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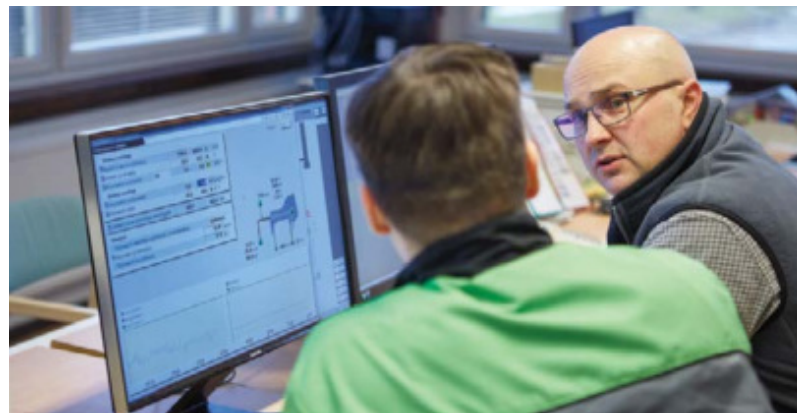
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THE QUEST FOR CLEAN AND SAFE WATER CONTINUES

The community drinking water system comprises of a treatment plant, water storage tank, distribution network, and household connections. The treatment plant removes impurities from the water and makes it safe for human consumption. The water storage tank stores the treated water before it is distributed to households through a network of pipes. Household connections ensure that every household in the community has access to safe drinking water.

Access to clean drinking water is one of the most basic necessities for human survival. However, in India, a large section of the population still lacks access to safe drinking water. According to a report by the NITI Aayog, around 600 million people in India face high to extreme water stress. This water scarcity is especially pronounced in rural areas where access to clean drinking water is limited. In such cases, community drinking water systems play a crucial role in ensuring that people have access to safe and clean drinking water.

In India, community drinking water systems are primarily set up and maintained by the government. The government has initiated several programs to ensure that every household in the country has access to safe drinking water. The following are some of the major programs initiated by the government:

National Rural Drinking Water Programme (NRDWP): The NRDWP was launched in 2009 with the aim of providing safe drinking water to every rural household in the country. Under this program, the government provides financial assistance to the states for setting up community drinking water systems. The program also focuses on capacity building of the community and the government functionaries involved in the implementation of the program.

Swachh Bharat Abhiyan: The Swachh Bharat Abhiyan or Clean India Mission was launched in 2014 with the aim of ensuring cleanliness and hygiene in the country. The program also focuses on providing safe drinking water to every household in the country. Under this program, the government has set up several community drinking water systems in rural areas.

Jal Jeevan Mission: The Jal Jeevan Mission was launched in 2019 with the aim of providing safe and adequate drinking water through functional household tap connections to every rural household in the country by 2024. The program aims to provide tap water connection to every rural household in the country. Under this program, the government provides financial assistance to the states for setting up community drinking water systems and household connections.

Despite the government's efforts, community drinking water systems in India face several challenges. The following are some of the major challenges:

Lack of Awareness: One of the major challenges faced by community drinking water systems is the lack of awareness among people about the importance of clean drinking water. Many people in rural areas do not understand the importance of clean drinking water and continue to use water from contaminated sources.

Poor Maintenance: Another major challenge faced by community drinking water systems is poor maintenance. Many communities drinking water systems are not maintained properly, which leads to a decline in water quality. Lack of proper maintenance also leads to leakages in the distribution network, which results in water loss.



Limited Resources: Community drinking water systems require significant financial resources for their establishment and maintenance. Many rural areas in India do not have the required financial resources to set up and maintain community drinking water systems.

Climate Change: Climate change is another major challenge faced by community drinking water systems in India. Changes in climate patterns have resulted in changes in the availability.

The search for clean and safe community drinking water in India continues. Though we have a long way from the times, when water borne diseases were rampant and the awareness of very basic things such as boiling of water before drinking used to be telecasted on DoorDarshan, but still, it is not at par with the advancements in other fields. Surely, we will reach the goal, but we really need to speed up.

Thanks & regards,

Deepak Chaudhary

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Daiki Axis India and Shri Vishwakarma Skill University Completes Successful Pilot Program for Wastewater Treatment Education

Palwal, Faridabad- 11th April – Daiki Axis India, a leading provider of sustainable wastewater solutions, and Shri Vishwakarma Skill University (SVSU) a state government university in Haryana, India, established in 2016 which promotes skill-based education and entrepreneurship. The university offers various undergraduate and postgraduate programs in different skill domains, focusing on industry-specific training and research have successfully completed a six-day pilot program on the importance of decentralized wastewater treatment plants and their proper operation. The program was attended by 12 students and three officials and aimed to educate and train individuals engaged in wastewater treatment to work in a more controlled and efficient environment.

Aligned with the Swachh Bharat Mission and the Amrut Mission, which promote the installation of sewage treatment plants (STPs) for water treatment, the pilot program aimed to address the gap in the market regarding the functionality of STPs. Officials lack proper training and education, which often results in the failure of STPs. Daiki Axis India aims to bridge this gap by providing guidance and support, leading to more sustainable and effective wastewater treatment solutions.

Daiki Axis India is also committed towards installation of STPs in every upcoming locality to ensure that the waters are fit for consumption. By providing education and training to individuals involved in wastewater treatment, Daiki Axis aims to improve the quality of wastewater treatment facilities across Haryana.

"By successfully piloting a program that educates students on wastewater treatment, SVSU has achieved a major accomplishment in both job creation and knowledge creation. This reflects our dedication to training and empowering the next generation of environmental professionals, who will be equipped with the necessary knowledge and skills to address real-world challenges." He further added "Our efforts are contributing to the development of a more sustainable future, where skilled professionals can create positive change for the benefit of all." - Mr. Raj Nehru, Vice-chancellors, SVSU.

"Mr. Kamal Tiwari, CEO, Daiki Axis India expressed his excitement about the successful completion of the pilot program with SVSU stating "The program aimed to provide sustainable wastewater solutions and enhance the efficiency of STPs across the country. By training individuals engaged in wastewater treatment, the program has created opportunities for new businesses and jobs, specifically for the youth. This clean and green initiative has the potential to generate employment for thousands of young people, while also benefiting the economy and contributing to a water-positive India." He further added "Additionally, the skilled workforce created through this program could potentially find millions of employment opportunities for our youth. This program is expected to have a positive impact on the quality of wastewater treatment facilities not only in Haryana but also across the nation."

Daiki Axis, as an organization, recognizes the importance of addressing the environmental challenges faced by the world today. To this end, the company has taken a strategic decision to align its operations with the United Nations' Sustainable Development Goals (SDGs). Daiki Axis is committed to playing its part in achieving these goals, particularly with regards to sustainable and responsible wastewater solutions. The organization recognizes that effective wastewater management is essential to ensure a sustainable future for generations to come. Daiki Axis is continuously working towards developing innovative and eco-friendly solutions that can reduce the environmental impact of wastewater treatment. The company's aim is to create solutions that are not only effective in treating wastewater but also economically feasible and socially responsible. Through its commitment to SDGs, Daiki Axis hopes to make a significant contribution to the global effort towards building a more sustainable future for all.

Cupix Adds CupixWorks to Bentley's Powered by iTwin Program

The one-stop digital construction solution enables every stage in the built-world lifecycle

San Jose, CA – Cupix™, a global spatial digital twin platform that provides visualization and analytics for owners and builders across the entire built-world lifecycle, announced today the addition of its leading product, CupixWorks, to Bentley Systems' powered by iTwin program.

CupixWorks is a state-of-the-art 3D digital twin platform that enables decision-making and collaboration through all stages of a building's life cycle. Project Managers, General Contractors, Architects, and Owners can remotely view, track, and manage on-site progress via 3D spatial contexts and life-like 3D navigation.

By leveraging the Bentley iTwin Platform, CupixWorks can synchronize and visualize 3D, 360° capture data — along with BIM models plus customized data — and use georeferencing to place the capture in the site's physical location.

"We are excited to add CupixWorks to Bentley's powered by iTwin program," said Simon Bae, CEO at Cupix. "The iTwin Platform's visualization and synchronization capabilities help CupixWorks to deliver life-like 3D navigation that feels like you're on site. This improves collaboration for stakeholders—wherever they are—based on what's actually happening at the site."

"We are very pleased to have Cupix add their CupixWorks solution to the powered by iTwin program," said Adam Klatzkin, Vice President, iTwin Platform, at Bentley Systems. "In doing so, the company joins a growing ecosystem of developers building powerful digital twin solutions on the iTwin Platform. CupixWorks is a great example of how 3D reality capture data and BIM can be synchronized for virtual site navigation and progress tracking of complex construction projects."

The addition marks another step in Cupix's efforts to democratize 3D digital twin adoption across the built-world industry. Last year, Cupix announced the release of their CupixWorks X 3D Digital Twin Platform, which is powered by the Gamma Engine 3rd generation AI engine. The platform launch included enhancements to spatial contexts, progress tracking and analytics, and image fidelity in 360° virtual walkthroughs.

Pump Academy Private Limited Signed MoU with JSS Academy of Technical Education, Bengaluru for Industry-Academic Collaboration

Bengaluru, April 22, 2023: Pump Academy Private Limited (PAPL), a leading provider of pump optimization solutions in India, has signed a Memorandum-of-Understanding (MoU) with JSS Academy of Technical Education (JSSATE), Bengaluru. The MoU aims to establish a strong industry-academic collaboration for knowledge partnership and focused research to create a vibrant ecosystem to foster technology entrepreneurship among students and incubation of start-ups in the field of pumps operations and pumping system management; and Internet of Things (IoT) enabled Industry 4.0 and Industry 5.0 revolution in the country.



The MoU was signed on April 21, 2023, by Mr. Anil Sethi, Chairman of PAPL, and Dr. Bhimasen Soragaon, Principal of JSSATE. The signing ceremony was witnessed by senior officials from PAPL, Dr. H R Mahadevaswamy, Joint Director, TED, JSSMVP, Mysuru, HoDs, Deans and faculties of JSSATE, Bengaluru. The collaboration aims to facilitate research and development for deep learning in design innovation, creative thinking, and adopting artificial intelligence to equip pump machineries with predictive analytics, performance improvement, and enhanced energy efficiency.

The Indian pump industry is a significant contributor to the country's growth and is expected to reach USD 3.3 billion by 2026, growing at a compound annual growth rate (CAGR) of 7% during the period of 2020-2026. Under the MoU, both parties will formulate strategies to incorporate the end user's perspective early on and make the solution more contextually relevant. They will also jointly conduct skill development programs, knowledge exchange through workshops, trainings, seminars, and faculty development programs in a timely manner for developing contemporary solutions for sustainable water pumping systems.

Mr. Anil Sethi, Chairman of PAPL, expressed his happiness over the signing of the MoU and said that the rapid urbanization trends in India, combined with depleting groundwater levels and government initiatives to improve water supply, have led to the rapid growth of the pump industry. He added that the association with a leading engineering and technology institution will certainly help bright minds work together and drive new and innovative ideas for the pump industry. Mr. Sethi further stated

that their association with JSSATE would support the students and faculty members with industry visits, internships, skill development, and hands-on experience on project execution, seminars, and other benefits.

The MoU between PAPL and JSSATE will pave the way for exciting new ventures and innovation across the pump industry, bringing together the most up-to-date technological solutions for the benefit of the nation.



West Bengal needs waste water treatment and reuse policy to save rivers: Experts

KOLKATA: A recent report by the Central Pollution Control Board (CPCB) estimates that urban areas in West Bengal generate 5,457 million litres per day (MLD) of sewage, but the installed treatment capacity is only 16%, resulting in untreated wastewater being discharged into rivers and other water bodies. Nitin Bassi, Programme Lead at the Council on Energy, Environment and Water (CEEW) suggested that adopting a comprehensive state-level wastewater treatment and reuse policy can help plug this gap and improve river health.

He added that the state-level policy should define both discharge and reuse-specific treated wastewater quality standards, following the guidelines of the National Framework on Safe Reuse of Treated Water.

According to CEEW analysis, urban centres in India will generate about 44,000 MCM of domestic wastewater by 2050, making substantial investments in wastewater treatment necessary for rejuvenating India's polluted rivers. To this end, the National Mission for Clean Ganga (NMCG) has taken steps towards cleaning Ganga, and this approach should be replicated for other polluted river stretches in India, Bassi said.

The 48th meeting of the Executive Committee of the National Mission for Clean Ganga (NMCG) was held recently, where eight projects worth approximately Rs 638 crore were approved. Four projects worth Rs 407.39 crore were approved for pollution abatement in the Shamli district as part of the comprehensive Hindon Rejuvenation Plan. These projects are aimed at preventing the flow of polluted water into Krishna River, a major tributary of Hindon. The four projects include the construction of sewage treatment plants, septage co-treatment facilities, interception and diversion (I&D) works, and other infrastructure in various towns and villages in the district.

Additionally, one project for the development of seven ghats in Prayagraj was approved as part of preparations for the Mahakumbh in Uttar Pradesh in 2025. Two more sewerage management projects were approved, one each in Bihar and Madhya Pradesh. The Bihar project includes the construction of three sewage treatment plants among other works, while the Madhya Pradesh project includes the construction of a sewage treatment plant and common effluent treatment plant, among other infrastructure.

During the meeting, G. Asok Kumar, DG, NMCG, urged officials to promote the use of solar power on STP sites and separate and dispose of solid waste from drains flowing into rivers. He also emphasized that it is the responsibility of state governments to maintain assets created under the Namami Gange Programme and urged them to communicate the standard operating procedures being adopted by the urban local bodies (ULBs) for cleaning existing ghats to the NMCG.

Finally, a project for ghat development was approved for Haridwar, Uttarakhand, where Akhand Param Dham ghat will be constructed at a cost of Rs. 2.12 crore.

Pune Infra Watch: PMC to recycle muddy water discharged from Parvati water treatment plant

To avert the threat of a major city like Pune running out of water, its civic body, the Pune Municipal Corporation (PMC), has undertaken a project to recycle the muddy water that is being released from water treatment plants so as to satisfy the daily needs of 80,000 people. This will help ensure that not a single drop of water the

corporation receives from the dam goes wasted.

The PMC draws water from four dams – Khadakwasla, Temghar, Varasgaon, and Panshet – while some parts of the city get water from the Bhama Ashed dam. In the last few years, Pune has been facing water scarcity during summer forcing the civic body to take measures to stop misuse of potable water and reduce the loss due to leakages.

A small capacity water treatment plant is being set up to treat the muddy water discharged from the large treatment plant of 300 MLD capacity in Parvati, said Nandkishore Jagtap, superintendent engineer in the civic water supply department. "Around four per cent of water of the total capacity of the water treatment plant is lost for cleaning the filter bed and is released in nallah. Accordingly, the small unit will recycle 12 MLD of water which will meet the water needs of around 80,000 residents. This is equivalent to the population of a large locality of 20,000 houses in the city," the officer explained.

The cost of the project is Rs 2.5 crore but it will be a permanent solution to stop the wastage of water at Parvati water treatment plant, Jagtap said and added that similar units will be set up at other large water treatment plants that have discharge of muddy water.

The civic body has set up large-capacity water treatment plants at Parvati, Vadgaon Budhruk, Pune Cantonment, Warje, and Holkar Bridge where the water from dams is treated before being supplied through a network of pipelines.

The treatment of water at various plants is done using alum and the water is separated from mud. The filter bed at the treatment plant is cleaned twice a day and the sludge is removed and the muddy water is released in the nearby canal. "It has been a normal practice to release the muddy water in nallah. Now, we have decided to clean this water and make it potable," he said.

Civic activist Vaishali Patkar of Bhujal Abhiyan said every drop of water counts and the efforts of PMC to recycle the muddy water that was discharged in nallah was a good initiative. "The population of the city is increasing and there is a need to ensure that their water demand is met efficiently. Every drop saved is like generating equal amounts of water," she said.

The civic body also has the task of stopping the leakage of water through its supply network, Patkar said. The state water resources department has also planned to build a tunnel to carry water for irrigation purposes instead of an open canal to avoid loss due to evaporation.

New sewage treatment plant (STP) at Baga continues to release raw sewage

Calangute: The Calangute Constituency Forum (CCF) has claimed that the new sewage treatment plant (STP) at Baga continues to release raw sewage into the Baga river even after the Calangute panchayat asked them to stop operations last week.

In a letter to the chief secretary, Goa State Pollution Control Board (GSPCB), State Biodiversity Board and other authorities, the CCF has demanded that an environment audit be conducted of the STP and to "check the pollution of the river water on priority and stop the operation of the STP to control further damage to the environment".

The CCF raised the issue after allegations by tourism stakeholders in Baga that raw sewage was being released by the STP in the Baga river. The Calangute panchayat had conducted a site inspection of the STP last week and had asked the STP management to shut down operations after they found the allegations to be true and

that the STP was operating without valid permissions from the GSPCB.

“Although the panchayat has asked the STP management to stop the operations immediately, it looks that the management of the STP is not serious on the said issue,” the CCF stated in the complaint.

CCF said that when their members visited the STP earlier this week, they found the sewage being released through a ditch and a pipe into the Baga river.

The CCF also pointed out that GSPCB had sometime ago conducted a site inspection of the Baga river following complaints from the Calangute panchayat and the Arpora-Nagoa panchayat that resorts were releasing raw sewage into the river and “found the water to be polluted”.

Upgraded Okhla Sewage Treatment Plant To Be Operational In June: Delhi Jal Board



The Okhla sewage treatment plant, Asia's largest, is set to become operational in June this year, said Delhi Jal Board Vice Chairman Somnath Bharti. The plant's four phases are being upgraded and rehabilitated to meet the prescribed standards (less than 10 milligram per litre) for biological oxygen demand (BOD) and total soluble solids (TSS) in the treated wastewater. The upgraded plant will be able to treat 56.4 crore litres of wastewater every day from South Delhi, NDMC area, and other parts of the capital, benefiting around 40 lakh people.

The government spent Rs 1,161.17 crore on the project, which began in June 2019 under the third phase of the Yamuna Action Plan. The plant will also feature artificial lakes, and 15 to 20 MGD of treated water will be reused in them. Bharti said this initiative would help reduce pollution in the Yamuna River.

Untapped wastewater from unauthorised colonies and jhuggi-jhopri clusters, and poor quality of treated wastewater discharged from sewage treatment plants and common effluent treatment plants is the main reason behind high levels of pollution in the Yamuna.

Twenty-two drains carrying domestic wastewater and industrial effluent fall into the Yamuna between Wazirabad and Okhla. Though the 22-km stretch is less than two per cent of the river length, it accounts for about 80 per cent of the pollution in the river.

Zila Parishad Nashik develops app to monitor Jal Jeevan

Nashik: The zilla parishad in Nashik has developed a mobile application to monitor Jal Jeevan Mission works.



The Nashik ZP got this application designed by a software engineer and this will enable the authorities to get updates on the various projects on real-time basis and even monitor the developments at the sites.

A senior ZP officer from the water supply department said that the application will ensure that right quality of work is being carried out and assist in taking appropriate action, including penalising the contractor if the work is not up to the mark.

“The application will give real-time updates with pictures and videos by geo-tagging the concerned officer. This will help the administration not only to remain updated about a project but also to keep a check on the quality,” said the officer. “If there are any issues related to delay in completion of works, the matter can be intimated so the senior authorities can look into them and give necessary instructions,” he said.

Jal Jeevan Mission achieves 60% of its target, says govt

Of India's total of 190.4 million rural households, 116 million now have a functioning water tap, an official statement said. The Jal Jeevan Mission, one of Prime Minister Narendra Modi's flagship programmes to connect every rural household in the country with a tap-water connection, has reached 60% of its countrywide target, adding 23.4 million households in the fiscal year ended 2022-23, an official statement said.

Of India's total of 190.4 million rural households, 116 million now have a functioning water tap, the statement said. “This is an outstanding achievement and will empower several lives. We are doing everything possible to increase this coverage at an even greater pace in the times to come,” said Prime Minister Narendra Modi in a tweet.

At the start of the mission, a baseline survey showed that less than 17% or 32.3 million households had a tap connection. “The country crossed another milestone in the journey towards ‘Har Ghar Jal’ on 4th April 2023, with over 11.66 crore (60%) rural households provided with tap water supply in their homes,” the statement said. As on date, Gujarat, Telangana, Goa, Haryana, Punjab and the Union territories of Andaman & Nicobar Islands, Daman Diu & Dadra Nagar Haveli and Puducherry have achieved 100% coverage.

DROPLETS

SNIPPETS

1. Bentley Systems Announces Two Colleagues Become Fellows with Professional Engineering Associations in the U.K.

EXTON, Pa. – May 4, 2023 – Bentley Systems, Incorporated (Nasdaq: BSY), the infrastructure engineering software company, today announced that two of its colleagues have qualified as Fellows with highly regarded professional associations.

Mark Coates, International Director of Public Policy and Advocacy with Bentley Systems, has qualified as a Fellow of the Chartered Institution of Highways and Transportation (CIHT). The CIHT is a United Kingdom charity, learned society and membership body with international chapters. The Institution represents and qualifies professionals who plan, design, build, manage, maintain, and operate highways, transport infrastructure, and services. CIHT is a leading voice of the highways, transportation, infrastructure, and services profession. It is a source of advice for national and local government and other strategic stakeholders seeking technical expertise and knowledge to guide future policy and investment.

Joe Rice-Jones, Strategic Account Director with Bentley Systems, has qualified as a Fellow of the Institution of Civil Engineers (ICE). ICE is a 95,000-strong global membership organization with over 200 years of history. It is a center of engineering excellence, qualifying engineers and helping them maintain lifelong competence, assuring society that the infrastructure they create is safe, dependable and well designed. Its network of experts offers trusted, impartial advice to politicians and

decision makers on how to build and adapt infrastructure so that it is more sustainable.

“The ICE and CIHT promote best practices and policies and provide guidance to assist governments and businesses in delivering infrastructure systems that support a sustainable future,” said David Shaman, Chief Legal Officer and Secretary with Bentley Systems. “With only 5% of members being awarded Fellowship status, we congratulate Mark and Joe on achieving such a high accolade, and, through their stewardship, Bentley will continue to share learning and insights to drive the infrastructure sector’s digital readiness and maturity.”

Fellowship is the highest membership grade, reserved for individuals who have led the promotion, planning, design, construction, maintenance, or management of significant projects. Coates and Rice-Jones qualifying as Fellows highlights their contributions to the industry and U.K. society.

Fellows contribute to the development of the infrastructure industry by imparting their knowledge, experience, and mentoring. They participate in the activities of these institutions, resulting in opportunities to join the boards of working groups and think tanks that generate value via leadership and insight driving direction, innovative thinking, and, most importantly, adoption of new working practices.

As Fellows, Coates and Rice-Jones will publish articles and conduct industry-focused seminars for institution members, as well as help influence government policy.



2. Municipal Advisory Board Celebrates 15 Years

Group Continues to Expand HDPE Pipe Educational and Technical Programs

IRVING, Texas – April 28, 2023 – The Municipal Advisory Board – MAB – is celebrating its crystal anniversary. Formed on May 1, 2008, MAB serves as an independent, non-commercial adviser to the Municipal & Industrial Division of the Plastics Pipe Institute, Inc. (PPI), and is made up

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of industry experts who volunteer their time and expertise to improve the design, installation, and operation of municipal high-density polyethylene (HDPE) water piping systems.

Created and organized by PPI's Camille George Rubeiz, P.E., F. ASCE, co-chair, Municipal Advisory Board and senior director of engineering, Municipal and Industrial Division of PPI, who gathered a team of experts. "This group can objectively advise municipalities on issues related to HDPE piping systems," he said. "It is also the goal of MAB to improve the standards, design and installation of HDPE systems. The members lend their expertise to performing joint research on HDPE systems to resolve or clarify issues, and also to better understand and address the needs of the municipalities primarily throughout North America and Europe."

Recently, MAB issued technical document MAB-9, MAB-9, Design of HDPE Water Mains for the Lateral Spread Seismic Hazard, updated MAB-01, the MAB Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe, and conducted several of its seminars that train utility operators on the proper fusion and electrofusion methods for HDPE water piping systems.

"This is the only class in the country that is 100 percent focused on HDPE water systems," said Rubeiz. "And the MAB website - www.plasticpipe.org/MABpubs - is the prime website within PPI that contains the full library of MAB documents, articles, papers and software."

"The formation of the MAB within PPI was a game-changer as far as identifying the resources needed by municipalities considering use of HDPE piping systems," stated David M. Fink, president of PPI. "MAB supports the utilities and PPI in the development of installation guidelines, calculators, and education for advancing the proper use of HDPE piping systems. These tools have further advanced the opportunities for the correct design, installation, and operation of HDPE piping systems."

"Under the leadership of Luis Aguiar, MAB co-chair and co-founder, Senior Associate with Hazen & Sawyer's Miami-Fort Lauderdale area office and previously the Assistant Director Water Operations at Miami-Dade Water & Sewer, the MAB has grown to include municipalities members and contributors from across the U.S., Canada and Europe. In addition, the group has representation from municipalities, college professors, contractors and engineering firms that bring together years of experience and expertise in potable water and wastewater piping infrastructure systems."

"The 15th year is known as the Crystal Anniversary," Rubeiz said, "symbolizing clarity and durability. MAB is now widely known for

bringing clarity in helping engineers design long life, leak-free systems, plus we are a very durable group as evidenced by our longevity of 15 years that will continue for many more years."

3. AVPN's India members share experiences on deepening climate impact in two new videos launched for Climate Action Platform for Earth Day

The Asian Venture Philanthropy Network (AVPN's) Climate Action Platform enables its members to work across the systemic change spectrum in the region

New Delhi, 21 April 2023: The Asian Venture Philanthropy Network (AVPN), Asia's largest network of social investors, has released two new videos as a part of establishing their Climate Action Platform 2.0 for Earth Day. Keeping with the 53 Earth Day theme, 'Invest in Our Planet', the videos spotlight Climate Impact Leaders as part of a series of dialogues, to highlight their work in scaling domestic climate philanthropy in India. The Climate Action Platform 2.0 was launched at AVPN's South Asia Social Investment Summit in January 2023, to address the philanthropic gap and climate change opportunities in Asia.

The vision of the Climate Action Platform is to drive Asian leadership in the global climate agenda, channel more resources into climate action, and accelerate the global transition to a resilient, sustainable, positive future for all. The Platform has recognised multiple challenges for Asian philanthropy in climate giving through an extensive landscape study, which includes climate issues taking a backseat, a lack of Asian-led climate philanthropies for Asia, and limited knowledge dissemination among the climate field in the region. AVPN's core strengths position it uniquely to build a bold vision for the Climate Action Platform – due to its well-established membership network, ability to mobilise capital, and ability to build relationships with policymakers.

"We strongly believe that clarity can greatly assist the climate-giving landscape in Asia – as one can see, in India, major funding is being channeled to a few areas only. This creates gaps for other issues that require urgent attention and impact-giving like heat stress, energy access, and sustainable livelihoods. Therefore, through the Climate Action Platform and the work of Climate Impact Leaders – we're trying to showcase the issues that require capital mobilisation and how critical climate funding can reap real results," shared Naina Subberwal Batra, CEO, AVPN on the occasion of Earth Day and the launch of the videos.

