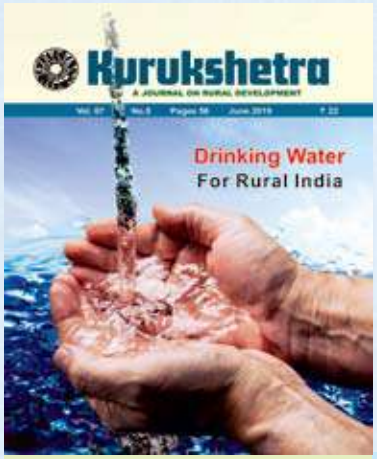


The Monthly Journal
Kurukshetra
MINISTRY OF RURAL DEVELOPMENT
Vol. 67 No. 8 Pages 56
June 2019

EDITORIAL OFFICE
ROOM NO. 653,
Publications Division,
Soochna Bhawan,
C.G.O. Complex, Lodhi Road,
NEW DELHI-110003
Phone : 011-24362859
E-MAIL : kurukshetra.english@gmail.com

FOR SUBSCRIPTION ENQUIRIES, RENEWALS AND AGENCY INFORMATION
PLEASE CONTACT:
JOURNAL UNIT, PUBLICATIONS DIVISION
MINISTRY OF I & B, ROOM NO. 48-53,
SOOCHNA BHAWAN, CGO COMPLEX,
LODHI ROAD, NEW DELHI-110 003
TELE : 24367453
FAX: 24365610
E-MAIL : pdjucir@gmail.com
WEBSITE : publicationsdivision.nic.in

For Online Sale, please log on to bharatkosh.gov.in/product, and for e-books, please visit Google Play, Kobo or Amazon.

SUBSCRIPTION* :
INLAND
1 YEAR : ₹ 230
2 YEARS : ₹ 430
3 YEARS : ₹ 610
ABROAD (AIR MAIL)
ONE YEAR
₹ 530 (SAARC COUNTRIES)
₹ 730 (OTHER COUNTRIES)
* REVISED FROM APRIL 2016 ISSUE ONWARDS

CONTENT

Sales Emporia : Publications Division: *Soochna Bhavan, CGO Complex, Lodhi Road, New Delhi -110003 (Ph 24365610) *Hall No.196, Old Secretariat, Delhi 110054 (Ph 23890205) * 701, B Wing, 7th Floor, Kendriya Sadan, Belapur, Navi Mumbai 400614 (Ph 27570686)*8, Esplanade East, Kolkata-700069 (Ph 22488030) *'A' Wing, Rajaji Bhawan, Basant Nagar, Chennai-600090 (Ph 24917673) *Press road, Near Govt. Press, Thiruvananthapuram-695001 (Ph 2330650) *Room No.204, IInd Floor, CGO Towers, Kavadiguda, Hyderabad-500080 (Ph 27535383) *1st Floor, 'F' Wing, Kendriya Sadan, Koramangala, Bangalore-560034 (Ph 25537244) *Bihar State Co-operative Bank Building, Ashoka Rajpath, Patna-800004 (Ph 2683407) *Hall No 1, 2nd floor, Kendriya Bhawan, Sector-H, Aliganj, Lucknow-226024 (Ph 2325455) *Ambica Complex, 1st Floor, above UCO Bank, Paldi, Ahmedabad-380007 (Ph 26588669) House No. 4, Pension Para Road, Post Office - Silpukhuri, Guwahati -781003 (Ph 2665090)

Editorial

Supply of good quality water in sufficient quantities and safe sanitation practices in rural areas are interconnected with the health and economic well-being of the people. Water is not only required for drinking and cooking but also to maintain hygiene.

The Sustainable Development Goals 2015-2030, include Goal 6, which emphasizes upon the importance of ensuring availability and sustainable management of water and sanitation. This also in a way means 'leaving no one behind' in terms of access to safe water which was also the theme of this year's 'World Water Day' observed on 22nd March.

The Government has been focusing on ensuring safe drinking water to the rural population. Significant measures have also been taken from time to time to meet the challenges that this sector is facing. Grants have been provided for construction of rural water supply schemes and groundwater recharge measures have been undertaken in addition to addressing the operational and maintenance aspects. Other measures include rainwater harvesting which is one of the most important initiatives that can help in a sustained supply of safe drinking water in rural areas. Plans have been envisaged for the construction of artificial recharge and rainwater harvesting structure in rural areas. There are many success stories in India which draw upon our ancient traditional knowledge and wisdom. One such success story is from Rajasthan where the revival of traditional rainwater harvesting structures occupies considerable importance in the policy framework.

People and organizations engaged in the drinking water sector need to be sensitized to the change in their role and responsibilities in order to cope with various critical issues facing this sector. Knowledge, skills and attitudes need to be improved through continuous professional development and capacity building by sector specialists. In terms of the critical issues for drinking water such as source sustainability, water quality management and better operation and maintenance, it is important that strong grassroots awareness is generated. More participatory processes need to be adopted to involve all sections of the community for providing water services.

This issue of Kurukshetra also covers two articles on Yoga describing various aspects of this ancient psycho-spiritual discipline. As we all know International Day of Yoga is observed on 21st June every year. The worldwide acceptance of Yoga is a matter of pride for the whole nation, as Yoga is an integral part of our cultural and spiritual heritage. Yoga is essentially a spiritual discipline based on an extremely subtle science which focuses on bringing harmony between the mind and body. Yoga, an art and science for healthy living, is gaining increasing relevance in the present times.

ENSURING SAFE AND ADEQUATE DRINKING WATER

Dr. Harender Raj Gautam

Rainwater harvesting is one of the most important initiatives which can help in a long way in sustaining the supply of safe drinking water in the rural areas. The Central Government is working on a master plan envisaging construction of about 23 lakh artificial recharge and rainwater harvesting structures in rural areas and 88 lakh in urban areas. The Central Ground Water Board has prepared a conceptual document entitled 'Master Plan for Artificial Recharge to Ground Water in India'.

In India, the provision of clean drinking water has been given priority in the Constitution, with Article 47 conferring the duty of providing clean drinking water and improving public health standards to the State. United Nations Conference on Environment and Development (UNCED) has rightly themed this year's Water Day as 'leaving no one behind'. This goes on par with the promise on the 2030 Agenda for Sustainable Development. The Sustainable Development Goals 2015-2030, a successor to Millennium Development Goals, include Goal 6 for clean water and sanitation for ensuring their availability and sustainable management. Goal 6.1 specifically says that by 2030, countries including India should 'achieve universal and equitable access to safe and affordable drinking water for all'. According to global reports released by the United Nations, 2.1 billion people live without safe drinking water at home and 80 per cent of those who have to use unsafe and unprotected water sources, reside in rural areas. Further, more than 700 children under five years of age die every day from diarrhoea due to unsafe water and poor sanitation. This report also makes a mention that in eight out of 10 households, women and girls are responsible for water collection. Nearly two-thirds of the world's population experiences severe water scarcity at least for 31 days per year. The intense impact of water scarcity could displace 700 million people by 2030.

Water consumption of the world is doubling every 20 years, which is more than twice the rate of increase of our population. Central Water Commission estimated that only about 1,123 km^3, (690 km^3 from surface water and 433 km^3 from groundwater) can be used due to topographical constraints and spatio-temporal variations in resources. In India, due to a 3-fold increase in population during 1951–2010, the per capita availability of water in the country as a whole decreased from 5,177 m^3/ year in 1951 to 1,588 m^3/ year in 2010.

Water Availability in the Rural Areas

India is among the world's most water-stressed countries. In 1950, India had 3,000–4,000 cubic meters of water per person. Today, this has fallen to around 1,000 cubic meters, largely due to population growth. Water resources are not evenly distributed. Half of India's annual precipitation falls in just 15

rain-soaked days, making floods and droughts a fact of life in the country. Rural India has more than 700 million people residing in about 1.42 million habitations spread over diverse ecological regions. According to the National Sample Survey Office (NSSO) (2011-12), about 88.5 percent households in rural India had improved source of drinking water and among these, 85.8 percent had sufficient drinking water. Further, 46.1 per cent of the rural households do not have drinking water facilities within their premises. A person in rural India has to spend, on an average, 20 minutes to fetch drinking water. The country has already spent an estimated Rs. 1,105 billion on providing safe drinking water since the First Five Year Plan launched in 1951 yet thousands of crore are still spent on controlling water-borne diseases, indicating that the problem needs to be addressed from different perspective. India loses 73 million working days due to water-borne diseases.

Government Initiatives

Supply of potable drinking water has been a top priority of Central and State Governments. Constant efforts have been made in this direction starting from the Bhore Committee in 1946 to Accelerated Rural Water Supply Programme (1972), and 'Swajal Dhara' scheme (1999) by empowering and involving local communities in tackling water and sanitation issues. In 1981, Government of India launched the international Water Supply and Sanitation Decade (81-90) Programme with one of the targets being 100 per cent coverage of rural and urban population with safe drinking water supply facilities. To supplement this effort, Technology Mission for drinking water was set up in 1986 which was renamed as Rajiv Gandhi National Drinking Water Mission in 1991. Again in 1999, the Department of Drinking Water Supply was created in the Ministry of Rural Development. Then came 'Bharat Nirman', a flagship programme of the Central Government which created the required infrastructure to have good quality water to rural households. Rural drinking water was one of the six components of Bharat Nirman. During Bharat Nirman period, 55,067 un-covered and about 3.31 lakh slipped-back habitations were to be covered with provisions of drinking water facilities and 2.17 lakh quality-affected habitations were targeted to be addressed for water quality problem.

Now, the task of providing safe drinking water in rural areas is through the National Rural Drinking Water Programme (NRDWP) which aims at assisting States in providing adequate and safe drinking water to the rural population in the country. In 2018-19, the scheme was allocated Rs. 7,000 crore and the Ministry is aspiring to achieve 'Har Ghar Jal' by 2030, in line with the UN's Sustainable Development Goals. In Financial Year 2019-20, Central Government allocated Rs. 8,201 crore for NRDWP. This is a 49 per cent increase from FY 2018-19. Source of drinking water assumes great significance as it should be sustainable. Earlier, drinking water to the rural population has been provided through hand pumps, tube wells and piped water supply but now the thrust area is piped water supply, preferably through a balanced mix of sustainable surface and ground water based resources. In 2011, the Ministry came out with a strategic plan for the period 2011-22. The plan identified certain standards for coverage of habitations with water supply, including targets for per day supply of drinking water. NRDWP now targets providing rural populations with 40 litres of water daily to cover domestic uses. On this measure, water coverage has increased from 70 per cent in 2011-12 to 81 per cent now. However, in 2012, the

target was increased to 55 lpcd (litres per capita per day), more than the World Health Organization's recommended amount of around 50 lpcd. As on 31 December 2018, 79 per cent of rural habitations had been covered at 40 lpcd but only 47 per cent at 55 lpcd. Till 6 January 2019, 18 per cent of rural households had been provided with Piped Water Supply (PWS) household connections. There is also significant variation in piped water coverage across States. Some States such as Gujarat, Sikkim and Himachal Pradesh have provided piped water to more than half of the rural households, while others such as Uttar Pradesh and Bihar have minimal (less than 5 per cent) piped water coverage. Himachal Pradesh government has spent the most on water supply and sanitation over the last eight years (in terms of the share of state government spending), according to data from PRS Legislative Research. The Central Government aims to cover 90 per cent rural households with piped water supply and 80 per cent rural households with tap connections by 2022. A pilot project in the name of "Swajal" that is designed as a demand driven and community centred programme to provide sustainable access to drinking water to people in the rural areas. Swajal was originally launched as a pilot scheme in February 2018 in six States of Bihar, Maharashtra, Madhya Pradesh, Uttar Pradesh, Uttarakhand and Rajasthan. Later, it was extended to all the 112 aspirational districts identified by NITI Aayog.

The Central Government has also come up with a ₹6,000-crore World Bank-aided Atal Bhujal Yojana with community participation to ensure sustained groundwater management in overexploited and ground water-stressed areas in seven states. It has been found that 1,034 blocks out of the 6,584 assessed blocks in the country are overexploited.

The quality of water supplied is also a major issue. According to one study in The *Lancet*, 105,000 children lost their lives in 2015 to water-induced diarrhoea. Official NRDWP data reveals that around 60,000 of all habitations are exposed to water contaminated by arsenic and fluoride. In March 2017, MDWS started a new sub-programme under NRDWP known as the National Water Quality Sub-Mission (NWQSM). The sub-programme aims to address the urgent need for providing clean drinking water in already identified 28,000 arsenic and fluoride affected habitations. Between FY 2017-18 and 2020-21, it is estimated that Central Government will provide Rs. 12,500 crore for the scheme. These funds will be taken from the water quality component of overall NRDWP allocations. To enable the rural community shoulder the responsibility in management, operation and maintenance of water supply systems at village level, decentralized, demand-driven, community-managed approach in the form of Swajal Dhara have been adopted. To further strengthen community participation in the drinking water sector for sustainability, National Rural Drinking Water Quality Monitoring & Surveillance Programme has been launched in February, 2006 under which 5 persons in each Gram Panchayat are to be trained to carry out regular surveillance of drinking water sources for which 100 per cent financial assistance including water testing kits, are provided by the Government.

Challenges and Future Initiatives

According to a recent report by the Britain-based charity WaterAid, nearly 163 million of India's population lack access to clean water close to home. As per the report submitted by the Committee on Restructuring the Central Water Commission (CWC) and the Central Ground Water Board (CGWB), 2016 if the current pattern of demand continues,

about half of the demand for water will be unmet by 2030. In addition, climate change poses fresh challenges as more extreme rates of rainfall and evapotranspiration intensify the impacts of floods and droughts. Moreover, 60 per cent of our districts face groundwater over-exploitation and with 251 cubic kilometre (cu km) annual groundwater extraction rate, our country is the world's biggest consumer of groundwater.

We need many initiatives to counter the challenges in our way, to achieve our goals. Rainwater harvesting is one of the most important initiatives which can help in a long way in sustaining the supply of safe drinking water in the rural areas. The Central Government is working on a master plan envisaging construction of about 23 lakh artificial recharge and rainwater harvesting structure in rural areas and 88 lakh in urban areas and the Central Ground Water Board has prepared a conceptual document entitled 'Master Plan for Artificial Recharge to Ground Water in India'. There are many success stories in India which draw their success from our ancient traditional knowledge and wisdom. In 2001, the Tamil Nadu government made it compulsory for each household to have rainwater harvesting infrastructure and the results are now reflected in the improvement of overall water quality within 5 years. A similar experiment has been tried out in the cities of Bangalore and Pune, where housing societies are required to harvest rainwater. There are number of such initiatives in Uttarakhand, Kerala, Himachal Pradesh, Rajasthan, Gujarat, Maharashtra, Karnataka and other States. The efforts by local communities in India to improve water availability have been lauded in a UN report that highlights the importance of finding nature-based solutions to meet global water challenges. The report notes that reservoirs, irrigation canals and water treatment plants are not the only water management instruments at disposal. It also cited the example of China's Sponge City which aims to recycle 70 per cent of rainwater." According to this report the collective water storage efforts have benefitted Kadwanchi village in Jalna district in Maharashtra to go in for high value crops such as grapes, ginger and chillies. The 455 families have nearly 600 wells. The villagers also built nine check dams apart from desilting nearly 25 km of stream. In the past, villagers have created 347 farm ponds and added 40 more in 2017 to store monsoon water. The report highlights the importance of beris, traditional system of harvesting rainwater, that have been working as lifesavers for both humans and animals in parts of western Rajasthan for centuries. Shaped like matkas (pitcher), these shallow wells are dug up in areas with gypsum or bentonite beds which prevent the rainwater from percolating downwards but guide them towards the wells through capillary action. Last year, Ramgarh and its surrounding villages hardly received any rain. But even then, these beris are fully charged.

Overexploitation of ground water is a major concern in India. There is need for regulatory mechanism by the State governments to check the overexploitation of this resource. Excess digging of wells should be avoided or restricted in severely affected areas. There is need for more role of Panchayati Raj Institutions (PRIs) in making the drinking water supply schemes functional. Presently, the role of PRIs is minimal. Partnership between village communities, NGOs and the government as the facilitator and co- financing has worked successfully. Empowerment of PRIs with more resources is a viable and sustainable option for scaling up the decentralized service delivery model. We need to remember that to widen the access and availability of drinking water in rural areas, we need to make every effort to preserve and use the water judiciously with active participation of the village communities.

(The author is Professor and Head, Department of Plant Pathology, Dr. Y.S. Parmar University of Horticulture and Forestry, Himachal Pradesh)
E-mail: hrg_npp@yahoo.com)

COMMUNITY PARTICIPATION AND QUALITY DRINKING WATER SUPPLY

Dr. K. K. Tripathy

Central and State governments need to provide timely and adequate technical and financial support and an enabling environment for PRIs and local communities like SHGs and Cooperatives to manage and monitor the rural drinking water sources and systems at the local level to achieve the objective of 'har ghar jal'. A shift in approach is required to 'area-specific development interventions' from 'universalization of programmes/schemes'.

The large magnitude of India's rural population, their socio-economic conditions and the quality of their life call for all-round development in rural infrastructure, to achieve the long-cherished objectives of equitable and inclusive growth. An important component of rural infrastructure is drinking water arrangements. Water is undoubtedly an important public good. To meet the demands of the citizens, increased public investment is required for the creation of water infrastructure. A water-secure nation will not only provide clean and safe drinking water to its citizens but also would ensure a healthy and economically productive society. However, meeting the drinking water needs of India's vast rural population has been a daunting task due to the lack of installed drinking water supply capacities, low level of socio-economic development, education and awareness about the access and usage of water.

Article 47 of the constitution mandates states to provide safe drinking water to improve public health. The provision of clean drinking water reduces the incidences of diseases and fatalities and helps in improving the overall standard of living. Provision and access to clean and safe drinking water and sanitation are vital to improving the overall health of the country's billion-plus population.

Schematic interventions:

In 1949, the Bhor Committee [Environment Hygiene Committee] advocated for the provision of safe water supply to cover 90 per cent of India's

population within a timeframe of 40 years. The first-ever formal schematic intervention was initiated with the implementation of the Accelerated Rural Water Supply Programme (ARWSP) during 1972-73. While ARWSP aimed at speeding up coverage of drinking water supply, its approach towards last-mile delivery got modified by the introduction of the National Drinking Water Mission (NDWM) in 1986. The first-ever National Water Policy was drafted in 1987 to give a concrete direction to the approach adopted to create sustainable water infrastructure. In 1991, Rajiv Gandhi National Drinking Water Mission replaced NDWM. In 1994, the 73rd constitutional amendment incorporated specific provisions of entrusting the responsibility of drinking water supply to Panchayati Raj Institutions (PRIs). Initiatives of Government of India (GOI) witnessed scaling up of water sector reforms and the implementation of the Swajaldhara scheme to fulfill the Millennium Development Goal commitment on sustainable access to safe drinking water. Swajaldhara accorded priority to serving villages which did not have an adequate source of water. The period 2005-2012 witnessed the implementation of Bharat Nirman programme during which the National Rural Drinking Water Programme (NRDWP) was launched in 2009. The objective of NRDWP was to cover all rural habitations with safe drinking water. With effect from 2016, NRDWP was transformed into an outcome-oriented schematic intervention to ensure adequate potable water availability without undermining the importance of convenience, affordability and equity in distributing drinking water in rural areas.

