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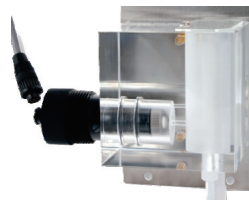


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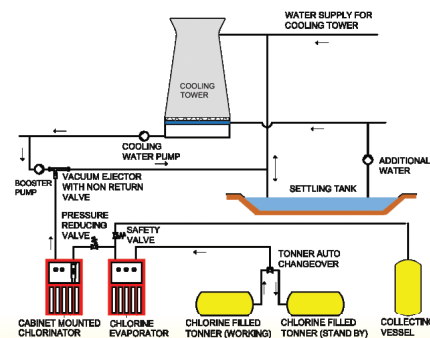
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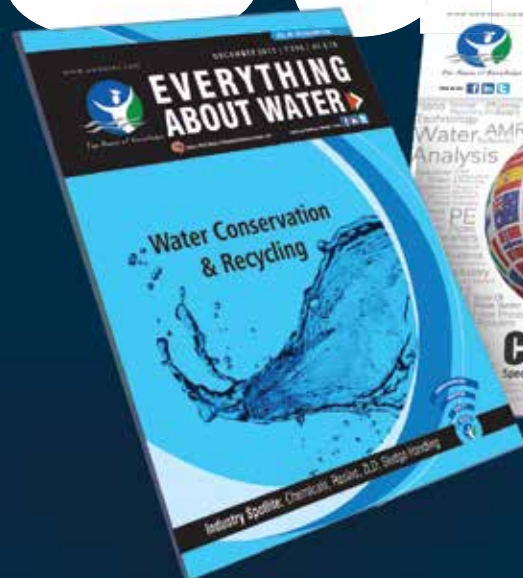
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IN THIS EDITION



REGULARS

- 04 Editorial Stream**
- 06 Global Water News**
Subscription Card - EverythingAboutWater
- 82 Advertisers' Index**
- 80 Tender News**
- 78 The Ozone Page - Column**

INDEPTH:

- 18 INDUSTRIAL WATER MANAGEMENT FOR INDIA - BY DESIGN (OR) BY INTUITION - A DISCOURSE**
Dr. S Saktheeswaran, Dr. S Sundaramoorthy
- 26 INDUSTRIAL WATER MANAGEMENT**
By Shantanu Choudhari, Forbes Marshall Pvt Ltd.
- 30 MICROAGAL-BACTERIAL CONSORTIUM BASED INDUSTRIAL WASTE WATER TREATMENT- THEIR POTENTIAL AND FUTURE OPPORTUNITIES**
By Pooja Nikhanj, Microbiologist
- 32 A NOTE ON INDUSTRIAL WATER MANAGEMENT**
By Pranab Das, Swach Environment Pvt. Ltd
- 36 INDUSTRIAL WASTE WATER MANAGEMENT - A NOTE**
By Dr. Anil Kumar Mishra, Delhi Jal Board, Govt of NCT Delhi
- 40 CHALLENGES IN INDIA'S WATER**
By Subhash Sethi, SPML Infra Limited

44 RAMPING ESSENTIAL INFRASTRUCTURE FOR IMPROVED WATER ACCESS IN INDIA

By Rangarajan Ramaswamy, Area Sales Director - Water Utility, Grundfos India

TECH 2.0:

46 WATER ACCOUNTING & BUDGETING FOR INDUSTRIES

By Dilip Yewalekar and Manisha Kinge, Jain Irrigation Systems Ltd

52 CUSTOMISED SERVICES - PLANT AUDITS, TREATABILITY, PILOT TESTING AND MEMBRANE AUTOPSY

By Anupam Pathak, Thermax Ltd.

54 COOLING WATER TREATMENT & MANAGEMENT: EXPERIENCE OF A FERTILIZER & CHEMICAL COMPLEX

By Dr. Mayur J. Kapadia

CASE STUDY:

70 BACK WASH WATER RECOVERY FILTER BY NEERWAY PROJECTS PRIVATE LIMITED IN RO SYSTEM

By Sachin Maurya, Neerway Projects Private Limited

72 SIBF SYSTEM - AVTAN IDEAL SOLUTION FOR FOOD PROCESSING WASTEWATER TREATMENT & REUSE

By Navin Singh & Rahul Babar, Energy Tech Solutions Pvt. Ltd.

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INDUSTRIAL WATER MANAGEMENT - NECESSITY OF MODERN INDUSTRIES

All manufacturing and most service industries have a need for large quantities of water. The needs vary from drinking requirements for the workers to process needs to utilities to fire-fighting to washing purposes. All industries recognize water as a critical need and work towards ensuring the quality and reliability of the water supply. With growing water scarcity and cost, industrial water management has come to the fore.

Most industries look at a wholistic approach to water management whereby they can conserve, harvest and reuse. The current thrust is towards reducing water-related costs and minimizing the environmental impact of discharge. Energy, consumable and labor contribute the biggest components of the operating cost of water. Superior planning, designing, selection, operation and

maintenance can ensure better water management.

Certain industries find water to be a key raw material of their production process. This includes industries like pharmaceuticals, packaged drinking water, other beverages and food processing. The purity of the input water is extremely critical and the industrial water needs are accordingly precise. Other industries like cement, power plants, fertilizers and steel plants are particularly concerned about water management for their utilities like boilers and cooling waters. Usually, these consume large volumes of water and involve huge costs for treatment, transportation and pumping.

Many industries have realized that the wastewater within their industry might well be the cheapest and most reliable source of

water for them. Applications like gardening, landscaping, washing and, particularly, cooling towers consume huge volumes of water which need not necessarily be of very good quality. Recycled water makes ideal sense for usage in these uses.

In certain other industries like distilleries, paper and tanneries, the biggest concern area is the wastewater management, disposal and possible reuse. The highly difficult nature of their effluent means a high level of pressure from environmental agencies. Discharging these effluents after treatment is a difficult proposition and better solutions are constantly needed.

Thus, industrial water management is a complex and evolving field. There are no easy solutions as needs constantly change and the demands

on a utility incharge are immense. The constant challenge is to provide practical solutions at the lowest cost. Naturally, any industry continues to look at water management as a support function and as a cost centre. There is a regular demand to lower operating costs and to consume less energy. Similarly, for large capital investments, a utility manager needs to justify the benefits and explain to the senior management on its efficacy.

Being a dynamic and changing field, the users need to stay updated on the latest developments in industrial water management. They need to be aware of the external environment and of the latest practices being followed by users in India and abroad. Industrial water management brings its own challenges and rewards. Hopefully, the readers of this issue would find more of the rewards.

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DROPLETS

SNIPPETS

1. India's First Privately Owned Energy Storage System Inaugurated At Danfoss Chennai Campus

Chennai, INDIA - Danfoss India recently inaugurated the country's first privately owned and operated grid-scale battery-based Energy Storage System (ESS) at the company's Oragadam campus in Chennai to store the excess energy generated by renewables (solar power plant) installed on campus. As a reflection of Danfoss's commitment towards achieving 'carbon neutrality by 2030', the ESS has been engineered using Danfoss' sustainable Drives technology.

Jurgen Fischer, President of Danfoss Climate Solutions, Denmark and Soren Kannik Marquardsen, Minister Counsellor, Regional Coordinator South Asia & Head of Trade Council at the Danish Embassy in India, presided the inauguration ceremony in the presence of Ravichandran Purushothaman, President - Danfoss India Region & other Danfoss India Management Team members.

Fuelled by a rise in the global focus on climate change, this energy storage system is one of the top priorities that will accelerate the growth of electrification, decarbonization and digitalization. The energy storage system will act as a key enabler in helping India realize its target of 40% installed renewables capacity by 2030. The system consists of a Danfoss 250 kW PCS, 270 Kwph SARA battery, a BMS, an EMS containerized integrated battery energy storage system with grid-scale technology system.

A scalable, versatile, dependable, and cost-effective solution, the Danfoss grid-scale battery-based energy storage system is an emerging landmark innovation in developing futuristic technologies and creating a sustainable tomorrow.

1. Sheena Gaynes of Bentley Systems Named to CRN's 2022 Women of the Channel List



EXTON, Pa. - May, 2022 - Bentley Systems, Incorporated (Nasdaq: BSY), the infrastructure engineering software company, today announced that CRN, a brand of The Channel Company, has named Sheena Gaynes, Bentley's director of business development and partnerships, iTwin platform, to its 2022 Women of the Channel list. This esteemed list honors the incredible accomplishments of female leaders in the IT channel. Those named on the annual list come from all corners of the IT channel, including vendors, distributors, and solution providers whose vision, expertise, and contributions impact the industry every day.

By bringing innovative concepts, strategic business planning, and comprehensive channel initiatives to life, these extraordinary women support partners and customers with exceptional leadership. CRN celebrates these women, who are so deserving of recognition, for their constant dedication to channel excellence.

Gaynes is recognized on the list for her work building out the Bentley iTwin platform developer

Eco system. Her expertise in establishing global partner programs and executing tactical go-to-market plans helped create the programs and processes for our partners and users to succeed. She leads a team that manages business development activities and nurtures partnerships with independent software vendors and global systems integrators, including supporting the sales organization to generate subscription revenue through engineering firms and owner-operators. Gaynes also manages accreditation programs, such as developer training, powered by iTwin validation, and promoting the adoption of the Bentley iTwin platform with academic institutions and students. Gaynes is being recognized for the fourth time on the CRN Women of the Channel list.

"Sheena has significantly contributed to the Bentley iTwin platform business by building out a framework for our developer ecosystem, creating a partner program with benefits and requirements, and recruiting and enabling partners of every size and type," said Adam Klatzkin, vice president of the Bentley iTwin platform. "We are extremely proud of the work Sheena has done here and are delighted that she is being recognized on the CRN 2022 Women of the Channel list."

"We are proud to once again recognize the remarkable leaders on this year's Women of the Channel list. Their influence, confidence, and diligence continue to significantly accelerate channel success," said Blaine Raddon, CEO of The Channel Company. "Their

ATER NEWS

MAY 2022

accomplishments will inspire others, and we look forward to witnessing their future contributions to the channel."

Natalie Plummer, Bentley's director of diversity, equity, and inclusion, said, "Sheena Gaynes' accomplishment is a testament to her hard work, but also serves as a clear example of the amazing things that can be achieved when you combine opportunity, inclusion, and preparation. This is why diversity, equity, and inclusion are critical for any and all organizations. Your next great leader is out there. Sheena sets the perfect example."

2. MENA District Cooling Projects Conference 2022 to explore US\$15 billion opportunities

Dubai, April, 2022 - Middle East and North Africa (MENA) region is driving the growth of the US\$ 150 billion global district cooling market - which will be the focus of the two-day MENA District Cooling Projects Conference taking place from June 14-15, 2022, in Dubai, UAE.

Organised by Great Minds Events Management (GM Events), more than 250 delegates including senior government officials, project owners, developers, utility suppliers, industry experts and key stakeholders will participate at the MENA District Cooling Projects Conference that will see more than 25 international and regional experts discuss the current market outlook, opportunities and challenges in the region's district cooling industry – that is becoming more popular due to its energy efficiency.

More than 20 leading organisations from 10 countries will showcase their products and services at the conference through an exhibition which will be covered by 35 trade publications.

Global district cooling market size is expected to cross US\$ 150 billion by 2025, according to Global Market Insights. The Middle East district cooling market value is estimated to exceed US\$ 15 billion by 2027 - or roughly 10 percent of the global market size.



DROPLETS SNIPPETS

2. Bentley Systems Releases The 2021 Infrastructure Yearbook



EXTON, Pa. - May, 2022 - Bentley Systems, Incorporated (Nasdaq: BSY), the infrastructure engineering software company, today announced the release of the 2021 Infrastructure Yearbook. The Yearbook is a compilation of outstanding projects from the 2021 Going Digital Awards in Infrastructure. The projects showcase going digital advancements and innovative uses of Bentley software in designing, building, and operating the world's infrastructure. Bentley received close to 300 project nominations from over 230 organizations across 45 countries for the 2021 Going Digital Awards in Infrastructure.

The Yearbook is available in two formats digital and print. The all-new digital version of the 2021 Infrastructure Yearbook has been created with Bentley's commitment to environmental sustainability in mind. We encourage everyone to sample the digital version as an alternative to the print version and to enjoy a multimedia experience, including project descriptions, finalist project presentations, awards celebration clips, images, and project

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DROPLETS SNIPPETS

playbooks.

For those who prefer a print copy of the yearbook, they may order a complimentary copy by completing this form.

No matter how the 2021 Infrastructure Yearbook is viewed, these stories illustrate the extraordinary work of our users from around the world.

Bentley users who want their projects included in next year's Infrastructure Yearbook should complete the nomination forms for the 2022 Going Digital Awards in Infrastructure by June 6.

3. SC Directs BMC To Award Contracts For STP Upgradation Project

Mumbai, May 2022 - The Supreme Court of India has permitted the Brihan mumbai Municipal Corporation (BMC) to award contracts for the Sewage Treatment Plants (STPs) upgradation project.

On Wednesday, the apex court, while expressing satisfaction over the progress in the project, directed the civic body to award tenders to eligible lowest bidders before May 31. The project has been delayed for more than a decade.

Under the Mumbai Sewage Disposal Project-II (MSDP-II), the BMC has finalised seven contractors for seven STPs, who have agreed to execute the work for Rs 25,963.32 crore. The seven STPs with capacity to treat 2,464 million litre sewage daily will be constructed at Worli, Dharavi, Bandra, Versova, Malad, Ghatkopar and Bhandup. While STPs at six locations will be upgraded, a new STP will be constructed at Dharavi.

4. Goan, Swedish Firms To Set Up Micro Water Plants At Resorts

PANAJI: The EP Kamat Group on Saturday inked an agreement with Swedish firm Wayout International, through which the two companies will set up micro water treatment plants at hotels and resorts. With this tie up,

decreasing initial capital investment and maintenance costs. The equipment can operate smoothly for up to a 30-year span, enhancing technology adoption.

Fares Ahmad, Head of Emaar District Cooling, says, "Driven by a number of inter-related global trends, the energy industry is experiencing unprecedented change and a lot of challenges. We should take an active approach in caring for the environment, being more sustainable and promoting our nation's green development.

"The UAE's commitment to finding green solutions, reducing CO2 emissions and the use of high, efficient and new sustainable district cooling technologies across the country has led to improved energy performances and reduced carbon footprint."

District cooling is ideal for large establishments such as airports, commercial buildings, university campuses, and residential towers. The technology relies on a centralized cooling plant, which facilitates cooling within its grid through a network of the underground piping system carrying chilled water.

"District cooling is by far the most energy-efficient way to cool buildings in arid environments. However, the goal is to find ways through our programme to make it more sustainable and efficient. We do see opportunities in improving plant efficiency through energy retrofits, digitalisation, modernisation, technology incorporation, reducing the usage of potable water, etc. While UAE is building its green economy, district cooling will be a key contributor to the UAE's Green Growth Strategy as we are marching towards COP28," Arvind Shekar, Production Lead, Great Minds Event Management - organiser of the MENA District Cooling Projects Conference, says.

"As the biggest district cooling market, we are pleased to organise the MENA District Cooling Projects Conference in Dubai. This will help industry stakeholders to look at the new district cooling projects very closely.

"Due to the 50 percent reduction in energy cost, district cooling is the most favoured source of utilities and we see new projects being announced in Dubai in the coming months and years, as the government wants to cut down the energy costs and reduce carbon footprint.

"In this regard, the MENA District Cooling Projects Conference, will help industry stakeholders to take advantage of the new business opportunities. The two-day conference will focus on the new district cooling projects, which will help contractors, suppliers, project owners and utility providers to prepare their business development plan."

Suliman Al-Khliwi, Managing Director of Saudi Tabreed, says, "District cooling adds enormous value in terms of improving building space utilisation, reduce noise pollution, reduce refrigerant use and most importantly reduce cost of cooling substantially.

"As of today, Saudi Tabreed has active 5 concessions and several lease and O&M contracts and is the leading district cooling provider in the region. It plans to maintain its leading footprint in the district cooling landscape in the country and intends to keep bringing further efficiencies by technology optimization to provide a sustainable district cooling solution for the country. Saudi Tabreed has recently achieved the financial close for three projects: Red Sea Development, KFUPM and Jawhara mall."

The district cooling market in the UAE is also witnessing consolidation in the UAE. Emirates District Cooling Corporation (Empower), the world's largest district cooling services provider, is expanding its capacity, while it is also acquiring other district cooling operators. In 2021, Empower acquired the district cooling plant of Dubai International Airport for Dh 1.1 billion.

Last year, Empower acquired Nakheel's district cooling unit, with a total cooling capacity of 110,000 Refrigeration Tons (RT) and a total value of Dh860 million.

Through 84 plant rooms and a more than 350 kilometers-long network, Empower operates on more than 1.64 million RT and serves more than 140,000 corporate and individual consumers in more than 1,252 buildings. Empower employs more than 845 professionals at its offices and plants in Dubai, and holds more than 76 percent market share of Dubai's district cooling sector.

Among the key topics, experts will discuss the future landscape of district cooling in MENA region, modernisation of district cooling plants; overcoming the challenges in energy management of district cooling, challenges in construction of a district cooling plant; digital transformation in district cooling that includes key issue such as – the digitalisation of district cooling plants to drive financial and operational competitiveness; joint ventures, mergers and acquisitions in district cooling industry and lots of new project announcements and updates on existing district cooling projects.

The MENA District Cooling Projects Conference will be attended by officials of civic bodies such as municipalities, utility providers, utility operators, contractors, sub-contractors, materials suppliers, consultants, engineers, regulatory bodies and developers, etc. Participants at the conference could also network to secure businesses from these latest projects that are currently in early stage of execution.

3.Elgi Equipments Limited - Fourth Quarter and FY 2021-22 results



Elgi Equipments Ltd, manufacturer of Air Compressors, announced today the results for the fourth quarter and for the financial year ended 31st March 2022. Consolidated PAT for the quarter was Rs. 73.1 Crore compared to Rs. 43.4 Crore in the same period in 2020-21. Consolidated PAT for the financial year was Rs. 178.4 Crore compared to Rs. 102.5 Crore in 2020-21.

Consolidated sales for the fourth quarter was Rs. 728 Crore as against Rs. 611 Crore in the corresponding quarter in 2020-21. Consolidated sales for the financial year 2021-22 was Rs. 2,525 Crores as against Rs.1,924 Crores in 2020-21.

The standalone PAT for the fourth quarter was Rs. 60.6 Crore compared to Rs. 48.9 Crore in the same period in 2020-21. The standalone PAT for the year was Rs. 189.4 Crore compared to Rs. 105.1 Crore in 2020-21.

The Board has recommended a dividend of Rs 1.15 per share (115%) for the year 2021-22, subject to approval of the shareholders. The compressor business' performance in the domestic exceeded plan owing to strong demand and go-to-market initiatives. Barring

DROPLETS SNIPPETS

the Rajkumar Kamat-headed firm aims to reduce the use of single-use plastic bottles in the production and distribution of water.