The first two videos as a part of the Climate Impact Leaders series

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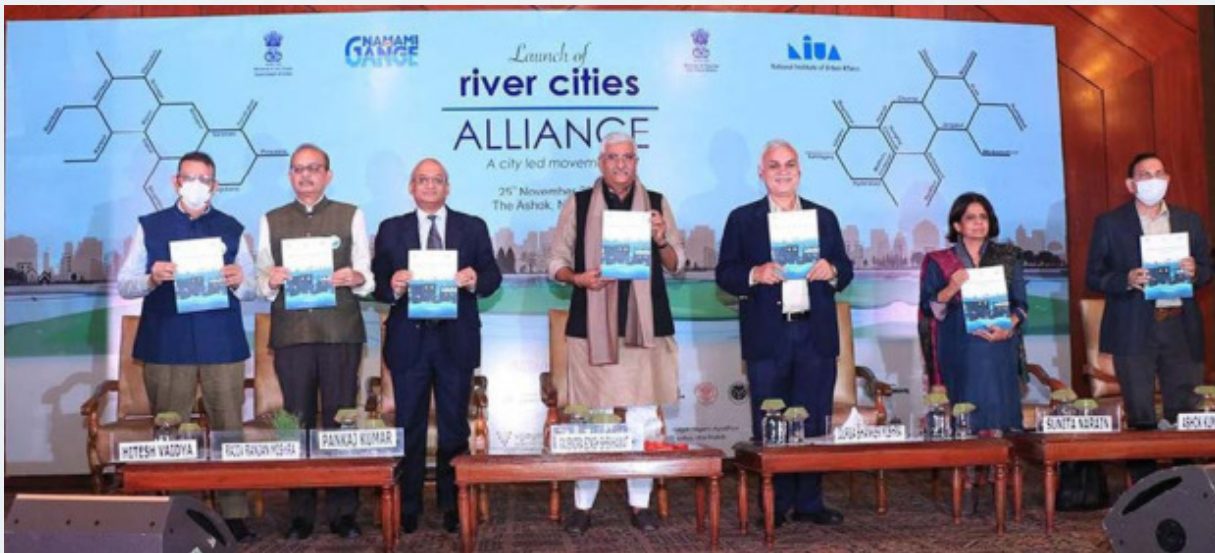
showcase the journeys of two climate changemakers: Leena Dandekar, Founder & Director of the Raintree Foundation, and Sameer Shisodia, CEO of Rainmatter Foundation. In the first video, Leena shares that the community is the true custodian of the environment, as they are the direct beneficiaries of everything good that the climate has to offer them. She also shares that the pilot project they're presently undertaking will do 47-49 years of work in a seven to eight-year span. In the second video, Sameer states that they focus on intersectionality to make millions of trade-offs better, to try and find the answers to climate change. The videos then move to cover their viewpoints on lived experiences, collaborations, and local solutions to highlight climate philanthropy and action.

4. National Mission For Clean Ganga Organizes River-Cities Alliance Global Seminar

National Mission for Clean Ganga (NMCG) in association with the National Institute of Urban Affairs (NIUA) organized the 'River-Cities Alliance (RCA) Global Seminar: Partnership for Building International River-Sensitive Cities' today in New Delhi. The purpose of the RCA Global Seminar was to provide a platform for officials of member cities and international stakeholders to discuss and learn good practices for managing urban rivers.

The RCA Global Seminar witnessed participation from Embassies/High Commissions of select countries and their respective river cities in order to highlight objectives, achievements, and potential collaborative outcomes of RCA. State Missions for Clean Ganga (SMCGs) and funding agencies like World Bank, ADB, JICA & KfW also were part of the discussions.

Addressing the gathering, Mr. G. Asok Kumar expressed happiness on the increase in number of cities joining the RCA and the immense interest NMCG has been able to generate on this issue. He noted that the trickle started with the Urban River Management Plan and has been flowing ever since. He emphasized the importance of issues related to climate change and urban water management, and how urban planners have a serious challenge at hand. "Climate change is a reality. We can see it now in Delhi where in the month of May we are needing blankets," he said.



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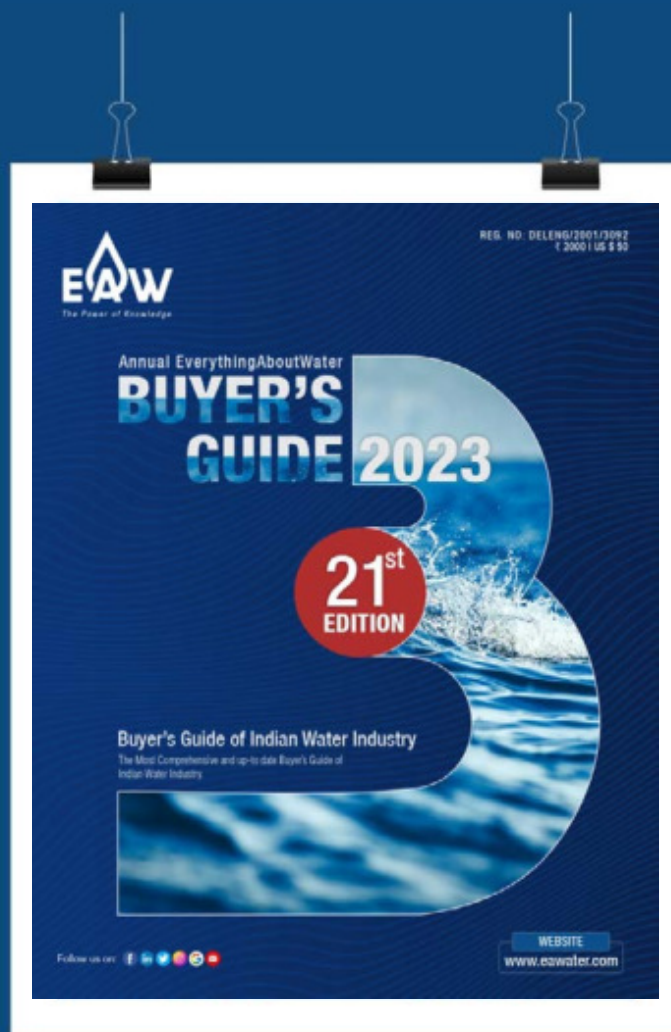
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CELEBRATING EARTH DAY 2023

Messages from the Industry Leaders



ANIL SETHI, CHAIRMAN, PUMP ACADEMY PRIVATE LIMITED

If earth could speak for itself, it will certainly tell us that it is starving, suffocating and getting warmer day after day. The natural resources like water, soil, minerals, air, environment and ecological habitats are all declining. Best practices, technological intervention, conservation and care for these resources are paramount so that all living things can benefit from them now and in the future.

The ever increasing pollution and contamination of the soil has far-reaching consequences that can be catastrophic for water, air, habitations, and all living species. The food and water we need to survive is grown and drawn from the surface of the earth. Our lives are intimately tied to the earth's resources and anything that degrades, damages, or destroys it ultimately has an impact on human life and threatens our ability to survive.

The leading resource of the planet earth and source of life to all living being – water; is needed utmost attention for it to be preserved, keep clean and safe for consumption.

The social and economic growth of people and nations majorly depends on the availability of water. In India, water is still treated a free commodity and sustainability plans are limited. We have taken water for granted for many years when it was available in abundance. But the scenario has changed entirely from abundance to extreme scarcity in the last few decades and we are now facing a tough challenge in getting clean water to drink at many places in the country.

Major cities are facing water stress and staring the 'day zero' scenario. Many of us still do not think that how much of this finite resource we over consume from the earth resources and does not realize that clean water is a very precious commodity.

Technology to Support Sustainability

In this era of new technological innovations and digital interventions, there are potentially huge advantages which have to be evaluated and implemented for water management in India as much as possible. Apart from other smart interventions, an enabling solution for accelerating the transition from traditional pumping system to smart and digitally integrated pumping system for effective water distribution management has become inevitably significant in the current times.

One such technology for water pump optimization is iPUMPNET. It is an advanced technological solutions for making pumping system smart and intelligent ranging from the operational efficiency, reducing energy cost, extending life of pumps, minimizing life cycle cost of pumping system and practically eliminating breakdowns and frequent maintenance requirements with powerful analytics. It also helps in environmental sustainability by significantly reducing carbon footprint of pumping station and reducing risk of accidents thus increasing workers safety.

The cost effective solution once implemented in a pumping station will not only yield good financial returns but the investment on iPUMPNET can easily get the break-even within a year. It will help all water utilities in India to remotely monitor their pump operations and save on time and money while conserving their precious resources to serve their valued customers.

It is estimated that around 5 GW of energy can be saved if iPUMPNET is put in use in all pumping stations across all water utilities and municipal water supply systems in India. It is a huge benefit not only in terms of saving electricity and cost, but it will reduce thousands of tonnes of carbon emission thus helping the earth to breathe and minimize climate change effects and global warming. The efforts by the Pump Academy Private Limited by introducing this pioneering solution, iPUMPNET to optimize pumping station operations with the patented IoT enabled



innovative system is in line with the vision of our Hon'ble Prime Minister to revitalize a sustainable green world at the 26th United Nations Framework Conference on Climate Change in Glasgow, wherein India is committed to achieve net-zero emissions by 2070.

This innovative solution will play an important role in achieving India's commitments to the world which also emphasize this year's theme, 'Invest in our Planet' while making earth a better place to live.



DR NUPUR BAHADUR, ASSOCIATE DIRECTOR, ENVIRONMENT & WASTE MANAGEMENT DIVISION & HEAD, NMCG-TERI COE ON WATER REUSE, THE ENERGY AND RESOURCES INSTITUTE (TERI), NEW DELHI

The Universe is created out of five basic elements, called the panchamahabhutas, namely the earth (prithvi), water (jal), fire (tejas), wind (vayu) and space (akasha). The Mother Earth is supreme and shall be saved when all elements are taken care of. Earth Day is an annual event on April 22 to demonstrate support for environmental protection. The concept of Earth Day was first introduced by peace activist John McConnell at a UNESCO Conference in 1969 and the first celebration was held on April 22, 1970, which now includes a wide range of events coordinated globally. The official theme of 2023 World Earth Day is "Invest in Our Planet". So let us resolve to invest our time, attention, and efforts to take care of at least one element to the best of our ability! I am taking care of the water, have you identified yours?



MANOJ NAINANI, EXECUTIVE DIRECTOR – ENERGY & SUSTAINABLE CITIES, EGIS INDIA AND SOUTH ASIA, EGIS INDIA

Our planet is an amazing place and we responsible to make it a better place to live for us and for the upcoming generations.

"Climate emergency, our absolute priority". We are a global leader in green infrastructure and as a company we are committed to fight against climate change and biodiversity erosion.

We offer a wide range of solutions to benefit the environment. In all our fields of work, our engineers develop innovative operational solutions to address specific environmental issues: care for In all engineering services, deployment of eco-design practices, energy

efficiency, material recycling, etc. We ensure that in all our engineering services to deploy eco-design practices. The Group's technical departments are particularly focused on new low-carbon technologies: eco-designed materials, positive energy building envelopes, construction waste recycling, etc. and on natural sequestration solutions such as the reconstitution of natural environments (forests, mangroves) and the revaluation of the sequestration potential in the soil.

We're proud to lead the way in sustainable infrastructure, mobility and energy, innovating across the entire value chain and every aspect of the built environment. Whether it's fighting climate change, cutting carbon emissions or protecting biodiversity, sustainability is at the heart of every project.

For more than 40 years, we've been proactively pursuing an innovation policy that will help in building green infrastructure. We also practice what we preach; we're working towards being carbon neutral by 2050. To achieve this – and help our clients do the same – the environment is a critical pillar in our strategy, CSR and innovation programme. Climate change is real, and it is high time that nations and organizations act on the ground to bring about the much-needed change. While every citizen should be responsible for safeguarding our environment, organizations also have to contribute to the cause.

'Being Responsible' is one of the core values of Egis and we have initiated an environmental sustainability-themed project, "Clean & Green", in Gurugram along with our NGO partner, "Hara Jeevan". Egis in India's "Project Clean and Green" focuses on adopting a Green Belt – cleaning a designated area and turning it Green by planting trees. We have already planted more than 2000 saplings in the green zone as our contribution in making our world a happier, healthier place to live.

Egis is committed to supporting all Government's efforts and playing its part by partnering in key green initiatives. Our ambition is to become a leading player in intelligent and sustainable infrastructure to combat climate change and improve people's living environments.



THE EARTH A SOLITARY PLANET! MANISHA KINGE, MANAGER-PROJECT & DESIGN, JAIN IRRIGATION SYSTEMS PVT. LTD

The Earth is called Mother! Where a favourable – liveable climate called the greenhouse effect is controlled for the growth of microorganisms to giant species.

Earth is providing useful elements & resources for us like water, food, shelter, clothes, air, minerals, fuel, power, and wealth for our day-to-day life and business.

There are many articles, books, poems, songs, etc written and could be found on Earth. In Sanskrit, Earth is treated as a goddess, and many kingdoms & civilizations flourished & disappeared. Many wars were fought among the kingdoms to become the owner of the earth!

The truth is nobody has become the owner of the Earth.

Earth is known as one of the elements among the five (panchamahabhutas) of the Universe. i.e. Earth (Prithvi), Water (Jala), Fire (Tejas), Wind (Yayu) and Space (Akasha).

We have forgotten & underestimated the importance of 'The Earth' while striving and focusing on industrialization and development for many decades. And resulted in the punishment i.e. Natural Calamities, Cyclones, Tsunamis, Earth Quakes, Heavy Rain & flood, Drought, and so on.....

Now Researches & Scientists are realizing and assessing the facts and talking & about the mitigation of Climate change, Global warming, rising sea levels, depletion of the ozone layer, deforestation, and pollution.

Our chairman Hon Dr. Bhavalalji Jain use to say, 'Leave this planet better than you found it'.

If we take care & protect the earth today, the earth will take care of tomorrow for us & next Generations ... to enjoy the glory of the earth!



DILIP YEWALEKAR, SENIOR VICE PRESIDENT, JAIN IRRIGATION SYSTEMS LTD

The Earth is the womb of the universe! Where everything takes birth, grows, and merges! Also protects all of us from external forces and radiation!

The Earth holds water, lava, and air, and balances a favorable livable climate for micro to mega creatures ... makes us Good Morning Every Day without fail!

In our culture, we respect the Earth as 'Bhoo Mata – Goddess Lakshmi' and offer prayers on many occasions, before the construction, doing farming, and many more activities as scripted in holy literature.

'Vasudhaiva Kutumbakam: The World is One Family' – A broad concept sprouted and extended in the world to live in peace & harmony in our culture!
The Earth is providing everything for us without any obligations:

- Food, Shelter, Clothes & Wealth.
- Ores, Minerals, Gold, Diamonds & valuable elements.
- Water, Air, Oxygen.
- Fuel, Power, Uranium, Nuclear.
- Electromagnetic power.
- Much more ... infinity!

One should keep in mind; nobody is the owner of the earth and everybody is living freely ... without paying any rent!

If humans learn and absorb a few qualities of the earth – calmness, generosity, kindness, then there won't be war in the world and everyone live in peace, harmony, and happiness and enjoy the benefits of the earth.

Just Thanks... word is not enough for the Earth and everyone has to do something beyond it to reciprocate the Earth!

SOURAV DASPATNAIK, MANAGING DIRECTOR, SWACH ENVIRONMENT PVT LTD

Earth is the only living planet and water is vital for sustaining life.

2/3 of the surface of earth is the ocean. Water is a finite resource within the Planet and we need to be mindful of the way we manage our water resources including waste water. Climate change is going to be critical for the Planet . On this day lets pledge to keep the Earth habitable and water neutral.



AISHWARYA AGRAWAL, CHIEF OF STAFF, CIMCON SOFTWARE INDIA PVT LTD

Earth Day is an occasion for individuals and organizations to unite and take action to safeguard the environment. As Indian Prime Minister Narendra Modi said, "Reducing waste, conserving water, and using public transportation can go a long way in protecting our natural resources and ensuring a sustainable future for generations to come."

On this Earth Day, let us take a moment to reflect on the importance of preserving our planet and finding innovative solutions to environmental challenges. One company that is leading the way in promoting sustainable technologies and practices is CIMCON. The firm's focus on energy-saving technologies has helped to reduce energy consumption, lower carbon emissions, and cut costs. Besides promoting energy efficiency, CIMCON is also committed to improving access to clean water in remote locations. It has developed innovative solutions

to monitor water quality and detect leaks in water supply systems. These solutions use advanced sensors and wireless communication technologies to provide real-time data and alerts, allowing authorities to take prompt action to address issues and ensure the safety of the water supply.

CIMCON's efforts to promote sustainability goes beyond just its products and services. The company also emphasizes sustainable practices in its operations, such as reducing waste, conserving energy, and recycling. CIMCON has implemented sustainable practices in its offices, manufacturing plants, and supply chain. By developing and implementing sustainable practices and technologies, CIMCON is not only contributing to a cleaner and more sustainable environment, but it is also making a positive impact on people's lives by improving access to essential resources like energy and water. The company's focus on sustainability serves as a model for other companies to follow as we work together to create a better future for the planet and all its inhabitants.

CIMCON's efforts to promote sustainability align perfectly with the values of Earth Day. The company's focus on energy-saving technologies and improving access to clean water highlights the importance of preserving natural resources and finding innovative solutions to environmental challenges. By promoting sustainable practices in its operations and offering products and services that reduce energy consumption and increase efficiency, CIMCON is making a significant contribution to the cause of protecting the planet.

As we celebrate Earth Day, it is vital to remember that we all have a role to play in creating a sustainable future. It is up to us as individuals and organizations to act and make changes in our daily lives that can help minimize our impact on the environment. By working together, we can create a cleaner, healthier planet for ourselves and future generations.

Best wishes for a happy and sustainable Earth Day!



COL. BHASKAR TATWAWADI (VETERAN), DIRECTOR, DOUBLESLOTZ PTE. LTD.

EARTHLINGS have lost yet another year since the last Earth Day 2022! And we have a lot to show for all the progress made in conferences, meetings, policy tweaks on papers, verbal assurances of implementing more and more conservation measures to push away the ZERO WATER DAY! In the meantime, summer of 23 has arrived with a vengeance and even as I write this quote in Mumbai, the outside temperature is about 400 C.

When Nature starts asserting itself notwithstanding the half-hearted human endeavours, it beats all predictions and computational models even as we keep developing our AI and ML capabilities. On the global scale all it means is that all-natural resources including water are under serious threat of acute scarcity. The social inequities are exacerbated by uneven distribution of water, food, healthcare and basic

civic amenities. SDG6 is not immune to these forces and in fact is most vulnerable. The provision of safe water (as a basic human need) is as uncertain in India and other poorer countries as it is in some neglected and under-privileged communities of the North.

The instances of accidental spills of human wastes and industrial products in water sources across the globe are all too common and affect humanity without borders! Given the fact that water is consumed directly and indirectly (as virtual water) by all earthlings, the demands exerted by the economic growth, global IT networks, data centres, chip manufacturers and green hydrogen factories have added to the problems of supply management. The neglected state of wastewater reclamation plants and their sheer inadequacy to cope with the emerging volumes of domestic wastewater create a state of grossly polluted sources which might degenerate beyond redemption.

While India is fast racing towards Har Ghar Nal, the race towards Har Ghar Jal might remain unfinished if sustainability of water sources remains questionable. The urban / rural divide may be partially bridged if sincere efforts, backed by state and private funding are made to refurbish all the existing wastewater reclamation plants. Additional capacity must also be created by every ULB to fully treat its wastewater for reuse locally for multiple purposes.

Once this confidence of local reclamation and reuse is reached, the next logical leap of faith of direct potable reuse will be just round the corner!!



KAMAL TIWARI, CHIEF EXECUTIVE OFFICER, DAIKI AXIS INDIA

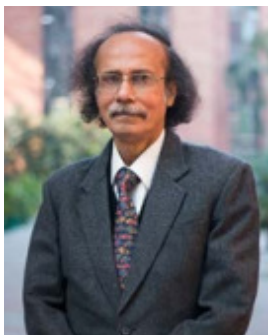
Earth Day is an important day that reminds us of the importance of environmental protection and sustainable development. It is a day when we all come together to celebrate the beauty of our planet and to raise awareness about the need to preserve it for future generations. On this Earth Day, I extend my best wishes to everyone and urge everyone to take concrete actions to promote sustainability and protect the environment. I urge everyone to take concrete actions towards promoting sustainability and environmental responsibility. We should remain committed to promote sustainability. The importance of preserving the Blue Planet, especially given the growing concerns over water scarcity on Earth.

"Water is a precious resource, and with the increasing global population, the demand for water is growing exponentially. It is time for us to address this global crisis together. India and Japan have a long history of collaboration, and we can leverage our strengths in technology and innovation to find sustainable solutions to the water scarcity problem." India has been a key participant, including Japan, that aims

to address global economic challenges. In recent years, India has used this platform to address critical issues related to climate change and sustainable development. Meanwhile, Japan, has been at the forefront of efforts to address global environmental challenges. This Earth Day provides special opportunity to Japan and India to provide direction to the world under G7 and G20 presidency as Japan has already demonstrated how the environment can be revived and India has demonstrated how Open Defecation Free can be achieved in short period of time.

We recognize the importance of responsible water management in promoting sustainability. Our waste water management initiatives help us minimize our environmental impact and promote sustainable development. Mr. Tiwari believes that the partnership between India and Japan could be strengthened further through increased collaboration on water management and conservation. Both countries have unique experiences and expertise in addressing water issues, and by working together, they can create sustainable solutions that benefit not only their citizens but also the world at large.

On Earth Day we should all come together to quench the thirst of the Blue Planet by reducing, recycling and reducing.



DR. S. K. SARKAR, DISTINGUISHED FELLOW, TERI

"Water is critical for life on earth and is an enabler of economic development. India has about 18 percent of world population, but has only about 4 percent of world's fresh water resources. There is temporal and spatial variation of water resources availability. For example, the per capita water availability in Barak and Brahmaputra river basin is about 11 times higher than that of Gangetic river basin. Due to climate change impact, there is high frequency of rainfall precipitation, and droughts are more frequent. Water demand for various uses is expected to exceed the available water supply.

For addressing water scarcity in India, water conservation is extremely essential. Kerala has shown the way by framing 'Water budget' in 94-gram panchayats covering 15 blocks in Kerala. This concept should be adopted by other states. A 'Water Action Agenda' covering all aspects of sustainable water management should be formulated and adopted in India.

India's progress in SDG 6.1 goals for safe and universal water access and SDG 6.2 goals for improved sanitation are significant. There are however big challenges for meeting targets on other goals of SDG 6. These are improving water use efficiency, waste water treatment for reuse, improving water quality by reducing pollution, integrated water resource management at all levels, restoring water related ecosystems such as rivers, wetland, forests, etc. Urgent attention of policy makers is needed for achieving SDG 6 goals by 2030.

High political commitment for sustainable water management is a must at all levels.



EARTH DAY 2023 QUOTE BY BY MANDARR KKAMTHE, INDUSTRY EXPERT-WATER

Dear friends, on this Earth Day 2023, let us take a moment to reflect on the beauty and importance of our planet. Let us recognize the impact that human activities have on our environment and make a commitment to take action. Our planet is facing significant challenges, from climate change to habitat destruction, and it is up to us to create a sustainable future. Let us celebrate the diversity of life on Earth and work together to protect and restore our planet's ecosystems. Each one of us has a role to play in making a positive change. Let us unite our efforts to create a healthier and more vibrant world for ourselves and future generations. Happy Earth Day 2023!



LET US MAKE AN IMPACT BY DR MAYUR J KAPADIA, FORMER ADDITIONAL GENERAL MANAGER, GNFC LTD, BHARUCH

Our Beloved Earth, the Ever-Generous Earth, the Mother Earth has given us everything that we have needed for our lives and our goals. Is it not our duty to repay her compassion as much as we can? The Earth Day renders us an opportunity to express our appreciation for nature through our words and deeds. If we give a thought towards the deeds which we can jointly perform to preserve our Earth, here are points that we should ponder and practice upon.

There are about 2 million single-use plastic bags across the globe every minute causing enormous plastic pollution. We must attempt to eliminate the single-use plastics by carrying our own water bottle, metal cutlery, and straws when eating outside, our own reusable bag while purchasing items or consuming biodegradable plastic items. Another thing to save the Earth is saving energy by unplugging unused

appliances, use energy-efficient light bulbs, air-drying clothes, etc. The most important commodity is Water. The ever-increasing water consumption by mankind is evident today.

Let us stop wasting it for future generations. Small steps like avoiding a running water tap, using broom & mop for cleaning homes instead of a water hose, sponging the car for cleaning instead of water jet, use of drip irrigation or self-watering systems for houseplants, and many more such ideas will greatly reduce water consumption. Tree plantation is an effective way to preserve the Earth from soil erosion. Let us start planting trees today so that the benefits can accrue after 15-20 years, when the trees grow to their full potential.

The present trend of consumerism, prevailing in the youth and elderly people, prompts people to throw away the old items and buy new ones. Let us understand that such impulsive shopping has been producing lots of packaging wastes - the main contributor to carbon emission. To save earth, we need to go back to the old tradition. We can get the old items repaired, reuse gift wrappers for decorations and jars for storing food and much more. Creation of 'best from waste' is a wonderful idea for averting unnecessary dumping on the Earth. All these habits will not only reduce wastes and thereby save earth, but also save money.

Change in lifestyle and behaviour is a long journey. But it will benefit not only us, but our future generations as well. Following these ways seem easy, however, difficult to maintain and practice.

Let us be fully committed towards saving our Earth with such small steps and demonstrate our commitment to the world through social media to bring change in their life styles. Thoughtful and wise acts, if performed jointly with families and society, will definitely make a GREAT IMPACT.



MOHAMMED ABDUL RAHMAN, CEO, SAHARA INDUSTRY EARTH'S NATURAL RESOURCES: SAVE TO SURVIVE

Earth Day is an annual event celebrated on April 22 every year to raise awareness about earth and the importance of protecting its natural resources. The Earth Day theme is announced every year by earthday.org, which was founded in 1970 by a group of environmental activists who were concerned about the impact of industrial development on the environment. Currently the organization has partners in over 192 countries to drive positive action for our planet.

Earth Day was first celebrated in 1970 in the United States, inspired by the devastating oil spill in Santa Barbara, California, in January-February 1969. An estimated 13.64 million litres of crude oil were spilled into the ocean creating a 35 miles long oil slick along California's coast that killed thousands of birds, fish and sea mammals. That year, at a UNESCO conference, peace activist John McConnell proposed a day to honor the Earth and the concept of peace.

Earth Day is a day of action and a reminder for everyone to reflect on the impact of human activity on the planet. It is also a day to celebrate our beautiful planet and take action to preserve it. The theme for 2023, 'Invest in Our Planet' was conceived to persuade nations, government organizations, industries, and common citizens around the world to invest in our planet to improve the environment and give our children a better and safer future.

Water: The Most Vital Resource

Water is most useful among earth's resources, vital for life and livelihood. Clean water is an essential need for human and all living objects for drinking and sanitation, producing of food and products, industrial and economic activities, and creating and sustaining the ecosystems on which all life depends. However, the accessible freshwater resources found in rivers, lakes, wetlands, aquifers, and other water bodies accounts for less than one per cent of the world's total water. With the limited resources, ever increasing global population, the demand for water is increasing manifold.

The climate change effects and global warming is altering weather patterns causing shortages and droughts in some areas and floods in others. With current consumption rate, this situation will only get worse and it is estimated that two-thirds of the world's population may face severe water scarcity by 2025, in just two years from now. At the same time, human activity and unsustainable practices are affecting freshwater resources in many ways.

Water Pollution

Water pollution can have several adverse effects on earth's surface and surrounding environment while also negatively impacting human health. According to a report by Lancet, over five lakh deaths occurred across India in 2019 due to water pollution. Globally, water pollution is responsible for 1.4 million premature deaths a year. It is also estimated that around 37.7 million Indians are affected annually by water-borne diseases like cholera, acute diarrheal diseases (ADD), typhoid and viral hepatitis etc. Another consequence of water pollution is the loss of valuable species and biodiversity. Water pollution can also have ecological effects on communities. It can lead to destruction of aquatic ecosystems and disruption of food chains.

Consider the situation in India where an estimated 73,000 million litres of municipal wastewater is generated every day in class I and class II cities only and over 70 per cent of it never receives any kind of treatment before disposal into water bodies. Similar situation is with industrial wastewater as well, although a lesser margin of its direct disposal is estimated. Water Aid, working on water, sanitation and hygiene sectors finds that an alarming 80 per cent of India's surface water is polluted. Central

Pollution Control Board estimates that 75-80 per cent of water pollution by volume is from domestic sewage, while untreated sewage flowing into water bodies including rivers have almost doubled in the recent years. Wastewater treatment has become essential to not only address the shortage of fresh water but also saving the surface and ground water sources from further contamination.

Sahara Industry has been promoting the integrated water management and established itself as a leading system provider for water and wastewater treatment with application of technology, exceptional quality, best practices and sustainable long-term solutions. With NSF certified products for water treatment, it has contributed immensely by making water safe for drinking, industrial and institutional purposes.

The ISO 9001:2015 certified company; it has employed technologically advanced machineries and manufacturing solutions combined with professional and well-qualified engineering teams to achieve the feat of being an indigenously creator of advanced water and wastewater treatment solutions matching with world standards.

The Earth Day is a call for action to protect the planet by adopting and implementing solutions that will help it restore its natural resources. Clean water is a precious resource and we must act in harmony to use it wisely and protect it from pollution and contamination. At Sahara Industry, we are committed to follow environment friendly practices and together, we can make a difference to protect the earth and its beauties.