Rural Drinking Water Supply Coverage:

The target for providing access to drinking water to identified habitations was achieved well before March 2012 under the Bharat Nirman programme. The strategy adopted to cover uncovered habitations [which included both 'not covered' and 'partially covered' habitations] was to ensure that the rural population gets at least 40 litres per capita per day (lpcd) of safe water from sources lying within the village or nearby. Post 2012, under restructured NRDWP, the focus shifted to improving the quality of water supplied to targeted habitations. Data regarding coverage of safe drinking water in rural areas is estimated in terms of fully covered habitations [i.e. More than 40 lpcd or more safe drinking water], partially covered

habitations [i.e. Less than 40 lpcd] and quality affected habitations [i.e. Water with chemical contaminant]. Government of India data indicate that around 80.61 per cent of rural habitations have been provided with 40 lpcd or more and 15.8 per cent of rural habitations get less than 40 lpcd. Drinking water coverage status of rural habitations between 2012-13 and 2018-19 [table 1] indicates that 13.85 lakh habitations out of 17.19 lakh rural habitations have been fully covered under NRDWP and 2.72 lakh habitations are partially covered.

Table 1: Drinking Water Coverage Status of Rural Habitations: 2012-13 to 2018-19

Year	Fully Covered	Partially Covered	Quality Affected	Total
	in Nos			
1	2	3	4	5
2012-13	11,61,018 (68.6 per cent)	4,48,439 (26.5 per cent)	82,794 (4.9 per cent)	16,92,251 (100 per cent)
2014-15	12,10,199 (74.2 per cent)	3,76,343 (21.9 per cent)	66,761 (3.9 per cent)	17,13,303 (100 per cent)
2016-17	13,25,302 (76.8 per cent)	3,26,005 (18.9 per cent)	74,724 (4.3 per cent)	17,26,031 (100 per cent)
2018-19 (till Feb'2019)	13,85,853 (80.6 per cent)	2,72,147 (15.8 per cent)	61,309 (3.6 per cent)	17,19,309 (100 per cent)

Notes: (1) Status is based on service norms of delivery of 40 lpcd
(2) Figures in parentheses are percentages to total
Source: Ministry of Drinking Water and Sanitation, GoI

Water Quality Issues

The status of coverage of drinking water in rural habitations registered an increase of 6.9

percentage points in the fully covered category and decrease of 5.9 percentage points (**Table 2**) between March 2014 and February 2019.

Table 2: Drinking Water Coverage Status of Rural Habitations in 2019 vis-à-vis 2014

Coverage of habitations as on March 2014 (in per cent)			Coverage of habitations as on February 2019 (in per cent)		
Fully Covered	*Partially Covered*	*Quality Affected*	*Fully Covered*	*Partially Covered*	*Quality Affected*
1	2	3	4	5	6
73.7	21.7	4.6	80.6	15.8	3.6

Source: Ministry of Drinking Water and Sanitation, GoI

Even though GoI data shows the coverage of 80.6 per cent (17.19 lakh) of rural habitations with drinking water, it indicates neither the average actual supply of drinking water over a considerable period nor the quality of water being supplied through the installed capacities in rural areas. Further, drinking water sources depend on ground water sources. Thus, there is every possibility of slipping back from 'fully covered' to 'partially covered' or 'quality affected'. This calls for an integrated quality monitoring and surveillance mechanism at the level of community.

Studies indicate that the ever-growing dependence on groundwater and its unsustainable over-extraction are lowering the ground water table and adversely impacting the quality of rural drinking water supply. The erstwhile Planning Commission had found that between 1995 and 2004, the proportion of unsafe districts (semi-critical, critical and overexploited), the proportion of area affected and population affected had grown from 9 per cent to 31 per cent, from 5 per cent to 33 per cent and from 7 per cent to 35 per cent, respectively (Planning Commission, 2010). The quality of water is deteriorating in rural areas due to the following major factors:

(a) Rapid depletion of ground water level due to over extraction by Agriculture and Industry sectors;

(b) Uncontrolled construction activities in rural areas and encroachment of the erstwhile water bodies;

(c) Siltation of rural water bodies and reduction of water bodies;

(d) Erratic rainfall and droughts or drought-like conditions;

(e) Water pollution due to incessant and increased use of pesticides, fertilizers and effluents coming from industry.

A study of quality affected habitations by category of contaminants shows that as many as 4.07 crore rural population are suffering from water contamination that varies from fluoride, arsenic, iron, salinity, nitrate, heavy metals, etc. (**Table 3**).

Table 3: Number of Quality Affected Rural Habitations and Population in India by Categories of Contaminants (As on 1st January 2019)

SN	Category of Contaminants	Habitations Affected	Population Affected
1	2	3	4
1	Fluoride	9,655	70,45,578
2	Arsenic	15,795	1,38,60,780
3	Iron	18,939	1,22,56,075
4	Salinity	13,494	36,62,305
5	Nitrate	1,562	15,50,958
6	Heavy Metal	2,106	24,13,001
Total		**61,551**	**4,07,88,697**

Source: Rajya Sabha Unstarred Question No. 2748 answered on 07/01/2019, available at https://rajyasabha.nic.in

Community & Water Quality Management

The community's involvement enhances the economic viability of operation and maintenance, better upkeep due to inherent community belongingness and also increases the life span of the system so created. Under the 73rd Constitutional Amendment, Gram Panchayats have been assigned

Community Water Management through Special Purpose Vehicle – A Success Story

Drying up water sources, rapid reduction of ground water table, recurring droughts and deteriorating water management in the State, prompted Gujarat Government to create a special purpose vehicle, Water and Sanitation Management Organisation (WASMO) in 2001. WASMO – an autonomous entity aimed at facilitating community managed drinking water facilities in rural areas of Gujarat.

WASMO, which believed in building partnerships and working with communities, marched towards attaining sustainability by adopting a demand-driven community-led cost sharing service approach to assure safe drinking water availability at the doorstep. The thrust is on capacity building and empowerment of Pani Samiti (Village Water and Sanitation Committee) towards planning, execution and maintenance of village level water supply infrastructure such as underground sumps, elevated storage reservoirs, stand-posts, pipelines, bathing and washing facilities and cattle troughs. The community is involved in recharging both traditional and other existing water structures by utilising both local and modern technical knowledge. Rainwater harvesting has become the rule for recharging the local water supply sources. WASMO focuses on bulk transfer of water from water-surplus south Gujarat to water-deficient north Gujarat, Saurashtra and Kutchh through canal and pipeline systems to supplement the local sources. As in 2018, WASMO has taken up 20,808 water projects under NRDWP and successfully completed 17,662 across 33 districts. It has vastly contributed to the State Government's drive for reforms and extensive community engagement in a mission mode. The relentless work to ensure sustainable safe drinking water in Gujarat's rural areas was bestowed the 2010 Commonwealth CAPAM International Award.

Source: www.wasmo.org

planning and managing rural water supply and sanitation systems as one of their prime duties.

Community has an important role in maintaining not only hygiene near the drinking water sources, but also in improving the ways and means by which water is collected and stored to avoid contamination during collection, storage and use. In order to arrest problems of arsenic and fluoride contamination in drinking water, NITI Aayog had recommended commissioning of community water purification plants and advocated for last mile connectivity of piped water supply schemes in 2016. In 2017, GoI launched the National Water Quality Sub-Mission to provide safe drinking water to 27,544 arsenic/fluoride affected rural habitations in a span of four years. The effective implementation of these schemes demands active engagement of community through PRIs, Self-Help Groups (SHGs) and Cooperatives in rural areas.

Government of India aims at providing safe drinking water to 90 per cent of rural population through surface water based piped water supply schemes by 2022 as a long-term sustainable solution. Further, it has outlined a strategic goal 2017-2030 to achieve '*Har Ghar Jal*' by 2030. This is attuned with the United Nations (UN) Sustainable Development Goal (SDG)-2030. The community through PRIs needs to take up responsibility of being programme implementing agencies (PIAs) not only to plan and install drinking water projects and extract water for drinking purposes but also to treat the same, wherever required, to eradicate contamination and improve its quality as per the specified standards before supplying to the rural households.

- The community should ensure the following to provide safe drinking water in each rural habitation:
- Social mobilization, initiation of need analysis, preparation of water security plan and village action plan;
- Discuss and deliberate on sustainability of drinking water schemes, explore new revenue sources like user fees, operation and maintenance fees, etc. for smooth operation and maintenance of water systems;

- Prepare water safety plan to ensure water quality;
- Ensure convergence with line departments of district to plan and execute water conservation projects under PMKSY, MGNREGA, etc. to ensure water recharge and increased water availability in rural areas;
- Set up technical support cells in consultation with the District/Block administration to ensure convergence in the community and near the project areas;
- Coordinate with District/Block level authorities for promoting timely execution of water projects and fund utilization towards improving household water connections, operation and maintenance of piped water scheme activities and other water supply systems;
- Coordinate with District/Block level authorities for adopting technologies and digital medium for monitoring of water schemes;
- Arranging social audit of water schemes from time to time in consultation with district line department officials;
- Arrange training and capacity building programmes on water collection, storage and usage for grass root workers like ASHA workers, *Anganwadi* workers, science teachers, high school girl children, panchayat members, retired army officials, etc.;
- Conduct periodic sanitary survey;
- Monitor water availability, water sources and quality of water and arrange awareness camps;
- Ensure availability of water testing kit for each Gram Panchayat and regular testing of water in accredited labs;
- Training a few educated community volunteers on monitoring parameters of the water system installed in the locality and disseminate in the community for better monitoring of schematic interventions.

Conclusion:

Central and State Governments need to provide timely and adequate technical and financial support and an enabling environment for PRIs and local communities like SHGs and cooperatives to manage and monitor the rural

drinking water sources and systems at the local level to achieve the objective of '*Har Ghar Jal*'. A shift in approach is required to 'area-specific development interventions' from 'universalization of programmes/schemes'. An independent mapping of development status at frequent intervals is the need of the hour to identify localities within the community itself with greater developmental issues relating to supply of safe drinking water. This would facilitate planning and execution of area-specific strategies to improve quality water supplies to rural households and facilitate achieving long-term goals of the government.

The major challenge before the government is to ensure (a) safe drinking water in the slipped-back habitations through vigorous restoration of defunct bore pumps, carrying out repairs of water supply pipelines, augmentation of supply wherever required; and (b) sustainability of quality water supply to areas covered under government programmes. The need of the hour is to go for a rigorous convergence drive of GoI's various rural development programmes, such as Mahatma Gandhi National Rural Employment Guarantee Act, Pradhan Mantri Krishi Sinchayee Yojana, other schemes for watershed development and restoration of water bodies, etc., backed by a need-based village-level water planning.

(The author is Director, Vaikunth Mehta National Institute of Cooperative Management, Ministry of Agriculture and Farmers Welfare.
Email: tripathy123@rediffmail.com)

TECHNOLOGY INNOVATIONS FOR SAFE DRINKING WATER SUPPLY

Dr. Manish Mohan Gore

Both human activities and natural processes cause water contamination. The technology used will depend on current water quality, future requirements and economics. The technology for water treatment removes contaminants that may be organic, physical or chemical in nature. Diverse water treatment technologies are available to clean and make contaminated water suitable for human consumption by removing unwanted chemicals or biological contaminants.

Once India's villages had rich sources of water and the villages were the hubs of the traditional knowledge of water conservation. Appropriate technologies and innovations can play a pivotal role in making available safe and clean drinking water to the rural population in our country. If technologies and innovations are equipped with the insight of traditional knowledge system of India, then drinking water supply in rural parts of the country can be realized. A rational approach is also essential to achieve this goal.

Availability of Safe and Clean Water

According to the World Health Organization, 84 per cent of Indians who don't have access to clean water and sanitation live in rural communities. As per the review of the Millennium Development Goals done by the United Nations, out of the 35 Indian states, only 7 have achieved full coverage of having a safe water source for their villages. Ground water in most cities and around 19000 villages contains fluorides, nitrates, pesticides, etc. beyond the permissible limits. Drinking water quality thus remains an issue and this reflects the fact that approximately 21 per cent of communicable diseases are waterborne and 75 per cent of water-related deaths are of infants under five years.

Water is essential for plants, animals, humans and other life forms on the Earth. Growing human population has created many challenges to environment and the existence of different living organisms. Environment and its major components such as air, water and soil are facing the pressure of human population. Pollution is a prominent and adverse outcome of increasing human population.

The decline in groundwater levels, contamination of water sources and increased consumption are some big problems related to water resources. In such a scenario, availability of safe, clean and affordable water is a big challenge.

The provision of safe drinking water and improvement of sanitation services to the disadvantaged and excluded were seen by developing countries around the world as the most challenging task. Inappropriate coverage, poor

quality and unreliable and unsustainable water supplies have an adverse effect on socio-economic development of these countries. In addition, it is not sufficient to guarantee safe water alone if people do not have proper sanitation facilities or develop good hygiene practices, because diseases cannot be propagated by water contamination alone but also by other means. UNICEF estimates the contribution of water-related diseases to almost 4 million child deaths each year globally. Millions of people around the world suffer from water and sanitation-related disease, mostly in developing countries.

It has become increasingly obvious that a new approach must be evolved in order to provide better service to vulnerable sections of society. Instead of being supply-led, the new approach should be demand-responsive. The selection of appropriate technological options and judgment at the required level of service are essential elements of this new approach. The community should be empowered to make informed choices about the services that it wants and is willing to pay for.

India has the world's largest rural drinking water scheme serving some 1.6 million dwellings spread across 15 different environmental regions and 74.2 crore people. In 1999, steps were launched to institutionalize the Community's participation in the implementation of rural potable water schemes through the sector reform project, as part of the National Water Policy, in order to ensure the sustainability of systems.

Water Quality: A Major Concern

Water quality has emerged as a major issue in the rural drinking water supply. The Government has launched the National Rural Drinking Water Quality Monitoring and Surveillance Programme, which institutionalized the community participation of district and state-level laboratories for the monitoring of drinking water sources at the grassroot level through Gram Panchayats. The States implement systems for drinking water supply schemes.

Many public authorities are involved in the supply of rural water. Central Water Commission (CWC) regulates the use of water to irrigate surface waters, the industry and potable water. It also mediates in disputes related to the inter-state water allocation. Central Groundwater Board (CGWB) monitors groundwater levels and rates of depletion and the production of water resource inventories and maps. National Rivers Conservation Directorate (NRCD) oversees the implementation of Action Plans to improve the quality of the rivers in India. Central Pollution Control Board (CPCB) promotes basin-wide pollution control strategies. It liaises with State Water Pollution Control Boards for laying down standards for the treatment of sewage

and effluents. The Board is also responsible for action in the case of non-compliance by agencies. The Ministry of Drinking Water and Sanitation is the nodal ministry for the overall policy, planning, funding and co-ordination of the National Rural Drinking Water Programme (NRDWP) for rural drinking water supply in the country. Ministry of Agriculture (MoA) deals with planning, formulation, monitoring and reviewing of various watersheds based developmental project activities. Central Bureau of Health Intelligence (CBHI) performs the collection, compilation, analysis and dissemination of the information on health conditions in the country. Bureau of Indian Standards (BIS) is responsible for the drafting of standards pertaining to drinking water quality.

The World Bank and UNICEF sponsored study shows that not only drinking water in rural India is insufficient but it has a high degree of imbalance and is very diverse across the country. Access to water has been mainly considered important and therefore the issue of water quality remains secondary.

In our country, groundwater is the major source of water and around 85% of the population is dependent on it. Remaining 15 per cent of the rural water supply comes from surface water sources. Though groundwater is less vulnerable to pollution as compared to surface water, the nature of the quality issue in groundwater is of two types. Firstly it is inherent in the form of contamination caused by the nature of the geological formation, e.g. excess fluoride, arsenic, brackishness, iron, etc. Secondly, groundwater pollution is caused by human intervention, such as the intervention of chemical fertilizers. The major causes for chemical and bacteriological contamination are poor hygienic conditions around the water sources, indiscriminate use of chemical fertilizers used in the agricultural sector, improper disposal of sewage and industrial waste water, pollution from industrial effluents (untreated), overpopulation and lack of public awareness.

Technology interventions for Drinking Water

The technology must be simple enough to undertake the task of operation and maintenance smoothly by the rural community itself. The design of hand pumps is very important for

better performance efficiency. The substantial improvement in hand pump technology has already taken place, but there is a scope for further improvement.

Both human activities and natural processes cause water contamination. The technology used will depend on current water quality, future requirements and economics. The technology for water treatment removes contaminants that may be organic, physical or chemical in nature. Diverse water treatment technologies are available to clean and make contaminated water suitable for human consumption by removing unwanted chemicals or biological contaminants. The Central Pollution Control Board (CPCB) established the use-based classification of surface waters in India.

Water treatment plants use technology that is both chemical and biologically safe and attractive in terms of colour, smell and taste. Below are some of the prevalent technologies for water purification & treatment.

- Capacitive deionization (CDI), is a technology in which a separator channel (with a porous electrode on each side) removes ions from water;
- Ozonation technique is based on the ozone infusion into the water for chemical water treatment;
- In Ultraviolets technology, ultraviolet light is used to kill micro-organisms of water;

- A large majority of contaminants are removed in reverse osmosis (RO) technology through a semi-permeable membrane;
- TERAFIL is a burnt red clay porous media used for filtration & treatment of raw water into clean drinking water. This technology has been developed by the Council of Scientific & Industrial Research (CSIR);
- OS-Community scale Arsenic Filter is an organic arsenic filter which is developed by the IIT Kharagpur;
- Filtration methods that may include rapid/slow sand filters which remove rust, silt, dust and other particulate matter from water and
- Solar water purification systems.

The method of filtration of domestic drinking water will vary depending on the purification method used, the required level of ' cleanliness ' or the type of water pollutants. No technology will satisfy all criteria. Some of the more popular methods for Household Water Treatment and Safe Storage (HWTS) options include boiling, Solar disinfection (SODIS), Filter combinations, Pureit filters, Chlorine Tablets, Liquid Chlorine (online, Biosand filters, Flocculent treatment, Ceramic candle, Ultra Violet filters, Reverse Osmosis and Ion Exchange (IEX).