Wayout International CEO Ulf Stenerhag said that a single Wayout micro factory can produce clean and safe drinking water for around 3,000 persons and may prevent up to 483 tonnes of greenhouse gases and 5.7 million single-use plastic bottles from entering the ecosystem.

"The government will fully support both the organisations in this agreement. In future, we are also working for a plastic free Goa and this (joint venture) will definitely help with the 'Clean Goa, Green Goa, ' initiative," chief minister Pramod Sawant, who was present at the signing of the agreement, said.

5.NMCG approves 11 projects related to sewerage management, water treatment

New Delhi, May 20 - The Executive Committee of the National Mission for Clean Ganga has approved 11 projects in multiple states related to rejuvenation, sewerage management, water treatment and construction of crematoriums, an official statement said. The committee approved the 11 projects with an estimated cost of around Rs 660 crore, it said. The projects were cleared during the 42nd EC meeting of the National Mission for Clean Ganga chaired by its DG, G Ashok Kumar.

The approved projects include 'Interception, Diversion and Treatment Works for Saharanpur Town' for Hindon river, 'Rejuvenation of Chamunda Mai Pond' in Garh Mukhteshwar, 'Environmental Upgradation of Shivala River' in Madhya Pradesh's Mandsaur, 'Evaluation of Natural Farming Practices on Water and Energy Savings', and 'Implementation of Membrane-based soil-less agriculture', according to the statement.

Two projects pertaining to crematoriums, including 'building an electric crematorium' at West Bengal's Kalyani (4.20 crore) and 'Development of Cremation Ghat' at Paudi Garhwal (1.82 crore) were also approved. In addition to this, two projects of river front development in Badrinath were also given a go ahead, it said.

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Middle East, Africa, and Australia and South East Asian Countries that were affected by COVID lockdowns, other geographies registered satisfactory sales and market share growth.

The automotive business overcame COVID restrictions, supply challenges, and volatility in the segment to register sales and profitability ahead of our plans.

Outlook for 2022-23

While we remain optimistic and are well prepared to achieve our FY'23 revenue targets, inflation, wars and political unrest could soften demand and affect margins. However, we are reviewing our processes and initiating actions to avoid margin erosion.

4. Taiwan International Water Week (TIWW) is coming back in October, 2022 | Achieving the future of water sustainability with smart water solutions



Taipei, Taiwan - The most anticipated B2B exhibition in the water industry, "Taiwan International Water Week (TIWW)," will be grandly unveiled at Taipei World Trade Center (TWTC), Hall 1 from October 13 -15, 2022. Organized by TWTC and co-organized by TAITRA, TIWW focuses on achieving water sustainability with smart technologies and providing an excellent gateway for global enterprises to enter the Taiwan and Asia markets. It is ideal for companies to apply for exhibiting at this exclusive platform to find new business opportunities in water.

It has become a global consensus to cherish our natural resources and pursue environmental sustainability. The theme of this year's Earth Day is "Invest in our planet," which evokes governments and enterprises around the world to promote and implement "environment, social, governance (ESG)" to realize the sustainable future of a "green economy."

Among all natural resources, "water" is both vital for people's lives and the foundation of economic development. However, according to a UN report, Taiwan is listed as the 18th country at risk of water scarcity in the world due to its narrow topography, crowded population, uneven distribution of rainfall, and ever-increasing demands for industrial water.

Therefore, Taiwan's government has drawn up a nearly USD 5 billion budget for water infrastructure, including desalination plants and water-recycling plants (WRPs). What's more, the government is going to start imposing water conservation charges on users consuming more than 1,000 tons of water per month in July, and incentivizing big industrial water users to use reclaimed and desalinated water to improve the overall water environment in Taiwan.

Exhibiting at TIWW 2022—Taiwan's exclusive water-related B2B exhibition to facilitate your global business

Being the only water-related tradeshow in Taiwan, TIWW 2022 demonstrates total water solutions and presents global industry trends. In addition, it features six exhibition areas, including "Reclaimed Water & Treatment," "Transport & Storage," "Smart Water Technology," "Water Purification Equipment & Drinking Water," "Process Control Technology & Automation," and "Green Infrastructure, Public Sector, & Related Services" to encompass the complete industry chain of water.

Besides rich displays, there are various events such as international forums (organized by the Water Resources Agency (WRA), a division of the Ministry of Economic Affairs in Taiwan), one-on-one procurement meetings, new product launches, technical seminars & workshops, and press conferences. These events help exhibitors maximize their global exposure and sales and foster collaboration among exhibitors, visitors and professionals worldwide.

Thus far, the TIWW team has received applications from significant players in both government authority and industry, including WRA of MOEA, the Public Works Department, Taipei City Government, the Industrial Technology Research Institute (ITRI), Chuan Yi Electric Machinery Works Co., Ltd., Envirolink Corporation, and Gungdai Technology Co., Ltd. Furthermore, the Functional Water Association of Taiwan, and the Taiwan Environmental Manufacturers Association (TEMA) will also participate in TIWW 2022 by organizing pavilions.

TIWW 2022 is the best and most trusted platform for you to display your products, grasp international industry trends, and seek global business opportunities. The TIWW team sincerely invites industry players to join the show and advance toward new milestones!

TIWW 2022 encompasses the complete industry chain of water and attracts visitors from all over the world in search of total water solutions.

The Water Resources Agency (WRA) in Taiwan, will organize international forums during TIWW 2022 and gather professionals from government, industry, and academia to explore the market trends and business opportunities in “water.”

5. GSSE 2022: Global Stainless Steel Expo held from 12th to 14th April in Mumbai concluded a successful note



Virgo Communications and Exhibitions successfully hosted the first-ever GSSE 2022: Global Stainless Steel Expo powered by Jindal Stainless and supported by the Ministry of Steel, Government of India from 12th to 14th April at Jio World Convention Centre, Mumbai.

The 3-day conclave provided an exclusive platform for the stainless steel industry stakeholders which included manufacturers, buyers, influencers, regulators, industry associations and media, to converge under one roof. The exhibition spread across 5000 sq. mts. space offered 80+ producers an opportunity to network, showcase products, build presence, and engage with their target audience and explore business opportunities. The exhibition was well attended by about 8000 trade visitors which included industry captains from the country and beyond.

GSSE presented a gateway to various end-user industries to familiarize themselves with cutting edge technology from across the world, deliberate on emerging business trends during knowledge-packed topical sessions, lay down a road map to accelerate industry's growth and jointly devise ways to reclaim India's position as second largest stainless steel producer. Incidentally, the cyclical and structural factors have been driving growth in the country's stainless steel segment post the pandemic.

The event indeed helped the industry to leverage and discuss issues pertinent to the growth of India's stainless steel industry and solutions needed to raise the bar for the whole country in the stainless steel ecosystem comprising of suppliers, users, traders, associations and regulators.

The maiden B2B exhibition-cum-conference was inaugurated by Chief Guest, Smt. Rasika Chaube, Addl. Secretary, Ministry of Steel, Govt. of India in presence of Mr. Abhyuday Jindal, MD, Jindal Stainless; Mr. Prakash Sanghvi, CMD, Ratnamani Metals & Tubes; Mr. K K Pahuja, President, Indian Stainless Steel Development Association (ISSDA) and Mr. Sanjeev Taneja, ED (SSP), Steel Authority of India Ltd (SAIL).

A brief research report Stainless Vision 2047 prepared by CRISIL in close coordination with ISSDA was also released by Smt. Rasika Chaube, Addl. Secretary, Ministry of Steel, Govt. of India during the Inaugural. The findings of the report aligned with new aspirational India and overall vision of the Ministry of Steel. The report stated that domestic stainless steel demand is expected to reach 20 million tons (MT) by fiscal year 2047.

India is the second largest consumer of stainless steel and one of the fastest growing markets. The country's per capita stainless steel consumption has more than doubled to 2.5 kg in 2022 fiscal from 1.2 kg in 2010. In 2021-22, the country's demand for stainless steel was 3.7-3.9 MT and as of March 2022, India's installed stainless steel capacity is at 6.6-6.8 MT. The capacity utilization is estimated to have improved from 50 per cent in 2021 fiscal year to 58-60 per cent in 2022.

The industry is further expected to register a compound annual growth rate (CAGR) of 6.6-7.5 per cent over fiscals 2022-2025 and reach 4.6-4.8 MT. Further, the consumption is expected to reach 12.5-12.7 MT and 19-20 MT by fiscal years 2040 and 2047 respectively. Remarkably, sectors like Construction, Infrastructure and Manufacturing are expected to drive the industry's growth and become key contributors to the country's GDP.

A by-invitation CEO Roundtable chaired by Smt. Rasika Chaube in presence of Smt. Aruna Sharma, Former Secretary, Ministry of Steel as Special Invitee was also held to discuss and deliberate various issues having a bearing on the survival, growth, and sustainability of the stainless steel industry.

The exhibits at GSSE mainly included flat & long products, duplex, bars, rebars, ingots, pipes, tubes, sheets, coils, wires, finished goods and latest machinery & technology from India and overseas. The trade visitors represented sectors like Architecture, Building & Construction, Automotive, Railways, Transportation, Dairy, White Goods, Water & Waste management, Oil, Gas & Energy,

GLOBAL WATER NEWS

Pharmaceutical/Medical Devices, Food Processing/Wine/Alcohol/Beverage, Hospitality/Lifestyle, HVAC & Refrigeration, Defence, Cookware/Utensils, Laminate/Hardware, 3D Printing and others. GSSE attracted major industry players like Outokumpu, Ratnamani, Laxcon Steel and Minox Metal as Gold Sponsors and Sunflag Steel as Entry Badge Sponsor. The exhibition was supported by Indian Stainless Steel Development Association (ISSDA) as Lead Association, Pegasus Consulting as Knowledge Partner, Stainless Bazaar as Digital Partner and other leading trade associations like Stainless Steel Pipe & Tube Manufacturer Association (SSPTMA), Metal and Stainless Steel Merchants Association (MASSMA), All India Stainless Steel Industries Association (AISSIA), Stainless Steel Merchants Association (SSMA), Process Plant & Machinery Association of India (PPMAI) and Non-Ferrous Metals Association-Karnataka (N'MAK).

Other key participants included Rimjhim Stainless, Jindal Saw, Aperam, Tubacex, Venus Pipes, Synergy Steel, Chandan Steel, Ambica Steels, Rajputana Stainless, Divine Tubes, Scoda Tubes, Welspun, Balaji Niryaat, Suncity, Shiv Ganga, Shree Ramdev, Alok Ingots, Vizinox, Avtar Steels, Phoenix Foils, Navbharat Tubes, Salem SS Suppliers, Steamline Industries, Krystal, Fronius, Hisar Metal Inds, ASB Tubes, S Plus Tube Tech, TBS Metal, Shree Tubes, Panchratan Steels, Quality Foils, Anil Metals, Ratnesh Metal Inds, Calico Metal Alloys, Laxmi Pipes, Mangalam Sarloha, Moonlight, Riddhi Siddhi Impex, Arnay Tubes, Shree Venktesh Wires & Steel, Kumar Steelways, Fortran Steel, Chaman International, SNB Enterprises, Grind Master, Rockford Abrasives, Dev Abrasives and many others.

The theme for the concurrent 3-day conference was moving towards Building a Stainless Future which boasted of 12 power-packed sessions, 50+ Renowned Speakers and 1000+ Delegates from 500+ Organizations.

6. Welspun India Receives Industry-Leading Scores in CRISIL's Sustainability Yearbook 2022



Mumbai, Maharashtra, India: Welspun India Ltd, a global leader in Home Textiles, has been rated Strong in the Sustainability Yearbook 2022, released by CRISIL, an S&P Global company and leading rating agency in India. Based on fiscal 2021 data, CRISIL analysed ESG efforts of over 575 companies across 53 sectors. Welspun India leads among the textile companies with the highest scores in all three dimensions of Environment, Social, and Governance.

Commenting on this, Dipali Goenka, Joint MD & CEO of Welspun India Ltd. said, "At Welspun India, we have always embedded ESG and circularity in every facet of our operations, setting benchmarks for the industry as a whole. We are therefore pleased to see our efforts reflected in the high scores assigned to our company in each of E, S and G dimensions. This motivates us to continue to pursue our ESG efforts, thereby creating a sustainable world."

Earlier this year, Welspun India received 1st rank under 'Best Industry' category at the National Water Awards by the Union Ministry of Jal Shakti for its water stewardship and state-of-the-art 30 million litres per day sewage treatment plant (STP) at Anjar in the drought-prone Kutch district. The company was also recognized with a Jury Special Mention Award for its STP to recycle and reuse domestic sewage at the Frost & Sullivan and TERI's Sustainability 4.0 Awards 2021, which honoured companies embedding Sustainability with Economic Value Creation.

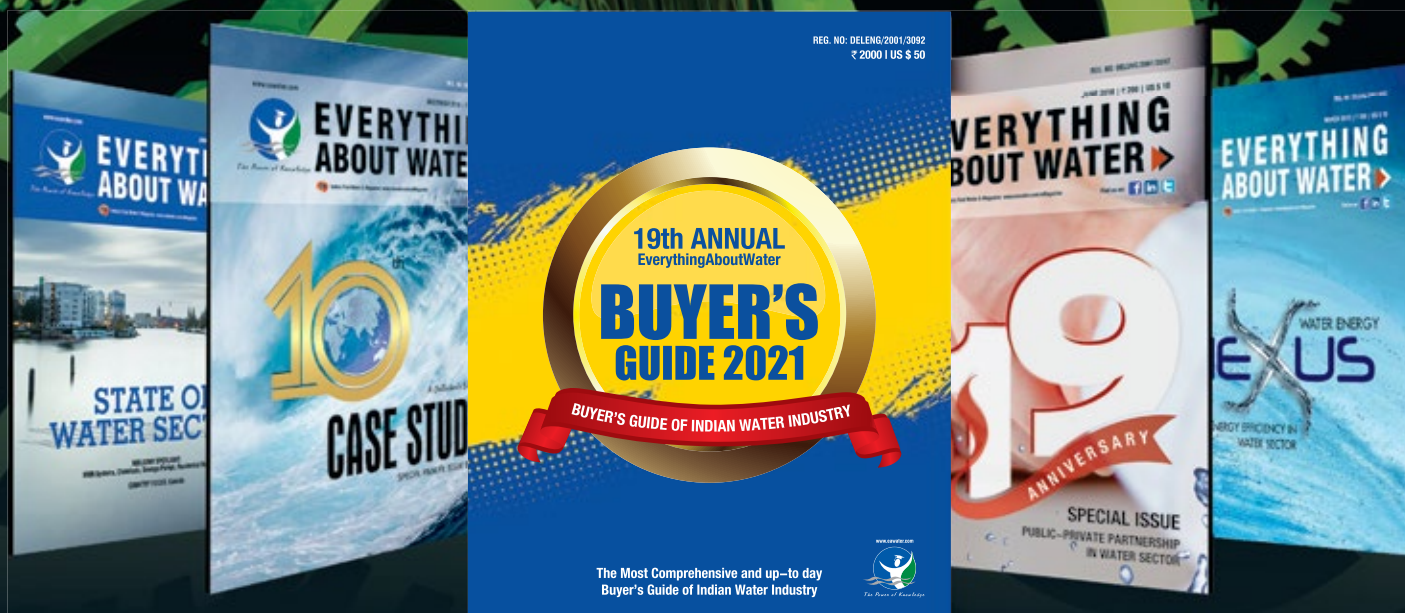
7. Bhandup STP bid 54% below estimate, BMC to go to South Korea to verify tech



Since the lowest bidder for Bhandup STP has quoted Rs. 1170 Crore, nearly 54% below the estimated cost, the BMC has decided to send representatives to South Korea to verify the technology. If the team finds that the constant level and continuous flow sequential batch reactor (CBSR) technology is not feasible and the project cannot be executed at such a low cost, the Bhandup STP tender may be scrapped, BMC commissioner Iqbal Chahal said. The BMC plans to construct seven STPs at Worli, Dharavi, Versova, Malad, Ghatkopar and Bhandup with capacity to treat 2,464 million



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litres of sewage daily (MLD) under the Mumbai Sewage Disposal Project-2. The STP project has been delayed for nearly 15 years. While the bids for most STPs were close to BMC's estimates, the lowest bid for Bhandup STP by JWIL-OMIL-SPML, a joint venture (JV) of companies, was 53.9% below estimate.

"The Bhandup STP tender was invited on an open technology basis, and the JV proposed the CBSR technology. We will request the bidder to submit a detailed cost breakup, along with rate analysis, for each component. We will also seek a detailed technical presentation," said P Velrasu, additional municipal commissioner (Projects). "We will also send a team for a site visit to South Korea to ascertain this technology, to check the plant operations, outlet parameters and understand the ongoing process cycles. We will also check the energy consumption of the installed plants and asset replacement components."

8. Ensure no untreated waste is discharged into Ganga: NGT to Uttarakhand



The National Green Tribunal (NGT) has directed the Uttarakhand chief secretary to look into a complaint alleging discharge of untreated waste into the river Ganga in Rishikesh and ensure adequate arrangements for setting up requisite sewage treatment plants in the state.

A bench headed by NGT Chairperson Justice Adarsh Kumar Goel noted the submission of the petitioner that agents of the municipal corporation were taking bath and washing vehicles using the tap installed outside a toilet complex on the banks of the river Ganga in Rishikesh.

"We direct the chief secretary of Uttarakhand to look into the matter and take remedial action in accordance with law," the bench said. The tribunal's order came on a plea seeking execution of the NGT's January 3, 2022 order directing the Uttarakhand government to ensure that no untreated waste is discharged into the river Ganga or its tributary.

The NGT had earlier said that there has to be an awareness programme as well as a monitoring cell created at each municipal level to ensure that no untreated waste is discharged into the river. "All the Ganga bank towns and villages need to follow septage protocols as well as norms applicable to the flood protection zones. Evacuation from septic tanks must be linked to the pre-identified STPs," it had said.

The directions came while disposing of a plea filed by Vipin Nayyar against construction activities in the flood plain zone of the river Ganga. The plea contended that the Rishikesh Municipal Corporation is constructing toilets on the flood plain zone illegally and discharging untreated waste there from in the Ganga.

No STP has been constructed to treat the waste, the plea said. The tribunal had directed that the arrangement in question should be interim and not treated as a precedent and shifted to an appropriate location, where construction is legally allowed.

9. All sewerage projects in Patna under 'Namami Gange' to be completed by FY23: Bihar Dy CM



Bihar Deputy Chief Minister Tarkishore Prasad said he has instructed officials of his urban development and housing department to ensure that all long-pending projects related to sewerage infrastructure in the state capital must be completed within the current fiscal.

The instruction came after the Comptroller and Auditor General (CAG) in its report tabled in the assembly in March had pulled up Bihar Urban Infrastructure Development Corporation Ltd, the executing agency, for failing to complete such projects under the "Namami Gange" initiative in the stipulated timeline.



