolled burning of the pellets derived from MSW may lead to harmful emissions

**P-P-P in SWM: Opportunities and Challenges - By Vijay Anadkat, Doctoral Researcher at Gujarat Technological University & Fellow, EMBARQ India**

Shri Vijay Anadkat presented the various possibilities of public private partnership in solid waste management and how it can be materialized. Starting with the type of solid waste and functions of solid waste management, he described the evolving concerns about managing solid waste and also talked about various initiatives taken by government.

He described various models in SWM Operation Services with the examples of Pune model (SWaCH Cooperative) and Coimbatore model for waste processing plant. He also talked about other options in solid waste management such as managing waste by Sakhi Mandals and use of m-governance in SWM. Night scraping is a best way to use PPP in SWM. Key ingredients for a successful PPP are good leadership, trust, clarity of purpose and objectives of privatization, political will, restructuring of government institutions, public acceptance and willingness to pay.



Figure 19: Technical Session on Solid Waste Management

**Legal Aspect of Bio-Medical Rules-1998 - By G.H.Trivedi, GPCB**

Mr G H trivedi explained that the concept of Bio-medical waste. It means any waste which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biological and including categories mentioned in Schedule I.

**Need of Biomedical Waste Management**

- BMW is hazardous, toxic and even lethal
- High potential for diseases transmission
- Poses potential health hazard to the health care workers, community and environment
- Worst affected are rag pickers and waste handlers.
- As per WHO , injections with contaminated syringes caused
- 21 million hepatitis B virus (HBV) infections,
- 2 million hepatitis C virus infections and
- 2,60,000 HIV infections worldwide

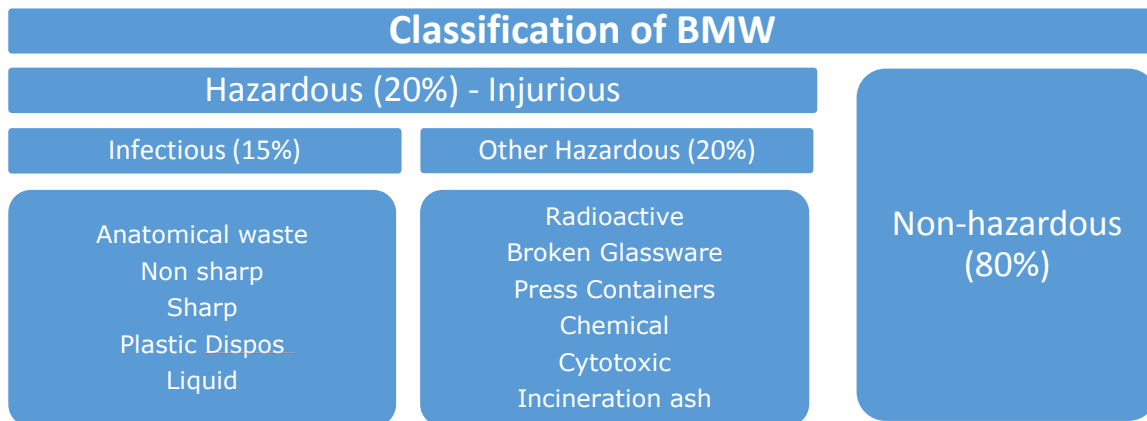


Figure 20: Classification of BMW

For Medical Waste monitoring the prescribed authority is Gujarat Pollution Control Board. Permission is granted by the prescribed authority for the generation, collection, reception, storage, transportation, treatment, disposal & any other form of handling of bio-medical waste. Except such occupier of clinics, dispensaries, pathological laboratories, blood banks providing treatment/service to less than 1000 patients per month.

Bio-Medical Waste (M&H) Rules 1998 & Amended up to 2003

BMW (M&H) rules contains 14 Rules, 6 Schedules and 5 Forms. The six schedule are listed below.

- Schedule I: Categories of BMW
  1. Human Anatomic Waste - Incineration/Deep burial
  2. Animal Waste - Incineration/Deep burial
  3. Microbiology and Biotechnology waste - Local autoclaving/microwaving/incineration
  4. Waste Sharps - Disinfections mutilation/shredding
  5. Discarded medicines and Cytotoxic drugs - Incineration/destruction and drug disposal in secured landfills
  6. Soiled - Incineration, autoclaving/micro waving
  7. Solid waste - Disinfections mutilation/shredding
  8. Liquid waste - Chemical treatment and discharge in to drain
  9. Incineration ash - Disposal in to Municipal landfill / TSDF
  10. Chemical waste - Treatment and disposal at TSDF
- Schedule II: Color Coding and type of container for disposal