Innovation: Key to Resolve Drinking Water Crisis:

One of the most serious issues the world now faces is the global water situation, which has received increased public attention during the past decade. To address the above mentioned problems related to drinking water, the United Nations included among the Millennium Development Goals (MDGs) the objective of halving the number of people lacking adequate access to clean water by 2015. Introduction of Sustainable Development Goals (SDG) is the MDGs next edition. In SDG, 17 Global Goals have been identified. Clean water and sanitation is the sixth goal of SDGs. Under SDG, it is targeted to achieve the following global goals by 2030:

- Universal and equitable access to safe and affordable drinking water for all;
- Access to adequate and equitable sanitation and hygiene for all and end open defecation,

paying special attention to the needs of women and girls and those in vulnerable situations;

- Improve water quality by reducing pollution, eliminating dumping and minimizing the release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally;

To improve sanitation and access to drinking water, cost effective and user friendly innovations are important. To improve this situation, innovative solutions for drinking water supply are truly required.

Water is used mainly in agriculture, drinking, sanitation and industry. The majority of the reduction in the world's water tables, large rivers that run dry and increasingly saline groundwater is caused by agriculture. If we look at it from a world viewpoint, we clearly have no shortage of fresh water. But significant differences in geographical, climatic, seasonal and population densities in many regions of the world lead to severe scarcity.

Both developed and developing countries, however, can be benefitted from innovations in the water industry. For example, in the technological sphere, it is particularly important to convert dirty, brackish, and salt water into fresh water using techniques that can be economically and ecologically acceptable, as is the design of appropriate small, standby, and affordable technologies to supply community-based, safe water in developing countries. There are also benefits from social, financial, and institutional innovations. Innovative communication and educational methods help facilitate dissemination

of knowledge and awareness related to water and sanitation, particularly in rural India.

Social and Technological Innovations

In the past decades, many attempts have been made to improve access to drinking water and sanitation facilities in rural areas of developing countries including India. The lessons learned from these attempts are that the improvements should be appropriate. It means they should be suitable as per the local needs, culture and conditions and that to ensure quality and sustainable access.

Many people fail to realize that technological innovation means not only the production of self sustained, state-of-the-art devices but also the creation of simple, affordable solutions that can be used efficiently in rural communities.

In order to provide clean water in developing countries, the technology must be efficient, affordable and simple to operate and maintain. In recent years, a great deal of research has been conducted to identify novel technologies for removing arsenic, particularly low cost as well as low tech systems that could be applied in rural areas.

Communication and Educational Innovation

Internet is the biggest source of information and sensitization in today's world. The past decade has seen a rapid development of web-based services like Wikipedia, YouTube, Facebook, Whatsapp, Twitter, Instagram etc. The internet has also inspired innovations in the areas of water and sanitation, which have long needed fundamental changes in terms of available information and communication technology. With the internet and other new technological tools, simple, appropriate technologies for the supply of water can be implemented within weeks rather than years. On the other hand, progress can be reported using text messages, digital cameras and short movies rather than time consuming reports.

A key element in providing adequate access to clean water especially in schools situated in rural parts of the country is most urgent. In developing countries, poor hygiene and health hazards caused by the lack of adequate water and sanitation facilities at the school level is one of the major problems. The lack of suitable sanitation facilities at school results in illness as well as the absence of children from school. Girls, in particular, remain absent during their menstruation periods. Numerous examples show that illness and absence drop by up to 50 per cent where sanitary facilities are provided at school. Worldwide programs to improve school facilities in developing countries have been developed by agencies such as UNICEF, UNDP, World Bank and WHO.

Water for drinking, hand washing, cleaning, preparing meals and toilet and urinal cleaning in schools is crucial to keeping children healthy. Schools are the places where many children gather, often in small class room spaces with limited ventilation, unhygienic conditions; no hand washing and thus children often get infections. Medical science research has established a direct link between diarrhoea and hygiene in schools. In the past, Millennium Development Goal 7, the United Nations created an innovative program called WASH (Water, Sanitation and Hygiene) which is essential for all time in improving people's health, education and lifestyle, as well as in reducing poverty around the world.

The Road Ahead:

There are enormous global efforts underway to revamp the water sector through technology and innovation intervention. The increasing knowledge accumulated and shared worldwide, including India, will continue to expand these efforts. More and more organizations realize that it is essential to improve the water quality, health, hygiene and environment of local communities because only healthy people can act as a catalyst for further development. Hence, it is our collective responsibility to think and act logically to save water. At the same time, we should support the government as well as non-government agencies that are developing technological and innovative interventions to make available safe drinking water.

(The author is associated with Vigyan Prasar, Department of Science & Technology, Govt. of India and has been engaged in popular science writing for various communication media)
Email: mmgore@vigyanprasar.gov.in)

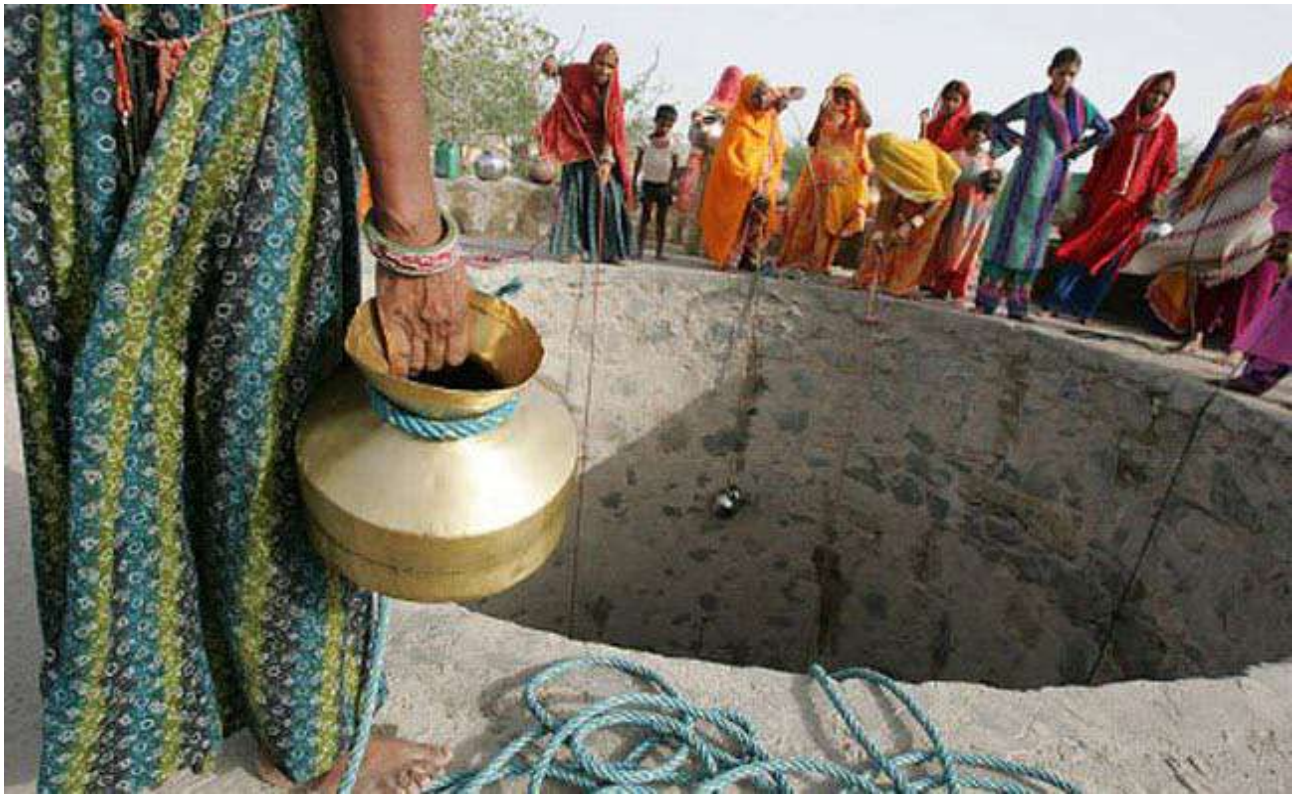
WATER SECURITY AND SUSTAINED DRINKING WATER SUPPLY

Rudresh Kumar Sugam

On the supply side, wastewater reuse and recycling and rain water harvesting should be encouraged across the country without further delay. On the access front, households and farms with poor access to water should be targeted on priority. The government should also look into decentralised solutions for topographies which are difficult to be connected to centralised systems. Decentralised systems need to be promoted in a big way to complement the existing water infrastructure.

For making India a water secured nation, especially the rural regions of the country, a lot of challenges need to be addressed. Demand pressures from various sectors, changing cropping pattern, high rate of urbanisation and industrialisation and most importantly, climate change are some of the factors that need to be addressed. Water pollution is another big challenge that India is facing today. The effort required to build a water secured nation is massive.

As India is a vast country the challenges related to drinking water in rural regions would be unique for different regions. India receives an average annual rainfall of around 1100 mm but there is a huge regional and temporal variation in the distribution of rainfall. The country receives more than 80 per cent of the rainfall from June to September. The unequal spatial distribution could be easily observed by the fact that the Brahmaputra and Barak basin, with only 7.3 per cent of the geographical area and 4.2 per cent of the country's population, have 31 per cent of the annual water resources (CPCB (2014) States of Water Quality in India). Across the year, it could be found that one region is facing floods while some other region is having drought at the same time. This shows the diversity in rainfall pattern across the country. Also, the same region might experience floods followed by droughts during different months in a year. Over-reliance on centralised systems and insufficient attention towards traditional water harvesting systems and disconnect of the community from water management is one of the major cause of such situation.



Climate change impacts are predicted to further the challenges currently being faced by India. The frequency and intensity of rainfall is predicted to change and it will have huge implications on water resources management and associated systems such as agriculture, which makes India even more vulnerable as we have nearly 70 per cent population (large share of small and marginal farmers) relying on agriculture for livelihood (World Bank) and nearly 2/3 of the cultivated land is rain-fed (Water Statistics, CWC).

Groundwater (GW) which is currently the lifeline of Rural India, as it supports more than 85 per cent drinking water requirements in rural areas, is depleting at an unprecedented rate. Overall, India in real sense is mining groundwater and is way ahead, in terms of total groundwater withdrawal, of various countries (see Figure 1 below).

Drinking Water Situation in Rural India

Rural regions in India, which primarily have agricultural and domestic water requirements, suffer from many challenges such as water pollution and decreasing groundwater availability, etc. Arsenic and Fluoride contamination is very high in some of the regions of the country. Figure 2, highlights the situation of drinking water supply in India.

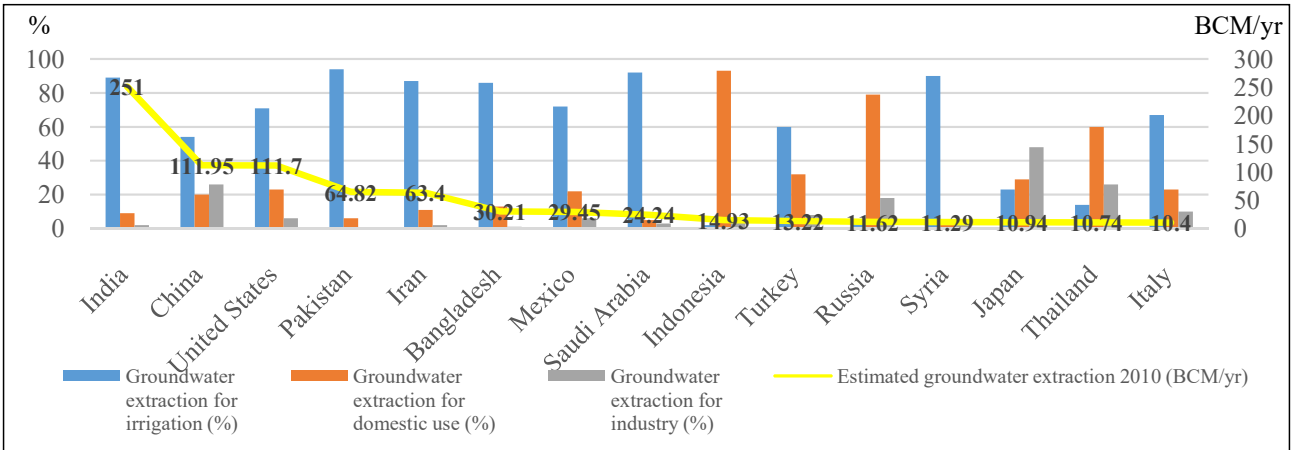
National Rural Drinking Water Programme (NRDWP): It is a Centrally Sponsored Scheme launched in April, 2009 aimed at providing every person in rural India with adequate safe water for drinking, cooking and other domestic basic needs on a sustainable basis. As per the Integrated Management Information System (Ministry of Drinking Water and Sanitation), more than 80 per cent of the rural habitations have reached Fully Covered status that means they are receiving 40 litres per capita per day. Whereas, around 15 per cent of the habitations are Partially Covered and 3.5 per cent habitations have some water quality related issues. This data is dynamic as it has been found in the past that many of the fully covered habitations have returned to partially covered status.Thus, providing infrastructure support alone is not enough for sustained rural water management.

A performance audit of the NRDWP was conducted by Comptroller and Auditor General (CAG) of India in 2018 to assess how far the objectives of the programme were achieved between 2012 to 2017 and examine various aspects of the Programme such as planning, delivery mechanism, fund management, implementation including coverage of partially covered and quality affected habitations, water quality monitoring and surveillance.

If we analyse this audit report, we find that insufficient community involvement, lack of long term sustainability plan, over-reliance on depleting groundwater resources and lack of focus on operation and maintenance of created infrastructure is not serving the purpose of building water secured rural India.

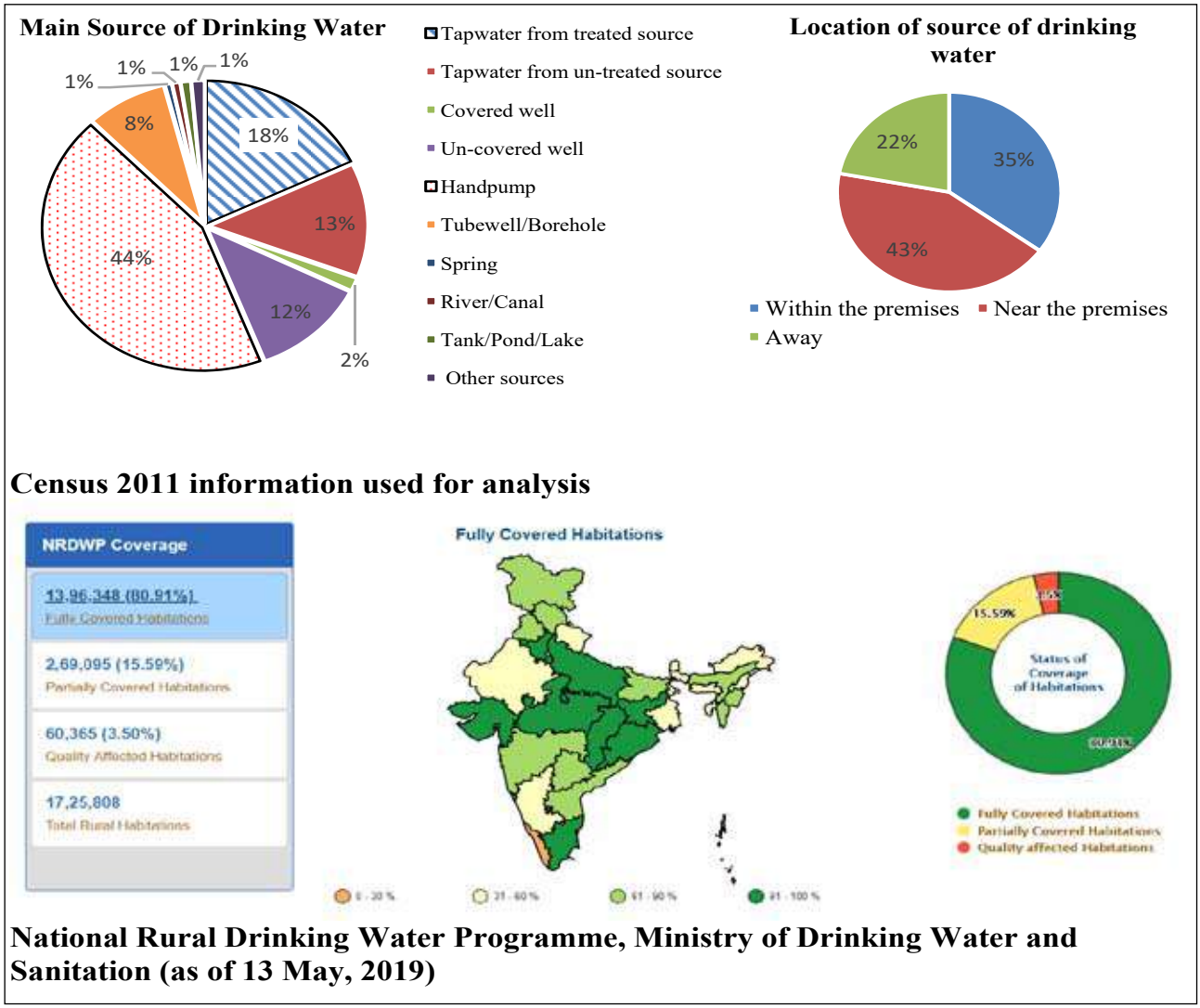
The larger question is do we always need to create new infrastructure and systems or

Figure 1: Top 15 nations with the largest estimated annual groundwater extractions



Adapted from National Ground Water Association data (2016)

Figure 2: Drinking Water Situation in Rural India



reviving traditional systems that worked for us for generations is a possibility.

Historically, communities in India managed water and had their unique mechanism of fighting climate extremes. Due to different topography and agro-climatic conditions, various regions in India had different structures to utilize and conserve water. Broadly these practices could be classified into the following three categories:

(i) **Obstructing/diverting the flow of stream/river:** In this practice, the natural flow of the stream/river is obstructed and water is stored by using gully bunds/check dams/gabion structures etc. Prominently built in hilly regions, these structures in addition to water conservation and groundwater recharge, also act as soil trap.

(ii) **Storage in wells/step wells/below ground level storage structure:** Mainly used to meet domestic water requirements, such structures could be found in western arid regions of India. The step-wells traps rainwater and because of no direct exposure to sunlight and surface temperatures it reduces evaporation losses. These were treated as auspicious as temples in Gujarat and Rajasthan.

(iii) **Collection and use of rainwater on surface:** Commonly found across India, these structures are constructed in the flow of a seasonal stream or the excess runoff is diverted into this. Some examples of such structures include *nadis, kundis, talabs, jaldhar, farm ponds etc.* The bottom of the

surface is generally pervious but it could be made impervious using plastic sheets to prevent GW recharge.