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“Construction work of all sewage treatment plants (STPs) in Patna will be completed in 2022-23. Officials have been directed to ensure quality in building such infrastructure under the Centre’s ‘Namami Gange’ programme,” Prasad told PTI.

Strict action will be taken against those who will violate the government’s rules and norms for building these infrastructure projects, he said. ‘Namami Gange’ programme is an integrated mission, approved by the Centre in 2014 with a budgetary outlay of Rs 20,000 crore, to accomplish objectives of effective abatement of pollution, conservation and rejuvenation of the river Ganga.

Six STPs and five sewerage networks were to be constructed in Patna and of them, nine were supposed to be completed by May 2021. Of the nine projects, only four were completed by July 2021 and the progress ranged from 53 to 93 per cent in others, the CAG had said in its report. As far as STPs at Digha and Kankarbagh, the progress was “negligible”, it said.

“The executing agency, Bihar Urban Infrastructure Development Corporation Ltd, failed to adhere to the stipulated timeline for completion of works, as no STP along with sewerage network completed till date and the discharge of sewage in Ganga and its tributaries could not be stopped in Patna as desired,” the CAG said. It also observed that only 16 to 50 per cent of funds were utilised during 2016-17 to 2019-20 financial year.

“As against the sanctioned cost, only 35.48 per cent financial progress was achieved till December 2020,” the report pointed out. Prasad, who is also the state finance minister, said the delay in completion of the construction work of STPs was “because of the pending clearances from various authorities, including the railways”.

“Now, we have got clearances from almost all authorities, and the construction work of all STPs would be expedited,” he said.

Reacting to the deputy chief minister’s comment, Shambhunath Pandey, the convenor (south Bihar) of Ganga Samagra, an organisation that makes people aware of cleaning of the national river, said early completion of the work of all STPs should be the top priority of the government.

The drainage system of Patna, the second-largest urban centre in eastern India after Kolkata, was laid about 200 years ago and is in bad condition, the CAG pointed out.

Due to “lack of sewerage infrastructure” in Bihar, the maximum total coliforms (TC) and faecal coliforms (FC) were measured up to a level of 9,000 mpn/100 ml (most probable number per 100 millilitre) and 3,100 mpn/100 ml in 2016-17 respectively, and

these have increased up to 1,60,000 mpn/100 ML for both TC and FC in 2019-20, it said. “This shows the gradual deterioration in water quality during the period. A new sewerage network needs to be laid in the majority of areas in Patna with **an efficient treatment and disposal system**,” the CAG had said.

10. Delhi Jal Board to automate 116 sewage pumping stations using Internet of Things

The Delhi Jal Board will automate 116 sewage pumping stations in the city using Internet of Things (IoT), devices to prevent sewage overflow and allow timely discharge into sewage treatment plants. The Internet of Things is a network of devices that feeds data into a platform to enable communication and automated control.

The IoT devices will alert the Delhi Jal Board employees whenever sewer water breaches the threshold level in the tanks at these pumping stations. Delhi Water Minister, Mr. Satyender Jain, said his government was committed to overhauling water supply and sewer services in the national capital just like it “transformed” the health and education sectors.



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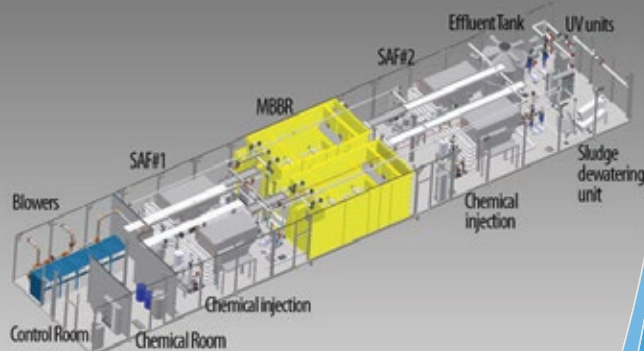
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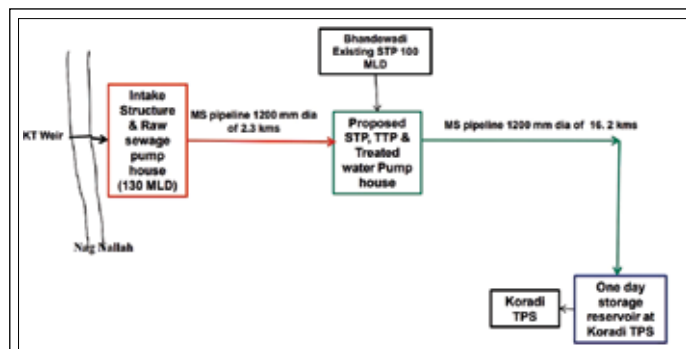
Abstract

Management by design is blinkered governance by “rules & regulations” whereas Management by intuition is site specific consensus between the industry, the people and the administration. Such intuition is to be driven by an adaptive policy. This is because, here in India, we have nearly 18 % of world’s population but only 4 % of the water and cannot afford luxury blinkered dispensations over-riding the human demands. Except drinking and sanitary, there is no justification for fresh water for industries (save food and pharma). After all, even in 1960’s the Bethlehem Steel Mills in Maryland, USA treated the city sewage for quenching the hot steel and has since expanded to 300 million liters per day (MLD) for plating, pickling, finishing and cooling. In India too, a more advanced technology including desalination has been perfected in 1978 itself after a 15 year real-time R&D and carried through in 1992 for 30 MLD at Madras Refineries and Fertilizers for cooling water makeup and was also demonstrated as drinkable. The Ministry of Environment in 2009 itself endorsed this as possible from urban cities. Two more plants of each 45 MLD for non-human contact uses were again commissioned at Chennai in 2019 and demonstrated as drinkable by the Minister and Secretary to Government of India. However, this is not yet a “movement” pan-India. The reason is the sewerage schemes have not kept pace, but then sewage is flowing in road drains and ends at outfalls. It has to be intercepted, treated and used in specific industries and their refusal should be made a cognizable offence enacted by the Parliament.

1. Maharashtra State Power Generation Company (MAHAGENCO)-The Trendsetter in 2008

An undated advisory (1) by Consultative Group for International Agricultural Research, the Water and Sanitation Programme (WASP), World Health Organization (WHO), FAO and UNEP was issued on “Recycling and Reuse

of Treated Wastewater in Urban India”. Only MAHAGENCO pioneered a 115 million liters daily (MLD) sewage renovation plant (SRP) in 2008 (2) for its evaporative cooling water (Fig.1). No other project is reported as industry waits for the local body to provide the SRP.



Salient Details

130 MLD raw sewage pumped from a nallah for 2.3 km to the sewage reuse plant where sewage from an existing STP of 100 MLD can blend. The reuse plant was SBR and multimedia filters. Treated water pumped 16.2 km to power plant. Cost Rs. 1800 million for power plant and Government. O&M Rs 15 million / year, Royalty to local body Rs 150 million / year. Product water cost Rs 3.4 / cum. Freshwater cost is at Rs 1.2 to 9.6 / cum. Treated water BOD and SS < 5 mg/l, pH is 6.8 to 7.8, MPN < 2 per 100 ml.

Fig.1 Schematic of Mahagenco Sewage Reuse project and Salient Details

2. The Chennai Example on Lines of MAHAGENCO in 1992

Chennai did the MAHAGENCO model further refined by pilot R&D and secondary treatment by local body and tertiary treatment & desalination by industry (3), (4). These are in Figs 2 to 4.



Fig. 2. The early R&D Pilot Plants of 1965 at Chennai to study Kinetics in Activated Sludge, Trickling Filter, High Lime, Carbonation 1 and 2 stages and the ground breaking of Prototype in 1988 in MFL



Fig. 3. The 17.5 MLD SRP commissioned in 1992. The second author as then Engineering Director, explaining the R O section to World Bank officials, and drinking the renovated sewage from the R O



Fig. 4. One of the later 2 SRPs of 45 MLD each. The Honorable Minister and the then Secretary to Government of India Ministry of Housing and Urban Development drinking the product water

3. What Exactly is “Symbiotic” for Industry.

Sewage from storm water drain outlets if taken by the industry will be symbiotic as under.

3-1 if it avails freshwater, the disadvantage for the industry is, the undeniable fact that in a drought, the local body will divert almost all fresh water for public and the industry will be “high & dry”

3-2 The advantage for the industry if it avails the sewage is the undeniable fact that in a drought, the local body will even import freshwater for the public and the industry is assured of full sewage.

4. The Test Case of Indore

Indore, the commercial capital of Madhya Pradesh has developed on the bank of the Khan River (5). The layout of the city, the river Khan is in Fig. 5 and river water quality is in Table-1

Fig. 5
Khan River (Bold Traverse) through Indore City

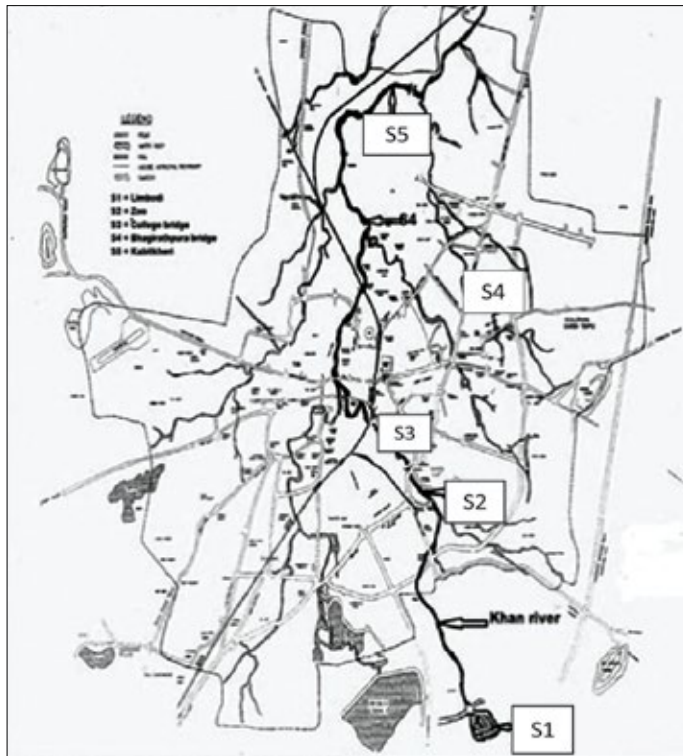


Table-1
Water Quality Parameters through Indore City in Khan River

	Parameter	Sampling Locations in the River				
		S1	S2	S3	S4	S5
1	Temp deg C	26	29	30	31	32
2	pH	7.7	7.9	7.9	8.0	8.2
3	Conductivity	230	1800	1925	1910	2110
4	Total Solids	280	1450	1560	1610	1860
5	Sus Solids	130	290	320	360	410
6	Tot Hardness	190	400	425	430	460
7	Ca Hardness	82	280	311	290	360
8	Chloride	30	230	250	254	300
9	Ammonia	0.02	5.1	9.8	9.1	10.1
10	Nitrate	0.85	12.1	14.6	15.1	16.3
11	Phosphate	0.03	0.8	1.2	1.27	1.69
12	Sulphate	3.1	33.1	42.4	45.4	56.1
13	D O	7.4	0.4	0.18	**	* *
14	B O D	6.1	80.2	110.2	119.2	133.2
15	C O D	21.1	333.1	360.1	393.2	423.3

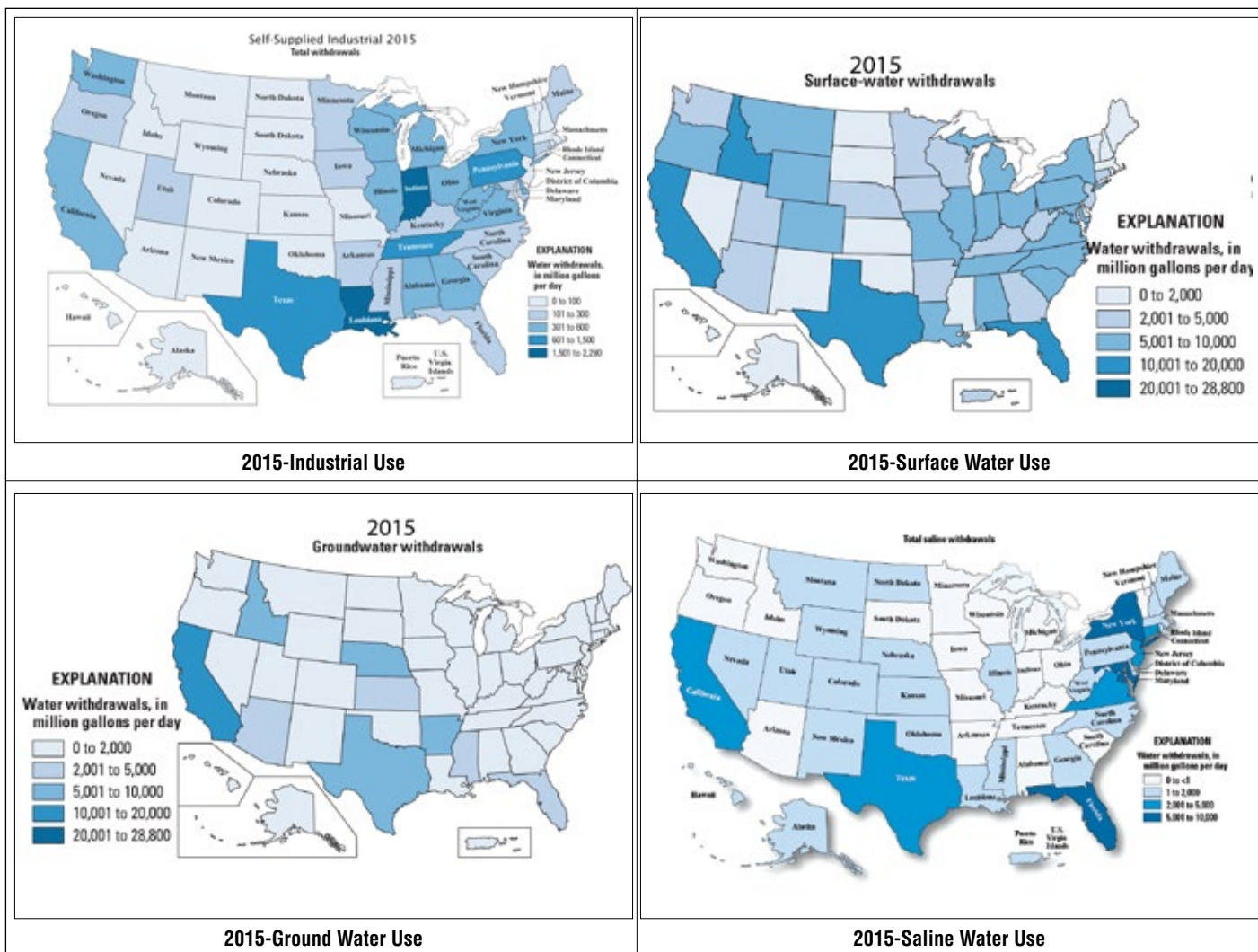
The River flows for about 64 km through the city
 The River Course is seen flowing upwards
 The sampling locations are marked S1 to S5
 D O vanishes beyond S3 at about 25th km
 Fortunately, Total solids is only 1800 even after 64 km

The entire water supply to Indore ends up as sewage at S5 and Indore can fully “harvest” all that sewage for its industrial and other reuses as the BOD and Total Solids are not high. A major problem in adoption is if every city does this, medium and small rivers will never run its full course and the downstream and tail-end habitations will be dry and may start contentious issues of water rights as cautioned by Ismail Serajeldin (6) that “wars of this century were about oil, but those of next century will be over water”

5. The Water Use Atlas of the Country - May not Help Industry Water.

This raises the overall view that all the states are not using the water in

the same pattern and may be the perennial rivers like the Ganga within the country can help the judicious usages by states through which it passes, but then, this river is also known to have droughts. The Brahmaputra is perennial but is already locked in dispute with Bangladesh, a state of India’s creation! The national water atlas of USA can facilitate inter-state transfers in times of unforeseen floods to sustain the industrial use besides avoiding land subsidence in droughts (7) (8). After all industrial use is a miniscule as for example reported by the Uttar Pradesh State Water Policy 2020 (9) that 92.2% of water is for irrigation, 5.2% for domestic and only 2.6% for industrial activities. Even if attempted here, with all its sophisticated pan-India instrumentation, still the will to share between the states may not be easy and will not fructify.



6. The Zero Liquid Discharge Syndrome

While the objectives are laudable, the methodology is in limbo. The Pollution Control Board (PCB) is not specifying the methodology, nor the Bureau of Indian Standards but the industry has to do it!. So much so, wherefrom the methodology is expected to come and more so, on what basis the Consent to Establish (CTE) is accorded are moot points. It all goes on except that the induction of thermal evaporators to deal with the rejects from Reverse Osmosis (R O) are mandated, when there are no Indian Standards and that laid down by the Middle East Desalination Research Center (MEDRC) are not able to be followed because of the material technology specifications and high costs.

Even though mechanical vapour recompressors (MVRs) are recent, still the cost is Rs. 280 per Kilo liter of feed to evaporators (10) is a deterrent. The saving grace was the pre-treatment before R O by the oxidation-reduction sludge less colour removal technology provided by the first author based on his Ph D studies in UK which continues to this day at the Tirupur textile CETPs as in Fig. 7. (11), (12). This has been since upgraded to nanofiltration (NF) to recover the Sodium Chloride solution and reuse in member industries. However, Pharma, insecticide & pesticide and Tannery NEED thermal oxidizers. The example is the Jeedimetla Pharma CETP at Hyderabad where the Supreme Court had to concede the city sewage as a diluent, as otherwise the industry threw up their hands into exiting if not conceded. (13).



Fig.7. From left. Lead Author with his Professor at Tirupur Mannarai CETP as part of inspection & validation of the work as transformed for sludge less colour removal as in the 1200 mm HDPE Looped Oxidation-Reduction Reactors with samples in Mannarai and Karaipudur CETPs in 2005; Demonstration of the technology at Vietnam Textile industry seen with raw & treated samples

7. The Pointers for the Future

7.1 In 2014, Andhra Pradesh stated (14) “Urban Development Dept. will prepare a comprehensive plan for recycling of Sewage water for non-potable industrial use and all such industries will be provided infrastructure assistance”.

7.2 Similarly, GOI-MoUD recommended “It will be better to allow the user to discharge the R O rejects back in the sewer itself at downstream and charge an additional fee “ (15). IN both the initiatives, the progress not traceable

7.3 In the USA, typical injection wells are legal (16) for disposal of volatile organic contaminants (VOCs), Solvent VOCs (SVOCs), fuels,

explosives, limited to a narrow range of specific wastes but its adoption crops up once in a while with out approval.