Color Coding	Type of container	Waste Category	Treatment option as per Sch-I
Yellow	Plastic bag	1, 2, 3,6	Incineration/Deep burial
Red	Disinfected container/ Plastic bag	3,6,7	Autoclaving/Microwaving/Chemical treatment
Blue/White translucent	Plastic bag /Puncture proof container	4,7	Autoclaving/ Microwaving/ Chemical Treatment and destruction/shredding
Black	Plastic bag	5,9,10	Disposal in secured landfill

- Schedule III: Labels for container  
Biomedical/ Biohazard symbol label shall be non-washable and prominently visible
- Schedule IV: Labels for transport
- Schedule V: Standards for treatment and disposal of BMW
  1. Standard for Incinerator
    - Operating standard
    - Emission standard
  2. Standard for waste autoclaving
  3. Standard for liquid waste
  4. Standard for deep burial
- Schedule VI: Schedule for waste management facility  
By December 2002 or earlier, all the BMW generator has to provide the requisite treatment facility



Figure 21: Biomedical/ Biohazard symbol

**As per rule 14 of BMW rules:**

Municipal Corporations, Municipal Boards or Urban Local Bodies shall provide suitable common disposal/incineration site for BMW generated in the area under their jurisdiction. Outside municipal limit occupier generating BMW facility to arrange for suitable site individually or in association. There are 18 existing Common Biomedical wastes treatment Facility (CBWTF) in Gujarat and 8 CBWTF are under development stage.

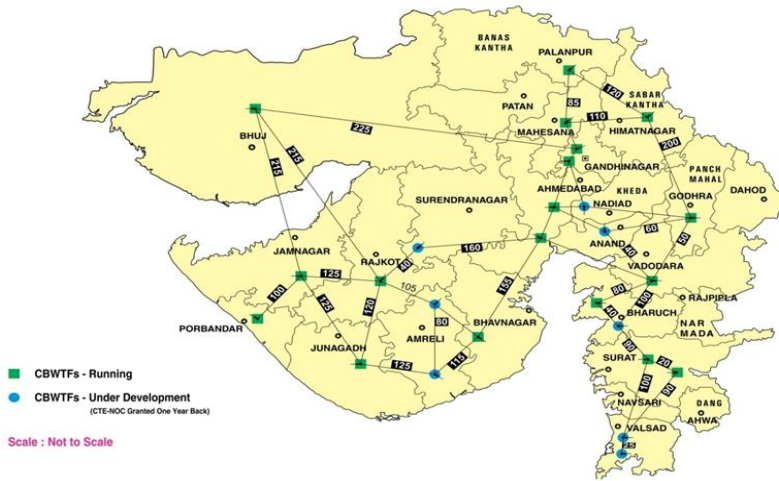


Figure 22: Common Biomedical wastes treatment Facility in Gujarat (Source: GPCB)

**Panel Discussion**

A Panel Discussion attempted to get a view on strategic technological options for Swachh Bharat Abhiyan. The Panel Discussion was chaired by Dr. Rajul K Gajjar, Dean of Research Gujarat Technological University, (Second from Left) and the members in discussion were Dr. B Nagendra Kumar, Dr. Sharad P. Kale, Prof S Mukherjee and Prof. Sejal Patel (Right to Left).



Figure 23: Expert Panel on the Dias



## Conclusion and Way forward

The technologies presented in the workshop were very important in view of making India clean. Foreign technologies for waste treatment which are usually high in capital as well as operational cost and very complex in terms of operations. Indigenous technologies presented in the workshop were flexible for different size unites, low capital cost and operational cost, easy to use, adaptable to Indian scenario.

The technologies are needed to be disseminated to all the stakeholders such as government departments, urban local bodies, consultants and contractors. Relevant technologies can implement in rural and urban area for more efficient liquid and solid waste management. For urban area, the technologies can be scaled according to the size of town, ranging from small and medium towns to large cities.

River water pollution has become a concern which essentially is due to disposal of the municipal liquid and solid waste in the water body. Small unites of the treatment facilities can be installed at the outfalls of waste water before disposing into the natural stream.

Solid waste is becoming an issue in large cities due to lack of treatment facilities. However if managed properly and treated with the simple techniques presented in the workshop, it can become a sustainable source of energy.

Moreover to induce more research work in this field interaction between research institute and government agencies should be encouraged.