In addition to the construction of these structures, the community was involved in regular maintenance work thus ensuring the longevity of water bodies. Annual cleaning of ponds, conservation of forests, distribution of resources etc. was observed as a regular practice across India without any government/external support. There is no reason why we cannot revive such practices which have sustained us for generations.

Drinking Water Treatment

While the quantity of water is generally considered as the parameter to define access to water, however, understanding the quality of water would be necessary to provide clean and safe water to rural households. The choice of treatment technologies would be largely determined by the quality of raw water and the nature of demand. Few of the basic water treatment technologies/ methods are discussed below:

- **Slow sand filters (SSF) –** SSF is one of the most recommended methods of water treatment for rural areas. If designed properly, it purifies the water efficiently by reducing turbidity and bacterial contamination and it does not require highly skilled labour for operation and maintenance.
- **Chlorination –** Disinfection using chlorine has been a common practice in various water supply systems. Being a strong oxidant, chlorine is used to remove taste and odour, as well as biological contamination. It can be used for community water supply system as well as at the individual household level.
- **Solar Disinfection (SODIS) - T**he SODIS method utilizes solar energy for water disinfection at the household level. A clean and transparent PET plastic bottle (preferably below 2 litres) is filled with water and kept in direct sunlight for 6 hours during noon on sunny days and two days if the sky is more than 50 per cent clouded. It has no chemical and external energy requirements thus making it an affordable choice. As reported, it removes 99.9 per cent of micro-organisms. The major limitations are that the raw water should not have turbidity more than 30 NTU and there is sufficient sunlight available.

Policy Recommendations

Different states in India face completely different water related challenges and thus "one size fits all" approach would not be applicable. Major policy reforms in regard to rural water management are discussed below:

i. **Better data:** The first and foremost step is to develop better data, on water quality and quantity, and a robust hydrological information

system for developing precise information about the resource availability and planning accordingly.

ii. **Basin/Sub-basin level water management** – As advocated by experts and also being realised by the people working on the ground, integrated water resources management is only possible at a larger scale as the resources supply and use are interconnected. Several basins are inter-state thus it would require the riparian states to come to a consensus, which is a complex process and would take time. Therefore, water management at the sub-basin level should be initiated.

iii. **Water source improvement:** Currently, as per a CPCB report 2018, 351 river stretches on 275 rivers across the country have got polluted due to the discharge of both municipal and industrial waste water over the years. Also, the ground water quantity and quality is degrading at an unprecedented rate which needs an immediate response.

iv. **Integrated water and waste management:** Open defecation, domestic solid waste, wastewater and waste from cattle are the major cause of water contamination in rural areas and it has high negative health impacts as well. Therefore, sanitation management would be a crucial element in achieving water security.

v. **Supply and access augmentation:** On the supply side, wastewater reuse and recycling and rain water harvesting should be encouraged across the country without further delay. On the access front, households and farms with poor access to water should be targeted on priority. The government should also look into decentralised solutions for topographies which are difficult to be connected to centralised systems. Decentralised systems need to be promoted in a big way to complement the existing water infrastructure.

vi. **Demand side management:** Water use efficiency across sectors is poor in India as compared to available best practices. Most of the rural population is still dependent on groundwater for drinking water and irrigation needs. The Government will have to come up with innovative policies, incentives and subsidies, for increased adoption of water efficient practices and agro-ecology based crop selection in the agriculture sector as the groundwater sources are finite.

vii. **Capacity building:** Capacity building of institutions involved in water resources management would encourage informed decisions. It would also trigger more interactions between such institutions, which are currently not so frequent.

viii. **Institutional and legislative reforms:** Water is segregated amongst so many institutions that accountability is difficult to be defined. There is no umbrella agency that controls the governance of the water sector. We would definitely need such bodies as well as better legislation for controlling ground water extraction and pollution.

ix. **Revival of traditional wisdom:** The first and most important initiative to preserve traditional knowledge is the documentation of traditional customs and practices. Also, the community needs to be made the guardian of water resources in their locality. It is essential to acknowledge and recognise the knowledge and contribution of indigenous communities. None of the suggested interventions could work without a collective effort. Thus, collective effort should be directed towards reviving traditional systems by reminding people about the long term benefits and the necessity of their participation. Schemes such as Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS) could act as a supporting mechanism for such initiatives.

x. **Preparedness for disasters:** Rural areas are vulnerable to both floods and droughts thus preparation of integrated plans for extreme climatic should be done. Drinking water is heavily affected during such extreme events, thus people should be made aware of actions to be taken for restoring drinking water sources.

(The author is National Long Term Technical Advisor, Smart City Mission, Kochi.
Email:rudreshsugam@gmail.com)

ACCESS TO DRINKING WATER AND PUBLIC HEALTH

Dr. Chandrakant Lahariya

As the global development community and India is focusing on advancing universal health coverage and addressing the social determinants of health, improved provision of safe drinking water should be prioritised. It would reduce hospitalisation and child deaths due to diarrhoeal diseases, would improve school attendance and education outcome, improve worker performance and contribute to the economic growth of a country. This would help India in achieving key development goals at the national and state level. India needs all of these and a healthier population and the road is through improved availability of drinking water and better sanitation.

There are many uses of water, and for domestic purpose, we use water to drink, wash, cook, water plants, and many other things. The fact that major civilizations across the world developed/ evolved along rivers is a testament to the relevance of water in human life. Without water there would not have been human civilization, indeed there would be no life. The Indus Valley Civilization (specially Mohenjo-daro and Harappa) had many water supply and sanitation related provisions: public and private baths in urban areas; sewage was disposed of through underground drains built with precisely laid bricks, and a sophisticated water management system with numerous reservoirs was established. Many of these were the first of their kind for human civilization. There is evidence that the Roman Empire had formalized the role of the state in improving health. The Romans believed that the state has the responsibility of well-being of individuals; had a keen sense of sanitation; hygiene and health. The idea of population health or Public health is said to have born in Rome with the development of bath (for hygiene), sewers (drainage) and aqueducts (to supply safe water to cities). Romans brought pure water to all their cities through aqueducts, drained marshes to combat malaria and built sewerage systems amongst other initiatives. Clearly, the modern quest for improving sanitation and provision of safe drinking water is not new.

The scientific linkage and importance of pure drinking water and good health was established around 1840 with experiments and observations of two British physicians and epidemiologists John Snow, who studied the spread of cholera in London from 1848 to 1854 and then William Budd, who followed up on John Snow's work on Cholera and conducted additional observations based on an

outbreak of typhoid fever in rural north of England and concluded that spread was by drinking water. By the beginning of the twentieth century, clean water was being counted as one of the pillars of public health.

Global Development Agenda and Water and Sanitation

The Millennium Development Goals (MDGs), 2000-2015, had the target of reducing the proportion of the world's population without sustainable access to safe water (MDG 7), measured by the population using improved drinking water sources. In 2010, the UN General Assembly (UNGA) explicitly recognized the human right to water and sanitation. Everyone has the right to sufficient, continuous, safe, acceptable, physically accessible, and affordable water for personal and domestic use.

In 2015, 5.2 billion people used safely managed drinking-water services – that is, they used improved water sources located on premises, available when needed, and free from contamination. The remaining 2.1 billion people were without safely managed services (Box 1). In addition, sharp geographic, socio-cultural and economic inequalities persist, not only between rural and urban areas but also in towns and cities where people living in low-income, informal, or unauthorised settlements usually have less access to improved sources of drinking water than other residents. In September 2015, the global leaders agreed to the Sustainable Development Goal (SDG) agenda 2030. The SDG 6 focuses on water and sanitation and target 6.1, calls for universal and equitable access to safe and affordable drinking water. The target is tracked with the indicator of "safely managed drinking water services" – drinking water from an improved water source that is located on premises, available when needed, and free from faecal and priority chemical contamination.

Box 1: Global situation on drinking water availability, 2015

In 2015, Nearly 72% of the world population or 520 Crore (5.2 billion) people used safely managed drinking-water services –they used improved water sources located on premises, available when needed, and free from contamination.

The remaining 210 Crore (2.1 billion or 28%) people were living without safely managed drinking water services. The distribution of these people

- 130 Crore (1.3 billion; 18%) people were living with *basic* services, meaning an improved water source located within a round trip of 30 minutes
- 26.3 Crore (263 million; 3.6%) people were living with *limited* services, or an improved water source requiring more than 30 minutes to collect water
- 42.3 Crore (423 million; 5.8%) people taking water from unprotected wells and springs
- 15.9 Crore (159 million; 2.2%) people were collecting untreated surface water from lakes, ponds, rivers and streams.

Water and Public Health

Safe and readily available water is important for public health. The basic physiological requirement for drinking water has been estimated at 2 liters per person per day. This is minimum for survival and consumption of water (for drinking and otherwise) depends upon lifestyle, climate condition and habits. The domestic use of water is considered for the purpose of drinking, cooking, bathing, washing, flushing of the toilet as well as for watering the plants at home or kitchen or in home-garden. For urban settings, the water availability of 150- 200 liter per person is considered adequate to meet all domestic purposes. In rural India, a norm of 40 liter per person per day is a set target. From the public health view point and to improve quality of life, water should be provided in adequate quantity and it must be available close to the people.

Contaminated water and poor sanitation are linked to transmission of diseases such as Cholera, Diarrhoea, Dysentery, Hepatitis A, Hepatitis E, Typhoid, and Polio. In addition to these water-transmitted diseases, there are water-borne, water-related and water-washed diseases. Absent, inadequate, or inappropriately managed water and sanitation services expose individuals to preventable health risks.

The water borne diseases are considered public health problem due to a number of reasons, which includes (a) their potential to cause large outbreaks; (b) high disease burden; (c) for being major causes of admissions and outpatient visits to the hospitals and health facilities mainly amongst young children; (d) for many water borne diseases, no specific treatment is available and prevention is the best approach and (c) finally, these diseases spread rapidly and may cause panic in the community.

Water Borne Diseases: Globally & in India

Diarrhoea is the most widely known disease linked to contaminated food and water but there are other hazards. Issue of drinking water is closely linked to waste (water) disposal and sanitation. Inadequate management of urban, industrial, and agricultural wastewater means the drinking-water of hundreds of millions of people is dangerously contaminated or chemically polluted. Globally, an estimated 842 000 people die each year due to diarrhoea as a result of unsafe drinking water, sanitation, and hand hygiene. Yet diarrhoea is largely preventable, and the deaths of 361 000 children aged under 5 years could be avoided each year if these risk factors were addressed. Where water is not readily available, people may decide handwashing is not a priority, thereby adding to the likelihood of diarrhoea and other diseases.

The water borne diseases are one of the key health challenges in India. As per official data published in national health profile of India-2018, nearly a quarter or one in every 4 cases reported and one in every 5 deaths reported are attributable to communicable diseases in India.

Access to Drinking Water in Rural India

Rural drinking water supply is a state subject in India. The Ministry of Drinking water and Sanitation (MoDWS) under the centrally sponsored National Rural Drinking water Programme (NRDWP) provides financial and technical assistance to State Government. The NRDWP aims at providing every person in rural India with adequate safe water for drinking, cooking and other domestic basic needs on sustainable basis. A strategic Plan for the rural drinking water sector has been prepared for the period 2011-2022, by the Government of India. The plan aims to extend the piped water supply to more households in the rural areas. The interim goal till 2017 was to cover 50% of all rural households with piped water supply which reportedly has been achieved. By 2022, the goal is to cover 90% rural households. A National Water Quality Sub-Mission was launched by the MoDWS, in March 2017, to address the problem of Arsenic & Fluoride affected habitations in the country and mitigate concerns.

Availability of Water Adversely Affects Health Service Delivery

Availability of water also affects the effective functioning of healthcare facilities where both patients and staff are placed at additional risk of infection and disease when water, sanitation, and hygiene services are lacking. The WHO/UNICEF Joint Monitoring Program (JMP) report, 'WASH in Health Care Facilities', is a comprehensive global assessment of Water, Sanitation and Hygiene (WASH) in health care facilities. It finds that 1 in 8 health care facilities has no water service and 1 in 5 has no sanitation service – impacting close to 900 million and more than 1.5 billion people, respectively. Globally, 15% of patients develop an infection during a hospital stay, with the proportion much greater in low-income countries. In India, in March 2017, nearly 20% of Health Sub-Centres and 4% of Primary Health Centres in rural India did not have access to running water. This adversely affects practices such as Hand washing, which is a very proven and cost-effective health intervention. Yet, lack or insufficient availability of water is amongst the reason that it is not practiced. There are ways available to make improvement in this area. In 2015, WHO & UNICEF jointly developed WASH FIT (Water and Sanitation for Health Facility Improvement Tool). WASH FIT aims to guide small, primary health care facilities in low- and middle-income settings through a continuous cycle of improvement through assessments, prioritization of risk, and definition of specific, targeted actions.

Economic and Social Effects

Improved water supply and sanitation, and better management of water resources, can boost countries' economic growth and can contribute greatly to poverty reduction. When water comes from improved and more accessible sources, people spend less time and effort in physically collecting it,

meaning they can be productive in other ways. Better water sources also mean less expenditure on health, as people are less likely to fall ill and incur medical costs, and are better able to remain economically productive. It is not the drinking water only which is linked to better health. Water, sanitation & Hygiene are interlinked, and the availability of safe drinking water is very much linked to the overall availability of water (for domestic use and otherwise) which in turn affects the overall health of people. With children particularly at risk from water-related diseases, access to improved sources of water can result in better health, and therefore better school attendance, with positive longer-term consequences for their lives. It is estimated that by 2025, nearly half of the world's population will be living in water-stressed areas. There is a need to conserve water, adopt approaches to re-use water, and invest enough resources to ensure the availability of water. This is not only a good return on investment but will result in a healthier and economically productive population with reduced healthcare cost. Ensuring drinking water availability and improving sanitation is a development issue and agenda, which will contribute to economic growth and achievement of many other Sustainable Development Goals in India and globally.

Conclusion:

Drinking water is a human necessity. From the health sector perspective, water & sanitation, hygiene, amongst others are considered Social Determinates of Health, which are attributed to nearly half of the improvements in health outcomes. There is a high burden of water-borne diseases such as diarrhoea, typhoid and hepatitis, which can be prevented with impoved availablity of drinking water. Availability of safe drinking water has a close link with the overall availability of water and sanitation conditions at the household level as well as at health facilities. The sufficient availability of water for sanitation services can facilitate hand hygiene, a proven and cost-effective intervention. As the global development community and India is focusing on advancing universal health coverage and addressing the social determinants of health, improved provision of safe drinking water should be prioritised. It would reduce hospitalisation and child deaths due to diarrhoeal diseases, would improve school attendance and education outcome, improve worker performance and contribute to the economic growth of a country. This would help India in achieving key development goals at the national and state level. India needs all of these and a healthier population and the road is through improved availability of drinking water and better sanitation.

(The author is s Senior Public Health Specialist and National Professional Officer with the World Health Organization, based at New Delhi,
Email: c.lahariya@gmail.com; lahariyac@who.int)

World Environment Day June 5, 2019

World Environment Day (WED) is celebrated on the 5th of June every year. WED was established in 1972 during the United Nations Conference on the Human Environment, which led to the creation of the **United Nations Environment Programme (UNEP)**. Its aim is "encouraging worldwide awareness and action for the protection of our environment". World Environment Day is the 'people's day' for doing something to take care of the Earth.

Each World Environment Day is organized around a theme that focuses attention on a particularly pressing environmental concern. Every World Environment Day has a different global host country, where the official celebrations take place.

In 2018, India was the host for World Environment Day and the theme was focussed on **Plastic Pollution**, which is one of the most challenging environmental concerns today.

In 2019, China is the host for World Environment Day celebrations on the theme, **'Air Pollution'**.

According to a new UN report, millions of lives could be saved and one billion people living in Asia could be breathing clean air by 2030 if 25 simple and cost-effective measures are implemented. Currently, about 4 billion people – 92 per cent of Asia and the Pacific's population – are exposed to levels of air pollution that pose a significant risk to their health.

The report, **Air Pollution in Asia and the Pacific: Science-based Solutions**, is the first comprehensive scientific assessment of the air pollution outlook in Asia and the Pacific. It details 25 policy and technological measures that will deliver benefits across sectors. These are as follows-

25 CLEAN AIR MEASURES

1. Strengthen emission standards for road vehicles

a. Strengthen all vehicle emissions standards with a special focus on regulation of light and heavy-duty diesel vehicles. This will require collaboration between environmental agencies, transport agencies, oil companies and vehicle manufacturers, among others.

2. Regularly maintain and inspect vehicles

a. Introduce legislation and enforcement of regular mandatory emission checks and maintenance. This includes random tests to prevent extended use of vehicles with failed emissions abatement systems.

b. Centralize inspection and maintenance systems and establish self-funding mechanisms for regular audits at test centres.

3. Mainstream electric vehicles

a. Develop fiscal and non-fiscal policies to promote electric mobility.

b. Invest in required infrastructure to encourage quicker uptake of electric vehicles

4. Provide better mobility options

a. Improve public transport system to encourage shift from private passenger vehicles to public transport and integrate with sustainable urban planning.

b. Invest in walking and cycling infrastructure (sidewalk and bike-paths, sufficient lighting, bike sharing options, etc.)

5. Control dust from construction and roads

a. Suppress construction and road dust through dust control measures including road washing and cleaning, road paving, water spraying, installation of barrier protection, avoiding dust-generating work during windy days, etc.

b. Increase green spaces and areas especially in cities. This includes public parks, gardens, etc.

6. Reduce emissions from international shipping

a. Require low-sulphur fuels and control of particulate emissions.

b. Collaborate with the International Maritime Organization to widen the ratification and implementation of International Convention for the Prevention of Pollution from Ships.

7. Improve post-combustion control

a. Introduce state-of-the-art end-of-pipe measures to reduce sulphur dioxide, nitrogen oxides and particulate emissions at power stations and in large-scale industry.

b. Examples include flue gas desulphurization for sulphur dioxide, selective catalytic reduction for nitrogen oxides, and high efficiency particulate matter controls like fabric filters, multistage electrostatic precipitators.

8. Strengthen industrial process emissions standards

a. Introduce advanced emissions standards in industries, e.g., iron and steel, cement, glass production, chemicals, etc.

b. Strengthen production, performance and emission standards to control end-of-pipe emissions and fugitive emissions. This will stimulate investment in pollution control and/or cleaner technologies.

9. Introduce efficient brick kilns technology

a. Improve efficiency and introduce emissions standards to stimulate shift to more efficient brick kiln technologies (such as zig-zag, vertical shaft brick kiln or tunnel kilns). This requires collaboration among kiln owners,

technical experts, and government to demonstrate benefits of cleaner kiln technology.

10. Control methane from oil and gas production

a. Encourage recovery of oil production and associated petroleum gas.

b. Stop routine flaring and either utilize or convert to liquids that can be sold at higher value.

c. Improve leakage controls in gas production and distribution networks.