7.4 Similar is the Thermal Oxidizers. This wonderful technology which is ideal for high strength organic wastewaters is somehow yet to blossom here for reasons not comprehensible

7.5 Our textiles and tanneries serving out advanced countries consciously has to bear pollution burden to offset the vast employment of unskilled labour and anyway, the “buyers” from advanced countries, meet the cost of pollution redressal.

7.6 The EIA and its “public hearing” were statutory. However, this became a severe drag on projects taking shape and the draft EIA

notification of 2020 aimed to set aside public consultation by ex-post facto clearance for many projects and monetisation of violations to fast-track projects (17).

7.7 Of recent times, climate change reflects on the water demand in droughts / deluges. An

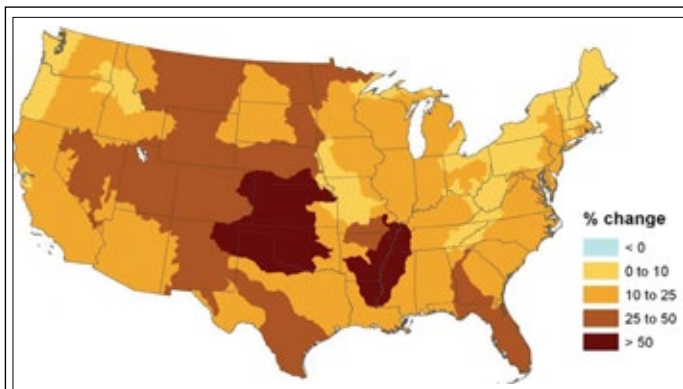


Fig.8. Projected Change in Water withdrawal from 2005 to 2060 in USA based on a complex assessment.

interesting exercise for USA for the position in 2050 is in Fig.8 (18). The nearly 50 % change in mid areas and 25 to 50 % in its engulfing west emphasizes from where this extra water will come and will it be ground water and in turn its inviting seawater intrusion or desertification if the population exits elsewhere for want of water? Interesting.

Such a change will not dent the industrial water demand which is just about a single digit percent of the community demand, but then, within this, the thermal power plants take away nearly 90 % of all industrial water demand and choose freshwater or seawater desalination..

The water stress was reported in India in 2016 as shut down of coal power plants for lack of cooling water (19-22) and over 40 % of proposed Indian coal fleet in highly water stressed areas to double the water consumption to 15.33 billion cum per year and that 417 out of 825 current and future coal blocks are in inviolate areas as per hydrological parameters. This is the single most area where sewage reuses from near and far cities should manifest and freshwater spared.

Interestingly, treating the wastewaters of industries has two dimensions namely, meeting the standards of water parameter qualities stipulated by the pollution control Board (or) extract bore well water camouflaged in the premises and surreptitiously use it to blend and thus reduce the pollutant concentration to prescribed limits. It is not that industry does in consciously, but that industry takes recourse when confronted like the “do or die” syndrome of specific pollutants which do not have a technology to be treated to the said levels. Examples are mainly the COD which is the “Pythal of Vikaramadithya” in the industries of pharma, insecticides, pesticides, tanneries and cosmetics to name the popular few. This is where the Thermal Oxidizer technology helps as pointed out in 7-4 supra. Why this technology is not entering our country is a mystery and makes one wonder whether there is a lobby perceiving it as professional competition. Here is a need for Government intervention in subsidizing initial imports of these.

In India, there is a multiplicity of authorities/ministries with different mandates which are often vaguely defined and overlapping (23) like line ministries in charge of policy, advisory nature and regulatory ministries with policing powers to even shut down the industry.

A strong example was the Tirupur textile knitwear which was 10 CETPs and hundreds of downstream feeder industries and millions of daily labour. The ZLD mandate was slapped all right but the technology is never known anywhere in the world and industry was running in search pell-mell. All of a sudden the court said the CETPs should place orders for ZLD plants and pay up 25 % money as advance to the contractor before the next hearing. Obviously, the CETPs could not comply believing some random contractors who themselves had no experience. The court ordered electricity to be disconnected to all CETPs and member individual units in the next 24 hours and-believe it-this was mercilessly implemented and millions of workers and hundredsof

industries and families living inside were plunged into darkness overnight. None of the departments or ministries came to the rescue, understandably for fear of “contempt of court”. It was the authors who dared to rescue 4 of the 10 CETPs by working out a technology and identifying financially and contractually sound firms to volunteer to render the project and the said 25 % advance was paid by the CETPs and we got the courts to reconnect the electricity. Other CETPs were emboldened and followed. This was ultimately elevated to the Supreme Court and the second author’s contentions were amplified by the one of the country’s top notch counsel and the CETPs were released from the hook with moderated riders.

7.13 Another strong example is the complex institutional framework even for such a noble project as municipal wastewater reuse in India as per World Bank as in Fig. 9 based on the MAHAGENCO project and cannot be helped in the administrative system of the country. Whenever a project is being processed by the various authorities, it is said that the “project is in the pipeline” and this in a cartoon in Fig 10 in a lighter vein. (Adapted from internet-author unknown)

8. Community Participation Taken for Granted and Failed Projects?

It has been the bane to take the “community participation” for granted and many a grandiose envisioned project has ended up in some sort of “quagmire” in the past. A few major examples are

8.1 The abolishing of one-time use plastic announced in a world forum without local community participation but arguably has become on the contrary, the more entrenched by now.

8.2 The 5*210 MW Thermal Power Plant of 1980 at Tuticorin with cooling water of 4 MLD from the sea and 6 MLD freshwater for DM plant now calls tender as of this May-2022 for additional desalination plant package of 2*500 W (25) (26) from seawater which can otherwise be treated sewage AT 300 % less costly on capital as well as O&M and as per National Policy and demonstrated in 1992 at Chennai. Taking to the community now is not easy because the suspicion will arise in the

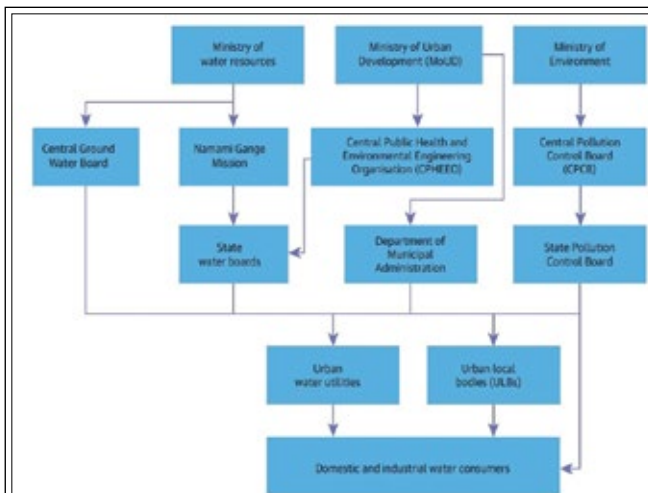


Fig.9. Institutional framework for sewage reuse in India in the Documentation by World Bank of the MAHAGENCO Project (24)



Fig.10. Caricature of "Project in Pipeline". The authorities' independent scrutiny for "loopholes" & plugging while the industry proponent waits

minds of the public as to why the "time tested" seawater desalination is being sought to be changed to sewage. Moreover, the labour force working so far with seawater desalination will not come to accept the "sewage" It took nearly a decade to get over this at Chennai in 1980's, but then, its successful use from then for over 25 years will help to use sewage from Tuticorin itself or Tirunelveli 47 km away. (MAHAGENCO pumps for 16 km !!)

8.3 The authors worked out in 2008 itself an indirect sewage reuse project to augment Bangalore Water Supply by 150 MLD. It was rushed and got sanctioned by Government and then taken for community participation which threw up apprehensions and even after 14 years (27) it is still being attempted. If only community participation was taken up before sanctioning the project, by now the subsequent editions of the project also could have materialized. A caricature is shown in Fig.9 (28)



Fig. 9. The Vital Community participation being consciously relegated to the back burner (28)

8.4 Transparency of public affairs keeps everyone around well informed, the recent example being, petrol, diesel and cooking gas with deliberations in TV every day. On similar lines, if the local water agency and the pollution control agency inter-alia on the same web platform reveal the water volume taken in by the industry and that reused as also discharged, we will know where to do interventional help. This has to be taken in positive sense and brought into public display.

8.5 Paradoxically, these initiatives may prove dicey in implementation when industry takes their investment elsewhere because of financial non-viability, for example, the Tirupur dying industries shipping their raw fabrics to Bangladesh and getting back the dyed fabrics. Net result is "anyway local problem solved" as far as our country is concerned. These are to be moderated intuitively.

Conclusions

The 2012 National water policy with no blanket approval from many states (29) and the prophecy

of Ismail Serajeldin (6) are disturbing. Be that as it may, ad-hoc policies as hereunder alone can succeed.

1. Industrial, non-human contact, non-product contact water shall be met only by intercepting sewage from drains without waiting for sewerage schemes and recovering the water and shall be mandatory for specific industries and non-compliance, a cognizable offence.
2. The community participation shall be right from the concept stage instead of the administration taking its own decisions (Cartoon-Fig.9) and later reaching out to people by public information meetings, leaflets, road shows etc to win over the consumer and industry. If only the community knows in advance that the proposed industry will bring jobs and the already flowing sewage will be intercepted by the industry for its use without snatching the freshwaters, surely the community will welcome the industry and the industry also get the goodwill of people.
3. The ZLD being enforced should be supplemented by authorization to dispose the R O rejects at a designated location in the sewers as already recommended by the GOI-MoUD-CPHEEO in 2013 itself instead of forcing the industry to go in for thermal evaporators-unless industry is itself willing.

The Government of Andhra Pradesh (14) order of "a comprehensive plan for recycling Sewage for non-potable industrial use and all such industries provided infrastructure assistance" is laudable but is contingent on para 2, lest it will be the same as the Bengaluru sewage indirect potable reuse project.

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INDUSTRIAL WATER MANAGEMENT

By Shantanu Choudhari, Head - Analytical Division, Forbes Marshall Pvt Ltd.



Water Management which is one of the most crucial topics today is aimed and implemented at various levels within the industry. Many progressive firms consider this under corporate policy or vision, EHS statement.

In country like India, a large population is dependent on surface & ground water as the source of drinking water supply needs. The groundwater is believed to be comparatively much clean and free from pollution than surface water. But prolonged discharge of industrial effluents and Untreated Sewage water and solid waste dump causes ground & surface water pollute which eventually creates health issues for masses.

The implementation of today's Industrial water management depends largely on two factors which is either scarcity of available source and secondly the cost of water. At times it is also

done from social responsibility point of view for the community purpose. Recent times, as the awareness and necessity of water management increased the industrial community has started giving due importance to this subject and implementation of various measures for achieving it.

It is observed while exercising Industrial water management, the primary emphasis is on the quantitative goals. But another factor which is either missed out or not given due consideration is the qualitative index. This also calls for monitoring and reporting needs of crucial parameters on real time basis.

The real time monitoring & reporting importance and effectiveness is not inheritably popular since it does not immediately give benefits or paybacks (ROI) to the industry and thereby could take a backseat in the overall decision making situation.

However on long term basis the aspect of online real time monitoring would not only result in taking corrective actions for the Industrial water management process but also operate the overall plant efficiently thereby giving appropriate capacity utilization and deliver better Water Quality Index (WQI).

A **Water Quality Index (WQI)** or Indicator is water quality parameter summarized but not exhaustive to Physical, Chemical and Biological characteristics of water as representation for public consent, similar to the UV index or an air quality index. And it tells us, in simple terms, what is the quality or health of ecosystem and safety scale for human contact and drinking water consumption

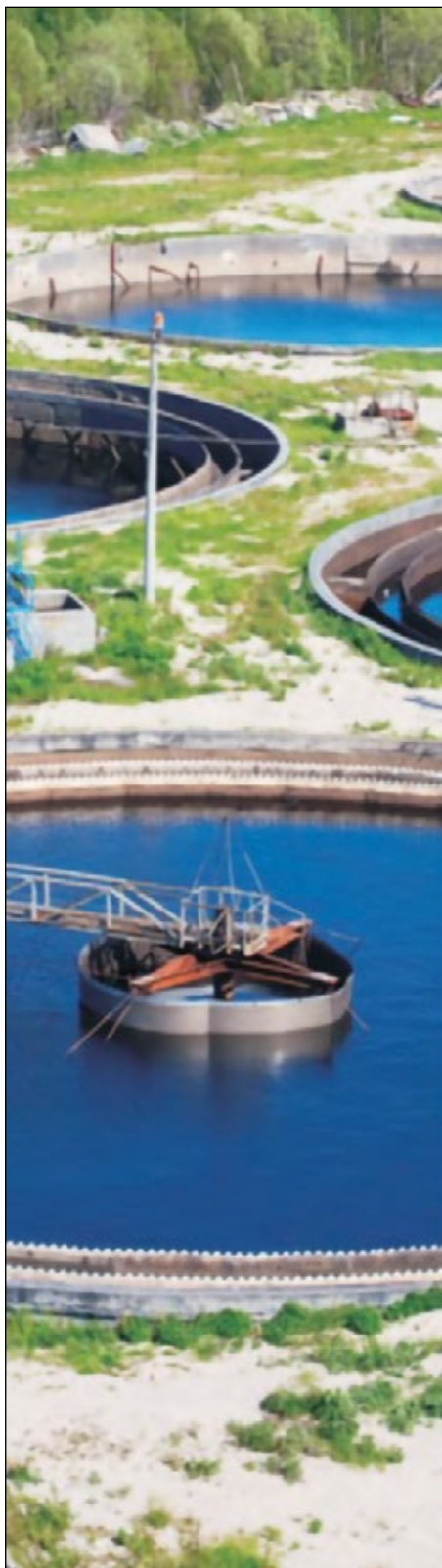
WQI is established through the measurement of various important physicochemical parameters of the surface water. The values of WQI (usually a scale of 0-100 point or %) showing the higher percent or number represent good or better quality and lower number or percent is poor category of water.

Viz. **CCME and UN Environment** programs use the scale as below;

Excellent	95-100
Good	80-94
Fair	65-79
Marginal	45-64
Poor	0-44

Various government authorities and other organization conduct surveys on regular basis for checking the WQI. The lower the number means polluted water and which is mainly due to the discharge of untreated effluents, Chemical waste from Industrial, agricultural and domestic uses. This WQI must be made more and more vigilant to industry and community to achieve the overall goal of better water management. Such vigilance can bring out continuous awareness; create healthy competition among industries and communities, Industrial clusters and even states. It could also be supported by certain incentives or benefits similar to carbon credits. This will thereby drive the overall improvement of WQI and not just Water Management. For increasing the awareness and vigilance, real time information and data analytics is vital.

Thus monitoring of Physicochemical parameters online and looping them into the Industrial plant KPI (Key performance Indicators) would allow better water management and optimum use of



resource and most importantly meet qualitative deliverables of the water needs.

The real time monitoring solutions thus play a vital role in Effective Industrial water management to deliver the right KPI and meet better WQI ratings.

Besides, there has been quite substantial developments in area of real time monitoring systems over the years and use of newer Nonconventional technologies like Optical (UV, IR), Non contact measurement, Ultrasonic etc. are now being available which offer higher uptime for the System, reliable measurements, are user friendly and most importantly easy to maintain.

These changes in the technological offerings have overcome some of the most challenging issues in past which the Industry has gone thru and was also one of the reasons why monitoring solutions were foreseen as liability rather than facilitator, resource and most importantly meet qualitative deliverables of the water needs.

The capital costs of non-conventional technologies could be higher initially but the long term cost of ownership is quite low compared to the traditional methods.

These new technologies avoid use of special proprietary chemicals which may be hazardous in nature. Handling, storage and disposal of such chemicals also become difficult while using such methods. So industry should move towards the lean and clean monitoring technologies which are now available with many manufacturers World Wide.

The non conventional methods also known as dry measurements offer state of art solutions for measurement of some of the most critical parameters like COD (Chemical Oxygen Demand), BOD (Biochemical Oxygen Demand), Nitrate, Ammoniacal Nitrogen, Organics (TOC, Oil, Phenol etc.), DO (Dissolved Oxygen), H₂S (Hydrogen Sulphide), TSS (Total Suspended Solids), Turbidity, Color, UV254, etc.

Apart from these, there are real time advanced solutions available for monitoring of parameters like TDS, pH, Conductivity, Chlorine, Ozone, Heavy Metals, Hardness, Phosphates and Sulphates, some carcinogenic parameters like Cr₆₊ (Chromium VI), SDI (Silt Density index), Cyanide, Salinity etc. which are based on either conventional or non conventional methods. Such monitoring parameters are based on inputs from smart & digital sensors which are able to provide appropriate real time data related to the health of system, validation reports and daily/weekly/monthly trend records. Such sensors with value added diagnostic services make water management a lot easier and more qualitative as compared to earlier quantitative approach. These services are also known Analyser or Asset Management solutions at times.

It becomes the right proposition for deliverables wherein the corrective actions for process improvement, avoid and arrest losses and also adherence to the regulatory norms can be achieved simultaneously.

Certainly the monitoring and value added solutions can offer improvements in process areas and address some key issues related to; Scaling, corrosion, Biofouling, abrasion, microbiological contamination, Foaming, Sludge accumulation etc.

The industries should thus go for an comprehensive approach for the overall water management exercise, which have end to end solutions with help of real time monitoring points across the plant.

The recommended comprehensive approach is to implement appropriate measurement right from inlet, intermediate stages and discharge point of an water treatment plant be it Sewage water or Industrial Effluent, or CETPs etc.

Below are certain key approaches which can be adopted for successful water management

implementation and also improvement in Water Quality Index as a whole.

Water Energy Connect

The industry should establish a good water to energy connect which will bring Energy Saving KPI under the water management program. Below are some examples which are proven and easy to implement across the industry resulting into specific energy savings within the treatment plant. These would help in improving the Water Quality Index and also give ROI through energy savings.

♦ Aeration control for specific Energy Saving

A real time aeration control can be implemented for effective and efficient operations of the basins and achieve desired Dissolved Oxygen levels which would thereby give control over COD, BOD levels of the water. The Non-Conventional UV or optical based technologies allows online and real time Dissolved Oxygen, TSS count, COD& relative BOD monitoring possible. Thus, a dynamic control can be implemented which was very difficult in earlier membrane based or electrochemical sensing technologies. The UV or Optical sensors are highly accurate, reliable and work with lowest down time, there by giving control for aeration blowers or compressors to run at necessary speed rather than working continuously (24x7) irrespective of the input influent organic load. The modulated operation of these equipment, based on input organic load (COD/BOD), DO levels, temperature and Sludge Count (TSS) can result into reduction of specific electrical energy consumption. This allows a connect between water management program and energy savings. There are certain solutions and data analytics available which can monitor, report data on real time basis to control the biological aeration treatment process with appropriate capacity utilization and deliver energy savings. Industry should implement such available solutions and avail benefits of better water management with saving and ROI (Return of Investment).