MOHAMMED NASER AZEEZ, MANAGING DIRECTOR, AQUALITY WATER SOLUTIONS PVT. LTD.

Save Earth: Harness the Solar Power

The earth started recuperating itself three years ago when coronavirus pandemic lockdowns across the globe forced to stop all commercial and other activities. The nature's recovering trail did show us that it could repair the damage inflicted due to excessive pollution, unsustainable use of resources, dumping of industrial and domestic solid and liquid waste, irresponsible chopping of trees, and every possible abuse. The lockdown has turned the skyline clearer, lakes and rivers were visibly purer, melting of glaciers stopped and the endangered flora and fauna started coming back to life. It cleared the air pollution to the extent that Himalayan range which is more than 100 miles away from Punjab was clearly visible with the naked eyes. The table has turned again now with earth's natural resources air, water, soil, and plants etc. started facing the assault of our activities.

Water: Vital Resource on Earth

Water is indeed a vital resource for all human activities, from survival to commercial, industrial and financial. It is essential for supporting life on earth and plays a critical role in producing food and products to even generating energy. The taken for granted approach has inflicted perennial damage to this natural resource and now a large population in the world has started facing the impact of water stress. On Earth Day, we are reminded of the current and emerging challenges and the theme of this year, "Invest in our Planet" has been designed to create awareness related to the environmental problems and calling out all governments, businesses, and citizens around the world of the need to invest to improve the liveability on earth and give our descendants a better and safer future.

We know that agricultural and industrial water consumption places heavy pressure on the world's limited water supply. In fact, these two sectors together consume approximately 90% of total water withdrawals. The World Bank has estimated that water demand is expected to exceed current supply by 40% by 2030 – just seven years away! The current water scarcity is mainly caused by unsustainable use and mismanagement of water resources.

Why should we care?

India, which has recently become the world's most populated country outpacing China, which has been the most populous country since at least 1950 as reported by the Wall Street Journal citing UN's world population projections. With the current population of 1425.77 million, it is an uphill task to provide essential resources including water to all the people when almost 80% of the surface water is polluted and we still dispose almost 70% of wastewater untreated into our water bodies. If we continue with the current practices of treating water ruthlessly, the predictions of the Water Ministry that per capita water availability will reduce by 36% in 2025 and 60% by the year 2050 from the level of 2001, may become a reality much earlier than predicted.

The total water demand in India is expected to rise by over 70% by 2025; a huge demand-supply gap is expected in the coming years. Rapid urbanization, steady commercial and economic growth, changing life style has intensified the demand of clean water, while also increasing the load of generated sewage. The demand for water in Class I and Class II cities is expected to increase to 110,000-120,000 MLD by 2025 and sewage generation is expected to increase to over 87,000-97,000

MLD by the same year. On the other hand, the industrial demand for water is expected to increase multifold, with a larger share coming from water-intensive sectors such as power, steel, paper and pulp, textile and oil refineries. It is estimated that almost 640 million people in three-quarters of Indian districts are facing severe water-related stress, and the number is increasing.

Water is integral to our survival and livelihood but the last few decades witnessed the unprecedented use that saw surface and ground water quality deteriorating due to human-related activities such as mining, livestock farming, industrial, municipal and agricultural waste disposal, soil erosion and chemical and heavy metal pollution. India, one of the 17 countries facing the highest levels of water stress in the world, has seen extraordinary pressure on water resources in recent years.

To address the emerging challenges, it will be necessary to make significant investments in sustainable water and wastewater infrastructure and adopting innovative technologies to avoid economic losses. If action is not taken now, the situation is likely to deteriorate further by 2050 with demand exceeding supply leading to a likely 6% loss in India's GDP.

Renewable and Sustainable Action

An important aspect that can help India manage its water resources is the use of sustainable technologies such as renewable energy for water treatment. Energy is one of the basic needs of water treatment and supply infrastructure. The consumption of fossil fuels to generate energy has resulted in serious ecological problems with climate change becoming a threat to not just natural habitats but the health of all living creatures. Tackling this challenge with the energy from renewable sources like solar, has led to a focus on renewable energy use for sustainable growth. In addition to being clean energy, solar powered water treatment system require zero conventional energy enabling India to meet its power needs for other sectors without carbon emissions or consuming water to generate more thermal energy.

Aquality Water Solutions Pvt. Ltd. has been leading the initiative to make clean drinking water available to people, security forces and other establishments globally including human habitats in African and Middle Eastern Countries by using the pioneering solution of Solar Powered Water Filtration System. The solar powered system has high speed water filtration unit that can purify water from practically any source, such as hand pumps, swamps, wells, floods, rivers, and even wastewater making it an ideal source of clean water without much investment. The embedded innovative technology utilizes high purification techniques to make water absolutely clean leaving contaminants behind, resulting in producing high grade water suitable for drinking at any place without the requirements of conventional electricity.

The purification device is compact, around the size of a big box, has low power requirements and no removable parts that need to be maintained or replaced. The best part of the system is, it can even reclaim the wastewater to be used in toilet flush in all Swachh Bharat Mission toilets that has been constructed but not being used properly due to lack of water.

The technology advanced treatment system will not only reduce the logistical challenges of transporting bottled water, but it will also reduce the risk of waterborne diseases affecting millions of people while ensuring constant clean water supply to all far-flung places wherever our security forces are deployed or even at villages where availability of clean water is a challenge due to electricity. Adopting water purification systems at a large scale can help us use fewer resources from the earth depository and reduce the amount of waste generated. It can also help reduce the amount of water that is wasted and reduce the amount of energy required to treat and transport water. In this way, using solar powered water purification systems can be a true tribute to the earth.



PROTECTION & PRESERVATION OF GROUND WATER – A PREDOMINANT SOURCE OF COMMUNITY DRINKING WATER IN INDIA

By Dr. Mayur J. Kapadia, former Additional General Manager & Head, Quality Control Division, GNFC Ltd., Bharuch, Gujarat



Drinking water scenario in India

India has 18 per cent of the world's population but has only 4 per cent of the global water resources. Nearly half the population is struggling with drought-like conditions. For India, it is neither domestic use nor industry that guzzles India's water supply, but agriculture consumes over 85 per cent of our water, a fact being contrary to general and popular belief! Only 40 per cent agriculture is having assured irrigation, therefore our farmers depend heavily either on rains or on groundwater for their needs. Monsoon in India, of course, extends over four months, but there are barely 30 days of heavy rainfall in all. And our efforts to conserve rainwater remain woefully inadequate. The water balance is severely adverse and India has been facing the worst water crisis.

Estimates indicate that if we continue with business as usual, India will have only half the water it needs by 2030. Day Zero for a catastrophe is not a century but just a decade away. Yet, amidst all this water gloom, the momentum to find innovative solutions out of the crisis has picked up speed in last several years with support of World Bank, UNICEF and other organizations. The community participation in water management have started showing positive signs. Let us take a broad look at the scenario.

Before 5-6 years, the official government reports had come out with alarming facts ...

- 600 million people, or nearly half of India's population at that point of time, faced extreme water stress.
- Three-fourths of India's rural households did not have piped, potable water.
- Those people were relying upon water sources posing a serious health risk.
- India has become the world's largest extractor of groundwater, accounting for almost 25 per cent of the total.
- 70 per cent of our drinking water sources were contaminated.
- Major rivers were dying because of pollution.
- Demand for drinking water will outstrip supply by 2030, if preventive steps were not taken.

The problems in India range from poor management of water sources, contaminated supplies, leaky distribution networks and vast volumes of untreated wastewater being poured into India's rivers. For last several years, however, India has been achieving a major stride in improving the situation of drinking water availability.

Actions through Ministry -The government has been taking several steps through a separate ministry - Ministry of Drinking



A safe water supply is the backbone of a healthy economy, yet is woefully under prioritized, globally.

Water and Sanitation (MDWS) for improving potable water availability and better hygiene. This ministry was restructured before 3-4 years for addressing the water sector in an integrated manner. The ministry was renamed as the Ministry of Jal Shakti ("power of water") and bifurcated into 2 key departments – (i) the Department of Water Resources & River Development, and (ii) the Department of Drinking Water and Sanitation. A special mission driven approach is taken through launch of The Jal Jeevan Mission ("water for life") which aims at providing piped water supply to every household in the country by 2024, against tap water availability to only 1 out of 6 households as estimated in 2019.

Despite the odds caused by Covid pandemic, over 30 million new households were provided with tap water upto 2021 through massive funding backed by mission mode management and technology to monitor progress. The Jal Jeevan Mission is reported to have increased functional household tap connections from 17 percent to over 49 percent between August 2019 and May 2022. Tap water has also been provided to almost all schools and pre-schools in the country.



Community participation -The state governments are encouraging community participation in the operation and maintenance of water supply to the homes of citizens through formation of the 'Pani Samitis' (Water Committees). The focus of the government is not only towards creation of the infrastructure, but also on establishing Decentralized, Demand-driven and Community-managed water supply systems. The local communities at Gram Panchayat level play a pivotal role in planning, implementation, operation and maintenance of their water distribution schemes.

Limiting water consumption in agriculture - Apart from efforts for increasing drinking water availability, another challenge is to reduce water use in farming. India has been aiming this challenge by a rare public private partnership between government and farmers towards application of innovative and cost-effective solutions. In some districts, thousands of farm ponds have been created, through cheap loans to farmers, to increase storage of monsoon water. This effort showed the impact almost immediately. From next season, the farmers were able to take more than 1 crop per year. The farmers themselves have started conserving water to turn around their fortunes.

State governments have been motivating farmers to convert to drip irrigation through subsidies of >60 per cent of the cost of sprinklers. Farmers switching over to micro-irrigation have been increasing. This technique is able to save 40 per cent in water and labour costs. Drip irrigation strives at 'more crop per drop' for water deficit India. Paddy is an example of a crop causing over-exploitation of water use and depletion in groundwater levels. Paddy growing areas have been switching over to less water-intensive crops without affecting the earning figure through government efforts. Haryana has started giving a cash subsidy to farmers to stop growing paddy in groundwater-stressed areas and switch to other crops. Sugarcane is another crop similar to Paddy, where water use efficiency remains dismal. States need to work as catalysts and persuade farmers to switch to crops that give them better remuneration while meeting the country's food needs.

Technological avenues - Transportation of approx. 100 grams faecal matter requires 6 litres of water to flush it down. Technology development to use less water in toilets, like in aircrafts, can lead a long way. Our old town-planning techniques have laid down sewage pipes to carry solid waste to a common treatment plant on the outskirts. Creation of many localised sewage treatment plants can reduce transportation costs and make treated water available for recycling either for industrial use or for parks in the vicinity of treatment plant. While keeping environment considerations in mind, interlinking of rivers should be considered to supply water to dry regions, with the added benefit of harnessing water wasted in floods. It is equally necessary to rejuvenate existing water bodies. Building large dams to meet our needs is not a good proposition, until revival of water bodies is prioritized.

Ground water scenario

Groundwater is the water found beneath the soil surface held in the spaces within porous soil and rock. Groundwater can be obtained from springs, boreholes or wells. Why ground water protection is so important can be judged by following facts...

- It is the world's most extracted raw material.
- About 70% of groundwater withdrawn worldwide is used for agriculture.
- Groundwater provides almost half of all drinking water worldwide.
- Globally, about 38% of irrigated lands are equipped for irrigation with groundwater.

Groundwater is, thus, one of the most important sources for irrigation as well as domestic use by rural and urban people. Groundwater, particularly from deep sources, provides water of good microbiological quality. This is because bacteria, protozoa, viruses and helminths are filtered from the water as it passes through the layers of soil and rock into the groundwater.

Overexploitation of this valuable resource has led to its depletion. India is known as the world's highest user of this source due to proliferation of drilling over the past few decades. Report of 2017 states that groundwater from over 30 million access points supplies 85 per cent of drinking water in rural areas and 48 per cent of water requirements in urban areas. 89% of extracted ground water in India is used for irrigation, followed by 9% for domestic and 2% for industrial use. Being a highly important water resource, it is utmost significant to protect, preserve and conserve this precious water source.



Protection of well water from pollution and contamination Before and during water source development, care should be taken to minimise possible risks. List of general guidelines for protection of ground water resources are listed below :

- The well should be located on a higher level than possible sources of contaminants such as latrines and pits for collection of waste matter. This is because the liquid from the pit may seep into the surrounding ground and into the groundwater. If the latrine is higher up a slope than the well, then the contaminated groundwater is likely to flow downwards and into the well.
- The natural flow of the groundwater (the hydraulic gradient) should be away from the well and towards the sources of contaminants, and not the other way round.
- In normal soils, the minimum distance between the well and the source of contaminants should never be less than 15 metres. The recommended distance is 30–50 meters. For limestone and some other soil formations, this distance needs to be greater because groundwater can pass very easily through some rocks and soils.
- The inside wall of the well should be made waterproof by constructing a well casing. For small diameter bored wells, the casing can be a pipe, but in larger wells the casing should be constructed by cementing from the top of the well down to a minimum depth of 3 metres.
- The casing of the well should be extended for a minimum of 60 cm above the surrounding ground level to prevent the entrance of surface runoff.
- A concrete cover should be fitted over the casing to prevent dust, insects, small animals and any other contaminants from falling in.
- The space between the drill hole and the outside of the casing should be properly sealed. In the similar manner, the junction of the pump lines and casing should be provided with proper sanitary seal.
- The immediate area of the well should preferably be fenced to keep animals away.
- The area surrounding the well should be given slope such that flow of storm water goes away from the well to avoid water pollution caused by contaminated water percolating through surrounding soil and rocks into the well.
- The well, pump, piping and associated structures should be regularly disinfected using chlorine solution or other means.
- The wells should be periodically assessed to identify a possible source of groundwater contamination through any of the several methods. One method is using sodium or potassium fluoresce in, which is a brightly-coloured,



fluorescent, water-soluble dye. It can be used as a tracer when a sewage disposal system is suspected of contaminating groundwater. A dye solution is flushed into the sewage disposal system or suspected sewage source and detected by sight, taste or analysis of well water. Generally, the dye appears in the well water within 12–24 hours of flushing in source contamination.

Apart from above general guidelines for well protection, different types of wells like dug wells, bored wells (also known as boreholes), and driven & jetted wells should be given specific attention as briefly shown below.

Dug well - The dug wells, generally of 90–180 cm diameter and 4.5–10.5 meter depth, are susceptible to contamination by pathogens, which may be deposited on the surface or naturally present in the soil and are washed in to the well during



heavy rains. Handpumps placed over the well need to be built so the surrounding ground is covered and protected. The associated pipe work with pumps should have watertight connections to prevent contamination from surrounding soil.

Bored well - Bored wells or boreholes are constructed with a hand- or machine-driven auger and tend to be used in relatively soft soils and rocks. Bored wells vary in diameter from 5–75 cm and in depth from 7.5–18 m. A lining, known as a casing, of concrete, metal, or plastic pipe is necessary to prevent the surrounding soil and rock from crashing into the well.

Driven and jetted wells - These types of wells consist of a metal pipe with a screen attached at the bottom end, which allows water to pass in to the pipe but keeps out

soil particles. The pipe is driven or jetted into a water-bearing rock layer found at a comparatively shallow depth. For a driven well, the end of the pipe is shaped into a point and it is hammered into the ground. Driven wells are commonly 2.5–5 cm in diameter and less than 15 meters in depth. Jetted wells may be 5–30 cm in diameter and up to 30 meter deep. Such wells should be tested to determine the volume of water reliably produced. These wells should be properly disinfected prior to completion of project.

Conclusion

Rainwater, surface water (from lakes, rivers, ponds) and groundwater (from springs, wells and boreholes) are the sources of water for various public and domestic purposes. India is a water deficit country in terms of potable piped drinking water. Therefore, it is necessary to develop new water sources after assessing the quantity and quality of the available water and a thorough sanitary survey. Efforts by Ministry of Jal Shakti and Jal Jeevan Mission have been improving the scenario of piped and potable water distribution to urban and rural households through involvement of the community, with particular emphasis on involvement of women. Ground water, a potential water source for India, is managed in better way through national groundwater program, the Atal Bhujal Yojana, in 8220 gram panchayats across seven Indian states. This is the world's largest community-led groundwater management program. Schemes like "Paani Bachao, Paisa Kamao" ("Save Water, Earn Money") in Punjab incentivizes farmers to reduce groundwater usage. By virtue of community driven approach, the citizens of India now understand their water availability and their consumption patterns, thereby they are empowered to budget their water use accordingly.



About the Author



Dr Mayur J. Kapadia, MSc, PhD, is a former Add General Manager & Laboratory Head of GNFC Ltd, Bharuch, Gujarat, India. He possesses professional industrial experience of 40 years in the fields of Quality Control of Chemicals / Fertilizers / FMCG products, New Laboratory Set up, Cooling Water Management, ISI certification, and many other areas. He has to his credit technical suggestion awards, >20 publications in journals / magazines and >15 presentations in conferences. He has successfully conducted full day training programs on Quality Control, NABL, Instrumental Analysis, ISI certification, Cooling Water Management, etc for benefit of delegates belonging to varied nature of industries.

He is an active member in technical committee of Bureau of Indian Standards (BIS), which has conferred upon him a 'Certification of Appreciation' for his immense contribution towards establishing and improvising various Indian Standards. He also has been rendering technical services to various organizations for quality improvement, process trouble-shooting and analytical aspects.

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I WATER A CHAMPAGNE OF NATURE!

By Dilip Yewalekar and Manisha Kinge, Jain Irrigation



Once I went to birthday party of my friends in the hotel. My friends ordered for Beer, Wine and they asked me what to do you want. I said Champagne they scrambled and looked strange... Do you drink? (They know I never drink), I repeated.... Champagne ... of Nature! They laughed!

Drinks...! Always raises an eyebrow when anyone says... mainly criticized to alcohol! Drinks could be Cold & Hot, and juice beverages manufactured by humans in the factory, and water is manufactured in the factory of nature!

Water is one of the principal elements among panchamahabhutas i.e. Earth (Pritivi), Water(Jal), Fire (Tejas), Wind (Vayu), and Space (Akash). Water has its importance in the world and universe. That's why many space agencies are spending billions of dollars in search of water on the Moon, Mars, and other planets. Because there is the truth, if water is available, means lives exist on that planets! Water has its own spiritual aspects in all religions. Also, it has medicinal properties, remedies and healing. There are 'N' number of articles, songs, books, phrases, quotes, and blogs available. Water is also called 'Nectar' (Amrut)! Water is life- Jal hi Jeevan!

It is a good beverage... drinks Champagne of nature!



Role &Function of Water.

- One of the primary functions of water is to provide hydration. All living organisms require water to survive as it is essential for the metabolic activities of their bodies. Water also plays a crucial role in promoting the photosynthesis process for plants which is the process by which plants use energy from the sun to convert carbon dioxide and water into glucose and oxygen. This process is essential for the growth and survival of plants, which in turn provide food for other organisms.
- Water also plays a vital role in regulating the Earth's climate. It can absorb and store large amounts of heat without changing temperature significantly. This characteristic allows water to moderate the Earth's temperature by absorbing excess heat during the day and releasing it at night, thereby helping to maintain a stable climate.
- In addition to its vital role in sustaining life, water is also a powerful force in shaping the Earth's surface. Over millions of years, water has carved out canyons, created vast cave systems, and eroded coastlines with significant damage through floods, landslides, and erosion, making it a powerful and sometimes destructive force.

H2O Anomalous Properties

Water (H₂O, HOH) covers 70-75% of the Earth's surface in its liquid and solid (ice) states and is present in the atmosphere as a Vapour. It is the most abundant molecule on the Earth's surface.

At room temperature, it is a nearly colorless, flavourless, and odorless liquid. Many substances dissolve in water and it is commonly seen as the universal solvent; because of this, water in nature and in use is rarely clean and may have some properties different than those in the laboratory. Water is the only common, pure substance found naturally in all three states on the earth.

One very unique property is, there is no duplicate water, no replacement, and no substitute of water neither exists nor is created by the human.

Generally, the volume of a liquid increases when heated, but the volume of water decreased when heated and the volume increases when temperatures go below 40C. Because ice is a poor conductor of heat, it does not allow heat energy transfer from the liquid water beneath the layers of ice, which prevents the liquid water from freezing. Hence, aquatic creatures survive in such places. Though water has various names in other languages, however as per chemistry water is known as:

- H₂O
- Rain
- Saliva
- Teas
- Adam's ale
- Aqua pura
- Aqua

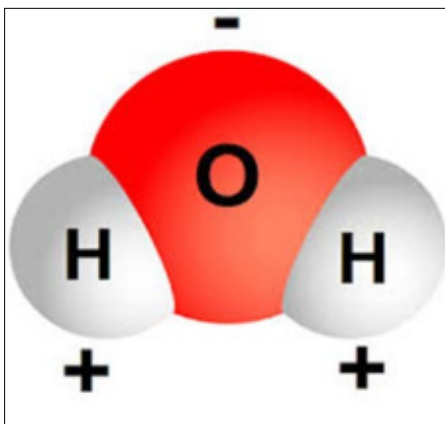


- Hydrogen oxide
- Hydrogen hydroxide
- Hydrate
- Oxidane
- Hydric acid
- Dihydrogen monoxide
- Hydrohydroxic acid
- μ -Oxido dihydrogen

Water Crystal & molecules



Crystal of water



Molecules of Water

A molecule crystal of water consists of water molecules arranged in a specific hexagonal lattice. The water molecules are made up of one oxygen atom and Two Hydrogen Atoms and form a tetrahedral structure with the Oxygen at the center. The water molecules in the crystal are held together by hydrogen bonds, and weak in electrostatic attraction with oxygen. Hydrogen molecule bonds form crystallization and results in to form ice at low temperatures and high boiling points.

Engineering Properties

The compressibility of water is a function of pressure and temperature. At 0 °C, at the limit of zero pressure, the compressibility is $5.1 \times 10^{-10} \text{ Pa}^{-1}$. At the zero-pressure limit, the compressibility reaches a minimum of $4.4 \times 10^{-10} \text{ Pa}^{-1}$ around 45 °C before increasing again with increasing temperature. As the pressure is increased, the compressibility decreases, being $3.9 \times 10^{-10} \text{ Pa}^{-1}$ at 0 °C and 100

megapascals (1,000 bar).

The bulk modulus of water is about 2.2 GPa.

The bulk modulus of water ice ranges from 11.3 GPa at 0 K up to 8.6 GPa at 273 K.

Triple point

The temperature and pressure at which ordinary solid, liquid, and gaseous water coexist in equilibrium is a triple point of water. Due to the existence of many polymorphs (forms) of ice, water has other triple points, which have either three polymorphs of ice or two polymorphs of ice and liquid in equilibrium.

Electrical conductivity

Pure water containing no exogenous ions is an excellent electronic insulator, but not even “deionized” water is completely free of ions. Water cannot be considered to be a completely dielectric material or electrical insulator but to be a limited conductor of ionic charge. It is known that the theoretical maximum electrical resistivity for water is approximately $18.2 \text{ M}\Omega \cdot \text{cm}$ ($182 \text{ k}\Omega \cdot \text{m}$) at 25 °C.

Water can also be electrolyzed into oxygen and hydrogen gases but in the absence of dissolved ions this is a very slow process, as very little current is conducted. In ice, the primary charge carriers are protons

Cohesion and adhesion

Water molecules stay close to each other because of cohesion, due to the collective action of hydrogen bonds between water molecules. These hydrogen bonds are constantly breaking, with new bonds being formed with different water molecules.

Water also has high adhesion properties because of its polar nature. On clean, smooth glass the water may form a thin film because the molecular forces between glass and water molecules (adhesive forces) are stronger than the cohesive

Surface tension

Water has an unusually high surface tension of 71.99 mN/m at 25 °C which is caused by the strength of the hydrogen bonding between water molecules. This allows insects to walk on water.

Capillary action

Because water has strong cohesive and adhesive forces, it exhibits capillary action. Strong cohesion from hydrogen bonding and adhesion allows trees to transport water more than 100 m upward.

Water as a solvent

Water is an excellent solvent due to its high dielectric constant. Substances that mix well and dissolve in water are known as hydrophilic (“water-loving”) substances, while those that do not mix well with water are known as hydrophobic (“water-fearing”) substances. The ability of a substance to dissolve in water is determined by whether or not the substance can match or better the strong attractive forces that water molecules generate between other water molecules. If a substance has properties that do not allow it to overcome these strong intermolecular forces, the molecules are precipitated out from the water. Contrary to the common misconception, water and hydrophobic substances do not “repel”, and the hydration of a hydrophobic surface is energetically, but not entropically, favorable.

Electromagnetic absorption

Water is relatively transparent to visible light, near ultraviolet light, and far-red

light, but it absorbs most ultraviolet light, infrared light, and microwaves. Most photoreceptors and photosynthetic pigments utilize the portion of the light spectrum that is transmitted well through water. Microwave ovens take advantage of water's opacity to microwave radiation to heat the water inside of foods. Water's light blue color is caused by weak absorption in the red part of the visible spectrum.

The expiry date of the water?

The topic of the expiry date of water is of much debate among the scientists and experts and is never-ending. While some argue that water does not have an expiry date, others maintain that it can go bad over time and become unsafe for consumption.

However, despite its many benefits and utility, water is also vulnerable to contamination and degradation over time. When water is stored for an extended period, it can become exposed to various environmental factors such as sunlight, air, and bacteria, which can cause it to spoil. The factors that affect the expiry date of water include the type of container used for storage, the temperature at which it is stored, and the presence of impurities and contaminants.

Plastic bottles are lightweight, durable, and easy to transport, making them an ideal choice for storing water. However, plastic bottles are also prone to degradation over time and they can release chemicals such as bisphenol (BPA) & Phthalates into the water when exposed to high temperatures. BPA is a chemical that is used in the manufacture of plastics and it has been linked to various health problems including cancer, obesity, and reproductive disorders.

Glass bottles are an alternative to plastic bottles which are safer and do not release any chemicals into the water. But because of fragile in nature and heavy makes it less convenient for transportation and use.

There is no expiry date of water as long as it remains in nature & natural!



Conclusion

In short, Water is the champagne of nature, playing a vital in sustaining life on earth and shaping the world we live in. so drink safe water, save water, conserve water.



About the Author



Dilip Yewalekar is the Senior Vice President of Jain Irrigation Systems Ltd. He has over 36 years of experience. He has done M.Tech-Civil Structural Engg, PG Diploma in Piping Engg, AMIE, UK, ASAE, USA. He is a Googlescholar, Member of ICID.

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SUITABILITY ASSESSMENT OF SURFACE WATER QUALITY FOR DRINKING USING WASPAS METHOD IN MAHANADI RIVER BASIN, ODISHA

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Abstract

Surface water is an important source of drinking water supply in Mahanadi River Basin, Odisha. An attempt has been made in this work to understand the suitability of water for human consumption using the efficacy of Canadian Council of Ministers of the Environment Water Quality Index (CCME WQI) and Multi Criteria Decision Making (MCDM) approach like Weighted Aggregated Sum Product Assessment (WASPAS).

The study was carried out in two phases. The first phase included the survey of the study area and the collection and analysis of water samples. In the second phase, CCME WQI and WASPAS were applied to the observed water quality data sets. The sampling campaign in 2022-2023 based on physicochemical parameters were carried out on the water from 19 sampling locations in the study area. The results revealed that while comparing with WHO guidelines, TC and TKN found to be higher than the permissible, in most of the locations. The CCME WQI in the study ranges from 34.61-85.58. It indicates good to poor water. According to percentage distribution, it shows 73.68% shows 'good water', 15.79% of samples is in 'fair category' and 10.53% falls under 'poor' water category. The interpolated map clearly indicates that places ST-8 and 9 lie in poor zone, thus needs treatment before consumption. Poor zone delivers about anthropogenic inputs such as domestic sewage and agricultural runoff. Employing the WASPAS approach, it identifies locations which have encountered the highest influence of cumulative factors such as discharge of sewage, lowering of water table, dilution and surface runoff, which lead to water quality variability in a waterbody over a monitoring period. Results indicated 3 sampling sites (ST-8, 9 and 19), which has encountered highest variability and are recommended most polluted monitoring locations.

This study introduces an innovative approach by blending both WQI and WASPAS, to derive maximum useful information by pinpointing sampling stations for regular monitoring purposes. Finally, from both the methods, the ongoing work suggests the surface water of most of the area is in good quality with a few exceptions at some places, which needs treatment before intake and also, to be protected from the perils of geogenic/anthropogenic contamination.