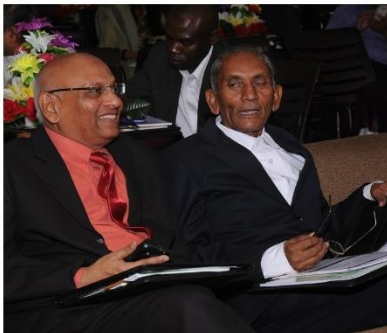
To refer the presentations of the speakers click on the following link.  
<https://drive.google.com/open?id=0B3mk28Vmn7SMV1ViX1F2NmtsM2c&authuser=0>

## Glimpse of the workshop





## Glimpse of the workshop



## Annexure I: Program Schedule

Time	Subjects	Speakers
09.00 - 10.00	Registration and Tea/Coffee with snacks	
10.00 - 11.15	<b>Inaugural Session</b>	
	Lightening of lamp and prayer	Dignitaries on Dias
	Welcome to Guests	Shri J C Lilani, Registrar, GTU
	Inaugural Speech	Hon'ble Dr. Akshai Aggarwal, Vice Chancellor, GTU
	Context Setting of the Workshop	Ms. Nisha Singh, IAS ,Jt. Secretary, Department of Atomic Energy, New Delhi
	Various Technologies	Prof. Dr. P K Tewari, Head, Desalination Division, Bhabha Atomic Research Centre (BARC), Mumbai
	Issues and Challenges	Prof. Saswat Bandopadhyay, CEPT University, Ahmedabad
	Vote of Thanks	Prof. Shri Rajnikant Patel, GTU Advisor (RCSC)
11.15 - 11.30	Tea/coffee Break	
11.30 - 12.15	<b>Technical Sessions I</b>	
	<ul style="list-style-type: none"> <li>India's Urban Water and Sanitation Challenges and Role of Indigenous Technologies</li> <li>Environment Friendly Plasma Technologies: Developments at Institute for Plasma Research</li> </ul>	<ul style="list-style-type: none"> <li>Prof. Shri Rajnikant Patel, Advisor (RCSC), GTU (Session Chair)</li> <li>Dr. Sharad P Kale, Senior Professor, Homi Bhabha National Institute, Mumbai Chairman of the Session</li> <li>Prof S Mukherjee, FCIPT Division, Institute for Plasma Research, Gandhinagar</li> </ul>
12.15 - 13.30	<b>Technical Sessions II</b>	
	<ul style="list-style-type: none"> <li>Indigenous technologies for water &amp; waste water treatment and for cleaning of Ganga &amp; other water bodies</li> </ul>	<ul style="list-style-type: none"> <li>Prof. (Dr.) K N Sheth, Director, Sardar Patel College of Engineering and Dean of Interdisciplinary Research, GTU (Session Chair)</li> <li>Dr. B Nagendra Kumar, Consultant, Coastal and Hydraulic Environmental Engineering, Chennai (On River Cleaning)</li> <li>Shri Maulik Joshi, General Manager SSBI Infrastructure Pvt Ltd, Ahmedabad</li> <li>Dr. U.K. Sinha, Scientific Officer 'G', Isotope Production and Applications Division, Bhabha Atomic Research Centre, Mumbai</li> </ul>
13.30 - 14.30	Lunch Break	
14.30 - 15.30	Technical Session III <ul style="list-style-type: none"> <li>Case study discussions on BARC indigenous water technologies already being used and dissemination of</li> </ul>	<ul style="list-style-type: none"> <li>Prof. (Dr.) P K Tewari, Head, Desalination, Bhabha Atomic Research Centre (BARC), Mumbai (Session Chair)</li> <li>Shri Pradip Lalla, Director, M/s Sonadka Asangaon, Maharashtra</li> </ul>