11. Improve solvent use and refinery controls

a. Introduce low-solvent paints for industrial and do-it-yourself applications.

b. Improve solvents recovery in industry. If not feasible, incinerate flue gas rich in hydrocarbons.

c. Establish leak detection and repair programs at refineries. Install double seal systems, vapour recovery unit, fixed covers and monitoring at refineries and fuel depots.

12. Use environmentally-friendly refrigerants

a. Ensure full compliance with Kigali Amendment to phase-down hydrofluorocarbons which are commonly used in air conditioning, refrigeration and a host of industrial products.

b. Establish regulations to support shift to low- global warming potential cooling agents.

13. Provide clean cooking and heating options

a. Use clean fuels – electricity, natural gas, liquefied petroleum gas in cities, and liquefied petroleum gas and advanced biomass cooking and heating stoves in rural areas.

b. Substitute coal with briquettes for cooking and heating.

14. Strictly enforce bans on household waste burning

a. Strictly enforce bans on open burning of household waste. Burning ban needs to be complemented with comprehensive solid waste management plan including proper waste collection system, recycling, waste treatment, and awareness raising.

15. Provide incentives for improved energy efficiency in households

a. Provide incentives to improve energy efficiency of household appliances, buildings, lighting, heating and cooling.

b. Encourage rooftop solar installations.

16. Increase renewable electricity generation

a. Establish renewable energy targets and supporting policies to achieve target. This includes providing incentives to foster extended use of wind, solar and hydro power for electricity generation and phase out least efficient plants.

b. Leverage public pressure to switch from fossil fuels to renewables.

17. Improve energy efficiency for industry

a. Introduce ambitious energy efficiency standards for industry.

b. Include energy efficiency targets for industry in national development plans.

18. Recover coal mining gas

a. Encourage pre-mining recovery of coal mine methane gas.

b. Provide fiscal incentives, well-defined gas property rights and unsubsidized free gas market.

19. Improve livestock manure management

a. Introduce covered storage (floating or permanent covers) and efficient application of manure (when plants need fertilizers, rapidly incorporate manure in soil or as narrow bands in canopy or grassland).

b. Consider low emission options for new animal housing: regular floor scraping, air ventilation cleaning, closed storage tanks.

20. Strengthen management of nitrogen fertilizer application

a. Establish efficient nitrogen fertilizer application (right timing and amount). Substitute urea and ammonium bicarbonate with e.g. ammonium nitrate fertilizer.

b. Promote alternative formulations, e.g., neem coated urea, or use of urease inhibitors, where available and affordable.

Beat Air Pollution

21. Better management of agricultural crop residues

a. Manage agricultural crop residues, including strict enforcement of bans on open burning. Complement burning ban with measures that use the residues. This includes alternative off-site use, technologies that plough residue into fields, no-till agricultural practice, or using residues as bedding for livestock or biogas digesters.

22. Prevent forest and peatland fires

a. Improve and enforce forest, land and water management and fire prevention strategies. This includes fire spread protection zones, fire alarm and brigade system, prohibit access to forests during droughts, and ban on land clearing.

23. Promote more efficient rice production practices

a. Encourage intermittent aeration of continuously flooded rice paddies (e.g. alternative wetting and drying – practice of allowing the water table to drop below the soil surface at one or multiple points during a growing season).

24. Stop biogas leakage from wastewater treatment

a. Introduce well-managed two-stage treatment with biogas recovery.

b. Promote decentralized wastewater treatment units.

25. Improve solid waste management

a. Encourage centralized waste collection with source separation and treatment, including gas utilization.

Sources- United Nations Environment Programme & Climate and Clean Air Coalition (CCAC)

SUCCESS STORY FOR SWACHHTA

TOILETS HELP REVIVE WEAVING INDUSTRY

Intricate threadwork, motifs and vibrant colours describe the handloom weaves of Odisha that have gained national and international acclaim. Of these the Sambalpuri sarees handloom which is a centuries old traditional family occupation that has all members of a family working together, comes from Sonepur district also called Subarnapur district of the Sambalpur belt of the state. The weaving skill of these cottage industries has been passed down for generations, making it a prized handloom.

The district is the hub of Sambalpuri handloom fabric in western Odisha and is home to predominantly a tribal community, one of the poorest in the State. According to official data, the district is home to 132991 households out of which about 21,310 families are engaged in weaving.

Prior to the commencement of the Swachh Bharat Mission Grameen (SBM-G) in October 2014, sanitation coverage of the district was a meagre 3.94 per cent. Barely 5243 homes had their own toilets. Further, as 40% of the villages were situated near the river banks it took a long time for people to stop the practice of defecating in the open near the river banks where there was easy access to water. Also, coming from economically weaker families, they were unable to construct their toilets.

To overcome these challenges, the district SBM team engaged in intensive behavior change IEC and IPC campaigns during which communities were mobilized to construct and use toilets.

Swachhagrahis were trained and Nigrani Committees were formed in all villages to rigorously carry out morning and evening follow up in common open defecation areas. In addition, they organized various awareness building activities such as sanitation rallies, village awareness drives, focused group discussions, etc. Convergence with SANJOG partners went a long way to motivate village opinion leaders who cooperated with the team SBM to stop the practice of open defecation.

Over the last two years, as many as 1,27,748 individual household toilets were built, ensuring 100% sanitation coverage. Sonepur was declared open defecation free (ODF) on 31st March 2019.

Significantly, toilets came as a critical game changer for handloom weaving families in the deep rural pockets of Sonepur district. It saved valuable time owing to which the families could spend more productive time on weaving which resulted in increased household income, according to Mr. Dayasagar Meher, IEC and HRD Consultant, DWSM, Subarnapur.

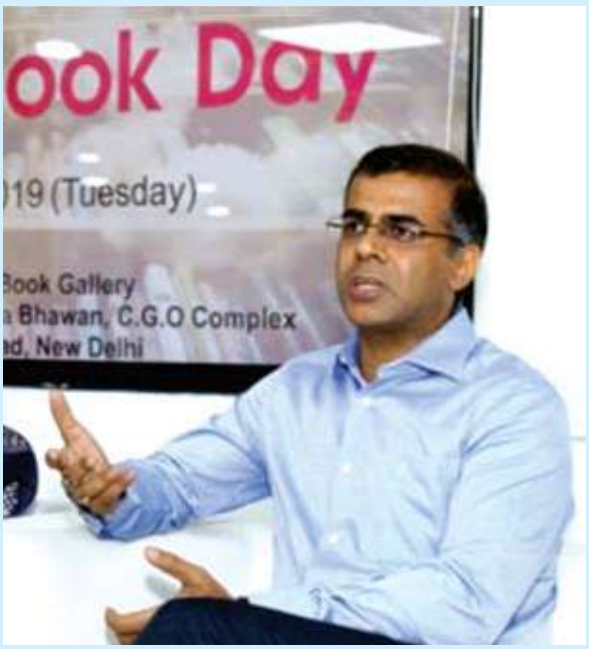
A few years ago, most of the families did not have access to toilets or safe sanitation. It meant family members had to go out to defecate and in the process waste precious income generation time. In addition, health impacts and issue of women dignity always existed.

"A good quality handloom saree sometimes takes more than a week to weave and hence time is a crucial factor for us," said Smt. Bishnupriya Meher, weaver of Nimna village of Ullunda Block.

Access to toilets is saving significant time for weaving communities which can be used to take up more saree orders. This has inspired other families in their gram panchayats to regularly use toilets.

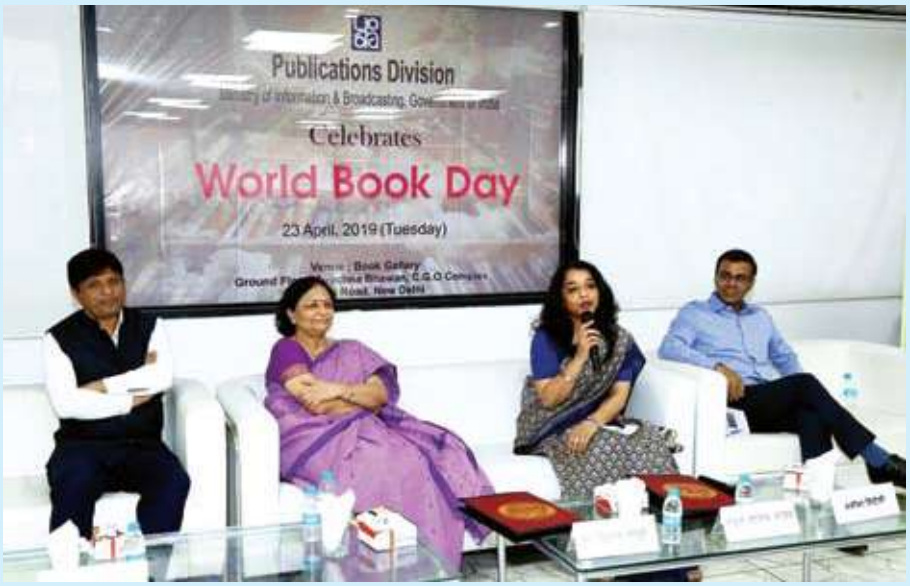
WORLD BOOK DAY 2019

Publications Division celebrated the World Book Day on April 23, 2019. UNESCO, in its General Conference held in 1995, chose this day as the World Book Day to be celebrated every year. It is a tribute to the value that authors and books add to our knowledge and ideas, transcending beyond boundaries of space and time. On this occasion, Publications Division organised a presentation on 'Future Trends of Publishing in India' which was led by Shri Vikrant Mathur – Director, India & Asia Pacific, Nielsen Book.



Shri Vikrant Mathur speaking on publishing trends

Shri Mathur shared valuable insights on the publishing industry in India and presented a comparative analysis with other countries of the world along with the needs of the market, emerging technological aspects related to book publishing and the demographic variations that impact book readership and hence the market. He presented data to showcase how not just the trade books that include popular fiction and non-fiction titles but other segments in publishing like K-12 (Kindergarten to 12th Grade), higher education and test preparation books are also an integral part and form the core of the publishing industry in India. He emphasised the need of vernacular publishing and highlighted its potential market. For instance, he stated that, within the English trade books segment, Adult Non-Fiction contributes maximum followed by Adult Fiction and Children's Literature and for Vernacular Trade Books, Hindi contributes maximum, followed by books in Malayalam and Bengali languages. He said that it is pertinent to note how books are also fast becoming one of the top choices for web series, television series and other digital platforms in addition to cinema, which has always had a long-standing relationship with books for its stories. Shri Mathur said that digital publishing and reading on Kindle is fast catching up. Analysing data and going by the trends, he also shared how audio books and e-versions are fast increasing. He however reiterated that print books, nevertheless, are here to stay.



Poet Shri Moin Shadaab, concluded the seminar by engaging the audience in a few couplets on books and the love for reading. The seminar was a success that engaged audience and readers from various age-groups and reading habits.

RURAL DRINKING WATER SUPPLY INFRASTRUCTURE: MONITORING, OPERATION AND MAINTENANCE

Dr. P. SivaRam

More than 80% of rural habitations have been provided rural drinking water supply infrastructure due to which 40 litres of water per day per person is ensured. The monitoring tools such as Water APP and Drinking Water Quality Testing are ensuring sustainable safe drinking water to the rural people. Further, the field studies have revealed that a good number of villages in the country are maintaining O&M with the active participation of communities, specifically women resulting in 24 X 7 safe drinking water supply.

Drinking water is increasingly becoming scarce owing either to reduced availability or manmade-environmental distortions or both. There is an urgent need to develop and implement newer ways of storing, conserving protecting and distributing water. An assured supply of safe and adequate drinking water can also be seen as one of the basic factors determining the quality of life of people and in the process enhancing their quality of life. Therefore, substantial interventions and investments (financial resources) are being made by Ministry of Drinking Water and Sanitation (MoDWS), Government of India to the State Governments to implement various Drinking Water Projects including National Rural Drinking Water Programme (NRDWP).

Further, MoDWS is aspiring to achieve ***'Har Ghar Jal'*** by 2030, in line with the UN Sustainable Development Goal (SDG) number six 'Clean Water and Sanitation' in other words achieving universal and equitable access to safe and affordable drinking water to each rural household through coordinated efforts of the State Governments. Access to safe and adequate drinking water and an adequate sanitation facility for communities has been recognized as a leading step towards universalization of health care in India. As of now, drinking water has been provided through Hand Pumps, Tube Wells and piped water supply in rural areas of the country. In the renewed focus, the thrust area is piped water supply, preferably

through a balanced mix of sustainable surface and ground water based resources.

Infrastructure of Rural Drinking Water supply:

The Ministry of Drinking Water and Sanitation has been making great efforts in providing safe drinking Water to the rural people of India with the constant cooperation with the State Governments. It is recorded that more than 80% of rural habitations have been covered under the National Rural Development Water Programme (NRDWP) in other words created drinking water infrastructure in the rural areas followed by partially covered habitations (15.59 %). It is further noted that 60,365 quality affected habitations with arsenic, fluoride, brackishness, iron etc had been provided safe drinking water. It is worthwhile to mention here that nearly 45% of habitations had been provided piped drinking water supply. If it goes at this pace, piped drinking water (***'Har Ghar Jal')*** could be provided to the rural people of the country before 2030. The details of rural drinking Water infrastructure – habitation-wise is presented in table-1:

Table 1: Rural Drinking Water Infrastructure – Habitation wise

S.No	Particulars	Coverage of Habitations
1	Fully covered	3,96,348 (80.9 %)
2	Partially Covered	2,69,096 (15.59%)
3	Drinking Water Quality Affected	60,365 (3.5%)
4	Piped water Supply Schemes	77,368 (44.84%)

(Source: Dash Board, Data Bank (12/5/19)
Ministry of Drinking Water and Sanitation, Government of India)

Drinking Water Infrastructure under SWAJAL in Aspirational districts:

The MoDWS launched SWAJAL, which is a community demand driven, decentralized, single village, preferably solar powered, mini Piped water supply programme for the 112 aspirational districts in 27 States identified by NITI Aayog. The aspirational districts have low coverage of habitations with piped

water supply as compared to National Coverage. Thus, there is a large scope for expansion of Piped Water Supply (PWS) through Swajal in these districts. It challenges the aspirational districts to have demand based scheme instead of a routine supply based one. Gram Panchayats in partnership with rural communities and State Sectoral agencies are being involved in the execution of the scheme and also operate and maintain the scheme. Swajal would ideally be implemented as groundwater based Piped Water Supply (PWS) scheme in all the habitations of these districts.

Swajal was originally launched as a pilot scheme in February 2018 in six States of Bihar, Maharashtra, Madhya Pradesh, Uttar Pradesh, Uttarakhand and Rajasthan. Later, it was extended to all the 112 aspirational districts identified by NITI Aayog. Pilot schemes were taken up, original Swajal being continued and funded under the programme.

As per Ministry's MIS, so far 2255 schemes have been identified for implementation in eight States. The States Governments are advised to access the funds under the "Flexi Funds" under NRDWP. 5% of the funds (both Central and state share put together) under NRDWP can be utilized by the State for funding Swajal. In order to build the capacity of the field officials, a first of its kind Training of Trainers (ToTs) programme has been organized by the Ministry with assistance from UNICEF in the recent past.

Infrastructure of Water through Convergence for Swachh Bharat Mission (SBM)

It is a well known fact that the availability of water is required to keep the toilets clean and usable. Provisioning of assured and sustainable water supply not only facilitates toilet construction and usage but also goes a long way in incentivizing and motivating people to adopt good sanitation practices including hand washing before and after meals, post defecation, as also maintaining cleanliness and proper hygiene within and outside houses. Thus the availability of enough water for sanitation purposes needs to be taken into account on priority. A conjoint approach to water and sanitation is being adopted through convergence with the National Rural Drinking Water Programme (NRDWP) and the SBM(G). Villages which have been declared ODF are given priority for Piped Water Schemes under NRDWP. Out of 8,02,054 Habitations in Open Defecation Free (ODF) declared villages, 4,22,305 Habitations have been provided Piped Water Supply Schemes (PWSS) (2017). The field observations revealed that this incentivised approach has motivated/boosted the people to achieve open defecation free and getting PWSS.

Water APP for monitoring water supply schemes:

The RWS mobile App has been developed by the Ministry in technical collaboration with NIC for monitoring of schemes on state/district / block/ panchayat /village level and description of those schemes are available through this mobile application. Using this App, the user can upload the photographs of beneficiaries /Source /Delivery Points using a Smartphone. While capturing the photograph, latitude and longitude of the location as well as date – time stamp is recorded automatically and gets uploaded on the central server of the Mission which is housed in the National Data Centre. One can register for using the RWS App through registration form which is available on the website http://indiawater.gov.in by logging into the system. At present this facility has been provided to state government officials, as a tool for reporting the progress of NRDWP to the central Ministry.

Drinking Water Quality Monitoring

The Integrated Management Information System (IMIS) facilitates the Ministry and the line departments to monitor the coverage status of rural habitations and population with potable drinking water. The system has details of over 16

lakh habitations and more than 60 lakh drinking water supply schemes which include both Piped Water Supply schemes, stand posts/taps and spot sources like open wells, hand pumps etc. The status of quality affected habitations and population and its coverage with safe potable water is regularly monitored on this platform. The system also provides a platform to the district and block water testing laboratories to upload the water sample test reports. An average of 35 lakh test reports are uploaded annually. Some of the salient features of the system are listed below.

- Provides near to real time coverage status of a particular habitation available with water supply assets created within that habitation and their functionality status, thereby promoting transparency.
- Allows viewing of the quality status of a source to find out if safe potable water is available in a particular habitation.
- Facilitates the monitoring of the covered habitations which have slipped back to uncovered status again.
- Helps in elimination of repeated investments in some habitations while other uncovered / difficult habitations remain deprived.
- Achieves high transparency through user-friendly reports available in public domain.
- Creates interaction between the government and the PRIs as both can monitor the community-based programs and the status of water supply assets handed over to the PRIs.
- SMS and email automation is also used to generate daily basis SMS alerts and sent to Ministry officials for monitoring of daily MPR reported, expenditure habitation covered etc.

Operation and Maintenance (O&M) of Infrastructure of Rural Drinking Water Supply

An efficient O&M of a water supply system is to provide safe drinking water as per designed quality and quantity (40 litres per day per person in rural areas), with adequate pressure at convenient location and time at a competitive cost on a sustainable basis.

"Operation refers to the timely and daily operation of the components of a Water Supply system such as headworks, treatment plant, machinery and equipment, conveying mains, service reservoirs and distribution system etc., effectively by various technical personnel, as a routine function."

"Maintenance is defined as the act of keeping the structures, plants, machinery and equipment and other facilities in optimum working order. Maintenance includes preventive /routine maintenance and also breakdown maintenance. However, replacements, correction of defects etc. are considered as actions excluded from preventive maintenance.