Keywords: Mahanadi, CCME, WASPAS, agricultural, dilution, geogenic, anthropogenic.

1. Introduction

Global water scarcity is caused not only by the physical inadequacy of the resource but also by the progressive deterioration of water quality in many countries, reducing the quantity of water that is safe to use (Yang et al. 2021). Combinations of various natural factors and anthropogenic activities in rivers and their catchments are affecting water qualities (Das, A. 2022). Water quality monitoring and assessment is an important tool to safeguard public health quality and to conserve water resources (Le et al. 2022). However, pollution causes the water to become unsuitable for human uses, and it is difficult and expensive to treat to the acceptable quality for use. On the other hand, drinking water quality in developing countries is poor particularly in rural

areas and the major source of multiple water borne diseases. Urbanization affects the hydrologic regime of catchments, and it has a profound influence on the quality of water runoff. Two major factors such as industrialization and urbanization take a heavy toll on fragile water supplies, creating both new demands and risks of pollution (Long-Ling et al. 2021).

The majority of industries in the river side discharge their wastewaters into the nearby water bodies with limited or without any form of treatment. Also, environmental pollution derived from domestic and industrial activities is the main threat to the surface water quality (Roy et al. 2021). With the ever-increasing demand on water quality, farmlands are frequently faced with utilization of poor-quality water (Mahadevan et al. 2020). However, due to the continued application of water, it can reduce the yield of farmlands and it may have effect on the farmers, the consumers of the products and the environment (Ram et al. 2021). Further, due to government development policies, and strategies, irrigated agriculture, industrial development, and urbanization are growing rapidly in the study area especially during the last decade (Parvin and Tareq 2021). However, waste collection and treatment systems are not in proportion to the development plans that their effect on drinking and irrigation agriculture is expected (Teshome 2020). Therefore, it is essential to assess and monitor the water quality of the available water resources which are primarily used for drinking purposes (Ma et al. 2020). Numerous studies have been conducted to monitor and evaluate water quality for drinking uses utilizing individual physical and chemical parameters and multiple irrigation water quality indices (WQIs). Therefore, WQIs may be assessed using a simple mathematical procedure that turns enormous amounts of water characteristics into a single number representing the cumulative effect of total water quality values (Balamurugan et al. 2020).

A large number of countries prefer the WQI method to assess overall river status because of being single valued and easy to understand (Zolekar et al. 2021). This approach was first introduced by Brown (1972) by using 10 parameters of water quality. The water quality integral indicator used in this study is the composite WQI developed by the CCME (Canadian Council of Ministers of the Environment). It is centered upon several water uses, such as drinking, leisure, agriculture, animals, and sea species (Sharma et al. 2020). It is a standardized approach for assessing water quality that was developed by Canadian authorities (Saffran K et al. 2001; Wagh et al. 2017). It has evolved from evaluation of the individual water quality indicators to more complex approaches that give rise to a deeper understanding of the vitality of the water body and the relationship between its ecological response and the anthropogenic impact (Nath et al. 2021). Another essential aspect of monitoring programs is prioritizing decisions to implement policies. In such situations, multi-criteria decision-making methods (MCDMs) are usually considered. It is essential to remove the gap between the information prerequisites on water quality and the information gained by the monitoring system. However, in recent years, Shannon entropy has had diverse applications in the field of hydraulic engineering and environmental engineering as a large number of random processes predominate our environment. In the light of Shannon entropy, several techniques such as development of entropy-based quality indices to address shortcomings of conventional WQIs, modification of conflicts between different WQIs by entropy-based MCDMs and

optimization of online monitoring systems to refine the information gained from monitoring programs have emerged (Dash and Kalamdhad 2021). Using MCDM method namely Weighted Aggregated Sum-Product Assessment (WASPAS), can be applied effectively to determining the value and utility degree of various areas and establishing the priority order for their implementation (Zavadskas et al. 2012). Using this approach, the problem of evaluating a discrete set of alternatives can be examined based on a set of decision criteria. However, in recent years, Geographical Information System (GIS) technique has been used to monitor and evaluate surface water frequently.

The Inverted Distance Weighted (IDW) interpolation method along with GIS technology has been shown to be an effective approach for interpreting and analysing spatial information of surface water. It is often called as time-saving method, and used to interpret patterns, correlations and sources of pollutants (Zhang et al. 2022). In the present study area, Surface water is the primary source of drinking water. However, minimal work has been performed on water quality assessment in Mahanadi River Basin (MRB), Odisha. Not even a single research article has been done with an integration of CCME WQI, GIS and WASPAS to assess the water quality of this region. Thus, there is a research gap here, and more discussion is needed to have a better understanding of the extent and causes of water quality degradation. The overall aim of the present study is to identify the best possible approach for water quality assessment in order to provide effective and efficient information at optimum cost.

2. Materials and methods

Description of Study Area

The Mahanadi River system is the third largest in the Peninsula of India and the largest river in Odisha State. River drains over an area of 141,600 Km², which is about 4% of the total geographical area of the country. It also has a peak discharge of 44,740 m³/sec. Along its course, this river receives effluents from different industrial and urban centres such as Sambalpur, Bouda, Cuttack, Choudwar, Jagatpur and Paradeep in Odisha. Human influences are pronounced at Sambalpur, Cuttack and Paradeep, where the proliferation of industries and sewer discharges is prominent (Das, A 2022). The basin lies between latitude 19°21'N and 23°35'N and longitudes 80°30' E and 86°50'E. It originates at an elevation of about 442 m above MSL in Dhamtari district of Chhattisgarh and drains into Bay of Bengal. It consists of length to be around 851 Km. Though a lot of work has been carried out on the role of different urban and industrial effluents upon the water quality of Mahanadi river-estuarine system, the study only covered a short stretch of the river course. This river experiences a tropical monsoon climate, with a temperature roughly ranging between 15.8°-28.7°C. Annual rainfall falls at a value of 1360 mm, which mostly occurs during the months of June to September with occasional cyclonic storms with heavy rainfall. Usually, agriculture, forest reserves, mining areas and urban centres are the major land uses. On the other hand, predominant soil types prevail in the river basin are red and yellow soils, mixed red and black soils. The detail location of effluent discharge points, are presented in Figure 1.

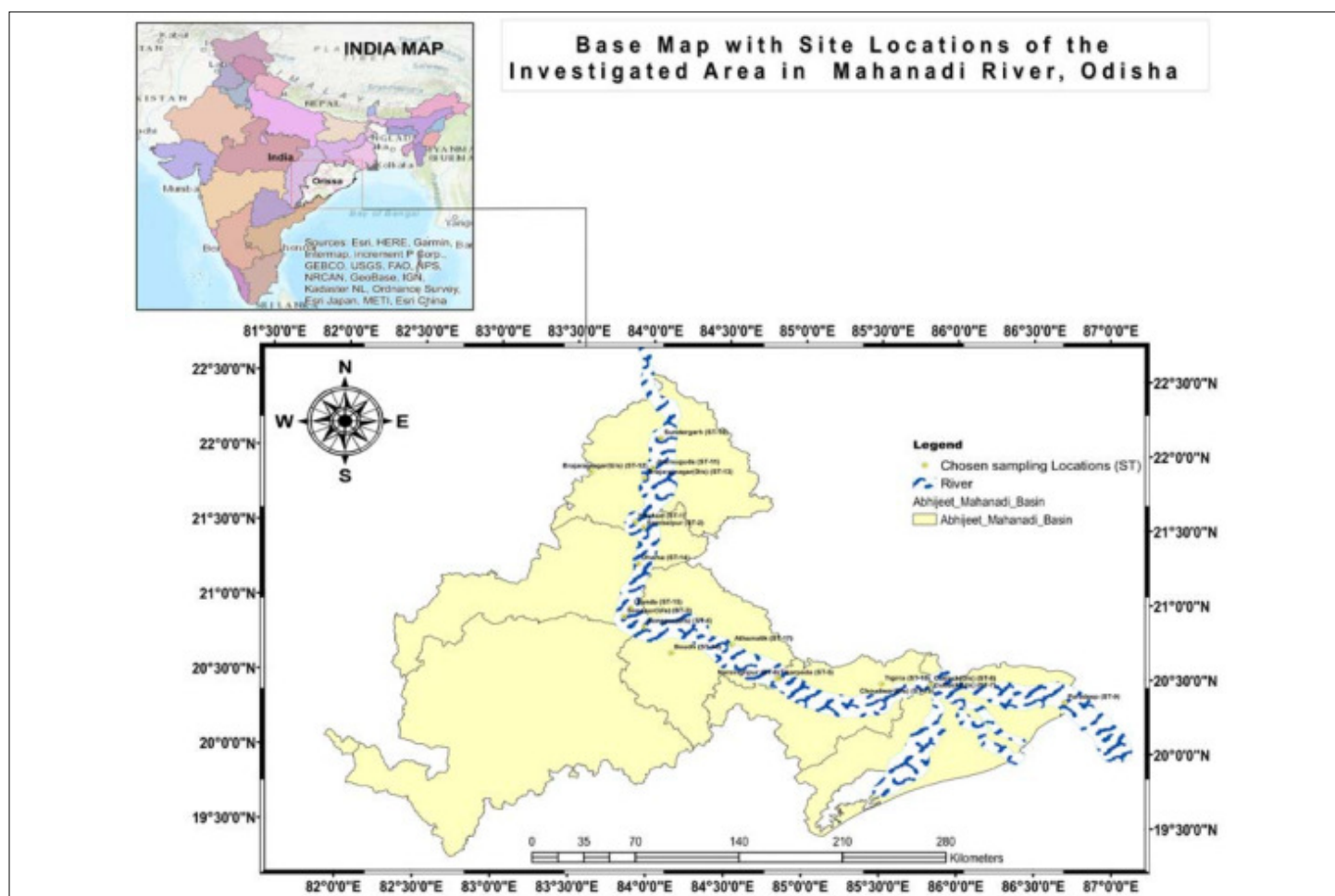


Figure 1. Map of H₂O sampling sites in the Mahanadi River, Odisha

Sampling strategies and analysis

Water samples were collected from 19 stations along the course of the river system, starting from the Hirakud reservoir to the estuary points, i.e., at Paradeep. Samples were collected with the help of boats for a period of 2022-2023. The mean value of three sets of data is taken for consideration. Twenty physicochemical parameters such as pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), coliform (TC), total suspended solids (TSS), total alkalinity (TA), chemical oxygen demand (COD), ammoniacal nitrogen (NH₃-N), free ammonia (free-NH₃), total kjeldahl nitrogen (TKN), electrical conductivity (EC), sodium adsorption ratio (SAR), boron (B+), total dissolved solids (TDS), total hardness (TH), chloride (Cl⁻), sulphate (SO₄²⁻), fluoride (F⁻), nitrate (NO₃⁻) and iron (Fe²⁺) were selected, which were assessed and compared with WHO (2011) standards for drinking purposes. All indicators were further examined using the procedures outlined by the American Public Health Association (APHA 2012). The overall evaluation of surface water quality was done using two methods such as CCME WQI and WASPAS. Moreover, ArcGIS 10.8 was used to prepare the digitized base map of the study area shown in Figure 1. All chemicals and reagents used in the analysis were of analytical grade unless otherwise stated. Deionized water was used for all dilutions. Standard solutions were prepared by diluting the stock solutions.

CCME WQI

The CCME WQI is based on three factors characterizing the anthropogenic impact on the water quality. F1 (Scope) represents the percentage of water quality indicators not meeting the regulatory guideline values ('failed variables') over the total number of variables included in the water quality assessment. F2 (Frequency) represents the percentage of measurements in which a water quality indicator exceeds the guideline values ('failed tests') over the total number of tests (measurements). F3 (Amplitude) represents the extent of deviation of the 'failed tests' values relative to the corresponding guideline values. The calculation of WQI is performed by aggregation of the obtained factors as follows: $WQI = 100 - [(F1 + F2 + F3) \times 0.5 / 1.732]$. The following equation gives a value between 0 and 100, with 0 being the 'worst' and 100 indicating the 'best' water quality. It divides the quality of water into five classes such as excellent (95-100), Good (80-94), fair (65-79), marginal (45-64), and poor (0-44).

Weighted Aggregated Sum-Product Assessment (WASPAS)

It is a multi-criteria decision-making method for ordering the alternatives. However, information entropy is used to calculate the weights, which is often described as a quantified measure of information, disorder or uncertainty associated with the occurrence of a random process. The application of information entropy, popularly known as Shannon entropy in the analysis of hydro-meteorological variables has been a matter of considerable scientific research in the recent years. In 2012, it is one of the robust utility determining approaches. This approach is an integration of Weighted Product Model (WPM) and Weighted Sum Model (WSM). In addition, this integration develop to achieve new weights of criteria by integrating subjective weights from decision makers with objective weights resulted from entropy approach. Moreover, this combination can lead to realistic weights of criteria for decision making and increases stability in various weights. The methodology of this technique was suggested by Zavadskas et al. 2012, 2015, 2016).

3. Results and Discussions

Surface water quality parameters

The several parameters considered in the study are explained in the following lines. The amount of hydrogen ions in water is indicated by the pH, which is neutral. It represents the acidic or basic nature of water. For drinking purposes, the pH must be between 6.5-8.5. However, the pH in the collected surface water samples varies

from 7.75 to 7.93 mg/l, indicating that is well within the permissible range. DO, which is critically important for aquatic life, however, low value indicates oxidation of organic sewage and influx of pollutants. The readings varied from 7.3-7.9 mg/l. In almost all stations, it is above the permissible limit for drinking water (6 mg/l). Hence, adequate amount of DO is available in the study region. BOD and COD are important indicators of organic pollution in the water bodies. BOD is the amount of oxygen necessary for the metabolic activities of aerobic microorganisms during the degradation of biodegradable organic matter. It was observed in the range of 1.1-2.5 mg/l, in the current work. The average value is found to be low as per WHO standards (5 mg/l) and hence safe for consumption. COD is a measure of chemical composition of organic and inorganic matter, dissolved or suspended substances in water. Low value indicates domestic wastewater discharges without proper treatment. It generally indicates the contents of organics mostly nitrites, sulphides, ferrous salts. The readings recorded in a range of 7-22 mg/l, which is found within the desirable threshold (30 mg/l). Coliform (TC) in water originates from sanitary contamination of the river. In the present study, its concentration ranges from 1250-42900 MPN/100 ml. Elevated levels at sites ST-8, 9 and 19, indicates pollution caused by chemical industry, sewage, fertilizers, and agricultural runoff. It can affect the growth and decay of plants and promote bacterial decomposition, all of which may reduce the amount of oxygen available in the water. TSS originates from the mining activities mostly during excavation, dust, and dirt. During monsoon, the kinetic energy of raindrops and subsequent runoff on exposed soil without vegetation cover causes a substantial amount of soil to be eroded and becomes suspended in the runoff water. Its value ranged between 30-75 mg/l, in the ongoing work. Its score falls within the permissible limit (100 mg/l). Alkalinity is caused by the presence of carbonate, bicarbonate and hydroxide ions in the water. Water has a better capacity to neutralize acids when it has a higher alkalinity and vice versa. It should not exceed 200 mg/l. For the study area, alkalinity ranges from 71-111 mg/l. NH₃-N indicates the fresh input of organic load into the water system. Municipal sewerage loads are accounted as the main source of organic matter for the river system.

The concentration ranged between 0.52-1.94 mg/l, which is below the threshold (2 mg/l). Higher value noticed at ST-19, is related to quantity of effluent/sewage discharge from major townships and two fertiliser industries. Free-NH₃, indicating the source of ammonia is from localized anthropogenic input rather river runoff. It may be assumed that the dilution effect is more prominent during the monsoon season. The range fluctuate in the current research is found to be 0.025-0.07 mg/l. The acceptable value for drinking is less than 2 mg/l. TKN, a very good indicator of negative influence of partially processed or unprocessed waste waters from agglomerations, industry and agriculture on the water recipients, indicates that the water quality at most sites (4-12 mg/l) is with higher organic matter pollution according to WHO standards (5 mg/l). Higher values in potable water increases the chances of gastric cancer and other health hazards to infants and pregnant women. EC is a measure of the ability of any substance or solution to conduct electric current through the water. It is directly proportional to the dissolved material in a water sample. The desirable limit of EC is 2250 µS/cm. In this study, the value varied between 139-7781 µS/cm. High EC at ST-9 suggests the mixing of sewage in surface water as these sites are near dense urbanization. In SAR, sodium can react with soil to decrease its degree of permeability. Finer the soil texture is and the more the organic matter amounts are and the bigger the effect of sodium on infiltration of water and aeration. The SAR was found to be in the range of 0.42-17 mg/l. Threshold value should be 10 mg/l. Higher value noticed at ST-9 (17 mg/l) indicates weathering of rock forming minerals i.e., silicate minerals (alkali feldspars) and or dissolution of soil salts present therein due to evaporation. Boron is present in many minerals and most of the rocks. It is also regarded as a highly reactive alkali metal. The surface water samples containing boron (B+) is in the range of (0.02-0.55 mg/l), which is below the detection limit to 2 mg/l. The majority of TDS is made up of inorganic salts and a little quantity of organic molecules dissolved in water. Water with exceptionally low TDS has a bland taste. The acceptable TDS for drinking water according to the WHO, is less than 100 mg/l. It lies in the range of 83-13231 mg/l. High TDS at ST-9 can alter the taste and hardness of the water. The agricultural practices, residential

runoff, leaching of soil causing contamination and point source water pollution discharge from industrial or sewage treatment plants are the primary sources at ST-9. TH is the amount of dissolved calcium and magnesium in the water. Water moving through soil and rock dissolves naturally occurring minerals and carries them into the surface water as it is a great solvent for calcium and magnesium. The maximum hardness that can be tolerated is 300 mg/l. Range of hardness is from 52-2196 mg/l. Elevated score at ST-9 may cause heart disease and kidney stone in human beings. It also related to farming practices and point source water pollution from factories and warehouses. The higher the Cl⁻ concentration in water, the more dangerous it is to human health. The associated cation influences the taste threshold of the Cl⁻ ion in water. Chloride levels should not exceed 250 mg/l. The amount in this study varies from 9-4910 mg/l. Geogenic or anthropogenic processes seems to be responsible for the increasing Cl⁻ concentrations at ST-9. Sulphate is an important parameter which refers to dissolved or leached from rocks containing gypsum, iron sulphides and other sulphur bearing compounds. In the present study, it ranges between the 4.50-378 mg/l, which is well within the acceptable limit of 200 mg/l except ST-9. Moreover, ST-9 is an industry hub, located in close proximity to the factories and SO_x in the atmosphere in the form of rainwater might have contributed to the sulphate concentration in water. F⁻ is primarily found in water as a result of geological processes. Fluoride in high concentrations (>1.0 mg/l) can cause skeletal fluorosis. The concentration in this study ranges from 0.20-0.90 mg/l. NO₃⁻ is naturally occurring ions and is a significant component in the nitrogen cycle. However, it is undesirable with excess quantity, as it causes blue-baby syndrome in infants less than 6 months of age. In general, its higher concentration causes

health hazards, if present beyond the permissible limit of 45 mg/l. Further animal wastes, plants and animals remain also undergo ammonification in the soil producing ammonia which undergoes nitrification/ammonia oxidation by Nitrosomonas and Nitrobacter bacteria to form nitrate. The value in the present study lies between 1.2-2.8 mg/l. The most common sources of iron in surface water is weathering of iron-bearing minerals and rocks. The iron occurs naturally in the reduced Fe²⁺ state, but its dissolution increases its concentration in water. In the current research, the concentration of Fe²⁺ was in the range of 0.50-2.7 mg/l. These concentrations were in normal of their permissible drinking water standards (3 mg/l).

For water quality evaluation, CCME WQI was determined for the 19 sample sites for the provided water quality parameters. The readings show that the numerous parameters have a great impact on water quality than a single one. The obtained WQI range is 34.61-85.58, i.e., from good to poor categories. Out of 19 surface water samples, 73.68% of samples are in good water, 15.79% are fair water and the remaining 10.53% indicates poor water. To create an index map, WQI values were interpolated over the entire study region. The developed map can be seen in Figure 2. Generally, minimum value of WQI is observed at the upstream side. This is because of no irrigation projects and human activities are less. The map clearly indicates that locations ST-8 and 9 lie in poor category. This may be due to effective leaching of ions, overexploitation of surface water, direct discharge of effluents and agricultural impact. In addition, higher value noticed at some locations is because of high TKN and TC in surface water.

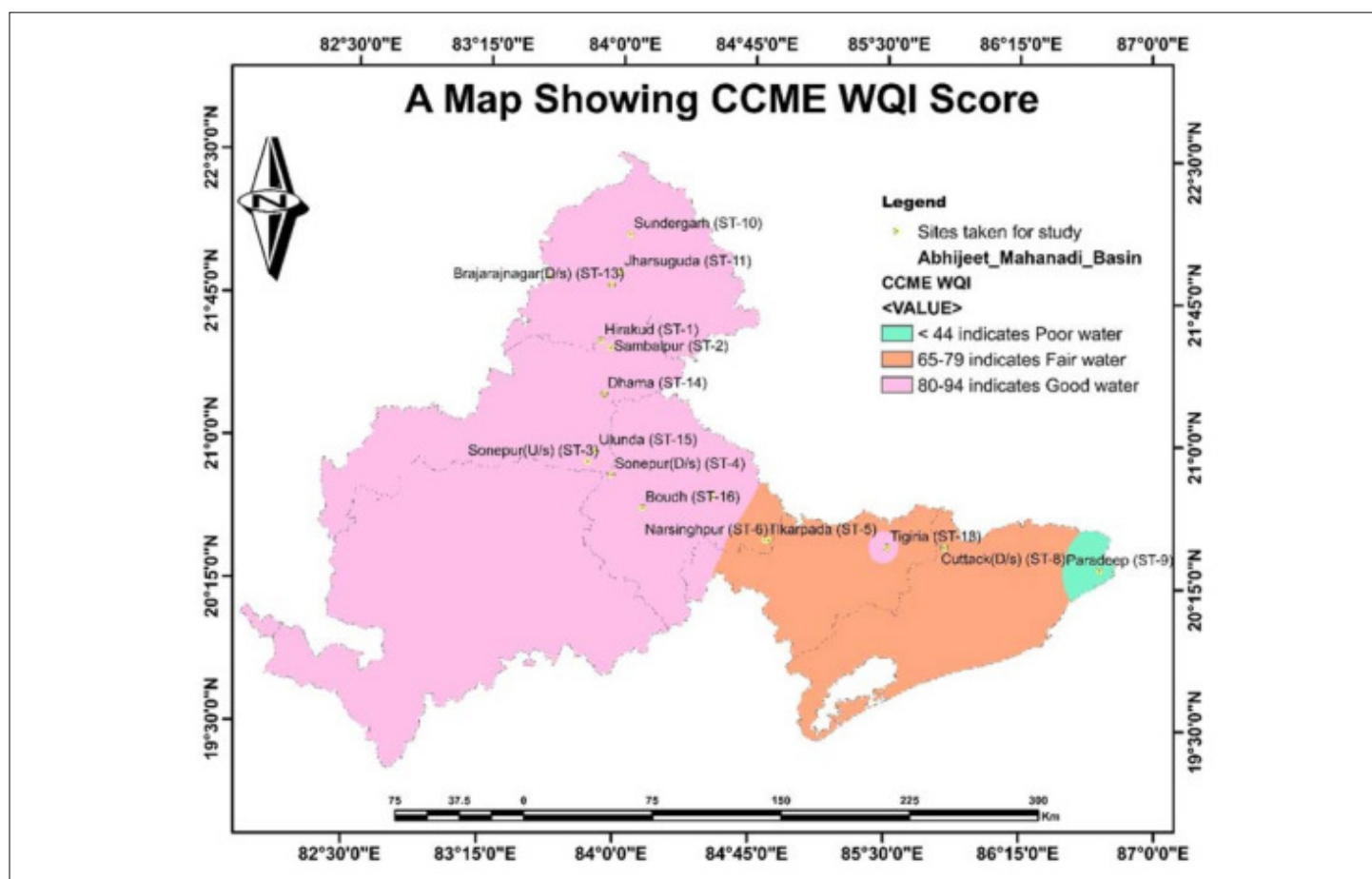


Figure 1. Map of H₂O sampling sites in the Mahanadi River, Odisha

Further, MCDM such as WASPAS were used to evaluate variations and interpret a large complicated data set. It allows for the extraction of hidden information (rank) from a data set concerning environment's potential effects on water quality. In this study, this method is used on 20 samples for 19 sites. It was performed on a physicochemical data matrix. MATLAB software was used to accomplish the analysis. The overall ranking of the sampling locations given by WASPAS methodology has been shown in the Table 1. The WASPAS method also ranked these locations as the most polluted site by giving them an overall rank of 1, 2 and 3 respectively. The identification of the relatively more polluted site (rank 1) is found to be ST-9 (0.909), followed by (rank 2) i.e., ST-8 (0.076) and finally (rank 3) i.e., ST-19 (0.063). However, WASPAS method provided an overall ranking to the sampling sites as well as proved efficient in ranking the sites, considering the pollution criteria. Figure 3 depicts the spatially generated map based on location coordinates and quality parameters. The various reasons are soil leaching and anthropogenic effects, such as mixing of chemicals and animal wastes during irrigation, traces of waste water with water resources. TKN concentrations above the norms found in the agricultural part of the study area. It could be also attributed to the dissolving of solids, which results in water turbidity and contamination due to soluble salts of chloride. In the present study, only one index approach is used to access the WQI. If more parameters are available, more indexing methods can be used. Furthermore, the current work is done for a period of 1 year. Future work can be implemented for seasonal periods to give a comparative result. As the water quality assessment is an important topic as it is a primary source of drinking water in the relevant study. Therefore, a stringent management plan must be designed before its quality deteriorates.

Locations	Scores	Rank
ST-1	0.036	18
ST-2	0.042	9
ST-3	0.037	16
ST-4	0.044	4
ST-5	0.041	11
ST-6	0.041	10
ST-7	0.040	12
ST-8	0.076	2
ST-9	0.909	1
ST-10	0.038	15
ST-11	0.035	19
ST-12	0.037	17
ST-13	0.040	13
ST-14	0.044	6
ST-15	0.038	14
ST-16	0.044	5
ST-17	0.042	8
ST-18	0.043	7
ST-19	0.063	3

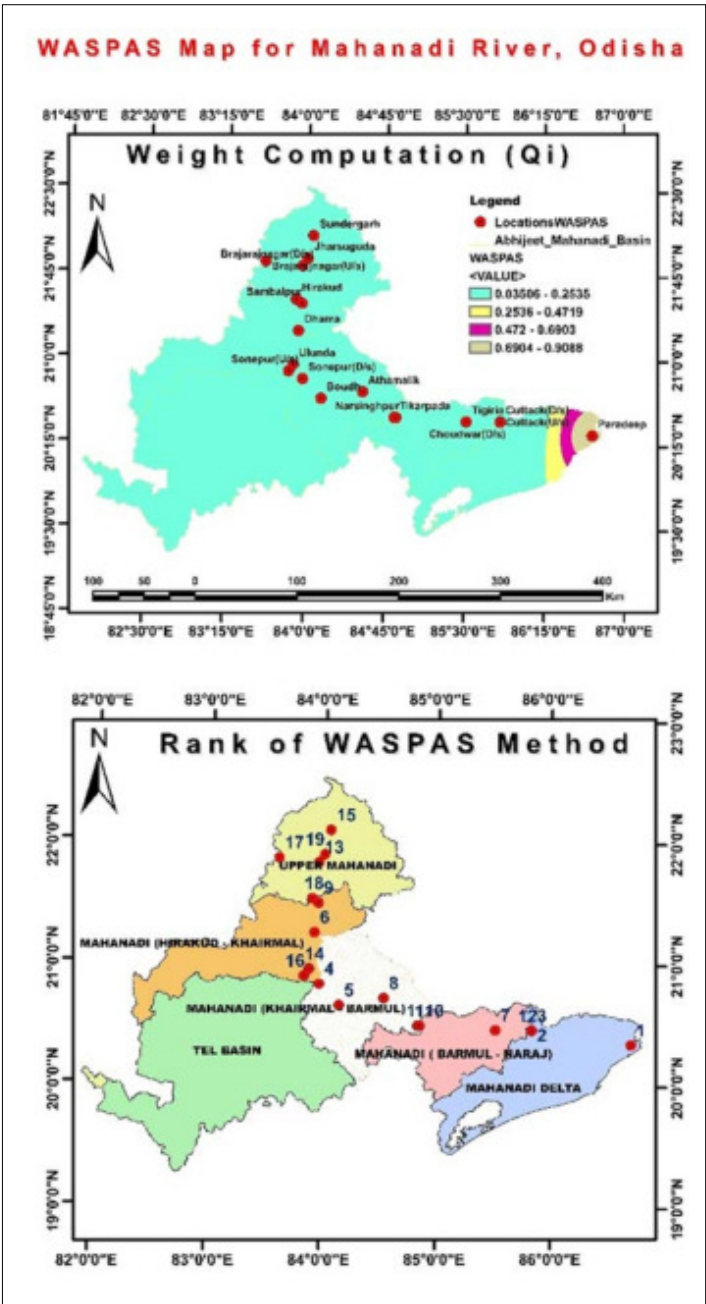


Figure 3. Variation of WASPAS at all sampling locations

4. Conclusion

The Mahanadi River in the State of Odisha, represents one of the main sources of water for drinking and irrigation. The recent water crisis in the region has prompted the necessity of assessing the quality of the river's water during the sampling period i.e., 2022-2023. Water samples from 19 locations along the river were taken to test 20 physical and chemical parameters in the selected stations. All the spatial maps were drawn and super imposed using Arc GIS 10.8 and integrated output was obtained to represent the overall suitability of surface water for drinking purposes. The study

was first assessed using CCME WQI at first. Then, the shortcomings resulting from solely applying this index method have been successfully repaired in combination with multi-criteria method, providing a broader picture of the actual quality of the observed water body. Overall observation advocates that surface water is slightly alkaline in nature. The parametric value for TKN exceeded the WHO permissible limit at all sites. The mean ionic dominance pattern is in the order $\text{Fe}^{2+} > \text{B}^+ \text{ and } \text{Cl}^- > \text{SO}_4^{2-} \text{ and } \text{NO}_3^-$ for cations and anions respectively. The CCME WQI assessment showed that 73.68% of samples exhibit good quality water, hence, suitable for human consumption. 10.53% shows poor grade, which is because of pollution contributors such as geogenic, domestic and agricultural runoffs, seasonal variation, unchecked application of fertilizers, and agrochemicals. Based on WASPAS findings, the highest calculated coefficient was found to be 0.909 i.e., ST-9. It denoted that this place was the most polluted site in comparison to other locations. However, since this place is subject to over-utilization, there is a need to set up efficient water wastewater treatment plants and sewage systems to prevent/mitigate the cumulative pollution's acuteness on less used rivers. This study recommends the establishment of a permanent commission to monitor water resources quality in some places (ST-8, 9 and 19) along the river. Water quality modelling should be envisaged to determine the control and limit the negative impact of human and industrial activities in the sub-catchments.