	the technologies in Indian market	<ul style="list-style-type: none"> <li>Shri Gajendra Kulkarni, Project Executive Officer, Rural Human &amp; Resource Development Facility, Department of Atomic Energy Out Reach Centre, Pandharpur, Maharashtra</li> </ul>
15.45 - 17.00	<b>Technical Sessions IV</b> <ul style="list-style-type: none"> <li>Municipal Solid Waste Management</li> </ul>	<ul style="list-style-type: none"> <li>Prof. Shri Rajnikant Patel, Advisor (RCSC), GTU (Session Chair)</li> <li>Dr. Lalit Varshney, Radiation Technology Development Division, Bhabha Atomic Research Centre, Mumbai.</li> <li>Prof. (Dr.) K N Sheth, Director, Sardar Patel College of Engineering and Dean of Interdisciplinary Research, Gujarat Technological University</li> <li>Shri Vijay Anadkat, Fellow, EMBARQ WRI India</li> <li>Shri G H Trivedi, Senior Engineer, Gujarat Pollution Control Board, Gandhinagar (Bio Medical Waste)</li> </ul>
17.00 - 17.45	<b>Panel Discussions</b> <p>Panel discussions on strategic Technology options for Swachh Bharat Abhiyan (Clean India)</p>	<ul style="list-style-type: none"> <li>Dr. Rajul K Gajjar, Dean, GTU &amp; Principal, VGEC, Ahmedabad (Session Chair)</li> <li>Dr. B Nagendra Kumar, Consultant, Coastal and Hydraulic, Environmental Engineering, Chennai</li> <li>Dr. Sharad P Kale, Senior Professor, Homi Bhabha National Institute, Mumbai</li> <li>Prof. (Dr.) K N Sheth, Director, Sardar Patel College of Engineering and Dean of Interdisciplinary Research, GTU</li> <li>Prof. Sejal Patel, Associate professor and Head, B Plan, Faculty of Planning, CEPT University, Ahmedabad</li> </ul>
Summary of workshop discussions and way forward by Ms. Nisha Singh, Jt. Secretary, DAE, New Delhi		
Valedictory function by Prof. Shri Rajnikant Patel, RCSC Advisor, GTU		
Distribution of Certificates by GTU		
End of Workshop & High Tea		

## Annexure II: Speakers at the workshop

### Ms. Nisha Singh - IAS

Jt. Secretary, Department of Atomic Energy, GOI, New Delhi

- Ms. Nisha Singh (IAS:HP:1987) born on 02nd November, 1964 is a PG (Political Science), M. Phil (International Relations) and Graduate (Geography, Political Science) with First Position.
- She has 27 years of administrative experience in various Ministries/Departments viz. Land Revenue Management & District Administration, Human Resource Development (Higher Education), Health & Family Welfare, Environment & Forests, Personnel & General Administration, etc. She has worked extensively in area of building of urban infrastructure, e-governance and human resource development. She has published many papers in the area of urban development in India.
- Ms. Nisha Singh has assumed the charge of Joint Secretary, Department of Atomic Energy, Branch Secretariat, New Delhi with effect from 26th September, 2014



### Prof. Dr. P K Tewari

Head, Desalination Division, Bhabha Atomic Research Centre (BARC), Mumbai

- Prof. (Dr.) P.K. Tewari has done his Ph.D. in Chemical Engineering from Indian Institute of Technology (IIT) Bombay (India). He is a Professor in Homi Bhabha National Institute (HBNI) and has over one hundred and seventy (170) research publications to his credit in journals, proceedings, books and encyclopedia. Dr. Tewari is working as Associate Director of Chemical Engineering Group as well as Head, Desalination Division in Bhabha Atomic Research Centre (BARC). He is President of Indian Desalination Association (InDA). He was Chairman of International Nuclear Desalination Advisory Group (INDAG) of International Atomic Energy Agency (IAEA) for the term 2005-08. Presently, Dr. Tewari is Chairman of Technical Working Group on Nuclear Desalination (TWG-ND) of IAEA. His current research interest includes advanced membrane development and applications. Prof. Tewari is a member of several national and international committees. He is an Associate Editor of 'International Journal of Nuclear Desalination' (IJND) and a member of the editorial board of 'Desalination and Water Treatment' journal. He is Editor-in-Chief of 'International Journal of Nuclear Hydrogen Production & Applications' (IJNHPA). Prof. Tewari is recipient of several awards and felicitations including Group Achievement Awards.



**Prof. Shri Rajnikant Patel**

MS (USA) , MBA(USA)

Advisor, Research and Consultancy Services Cell, GTU



- Present Activities
  - National Consultant to KALPASAR INFRASTRUCTURE PROJECT, Government of Gujarat, Gandhinagar
  - Visiting Faculty, CEPT University, Ahmedabad
  - Visiting Faculty, PDPU University, Gandhinagar
  - Chairman I Q Forum for Justice (Registered NGO), Ahmedabad
- Prof. Shri Rajnikant Patel has thirty five years as Global Turnkey Project Consultant and CMD of ECOTECH CONSULTANTS PVT LTD, Ahmedabad.
- He is specialized in development of new Agro Industries, Food Processing, Chemical processing units, and Renewable Energy Projects, Service Sector etc. in India & Africa. He has also arranged Technology Transfer from USA, Europe, and China to Ecotech Projects in India.
- Prof. Shri Rajnikant Patel has received several national and international achievement awards and medals for project Management Consultancy work over 3 decades.