♦ Sludge Level and Density measurements

Another area of energy savings would be the primary and secondary clarifiers, wherein desludging is done on regular basis. The

process is usually run manually, but monitoring is usually not implemented to measure and control the sludge blanket level or accumulation. The sludge accumulation is rather complex process, depending on changes in input load (qualitative and quantitative both), season, climate, shifts, etc. and makes the sludge level control and de-sludge activity lot more dynamic. It thereby demands a good real time monitoring and reporting solution. The UV/IR/Optical technologies are now available which can dynamically give monitoring and control for sludge profile measurement, density and level monitoring. It allows plant to make use of its full installed capacity, improve qualitative treatment of water and save certain energy on equipment like pumps etc. within the process. An appropriate Sludge level and inline density measurement solutions can be implemented at settling basins, tanks, Clarifiers, sedimentation ponds, de-sludging settling tanks etc.

Some other areas for process improvement and water management are;

- Turbidity monitoring in Filter backwash control
- Chlorine or Chlorine Dioxide monitoring for dosing control in disinfection process
- Oil in Water (HC) measurement for Water & oil separators (TPI/CPI etc.)
- TOC monitoring for condensate & cooling water leak detection etc.

Supplier (Vendor), Associate Involvement:

The aspect of water management cannot be just implemented without active and comprehensive involvement of vendors and associates. The concept and goals should be set right initially with all stake holders. Vendors with right experience and knowledge need to be considered for the same. The implementation of any water treatment process, improvement or changes, new monitoring product or solutions should be done based on deliverable and assigned KPI which should be measurable on real time basis. An important aspect which needs to be considered while selecting the vendor is; he should have adequate local and in-house resource to provide workable solution and long term service backup. Secondly, the supplier should have experience in implementing such solutions rather than just been reseller of some overseas technology. There has to be significant involvement in delivering the right product and solution by the local team of experts , rather than depending on only overseas partners or manufacturers. Usually the initial capital costs are given importance but land up in losing long term cost of ownership, spares shortages, higher manpower & service costs etc. To avoid such challenges, the supplier involvement in right spirit as a team should be encouraged rather than just price competitiveness criteria.



Monitoring and Reporting:

In today World, Information is the key strength for success. No doubt we are into the digital World wherein AI, IOT, IT etc. are evident in every step of Industrial ecosystem. Availability of such large amount of information calls for processing the data and converting it to usable form which will make a “real” difference in achieving the set goals. The monitoring and reporting of water quality parameters at each stage and step is therefore the most critical and demanding need of the hour. The availability of technology has enabled the products and solution to provide most needed data and diagnostics which can be used to effective industrial water management. Special parameters like COD, BOD, TSS, Ammonia, Nitrate, TOC, DO, phenolics, Sludge level & Density etc. can be looped in the system which gives complete control of the industrial water management aspect. These monitored parameters when coupled with right diagnostic & data reporting software can reveal huge potential for **water savings, energy savings, Improvement in WQI, avoid process losses, prevent accidents, avoid man hours & material (chemical) losses, stay within the**

Pollution regulatory norms, avoid penalties and statutory arbitration and above all help conserve the water in sustainable manner. This has tremendous potential and also such services helps improve the overall asset uptime with ROI possibilities.

Besides such diagnostic software and data analytics services can be handled remotely at 24x7 real time basis. The Industry and vendor (experienced suppliers) should jointly render such services for some good reasons. As the right product and application knowledge is also very important while data processing. The Industry should not focus on building such expertise in-house. Rather they should focus on their core business and work with right suppliers & associates to achieve the desired water management KPI. The recent Covid pandemic did open the immense possibility of offsite and remote management services. Industry should take benefits of such available solutions in much focused way.

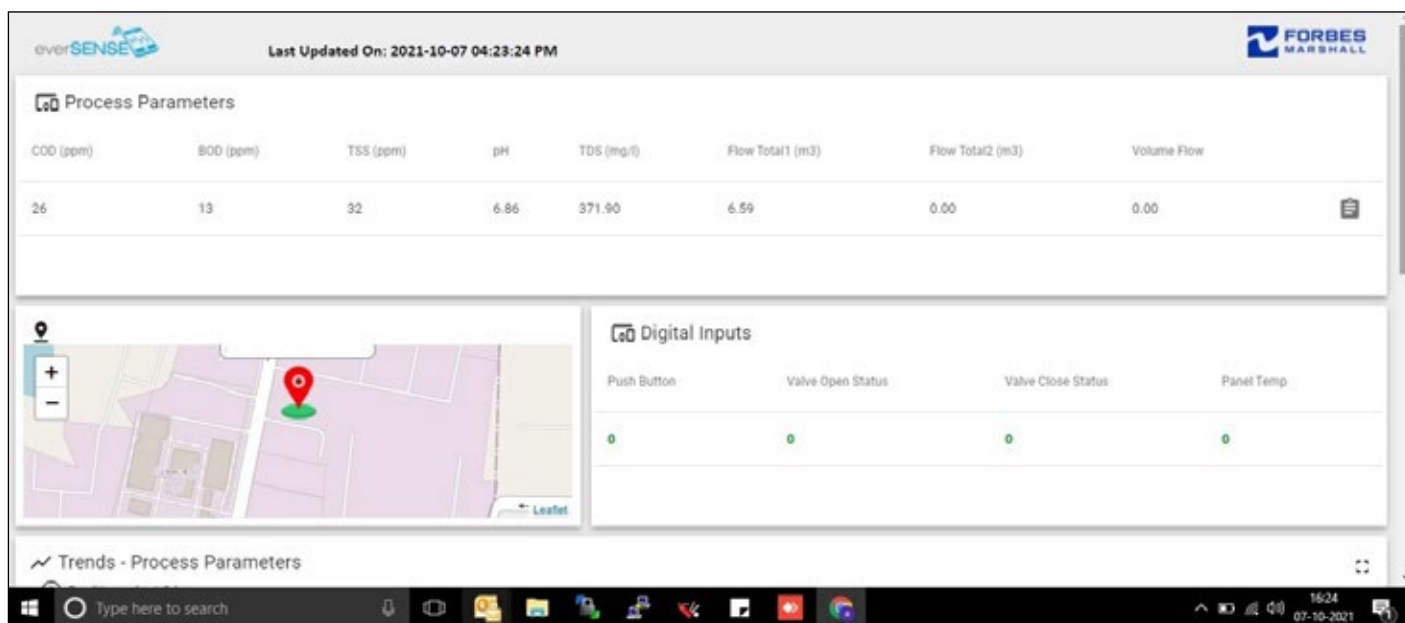
Implementing Industrial water management keeping aspects of improvement in Water Quality Index, through real time monitoring

solutions, adding the Water Energy connect, Involvement of Vendors, Associates and availing the enhanced diagnostic value added services gives the right blend for comprehensive and sustainable approach to this subject.

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MICROAGAL-BACTERIAL CONSORTIUM BASED INDUSTRIAL WASTE WATER TREATMENT-THEIR POTENTIAL AND FUTURE OPPORTUNITIES

By Pooja Nikhanj, Microbiologist



Improving the ecological status of water sources is a growing focus for many developed and developing nations, in particular with reducing nitrogen and phosphorus in wastewater effluents. In recent years, mixotrophic microalgae - bacterial cultures have received increased interest in implementing them as a part of wastewater treatment due to their higher ability to utilize organic and inorganic carbon, as well as inorganic nitrogen (N) and phosphorous (P) in wastewater for their growth thereby reducing their concentration in the water.

Prior to being released into receiving systems, the major goal of wastewater treatment is to considerably reduce the amount of carbonaceous (organic; mostly determined as biological oxygen demand (BOD) materials, as well as nitrogen (N) and phosphorus (P) components. This is because the presence of

these compounds in high concentrations can have negative impacts on dissolved oxygen (O_2) levels, trophic status, and, ultimately, the health of aquatic fauna and flora. Blooms of toxic and non-toxic algae associated with eutrophication lower water transparency, resulting in attenuated light levels to submerged aquatic vegetation and thus reduced dissolved O_2 generation via photosynthesis. The concentration of dissolved O_2 is further reduced during the decay of the formed biomass following nutrient deprivation, as heterotrophic bacteria digest the biodegradable organic matter (i.e. dead phytoplankton). Consequently, hypoxic or anoxic conditions form and that can adversely affect the indigenous fauna and flora, causing loss of species diversity and ecosystem function in water bodies.

Why to prefer micro-algae and bacteria?

Micro-algae, such as eukaryotic algae and cyanobacteria, have been discovered to be an environmentally benign and sustainable alternative to today's energy-intensive and conventional biological treatment techniques. Micro-algae in wastewater treatment is a cost-effective and practical approach for CO_2 bio-fixation, in addition to being a renewable supply of biomass. The ability of microalgae and bacteria to consume organic and inorganic carbon, as well as inorganic N and P in wastewater for their growth, is the basis for their usage in wastewater treatment. The creation of O_2 by photosynthesis, which is required for heterotrophic bacteria to biodegrade carbonaceous materials, is the main benefit of adding micro-algae into wastewater treatment.

The principal advantage of incorporating micro-algae into wastewater treatment is the generation of O_2 through photosynthesis, necessary for heterotrophic bacteria to biodegrade carbonaceous materials. Although it's difficult to compare the effects of algal growth on wastewater treatment, some studies have shown that algal production can help with nutrient removal. Algae granules in synthetic wastewater have been shown to be highly effective at removing phosphorus and recovering and reusing it from the resulting P-rich algae biomass. Microalgae have demonstrated to be a viable source of energy generation in addition to being efficient at capturing CO_2 and removing nutrients from wastewater. Microalgae may use both organic (urea) and inorganic (ammonium/ammonia) nitrogen, as well as nitrite and nitrates. Furthermore, wastewater treated by an algal-bacterial co-culture does not require transitioning between distinct operational conditions to assist inorganic N and P removal, resulting in a single-step treatment stage that reduces the treatment process's complexity and energy consumption. This is because microalgae immediately and simultaneously ingest ammonia (NH_3) and phosphate (PO_4) for cell development and metabolic function. As a result, micro-algae treatment processes have a lower greenhouse gas emission rate; for instance, the majority of N is assimilated by the micro-algae instead of being converted to oxides of nitrogen. Various studies have reported on the negligible emission of N_2O caused by micro-algae in conjunction with associated microorganisms in wastewater treatment. Overall, furnishing wastewater with dissolved O_2 through micro-algae photosynthesis is a sure

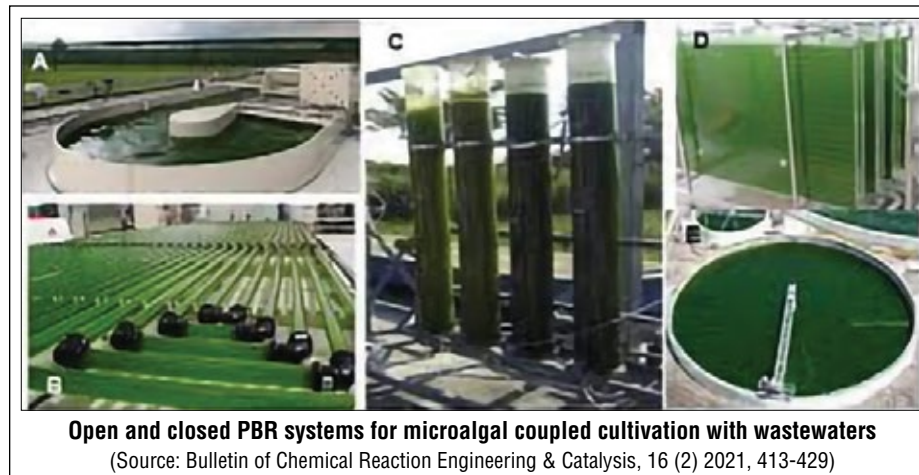
bet for significant savings in energy demand and reductions in associated greenhouse gas emissions.

Micro-algae wastewater treatment reactors

Several researches have looked into the biological removal of carbonaceous, nitrogenous, and phosphorus substances from wastewater effluents using microalgae. This has been done with a variety of microalgal species on a variety of wastewater types, including municipal, agricultural, brewery, refinery, and industrial effluents, with different treatment efficiency and microalgal growth. *Scenedesmus obliquus* has been shown to successfully extract nutrients (carbon, nitrogen, and phosphorus) from pig wastewater, while *Chlorella pyrenoidosa* has grown successfully in dairy effluent. Other *Chlorella* species, including *Chlorella vulgaris*, have been reported to be suitable candidates in the remediation of N and P from municipal wastewater effluent at the primary stage, secondary stage and from centrate. *Chlamydomonas* sp., *Nanochloropsis* sp., *Dunaliella* sp., *Spirulina* sp., and *Botryococcus* sp. were among the microalgae species studied for their bioremediation capabilities.

Micro-algae bacteria co-culture bioreactor

Microalgae treatment of wastewater has numerous problems, ranging from variable effluent composition to high volumes to treat. To provide optimal micro-algae productivity, high effectiveness in the removal of nutrients or toxins, and to accommodate huge quantities of wastewater, many micro-algae culture techniques have been researched. The reactor's design and configuration have a significant impact on treatment performance, with light and temperature management influencing growth, and hence the assimilation and removal of toxins from wastewater. The various microalgal cultivation techniques can be divided into two categories: suspended and immobilized systems. These systems are further sub categorised as being either open to the environment or enclosed. The bioreactor's primary performance factor is its cost, with examples of micro-algal wastewater treatment systems including (but not limited to) PBR, HRAP, matrix-immobilized micro-algae, and connected micro-algal biofilms. Varied types of reactors have different levels of wastewater



treatment efficiency and biomass productivity.

Conclusion and future directions

The sustainable development of a wastewater treatment system needs to be technologically feasible, environmentally friendly and economically viable. The current evidence is that integrating micro-algae as an alternative biological wastewater treatment option is technologically and environmentally feasible. It is also economically competitive if it is borne in mind that the huge cost associated with the cultivation of a micro-algae plant discussed here can be regarded as "installation" cost. As regards operational costs, micro-algae systems incur little or no operational costs, which altogether makes them much more sustainable than conventional systems. As a result, when compared to traditional biological wastewater treatment procedures, the employment of micro-algae to reduce nitrogenous, phosphorous, and carbonaceous material has the potential to operate at a smaller footprint in terms of energy consumption and greenhouse gas output. The non-sterile environment connected with the procedure is another important problem that currently limits the use of microalgae to clean wastewater. Researchers should be encouraged to co-cultivate natural communities of microalgae and other microorganisms such as yeasts, fungus, and bacteria to establish stable communities that operate predictably while satisfying all ecological niches to reduce the risk of contamination and culture crashes. Therefore, future work should assess the organic carbon enriched wastewater treatment strategy on a naturally formed micro-algal-bacterial

consortium, both in regards to its treatment performance and settling characteristics, in order to further reduce operating cost and improve treatment efficiency and operating the micro algal bacterial co-culture for the waste water treatment at a higher scale.

About the Author

Dr. Pooja is a Microbiologist in Punjab Agricultural University since 2018. She was an INSPIRE National fellowship holder from DST, New Delhi during her PhD and also qualified the ASRB-NET. She was awarded with two Gold medals for her excellence in academics during PhD and M Sc degree. She is currently working on Postharvest management of Horticultural crops along with quality analysis of water, waste water and all types of fresh and processed food products. She is handling researches on Fresh cut fruits and vegetables shelf life extension by the use of disinfection treatments, edible coatings and Modified atmosphere packaging techniques. She is also involved in the use of horticultural wastes for the production of valuable products by fermentation processes. She has published more than 20 publications including research papers, book chapters, review articles and popular articles on various aspects of fermentation, fresh cuts and value added products development.

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A NOTE ON INDUSTRIAL WATER MANAGEMENT

By Mr. Pranab Das, Mr. Akshan Gupta and Mr. Amit Ghosh, Swach Environment Pvt. Ltd.



Water is used intensively by various sectors such as agriculture, industry, and the public. Increasing global water demand and the effects of climate change are leading to overuse of water resources in many regions. One strategy to meet these challenges is to implement an integrated industrial water management, e.g., by water reuse or the use of alternative water resources. The development of new concepts and technical, digital, and nontechnical innovations together with priorities will continue to set the course for future integrated water management, particularly in the industrial environment.

Introduction

Water is one of the most important resources on earth for daily use in many different ways. However, water resources are affected by overexploitation and pollution, and the increasing demand for water with limited resources is a major challenge. This and the climate change led to water shortages due to, e.g., population growth, migration to cities, and higher per capita water consumption in growing urban, domestic, and industrial water sectors as well as the increasing establishment of industrial estates and intensification of agriculture. This situation will continue to worsen worldwide. Already today, half of the world's population lives in urban areas. Global water demand is expected to increase by around 55 % by 2050, mainly due to growing demand from production, thermal power generation, and household use. Consequently, the availability of fresh water will be adversely affected and will be facing shortages. More than 40 % of the world's population is expected to live in areas of severe water stress by 2050.

1.1 Integrated Industrial Water Management

Water is used intensively by various sectors such as agriculture, industry, and the public. This makes water management a difficult issue that cannot be solved by one sector alone. To implement effective water governance,

a considerable number of challenges have to be addressed. One strategy for improving water management is the implementation of integrated water resources management (IWRM). The Global Water Partnership has defined this as “a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner, without compromising the sustainability of vital ecosystems”. In other words, IWRM is a holistic strategy to address the impacts of water-related challenges such as climate change and urbanization to ensure sustainable water security.

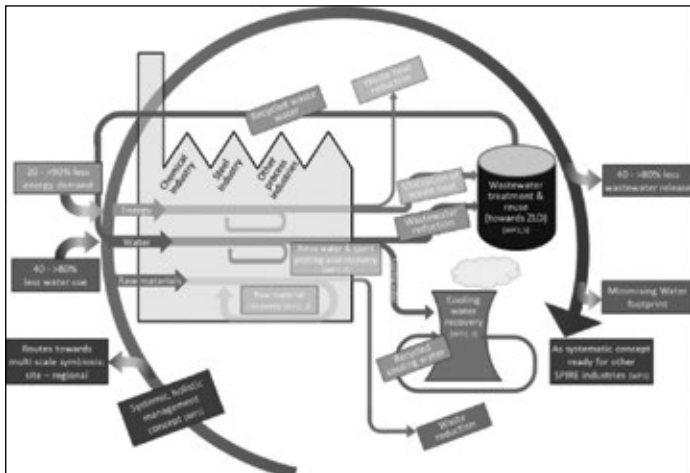
Water security plays a major role in IWRM. The concept of water security was developed in response to the complexity of the global water crisis. The core idea is to balance the water needs of humans and the environment. Water security and access to modern water supply and sanitation, as described as an important global trend, are linked to technological and industrial development and, more generally, to economic development. As a measure within IWRM, besides urban water management and agricultural water management, the integrated industrial water management is a priority. With regard to the requirements of water policy, eco-efficient and sustainable industrial water management is regarded as one of the most important strategies for environmental protection in many European countries. Water is a key element for the process industry and a core component for recycling and sustainable management. In industry, water fulfils many functions, including its use as raw material, as means of transport as well as its use for cleaning and cooling.