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PERFORMANCE BASED CONTRACTING MODEL (PBC'S) IN WATER INDUSTRY

By Mrunal Parkhi, Head, Team CCO



Introduction

Although Water is one of the basic human needs, due to scarcity of clean drinking water it is gaining importance among the governments and Municipalities across the globe and world monitoring bodies like WHO and World Banks, are also working on how to get clean and safer water to all. Since the public money is used for these projects, Govt's across globe are much careful about money invested gives good returns and this is how the Performance Based Contracting (PBC's) models is gaining fast recognition.

Water is also a vital ingredient in number of industries which includes chemical, textile, Hydrocarbon etc and with entry of Hydrogen as an alternate fuel, where pure water is a key resource, the water industry will undergo serious revolution in coming days.

Some of the key characteristics of a performance-based contract:

- The requirements of the contract are focused on the contractual outcomes.
- The contract does not include details pertaining to how the work is performed.
- Indicators are set that are tied to the expected outcome.
- Each performance parameter includes an achievable performance standard.
- Each indicator has a way to collect, analyze, and report necessary data.
- The contract includes performance-based rewards and penalties that have either monetary or non-monetary consequences

Developing a Performance-Based Contracts

a) Contract Formation stage

The contract formation stage is critical for the success of the future partnership. During this stage, the contracting authority needs to make some important decisions with regard to the type of contract, type of bidding process and the methodology for selecting the contractor.

- The experience shows that starting public-private partnerships with less complex contracts, such as service or management contracts, can have a lot of benefits. This strategy allows authorities to gain experience with and confidence in dealing with intricate legal and technical matters before they move to more complex contracting models.
- Before drafting a contract, the contracting authority needs to conduct a thorough review of the relevant legislation and

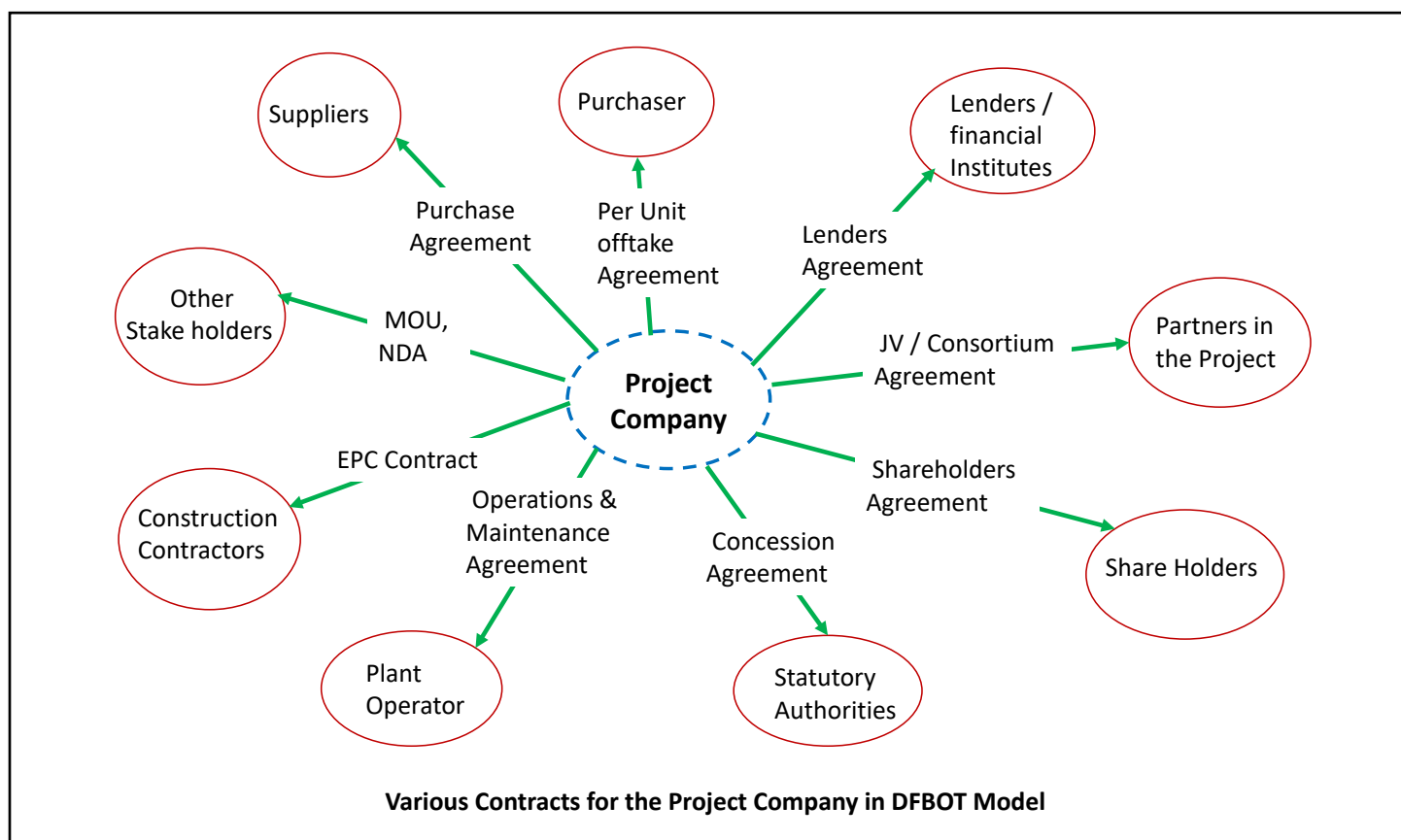
regulations as well as clarify the objectives that the contract will be expected to achieve. The contract needs to be in sync with the legal framework in force. This can help avoid future time-consuming disagreements or conflicts between the parties, which normally goes into litigation mode.

- Before entering into a contract, the contracting authority needs to carry out a thorough review and evaluation of the utility's assets and liabilities. If the review shows the need for restructuring of the utility, this has to be done before the contract is in place and in line with good industry practices.
- Setting simple, straightforward and well-designed technical and financial evaluation and selection criteria can help ensure transparency and encourage market choices in selecting a contractor.

b) Fixing the Performance indicators

Performance indicators allow the contracting authority to measure the performance of the operator in a more objective and transparent way. From an environmental point of view, it is the performance indicators that are of particular importance as they will usually include very specific water quality targets. For this reason, environmental authorities need to be closely involved in the process of contract preparation in order to ensure that environmental objectives are adequately reflected in the contract. In addition, the bonus and penalty system which is often built into performance-based contracts may be also directly linked to the achievement of the performance indicators. This is one of the reasons why parties to contracts are so much concerned with the definition and methodology for setting and measuring indicators. In this context, the main lessons learnt include:

- Indicators should be few and easy to monitor and verify. They should be targeted at the needs of the individual utility and should reflect the most urgent and critical issues to be solved by the operator.
- Providing a clear definition of the indicators is crucial. Indicators need to be defined in terms of levels, timeframe for their achievement and methodologies for their monitoring, calculation, measuring and revision.
- Where initial data are poor, it is better to set indicators as increments, or improvements defined in terms of percentage above a baseline, rather than as absolute values. Indeed, using a percentage of the improvement as an indicator makes it easier to integrate modifications to the baseline calculations, when necessary.
- Closely and regularly monitoring progress with achieving



performance indicators makes the system credible and allows parties to the contract to better understand the challenges as well as encourages them to seek timely and effective solutions.

c) Risk management

Including risk mitigation clauses in the contract helps prevent future costly failures for each of the parties to the contract as risks may be substantial (including revenue risks (low tariff collection), operation and maintenance risks, currency rate risks, regulatory and policy or political risks, and force majeure).

Defining risks and risk mitigation measures in the water sector is a difficult exercise and requires a good understanding of the conditions and the environment in which the contract will operate. All Contracting authorities envisage some kind of risk mitigation measures (tariff adjustment and revisions rules, bonuses and penalties, early contract termination clauses).

d) Contract monitoring and conflict resolution.

Contract monitoring and reporting obligations are a major element in all performance-based contracts. Regular, timely and consistent reporting by the operator on progress with contract implementation allows detecting problems early in the process. All reviewed contracts include reporting requirements but with a different degree of specificities.

Similarly, all contracts reviewed envisage some kind of enforcement and conflict resolution mechanisms which are either directly included in the contracts or more generally prescribed in the governing law.

- Reporting requirements should be specified in the contract as precisely as possible. If this is not feasible, the contract should envisage a procedure for developing such reporting requirements by some precise date after the contract starts.
- Given the significant risks involved in water sector contracts. There is a need for more explicit mechanisms to ensure contract enforcement. These mechanisms need to be aligned with the legislation in force.
- In terms of conflict resolution, there has to be fair method for both i.e Contractor as well as authority to sought out any conflict during performance. Arbitration through (a panel of) experts has proven its effectiveness as a working mechanism and is worth considering in contractual arrangements. Solving conflicts through courts usually costs a lot of time and money and should be a solution of the last resort.

Types of Contracting Models under PPP:

PPP is very broad terminology where public enterprise (a state Govt. or Municipality) and private contractor shares the authorities, responsibilities, revenues and liabilities to offer a quality services to a public at large.

Although it is much widely used in infrastructure projects such as road, bridges, etc. Also can be used in water and sanitation sector extensively.

- **Services Contract:** The participation of the private sector is limited to technical and administrative tasks, such as repairs, meter reading or payment collection. The private sector does not bear any commercial risk regarding

water services. The contract period rarely exceeds one or two years. This contract is adapted to all situations even when the regulatory framework is particularly weak.

- **Management Contract (PMC):** Project is developed by Public Sector however, the private sector takes over operation and management responsibilities. The Contractor offers Project Management Consultancy (PMC). The private contractor is paid on a "fee per unit" basis defined in the contract: per volume of water sold, per number of connections. The private company does not bear commercial risks regarding water services.
- **Lease Contract:** These are differing from the PMC contract. The asset is built by the Public Enterprise and the private company assumes the responsibility for operating the service in exchange for payments for the use of the fixed assets. The main tasks are operation and maintenance. Users become direct clients of the private contractor, which bears a much more important part of commercial risks. However, while it is not in charge of capital investment it may be made responsible for providing working capital for repairs. In exchange for greater risks, the leaseholder receives a part or the totality of water revenues.
- **Build-Operate-Operate-Transfer (BOOT) Contract:** the private sector is in charge of designing, building and financing a new investment project. It also has to operate and maintain it for the concession period and then hand it over to the public sector. This mechanism has the advantage of not increasing the sovereign debt. This type of contract is usually used for construction of water production and desalination plants and sale of bulk water to the public provider rather than for water distribution. Currency risks and the significant length of legal negotiation increase the cost of projects financed under a Build-Operate-Transfer contract. (Figure 1 shows the contracting complexity for the Contractor)
- **The concession contract:** is similar to the lease contract, but the contractor is in charge of financing the expansion and the rehabilitation of the network. As in the lease contract, users are direct clients of the private contractor. The duration of the contract are large duration generally ranges around twenty

years and above. At the end of this period, the private operator hands over the installation to the state/ Municipality.

All pervasive Contracting Models:

These models offers a win-win situation where the public enterprise who has power and feed gets it processed through a private operator who has design and management capability. Therefore these Contracting models where public and private come together does not only restricted to public infrastructure or Power utility sector but also used in industrial sectors quite extensively, where the role of Public enterprise is played by the project owners.

In one of the leading refineries in India a BOOT model is successfully operated for a waste treatment plants. An airport in Saudi Arabia get its entire water supply using BOOT model. Some of the large housing and industrial developers have used the BOOT model for getting benefit of "pay as you use" scheme using these models.

Some of the municipalities use these models (BOOT / DFBOT) to dispose of the Kitchen waste collected from the city and make Bio CNG out of the same to get additional revenue along with disposal of waste.

Conclusion:

One of the reason why various forms of BOT models (BOO/BOOT/DFBOT) are becoming popular is, they based on "Pay as you use" principal i.e the customer pays, only for that portion which is used by him.

Generally, performance-based contracts are developed to help define the water quality and distribution goals. The performance-based contracts focus on results, this compels the Contractors to be innovative and to find cost-effective ways of delivering a continuous quality services. More specifically, these contracts include time-bound performance targets against which the performance of the operator is measured and good performance is rewarded while poor performance is sanctioned. If designed properly, performance-based contracts can help lay the basis for the long-term sustainability of the utilities, increasing their efficiency and creating conditions where investment capital can be attracted



About the Author

Mrs. Mrunal Parkhi heads a Legal and Contracts Management consultancy based out of Pune.

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PUMPING SYSTEM OPTIMIZATION: REDUCING CARBON FOOTPRINT

By Anil Sethi, Chairman, Pump Academy Private Limited



At COP26, India's commitment to achieve Net-Zero Emissions by 2070 was a significant announcement. The Nationally Determined Contribution (NDC) is a non-binding national plan that outlines India's climate change mitigation strategies, including targets for reducing greenhouse gas emissions.

In August last year, our Hon'ble Prime Minister approved India's updated NDC, which was communicated to the United Nations Framework Convention on Climate Change (UNFCCC). The updated NDC aims to enhance India's contributions to strengthening the global response to climate change, as agreed upon in the Paris Agreement. This action will also facilitate India's transition towards low-emission growth pathways, protecting the country's interests and future development needs in accordance with UNFCCC principles and provisions.

As per the updated NDC, India has committed to reducing the emissions intensity of its GDP by 45% by 2030, compared to the 2005 level. Additionally, India also aims to achieve a cumulative installed capacity from non-fossil fuel-based energy resources, mainly renewable in its electric power sector by 2030. This decision reflects India's high-level commitment to decoupling economic growth from greenhouse gas emissions.

Reducing the carbon footprint is of great importance to India due to its positive impact on mitigating the effects of global climate change, improving public health, boosting the economy, and preserving biodiversity. By reducing carbon emissions, India can ensure cleaner air, water, and food for the current and future generations.



According to a report by MDPI, pumping systems consume approximately 20% of the world's energy. The International Energy Agency estimates that the water sector's electricity consumption worldwide accounts for 4% of the total global electricity consumption. Various research conducted by international agencies has highlighted that the energy used for pumping water represents a significant portion of the overall operational costs of water systems.

“ About 20% of the world's energy is consumed in pumping systems. ”

Rapid urbanization across the globe has placed considerable pressure on urban water supply systems, and water utilities face increasing challenges in providing reliable and safe drinking water and wastewater treatment services to the growing urban population. India, which has become the most populous nation in the world, experienced an increase from 27.9% urban population in 2002 to 35.9% in 2022, and it is projected that over 50% of the country's population will be living in urban areas by 2050.

Optimizing Water Infrastructure

The optimization of the operational framework for urban water supply system is a crucial yet complex task. It involves various aspects that need to be carefully considered to ensure efficient and sustainable water management in urban areas.

One of the key challenges in optimizing the operational framework is balancing water supply and demand. This requires accurately assessing the water requirements of the urban population and developing strategies to meet those demands while minimizing wastage. The report by Niti Aayog suggest that India is already experiencing severe water scarcity with over 600 million people, more than 40% of its current population is facing extreme issues in accessing clean drinking water. The situation is further threatening with World Bank estimating that by 2030 India's water demand will outstrip supply by almost 50%, a significant challenge to arrange water for domestic, agriculture and commercial purposes. While planning to optimize, factors such as advancing population, urbanization trends, industrial growth, and changing consumption patterns must be taken into account to effectively manage water supply.

Another aspect to consider is the infrastructure and network management. This involves maintaining and upgrading the physical infrastructure of the water supply system, including pumping stations, pipeline networks, treatment plants, storage facilities, and distribution systems. Aging water infrastructure in India presents significant challenges as many of the existing water supply systems have surpassed their intended lifespan. Most of our legacy water supply systems were designed to cater to smaller populations or less urbanized areas when it was constructed decades ago. As cities got expanded and populations grow, these systems mostly running on traditional methods struggle to meet the increased demand for water, leading to inadequate capacity and service disruptions. These outdated and deteriorating water infrastructures have adverse effects on water supply, sanitation, and overall public health. Regular inspections, maintenance, and timely repairs have become necessary to prevent leaks, breakages, and system failures, which can result in water loss and service disruptions.

Optimizing the operational framework requires implementing advanced technologies and smart solutions. This includes the use of real-time monitoring systems, data analytics, and automation, reducing energy cost to improve the efficiency of water distribution network, detect anomalies, and enable proactive decision-making.

Pumping System: Essential for Water Management

Pumping systems play a crucial role in various sectors and industries, including agriculture, industrial processes, and public water supply and sanitation. They are integral to the smooth functioning and efficiency of operations in these sectors:

Municipal Water Supply and Wastewater Management: Pumping systems are critical for municipal water supply and wastewater management services. They facilitate the distribution of treated water from water treatment plants to residential, commercial,

and public areas while also getting raw water from the source to the treatment plants. It is used to transport used water from homes, businesses, and industries to wastewater treatment plants for proper treatment and disposal back to water bodies.

Agricultural Water Management: In agriculture, pumping systems are used for irrigation purposes. They help in drawing water from rivers, lakes, wells, reservoirs or underground sources and distributing it to crops through an irrigation network. Properly designed and operated pumping systems ensure that water reaches the fields at the right pressure and volume, promoting efficient water use and maximizing crop productivity.

Industrial Processes: Industries across various sectors rely on pumping systems for a wide range of applications. For example, in the power sector, pumps are used to circulate cooling water in thermal power plants. In the chemicals industry, pumps are employed for the transfer of fluids in manufacturing processes. Similarly, sectors such as textiles, mining, and oil and gas utilize pumping systems for various purposes, including fluid transfer, filtration, and pressure boosting.

Pressure and Filtration Improvement: Pumping systems are often used to increase water pressure in distribution networks, ensuring adequate supply to consumers at different locations and elevations. They also play a vital role in filtration processes by driving water through filtration systems, removing impurities and ensuring the delivery of clean and safe water to the designated places.

Pump Optimization

Pumping system optimization is an essential aspect of optimizing the operational framework for urban water supply systems. Pumping stations play a critical role in water supply system from its source, such as reservoirs or treatment plants, to the distribution network and ultimately to end consumers. Optimizing pumping systems can result in significant benefits in terms of longevity of pumps, energy efficiency, cost savings, operational effectiveness and overall system performance.

“ 5 GW of energy could be saved if iPUMPNET is implemented across all water pumping stations in India. ”

Pump Academy Private Limited has launched an innovative solution called iPUMPNET, an IoT-enabled system designed to optimize pumping station operations. This system introduces cutting-edge technology to enhance energy efficiency and transform traditional pumps into smart and responsive devices. With iPUMPNET, Pump Academy aims to revolutionize the way pumping stations are managed and operated in India.

The iPUMPNET system utilizes a patented IoT (Internet of Things) framework, which enables real-time monitoring and control of pumping stations. Through the system's intuitive dashboard interface, accessible via the internet and mobile applications, water utilities can efficiently manage and streamline pump station operations. This advanced monitoring system provides valuable insights and analytics, allowing operators to make informed decisions and optimize the performance of their pumping stations.

Among the projects undertaken by Pump Academy is the implementation of iPUMPNET for a large-scale project in Bengaluru, India. The goal of this project is to improve the efficiency and effectiveness of pump station operations. By leveraging real-time monitoring capabilities and the intuitive dashboard interface, water utilities can enhance their decision-making processes, respond swiftly to any issues, and optimize energy consumption thus reducing the cost of energy and increasing operational efficiency.

The iPUMPNET

iPUMPNET is transforming existing pumping systems into more efficient fluid management solutions suitable for various sectors. It offers several benefits, including:

Real-time Monitoring: Operators can monitor key parameters and performance metrics of pumping stations in real-time, allowing them to promptly identify any abnormalities or inefficiencies to take swift remedial actions.

Energy Efficiency: By analyzing data and optimizing pump operations, iPUMPNET helps to minimize energy consumption by upto 40%.

Operational Effectiveness: It enhances pumping station operational efficiency by 35% and extends the life of pumping stations by up to 50% and reduces operational costs significantly. It also helps in reducing the life cycle cost (LCC) of pumping stations by 40%.

Predictive Maintenance: The system utilizes predictive analytics to detect potential failures or maintenance needs in advance, enabling proactive maintenance and minimizing downtime.

Intuitive Dashboard: The user-friendly dashboard interface provides a comprehensive view of the pumping station's performance, allowing operators to access information easily and make data-driven decisions.

Remote Accessibility: The system can be accessed remotely through internet and mobile applications, providing convenience and flexibility for operators to monitor and manage pumping stations from anywhere.

Return on Investment: It effectively provides a return on investment within a year, making it a smart and cost-effective asset for water utilities and other pumping station owners.

Reduction in Carbon Footprint: It helps in considerably reducing the carbon footprint of pumping system and creation of a sustainable environment. It is estimated that almost 5 GW of energy could be saved if iPUMPNET is implemented across all water pumping stations in India. As per a conservative calculation, one MW reduction in energy

consumption in the pumping station can save approximately 612 tonnes of Co2 emission per month which is equivalent to planting 21,500 trees.

Way Forward

Pumping systems are essential in various sectors and industries, providing the necessary means to manage water supply, support industrial processes, and ensure efficient wastewater management. Pumping station optimization is crucial for achieving efficient and sustainable urban water supply systems. It helps in conserving resources, reducing energy consumption and costs, improving system reliability, and minimizing the environmental footprint of water utilities. By implementing appropriate technologies, maintenance practices, and operational strategies, water utilities can maximize the benefits of pumping system optimization and enhance the overall performance of their water supply systems.

By implementing iPUMPNET, Pump Academy Private Limited aims to enhance the efficiency, reliability, and sustainability of pumping station operations in water utilities. Through the integration of IoT technology and advanced monitoring capabilities, this pioneering solution has the potential to transform the way pumping stations are managed, leading to improved performance, energy savings, better water resource management and significantly reducing carbon footprints and global warming.



About the Author



Mr. Anil Sethi is Founder Chairman of Pump Academy Private Limited. He is a highly accomplished industry leader with over 45 years of diverse experience in which he has made significant contributions to the industry through his entrepreneurial acumen and strategic vision. He has successfully transformed the organization into a unique solution provider by leveraging modern technology.

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SILO AI DEVELOPS INTELLIGENT DIGITAL OPTIMIZATION SERVICE FOR FINLAND'S WATER AND DISTRICT HEATING SYSTEM OPERATORS

By Sandra DiMatteo, Industry Marketing Director, Water Infrastructure, Bentley Systems



Using the Bentley iTwin Platform Results in Record Project Delivery Times and Improves Energy Efficiency

Optimizing Aging City Pipeline Networks

Finland maintains over 16,000 kilometers of district heating pipelines and approximately 3,000 kilometers of water and sewerage lines in the Helsinki metropolitan area alone. A significant portion of these networks are aging and expiring, resulting in water leaks, higher costs, and unreliable service for pipeline network customers. The inefficient network performance and leakages increase fuel consumption and wasted water, which is not only detrimental from a business perspective, but also environmentally. To improve performance, reliability, and energy efficiency of Finland's water and district heating networks, Silo AI initiated a project to develop a smart, data-driven asset optimization service for city pipeline operators.

As the largest private artificial intelligence (AI) lab in the Nordics, Silo AI develops customizable, AI-driven solutions and products to enable intelligent monitoring and forecasting in city infrastructure, energy, and logistics. The company set out to pilot their digital pipeline optimization solution in cooperation with Helsinki Environmental Services Authority HSY and Suur-Savon Sähkö Oy, one of the largest grid operators in Finland. The goal was to enable these system operators to offer more sustainable energy services, optimizing performance of district heating assets and eliminating pipeline leakages. Known as Silo Flow, the system optimization service will help predict network failures and prioritize proactive asset maintenance to avoid costly repairs and potential network shutdowns, ensuring efficient and reliable service while minimizing environmental impact. "Silo AI's service will increase energy efficiency, performance, and productivity of [our] customers' network systems by several percentages," said Harri Kaukovalta, business development executive at Silo AI.

Dispersed Data Sources and Manual Workflows

System operators have been trying to localize leakages by different methods. However, these methods take place only after the leaks have occurred, requiring extensive repair and often resulting in service interruption. Silo AI sought a proactive solution to optimize pipeline operations, using AI and data analytics to pinpoint areas prone to leakage and prioritize pipeline maintenance renovations. They wanted to develop a digital twin model to identify and predict network failures before leakages occur. However, previous workflows required a combination of numerous data sources in various data formats, resulting in partial and inaccurate representations of the network. "Today, scattered data sources make it difficult to have a holistic overview of the pipeline network

health, and manually driven investment planning takes only a very limited amount of data sources into account," said Kaukovalta.

The multisourced, disparate data and manual workflows prevented operators from accurately identifying potential risks and proactively addressing them before they become costly, environmentally damaging problems, leading to shutdowns and interrupted service. Operators had to aggregate the data and visualize their network in its entirety to predict and prioritize pipeline maintenance. "This is where Silo Flow can provide an answer where you can optimize your network assets by investing in the right locations, at the right time while guaranteeing a high level of services for your customers," said Kaukovalta. However, to execute their solution, Silo AI needed a user-friendly, web-based interface. They sought to integrate the multiple pipeline data sources and perform advanced data analysis in a digital platform, providing operators a visual, comprehensive overview of asset health, systematically identifying and addressing leakages before they occur.

Developing a Digital Prediction Model

To predict pipeline maintenance needs and optimize network management, Silo AI developed its smart Silo Flow prediction model based on the Bentley iTwin Platform. The solution combines Silo AI's advanced data analytics with Bentley's digital, cloud-based interface for easy, accessible visualization of the pipeline data and assets. "Bentley's iTwin framework offered a simple and straightforward way to visualize data and data analysis results," said Kaukovalta. Combining advanced data science with cutting-edge visualizations, district heating and water network operators can pinpoint assets in need of maintenance prior to leakages or asset failure. They can optimize their network to timely invest in the right locations, ensuring safe and reliable service while promoting energy efficiency and carbon neutrality.