**Dr. Sharad P. Kale**

Associate Director Bio-science Group, BARC Trombay, Mumbai



- Prof. S. P. Kale joined Bhabha Atomic Research Centre in 1976 through 20th batch of Training School after completing his M. Sc. (Microbiology) in Pune University. He joined Biology and Agriculture Division of BARC in 1977 and is working for last 36 years in this Division. Currently he is Head, Nuclear Agriculture and Biotechnology Division. He is also Professor at Homi Bhabha National Institute. The main thrust of Dr. Kale's work has been research and development. He is engaged in research on pesticide degradation and environmental pollution. He has 63 publications in international and national journals. He initiated work on solid biodegradable waste processing in 2001 and has developed NISARGRUNA technology for this purpose. Nisargruna technology offers an effective solution for this purpose. This technology uses a biphasic (aerobic and anaerobic) route for processing the biodegradable resources generated in kitchen, agricultural fields, vegetable markets, abattoirs and food and beverage industries. There are more than 160 such plants functioning in various parts of the country and several more are under construction or commissioning state. He is a member of Sub-committee appointed by Planning Commission for drafting National Funding Policy for Solid Waste Management.
- His work on green synthesis of metal nano particles is an important contribution and has resulted in development of technology which is now ready for transfer. He has also developed and transferred technologies for
  - a. water purification using solar energy

- b. soil organic carbon detection kit
  - c. Inexpensive growth medium for growing Trichoderma and other fungal bio-pesticides
  - d. Nisargruna technology
  - e. Using photo-catalysis for disinfection of drinking water
- He writes popular science articles in Marathi for spreading awareness in the common people. He conducts seminars for teachers, students and farmers regularly in various parts of the country.
  - He has been conferred prestigious civilian award PARMA SHREE for his outstanding contributions in Science and Engineering for the year 2013 by President of India.

### **Prof. Saswat Bandyopadhyay**

Faculty of Planning, CEPT University, Ahmedabad

- Saswat Bandyopadhyay, is a Civil Engineer with advance qualifications in Urban Planning and Infrastructure Management. His ongoing doctoral research work focuses on Climate Change and Urban Vulnerability in India. He is presently a Professor and Head of Infrastructure Planning programme at the CEPT University.
- Saswat Bandyopadhyay has over 22 years of experience in the Urban Development sector in South Asia with a focus on City Development Planning and designing of environmental infrastructure. Since 2007, he has been spear heading urban capacity development activities in several Indian JNNURM cities in India, extending support in City development Planning and Infrastructure prioritization.
- As a Team Leader, he has been involved preparation and appraisals of several city and comprehensive development plans across various regions of India. He has also led the roll out of National Urban Capacity development initiatives such as RTP and RCBH under the JnNURM by Government of India. He has also been involved in several pan-asia pilot initiatives such as Green Cities Toolkit in Asia, Localisation of CIIPP Toolkits in India & Nepal, piloting of Cultural Heritage and Tourism Assets based City Development strategies and Sustainable Tourism Assessment Toolkit for India.
- Prof. Saswat has also worked extensively in the field of Urban Water and Sanitation studies in South Asian as well as cleaning up of lakes and water bodies such as Management of Bhoj Wetlands in Bhopal and East Kolkata Wetlands amongst several others. Prof. Saswat has worked in India, Bhutan, Bangladesh, China, Nepal and in Pacific Island Countries.





**Dr.(Mrs) Rajul K Gajjar**

Dean Research, Gujarat Technological University & Principal, Vishwakarma Government Engineering College, Ahmedabad



**Experience:**

- Teaching structural engineering since 30 years
- Dean of Post Graduate Studies and Research at Gujarat Technological University
- Held various positions as Joint Director of Technical Education with Government of Gujarat; State Project Coordinator for Canada-India Project; State Project Coordinator for World Bank Aided TEQIP-I.
- Besides 36 Technical Papers in International and National Journals and Conferences, authored a book on Mechanics of Solids with McGraw Hill Education.

**Major Projects :**

- Coordinating Research Week since 3 years during which 3000 PG and PhD students of the state are reviewed on their research work, by National and International experts from Foreign Universities, IITs, Central Labs and Industry.
- Started PhD program at GTU with 160 candidates in 1st batch and 130 in 2nd batch.
- Various innovative initiatives such as first Open Book exam and self-study courses for all PhD students.
- Conducted workshops at LDCE, CEPT and BVM on Research Methodology.
- Conducted workshops at LDCE on Effective Teaching and Outcomes Based Curriculum
- Presented papers at AIT Bangkok, Budapest, Hungary and Singapore
- Coordinated TEQIP project

### **Prof. (Dr.) K N Sheth**

Dean of Interdisciplinary Research, Gujarat Technological University & Director, Sardar Patel College of Engineering