1.2 Challenges and Drivers for an Integrated Industrial Water Management

The specific challenges for industry in this respect are: increasing resource efficiency (water, energy, raw materials) while decoupling the increase in production, and developing wastewater management

for circular economy. New concepts and innovative technologies need to be applied to address these challenges. Industry tends to focus on maximizing production and minimizing costs, and due to the very low economic price of water, minimizing water consumption is rarely a priority. Moreover, company-specific information on water flows and actual water-related indirect and hidden costs is limited or not included, which makes it difficult to estimate the actual costs / values of water. An example of this could be that a company has to reduce its production due to water shortages, which is accompanied by a tremendous economic deficit. There is currently no standardized methodology or framework, the estimation of the value of water must be based on an integrated approach.

Some challenges can also be drivers for an integrated water management. There are drivers of natural or man-made origin; the most important natural factor is water scarcity, but human factors are also important, such as regulatory frameworks, e.g., stricter discharge limits, sustainability, or economic aspects. With regard to water security, the most important driver is water scarcity. Moreover, water stress is caused by usage competition - several actors, such as municipalities, agriculture, industry with several water functions, such as resources for supply, transport, and ecosystem services, are drivers for integrated industrial water management. These drivers are risk-based. Physical risks (water quality/quantity), regulatory risks (restrictions on water withdrawal/discharge, rising water prices), and strategic risks (securing production capacity, negative image in the media) play an important role here.



EXAMPLE OF INTEGRATED INDUSTRIAL WATER MANAGEMENT

2. Solutions: Examples for Integrated Industrial Water Management

Solutions can include water reuse, industrial symbiosis, the use of alternative water resources and, under certain circumstances, the utilization of resources up to zero liquid discharge.

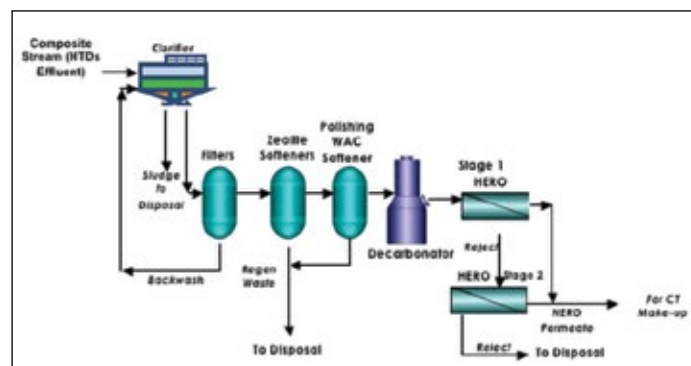
2.1 Water Reuse

Reusing water in industry is becoming increasingly important, especially in view of the concepts of circular economy. The paradigm of wastewater management is shifting from treatment and disposal to reuse, recycle, and

resource recovery. This trend is especially evident in the process industry. As an essential part of circular economy, the reuse of wastewater, can be cost-efficient and the recovery of by-products can open up new business opportunities, e.g., for nutrients, metals, and other valuables.

2.2 Industrial Symbiosis

Water can be reused within a business itself or integrated as an element in a wider network of users through industrial symbiosis. In an industrial symbiosis, one company uses underutilized resources, e.g., waste, by-products, residues, energy, water, logistics, capacity, expertise, equipment, and materials, from another and generates benefits for itself and all parties involved. The benefit can be economic, but also a reduction of environmental impacts and the increase of operational efficiency in a certain area can be achieved.



EXAMPLE OF INDUSTRIAL WATER REUSE

2.3 Zero Liquid Discharge

Zero Liquid discharge (ZLD) is an ambitious wastewater management strategy that prevents liquid waste from leaving the plant boundary to recover and reuse most of the water. No wastewater leaves the system, but sludge, brine, steam, aerosols, or water by leaching. The solids are recycled or separated to be disposed. In general, the ZLD process is

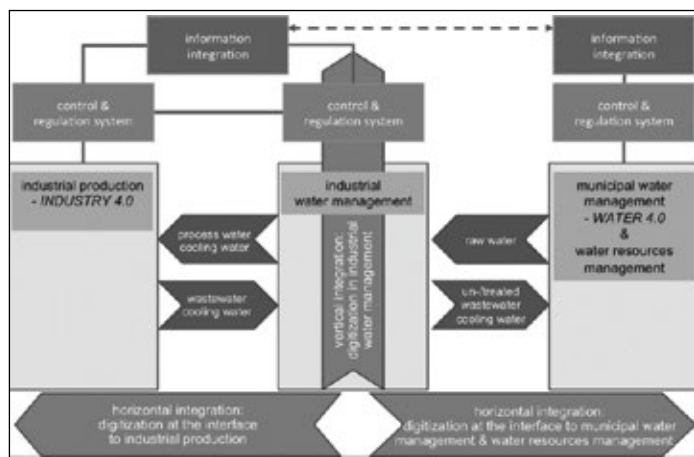


EXAMPLE OF WASTE STREAM MANAGEMENT

characterized by intensive energy use (resulting in higher CO2 emissions) and high costs for concentration, concentrate treatment, and disposal.

3 Future Priorities

The aforementioned challenges, drivers, and solutions towards an integrated industrial water management result on the one hand from the main anthropogenic developments such as climate change and increasing water stress. On the other hand, increasing social attention to clean water and sanitation, water safety, stricter regulations (health and ecology), and corporate responsibility are among the priorities of the future. They prepare the ground for technical, digital, and nontechnical innovations. These developments and priorities will continue to set the course for future integrated water management, especially in the industrial environment.



EXAMPLE OF INTEGRATED INDUSTRIAL WATER MANAGEMENT

Alongside the challenges associated with digitization, aspects such as stricter regulation and increasing water scarcity will set the tone for developments in water reuse and effective integrated industrial water management. One example are the stricter environmental regulations in China, which put pressure on industrial sites with regard to their emissions. The government is increasingly focusing its attention on industrial water management. The Environmental Protection Law, which came into force in 2015, calls for greater transparency and stricter monitoring. Companies that meet the legal requirements are rewarded with financial incentives, e.g., tax relief, while other companies face high administrative and financial penalties, including closure of the production plant. Furthermore, costs for fresh water will most likely increase in the future. Reasons are the aggravating water stress, e.g., caused by water usage competition, the increasing energy demands, and the concept of the value of water.

Companies are expected to declare a water footprint in a similar manner to the declaration of a carbon footprint presently. This footprint will be applicable to products, processes, and organizations and will be based on life cycle assessments (LCAs). It will be necessary to accurately quantify the water used, in a verifiable and consistent manner. To facilitate this, a new international standard, ISO14046, entitled Environmental Management: Water Footprint, was launched in July 2014. Water may

also be managed in modus similar to energy. Certain organizations have already adopted water as a form of energy and successfully managed the demand-side using standards including ISO50001, the Energy Management standard, and have proven it to be successful. Decisions are taken on the basis of the LCA, life cycle costing (LCC), and other tools to evaluate sustainability; knowing the substances contained in industrial wastewater and wastewater partial flows and avoiding transformation products resulting from biological/chemical degradation processes as well as the release of substances by water treatment processes.

Continuing the transformation of our economy towards a biobased economy will also require efficient water management solutions for biobased production processes. A lot is already done in this sector but realizing the aforementioned targets also for this sector is an important future development path.

Swach Environment Pvt Ltd, SPV of Haldia Water Services Pvt Ltd (HWSPL) is managing 50 MGD water treatment facility providing bulk water supplies to both Industries and Municipality through a dedicated network.

4 Snapshot of Haldia Water:-



PRE-SETTLING TANK



OLD WATER TREATMENT PLANT



NEW WATER TREATMENT PLANT

5 Techno - Commercial Details:-

- » **Area covered:** Haldia city of about 11000 hectares spreads across 5 assembly constituencies.
- » **Population served:** Over 250, 000 population with Bulk Water to Municipal Corporation which serves around 50, 000 house hold connections.
- » **Customers:** Domestic, commercial and predominantly industries viz. Haldia Petrochemicals, Indian Oil, MCPI, Tata Power, Kolkata Port Trust etc.
- » **Key Stake Holders:** Haldia Development Authority, Haldia Municipal Corporation, Industrial and commercial customers and Vendors.
- » **Project components:** More than 180kms of transmission main, around 80 pump sets.
- » **Industries served:** Serving more than 65 various types of industries, supplying about 200 MLD of water, which also caters to Industries providing employment to over 100,000 persons.
- » **Employment creation:** Around 30 professional staff, around 262 operators on contract 25 vendors for service and supply (indirect workers around 100 nos).
- » **Power consumption:** HWSPL is one of the major customers to WBSEDCL with average monthly bills of Rs 170 lakhs per month on a consistent basis.
- » **Payments for Salary, Wages and Services:** Around 150 lakhs per month.
- » **Licence Fee:** Consistently paying Rs 200 lakhs of monthly licence fee to Haldia Development Authority (HAD), GoWB.
- » **Improvements planned:** Around Rs 20 Crs to be invested in the next few years.

About the Author

Mr. Pranab Das is the Business Development Head At Swach Environment Pvt. Ltd. He has over 20 years of experience of successful engagement in Project Management as well as in Business Development in various technological sectors as well as EPC companies in the field of water and wastewater infrastructure projects. He is currently heading business development initiatives with focus on projects under various missions - Jal Jeevan Mission, National Mission for Clean Ganga, Atal Mission for Rejuvenation and Urban Transformation and Swach Bharat Mission. Has previously worked with S::canGmbH, Fives Group, Ion Exchange Infrastructure Limited, Balmer Lawrie & Co. Limited. He is an MBA in Production and Operation Management from Calcutta University and B.Tech in Mechanical Engineering from Rajasthan University.

Mr. Akshan Gupta is a young professional with work experience in Project & Corporate Finance at Swach Environment Private Limited. He works closely with senior management on project planning and various project tenders to provide strategic support to the operations team and ensures compliance to various contractual obligations. He has completed his MBA in Finance from IBS Hyderabad.

Mr. Amit Ghosh a passionate career aspirant serving at Swach Environment Private Limited as a manager in Business Development & Project Execution Department. He is successfully handling the development of the business with strategic steps and proper support of the management from the organization. He has completed his MBA in Marketing & Finance from IEM Kolkata and B.Tech form Techno India College Kolkata.

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INDUSTRIAL WASTE WATER MANAGEMENT - A NOTE

By Dr. Anil Kumar Mishra, Bacteriologist, Delhi Jal Board, Govt of NCT Delhi



Since ancient time, almost all type of industries required sufficient quantity of water for getting sufficient amount of output/product means water is an essential component/back bone for every kind of industries. The water used during various industrial processes, required proper pre and post treatment in treatment plants (STPs/ETPs) as per quality standards mentioned in various national and international standards before reusing for different industrial processes, like heating, cooling, processing, cleaning, rinsing etc. due to urbanization, industrialization, increasing population, quality and quantity of fresh water reducing drastically in India and worldwide. For fulfillment of this gap, Proper treatment and management of sewage/waste water (industrial, household and from other sources) is utmost important, and after proper treatment; reducing or removing different type of contaminants (Physical, organic, inorganic Microbiological, biological and other contaminants) present in waste water may be re-utilized in various industries, irrigation of crops, recharging

ground water, domestic purposes other than drinking and cooking, mixing into rivers, ponds, drains or other natural water bodies without any environmental issues as per national and international guidelines. Industrial and other type of waste water treatment and its proper management, playing important role for maintaining environmental hygiene and sanitation.

Industrial wastewater, which is produced by industries as undesirable by-products, may be reused or released into drains or in surface water bodies after proper treatment in ETPs for further natural treatment. Generally, industrial and other type of waste contains many type of pollutants like pathogenic/non-pathogenic microorganisms (Bacteria, Viruses, Protozoan, Fungi, Algae etc.), Organic and inorganic contaminants, plant nutrients, synthetic organic and inorganic chemicals, micro-plastics, radioactive substances, oil & grease, heat etc.

Untreated Industrial or other type of waste water pollutes natural water resources mainly by two ways. These are:-

- A. Point Source Pollution:-** In this type of pollution, waste water reached into water bodies from fixed known sources like pipelines or channel. Point-source pollutants are easier to control as compared to dispersed-source pollution, as such type of pollutants flow in single location where treatment processes can remove them from the water.
- B. Non-point source or dispersed sources pollution:-** In this type of pollution, waste water reached into water bodies from unknown/broad spectrum sources like

Surface runoff from farms (fertilizers, pesticides etc.), animal waste, industrial waste or other sources. Dispersed sources pollution control is not so easy, as this causes pollution from various known/unknown sources. Dispersed-source water pollution is best reduced by enforcing proper land-use plans, policies and regulatory standards/norms.

Industrial or other type of waste water may be treated into Centralized STPs (means sewage is collected from sewerage network of command area into sewage pumping station then pumped into STPs for treatment) and in decentralized system (not required major SPS for pumping of sewage as treatment made through on-site small plants). Some industries establish their own ETPs (Effluent Treatment Plants) as per their requirements for proper treatment of their waste before mixing into drains or other natural water bodies. On the basis of process control and quality management in STPs/effluent treatment plants (ETP), three to four stages followed. These are:-

- A. Primary treatment:-** In this stage suspended solids, Organic matters, oil and grease, floating materials etc. are removed upto maximum extent by physical processes like screening, grit removal, sedimentation, skimming (for removal of oil and grease from sewage) etc.
- B. Secondary Treatment:-** In this stage remaining organic matter removed by aerobic and anaerobic biological treatment process.
- C. Tertiary treatment:-** In this stage removing microbiological loads and

A. other remaining organic and inorganic pollutants through filtration and proper disinfection by Chlorination, Ozonation or by any other agents or technologies.

B. Quaternary or advanced stage Treatment:- In this stage, micro-pollutants such as pharmaceuticals, ingredients of domestic and industrial chemicals, pesticides, algal toxins (Blue green algae like microcystis, oscillatoria, anabaena, lyngbya etc. produce different type of toxins, which are harmful for animals).etc. are removed by using advanced filtration system or by using other advanced and sophisticated technologies. These micro-pollutants generally may not eliminate through commonly used waste water treatment processes (primary, secondary and tertiary treatment).

Purpose of industrial and other waste water treatment:

The main objective of industrial and other type of waste water treatment is to remove different type of physical, organic, inorganic, microbiological/biological pollutants and produce final treated effluent which must be fit for intended purposes as per national and international norms /guidelines, required for maintaining environmental sanitation/ hygiene.

Major industrial and other waste water treatment technologies:

In India and worldwide many technologies are available since ancient time for proper treatment of waste water and now a days other new advanced and sophisticated technologies are establishing or arising which treats waste water upto quaternary level (depends on requirements or usability of treated effluents). These technologies are based on biological and non-biological treatment principles (Physical, Chemical, Microbiological, Membrane filtration, Activated Charcoal/ sand filtration etc.). But all the technologies are not suitable universally for all the places and all type of waste water /sewage treatment; as its depends on quality and quantity of waste water, nature of industries, climatic condition, construction and operating cost, availability of land and energy, sustainability, environmental impacts (odors, vectors attraction, sludge

transportation, sanitary risk, water, soil and sub-soil contaminants, surface and ground water contamination etc. Most common technologies are:

- A. Activated Sludge process (ASP)
- B. Up flow Anaerobic sludge blanket (UASB)
- C. Waste stabilization ponds (WSP)
- D. Moving Bed Bio reactor (MBBR)
- E. Sequential Batch Reactor (SBR)

Management of Sewage / Waste water: In India and worldwide proper sewage or waste water management is challenge and If manage it properly then may save natural resources, economical and health loss, environment, water, soil fertility etc. Properly treated effluents may utilize for different purposes, some important aspects are as underneath:-

A. Supplied in household for secondary purposes like gardening, washing, etc: Every day, we are using millions liter of water in various industries and households and apprx. 90% of this water again reached into drains as sewage. If, we properly treat this water in STPs/ ETPs then this water may be supplied again in industries, households for secondary purpose like washing, bathing cleaning etc. (except drinking and cooking), through separate pipelines (dual pipe supply system). This may save millions liter of treated water which may be supplied to new consumers.

B. Recharging of underground water aquifers: Now a days, we are extracting much quantity of underground water for construction, irrigation, households industrial purposes etc. If, we treat waste water (industrial and households) as per national and international standards, then this water may be utilized for recharging of aquifers through different water bodies like lakes, ponds etc; resulting quality and quantity of underground water will also improved.

C. Irrigation of crops, trees and other plantations: Farmers using sewage water (untreated/partially treated) for irrigation of herbaceous vegetables, fruits, and other crops. As this water is easily available in metropolitan cities and having sufficient amount of nutrients, which are required

for the purpose of growth of the plants but in the other side this sewage water also contains pesticides, heavy metals (Hg, Pb, As etc.), bacteria, viruses, spores, and other microorganisms, organic and inorganic pollutants which are very harmful for humans, plants and other animals. Properly treated sewage (As per guidelines of WHO, CPCB and other national and international standards) is ideal for agriculture for irrigation purpose and is already being widely used throughout the world. Final treated effluent may also used for irrigation purpose of Parks, crops, green belts and other greenery in central and side verges of roads. This practice may save billion liters of surface as well as underground water every year; resulting, we may conserve that water for other purposes.

D. Mixing into natural water bodies like ponds, river, drains etc.: In present scenario, natural water bodies like river, ponds, lake etc. have been dried or water only available during rainy season and that's quality is also not good as per national and international standards framed for using various purposes. If after proper rejuvenation of those water bodies, we use properly treated effluent for maintaining water level of these water bodies then this water may be available for consumers, drinking purpose of cattle, birds or other animals and for other purposes.

E. Supplied to thermal power and other industries etc.: In present scenario, ground or surface water is being used in thermal power, nuclear power stations or such type of other industries as a coolant or for other purposes; resulting surface or underground water reducing. If we use treated effluent for this purpose then that remained water may be utilized for maintaining water table or for other purpose.

F. Maintain environmental sanitization: Proper sewage treatment (Industrial and other household) and its management also helpful for maintaining environmental sanitation and hygiene; as sewage contains different type of physical, chemical and

A. microbiological contaminants (bacteria, virus, fungi, protozoans, nematodes) etc. and if not managed properly then different type of water born and air born diseases may spread in community. Inadequate sanitation kills people, causes disease, environmental pollution and diminishes welfare- this is the well known but the economic impacts of the poor sanitation have not been counted properly.

Steps to be taken for proper treatment and management of Industrial, household and other type of waste:

1. STPs/ETPs should be upgraded with advanced and sophisticated treatment technologies which should be sustainable, economical, environmental friendly, suitable and fulfil the purpose of treatment.
2. Final treated effluent (After tertiary/quaternary treatment) directly transmitted

till green belt/ crop site through separate pipelines inspite of mixing into drains. Training and awareness must be provided to farmers and other stakeholders.