As the foundation for Silo Flow, Silo AI used the Bentley iTwin Platform to integrate the multisourced data into a living digital twin and aligned it with reality data, sensors, and AI without any additional equipment needed by the network operators. The combined solution can consolidate and analyze data into an understandable, valuable format facilitating data-driven decisions. "We built a solution for city pipeline infrastructure owners to predict pipeline failures and increase operation efficiency of district heating by several percent," said Ville Hulkko, cofounder of Silo AI.

Working within a fully accessible visual interface, operators can achieve comprehensive insight into asset health, and analyze and predict where better cooling can bring savings and more efficient productivity, optimizing heat balance in district heating as well as water flows throughout the network.

Smart Solutions Drive Savings and Sustainability

The Bentley iTwin Platform was easy for Silo AI to use. It allowed them to integrate data and visualize the new data analysis capabilities that they implemented. The flexibility and interoperability of Bentley's application shortened the project time, and any needed additions were easy to make to the digital platform. Using iTwin reduced visualization efforts by 50% and significantly reduced delivery time for the digital AI leakage prediction and flow optimization solution. "The project was delivered in a record time just because [the Bentley iTwin Platform] was so easy to use and make great visualizations real," said Kaukovalta.

Having easy accessibility to the data and visually analyzed results, network operators can improve pipeline operations. The iTwin-based smart solution offers a holistic view of pipeline network health, where maintenance needs and potential risk areas are clearly identified and visualized. It predicts and prioritizes pipeline maintenance to ensure customer satisfaction and sustainability, avoiding unwanted shutdowns of the grid, environmental damage, and waste from leakages. The successful project decreased the client's district heating network supply temperature by 3 degrees, improving energy efficiency while decreasing fuel consumption. "Silo Flow adds predictability and restores control over your system. It also helps you to optimize energy production," said Kaukovalta.

With one degree cooling improvement providing a 1% to 1.5% increase in the network energy performance, system operators can deliver more sustainable service and increase ROI through pipeline system optimization, preventing leakages, eliminating lost resources, and budgeting future maintenance and network investments. By combining progressive data science with advanced visualizations in a digital twin platform, Silo AI is simplifying decision-making for network operators, enabling straightforward conclusions to support reliable heating and water access crucial to quality of life. "The solution is currently being scaled up for multiple customers and pipeline types," said Hulkko.

Project Summary

Organization: Silo AI

Solution: Water and Wastewater

Location: Helsinki, Uusimaa, Finland

Project Objectives:

- To combine a digital twin with AI, creating a prediction model for proactive network maintenance.
- To ensure efficient, reliable, and sustainable network water and district heating services throughout Finland.

Project Playbook: iTwin

Fast Facts

- Silo AI developed a smart, data-driven asset optimization solution for city pipeline operators.
- Known as Silo Flow, the service predicts pipeline leakages and identifies the potential cooling upside of district heating systems.
- Leveraging iTwin facilitated data integration and provides a holistic visualization of the pipeline network.

ROI

- Bentley's flexible and user-friendly application cut visualization efforts by 50%.
- Silo AI decreased their customer's district heating network supply temperature by 3 degrees, improving energy efficiency and fuel consumption.

Callout Quote: "Silo AI developed the whole system, including several other data sources, AI models, and a visual analytics user interface utilizing the iTwin Platform." – Harri Kaukovalta, Business Development Executive, Silo AI.

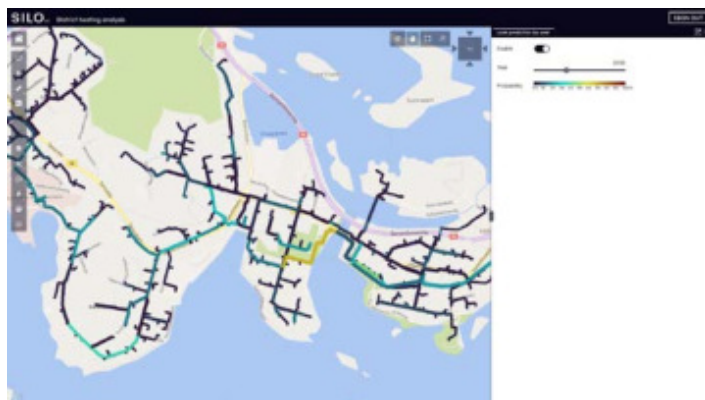


Image caption/courtesy 1: Silo AI developed a smart, data-driven asset optimization solution for city pipeline operators. Image courtesy of Silo AI.



Image caption/courtesy 2: Bentley's iTwin Platform enabled Silo AI to deliver their system optimization service in record time. Image courtesy of Silo AI.



About the Author



Sandra DiMatteo is the Industry Marketing Director, Water Infrastructure at Bentley Systems. She has more than 25 years of experience in reliability and asset performance management software, asset lifecycle information management, and is an expert in digital twin cloud solutions in the water and wastewater, energy and process industries. Sandra holds an honors degree in accounting and is a Certified Reliability Leader. She sits on the Reliability Leadership Institute Board of Advisors and founded the Ontario Chapter of the Society of Maintenance and Reliability Professionals.

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CYANIDE, THIOCYANATE AND PHENOL REMOVAL FROM WASTEWATER IN STEEL PLANT BY BACTASERVE BACTERIAL CULTURE

By Ashutosh Vadanagekar, Managing Director, Amalgam Biotech and Suraj Kale, Service Engineer, Amalgam Biotech

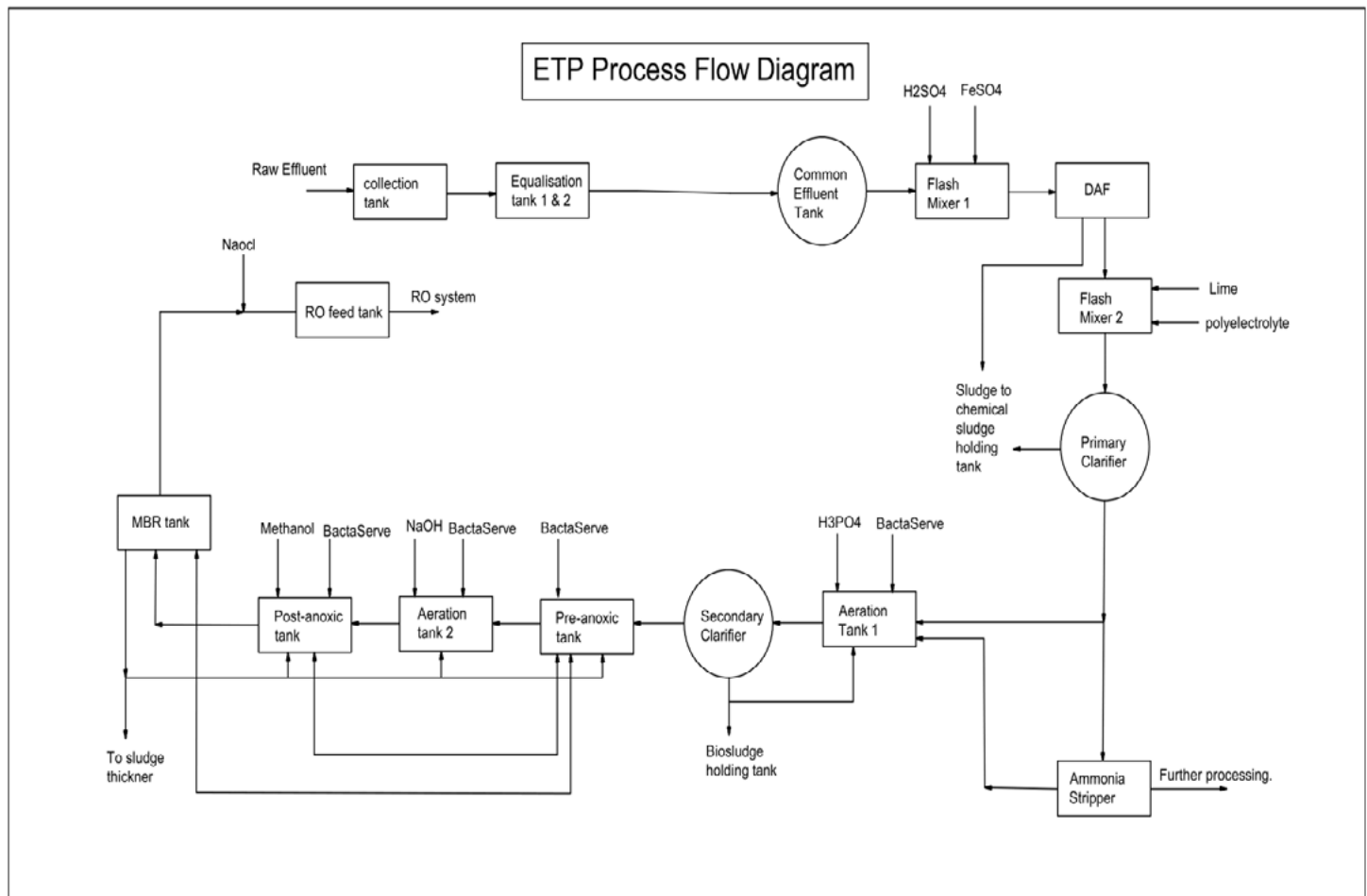
1. Background: -

In the steel industry, toxic materials like Cyanide, Thiocyanate and Phenol are produced in industrial processes during the production of coke. This steel plant is located in the eastern part of India. It is one of the largest manufacturers of Plate Mill plates, HR plates and coils, ERW pipes, SW pipes, CR sheets and coils, Galvanised sheets (GP & GC), and silicon steel sheets.

1.1 Plant Specifications: -

The capacity of this ETP is 3600 m³/day, having two aeration tanks in series along with pre-anoxic and post-anoxic tanks followed by a membrane bioreactor. ETP-treated effluent is then fed to R.O. for effluent recycling.

1.1.1 Process Flow Diagram: -



2. Challenges: -

The coke manufacturing process generates cyanide and thiocyanate which comes in the effluent. Cyanide at 6.5 ppm is a toxic molecule that requires adequate safety measures for 100% degradation. Thiocyanate at 350 ppm is relatively more stable than cyanide, requiring a higher degree of biodegradation efficiency. Phenol at 250 ppm also is a big challenge. NH₃-N at 300 ppm further increases to 400 ppm after bacterial action on the thiocyanate molecule. Stage-2 NH₃-N and subsequent denitrification requires 2 stages of bacterial anoxic denitrification.

Sr No	Types of bacterial culture required	Where to add	Targeted pollutants	Strains added
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Table 1: Inlet parameters- Routine.

Sr No.	Parameter	Values (mg/Lit.)
1	pH	9 – 9.5
2	Colour (Hazen)	< 20
3	Temperature (oC)	35 – 38
4	Total suspended solids (TSS)	20 – 30
5	Total dissolved solids (TDS)	4200 – 4500
6	Conductivity (uS/cm)	6700
7	Oil & Grease	< 5
8	Iron	3 – 5
9	Total chromium	< 0.05
10	Silica	13.6 – 14.14
11	Fluorides	< 8

Table 2: Inlet parameters- Critical.

Sr No.	Parameter	Values (mg/Lit.)
1	Chemical oxygen demand (COD)	1300 – 1800
2	Biological oxygen demand (BOD)	500 – 800
3	Ammoniacal nitrogen (NH ₃ -N)	250 – 300
4	Nitrate (NO ₃)	25 – 30
5	Total Kjeldahl nitrogen (TKN) (As provided)	150 – 200
6	Cyanide (CN)	2.5 – 6.5
7	Thiocyanate (SCN)	300 – 350
8	Phenol (C ₆ H ₅ OH)	150 – 250

3. Special Technical Solution: -

As a solution, we dosed BactaServe Aerobic along with special strains of paracoccus and pseudomonas species for the removal of cyanide and thiocyanate. Pseudomonas species worked exceptionally well for phenol reduction from 250 ppm to 2.5 ppm.

Table 3: Bacterial cultures required over 45 days period

1	BactaServe- Aerobic	Aeration tank 1	Thiocyanate	Paracoccus species & other mixed culture consortia.
			Phenols	Pseudomonas species.
2	BactaServe- Aerobic	Aeration tank 2	COD, BOD	Bacillus species like megatherium, amyloliqueficans& others.
			NH ₃ -N, Nitrification, Nitrate N ₂	Nitrobacter & Nitrosomonas species.
3	BactaServe- Nutrient Removal	Anoxic Tank	Denitrification	Thiobacillus Species.

For the degradation to occur, we have provided them with a Bioculture dosing protocol as below:

Table 4: Dosing protocol.

Dosage BactaServe – Aerobic & nutrient removal.					
Sr no.	Days	BactaServe- Aerobic.	A.T -1 (kg/Day)	A.T -2 (kg/Day)	Anoxic Tank (kg/Day)
1	Day 1 - Day 5		10	5	7
2	Day 6 - Day 10	BactaServe- Nutrient Removal	8	3	6
3	Day 11 - Day 20		5	2.5	5
4	Day 21 - Day 30		4	1.5	3.5
5	Day 31 - Day 45		2	1	2

BactaServe nutrient removal containing nitrifiers ensures the conversion of 400 ppm NH₃- N to nitrates. The De-nitrifiers in an anoxic tank convert the NO₃-N to N₂ gas.

CASE STUDY ➤

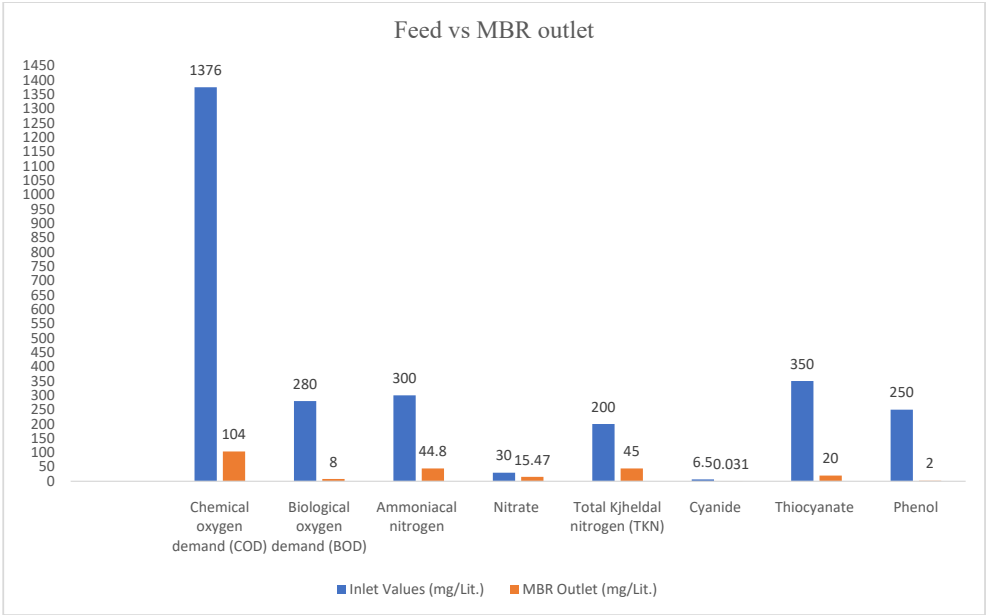
3.1 Photographic presentation of site performance: -



Table 5: Results.

Sr No.	Parameter	Inlet Values (mg/Lit.)	MBR Outlet
(mg/Lit.)			
1	Chemical oxygen demand (COD)	1376	104
2	Biological oxygen demand (BOD)	280	8
3	Ammoniacal nitrogen (NH3-N)	300	44.8
4	Nitrate (NO3)	30	15.47
5	Total Kjeldahl nitrogen (TKN)	200	60
6	Cyanide (CN)	6.5	0.031
7	Thiocyanate (SCN)	350	20
8	Phenol (C6H5OH)	250	2

3.2 Graphical Presentation of Parameters: -



% REDUCTION WITH INLET AND OUTLET PARAMETERS

■ Inlet Values (mg/Lit.) ■ MBR Outlet (mg/Lit.) ■ Percentage Degradation

8	PHENOL	250	2	99.2
7	THIOCYANATE	350	20	94.3
6	CYANIDE	6.8.031		99.5
5	TOTAL KJHELDAL NITROGEN (TKN)	200	45	77.5
4	NITRATE	30	15.47	48.4
3	AMMONIACAL NITROGEN	300	44.8	85.1
2	BIOLOGICAL OXYGEN DEMAND (BOD)	280	8	97.1
1	CHEMICAL OXYGEN DEMAND (COD)	1376	104	92.4

4. Executive Summary: -

This assignment presented us with challenges like high inlet COD, Cyanide, Thiocyanate, Phenols, and NH₃-N. Low inlet BOD further complicated the situation. BactaServe Bioculture could solve the issue since it was incorporated with specific

bacterial strains which were pre-acclimatized for cyanide, Thiocyanate, Phenol, and NH₃-N degradation.

A tailor-made Bioculture of Amalgam Biotech could only solve this with the help of our indigenous strain bank.



About the Author



Ashutosh Vadanagekar is the Managing Director of Amalgam Biotech. Ashutosh's expertise is his knowledge of Production process industries because of his past experience of commissioning close to 55 different ETPs & ZLD plants in India & overseas. He has an overall experience of 24 years, of which 12 years have been spent at Wastewater sites in commissioning & troubleshooting the plants. Ashutosh undertakes wastewater training & consulting assignments at an individual level. His work profile in Amalgam Biotech is focused on New product development & site troubleshooting.



Suraj Kale is a service engineer at Amalgam Biotech, Pune. He has field 1 year of experience in ETP/STP commissioning and troubleshooting and 2 years of experience in ETP operation and maintenance. He has completed B.Tech in chemical engineering from MITAOE, Pune.

About the Amalgam Biotech :

Amalgam Biotech is a Bio-technology based company.

For Wastewater Treatment (BactaServe):

We provide customized sustainable solutions for different categories of wastewater treatment and solid wastes; in the form of Specialized Bacterial cultures for Industries like Pharma, Textile, Chemical, Dairy, Tannery, Slaughterhouses, Food Processing, Oil Refineries and others. We are also associated with the Government of India Research Institutes for Specialized technologies for treating specific wastes.

For Odour Control (OdoServe):

We have an Odour control system for Neutralizing the Odour from both Industrial and Domestic-Municipal segments. We are associated in giving solutions in the form of product additives for the removal of odour from finished product lines like recycled plastic, rubber, craft paper, pyrolysis oil, others

For Process Additives (NutriServe):

We are providing the products mainly essential micronutrients that nourishes the essential bacteria's for aerobic and anaerobic process associated with WWTP. The other products mainly required in enhancing the conditions of Aerobic and Anaerobic Process is also being manufactured and supplied like BOD enhancer, Supply of Nitrogen-Phosphate from Organic sources, others.

Amalgam Biotech

- * Helps in Providing optimised and sustainable solutions for different category waste
- * A Biotechnology company is one-stop solution for your generated waste type.
- * Has expertise in ETP-CETP-WWIP-STP process.
- * Hands-on experience in Primary, Secondary and Tertiary treatment processes.
- * Has Engineering solutions for Odour Control Systems.

JACOBS ENGINEERING REMOTELY DESIGNS AN EXPANSION TO AN ADVANCED WASTEWATER TREATMENT PLANT WITH A REALITY MODEL

By Sandra DiMatteo, Industry Marketing Director, Water Infrastructure, Bentley Systems



Bentley Applications Accurately Visualize Existing Conditions, Improve Decision-making, and Reduce Modeling Time

Further Improving Advanced Wastewater Treatment Methods

Gwinnett County, northeast of Atlanta, has a population of 950,000. The Gwinnett County Department of Water Resources (GCDWR) provides wastewater treatment services to these residents via the F. Wayne Hill Water Resources Center. Originally constructed in 2000, it utilizes advanced ozone, granular activated carbon, and membrane treatment processes to return high-quality effluent to the Chattahoochee River and Lake Lanier while going beyond regular water quality requirements. Since it began operations, the facility has received a number of awards from water associations, including the Platinum 18 Peak Performance Award from the National Association of Clean Water, and has never received a water quality violation.

Despite the relatively young age of the treatment plant, Gwinnett County has experienced the second-fastest population growth in Georgia at 19.18% from 2010 to 2022. Even with a maximum flow of 60 million gallons per day, the plant frequently experienced flow issues that would need to be addressed to keep the effluent flow constant for the increasing number of residents. In addition to fixing existing flow issues, GCDWR wanted to improve the capacity of the membrane treatment process. The organization tasked Jacobs Engineering with designing a renovation to the plant that would address both needs. “This project will allow for the continued delivery of superior wastewater effluent to one of the most important lakes in the state of Georgia,” said Nathan Meade, design manager at Jacobs.

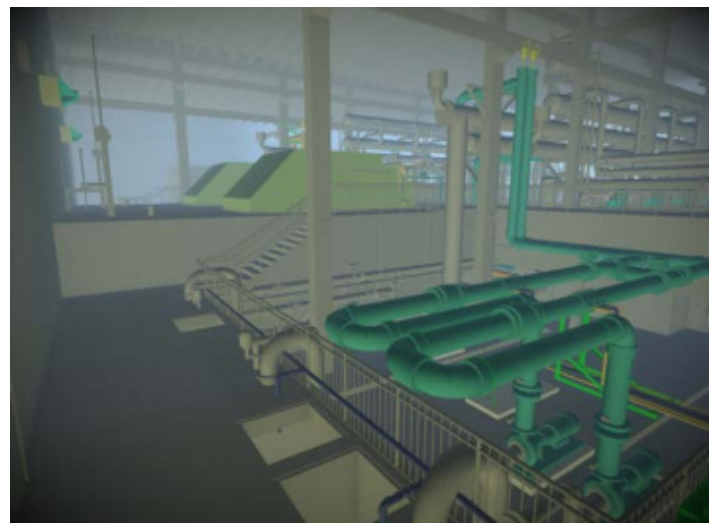
Squeezing New Equipment into Tight Spaces

The scope of the project includes various improvements at the Membrane Building and East Chemical Building. For the Membrane Building, Jacobs is designing and building additional membrane cassettes, permeate, and back pulse pumps and piping, high-capacity drum screens, HVAC equipment, and electrical and variable frequency drive equipment. The East Chemical Building improvements include chemical tanks, chemical pumps and piping, and an architectural canopy over a fill station. Both buildings would also receive various architectural and structural improvements.

The project posed numerous challenges to Jacobs. Since the new design and equipment would be incorporated into an older building, the design team needed to carefully build the new elements alongside existing features that could not be moved. “Since this was a retrofit project, it was essential for the design team to have a thorough understanding of existing space and equipment placement, particularly in the Membrane Building where space is limited,” Meade said. They had to tie into the building’s original piping, avoid or incorporate existing structural elements, and create complex spatial arrangements that would push the design accuracy to the limits. The team could not easily import older, limited 3D models created for the plant, and they could not visit the site due to the COVID-19 pandemic, preventing them from collecting specific information on building conditions. Jacobs needed an alternative method for the team to view and interact with as-built conditions of the site.

Visualizing the Impact of Design Work in a 3D Model

The design team determined that they could overcome the project’s challenges by using Bentley applications to create a federated digital model that included accurate data for both the existing conditions and the new equipment. First, they undertook a laser scan of the project areas and imported the point cloud data into ContextCapture, creating a reality model of the current site. Next, they used ProjectWise to establish a connected data environment for both the reality model and models of the new components. By providing current conditions and all project data to the design team and stakeholders, they could undertake modeling and design review in a central location without having to visit the job sites.



Within the reality mesh, the team visualized the combination of the legacy plant data, as-built conditions, and proposed improvements. Because the applications were open and interoperable, they were also able to incorporate older 3D models

that had been created with AutoPLANT and update them with the current operational conditions of the facility. In the process, they updated the models to correct errors and build out architectural elements that were missing, ensuring they worked with a complete, accurate digital replica of the work site. Using OpenBuildings, OpenPlant, OpenRoads Designer, and other Bentley applications, they modeled new elements for the renovation. Since the federated model helped them immediately see how each aspect of the design would impact the piping, equipment, and structure of the existing facility, they could make adjustments to correct clashes.

Working Remotely to Improve Collaboration

By establishing both a connected data environment and a federated model, all project stakeholders were able to greatly improve communication and collaboration. The design team and stakeholders reviewed the model's development during weekly calls, facilitating discussion of any project concerns and improving decision-making. "These team calls and screensharing

proved invaluable to the success of the project, and utilization of the new reality mesh produced real value-adding design decisions," Meade said. In total, working in the federated model facilitated at least 20 major design decisions that would have required an additional 300 hours of modeling to resolve using older design methods.



Location

Buford, Georgia, United States

Project Objectives

- To improve the flow of reclaimed water at an advanced wastewater treatment plant.
- To incorporate new elements around existing assets within a tight space.

Products Used: AutoPLANT, ContextCapture, MicroStation, OpenBuildings, OpenPlant, OpenRoads Designer, Pointools, ProjectWise 365

Fast Facts

- The F. Wayne Hill Water Resources Center utilizes advanced ozone, granular activated carbon, and membrane treatment processes to go beyond regular water quality requirements associated with returning high quality effluent to Lake Lanier.
- Jacobs Engineering was tasked with designing a renovation to the plant that would improve flow and accommodate a growing population.
- The new elements had to tie into the building's original piping, avoid or incorporate existing structural elements, and fit within a tight work footprint.

ROI

- Using Bentley applications to create both a connected data environment and a federated model greatly improved communication and collaboration among all stakeholders.
- The reality mesh provided a detailed representation of every area and angle of the project, eliminating the need to travel to the worksite.
- Working in the federated model facilitated at least 20 major design decisions that would have required an additional 300 hours of modeling to resolve using older design methods.

Callout Quote: "The collaboration between the design team and Bentley to drive the use of a high-quality reality mesh resulted in many design decision improvements through the life of the project. Continuous positive feedback from the client further validated the ambitious decision to capture the original laser scan of the highly complex facility." — Nathan Meade, Design Manager, Jacobs Engineering

Project Summary

Organization

Jacobs Engineering

Solution

Water and Wastewater Treatment Plants



About the Author



Sandra DiMatteo is the Industry Marketing Director, Water Infrastructure at Bentley Systems. She has more than 25 years of experience in reliability and asset performance management software, asset lifecycle information management, and is an expert in digital twin cloud solutions in the water and wastewater, energy and process industries. Sandra holds an honors degree in accounting and is a Certified Reliability Leader. She sits on the Reliability Leadership Institute Board of Advisors and founded the Ontario Chapter of the Society of Maintenance and Reliability Professionals.

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EVOQUA'S CEDI TECHNOLOGY HELPS THE LEADING MANUFACTURER AND SUPPLIER OF AUTOMOTIVE ENGINE OIL ACHIEVE THEIR SUSTAINABILITY GOAL WITH INCREASED ROI

By Evoqua India

Overview:

Replacing the conventional DI water system with Evoqua's CEDI technology helps conserve water and reduces operation downtime.

Customer: Lakhi Ram Lube Control – Manufacturer of Automotive engine oil, Patalganga, Maharashtra, India

Challenge: With conventional DI (Deionization) system the major challenges were inconsistent water quality and constant system break-in time for resins regeneration process, and thus increasing the plant downtime period and operational cost.

The Key to Success: Good Customer relationship, huge installed base, and presence of local sales/technical support from Evoqua.

Our Solution: Ionpure® CEDI model

Applications: Manufacturer of Automotive Engine Oil

Markets: Automotive Industry



Our installation at the site



Main Page Contents:

Since 1992, Lakhi Ram Lube Control Pvt. Ltd. has been a leading manufacturer and supplier of diesel exhaust fluid, intermediate bulk containers, engine oils, gear oils, etc. The company is well known in the automotive industry for its top-notch quality, services, on-time delivery, and contributions to water conservation and waste management initiatives.

Challenge:

Lakhi Ram Lube Control Pvt. Ltd. operates their manufacturing plant 24/7. It treats the municipal water supply by using conventional DI water systems to generate product water of the required capacity within a 20 hr cycle.

The plant needed to fulfill the increasing demand for constant high-purity water throughout the operation and reduce downtime. In conventional DI system treatment, ion exchange resin regeneration is necessary for recovering exhausted resins. This requires periodic break-in time, which affects plant operations. With their current low-capacity DI water systems, the facility could not meet the increased demand. Also, the wastewater from the regeneration process was high in pH and alkaline value and needed to be neutralized in a separate effluent treatment plant (ETP) with chemicals like NaOH and HCl before it was discharged. The untreated wastewater discharged resulted in irreversible repercussions to the environment and local community. Hence, the customer sought an alternative technology that would provide consistent water quality, reduce break-in time, and require less chemical consumption.