- Prof Dr K N Sheth is BE (Civil) 8th in the University, ME (Civil) with a specialization in Environmental Engineering from LD college of Engineering (Gold Medalist of Gujarat University), PhD in Environmental Engineering – adsorption technology
- Prof Dr Sheth is also LL.B (General), LL.B (Special), LL.M (Criminal Law) and PhD in Law (Environmental law) from University School of Law, Gujarat University
- He is also MBA from TIU, USA in Marketing Management, MBA in Information Systems and about to complete his PhD (Management) in Human Resource management this year.
- Dr Sheth worked in Government for 9 years as Executive Engineer (directly through GPSC), 9 years in industry- as Deputy General Manager (Administration) in Reliance Industries, General Manager in Arti Pipes Ltd and reached to the position of CEO – Green Environment Cooperative Society, Vatva
- He then entered Academics as a Head of Post Graduate Department of Environmental Engineering in ISTAR affiliated to Sardar Patel University
- Prof Dr Sheth has been working as a Principal/Director of GTU affiliated colleges since more than 8 years. Presently he is a Director of Sardar Patel College of Engineering, Bakrol.
- He is a Dean – Advancement, Alumni affairs and Interdisciplinary Research including ME and PhD programme of Environmental Engineering in Gujarat Technological University.
- Dr Sheth has guided 71 ME thesis and at present he is guiding 4 PhD students in GTU. He has to his credit, peer reviewed national and international 63 research papers.



### **Dr. B Nagendra Kumar**

Independent Consultant Coastal, Port, Harbour & Hydraulic and Environment Engineer, Chennai

- Dr. B.Nagendra Kumar is in the field of Marine/Coastal/Hydraulic and Environmental Engineering since 1985 through teaching, research and development with basic degree in Civil Engineering covering the areas of port development, channel stability, dredging, coastal protection, hydraulic measurements, marine effluent disposal, pipeline designs for water intake and supply both in coastal and land areas. He provides consulting service to marine water resource project with a dam across Gulf of Khambhat to the Government of Gujarat as a National Consultant. He has a patent for Green SAB Technology to provide coastal protection in all coastal climates by sediment accumulation in beach without interfering the adjacent coastal process significantly. His assignments include beach protection in Gujarat and other parts of Indian Coast and coastal infrastructure like ports. He was associated with a study related to



the development of Karwar Port, Jumeirah Beach Erosion in Dubai, an Asian Development Bank funded project of ANZDEC, New Zealand on Coastal Protection in India, seawater intake and outfall for Fichtner Consulting Services both in India and Sri Lanka, Global EnviroTec as a Senior Marine Advisor, Open channel intake for a power plant in Lebanon, World Bank funded fisheries infrastructure under Tsunami Rehabilitation both in Tamilnadu and Puducherry, Tuticorin port planning and development of inner harbor including traffic studies. His teaching & research experience covers mathematical and numerical, physical and field investigations for field engineering projects. He has a book to his credit titled "Coastal and Harbour Engineering (Indian Scenario)" co-edited by him. Further, he has number of research publications and project report to his credit. He has visited Netherlands, Denmark, England, Israel, Dubai, Denmark, USA, South Korea, and Sri-lanka on professional assignments. He has been professional associated with both Indian and International Association and has been examiner for Ph.d and M.S research degrees of various universities across India.

### **Maulik Joshi**

Manager Projects, SSB Infrastructure Pvt. Ltd., Ahmedabad

- Working with SSB Infrastructure along with Mr. Nirmalya Pandit since last 7 years in the fields of Water Treatment Plants as well as Water Infrastructure Projects.
- Closely working with various government organizations like Urban Development Ministries, Environment Ministries and water resources development departments.



### **Dr. U.K. Sinha**

Scientific Officer 'G', Isotope Production and Applications Division, Bhabha Atomic Research Centre, Mumbai

- Dr. U.K. Sinha has more than two decades in the field of low level measurement of measurement of tritium and carbon-14 and its application in hydrological investigations in conjunction with other environmental isotopes in solving various hydrological problems for societal benefits
- Presently he is Officer-in-Charge Isotope Hydrology Section and supervising all the section activities.
- Dr. U.K. Sinha has published 30 Journals and Symposium.
- **International projects**
  - Principal investigator of IAEA/CRP on "Application of isotope techniques to the assessment of aquifer systems in major urban areas" during 1997 – 2000