As per the records that expenditure for O&M on running, repair and replacement costs of drinking water supply projects, the States allocate a maximum of 15% NRDWP allocation. This is being shared by 50:50 (Central and State). Further, States are encouraged to achieve drinking water security at the local level through the sustainability of sources and systems.

The community-based O&M of drinking water projects in several villages in the country is an initiative aimed at enhancing the provision of safe drinking water to rural communities through community-managed drinking water projects. Local community members, notably Self Help Group (SHG) women, are recruited and trained as mechanics, thereby creating a cadre of capable technicians amongst the user community.

Role of Gram Panchayat (GP) in O&M:

- The village Panchayat/GP would pass a resolution

for taking up maintaining works in the distribution system of the multi village WSS which is under their maintenance. The works may be such as attending leaks and burst, changing gate valve, extension of pipe, replacement of old pipeline etc.

- The GP may pass the necessary resolution for executing the above works utilizing the Panchayat funds. The GP would maintain their single village water supply schemes and attend repair works in components such as pump sets, pipeline etc. and collect water charges as fixed by the respective state government.
- The GP may provide household tap connections after passing GP resolution and after obtaining the concurrence of PHED/Boards/PRIs Engineer.
- The GP incur expenditure on water supply maintenance work as per the finance limit as fixed by the State Government, when expenditure exceeds the limit, the countersignature of the Block Engineer may be obtained.
- The GP would collect water charges from the households at the rate fixed by the Govt./ DWSM.
- The GP should remit the monthly bulk water charges to the PHED/Board every month.
- For effective maintenance of the Distribution system, the VWSC assist the GP.
- The GP should consult and discuss with the VWSC before taking any decision/resolution regarding water supply maintenance works
- The VWSC is fully empowered to supervise and monitor all water supply maintenance works.
- **The VWSC undertakes the following activities:**

- To assist the Panchayat to appoint a suitable candidate for the post of scheme operator/ plumber etc.
- To ensure equitable distribution of water for all section of the village population.
- To assist the Panchayat in the collection of water charges.
- To check whether the water distributed is free from contamination and whether having the adequate residual chlorination using Field test kit or by sending a water sample to the nearest labs of PHED/Other institution.
- To clean and chlorinate the OHTs periodically
- To assist the Panchayat in hundred percent collection of water charges.
- To close all illegal connection and pit taps.
- Cases pertaining to theft of water and damage to assets of water supply scheme treated as public offence.

The field observations envisaged that lack of attention to the important aspect of O&M of water supply schemes in many GPs now and then specifically in summer months leads to their dysfunction or deterioration of the useful life of the systems necessitating premature replacement of many components, incurring huge losses. However, the GPs are being strengthened with huge funds through the 14th Finance Commission for overcoming the said problems.

Conclusion:

No doubt, more than 80% of rural habitations have been provided rural drinking water supply infrastructure due to which 40 litres of water per day per person is ensured. The monitoring tools such as Water APP and Drinking Water Quality Testing are ensuring sustainable safe drinking water to the rural people. Further, the field studies have revealed that a good number of villages in the country are maintaining O&M with the active participation of communities, specifically women resulting in 24 X 7 safe drinking water supply on a sustainable manner. This is one of the contributing factors for preventing water borne diseases in achieving health for all.

References

- Operation and maintenance manual for rural water supplies, Ministry of Drinking Water and Sanitation, Government of India – 2013.
- Dash Board, Data Bank (12/5/19) Ministry of Drinking Water and Sanitation, Government of India.

(The author is Professor and Head, Centre for Rural Infrastructure (CRI) and Centre for HRD, Director I/c CIRDAP Centre at NIRDPR National Institute of Rural Development and Panchayati Raj, (Ministry of Rural Development)
Email: polankis@gmail.com, sivaram.nird@gov.in)

SAFE RURAL DRINKING WATER SUPPLY: A STUDY ON ROs AND WATER ATWs

Dr. R Ramesh & Prof. P SivaRam

Drinking water is a basic service that the Gram Panchayats are expected to deliver. In order to address quality problems in water Gram Panchayats have decided setting up a technology such as RO. The daily operation and maintenance (O & M) of such plants is most likely to go beyond the capacity of a Gram Panchayat to handle. Therefore, the GPs invite private players, and NGOs / CSRs to run RO Plants, often on commercial terms. However, the Panchayats need to have the powers to control and regulate issues such as quality of treated water, plant hygiene, pricing, and the reuse of reject water for acceptable purposes.

Drinking water is a basic service that the Gram Panchayats are expected to deliver. In order to address quality problems in water, Gram Panchayats have decided setting up technology such as RO. The daily operation and maintenance (O & M) of such plants is most likely to go beyond the capacity of a Gram Panchayat to handle. Therefore, the GPs invite private players, and NGOs / CSRs to run RO Plants, often on commercial terms. However, the Panchayats need to have the powers to control and regulate issues such as quality of treated water, plant hygiene, pricing, and the reuse of reject water for acceptable purposes.

The goal of Government of India, with regard to the rural drinking water supply is providing safe water in adequate quantity to all at all times of the year. By safe water is meant water that is free from (i) bacteriological contamination; (ii) chemical contaminations; and (iii) the physical characteristics such as colour, smell, and acceptable taste. Water can get contaminated due to various reasons - man-made and natural. Over-dependence on groundwater is also a reason that may cause drastic changes in the physical and chemical properties of drinking water sources. The guidelines on National Rural Drinking Water Programme (NRDWP-2013) warns against

India's over-dependence on groundwater sources and suggests that there should be a move from groundwater (or any one source of drinking water) to the conjunctive use from several sources.

In rural areas, more than 85% of drinking water sources are groundwater based and in the short term, chemical constituents in groundwater do not change much, therefore testing once in a year for chemical contaminants is adequate. Testing for bacteriological contamination is recommended 4 times a year, once in every season. However, every year it should be carried out at least twice i.e. during pre-monsoon and post-monsoon seasons. Reverse Osmosis Plants (popularly known as 'RO Plants') came up in order to address the problem of physio-chemical contaminants in drinking water.

Drinking water is an important source of minerals to the body. The World Health Organization recommends that humans get between 10 – 20% of our daily needs for minerals from drinking water. The human body absorbs minerals 30% faster and easier from water than it does from food. For instance, adults need to get 1,000 mg of calcium, and 400 mg of magnesium per day, a considerable portion of this can come from the water we drink. The Bureau of Indian Standards (BIS) has given acceptable/permissible limits to the number of minerals in drinking water. Water that is too high on a certain type of minerals might cause health problems, so much so water that is completely robbed off of various minerals might deprive the body of the essential minerals that our body should be getting from drinking water. RO technology is used for removing excessive minerals from drinking water.

The culture of setting up Reverse Osmosis (RO) Plants in rural water supply system is catching up fast in many states of India. The reason stated, often, is: there is a quality problem in water – chemical contamination such as excess fluoride, arsenic, hardness, etc. RO Technology that started with simple 'sand filtration' and 'charcoal filtration' comes with multiple modules today as a complete water purification system. The practice of setting up RO plants in rural areas started as a gift or give away from some NGOs, INGOs, and CSR Projects. Later on, state governments also started setting up RO Plants in rural areas. The number of RO Plants in India is so large that the Ministry of Drinking Water and Sanitation (MDWS) maintains an MIS portal to keep track of the number.

The Issue of Safe Water:

'Water safety' or ensuring 'safe water' to every household in rural areas is essential. Pragmatically, the decision to set up an RO Plant must be driven by water safety concerns, and not following a 'trend'. The trend we notice in many states of India make us postulate if GPs in India are setting up this [RO] infrastructure in order to address genuine water quality problems or as an infrastructure influenced by the demonstration effect from the neighbourhood villages?

The Study:

Is it really water quality related problems that have induced these GPs for setting up RO Plants? If yes, to what extent does the RO Plant address the problem of water quality in the study villages?

What is the quantum of reject water from the RO plants, and how do the RO Plant Operators deal with the reject water?

What is the place of Gram Panchayat in the arrangement?

Objective:

Examine the exposition behind (explanation for) setting up of RO Plants / Water ATWs in the study States vis-à-vis the quality of water.

Determine the performance of RO Plants and water ATWs in terms of delivering safe water to rural households.

Find out the community perception of quality, quantity, pricing and the new culture of swiping for water.

Analyse the role of Gram Panchayats in ensuring an adequate quantity of safe water to various segments of the community in the states under study

Case Study:

Multiple case study designs have been used. The study covered 21 Gram Panchayats with RO plants from seven states, viz. Karnataka, Andhra Pradesh, Tamil Nadu, Telangana, Gujarat, Punjab, and Rajasthan. The selection of states is based on the concentration, where the highest number of RO Plants is reportedly available as per the data provided by the Ministry of Drinking Water and Sanitation. Three southern states and three northern states

were selected for the study. From each State, 3 GPs with RO plants were selected.

Data Collection

Water Quality reports of these villages were obtained from Gram Panchayats. Where it was not available, water samples were collected and given for lab test. The results thus obtained were used for analysis and discussion. In every village, there are RO water users, as well as those who do not use RO treated water. Interviews were conducted with both the categories, to obtain their views with regard to service delivery, pricing, etc. In order to have uniformity in scale, the BIS standards for drinking water quality have been used to determine 'the acceptable and permissible limits' of various minerals in drinking water from the sample villages.

Water Quality Standards

Bureau of Indian Standards (BIS) has specified drinking water quality standards in India to provide safe drinking water to the people. It is necessary that drinking water sources should be tested regularly to know whether water is meeting the prescribed standards for drinking or not and, if not, then, the extent of contamination/unacceptability and the follow-up required.

The revised edition of IS 10500: 2012 standard specified by the BIS is followed in Uniform Drinking Water Quality Monitoring Protocol. This standard has two limits i.e. desirable limits and maximum permissible or cause for rejection limits. If any parameter exceeds the cause for rejection limit, that water is considered unfit for human consumption.

Findings

Out of the 21 cases (Gram Panchayats) studied 13 GPs have gone for RO Plant so as to address water quality related problem, and the remaining 8 GPs have set up RO Plant not based on fact-based need. In other words, the water quality test results obtained from 21 Gram Panchayats showed that there were no problems of water quality in eight of the Gram Panchayats. That means RO Plants have come up as a consequence of demonstration effect only. In Telengana villages an NGO has set up RO Plants for free. In Andhra Pradesh villages a private firm has set up RO Plants, besides the ones set up by the State Government of Andhra Pradesh. Thus, it can be inferred that RO Plants are set up in some of the Gram Panchayats, despite the fact that the existing drinking water was within acceptable limits, going by physic-chemical parameters.

In most of the places RO Plants have been set up by the state government, and in some of the places CSRs (including banks or Insurance Companies) and NGOs have set up. In 16 out of 21 GPs, RO Plants are operated by GPs. In other places, they are operated by private operators either for-profit or in an agreement with State govertment. There are places where both Panchayat-run and private operators' managed plants are operating side by side.

In all the 21 study villages, people pay for water. They pay anywhere between Rs. 50 to Rs. 150 per month, depending upon how much water they use. The new culture of swiping ATW card for water, coin-operated system, coupon system, etc. is bringing about a new culture of paying for water, which the state governments have been striving to put in place for long. This perhaps will ease meeting out the O & M expenses of water supply, which is one of the major expenditure items for any GP in India. In most of these places, people have to go with a container (often a 20 Litre plastic can) so as to buy water. That you get only a measured quantity (10 litres or 20 litres) gives a feeling of a commodity being measured and sold by a vendor. When the mindset prevails that a person purchases a commodity in the certain agreed quantity, which is measured and sold, there is no questioning about 'free access to water as a basic right'.

With regard to the performance of RO Plants and water ATWs in terms of delivering safe water to rural households, most people have no problems, although some households do not like the taste of RO treated water; and some think their family income does not permit them to purchase drinking water. They feel the taste to be bland, and it never quenches thirst, and some do not have the ability to pay for water. Such people still depend on the piped water supply that exists in parallel. However, among the RO Plant users, there was no complaint about the adequacy of water because as you pay so you get. One can get any amount of water, so long as one is ready to pay.

RO, as a purification technology, is infamous because of the huge quantity of reject water, the system ejects in the process of purification. However, in areas with unacceptable levels of chemical

contamination (such as fluoride affected areas), as of now, there is no better system one can think of. That twenty-five to thirty percent of the water gets rejected during every pumping is not a small amount. It can be channeled for use in local school toilets, as it is done in some of the Rajasthan villages. The reject water contains highly concentrated minerals, which can further aggravate the groundwater levels in the region. The study concludes that RO Plants are set up as following a 'trend' is only partly true, because out of 21 cases studied at least in 13 Gram Panchayats, RO plants have been set up to address a genuine water quality problem. In the remaining eight Gram Panchayats, RO Plants have come up due to demonstration effect, having been influenced by the prevailing trend.

Conclusion:

Chemical contamination in water causes physical ailments and diseases. Water safety plan aims at minimizing risks of contamination via sanitary surveillance and by providing treated water for drinking. Until a technology that is better than RO is introduced, RO technology has to be accepted, despite a huge amount of reject water. However, this study finds that out of the 21 cases studied only 13 of them have gone for RO Plant so as to address water quality related problems. The remaining eight Gram Panchayats have set up RO Plant, not on the fact-based requirement. In other words, the water quality test results obtained from 21 Gram Panchayats showed that there were no problems of water quality in eight of the Gram Panchayats. Yet, RO Plants have been set up in those eight villages also. This can be viewed as a consequence of demonstration effect of a neighbourhood village that has an RO Plant, or some institution such as NGO/ CSR wanted to donate RO Plant free of cost to those Gram Panchayats.

Safe drinking water is essential for a healthy community. But, setting up RO Plants in places where the quality of water is at par with acceptable standards would entail an additional burden of maintenance expenses to the Gram Panchayats. Secondly, RO technology tends to filter out or remove essential minerals as well, even when they are well within permissible limits. This deprives the water users, the essential minerals that they should be getting from drinking water. Therefore, RO Plants should be set up only in places that have water quality problems, as certified by water quality laboratories. It should not be allowed to become a fashionable infrastructure.

References:

1. BIS, (2012) Indian Standard IS:10200: 2012 – Drinking Water Specification (Second Edition), Bureau of Indian Standards, NewDelhi.
2. Jacob, N. (2009). Use of R O Systems for Providing Safe Drinking Water - Experiences. Kerala: Solution Exchange.
3. Kumari, S. (May 2015). Drinking Water Quality in Rural India. Kurukshetra.
4. MDWS. (2013). National Rural Drinking Water Programme (NRDWP) – 2013. Ministry of Drinking Water and Sanitation, Govt. of India, New Delhi
5. Ministry of Panchayati Raj. (undated). Best Practices in Panchayats: Management and service delivery. New Delhi: GoI.
6. Paliwal, A. (2013, Jan 15). Water ATM. Down to Earth.

(Dr. R Ramesh is Associate Professor, CRI and Dr. P. SivaRam is Head, Centre for Rural Infrastructure (CRI), National Institute of Rural Development & Panchayati Raj, Hyderabad.
(Email: rramesh.nird@gov.in)

REVIVAL OF TRADITIONAL RAINWATER HARVESTING STRUCTURES IN RAJASTHAN

Dr. Anju Bhatia and Navin Bhatia

The success stories on the revival of Traditional Rainwater Harvesting Structures available from different parts of the state indicate that such efforts are a viable and cost-effective option for mitigating drought and for meeting water needs. It is significant that the success of the revival of such structures has largely been due to the involvement of the community at large.

Rajasthan is India's largest state by area, accounting for more than 10 per cent of the country's geographical area. While the state supports about 5 per cent of the human population and 20 per cent of the livestock, it possesses just 1.2 per cent of the total surface water and only 1.7 per cent of the groundwater available in India.

The state is heavily dependent on groundwater for drinking water and irrigation. About 90 per cent of the drinking water and 60 per cent of the irrigation water is sourced from groundwater supplies. During the 1970s and 1980s, the era of Green Revolution in India, there was widespread use of groundwater in Rajasthan and the pressure on groundwater is further increasing due to population growth and an increased number of industries. About 80 per cent area of the state has witnessed groundwater depletion and many towns and villages have experienced a shortage of drinking water, particularly in summer months.

The importance of water resource management has been recognised since ancient times. While water is a renewable resource, its availability is largely determined by climatic conditions and technology that permits its exploitation and also by the efficiency with which it is conserved and used. Rainwater, which is the purest form of water, has been collected and stored for later use for centuries. If collected properly, it would not only provide the supply of safe drinking water but also help in combating water-borne diseases to a great extent.

For the last three to four decades, rainwater harvesting has been getting increasing attention after having been ignored earlier.

Traditional Rainwater Harvesting (TRH) Structures:

Hundreds of years ago, the rulers of princely states in Rajasthan had created structures for rainwater harvesting, now called traditional rainwater harvesting (TRH) structures. These structures catered to the local needs ,utilised local resources and were based on the wisdom and knowledge handed down from generation to generation. They were replenished each year with monsoon rain and served the people all round the year. Many community TRH structures also had temples or religious associations with them and became centres of pilgrimage. Many were built with royal patronage or rich businessmen.

The main TRH structures in Rajasthan, namely, kundi, kui/beri, baori/ber, jhalara, nadi, toba, tanka, khadin, johad and anicut are described below in brief.

- A kundi is essentially a circular underground well with a saucer-shaped catchment area that gently slopes towards the centre where the well is situated. A wire-mesh across water inlets prevents debris from falling into the well pit. The sides of the well-pit are covered with lime and ash. Most wells have a dome-shaped cover for protection.
- A kui/beri is a 10-12 meter deep pit dug near tanks to collect the seepage. It is used to harvest rainwater in areas with meager rainfall. The mouth of the pit is made narrow to prevent the collected water from evaporating. The pit gets wider under the ground so that water can seep into a large surface area. The structures are generally covered with wooden planks. The water is used sparingly, as a last resort in times of crises.
- A baori/ber is a community well, whose water is used mainly for drinking. Most of these are very old, having been built by banjaras (mobile trading communities) for their drinking water needs. They are shallower than wells and have beautiful arches along their height.
- A jhalara is a human-made tank, essentially meant for community bathing and religious rites. Often rectangular in design, it is built at a series of levels and has steps on three or four sides. It collects subterranean seepage of a lake located upstream.
- A nadi is a small excavated or embanked village pond used for storing water from an adjoining natural catchment during the rainy season. Its depth ranges from 1.5 to 12 metres. Water availability from such source lasts from two months to a year. This practice of water harvesting is over 500 years old and in arid regions, each village has one or more such structures. Water from these structures is generally muddy and dirty and unfit for human consumption.
- A toba is a natural ground depression within a catchment area. It is usually flanked by groves of shady trees, which helps in reducing evaporation of water. The water in the toba generally lasts for about four months.
- A tanka is a small circular or square underground tank constructed with lime mortar or cement plaster. It is normally constructed on the fallow ground where surface runoff can be diverted to the tank by creating a clean catchment all around. It is constructed either for an individual family or for a community depending upon the requirements.
- A khadin is a construction designed to harvest surface run-off water for agriculture. In this system, run-off water from uplands and rocky surface is collected in suitable deep soil plots located in the lower valley segments of the area. An earthen bund is put in place on which trees and grasses are established. These help in stabilising the bund and reducing evaporation losses.
- A johad is a small earthern check dam that captures and conserves rainwater, improving percolation and recharging ground water.
- An anicut is a structure constructed across a stream. It uses an earth fill section with a spillaway and is designed to hold sufficient water to submerge a substantial upstream area during the rainy season.