Solutions:

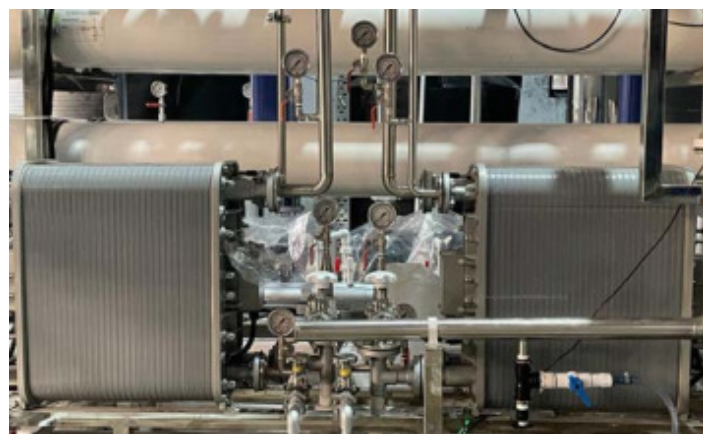
Lakhi Ram Lube Control Pvt. Ltd. reached out to Evoqua Water Technologies to supply a solution due to our technology reputation and large install base in India. After assessing the client's current situation, our team recommended the chemical sanitizable Ionpure® CEDI LXM30Z modules to replace the conventional DI technology they were currently using. This solution would help solve their current issues and fit within their budget, meeting ROI requirements.

Our CEDI technology provides a one-step process for producing high-quality deionized water with a self-regenerating system that reduces the need for chemicals. The system generates 160 KL of deionized water per day, providing consistent quality throughout the operation. In addition, the system has a smaller footprint, user-friendly operating system, and requires no extra manpower. Below is the comparison sheet of DI and CEDI technology on space saving.

m ³ /h	MBDI System m ²	CEDI System m ²	Floor space Savings
11.4	4.2	1.4	67%
68.1	15.8	7.0	56%
227.1	31.6	13.9	56%
681.4	267.9	62.7	77%

Result:

Our technology has helped Lakhi Ram Lube Control Pvt. Ltd. maintain product quality, enhance its brand image, and reduce operational costs and production downtime with less chemical consumption. After one year of commissioning the project, the client has been satisfied with the Ionpure® CEDI system.



About the Companies:

Lakhi Ram Lube Control Pvt. Ltd. is one of the leading manufacturer and supplier of automotive engine oil to major OEM's, Distributors, dealers and stockiest, for automotive engine oil. This engine oil prevents friction in the engine, protect the engine from rusting, keep the pistons cool, and protect engine oil from combustion gases. Established in the year 1992, Lakhi Ram has been a known name in its field for its top-notch product quality, services and on time delivery. The main product they manufacture are Diesel exhaust fluid, Intermediate bulk container, engine oils, gear oil, etc. This industry strives to produce environmentally friendly products for automotive industry with 24 hrs. operational plant to serve the customer without delay. The firm has been major contributors to many sustainability initiatives and water conservation and waste management.

*Evoqua Water technologies is a leading provider of water and wastewater treatment solutions, offering a broad portfolio of products, services and expertise to support industrial, municipal, and recreational Customers and helps customers protect and improve the most fundamental natural resource: Water, Evoqua has more than 100 year heritage of innovation and industry firsts, market leading expertise and unmatched customer service where continue to transform water and wastewater. We help more than 38,000 customers and 200,000 installations worldwide and operate in more than 160 locations across 10 countries. Please contact for any enquiries :
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IMPORTANCE OF GOOD WATER QUALITY FOR FOOD AND BEVERAGE INDUSTRY

By MandarrKkamthe, Industry Expert–Water



Introduction

Food production frequently requires the use of water that is why there is a direct link between water quality and food safety. Water is a valuable resource in the food sector. Water is employed in many different stages of food manufacturing and preparation, not just as an ingredient. Food preparation and processing, in essence, necessitates the use of water. People often take water for granted since it is such an evident truth. Furthermore, a large number of individuals poorly understands the impact of water quality on food items and other processes in the food industry. This lack of understanding is one aspect that contributes to water mismanagement, equipment malfunctions, maintenance concerns, revenue loss, product quality degradation, and, most critically, food safety.

Water can be contaminated in a variety of ways and at any point along the supply chain, from the water reservoir to the end user. Food can be contaminated with physical, chemical, or biological factors during production, rendering it unhealthy. Water that has been contaminated with a variety of pathogenic bacteria can pose a threat to human and animal health. This is a significant challenge in terms of food safety. This is why water quality is very crucial in food and beverage industry.

Pathogens and pollutants that would otherwise be hazardous to human health or unsightly are removed during water treatment. Depending on the source water, several treatment methods are used. However, to bind dirt and form heavy particles that fall to the bottom of a water storage tank, an absorbent ingredient is usually added to the water. After that, the water is filtered again to remove even smaller particles. Finally, a little amount of disinfectant (e.g. chlorine) may be added to destroy any remaining germs at a level safe for human consumption.

Impacts of Water Used in or Touched by the End Product Health of the Consumer

Consumers, of course, want their food and beverages to be free of contamination. As a result, all water that is exposed to any aspect of the food manufacturing process (ingredients, packaging, bottles, pipes, and food processing equipment) must pass strict purity tests. According to WHO guidelines, any water used in the preparation, washing, or processing of food must be disinfected to high drinking-water standards using a method like industrial-grade reverse osmosis.

A plant producing food or drink must have rigorous sanitation

requirements across the board, regardless of what touches the ultimate consumer product. Even if those goods are washed outside of the food production area, this includes water used for washing packaging equipment, storage, and transportation vehicles.

Efficient Utility Means Clean Water

Impurities of any kind can cause inefficiencies in the food and beverage sector, even if they do not contact the final product. Water used in boilers and cooling towers, for example, must also fulfil high purity criteria, with a low concentration of concentrated solids passing through these systems. Impure water can accelerate wear and tear, corrosion, and scale build up, reducing efficiency, causing costly downtime, and increasing repair and maintenance costs. Because the water utilized in these systems is clean, a high-quality industrial reverse osmosis water purification system can increase efficiency, decrease downtime, and lower repair and maintenance costs.

Food and beverage manufacturers have more control by reusing water

With today's uncertain water supply, it's critical for food and beverage facilities to have an industrial water purification system that can convert feed and waste into purified water that can be reused safely for a range of purposes. Closed Circuit Reverse Osmosis (CCRO), a smart, autonomous, and advanced industrial reverse osmosis system, enables food and beverage firms to reclaim water and minimize water waste much beyond the ability of prior industrial reverse osmosis systems. This allows businesses to have significantly more control over their water supply, water costs, and total operational costs.

CONCLUSION

Water is essential for food safety operations; hence, the food business must have access to it. Water quality and its impact on food safety are unfortunately little known. Water mismanagement, equipment operation and maintenance concerns, loss of income, food product quality, and safety are all consequences of this deficiency or lack of awareness about the importance of water quality in food production.

As a result, it is critical to educate those involved in food production and safety about the significance of water quality. Apart from that, consumers should be educated about how water quality issues at various stages of food production can jeopardize the product's safety.



About the Author



MandarrKkamthe is an Industry Expert-Water. He has been working in the water sector for 12 very fruitful years. He was previously associated with organizations like JUSCO, SuezEnvironnement, Vishvaraj Environment Pvt. Ltd., Siemens, GE, etc. During this time, he achieved much in terms of expanding program offerings and enhancing the quality of existing Systems. He is an expert in developing and implementing a strategy for program teams, as well as developing robust mitigation plans. He has demonstrated ability to liaise with different engineering teams to increase system awareness. He has In-depth knowledge of developing new programs to support the strategic direction of the organization.

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FOOD & BEVERAGE AND BOTTLED WATER INDUSTRY IN INDIA- BEING BOTTLED UP??

Dr S Sundaramoorthy and Dr S Saktheeswaran

Abstract

Logically and legally, the public water supply system should be the benevolent provider of protected water to all the requirements in a habitation. That encompasses the drinking needs of the population and mandates the needs of the food & beverage industry as also other process industries as well. Only then, the standards of the water quality can be held in control of the habitation as a whole. However, in most cases, the food & beverage as also the bottled water industries are forced to fend for themselves. All such industries have to obtain certification from BIS as well as FSSAI under BIS 13428 and BIS 14543. Unlicensed manufacturing units are also reported to thrive across the country but the fact remains that all these industries also do serve the society in their own way. This article evaluates the scenario and attempts a sustainable framework for future from justifiable practices.

The Industry Scenario

With public water utilities struggling to supply even the statutory demand of 135 liters per person per day and that too sometimes enforcing water supply once in two days or even three days, the industries face the predicament to either purchase their water from suppliers by water tankers or extract the groundwater within their premises. The water tanker operators deal with the committed delivery of quantity and in turn they extract from random open wells or bore wells and run their business. This challenges the industry in its very existence as the local authority while welcoming the industry initially for its employment and tax revenue potential, later on starts the familiar trouble of reducing the licensed volume of extraction and virtually strangling the industry which cannot re-locate elsewhere fearing the same story there as well. The plight of one such soft drinks industry and its eventual relief from the High Court of Kerala directing the local panchayat to renew the originally allocated water extraction license was legally in order, but not socially pragmatic because the local produce of more than 50 sacks of rice and 1,500 coconuts a year was contested as yielding barely five sacks of rice and about 200 coconuts after the industry came in. (1) At around that time, the tale of the director of the Centre for Science and Environment announcing that 12 large cold-drink brands manufactured and sold in and around Delhi, contained a cocktail of pesticide residues, including chemicals which can cause cancer, damage the nervous and reproductive systems and reduce bone mineral density,

shocked the country even though the industry denied the allegations and to defuse matters and all that happened was an employment to a former chief justice of India who was instituted to guide and prevail on the issue (1) There is also the case of the Rajasthan where the soft drinks industry ended up in a contentious issue of extraction of ground water (2). These instances do not auger well for the local authority which becomes helpless in many other related issues as well. The biggest challenge faced by the industry especially the bottled water industry is the duplicacy especially in case of one liter bottle where it is stated that it is very easy to create fake bottled water compared to any other product. Indian consumers tend to believe that any bottled water is safe but this may not be true in case of fake product with such type of fake products produced by filling water in the used pet water bottles and sold only in few places where public travels most like railway stations, bus stations and metro stations and the bottle used to fill such type of products stated as collected in the dustbins, roadsides and dumpyards(3). The other major challenges are stated as from the unorganized sector which is leading in the production of bottled water in rural, semi-urban and few urban areas. As the production does not require big machinery it can make counterfeiters to produce bottled water in different regions with single license and without on-spot licenses and quality and safety as the biggest challenges in this unorganized sector. It is also stated that food safety departments lifted 1,123 samples across the country in 2017-18. Of these, 496 samples failed to meet the quality standards prescribed by the country's apex food regulator FSSAI (3). It is further stated as water bottling companies are booming in the market although they face several obstacles from the unorganised sector and availability of one-time investment water purifiers. A huge profit in the market is due to demand raised by the increase in the population and taste of the water. Although several raids are made by BIS and FSSAI but the unorganised sector is rising because of low investment in the production and indiscriminate disposal of used water bottles. So, it is the responsibility of the government and every citizen to eradicate unorganised sector and producers not following the required to ensure safe bottled drinking water.(2) The Puducherry setting is unique in that drinking water supply is privatized with private vendors extracting brine water from local bore wells and erecting on-the-spot RO membrane plants and vending as bulk sales in the standard 20 liter cans to be brought by the public and the filled can taken away by the public at Rupees seven per filling a can (4). The rejects are of course let into the public drainage system. The Kerala administration is also operating one such bottled water plant (5). These are shown in Fig.1



Fig.1. (Left & Middle) Chief Minister Puducherry at the private purified drinking water station. (Right) Kerala Water Authority's bottling water plant at Aruvikkara.

There is also news of a Special Officer of the Puducherry Department of Revenue and Disaster Management, writing to the Station House Officer, alleging that a poisonous colourless liquid was served during an official meeting in the chamber of the District Collector and taking cognizance of the incident, the Puducherry Lieutenant Governor Kiran Bedi is reported as having said that "Puducherry Collector Purva Garg IAS, gets served 'toxic' colourless liquid by her personal staff in her office, as bottled drinking water. FIR registered. DGP has ordered for a special investigation into this reported crime".(6)

What the situation foretells for the food & beverage industry in India?

Given the above, this industry may possibly be heading towards migrating out, yes, in the near future to nearby water rich, less mandated statutes countries such as Myanmar, Vietnam, Bangladesh and Sri Lanka. After all, these countries are not losers in this bargain and in fact the same products will come back to us at possibly double the cost unless of course the Chinese also step in. This may sound rather funny, but then it is a distinct possibility. After all, with the market being so vast and production nitty-gritty's of pollution control not there, the food ingredients and raw materials are equally available to an extent in those countries why should not this industry migrate out? Another crucial factor is the local unworkable mandate of zero liquid discharge (ZLD) of the wastewaters. When the ingredients are edible, the end products are also equally edible and why not take the wastewater into the wastewater system of the habitation? Sounds perfectly logical. The secret is India has a coverage of only about forty percent when it comes to sewerage in urban and nothing in rural. So much so, the compulsion of ZLD on a blanket scale. Added to this the mandate of disposal of residual solid wastes at a private developer's secure landfill handling facility on his terms and costs which are over and above the transportation to such facilities sometimes more than 100 km away. The wonder of wonders is the treatment scheme for this ZLD is required to be made available by the pollution control boards (PCBs) under article 17 (h) of the Water Act which mandates the PCBs to evolve economical and reliable methods of treatment of sewage and trade effluents, having regard to the peculiar conditions of soils, climate and water resources of different regions and more especially the prevailing flow characteristics of water in streams

and wells which render it impossible to attain even the minimum degree of dilution, but which is not complied with by the PCBs in view of the inherent conflict within the Act itself. This is because, the PCB is required to accord consent to establish the treatment plant and more so, subsequently inspect and accord approval to operate. The moot question is, having complied with section 17 (h) in prescribing a treatment scheme and also having approved the treatment and more so approved its operation, suppose the treatment is not functioning to standards of treatment, it is the PCB itself which is at fault. It is this inherent conflict not conceded and not rectified since the inception of the act in 1974 that is making things uncomfortable for both the industry and the PCB. It may not be a surprise if the food & beverage industry bids adios to India in the near future and returns in full might to sell the products. This will push up the costs beyond the reach of the common man who will be the real loser.

What the situation foretells for the bottled water industry in India?

This industry has a different tale of woe, apparently more simpler but in actual a far more challenging issues. It arises mainly from the raw material of ground water having higher dissolved solids and needed to be invariably removed by the reverse osmosis (R O) membranes. The percentage of recovery has to be maximized and to that extent, the dissolved solids in the reject stream becomes highest. For example, if we take an ordinary brackish water with the dissolved solids (TDS) of say, 4000 mg/l and get a 80 % recovery of drinkable water with about 100 mg/l TDS, the reject stream will have a TDS of about 19,600 mg/l or half the TDS of seawater (which is just about 40,000 mg/l). The "million dollar question" is how does the bottled water industry deal with this? The PCB will go by the scripture and proscribe "thou shall not discharge onto land or water". Understandable no doubt, but then what to do? The typical answer by the PCB is to install thermal evaporators. In these equipments, steam and the concentrated RO rejects are engineered to evaporate as vapour and further thicken the R O rejects into slurry. This slurry has to be further fed to a crystallizer where it is engineered to a paste and is to be put through either air drying or hot air facilitated drying. Ultimately, the dried salt has to be transported; sometimes even beyond 100 km to designated secure landfills operated by private developers who will charge a fee based on volume of dry solids and percent moisture. Some photographs of these equipments are shown in Figs. 2 to 4.

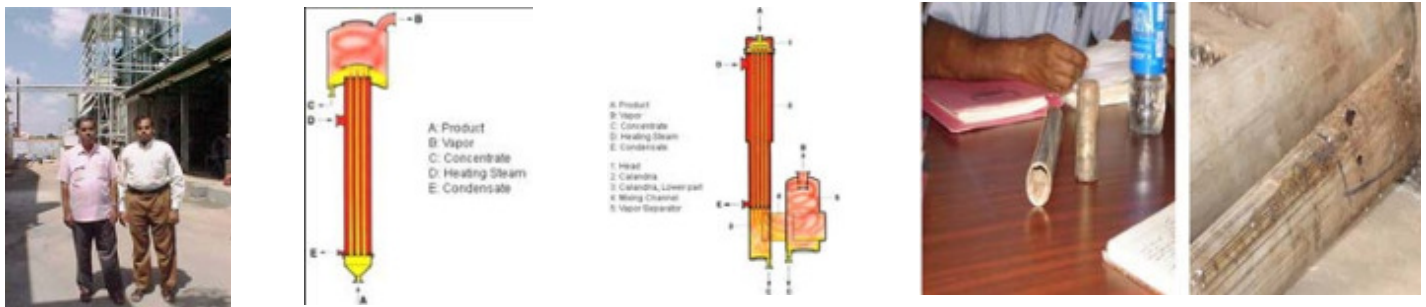


Fig. 2. Principle of falling film and rising film calandrias (courtesy-M/S Gea Process Engg, Incorporated, USA), (Fourth) Authors's experience in the internal scale and spalling of a calandria clad by Titanium



Fig. 3. The Mechanical Vapour Compressor Evaporator. The calendria spalling issues are overcome by synthetic sheets demonstrated by the second author and the typical final centrifuge to get at the salt



Fig.4. Left and second The Israeli WAIV evaporator with simple drop sheets and which can crystallize the salt by controlled evaporation. Third and fourth. Two such installations in India not conceded by the respective PCBs and favored to provide mechanical thermal evaporators

The operational cost of the evaporators in Figs 2 and 3 are high at about Rupees 200 to 250 per kilo liter of feed. Thus considering the 20 % rejects from R O, the cost to the industry is Rupees 50 per kilo liter of product which per liter and cannot be argued by the industry as a financial burden. However, the sustaining of the repairs and renewals of the entire electro-mechanical components which is fearsome. Also, the fact that these equipments are heavily maintenance oriented by respective suppliers, makes these unviable for the bottled water industry. Compared to this, the cost of operating the natural evaporation system of Fig. 4 is almost negligible because there are no steam generators, no calendrias and no centrifuges. In almost all installations, there is a justification to allow these natural evaporators. At some point, the public will start a campaign against these R O rejects on land and / or drains and that is the tipping point for this industry also takes a call on exiting the country. It will be a difficult choice for the PCB also to dispense a reality. The bottled water is here to stay but the PCB emphasizing on thermal evaporators for R O rejects will be an impossible proposition.

Where does it all Add up?

The pursuit of drinking the water “direct from tap” as in the advanced countries is still a dream in India. However, the immunity of the average Indian is admittedly much higher than his counterpart in the said advanced countries and this literally makes the piped water drinkable to the extent of the country providing rural water supply schemes by the “India Mark-II” deep bore well pumps and leave it at that. But then, of late thanks to the media, particularly in the smart phones and television, the apprehension to continue to drink the above said water supplies have given way to the “can water” at homes to “bottled water” at meetings, feasts etc and to a minor extent, the table-top or wall mount water gadgets at high end homes. The food & beverage industry and the bottled water industry are assumed to practice the quality controls internally as part of its in-house quality control, but then, the insistence on ZLD in the food & beverage industry and the thermal evaporators in both these industries for the R O rejects and the reluctance by the industry mainly from complications of equipment vendor dependence may soon build up to a level of

attrition that the food & beverage industry may decide to exit and the bottled water industry may metamorphize to another business. Either way, it is the citizen who will suffer very, very hard. It is up to the PCBs and decision makers to take a call. In the case of Puducherry town, the dependence of the entire population on the can water for drinking and cooking may be in order, but the other side of the coin is the piped water has been observed by the audit itself as not meeting the standards mainly due to the higher TDS ranging anywhere up to even 4000 mg/l as compared to the permissible limit of only 500 mg/l. To that extent, an integrated regional brackish water desalination plants and disposing the R O rejects into the city sewerage system draining to the Bay of Bengal would be in order and can be entrusted to co-operative federation of existing private vendors who cannot also be forced out of business.

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- 6 Staff Serves Toxic Liquid In Mineral Water Bottle To Puducherry Collector, FIR Registered, January 08, 2021 7:07 pm IST <https://www.ndtv.com/india-news/puducherry-collector-served-toxic-liquid-in-mineral-water-bottle-by-personal-staff-fir-registered-2349752>



About the Author

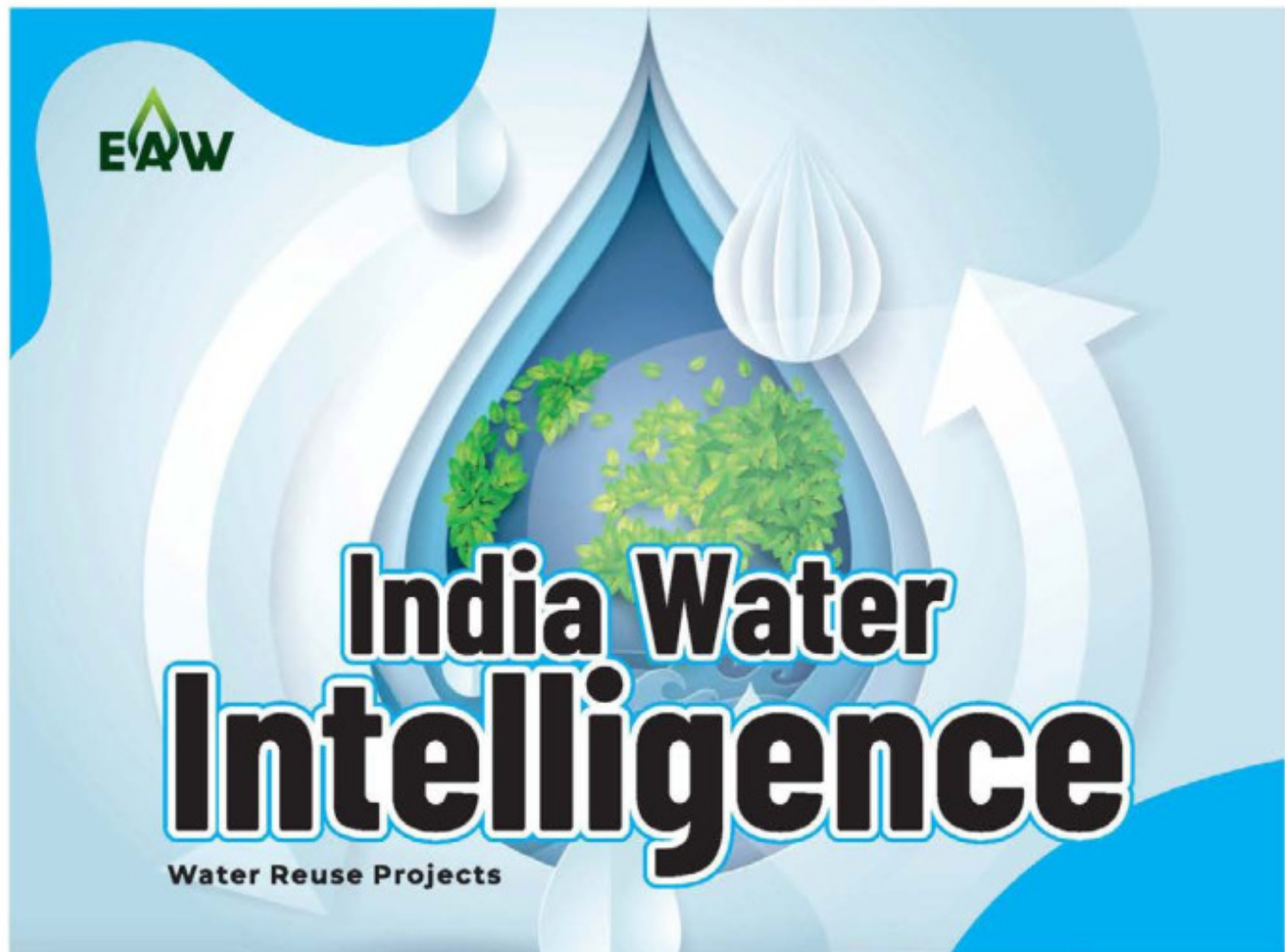


Dr S Sundaramoorthy and Dr S Saktheeswaran are freelance consultants of over thirty years standing in pollution control project management assignments in India and abroad and are not obligated to any equipment vendor or technology provider and are free to express the views in this article.

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HOW TO EVALUATE AND SELECT AN OZONE GENERATOR -PART 2

Continuing from last month

The solubility of Ozone in water is only partial and is governed by Henry's Law (the solubility of the gas in water is directly proportional to its partial pressure in the gas phase). Consideration of Henry's Law led to the obvious conclusion that the higher the Ozone concentration the greater will be the solubility of ozone in water. **The more ozone is dissolved in water the more effective it is as a disinfectant.** It is therefore very clear that Ozone generated through UV radiation, not much of Ozone is available in the water for both Oxidation and disinfection. The following table explains:

Table ref. STOVER et al 1986

Temperature Deg. Cel	GAS PHASE OZONE CONCENTRATION (% w/w)					
	0. UV- 254 nm	0.1% UV 185 nm	1% CD	1.2% CD	2%	3% CD
	EQUILIBRIUM OZONE WATER SOLUBILITY mg/liter					
5 Deg Cel	0.007	0.74	7.39	11.09	14.79	22.18
25 Deg Cel.	0.004	0.35	3.53	5.29	7.05	10.58
30 Deg Cel	0.003	0.27	2.7	4.04	5.39	8.09

SOLUBILITY OF OZONE IN WATER (in mg/liter) AS GENERATED BY UV VS CORONA DISCHARGE

UV lamps used

Most UV Ozone generators available today use 254 nanometers (nm) radiation. 89% of relative spectral energy of UV lamps are at 254 nm, and low of 218 nm. Maximum production of UV ozone occurs at 260–265 nm. Hence by using 254 nm UV bulbs, it is impossible to produce more than **traces of Ozone**.

Chicks law

The disinfection process of ozone is governed by Chicks law. This law follows the CT Factor more commonly known as Contact time factor. Just as antibiotics used have specific doses for different strains of Bacteria, and the minimum inhibitory concentration of that particular antibiotic in the blood will decide on the efficacy of the antibiotic, Ozone also has different CT factors for bacteria / virus etc. Therefore, for effective Ozonation, CT levels are to be maintained if full benefits are to be achieved. Therefore, the concentration/ and time factor is the most important in ozone disinfection, both of which are not achievable with UV ozone.

Air-borne Bacteria/ virus are more easily destroyed by ozone than water borne

organisms. This is the precise reason why for air treatment ozone requirement is so very low.

Mechanism of action

This is the most important difference. The ozone generated by UV ozone is immediately decomposed by UV radiation to form free Hydroxyl radicals. In aqueous solutions these Hydroxyl free radicals (OH•) are very powerful oxidizing agents. But the greatest disadvantage is that the half-life of these Hydroxyl radicals is in the order of MICROSECONDS compared to 22 minutes of Ozone. Consequently, Ozone Generated by UV method cannot be expected to remain in solution for sufficient period of time to provide adequate disinfection, although chemical oxidation can occur. As a result, UV produced Ozone is only remotely effective when it comes to air sterilization.

PLATE TYPE CORONA DISCHARGE METHOD OF OZONE GENERATION

The plate type Technology was first developed in Russia and has now been considered out dated. All over the world this plate type Technology has been superseded by the tube technology due to the following reasons:

The plates are usually connected to the high voltage wires by means of alloy solder. During the course of the Corona discharge formation, the system is at a very high-energy state and resulting also in significantly high temperature. This combination creates weakness in the solder and together with the reaction with the ozone produced at the critical phase, the joints break-up within a short time causing generator failure.

The other factor is that when air is passed through the parallel plates, the small width of the space between the plates would increase the resistance to the airflow that only a portion of the air is available for Ozone production

continued Next month

ISSUED IN PUBLIC INTEREST BY V.BARATHARAJ

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HISTORY OF THE INDIAN WATER INDUSTRY

The modern Indian water industry is advancing by leaps and bounds and has come a long way since its inception. Let us have a look how it all started.

FIRST WATER TREATMENT PLANT

India's first water treatment plant was established in Mumbai in the year 1901. At that time, Mumbai was known as Bombay and was the capital of the Bombay Presidency of British India.