- National Project Co-ordinator for IAEA/RCA (RAS/8/084) Regional Project on Isotope Application for Improved Drinking Water Resources Management during 2001-2002
- National Project Co-ordinator for IAEA/RCA (RAS/8/097) Regional Project on "Isotope techniques on groundwater contamination studies in urbanized and industrialized areas" during 2003-2006 cycle
- Conducted IAEA/RCA (RAS/8/097) Regional Training Course on Isotopes and Geochemical Modeling in Groundwater Contamination, Mumbai, India, 03 to 14 October, 2005 as a Course Director

### Shri Pradip Lalla

Director, M/s Sonadka, Asangaon, Maharashtra

- Founder of M/s Sonadka. Pioneered in manufacturing porous plastic components including Filter Candles for Water Purifiers. Other products are Fluidisers, Silencers, Breathers and Carbon Blocks. The filter candle is the base on which the BARC technology has been made. Took the Licence for the BARC technology and started manufacturing in the name of JALTARA. Also took license for the Arsenic Removal Technology and Nano Composite Technology for Domestic Water Purifiers. Supplier to many OEM companies in India.
- Shri Pradip Lalla's topic for today's workshop is "Implementing BARC's technology for Domestic Water Purifier"



### Shri Gajendra kulkarni

Project Executive officer, Rural Human & Resource Development Facility, Department of Atomic Energy - Outreach Centre, Pandharpur, Maharashtra

- Mr Gajendra kulkarni has done his M.Sc in Environmental science from Aurangabad university. After completion of education he has started worked for rural development. He spent his 10 years to promote organic farming in Beed District for farmers. From 2010 he joined AKRUTI program. At present he is working as Project Executive officer at RHRDF, Pandharpur.



### Prof S Mukherjee

Associate Dean- Academics & Head, FCIPT Division , Institute for Plasma Research - An Autonomous Institute of Department Atomic Energy, Gandhinagar

#### Prof. S Mukherjee's major areas of research works are

- Plasma surface engineering
- Understanding fundamental aspects of plasma material interaction
- Development of instrumentation related with plasma surface engineering

#### Awards and special achievements





- Alexander von Humboldt fellowship, Govt. of Germany: Worked with Prof. W. Moeller, Director FWII/FZD - Dresden (Germany) on “Compressive stress control in plasma immersion ion implantation assisted deposited coatings”; visited Germany on Humboldt re-invitation program many times
- BUTI award - 1st recipient; for outstanding contribution in plasma science & technology – 2007; Award given by BUTI Foundation and Physical Research Laboratory
- National Merit Scholarship during Master in Science (M.Sc.) study (1985-1987)
- Member, International Scientific Committee, 5<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup> Asian European International Conference on Plasma Surface Engineering
- Member, SPT Standing Design Review Committee at LPSC, Bangalore
- Member, Programme Advisory Committee, National Fusion Programme: ITER & Beyond Workshop
- Member, International Scientific Committee, 7th Asian European International Conference on Plasma Surface Engineering, September 2007, Nagasaki, Japan
- Chairman, Scientific and Local Organizing Committee, DST-PSSI Interaction Meeting for Popularizing Plasma Sciences in India, April and August 2008
- Member, Planning Committee - SERC School on Plasma Sciences, May 2008-2012, DST
- Sponsored Projects completed/ongoing: DST – 9; ISRO – 3; BRNS – 2; BRFST – 2; DRDO – 1; Private sponsorship - 5
- Referee of Surface and Coatings Technology, Thin Solid Films, IEEE Transactions in Plasma Science, Plasmas and Polymers, Journal Vacuum Science and Technology, Pramana, etc.
- Invited speaker in
  - Asian European International Conference on Plasma Surface Engineering (AEPSE) conference at China
  - Plasma Based Ion Implantation & Deposition (PBII&D) workshops at France and China
  - Asia-Pacific Physics Conference, Japan
  - Several Domestic conferences and symposia

### **Dr. Lalit Varshney**

Radiation Technology Development Division, Bhabha Atomic Research Centre, Mumbai

- Dr. Lalit Varshney joined Isotope Division, Bhabha Atomic Research Centre in 1982 after completing 25th batch training school of BARC. He obtained Masters in Science (Chemistry) degree from University of Delhi and Ph.D from Mumbai University. He is presently, Head Radiation Technology Development Division, BARC and Prof. Homi Bhabha National Institute, Mumbai.
- Dr. Varshney’s contributions in the area of radiation processing of polymers and pharmaceuticals has given a lead to understanding and development of Radiation Processing applications. His work has significantly contributed to growth of pharmaceutical sectors in respect of Radiation Sterilization technology in India and developing countries. Dr. Varshney’s dedicated research work on Hydrogels resulted in the development of technology of ‘Hydrogel Dressing’ which has already been transferred to four companies. He is instrumental in promoting dry sludge hygienisation using Radiation Technology.