The various types of TRH structures existed for centuries and catered to the essential water requirements of the people of the water-scarce state.

Dysfunctional State of TRH Structures

In the olden days, TRH structures were considered as important assets and a thing of pride for the family. At the time of distribution of family wealth, TRH structures were also considered along with gold, land and livestock.

The decline of TRH structures began during the British colonial rule in India. It is believed that as these structures were based on local knowledge, they were incompatible with knowledge and systems

introduced by the British rulers, which were based on ecological, cultural and social context, different from the Indian one. The control of communally-owned forests and water resources was gradually taken up by centralised authorities.

With the passage of time, the nature of the community changed to a great extent. The "we" feeling of communities got replaced by "me" or individual feeling and everybody's concern became nobody's concern. Over time, the community TRH structures were not owned by anyone.

The further march of industrialisation and urbanisation led to the TRH structures being degraded and falling into disuse. While community TRH structures became almost defunct, the household structures remained sub-optimally utilised, even in western Rajasthan, where once upon a time these were the only source of water. The main reasons for the dysfunctional state of TRH structures are:

- Availability of other sources of water (piped water, hand pumps and canal water);
- Requirement of financial resources for their use and maintenance;
- Requirement of time and labour to use water from these structures;
- Lack of ownership and participation of the community, and;
- Tendency to disregard age old and time tested lifestyle in favour of the latest technology in the name of modernisation;

Revival Strategies for TRH Structures

As outlined above, the water scenario in Rajasthan is quite grim. On the one hand demand is increasing due to population explosion and rapid urbanisation and on the other hand, water table is going down dangerously and more and more areas are coming under the category "grey zone". There is a total mismatch between demand and supply. The old wisdom pertaining to water conservation in the state needs to be revived. Reviving old rainwater structures and giving them a facelift through modern materials and technology can solve the problem to a great extent. A few initiatives taken by various agencies in the state are outlined below.

The work done by an NGO, Tarun Bharat Sangha (TBS) has received maximum attention. TBS has been

working on the revival of johads since 1986. The NGO revived five river systems, which were dried up for the last several decades. By 2016, 11,600 johads had been built in 1280 villages, most of them in Alwar district of the state.

Of the structures built, most were community structures. TBS relied on community participation by undertaking padyatras and involving religious leaders. The entire work was done without relying on any engineers and guided entirely by the traditional wisdom of the people. Due to these structures, 2.5 lakh wells were recharged. The entire area, which was earlier classified under 'dark zone', got converted to 'white zone'. Rajendra Singh, who runs the NGO, was awarded the Ramon Magsaysay award for community leadership in 2001 and the Stockholm Water Prize (known as the Nobel Prize for Water) in 2015.

Another prominent NGO, Jal Bhagirathi Foundation (JBF), founded in 2002 has been working in the area of water security for the Marwar region, comprising seven districts in the western part of the state. JBF promotes the revival and construction of TRH structures by using inexpensive, simple and traditional technology. It has evolved a community-led water management system working through over 20,000 village level volunteers assisted by trained professional workers.

JBF has revived or constructed over 2,000 TRH structures covering about 500 villages. It has improved water availability in the area from an average of four months to 10-12 months in a year. The financial sustainability and community ownership are ensured through a development fund, called Jal Kosh, in which community deposits at least 30 per cent of the project cost.

Numerous other NGOs have undertaken region-specific projects for restoring TRH structures

in the state. For example, Gramin Vikas Vigyan Samiti (GRAVIS) has built over 7,000 tankas and over 600 beris in the Thar desert area. Its focus has been on capacity building of rural communities by involving them in this task. Samajik Vikas Sansthan has promoted restoration of existing ponds and underground water storage systems and construction of new ones in Shekhawati area. Mewar Krishak Vikas Samiti has constructed about 30 nadis in Rajsamand district. The Bhoruka Charitable Trust has encouraged villagers in Churu district to build and renovate kundis and johads. Over 1,000 structures were developed, including 40 community structures.

Under their Corporate Social Responsibility (CSR), some corporates have also been involved in supporting the revival of TRH structures. For example, in 2015, Vedanta Cairn was involved in cleaning and maintaining the Bhap Nadi in Barmer district, benefitting 19 villages. Lupin Limited has been involved in constructing check dams and anicuts in Bharatpur and Dholpur districts.

Educational and research institutions have also been involved in working for popularising revival of TRH structures. In the 1990s, the Central Arid Zone Research Institute (CAZRI), Jodhpur developed improved technology of tanka construction for various types of users (capacity ranging from 5000 litres for individual family to 600,000 litres for community use) using stone masonry with cement plaster and cement concrete. The designs were accepted, replicated and widely used in thousands of tankas.

A Working Paper prepared by researchers from CAZRI for International Water Management Institute in 2005 observed that the TRH systems, prevalent for centuries in the region, are still viable and cost-effective. If these systems are improved and utilized on a large scale, they can meet the requirements of drinking water of the rural population and mitigate the drought impact, at least partially.

The success stories on revival of TRH structures available from different parts of the state indicate that such efforts are a viable and cost-effective option for mitigating drought and for meeting water needs. It is significant that the success of the revival of TRH structures has largely been due to the involvement of the community at large.

Seeing the success of such efforts and concerned about the situation, in 2016, the state government launched a comprehensive scheme to ensure effective implementation of water conservation and water harvesting related activities in rural areas. It aims to cover about 21,000 villages with 7 lakh water conservation structures in four years. By 2018, over 12,000 villages were covered and 3.8 lakh water storage structures created. Besides budgetary support, for the first time ever, the state government has created an online crowd-funding portal where donations for the scheme are accepted.

Further, following the Union Government's Model Bill for Ground Water Management (2011) and National Water Policy (2012), the State Government has made rainwater harvesting mandatory for all public establishments and all properties in plots covering more than 500 sq m in urban areas.

Conclusion:

As may be seen from above, the revival of TRH structures now occupies considerable importance in the policy space in Rajasthan. It has been recognised that despite the depleting water resources, the state still has significant potential for harvesting and conserving rain water. If an integrated water resources management approach is adopted and proper policies and investment actions are implemented using recent technologies, the problem of water scarcity can be mitigated to a large extent. Although water is available for free, it is an invaluable resource and its value needs to be understood.

However, it is important that the actions planned under various schemes are implemented in true spirit. Poor management of water bodies has been the main reason for their neglect and disuse. While constructing or renovating TRH structures is necessary, it is even more important to maintain these structures properly so that their benefits can be derived for many years to come. For that, community participation and involvement is a must. All stakeholders, namely, government agencies, NGOs, corporate and media houses and the community at large must come together to tackle the problem of water scarcity in the state.

(Dr Anju Bhatia is former Professor and Head, Department of Home Science, University of Rajasthan, Jaipur and Navin Bhatia is retired General Manager, Reserve Bank of India, Jaipur. Email: bhatianju@yahoo.com)

YOGA: ART AND SCIENCE FOR HEALTHY LIVING

Dr. Ishwar V. Basavaraddi

Yoga, as originated over five thousand years ago in the Indian subcontinent, can be described as a psycho-spiritual discipline which integrates both mental and physical practices with the ultimate goal being spiritual enlightenment.

Yoga is essentially a spiritual discipline based on an extremely subtle science which focuses on bringing harmony between mind and body. It is an art and science for healthy living. According to Yogic scriptures, the practice of Yoga leads to the union of an individual consciousness with the universal consciousness. According to modern scientists, everything in the universe is just a manifestation of the same quantum firmament. One who experiences this oneness of existence is said to be "in Yoga" and is termed as a yogi who has attained a state of freedom, referred to as mukti, nirvāna, kaivalya or moksha.

"Yoga" also refers to an inner science comprising of a variety of methods through which human beings can achieve union between the body and mind to attain self-realisation. The aim of Yoga practice (sādhana) is to overcome all kinds of sufferings that lead to a sense of freedom in every walk of life with holistic health, happiness and harmony.

Brief History and Development of Yoga

The science of Yoga has its origin thousands of years ago, long before the first religion or belief systems were born. The seers and sages carried this powerful Yogic science to different parts of the world including Asia, the Middle East, northern Africa and South America. Interestingly, modern scholars have noted and marvelled at the close parallels found between ancient cultures across the globe. However, it was in India that the Yogic system found its fullest expression. Agastya, the saptarishi, who travelled across the Indian subcontinent, crafted this culture around a core Yogic way of life.

Yoga is widely considered as an "immortal cultural outcome" of the Indus Valley Civilisation - dating back to 2700 BC - and has proven itself to cater to both material and spiritual uplift of humanity. A number of seals and fossil remains of Indus Valley Civilisation with Yogic motifs and figures performing Yoga sādhana suggest the presence of Yoga in ancient India. The seals and idols of mother Goddess are suggestive of Tantra Yoga. The presence of Yoga is also available in folk traditions, Vedic and Upanishadic heritage, Buddhist and Jain traditions, Darshanas, epics of Mahabharata including Bhagawadgita and Ramayana, theistic traditions of Shaivas, Vaishnavas and Tantric traditions. Though Yoga was being practiced in the pre-Vedic period, the great sage Maharishi Patanjali systematised and codified the then existing Yogic practices, its meaning and its related knowledge through Patanjali's Yoga Sutras.

After Patanjali, many sages and Yoga masters contributed greatly for the preservation and development of the field through well documented practices and literature. Yoga has spread all over the world by the teachings of eminent Yoga masters from ancient times to the present date. Today, everybody has conviction about Yoga practices towards prevention of diseases, and promotion of health. Millions of people across the globe have benefitted by the practice of Yoga and the practice of Yoga is blossoming and growing more vibrant with each passing day.

Yoga – in East and West

Yoga has been India's answer to fancy fitness regimes followed in the west. It has spread to all parts of the world to such an extent that we celebrate the International Day of Yoga every year on 21st June. Almost every Indian city has something planned to celebrate on this 'special' day.

Although, both the East and the West share the same goal, there are still a few things that make us different such as the relationship between teachers and students, clothing, and yoga's growing popularity. People living in the East have much more traditional values as opposed to many living in the West.

Yoga is not widely practiced or popularized in the East. The practice of yoga is a science and a tradition that is passed down to generations. Many people in the East practice yoga in the comfort of their own home.

Western world has picked up yoga-asana which is being mainly viewed as good fitness regime for common man. This yoga is in public domain. But real Yoga is not in public domain and cannot be. It is in private or secret domain i.e. secret between Guru and disciple. Secret Yoga leads to realization of All-Pervasive self and gives yogis access to every nook and corner of this creation by sitting at asana. It is Kriyayoga which is real yoga or secret yoga practice for soul-realization or salvation.

Yoga is one of the most prominent well-being practices today. Yoga, as conceived in India, is a comprehensive practice that includes each and every aspect of life; it's a way of life. This type of Yoga involves moral aspects (such as not harming another living creature, and being truthful), relationship-based instructions (such as kindness and generosity), evolvement of one's consciousness (meditation and enlightenment) and, finally, the physical practice (meant to purify body and mind).

Yoga in Western society is synonymous with the practice of asana (posture), and such asana-centred Yoga sessions are easily accessible in almost every city in the West. Yoga is being practiced as part of a physical fitness regime, and it is known that asana improves flexibility and strength.

Yoga, as originated over five thousand years ago in the Indian subcontinent, can be described as a psycho-spiritual discipline which integrates both mental and physical practices with the ultimate goal being spiritual enlightenment. This ancient Indian practice was first conceived by rishis (sages) who were in search of a blissful state; this became known as "Yoga", embodying the concept of unity between the body, mind and spirit. The rishis were able to exercise Yoga and attain samadhi (enlightenment) by developing their meditative skills and letting go of attachment to the mind. The ancient Indian philosophy, that is Yoga, is deeply rooted in spirituality-promoting components, including niyama (self-discipline), pratyahara (detachment from the senses) and dhyana (meditation). And yet, Western literature and practice offer very little reference to the Yogic experience acquired by commanding such modifications of the mind. Certain types of Yoga are more aligned with this original spiritual intention of the Yogic practice.

Yoga is made of eight essential elements- Pranayama, essentially controlling breathing; Dhyana; Pratyahara which means not letting external factors influence oneself; Dhaarna or retention, Samaadhi or trance; Yama or control; Niyama or self-restraint, and Aasana or posture.

Above mentioned dimensions are important aspects in the promotion of Yoga in various fields of life like education, workplace, extreme weather conditions, etc. For each dimension, there are standard yoga protocols, modules and human resource available which can be explored to promote Yoga.

The knowledge aspect of Yoga Sadhana is being extensively researched, with advantage to Yoga practitioners. Psychological, Anatomico-physiological, Bio-chemical and philosophical phenomena underlying Yoga Sadhana have been commendably understood by us today. There is also a worldwide growth of teaching schools of Yoga across the globe. An earnest scientific and philosophico-literary research has also caught up globally and is yet another encouraging sign of evolution of Yoga further.

Physical fitness is a state of health and well-being and, more specifically, the ability to perform aspects of sports, occupations and daily activities. Physical fitness is generally achieved through

proper nutrition, moderate-vigorous physical exercise, and sufficient rest.

Before the industrial revolution, fitness was defined as the capacity to carry out the day's activities without undue fatigue. However, with automation and changes in lifestyles physical fitness is now considered a measure of the body's ability to function efficiently and effectively in work and leisure activities, to be healthy, to resist hypokinetic diseases, and to meet emergency situations.

Fitness is defined as the quality or state of being fit. Around 1950, perhaps consistent with the Industrial Revolution and the treatise of World War II, the term "fitness" increased in western vernacular by a factor of ten. The modern definition of fitness describes either a person or machine's ability to perform a specific function or a holistic definition of human adaptability to cope with various situations. This has led to an interrelation of human fitness and attractiveness that has mobilized global fitness and fitness equipment industries. Regarding specific function, fitness is attributed to persons who possess significant aerobic ability, i.e. endurance or strength.

Many sources cite mental, social and emotional health as an important part of overall fitness. This is often presented in textbooks as a triangle made up of three points, which represent physical, emotional, and mental fitness. Physical fitness can also prevent or treat many chronic health conditions brought on by unhealthy lifestyle or aging. Working out can also help some people sleep better and possibly alleviate some mood disorders in certain individuals.

Thousands of years ago Yoga originated in India, and in present day and age, an alarming awareness was observed in health and natural remedies among people by Yoga and Pranayama which has been proven an effective method for improving health in addition to prevention and management of diseases. With increasing scientific research in yoga, its therapeutic aspects are also being explored. Yoga is reported to reduce stress and anxiety, improves autonomic functions by triggering neurohormonal mechanisms by the suppression of sympathetic activity, and even, now-a-days, several reports suggest Yoga is beneficial for physical health of cancer patients. Such global recognition of Yoga also testifies to India's growing cultural influence.

Yoga, as practiced and taught in India, entered the Western world in the 19th century with the translation of basic Yogic texts. Following attendance at the World Parliament of Religions in Chicago in 1893, Swami Vivekananda introduced Yoga to the USA. In the 20th century, numerous versions of Yoga were developed and taught.

The stress and stress-induced disorders like hypertension and angina are fast-growing epidemics and bane of "modern" society. The holistic science of Yoga is the best method for prevention as well as management of stress and stress-induced disorders. Numerous studies have shown Yoga to have an immediate down-regulating effect on both the HPA axis responses to stress. Effectiveness of Yoga against stress management is well established.

Yoga as Therapy

Yoga is the most perfect wellness module as it is comprehensive and holistic in its nature. Yogic principles of wellness help to strengthen and develop positive health enabling us to withstand stress better. This Yogic "health insurance" has achieved by normalizing the perception of stress, optimizing the reaction to it and by releasing the pent-up stress effectively through the practice of various Yogic practices.

Yoga was also found to be beneficial as an adjunct to conventional medical management of hypertension, coronary artery disease and diabetes. Yoga may also be useful in reducing medication requirements in patients with diabetes, hypertension and could help prevent and manage cardiovascular complications.

Mechanism of Action how Yoga Works:

The following are just a few of the mechanisms through which Yoga works as an integrated mind-body medicine:

1. Cleanses the accumulated toxins through various *shuddikriyas* and generates a sense of relaxed lightness through Yogic *sukshmavyayama* (simple micro movements for all joints and ligaments of body). Free flow in all bodily passages prevents the many infections that may occur when pathogens stagnate therein.
2. Adoption of a Yogic lifestyle with proper nourishing diet, creates positive antioxidant enhancement thus neutralizing free radicals while enabling a rejuvenative storehouse of nutrients packed with life energy to work on anabolic, reparative and healing processes.

3. Steadies the entire body through different physical postures held in a steady and comfortable manner without strain. Physical balance and a sense of ease with oneself enhance mental / emotional balance and enable all physiological processes to occur in a healthy manner.
4. Improves control over autonomic respiratory mechanisms though breathing patterns that generate energy and enhance emotional stability. The mind and emotions are related to our breathing pattern and rate and hence the slowing down of the breathing process influences autonomic functioning, metabolic processes as well as emotional responses.
5. Integrates body movements with the breath creates psychosomatic harmony. In Yoga the physical body is related to *annamayakosha* (our anatomical existence) and the mind to *manomayakosha* (our psychological existence). As the *pranayama kosha* (our physiological existence sustained by the energy of the breath) lies in between them, the breath is the key to psychosomatic harmony.
6. Focuses the mind positively on activities being done, enhances energy flow and results in healthy circulation to the different body parts and internal organs. Where the mind goes, there the *prana* flows!
7. Creates a calm internal environment through contemplative practices that in turn enable normalization of homeostatic mechanisms. Yoga is all about balance or *samatvam* at all levels of being. Mental balance produces physical balance and vice versa too.
8. Relaxes the body-emotion-mind complex through physical and mental techniques that enhance our pain threshold and coping ability in responding to external and internal stressors. This enhances the quality of life as seen in so many terminal cases where other therapies are not able to offer any solace.
9. Enhances self-confidence and internal healing capacities through the cultivation of right attitudes towards life and moral-ethical living through *yama-niyama* and various Yogic psychological principles. Faith, self-confidence and inner strength are most essential for healing, repair, rejuvenation and reinvigoration.
10. Yoga works towards restoration of normalcy in all systems of the human body with special emphasis on the psycho-neuro-immuno-endocrine axis. In addition to its preventive and restorative capabilities, Yoga also aims at promoting positive health that will help us to tide over health challenges that occur during our lifetime.