The need for a water treatment plant in Mumbai arose due to the rapid industrialization and urbanization that the city was undergoing. The city was growing at an unprecedented pace, and its population had doubled between 1872 and 1901. This rapid growth put a tremendous strain on the city's water resources, and the quality of the water was severely compromised due to pollution from industrial and human waste.

To address this issue, the Bombay Municipal Corporation decided to build a water treatment plant that would purify the water and make it safe for consumption. The plant was designed by British engineer, C.V. Boys, and was constructed in Bhandup, a suburb of Mumbai.

The Bhandup water treatment plant was a pioneering effort in India, and it utilized the latest technology of its time. The plant consisted of sand filters and chemical treatment tanks that removed impurities and bacteria from the water. The purified water was then distributed to the city through a network of pipelines.

The success of the Bhandup water treatment plant led to the establishment of similar plants in other cities across India. Today, India has one of the largest water treatment capacities in the world, and its water treatment plants play a crucial role in providing safe and clean drinking water to millions of people across the country.

INDIA'S FIRST WASTEWATER TREATMENT PLANT

India's first wastewater treatment plant was built in the city of Chennai (formerly known as Madras) in the southern state of Tamil Nadu in 1986. The plant was established by the Tamil Nadu Pollution Control Board (TNPCB) and was designed to treat 23 million liters of wastewater per day.

The primary goal of the plant was to address the issue of untreated sewage being released into the Adyar River, which runs through the city. The treated water from the plant is now used for irrigation, and the sludge produced is used as a fertilizer.

Since the establishment of the first plant, India has made significant progress in the area of wastewater treatment, with many more treatment plants now in operation across the country. However, there is still much work to be done, as many areas of the country continue to struggle with untreated sewage and water pollution.

INDIA'S FIRST DESALINATION PLANT

India's first desalination plant was set up in Minjur, near Chennai, in the state of Tamil Nadu. The plant was commissioned in 2010 and has a capacity of

producing 100 million liters of water per day. The project was undertaken by the Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) with technical assistance from the Singapore-based firm, Hyflux. The Minjur desalination plant uses reverse osmosis technology to produce potable water from seawater. This plant has played a significant role in addressing the water scarcity issues faced by the city of Chennai. Since then, several other desalination plants have been set up in different parts of India, including Gujarat, Karnataka, and Maharashtra.

INDIA'S FIRST INDUSTRIAL WATER TREATMENT PLANT

India's first industrial water treatment plant was established in the year 1964 at Narora Atomic Power Station in Uttar Pradesh. The plant was designed to treat the wastewater generated from the power generation process and convert it into usable water for various applications within the plant.

Since then, many more industrial water treatment plants have been established in India to cater to the increasing demand for water in various industries. These plants use advanced technologies like reverse osmosis, ultrafiltration, and ion exchange to treat the water and make it suitable for various industrial processes.

The industrial water treatment sector in India is growing rapidly, and there is a growing need for sustainable and efficient water treatment solutions to address the challenges of water scarcity and pollution. The government and private companies are investing heavily in this sector to promote sustainable industrial growth and ensure the availability of clean water for future generations.

INDIA'S FIRST EFFLUENT TREATMENT PLANT

The first effluent treatment plant (ETP) in India was established in the 1960s by the Tamil Nadu Pollution Control Board (TNPCB) in the city of Tirupur, Tamil Nadu. This ETP was set up to treat the effluents from the textile dyeing and printing industry in the region, which were causing severe pollution of the nearby Noyyal River.

The ETP in Tirupur was a pioneering effort in India to tackle industrial pollution, and it served as a model for other states and industries to follow. The plant was designed to treat the effluent from textile dyeing and printing units by using physical, chemical, and biological treatment processes. The treated water was then discharged into the river, meeting the required environmental standards.

Over the years, many other industries in India have set up their own ETPs to treat their effluent before discharging it into the environment. The Central Pollution Control Board (CPCB) and state pollution control boards have also set up guidelines and regulations to ensure that industries comply with the environmental standards and operate their ETPs efficiently.

The Indian water industry started very late as compared to other industries and also in comparison to the developed economies of the world. But we have covered a big distance with incredible timing in this unique marathon.



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TENDERS

Development Of Clarifloculator Bridge At 9mld Water Treatment Plant In Narasaraopet Municipality Including Supply, Delivery, Fabrication, Welding ,Labour And Other Incidental Charges Including Electro Mechanical Items Etc.As Instructed By Departmental Authority

Authority Municipal Corporation

Address: Municipal Office, Narasaraopet, Pincode

City: Narasaraopet

Location: Narasaraopet | Andhra Pradesh | India

Bid Open Date: 16 May 2023

Tender Value: Indian Rupee 209.27 Crores

Doc Collection Date: 16 May 2023
FTID 230503457780

Supply And Engage Of 1 No Tata Ace In For Partolling And Maintenance Of 1000mm Dia Ci Pumping Main And 1400mm Dia M.S Pumping Main From Kbr Pump House To Water Treatment Plant S At Narava For Year 2023-24

Authority Municipal Corporation

Address: Tsr Complex, Pincode

City: Visakhapatnam

Location: Visakhapatnam | Andhra Pradesh | India

Bid Open Date: 15 May 2023

Tender Value: Indian Rupee 20.95 Crores

Doc Collection Date: 15 May 2023
FTID 230503461200

Hansi Town Upgradation Of Sewerage Treatment Plant Of 7.50 Mld Based On Mbbt Technology In Hansi Town Distt Hisar Authority Public Health Engineering Department

Address: O/O Ee Phed Hansi, Near Jind Chungi Hansi, Pin-125033, Pincode 125033

City: Hansi

Location: Hansi | Haryana | India

Bid Open Date: 09 May 2023

Tender Value: Indian Rupee 9.99 Lac

Doc Collection Date: 09 May 2023
FTID 23050345360

Uws Schemes Under Gomati District/1.3 Mgd Surface Water Treatment Plant At Banduar, Udaipur/ Repairing Of Centrifugal Pumps Under Dws Sub-Division No-I, Udaipur During The Year 2023-2024.

Authority Public Works Department

Name: Executive Engineer

Address: O/O The Executive Engineer Dws Division Udaipur

Location: South Tripura | Tripura | India

Bid Open Date: 25 May 2023

Tender Value: Indian Rupee 6.07 Lac
Doc Collection Date: 25 May 2023
FTID 23050327750

Uws Scheme Under Gomati District / Sh- Providing And Fitting Fixing Of Electrical Equipments, Accessories At 1.3 Mgd Surface Water Treatment Plant At Banduar, Udaipur During The Year 2023-2024.

Authority Public Works Department

Name: Executive Engineer

Address: O/O The Executive Engineer Dws Division Udaipur

Location: South Tripura | Tripura | India

Bid Open Date: 25 May 2023

Tender Value: Indian Rupee 14.26 Lac

Doc Collection Date: 25 May 2023
FTID 23050327780

Jaipur-Annual Maintenance And Operation Of 400 Kld Capacity Sewerage Treatment Plant Based On Mbbt Technology At Ganpati Nagar Colony)For 2 Years).

Authority North Western Railway

Address: Pincode 302001

City: Jaipur

Location: Jaipur | Rajasthan | India

Bid Open Date: 23 May 2023

Doc Collection Date:

23 May 2023 FTID
2305034128000

Work Of Overhauling Of Various Vessels At Water Treatment Plant On As And When Required Basis For 12 Months.

Authority Gujarat State Electricity Corporation Limited

Address: Chief Engineer (Gen.)

Kltps, Adm Building, Skv Nagar, Dist. Kutch. Pin Code No. 370601., Pincode 370601

City: Lakhpat

Location: Lakhpat | Gujarat | India

Bid Open Date: 30 May 2023

Tender Value: Indian Rupee 8.61 Lac
Doc Collection Date: 22 May 2023
FTID 230503461530

Procurement Of Electromagnetic Flow Meter For Effluent Treatment Plant Etp Of Ph-Iv, Stps, Sarni.

Authority Madhya Pradesh Power Generating Company Limited

Name: Se Pnw, Sarni

Address: Stps, Mppgcl, Sarni

Location: Betul | Madhya Pradesh | India

Bid Open Date: 08 May 2023

Tender Value: Indian Rupee 4.97 Lac

Doc Collection Date: 08 May 2023
FTID 230503216310

Provn Of Sewage Treatment Plant At Nd Minicoy Under Ge (Navy) Lakshadweep

Authority Military Engineering Services

Address: Commander Works

Engineer Nb Kochi Kataribagh Naval Base Po Kochi 682 004, Pincode 682559

City: Lakshadweep

Location: Lakshadweep | India

Bid Open Date: 31 May 2023

Tender Value: Indian Rupee 1.44 Crore

Doc Collection Date: 29 May 2023
FTID 230503415380

Repair Works To 100 Kld Sewage Treatment Plant Installed At C.G.O Complex, Poonkulam, Trivandrum

Authority Central Public Works Department

Address: 98 B Pocket F :, Pincode

City: Trivandrum

Location: Trivandrum | Kerala | India

Bid Open Date: 08 May 2023



TENDERS

Doc Collection Date:

08 May 2023 FTID
2305034110170

Installation Of Solar Water Treatment
Plant At Kedertala Uttar Primary
School Under Khidirpur Gp. (A.C-
56954621)

Authority Zilla Parishad

Name :Prodhnan, Khidirpur Gp
Address: Khidirpur Gp, Po- Baruipara,
Ps- Hariharpara, Pin- 742165, Dist-
Murshidabad

Location: Murshidabad | West Bengal
| India

Bid Open Date: 17 May 2023

Tender Value: Indian Rupee 9.36 Lac

Doc Collection Date: 17 May 2023
FTID 230503227110

Installation Of Solar Water Treatment
Plant At Kumardaha Ghat Market
Under Khidirpur Gp. (A.C-56955345)

Authority Zilla Parishad

Name: Prodhnan, Khidirpur Gp
Address: Khidirpur Gp, Po- Baruipara,
Ps- Hariharpara, Pin- 742165, Dist-
Murshidabad

Location: Murshidabad | West Bengal
| India

Bid Open Date: 17 May 2023

Tender Value: Indian Rupee 9.36 Lac

Doc Collection Date: 17 May 2023
FTID 230503227130

Installation Of Solar Water Treatment
Plant At Mir Abdul Balika Vidhyalaya
At Nichintapur More Under Khidirpur
Gp. (A.C-56955034)

Authority Zilla Parishad

Name: Prodhnan, Khidirpur Gp
Address: Khidirpur Gp, Po- Baruipara,
Ps- Hariharpara, Pin- 742165, Dist-
Murshidabad

Location: Murshidabad | West Bengal
| India

Bid Open Date: 17 May 2023

Tender Value: Indian Rupee 9.36 Lac

Doc Collection Date: 17 May 2023
FTID 230503227160

Annual Operation Repair Maintenance
Of Electrical Installations At 27 Scg
Nsg Chennai During 2023 24 Sh
Repair Rewinding And Servicing Of
Various Types Of Motors Fans Repair
Maintenance And Amc Of Sewage
Treatment Plant R And M Of Solar
Heater

**Authority Dg, National Security
Guard, Mha**

Name: Sqn Cdr Engg

Address: 27 Rh Nsg Chennai

Location: Chennai | Tamil Nadu | India

Bid Open Date: 15 May 2023

Tender Value: Indian Rupee 10.72 Lac

Doc Collection Date: 15 May 2023
FTID 230503240020

Supply And Laying Of Upvc Pipeline
200 Mm Dia (10 Kg/Cm2 Approved
Quality Brand) At Ward No 26 (Pump
House) Sidhbaba Dongariya To Ward
No 20 Water Treatment Plant .(Raw
Water Rising Main)

Authority Directorate Urban

Administration And Development

Name: Cmo

Address: Nagar Palika Parishad
Dhanpuri

Location: Shahdol | Madhya Pradesh
| India

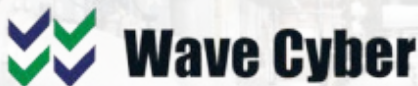
Bid Open Date: 02 Jun 2023

Tender Value: Indian Rupee 25.00
Lac

Doc Collection Date: 02 Jun 2023
FTID 230503259750



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EVENT CALENDAR



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Smart Water Systems

Mon, 17 - Tue, 18 Apr 2023
London, UK
www.smartwater.com/

CIFA Water Infrastructure Summit

April 11-14, 2023
Washington, D.C., USA
www.cifanet.org/summit

Water Expo

14-16 April 2023
DC Ground, Yerwada, Pune, India
tradeshows.tradeindia.com/waterexpo-pune

WQA Convention and Exposition

18 April, 2023 to 20 April, 2023
Las Vegas, United States
www.wqa.org/convention/

Texas Water

Tue, 11 - Fri, 14 Apr 2023
Houston, USA
www.txwater.org

IE Expo China

April 19-21, 2023
Shanghai, China
www.ie-expo.com

SDARWS Rural Water Expo

April 26-27, 2023
Rapid City, SD, USA
<https://www.sdarws.com/expo.html>

Beijing International Irrigation Technology Expo

April 26-28, 2023
CNCC, Beijing, China
expotobi.com/irrigation-technology-expo

MAY 2023

World Utilities Congress

May 08-10, 2023
ADNEC, Abu Dhabi, UAE
www.worldutilitiescongress.com

AZ Water Conference & Exhibition

Tue, 09 - Thu, 11 May 2023
Phoenix, USA
www.azwater.org

Ozwater 2022

10 May, 2023 to 12 May, 2023

Brisbane Convention & Exhibition Centre
Australia
www.ozwater.org/

Watrex Expo

Mon, 15 - Wed, 17 May 2023
Cairo, Egypt
waterexpo.com

Trenchless Asia

17 May, 2023 to 18 May, 2023
Kuala Lumpur Convention Centre, Malaysia
www.trenchlessasia.com/

Water and Plumb Skills Expo

18 May 2023 - 19 May 2023
Pragati Maidan, New Delhi, Delhi
www.plumbskillsexpo.com

Water Expo- Bangaluru

18 May 2023- 20 May 2023
BIEC, Bangalore, India
waterindia.net

Water Management Show

May 11-13, 2023
ICCB, Dhaka, Bangladesh
10times.com/water-management-show

E-World Energy & Water Exhibition

May 23-25, 2023
E-World Energy & Water Exhibition
www.e-world-essen.com

Western Canadian Shale Water Management

24 - 25 May 2023
Calgary, Canada
<https://www.canada.shale-water-management.com/>

Global Smart Water Summit

25 - 26 May 2023
Berlin, Germany
<https://10times.com/global-smart-water-summit-berlin>

IWA Leading Edge Conference on Water and Wastewater Technologies

28 May - 02 Jun 2023
Daegu, South Korea
<https://iwa-let.org/>

China International High-end Healthy

Drinking Water Industry (Beijing) Exhibition

28 - 30 May 2023

Beijing, China
<https://10times.com/china-international-high>

Power of Water Canada Technical Conference & Trade Show

29 - 31 May 2023
Niagara-on-the-Lake, Canada
<https://www.owa.ca/conference/>

Watertech Africa

31 May - 03 Jun 2023
Nairobi, Kenya
<https://10times.com/e1r5-p9r2-k8fz>

Florida Water Resource Conference

31 May - 03 Jun 2023
Kissimmee, USA
<https://www.fwrc.org/>

JUNE 2023

International Conference on Sustainable Water Management

01 - 02 Jun 2023
Mississauga, Canada
<https://10times.com/icbmse-mississauga>

Watertech Africa

01 - 03 Jun 2023
Kenyatta International Convention Centre, Nairobi, Kenya
expogr.com/watertech

Canadian IWA YWP Conference

01 - 03 Jun 2023
Vancouver, Canada
<https://10times.com/e1kf-d00x-3s2x>

International Conference on Sustainable Water Management

03 - 04 Jun 2023
Aarhus, Denmark
<https://10times.com/icbmse-aarhus>

Symposium on Health-related Water Microbiology

04 - 09 Jun 2023
Darwin, Australia
<https://iwa-network.org/events/21st-international-symposium-on-health-related-water-microbiology/>

Aquatech China

05 - 07 Jun 2023
National Convention & Exhibition Center, Shanghai, China
www.aquatechtrade.com/china

World Environment Expo

05 - 07 Jun 2023
Pragati Maidan, New Delhi, India
worldenvironment.in

Algeria Electricity & Water Expo

05 - 07 Jun 2023
Algiers, Algeria
expotobi.com/algeria-electricity-water-expo

International Chemical Waste Water Treatment Technology & Equipment Fair

05 - 08 Jun 2023
Shanghai, China
<https://10times.com/cwtf>

Annual Canadian Water Summit 2023

07-09 June, 2023
Ottawa, Canada
<https://watersummit.ca/>

Connecticut Rural Water & Wastewater Association Annual Conference

08 Jun 2023
Wallingford, USA
<https://www.ctrwwa.org/conference>

The Boundary Waters Expo

10 - 11 Jun 2023
Grand Marais, USA
<https://10times.com/boundary-waters-expo>

Conference of the UK Water Network

14 Jun 2023
Cranfield, UK
<https://www.cranfield.ac.uk/events/events-2023/16th-conference-of-the-uk-water-network>

Power & Water Nigeria Exhibition & Conference

20 - 22 Jun 2023
Lagos, Nigeria
pnwnigeria.com

Russian Water Congress Conference

20 - 22 Jun 2023
Expocentre, Moscow, Russia
<https://www.watercongress.ru/en/>

Vodexpo

20 - 22 Jun 2023
Expocentre, Moscow, Russia
<https://www.watercongress.ru/en/#exposition>

World Congress on Environment Management and Climate Change
22 - 23 Jun 2023
Bengaluru, India
<https://10times.com/wcem>

Water Environment Federation Stormwater Summit
27 - 29 Jun 2023
Kansas City, USA
<https://10times.com/e1r1-80g3-xzrr>

African Smart Cities Summit
28 Jun 2023
Gallagher Convention Centre, Johannesburg, South Africa
10times.com/asc-summit

JULY 2023

European Water And Wastewater Management Conference And Exhibition
04 - 05 Jul 2023
The Point at Lancashire County Cricket Club, Manchester, UK
ewwmconference.com

IFAT Africa
05 - 07 Jul 2023
Gallagher Convention Centre, Johannesburg, South Africa
www.ifat-africa.com

INDO WATER
05 - 07 Jul 2023
Jakarta Convention Center, Jakarta, Indonesia
indowater.com

Water Resources Research Centers Conference
11 - 12 Jul 2023
Tucson, USA
<https://wrrc.arizona.edu/conference/2023>

West Africa Water Expo
11 - 13 Jul 2023
Landmark Centre, Lagos, Nigeria
elanexpo.net/waweexpo

Delhi Water Expo
13 - 15 Jul 2023
Pragati Maidan, New Delhi, India
www.waterex.biz

Milwaukee Air and Water Show
22 - 23 Jul 2023
Milwaukee Lakefront, Milwaukee, USA
mkeairwatershow.com

Arizona Water Reuse Symposium
23 - 25 Jul 2023
Flagstaff, USA
<https://watereuse.org/sections/watereuse-arizona/2023-watereuse-arizona-symposium/>

AUGUST 2023

18th EverythingAboutWater Expo 2023
Thu, 03 - Sat, 05 Aug 2023
Pragati Maidan, New Delhi
www.eawaterexpo.com

Public Drinking Water Conference 2023
Tue, 8 - Wed 9 Aug, 2023
Austin, USA
<https://www.tceq.texas.gov/drinkingwater/conference.html>

Water Tech 2023
10-11 Aug 2023
New Delhi, India
<https://cam.mycii.in/OR/EventDetailOR.html?id=E000061989>

The Water Expo
Wed, 23 - Thu, 24 Aug 2023
Miami, USA
www.thewaterexpo.com/

World Water Summit 2023
25- 26 Aug 2023
New Delhi, India
<http://worldwatersummit.in/who-can-exhibit.html>

International Conference on Water Resource, Environmental Protection & Sustainable Development
25 - 26 Aug 2023
Zhengzhou, China
<https://10times.com/e13z-gh3s-fs30>

SEPTEMBER 2023

Water Indonesia
Wed, 13 - Sat, 16 Sep 2023
Jakarta, Indonesia
www.waterindonesiaexpo.com/

CamWater
14 - 16 Sep 2023
Phnom Penh, Cambodia
<https://www.camwaterexpo.com/>

THAI WATER
Wed, 30 Aug - Fri, 01 Sep 2023
Bangkok, Thailand
www.thai-water.com

SR Onshore Wind Conference
Wed, 06 Sep 2023
Glasgow, UK
www.scottishrenewables.com

Gat Wat
Wed, 06 - Thu, 07 Sep 2023
Cologne, Germany
www.gat-wat.de

WasteEcoExpo
Tue, 12 Sep 2023
Krasnogorsk, Russia
en.waste-tech.ru

Contamination & Geotech Expo
13 - 14 Sep 2023
Birmingham, UK
<https://www.ess-expo.co.uk/four-shows/clr>
Taiwan International Water Week
Wed, 20 - Fri, 22 Sep 2023
Taipei, Taiwan
www.taiwanintlwaterweek.com

P3 Water + Energy Summit
21 - 22 Sep 2023
San Diego, USA
<https://www.p3electrified.com/>

Water Expo - Hyderabad
Thurs, 21 - Sat, 23 Sep 2023
Hyderabad, India
<https://waterindia.net/>

LANKAWATER
21 - 23 Sep 2023
Colombo, Sri Lanka
<https://lankawater.org/>

WCW Conference & Exhibition
Mon, 25 - Thu, 28 Sep 2023
Saskatoon, Canada
www.wcwwa.ca/page/AnnualConf

OCTOBER 2023

Wetex
Mon, 02 - Wed, 04 Oct 2023
Dubai, UAE
www.wetex.ae

AWT Convention and Exposition
Wed, 04 - Sat, 07 Oct 2023
Grand Rapids, USA
www.awt.org/events/annual-convention

Envitech
Tue, 10 - Fri, 13 Oct 2023
Brno, Czech Republic
[http://envitech.co.in](https://envitech.co.in)

VietWater
Wed, 11 - Fri, 13 Oct 2023
Ho Chi Minh, Vietnam
www.vietwater.com/en

Minnesota Water Resources Conference
17 - 18 Oct 2023
Saint Paul, USA
<https://wrc.umn.edu/events/conference-2023>

IFAT India
Wed, 18 - Fri, 20 Oct 2023
Mumbai, India
www.ifat-india.com

Pak Water & Energy Expo
Wed, 25 - Fri, 27 Oct 2023
Lahore, Pakistan
pakwaterexpo.com

Aqua Ukraine
17 - 19 Oct 2023

Kiev, Ukraine
<https://10times.com/aqua-ukraine>

Water In Industry
Tue, 31 Oct 2023
Moscow, Russia
www.aquatechtrade.com/news/industrial-water

NOVEMBER 2023

Water Loss Forum
01 - 03 Nov 2023
Lutfi Kirdar International Convention & Exhibition Center, Istanbul, Turkey
www.waterlossforum.org

Bangladesh Water Expo 2023
02-04 Nov 2023
Dhaka, Bangladesh
<https://www.bangladeshwaterexpo.biz/>
Aquatech Amsterdam
06 - 09 Nov 2023
RAI, Amsterdam, Netherlands
www.aquatechtrade.com/amsterdam/

The International Water Conference
12 - 16 Nov 2023
San Antonio Marriott Rivercenter, San Antonio, USA
iwconf.org

Smart City Expo - Dubai
14 - 15 Nov 2023
The Ritz-Carlton, Dubai, Dubai, UAE
10times.com/smart-cities-nh

WETEX and Dubai Solar Show
15 - 17 Nov 2023
Dubai World Trade Centre, Dubai, UAE
www.wetex.ae

Myanwater
16 - 18 Nov 2023
Myanmar Expo, Yangon, Myanmar
myanwater.com

Sand Water Rv Expo
17 - 18 Nov 2023
Lake Havasu State Park, Lake Havasu, USA
sandandwaterexpo.com

Cairo Water Week
29 Oct - 02 Nov 2023
Cairo, Egypt
www.cairowaterweek.eg

East Africa Water Summit
29 Nov - 01 Dec 2023
Nairobi, Kenya
<https://www.eawaters.com/>

DECEMBER 2023

Water Bangladesh International Expo
07 - 09 Dec 2023
International Convention City Bashundhara (ICCB), Dhaka, Bangladesh
www.water-exhibition.com



Aquatech China 2023

Aquatech China is the Asia's leading trade exhibition for process, drinking and waste water. Get a complete overview of the promising Chinese water market and see the latest products and innovations.

China's economy is improving rapidly and could register impressive growth. Production facilities are running tight schedules to respond to the global demand of Chinese made products and parts.

Aquatech China takes place at the newly built National Exhibition and Convention Center (Shanghai). The event brings together the worlds of water technology and water management, aiming to present integrated solutions and holistic approaches to water challenges that Asia is facing.

It is the only trade show in China focusing entirely on water attracting 1,750+ exhibitors and 65,000+ water professionals.

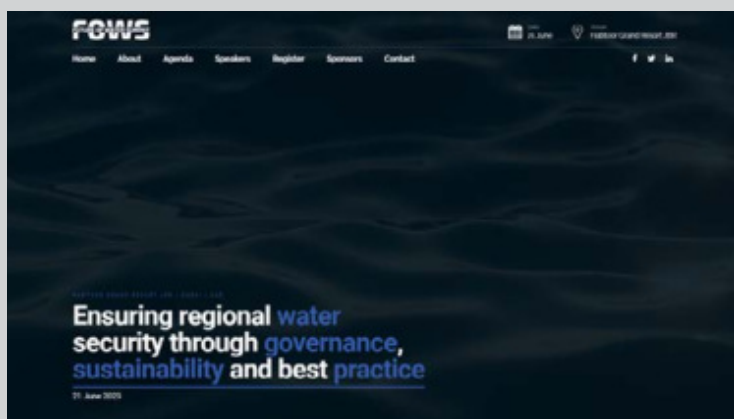


Date: 05-07 June 2023
Venue: National Exhibition and Convention Center (Shanghai), China
Website:
www.aquatechtrade.com

Future of Water Summit

As the pressures of population growth, urban development, and climate change continue to deplete naturally available water resources, GCC and MENA governments are investing billions of dollars into creating alternative water supplies, improve water usage efficiencies, and diversify water resources.

The inaugural Future of Water Summit will examine a variety of topics in the water utilities space, ranging from improving and developing desalination technology, through to the construction of dams and water canals to boost capacities and manage collection of both ground and rainwater supplies.



Furthermore, the FOW Summit will bring together leading experts to share insights and information on a variety of topics, including the improvement, management, and rejuvenation of existing resources through technology, and the investment in wastewater treatment to support water sustainability.

Date: 21 June 2023
Venue: Habtoor Grand Resort JBR, UAE
Website: 2023.fowsummit.com

Webinar on Automation and Digitization in Wastewater Treatment Plants

Implementing Industry 4.0 technologies for Automation and Digitalization in Wastewater Treatment Processes involve time consuming and pain staking modifications, often with a high initial investment in instrumentation, and software set up and software subscription costs.

With new technological easing the implementation of Automation and Digitization of Wastewater Treatment Processes, we can now easily and rapidly automate and digitalize any wastewater treatment plant without high initial investments.



Bio Petro Clean Limited, a company from Israel which has focused on bringing breakthrough technologies in wastewater treatment processes invites you to join us for a webinar on Rapid Automation and Digitalization of Wastewater Treatment Plants on complimentary basis. The webinar is on 8th June 2023 at 9:30AM (UAE Time).

Date: 08 June 2023

Venue: Online (ZOOM)

Website: www.eawater.com/event/webinar-on-automation-and-digitization-in-wastewater-treatment-plants/



18th Everything About Water & Waste Expo 2023

18th EverythingAboutWater Expo 2023 is one of the most unique & comprehensive annual events in India showcasing the latest technologies & solutions in the water sector. Also, recognized as South Asia's largest water event during recent times, this is a perfect gateway for stakeholders from across the globe to penetrate into the vast & dynamic ecosystem of the Indian Water management industry to share business opportunities, network & explore innovative water solutions.

The 18th EverythingAboutWater Expo 2023 will offer unparalleled business opportunities to both national as well as international players from the water industry to learn, explore the future trends in the Indian water market



Date: 03-05 August 2023

Venue: Hall No. 11, Pragati Maidan, New Delhi, India

Website: www.eawaterexpo.com

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