3. Proper guidelines and incentive policy should be framed by the Central, state or local government level for promotion of use of treated final effluent for various purposes like irrigation etc.
4. Strict guidelines may be framed by regulatory organization and must be mandatory for all the STP/ETPs, and other waste water treatment industries or agencies.
5. Awareness programmes may be started by Govt./any other responsible organizations through various means like social media, included in the syllabus of school/colleges etc. So that public/ stakeholder may aware about the reuse of properly treated waste

water, its importance and sustainably use of water etc.

In conclusion, industrial and other type of waste water treatment and its proper management is a burning issue in India and worldwide. If, we properly manage process control of waste water treatment, quality (as per national and international standards/ guidelines), proper reuses of treated effluent/ other by-products of waste water treatment and solid - waste management, we may save energy, maintain environmental hygiene, reduce scarcity of water, improve quality and quantity of underground water, increasing crop production, improved health and life style of human and other living organisms, save money etc. Various national and international organizations have been also included waste water and its proper management in SDG-6 (Sustainable Development Goal-6) due to its importance and to achieve desired outcomes in this field.

About the Author

Dr. Anil Kumar Mishra is presently working as "Bacteriologist" in Delhi Jal Board, Govt. of NCT Delhi since August 2007. He has qualified CSIR-UGC (NET) June 2002 for Lecturer ship and ICAR (NET) 2004 and 2006 for Lecturer ship. He also qualified UNERA fellowship of Australia government for advance studies in January and June 2006. He secured IInd level prize in senior level comprehension certificate test on Right to Information Act-2005 in the year 2011 conducted by Govt. of NCT Delhi. He is also the recipient of Best Employee Award for the year 2019-2020 for Delhi Jal Board by Chief Minister of Delhi.

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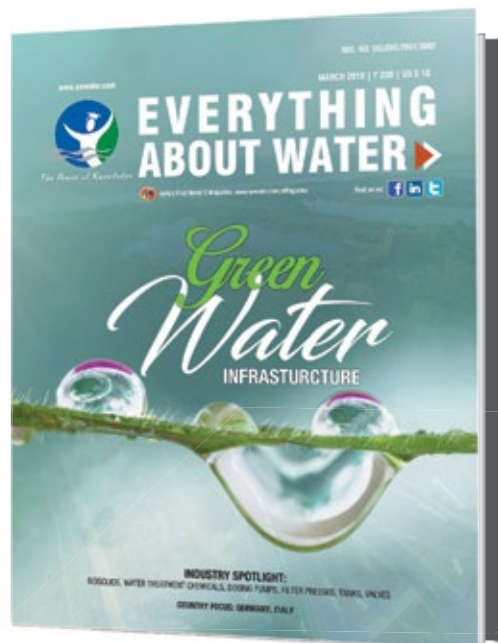
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CHALLENGES IN INDIA'S WATER

By Subhash Sethi, Chairman, SPML Infra Limited



We do not really understand water. The two-third cover of our planet is still a mystery. The deeper we look into it, the secret deepens. Water defines the life on earth. It is central to atmospheric sciences, ecology to biology and many technological innovations.

Whether it's a growing population, rapid urbanization, a changing climate pattern or increasing expectations from people and businesses, water is at the heart of every situation. Every cell, tissue and organ in our body needs water to work properly. Water gets rid of wastes from our body, it keeps body temperature normal, and water also lubricates and cushions our joints. Water is also critical for your heart health. Our heart is constantly working, pumping about 2,000 gallons of blood a day. We help our heart to do its job by staying hydrated - by drinking water at regular intervals.

Water is essential for survival. Even as people struggle to find the water they need for drinking, cooking, washing and farming, many more faces the fury as climate extremes batter their homes with storms and floods. Climate change is perhaps the greatest threat facing the global water system, simply because in reality it is composed of many different threats. As greenhouse gas emissions cause the planet to increase in temperature, the world's hottest regions are becoming even hotter and the water sources are drying up leading to water scarcity. Nobody has imagined that Delhi will face a plus 49 degree temperature in summer, but the unthinkable is happening.

India is currently facing a historical water stress with more than 40% of its population facing extreme water scarcity and some of the major cities in the country have reached to zero groundwater situation. The situation is further threatening with World Bank estimating that by 2030 India's water demand will outstrip

The crisis of our diminishing water resources is just as severe as any wartime crisis.

supply by almost 50%, a significant challenge to arrange water for domestic and commercial purposes.

India constitutes about 18% of the world's population, but the country has only 4% of world's freshwater resources. With the changing weather patterns and recurring droughts, India has become a water stressed nation. As many as 256 out of 770 districts have reported 'critical' or 'over-exploited' groundwater levels.

This means that fetching water in these districts has become harder as the water table has fallen sharply.

Groundwater Depletion

Around a third of the planet's fresh water comes from underground aquifers, and while these are not visible, they are vital to maintaining our agriculture and industry. Unless urgent action is taken, 60% of India's aquifers will be running perilously low on water within next 18 years. Not only water is scarce in India, but the extraction of groundwater has been on the rise for decades. India is also the largest user of groundwater in the world. It uses an estimated 230 cubic kilometers of groundwater per year - over 25% of the world's total. More than 60% of irrigated agriculture and 85% of drinking water supplies are dependent on groundwater.

Since 1960s, government's support for the "green revolution" to ensure food security has increased the demand for groundwater for agriculture. The rural electrification drive combined with the availability of modern pump technologies has led to an increase in the number of bore wells to meet the demand. The number of bore wells has grown in the country from 1 million to 33 million in past over five decades, making India the world's largest user of groundwater.

The Central Groundwater Board of India estimates that about 17% of groundwater blocks are overexploited (meaning the rate at which water is extracted exceeds the rate at which the aquifer is able to recharge) while 5%

are at critical and 14% at semi-critical stages. The situation is particularly alarming in three major regions – north-western, western, and southern peninsula.

Groundwater quality is very important because the consequences of contaminated groundwater for human health, agriculture, and the economy are critical. The chemical and microbiological quality of groundwater is central to its utility, yet the resource remains vulnerable to contamination from both natural processes and human activities.

Water Pollution

Tackling water pollution is an enormous challenge, as it encompasses everything from sewage entering into drinking water supply to the endless plastic waste pouring into river systems around the world. According to the United Nations, around 80% of generated wastewater containing anything from the human waste to industrial discharges goes untreated.

Water Aid, working on water, sanitation and hygiene finds that an alarming 80% 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 recent years.

The urban India is currently generating nearly 73,000 MLD of sewage per day which is expected to increase to over 87,000-97,000 MLD by 2025. Presently, there are only 28%

of generated sewage is being actually treated leaving a big gap of 72% not receiving any form of treatment and released into water bodies. While the industrial water demand is increasing, there is still a big gap in the treatment of industrial effluents.

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. SPML Infra Limited has been promoting sustainable integrated water management systems and established a leading position in the treatment of wastewater from design to application of technology, construction to management and operation of sewage treatment plants, effluent treatment plants, tertiary and water reuse treatment plants, sludge treatment, bio-gas & power generation. It has the capabilities to provide reuse with recovery of resources from waste as well as solutions for proper treatment and disposal of wastewater with specific processes such as anaerobic, anoxic, and aerobic. SPML Infra has executed numerous wastewater treatment plants across the country which is fully equipped with modern technology and automation system for reliable and efficient operation and maintenance.

Poor Infrastructure

The most obvious issue with water supply is poor condition and failings of infrastructure, among the biggest barriers to keeping water safe and supplied. Water must be transported around in vast networks of pipes and dealt with at treatment plants, and these take a lot of

maintenance and investment. While there are many problems contributing to this situation, the impending one is that the country is losing around 3.4 trillion litres of water each year to old and leaking pipes. The average household leaks can account for nearly 45,500 litres of water wasted every year and 10% of homes have leaks that waste 1, 46,000 litres or more in a year. The World Bank has calculated that

We have seen water availability change drastically in India from abundance to almost half of the population living in a true water crisis.

the cost of non-revenue water due to frequent leaks along with standard theft and billing errors exceeds \$14 billion globally and increasing.

The water needs to be transported, treated, and discharged. India is facing a huge challenge of dismal state of its water infrastructure - treatment plants, pipe networks, and sewer systems in a state of disrepair. While almost 50% of supplied water is lost in India as non-revenue water due to leaky pipes and poor control, the water utilities tend to ignore growing infrastructure issues until disaster strikes.

A classic example of attending the water loss issue is in Bangalore. The city water utility, Bangalore Water Supply and Sewerage Board has implemented a water loss management project and saved about 170 MLD of treated water in the project areas. SPML Infra has executed a part of this project in 43 DMAs having around a million populations, where it has replaced 50-60 year old pipes and innovative leak detection technology were used to accurately identify and locate hidden leaks in large and small pipes and fixed them with sustainable methods with GSM/GPRS communication system for measuring flow and pressure control. The determined effort to improve the situation helped in significantly reducing water losses from as high as 72.56% in some area to reduce it to 10.24% with average of all DMAs reduction from 53% to 21%, saving almost 50 million litres' of potable water per day. Saved water is being used to provide drinking water facilities to over 110 newly developed settlements of Bengaluru.

Inaccurate Pricing

Water is seriously undervalued in India due



68 MLD Water Treatment Plant, Hubli-Dharwad, Karnataka

to political and various other reasons. Its price does not reflect the true, total cost of service, from its transport via infrastructure to its treatment and disposal. This has led to mismanagement and wastage of water and a lack of funds with utilities to invest in infrastructure development and repair. It also affects the adoption and implementation of new water technologies that manage water more efficiently. The pressing question is why a water utility or government would invest in expensive water-saving technologies, when water is cheaper than the technology itself. When the price of receiving clean water is closer to its actual service cost, efficient water use will be encouraged. The flip side is the poor often end up paying disproportionately high prices for water, due to water mafia controlling the distribution by transporting it.

Bright Spot

Amidst all these water inequalities, there is good news: governments, businesses, institutions and citizens are waking up to water challenges, and beginning to take action. Each year brings more solutions – like using wastewater for potable and non-potable purposes, catching the rain, using restoration to bring water back to dry topographies, monitoring groundwater levels more closely, and developing and adopting new technological solutions to manage water storage to distribution network as well as making focused approach to curb water losses. Even the best solutions will not implement themselves; political will and public participation is critical in ensuring a sustainable water future.

About the Author

Mr. Subhash Sethi is leading SPML Infra Limited with a mission driven approach to get clean drinking water to people. His dedicated efforts have made the company execute over 650 projects and provide drinking water to more than 50 million people. His contributions have been well recognized with several national and international awards.

To know more about the contributor of this case study, you can write to us. Your feedback is welcome and should be sent at: deepak.chaudhary@eawater.com



2587 MLD Pumping House for SAUNI Yojana Phase-1, Gujarat



Aerial View of Pokhran Water Supply Project



Water Supply Pipeline, Pali, Rajasthan

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RAMPING ESSENTIAL INFRASTRUCTURE FOR IMPROVED WATER ACCESS IN INDIA

By Rangarajan Ramaswamy, Area Sales Director - Water Utility, Grundfos India



The ongoing heatwave in India has affected several parts of the country. While Rajasthan and Madhya Pradesh have suffered the worst, surprisingly the mountainous state of Himachal Pradesh too have also been affected this year¹. This has led to water crisis in the country as water utilities are not able to meet the supply of water as per demand.

India, already a water stressed nation suffered its hottest month of March this year² in more than 100 years. Water utilities and local administration have had to scramble their resources to meet the water demand due to the rising heat. The Delhi Jal Board had to request

Haryana Irrigation Department to release additional 150 cusecs of water due to water level depletion in Yamuna³. India's per capita water availability is 1100 cubic meter which is close to the threshold of water scarcity of 1000 m³ per person⁴. We need to focus on the key aspects of water management to address the missing links in India's water infrastructure.

Providing an efficient digital water infrastructure

Indian cities are under a lot of pressure to meet their growing water demands. With intelligent solutions, the government as well as local administration can plan for better, more efficient and more sustainable water management. The crucial need is to provide digital infrastructure mechanisms that will help water utilities meet the demand of water across the country. Technology such as Artificial (AI) and Internet of Things (IoT) are already helping water utilities with range of services like leakage detection, predictive maintenance among others.

Digitization of the water infrastructure will help in solving India's water crisis by identifying pain points and providing real-time monitoring of the water infrastructure system, thereby providing leads for easier identification of failures. The key is to develop industry specific solutions that will utilize IoT, AI and machine learning in

an effective way to ensure optimum utilization of water thereby protecting our finite water resources.

For example, Grundfos's Demand Driven Distribution (DDD) is a technology that is based on the equitable distribution of the resource. The system ensures that the user receives the required amount of water based on their needs by studying the consumption patterns of the user. The system also ensures supply at the optimum pressure, in turn, reducing chances of pipe bursts caused by irregular water pressure. This is particularly helpful in India to tackle Non Revenue Water (NRW) losses as the country has an average NRW of 38% above the global average of 30-35% as prescribed by the World Bank⁵.

DDD's predictive maintenance feature also reduces the downtime, increasing reliability. In Cambodia, the Takeo Safe Water Supply Company upgraded their infrastructure with Grundfos DDD to monitor critical parameters such as NRW losses, energy savings, water flow and pressure. Within a year of installation, the plant has achieved 20% savings in energy use, 13% reduction in NRW water losses due to leakages, and a 29% reduction in pipe bursts⁶.

Boosting traditional mechanisms of water management

It is also crucial to ramp up our efforts towards traditional methods of water conservation to fight against water scarcity. Focus should be on enhanced mechanisms of water conservation practices like rainwater harvesting, groundwater recharge that will help us lessen our dependence on natural water resources.

For example, drought prone villages in Maharashtra have integrated traditional and modern methods of water conservation to overcome water crisis. Proper planning at the local level along with state and central schemes have motivated community participation through installation of rooftop rainwater harvesting systems, enabling 1,00,00 villagers across four villages in the state to have access to water throughout the year.

In a country like Denmark, drinking water is entirely dependent on groundwater resources. But Denmark has been successfully preserving its natural water resources with processes like groundwater modelling. This has enabled authorities with information for optimized groundwater abstraction.

Similarly, water reuse can be an extremely efficient tool for water management for water utilities and industrial establishments. Recycling of water presents an opportunity for businesses and industries to look at water reuse as a path toward reducing water consumption

and creating a more sustainable future. In Singapore, the public utilities board launched NEWater, the country's water sustainability plan that recycles treated used water into ultra-clean, high-grade reclaimed water, helping Singapore move towards water sustainability⁷.

Paving the way for a water secure future

As a growing economy, India is one of the largest water users per unit of GDP⁸. We must understand that water is not a commodity, hence we need to act together to save this precious resource. Unavailability of water will have major impacts on the livelihood of people and their economic prosperity.

Involving stakeholders will be the key to help communities overcome water shortage and make way for a water secure future. While India focuses on sustainable growth, water will continue to play an intrinsic part in achieving its sustainable development goals like SDG 6 of achieving universal and equitable access to water⁹.

referrer=aHR0cHM6Ly93d3cuZ29vZ2xlMmNvb
³<https://indianexpress.com/article/cities/delhi/water-level-depletes-yamuna-delhi-jal-board-haryana-release-more-7899837/>

⁴<https://www.worldbank.org/en/news/feature/2019/12/09/solving-water-management-crisis-india>

⁵<https://www.industrialautomationindia.in/articleitm/9351/Non-Revenue-Water-%E2%80%93-A-Fundamental-Challenge-in-India%E2%80%99s-Water-Utility-Sector/articles>

⁶<https://www.grundfos.com/solutions/learn/cases/cambodian-water-plant-enjoys-15-energy-and-water-savings>

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⁹<https://in.one.un.org/page/sustainable-development-goals/clean-water-sanitation-sdg-6/#:~:text=By%202030%2C%20improve%20water%20quality,recycling%20and%20safe%20reuse%20globally.>

¹<https://www.cseindia.org/heat-waves-in-india-a-cse-media-briefing-note-11241>

²https://news.yahoo.com/heatwaves-trigger-water-shortage-across-115322748.html?guccounter=1&guce_

About the Author

Rangarajan Ramaswamy is the Area Sales Director of Water Utility segment. In his role, he is responsible for the Water Utility segment's Business Development and Sales in India, Bangladesh, Bhutan, Maldives and Nepal. With more than 20 years of association with Grundfos India, Rangarajan held various roles in the company. His 29 years of industry experience includes his work across the industrial, commercial building equipment, water treatment, water services and wastewater sectors.

He had a two-year stint with Sun Edison (2014-2015) in their Solar Water Pumps division before returning to Grundfos India in 2016. Rangarajan is a Certified Trainer at Grundfos Training Academy and conducts sessions on pumps and various applications, solar water pumping, energy audit and service marketing.

He also actively participates in industry discussions and platforms focused on sustainability, energy & water conservation, sustainable irrigation, renewables and rural development. Rangarajan graduated with a Degree in Mechanical Engineering from Golden Valley Institute of Engineering, Bengaluru University in 1991.

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WATER ACCOUNTING & BUDGETING FOR INDUSTRIES

By Dilip Yewalekar and Manisha Kinge, Jain Irrigation Systems Ltd.



Water is one of the most critical resources in the world and is necessary for all types of industry. Water is required in substantial quantities to create goods from food products to silicon chips and as a result, there are many opportunities to reduce water use. In the case of the high-tech industry, which uses considerable quantities of water to manufacture semiconductors and other components, water is vital to industry operations. Cleaning and rinsing silicon chips can require billions of litres of water per year; to produce a single chip can use up to 27,000 litre. Apparel also ranks high in the list of water-intensive industries, with cotton production and textile processing requiring substantial inputs of water. Among industrial manufacturers, the forest products sector is the third-largest consumer of water, requiring high volumes of water for pulp and paper manufacturing. The electric power industry directly uses water extensively for cooling and emissions scrubbing; fossil fuel plants and nuclear power plants require hundreds of litres of water for every kilowatt-hour of electricity that they produce. Table 1 shows typical water quantities required to produce one ton of products.

WWS (World Water Stress)

In the world, 18.4 % of total renewable freshwater resources available are

Table 1: Water Quantities to produce a one-ton product.

Paper	79,000 - 1,998,000 litre
Beer	8,000 - 25,000 litre
Sugar	3,000 - 400,000 litre
Steel	2,000 -350,000 litre
Soap	1,000 - 35,000 litre
Gasoline	100 - 40,000 litre
Textile	8,000 -14,000 litre per 100 kg
Fertilizer	8,000 - 20,000 litre

Source: UN, World water assessment program-report 2009

being withdrawn and 72% of all water withdrawals are used by agriculture, 16% by municipalities for households and 12 % by industries. Including India, many Asian countries reach high water stress (Fig.1), which means there is not enough water to cater for the need of agriculture, community and industries. So it is necessary to do the precise water management, budgeting and accounting of fresh water and wastewater without losing a single drop of water and minimizing losses of water, help in reducing the water stress up to certain extend.