CONCLUSION:

At present, global healthcare is dominated by modern medicine. Cost of medicine is going beyond the reach of poor and middle class people. On the other hand, communities need safe, effective, affordable and accessible healthcare. The holistic wisdom of Yoga and other ancient health systems offer the necessary wisdom, experience and capabilities that are crucial for such transformational change. The increasing use of alternative medicine not only in developing nations but also in industrialized and presumable advanced Western nations presents itself as something of an enigma. As a social phenomenon, Yoga is not well understood as a therapy or indeed much researched in terms of modern medicine. It is curious that its growth is occurring in countries where Western science and scientific methods generally are accepted as the major foundations for healthcare, and "evidence-based" practice is the dominant paradigm. As medicine experiences an explosion in its knowledge base and genomic medicine opens a whole new approach to medical care, there seems to be an insatiable desire for ancient philosophies and approaches to medical care by the general public. One reason for the popularity of complementary and traditional medicine is the upwardly spiraling cost of modern allopathic medical care and associated adverse effects. New technologies have been developed at a record pace, producing many medical, surgical and diagnostic innovations, most of which are unquestionable improvements but are also very expensive that have placed them out of reach of a large segment of the population. One consequence appears to be the creation of a strong public desire for a wide range of complementary modalities to prevent and treat the full gamut of human illness, particularly non-communicable diseases. Yoga is proving to be the most desirable complimentary and traditional system of health care in the present scenario.

(The author is Director, Morarji Desai National Institute of Yoga, New Delhi.
E-mail : ibasavaraddi@yahoo.co.in ; directormdniy@yahoo.com)

PROMOTING YOGA: FEATURES AND BENEFITS

Dr. Neha Gupta

Yoga is a clear-cut science with meditation and pranayama as its integral parts. This entails immense benefits for physical and mental health; however benefits depend on the chosen path of yoga and the way you connect with different yoga asanas and practices.

"YOGA IS THE JOURNEY OF THE SELF, THROUGH THE SELF, TO THE SELF." - ***The Bhagavad Gita***

'Yoga' has entered into the vocabulary of almost every Indian household. Especially in the last two decades or so, Yoga propagators have played a crucial role in popularizing it in the country. Awareness about yoga techniques have amplified after announcement of holding International Day of Yoga (IDY) every year on 21st June. Yoga's rising outreach to the different countries of Europe, America and other Asia has come into the limelight. IDY was suggested by India at the 69th session of United Nations General Assembly on September 27, 2014 by the Prime Minister of India. This proposal was unanimously approved in December 2014. As 21st June is the longest day, 1st IDY was celebrated on this day in 2015 at Rajpath, New Delhi, India (organized by AYUSH Ministry). This helped India to gain two Guinness World Records for holding largest yoga class at one place and for presence of most nationalities in a lesson.

Although origination of 'Yoga' is a matter of debate, this can be traced to be born in India several thousand years ago roughly around 5th century BCE. Adiyogi Lord Shiva is regarded as the father of yoga who transmitted knowledge about mechanism of human system to the Saptarishis and saints. In the 20th century, yoga transformed to include more asanas/postures/exercises and also moved to West. Maharishi Patanjali, as father of Modern yoga, brought the concept of *Ashtanga yoga* which provides yoga sutras: *Yama* (those things which should not be done, i.e., self-restraints in life covering non-violence, truthfulness, etc.), *Niyama* (rules to be observed daily including purity, concentration, persistence, etc.), *Asana* (physical exercise to discipline body), *Pranayama* (regulation of breath to conserve life force), *Pratyahara* (limiting the use of senses), *Dharana* (introspection), *Dhyana* (contemplation, meditation) and *Samadhi* (union with our higher self or universal energy). Overall, yoga improves physical health by supplying adequate level of blood and oxygen and calms down the mind by defeating unnecessary ripples.

Yoga as Science of Linking Mind-Body-Soul

Simply, yoga is a scientific stream aiming to unite mind, body and soul. This is the proven method for disciplining our mischievous mind and restless senses (away from materialistic things), and coordinating and controlling subtle forces in our physical body. These forces are pranic energy not visible with eyes. Humans are still not clear about this life force. But Yoga is all about developing or improving this inherent power in a balanced way. It offers the spiritual channel to attain complete self-realization. Heart is considered to be gateway.

The literal meaning of the Sanskrit word Yoga/ *Yuj* is 'Yoke' which is joining of individual's soul energy with that of God's (supreme soul). Yoga allows us to look inward to nurture spirit and stay healthy in all spheres, as well as actively enjoy the life by balancing emotions. Commonly perceived benefits include reduction of stress, weight management, resolving psychosomatic diseases, strengthen immune system, etc.

Interestingly, yoga is universal with no relation with caste, sex, religion, region, etc. Its daily practice is essential to understand the ongoing linkages in body and mind, as yoga is evolutionary process to reach higher consciousness.

But the success is still limited. Only few educational institutes have promoted this as daily activity. People indulge in yoga only when they suffer some ailments. Limited set of people are doing it from childhood in schools or as part of family tradition. Its actual benefits at the deeper levels in the form of attaining peace and everlasting happiness remain largely untouched.

Moving through Paths of Yoga

Broad paths of yoga are designed to capture different needs of humans. *Bhakti Yoga* is mainly to help highly emotional people so that they remain unaffected by the dualities prevalent in the society. This yoga of devotion has practices like prayers and worship to connect person with the divine, which is seen as the epitome of love. This contains *Japa/ Mantra Yoga* as integral part. It is the case when one puts his/her mind on reciting name of the God or chant mantras like Om, Rama, Vahe Guru, etc. For intellectual folks, *Jnana/Gyana Yoga* is highly beneficial where lessons are taken from Vedanta philosophy which teaches how to do self-enquiry (understand one's own nature and spiritual entity) and surpass identification with thoughts and ego. This Yoga of Wisdom uses scriptures, lessons of saints/gurus, meditation, etc. *Karma Yoga* is more advanced for common man, but really valuable for people with active outlook. Under this, people do their duties with full dedication but without any expectation of the outcome (selflessly) as everything is observed as service to the divine power. This opens heart for pure meditation and kills ego. *Raja/ Ashtanga yoga* scientifically controls both mind and body, combining features of Hatha yoga (asanas, pranayama) and silent meditation, to gain spiritual energy. This yoga particularly is incomplete without breathing techniques.

There is popular science of yoga known as Pranayama which regulates breath/*prana shakti* in the body. Controlling of breath directly controls mind. Pranayama involves various practices relating to inhalation (*Puraka*) and exhalation (*Rechaka*) as well as retention of the breath (*Kumbhaka*), such as, *Nadi-Shodhan/Anulom-Vilom, Bhastrika, Shitali,* etc. Even practicing pranayama for few minutes a day can radically relax mind, strengthen nerves, removes lethargy and stimulate digestive fire for better food absorption. Technically, pranayama yoga leads to the purification of *Nadis*

which ultimately helps to awaken Kundalini. Fundamentally, nadis are nerves/tubes in the body which are not physically visible but carry pranic currents throughout the body to keep us alive. *Kundalini* is the elementary energy lying dormant at the base of the spine. This is the energy of breath which flows in pattern through nadis and focuses itself by forming intersections along spinal column called *Chakras*. The latter cover Muladhara/Root (at anus), Swadhishthana/Sacral (root of the organ of generation), Manipura/Solar Plexus (navel), Anahata/Heart, Visuddha/Throat, Ajna/Third Eye (space between eyebrows) and Sahasrara/Crown.

These are roughly 72,000 Nadis, but three important ones are *Ida*, *Pingala* and *Sushumna*. Centre–most vital nadi is Sushumna where kundalini shakti awakens by flowing from base through the seven chakras upto the crown of the head. This practice takes the person to super-conscious blissful state. After nadi purification, Kundalini Yoga can be done by using higher level of pranayama, asanas, mudras and concentration in case of Hatha/Raja Yoga, higher level of devotion and surrender practiced in Bhakti Yoga, Mantra Jaap in Bhakti Yoga, etc. However, this must be done under expert's guidance as it involves lot of mudras, bandhas and energy shifts. Generally common people do not use them and mostly struggle between Ida and Pingala. These are the two axis located respectively on the left and right of the centre nadi. Ida is lunar nadi for rest and sleep and controlling mental processes, whereas Pingala is solar nadi which is stimulating in nature and promotes growth. Interaction between the two at different times of the day allow us to move between right and left brain, logic and creativity, etc. Shushmna nadi generates neutral spiritual energy signifying balance. Yoga makes us aware of nadis/chakras that form subtle body and its links to physical body, teach us how to use them during asanas, how to move into meditative state, etc.

Yoga Improves Mental & Physical Health

Traditional yoga techniques are being modified to suit modern lifestyles. Even medical practitioners advice their patients to opt for yoga in their routine along with medicines. Now due to rising risks of diabetes, heart diseases, cancer, etc., number of yoga ashrams and studios are opening all around. Stress makes our body parts stiff and even teenagers find difficulty in bending and picking up things, touching toes, etc.

Health benefits of doing yoga are immense for our physical body. For instance, this gradually loosens up our tight hamstrings, hips, etc. and makes them flexible enough. This improves our postures and prevent us from issues of alignment and pain in legs, back, and other parts. Yoga is the most reliable and cheapest source to strengthen our muscles and bones which averts chances of continuous injuries, arthritis, neck pains, etc. In fact, this supports our joints by maintaining cartilage. Face wrinkles also fade away with regular practice making us more young and attractive. Our body remains in shape.

We know that spinal discs are our survival kit, but cannot stay in perfect shape without movement. Many backward, forward and twist asanas such as *Dhanurasana (Bow Pose), Adho Mukha Svanasana (Downward-Facing Dog), Ardha Matsyendrasana (Half Lord of the Fishes Pose)*, respectively, are blessings to lengthen and strengthen spine. Yoga particularly improves body's blood circulation which further assists in normalizing blood pressure and hypertension. In effect, levels of stress hormone called cortisol are drastically reduced. Good hormones namely dopamine, serotonin, etc. then flow in abundance which are essential to absorb food nutrients (vitamins, iron, calcium etc.). Vitamin D also rises and digestion improves when solar plexus is balanced through kriyas like

Sun Salutation (Surya Namaskar). Yoga not only supplies blood to all parts, but also pumps more oxygen to the cells. Illustratively, inverted asanas namely *Headstand (Shirshasana) and Shoulderstand (Sarvangasana)* helps by bringing blood flow towards heart and then to the lungs. Risk of heart strokes thus declines and we tend to feel happier. Through yoga, immune system is strengthened thereby enabling our lymphatic system to fight cancerous cells and let go of infections. This is very useful in curing diabetes as *kapalbatti, Bow Pose, etc.* stimulate proper functioning of pancreas to naturally secrete insulin. In fact all vital organs gets protected. Yoga nidra as ultimate relaxation helps to ease discomfort and build inner strength. This relaxes our nervous system to rest more in parasympathetic state than in fight-or-flight mode. Overall, yoga helps to remove toxins from our mind and body in the form of sweating, carbon dioxide, etc.

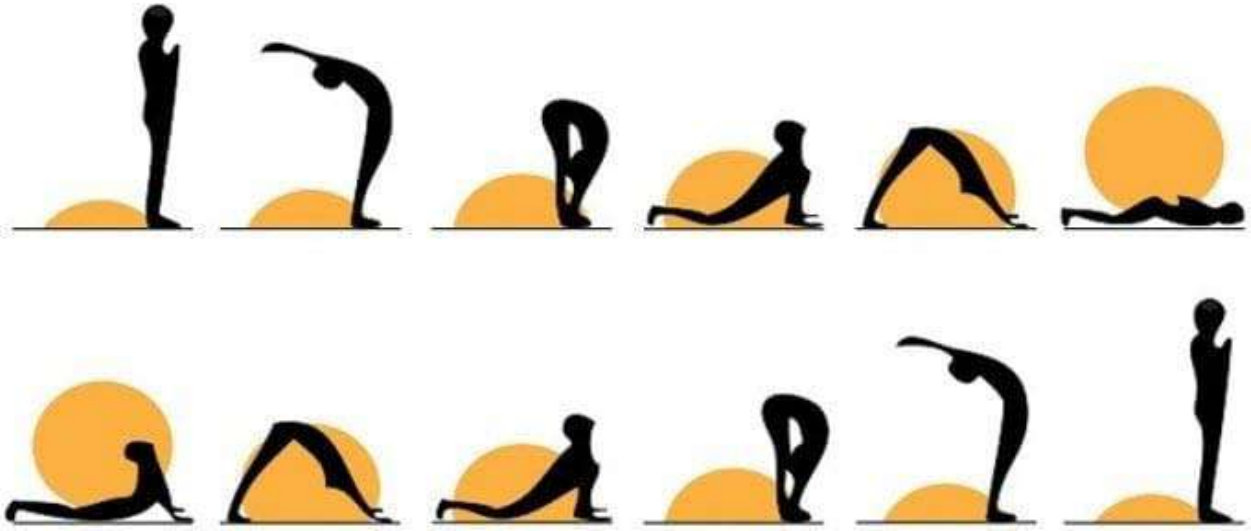
There are a number of mental benefits of yoga. For instance, pranayama and meditation (Vipassana, mindfulness, etc.) increase concentration power by silencing mind, teach us ways to cope with worries/stressful situations and make us more optimistic. Confusions are drastically reduced mainly for students. Yoga helps to overcome addictions (including drugs), temptations, and higher expectation levels. Peace comes when we are able to accept the reality for what it is and become aware of what's going inside us. This way we can timely detect problems and reach solutions. In fact, we are also able to appreciate many problems in life which are actually the by-products of our own lack of patience, knowledge or ego. Yoga empowers us to see this fact and prevent us from getting caught

in vicious cycle of guilt, anger, jealousy, etc. We are able to better regulate and direct our wasteful emotions and feelings in a balanced manner and achieve serenity. Importantly, through yoga, clarity is progressively obtained on who am I and what my purpose in life is.

Connecting to the Real Meaning of Yoga

Atypically, many people do not get the desired benefits despite years of practice. This may be due to doing yoga forcefully due to stress or illness or in a hurry to cope with other things which cause fatigue rather than relaxed breathing. Importantly, yoga is largely seen as a set of exercise excluding meditation. But at that level too, people hardly connect with their body and feel the posture.

To elaborate, we all have heard that our body is like a temple and we need to worship it as this is the only place we have to live in. Let me tell you that body has its own intellect which exactly knows how to heal anything. It is our mind which acts as a hindrance by continuously playing with past stories/memories/experiences. Even medical doctors agree with this. Yoga foremost helps us to realize this fact and demonstrates how to talk to our body with lot of compassion and heal it logically. Yoga builds our trust in the process of life. Specifically, each asana in yoga has some underlying meaning about values



of living correctly and understanding ourselves with purpose of life. For instance, forward bending asanas such as balasana (child's pose), Uttanasana (Standing Forward Fold), etc. not only heal chakras and resolve number of physical ailments, but in reality advocates to stay in present and heal the past, accept the changes, develop faith, and finally surrender to the flow of life with lot of strength. Balancing postures namely Tadasana (Mountain Pose), Vrksasana (Tree Pose), etc. guide us on how much to hold in life and how much to let go for gaining balance and confidence. Doing pranayama is like sending love and gratitude notes to the body and soul. Full yoga class signifies movement with the nature: first we warm up to put new seeds, then grow into the flower during practice to express, then we are able to look inward by attaining coolness and finally we relax/still ourselves through Savasana (Corpse Pose).

That is, aim of yoga is living life ethically based on certain rules of eating, sleeping, and performing duties without fear and attachments. The goal is to open your heart, let go of toxic things, appreciate body, master your mind and uncover its immense powers, and bring more joy be it in job, business or relations. That is, when you come to yoga mat, you are there to grow as a better individual with lot of self-love and self-respect.

Smartly Incorporating Yoga in Routine

Start with any yoga path. Join yoga classes nearby home to learn asanas and pranayama. Regular practice is a must even for few minutes. Easy way is to do deep breathing on/before/during meetings or household work like cleaning. Learn count techniques where inhale, retain and then exhale more in different ways, namely, 4-5-8, 2-5-7, etc. Wake up 5 minutes earlier than scheduled and say positive affirmations, smile, sit in silence, listen to chirping of birds to revive brain cells. Do 5-10 minutes meditation every day. If time permits, do at least 5-10 minutes pranayama, 1-2 stretching or warm-up exercises (few can be done on bed), 1-2 rounds of surya namaskar, and few forward, backward or twist asanas. You can smartly choose everyday as per need and time. There is no age to start yoga. I have seen many people in their 40s, 50s, and 60s and even beyond using this to transform their dull life.

If you still think you lack time for yoga lifestyle, or if you think these are theoretically correct but not feasible in busy life, or if you find all these as good information and must be followed but still do not have intention to follow, then you are just missing beauty of life which can be achieved even in 10 minutes daily practice.

(The author is a yoga practitioner, kathak dancer, and an international trade economist by profession.
Email: nehag.iitd@gmail.com.)

Abu Dhabi World Book Fair - 2019

Abu Dhabi International Book Fair (ADIBF) 2019 was held from 24th to 30th April, 2019 at ADNEC - Abu Dhabi National Exhibition Centre, United Arab Emirates. India was the Guest of Honour and Publications Division participated in the Fair as part of the Ministry of Information and Broadcasting's delegation under the overall coordination of National Book Trust. The India Pavilion, comprising around 20 publishers, was accorded a prominent position in the Book Fair which was jointly inaugurated by Deputy Prime Minister of UAE, Hon'ble Saif bin Zayed Al Nahyan, Indian Ambassador, H. E. Navdeep Suri and Chairman, National Book Trust, Shri G.P. Sharma. As the activities of the Indian delegation were pivoted around the 150th birth anniversary of Mahatma Gandhi, Publications Division displayed its wide array of Gandhian publications and also actively established bonds with the NRI community.

Publications Division also made a presentation on the topic 'Making of the Collected Works of Mahatma Gandhi' at the Book Fair on April 28, 2019. The voluminous CWMG and its e-version brought out by Publications Division, is a monumental document of Gandhiji's words which he spoke and wrote, day after day, year after year, till his assassination on January 30, 1948. The event generated lot of interest among the international audience present.

Books on Indian heritage and cultural values were presented to dignitaries who visited the Publication Division's stall. Large number of visitors, including Indian expatriates to international visitors, enthusiastic school children and distributors of books visited the stall. They got acquainted with the rich repository of books available ranging from Indian history and freedom movement to art and culture, issues of contemporary importance and children's literature.