Dr. Varshney is currently engaged in the development of advanced materials for medical and environmental applications using radiation technology. Dr. Varshney has about 70 publications, four patents and 4 technology transfers to his credit. Dr Varshney is recipient of prestigious INS award 2004 and BARC Technical Excellence award-2003

### **Shri Vijay Anadkat**

Fellow, EMBARQ-WRI, New Delhi & Doctoral Researcher at Gujarat Technological University

- Vijay has previously worked as City Engineer (Special) and Head, JnNURM at Rajkot Municipal Corporation for more than 22 years. During that, he had been also deputed to UNDP as well as Urban Development Department, Government of Gujarat for three years.
- He has prepared and implemented Rajkot City Development Plan, Rajkot City Mobility Plan, Rajkot Poverty Alleviation Plan, Detailed Project Reports for Rajkot BRTS, Water supply, sewerage and Solid Waste Management. He had also rendered his duty as member secretary for water supply and sanitation projects of Swarnim Jayanti Mukhyamantri Shaheri Vikas Yojana (Golden Celebration Chief Minister Urban Development Scheme) of Gujarat.
- He opted for volunteer retirement from RMC and joined CEPT University Ahmedabad. Here, he has taught infrastructure and transportation planning subjects to the students of Bachelor and Master of planning (Urban and Regional Planning as well Infrastructure Planning).
- He is currently working at the world resource institute as Fellow at its Embarq India program, New Delhi.
- He has bachelors in Engineering, Law and Journalism, Diploma in Local Self Govt., and Master of planning degree in Urban and Regional Planning from CEPT, Ahmedabad.
- Doctoral researcher at Gujarat Technological University



### **Shri G H Trivedi**

Senior Environment Engineer, Gujarat Pollution Control Board, Gandhinagar

- At present he is working as senior Environment Engineer at Head office. He is responsible for a implementation of Bio Medical Waste (Management and Handling) Rules 1998 And Municipal Solid waste (Management and Handling) 2000 rule in Entire Gujarat. He is also looking after policy planning Division of board.
- Shri G H Trivedi has done Civil Engineering from L.D. Collage of Engineering in 1984. He Started his Carrier or Assistant Engineer in Irrigation Dept of Govt. of Gujarat. Later he joined Gujarat Pollution Control Board In 1986. He got regular promotion as Dy. Engineer & Environment Engineer. Based on Performance he was Selected and Promoted in Senior Environment Engineer out of Turn.



- During his tenure he has worked as Regional Officer at Jamnagar, Mehsana and Kuchh. He also worked as Unit Head Vapi & Ahmedabad region at Head Office and Vigilance Office for South Gujarat region.
- In Early 2004, Ahmadabad was declared as 4th most polluted city of the country.
- During his tenure as Unit Head Ahmadabad with the Effective Implementation of Air Action plan, ambient Air quality of Ahmadabad city was improve from RSPM 145 To 86 Mg/Nm3 and ranking of Ahmedabad was Improve from 4<sup>th</sup> to 44<sup>th</sup>.
- Laying of CNG Network in Ahmedabad, Conversion of Entire public Transport like Auto Riksha and city bus on clean Fuel like CNG, Increase the public transport by BRTS, Increase no of City Buses and effective air pollution control in industrial area was the major action points Implemented during those times.

**Prof. Sejal Patel**

Associate professor and Head, B Plan, Faculty of Planning, CEPT University, Ahmedabad

- Associate Professor and the Head of Undergraduate Program in Planning. She has 17 years' experience in professional practice, research, training and teaching during which she has worked with National, State and Local governments, Multilateral Agencies and collaborated with National and International Institutions/ Universities. She focuses on professional practice and research on urban development plans and legislations, urban regeneration and gentrification policies, affordable housing policies, slum redevelopment programs and collaborative and participatory planning. Her research papers have been well received in International Conferences such as APSA, AESOP, AESOP-YA, NAERUS etc. Her ongoing Doctoral Research from University of Twente, The Netherlands is supported by European Union and focuses on participatory planning in urban regeneration processes in cities of the global south. She has been a recipient of international grants for academic and research activities such as Erasmus Mundus, UKIERI etc. She teaches courses on Builtform and Landuse Planning, Urban Development Laws and Legislations, Affordable Housing Project Formulation and studios on Urban Development Plan and Neighbourhood Planning. She has undertaken international studios on Affrodable housing and urban development plans in collaboration with universities in Srilanka, Thailand, Bhutan, Cardiff, etc.