Water End Uses: How Water Is Used at Facilities

Understanding water end uses is critical to identifying water savings opportunities. While end uses of water vary by industry and by facility, there are categories of water use that are present at most industrial facilities. A typical configuration water management chart for the industry is shown in fig.3.

Water use in most industries can be classified into the following broad end uses:

- Production processing and in-product use
- Auxiliary processes.
- Cooling and heating.
- Indoor domestic use.
- Landscape irrigation.

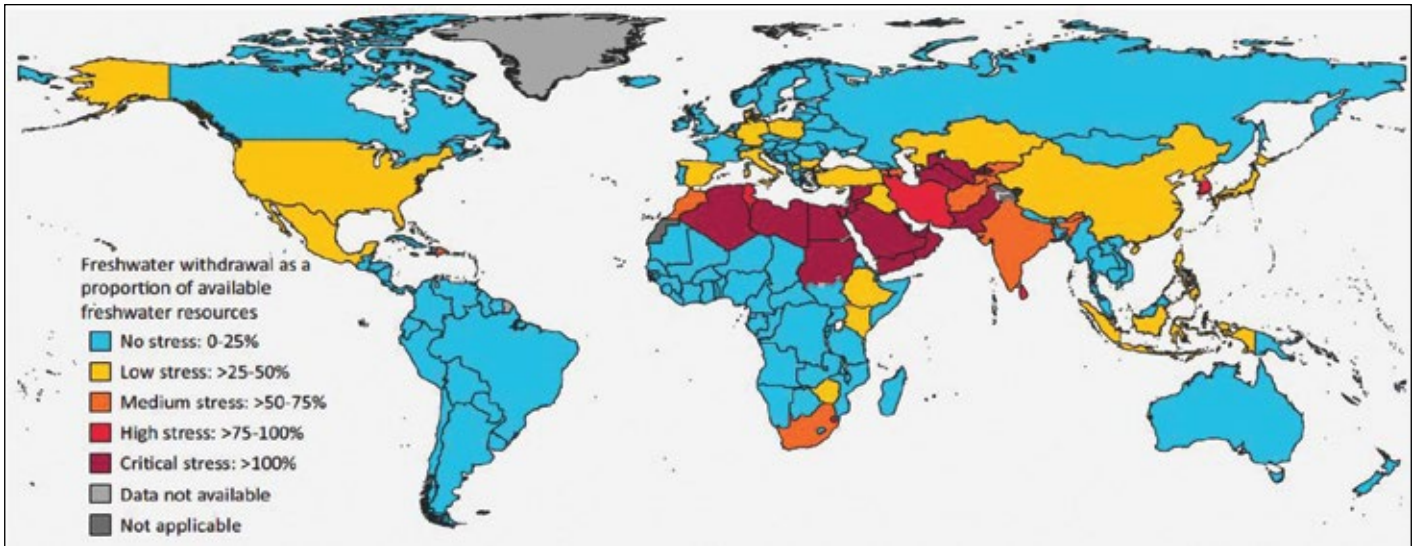


Figure 1. Water Stress Countries (Ref: UN-Water Report July 2021)

The amount of water required for the various end uses differs by industry. Service and manufacturing facilities require the most water for washing and processing, while food and beverage facilities use most of their water intake in product preparation.

Major end uses of water often provide the greatest opportunities for minimizing water losses and waste reduction and efficiency improvement. For example, in many foods, beverages, and pharmaceutical companies, cleaning process equipment can account for as much as 50 to 70% of a facility's total water use and represents a substantial opportunity to save water.

Water Supply Scheme for industry shall be designed normally to meet the requirement over a period of 30 years as per the need & type of industry. However, the design span can be modified as per the life of components, serviceability, and expansion of industries, advancement, government policies, and use of automation.

Factors affecting consumption of water in Industries

1. Size of industry. (Area).
2. Type of Industry.
3. Requirement of water for industry.
4. Amenities.
5. Manpower.
6. Climate.

7. Quality parameter of water for Industry and personnel.
8. Source of water.
9. Government policies and norms. i.e. Water resources and Environment & Pollution board.

Water allocation norms for Institutions

In the code of Basic Requirement of water

supply, drainage, and sanitation (IS:1172-1983), as well as the national building code, a minimum of 135 lpcd, has been recommended for all residents. The institutional water requirement shown in table 2.

While the per capita rates of supply recommended will ordinarily include the requirement of small industries distributed within a town, separate provisions will have to

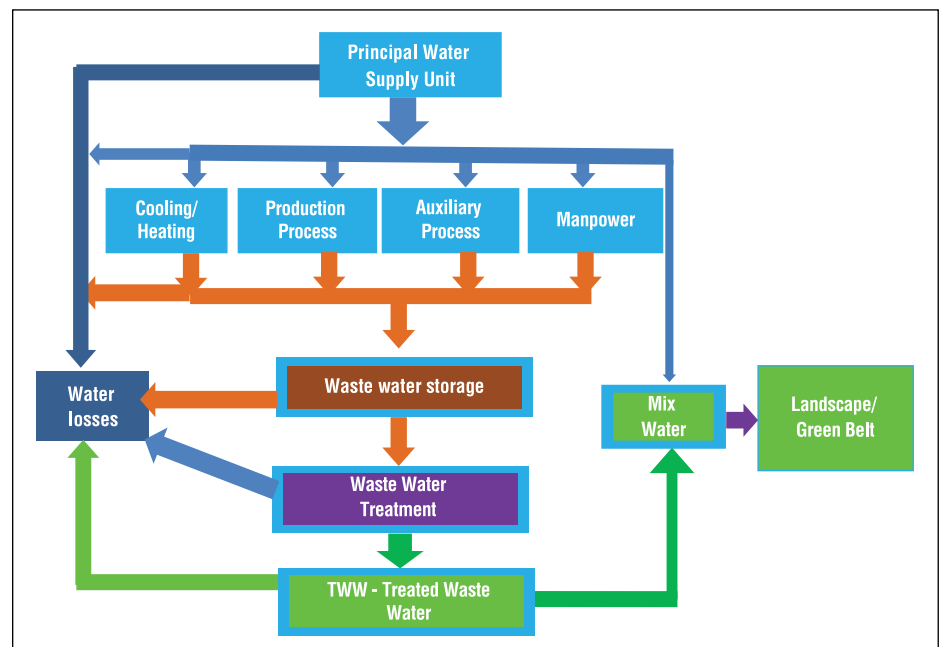


Fig 3. Water management flow chart for the industry

Table 2. Institutional Water requirement.

Sr.	Institutions	Litre per head per day
1.	Hospital	450
2.	Hostels	135
3.	Boarding schools/colleges	135
4.	Restaurants	70
5.	Airport and Seaports	70
6.	Railway Station	70
7.	Offices	45
8.	Cinema	15
9.	Industries	45

be included for meeting the demand likely to be made by specific industries in the urban areas. The forecast of this demand will be based on the nature and magnitude of each such industry and the quantity of water required per unit of production. The potential for industrial expansion should be carefully investigated, so that the availability of adequate water supply may attract such industries and add to the economic prosperity of the community. As can be seen from table 2, the quantities of water used by industry vary widely. They are also affected by many factors such as cost and availability of water, waste disposal problems, management, and the types of processes involved. Individual studies of the water requirement of a specific industry should, therefore, be made for each location, the value given below serve only as guidelines. In the context of the reuse of water in several industries, the requirement for fresh water is getting reduced considerably

Integrated Water Management (IWM)

Concrete strategy has to be implemented to establish integrated water management in the industries right from creation of water source and its uses for various purpose. Use of Digital Technology, Sensors, Artificial intelligence/IOT, devices and advanced methodology must be used to minimize the losses and use water efficiently in the industries.

Stages in IWM

Broadly following stages shall be considered during IWM.

1. Water Source / Creation of water source.
2. Pre-water treatment before use for the specific purpose as per need.
3. Water distribution at various units by using a piping system.
4. Wastewater collection.
5. Zero Liquid Discharge (ZLD) Waste Water Treatment or Treated Waste Water (TWW) shall be used.
6. Use of Treated Waste Water (TWW).
7. Metering at various places to monitor the flow and losses.
8. Control devices- valves.
9. Use of sensors, and controllers to monitor the process.

10. Mathematical module to work out the correct requirement of water.
11. Power savings devices / Use of solar power.
12. Use of mixed water (fresh + TWW) for landscape or green belt by using a sprinkler/drip irrigation system.
13. Budgeting and accounting of water.
14. Audit and mitigation for judicious use of water and cost control.
15. Control or Minimize the ground /river/sea or freshwater pollution.
16. Meeting norms of Pollution board.

Use of Digital technology in IWM

To get a better & accurate timely accounting of water use patterns in the industries, it is better to use Digital Devices, Sensors, and Controller & Software.

It will be help to stabilize the entire process of water uses in the industry. Also it helps to optimize the power uses and cost at various stages.

Features of Digital technology

- Digital flow meter (Magnetic/Laser) & pressure sensors can provide accurate data and other system can be integrated to it at single point.
- Laser Water level sensors at water storage tank can be integrated to motor pump set, controller & supply point to optimize the use of power and power cost.
- EC/pH on line sensors can be installed and interconnected to auxiliary injection pump to maintain the desired value, thereby wastage of chemical avoided.
- Water losses can be controlled or avoided by using advanced equipment.
- Data base is used, to determine the appropriate frequency of water uses on hourly, daily or weekly basis that best meets the various facility's needs.
- Alarm system can be set up for leakages, wastages, losses, pressure drop, negative pressure, functioning / non-functioning of any valve-devices, flow in the network.
- Post water use reduction goals and water usage information on the factory floor on Lean production control boards or in other accessible places to raise awareness of water use and efficiency among employees.
- Track data from water meters, other devices over time. Portfolio Manager, an online building performance benchmarking tool available from the ENERGY STAR program can help to track and benchmark water consumption data.

Algebraic Logic: Water Balance Equation

Appropriate industrial water management can be programmed in water balance equation and configured. (fig.4). Means, (B) balance water is a credit balance of water after (C) Consumption and (L) losses from (A) inflow. It will help to do accounting and audit of water as demonstrated in Table 3.

Table 3. Accounting of water for Industries (*)

Sr.	Heads	Cost (Rs per 1000 litre)
1.	Capex	
a.	Creation of water source (drilling bore well)	
b.	Purchase of water from agency (Corporation, Irrigation Dept, Water Resource Dept, Water Supply Dept).	
c.	Infrastructure cost- intake structure, water tank, Pump equipment.	
d.	Water purification plant/ RO Plant.	
e.	Water transportation & distribution cost.	
f.	Power equipment (Electrical/DG set/Solar)	
g.	Digital control cost, devices, program.	
h.	Waste water Treatment	
i.	Landscape /Green Belt with irrigation facility.	
j.	Other related cost.	
k.	Taxes (GST, Service)	
l.	Sum of Capex (Rs)	
m.	Capex per 1000 litre of water (Rs)	
2.	Opex	
a.	Interest rate of Capex (assumed 10% pa)	
b.	Equated Principle	
c.	Depreciation	
d.	Insurance of materials / manpower	
e.	Water charges / Water bill	
f.	Power Charges /bill/Fuel cost	
g.	Consumable parts.	
h.	Chemical for treatment.	
i.	Fees for Pollution board, Govt, Audit & others	
j.	Admin Cost @ 2% of capex.	
k.	O & M cost @ 2% of capex	
l.	Subscription fee Software /Cloud storage/Internet	
m.	Sundry / unforeseen expenses	
n.	Sum of Opex (Rs)	
o.	Opex per 1000 litre of water (Rs)	
3.	Revenue	
a.	Total volume of water at inflow measured by devices.	
b.	Volume of water consumed measured by devices.	
c.	Volume of water losses measured by devices.	
d.	Volume of water Balance measured by devices.	
e.	Unit cost per 1000 litre of water at inflow	
f.	Unit cost per 1000 litre of water consumed.	
g.	Unit cost per 1000 litre of water balance	
h.	% of Capexsharing of total product cost.	
i.	% of Profit sharing for water used or profit per 1000 litre of water.	
4.	Benefit Cost Ratio	
a.	Opex per 1000 litre of water.	
b.	Sharing profit per 1000 litre of water.	
c.	B.C. Ratio (BC ration = b/a).	

Source: Modified-North Carolina Department of Environment & Natural Resources, Water efficiency manual for commercial, industrial and institutional facilities, May 2009.

(*) This table is given for reference purpose only. It will vary as per the type of industry, water uses and allied factors.

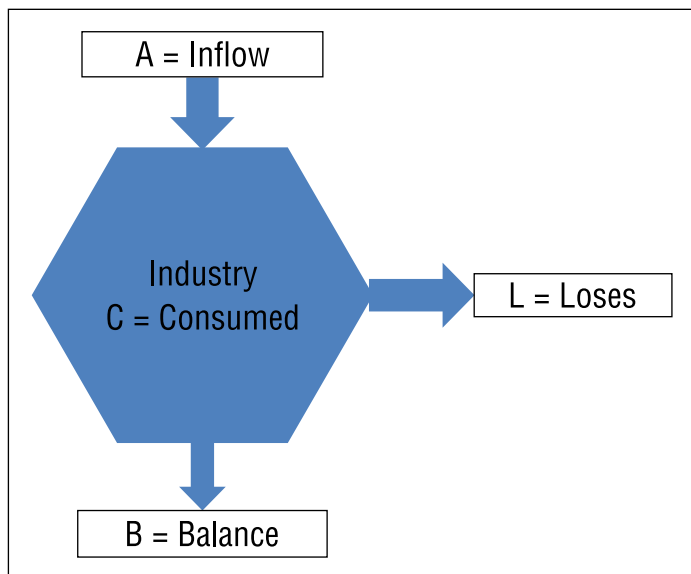


Fig 4. Water Balance Equation

$$\sum B = \sum A - \sum (C+L)$$

Conclusion

Water is very important input for the industry and contributes cost in the production process, unfortunately no accounting/auditing is being done in proper way or neglected or under estimated by many industries. This article will help to understand the importance of water accounting and to can be incorporated as a separate profit center in balance sheet instead of conventional type of balance sheet. It also help to meet the requirement of water foot print and environmental certification. Mix of TWW (Treated Waste Water) and fresh water can be used for irrigation of lawn, landscape, green belt by using Sprinkler and Drip Irrigation System, thereby losses of water, water savings and power savings can be achieved.



PopUp Sprinkler-Use of TWW for lawn.



Micro Irrigation for Landscape, Garden

Thanks & Acknowledgement.

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- 2) Dennis Becker & others- Integrated industrial Water management- Challenges, Solutions, and future priorities, WillyOnline library, Germany.
- 3) Manual on water supply & Treatment, CPHEEO, Govt of India.

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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 Google scholar, Member of ICID.

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By Anupam Pathak, Thermax Ltd. | Innovation and Technology Group



One of the key challenges industries face today is fulfilling their freshwater demands. As per the World Bank's estimate, the present industrial water use in India is about 13 percent of the total freshwater withdrawal in the country. Water demand for industrial uses and energy production will rise at a 4.2 percent annual rate, from 67 billion cubic metres in 1999 to 228 billion cubic metres by 2025.

- Unexpected events and uncertainties associated with operations and feed

To overcome these challenges, customised plant audits will be helpful. These audits will not only help to find solutions for a specific case, but also prevent any unforeseen events that may arise in the future. The findings from the audit can be used to reduce operational costs. Audits can help to formulate efficient ways to upgrade the existing treatment. Plant audits are useful when there is a need to decide whether retrofitting new technologies or revamping existing ones can solve a problem. Thermax provides expert services such as plant audits, treatability tests, pilot testing, and membrane autopsy. These services are crucial in identifying wastewater characteristics, design challenges, and providing innovative as well as cost-effective solutions to modern-day challenges associated with existing treatment schemes faced by industries.

Treatability studies are effective in understanding wastewater, its behaviour, and suitable treatment alternatives. It helps in optimising

This creates space to set up treatment facilities for water recycling and reduce dependency on conventional sources. Zero Liquid Discharge (ZLD) is an effective wastewater management system that ensures net-zero discharge of industrial effluent into the environment. This can be achieved through recycling, recovering and reusing the treated effluent. However, sustainable operations of recycling and ZLD are not easy for various reasons, such as changing water quality, operational costs, and related uncertainties.

Various industries have installed ZLD plants to recover the wastewater generated. However, operating teams may face challenges while achieving the desired performance for the following reasons:

- Ageing infrastructure
- Changing wastewater quality and quantity
- New streams are being added due to changing product mixes
- Presence of complex, emerging constituents



Zero Liquid Discharge plant installed by Thermax

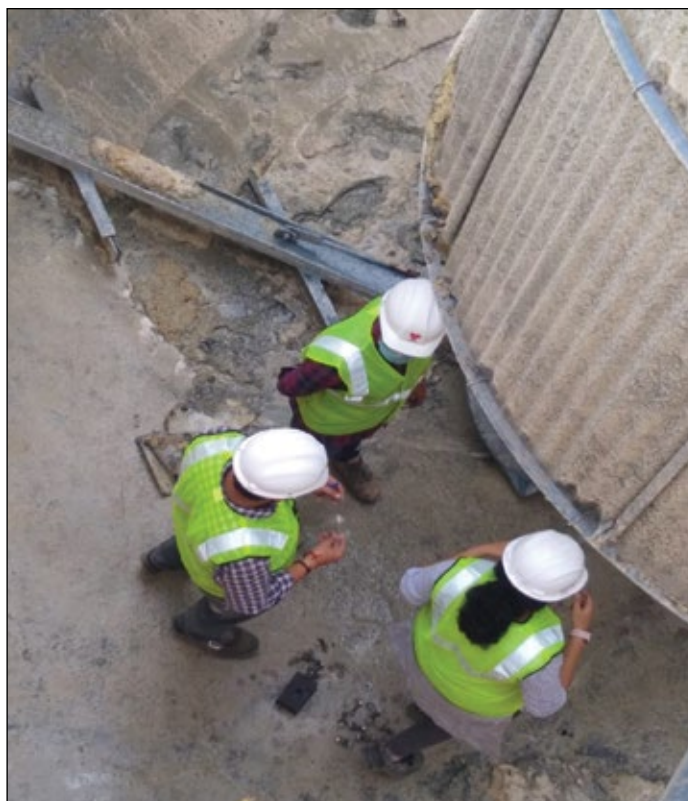
chemical consumption and dosages required for treating wastewater, which reduces the operational costs. Pilot testing, on the other hand, is suggested to minimise uncertainties while treating complex effluent streams. For example, one of the largest steel manufacturing units was generating wastewater from coke oven operations. The wastewater was treated to a certain extent and reused for quenching. The customer had expanded the production capacity and wanted to comply with stringent marine discharge standards. An expert team from Thermax carried out extensive treatability tests, and an efficient solution was offered.

Membranes are widely used for MF, UF, and RO applications for recycling plants. Any change in water quality or operational conditions can have an impact on membrane life, plant performance, and operational costs. Sometimes, due to unforeseen events, the membrane may get damaged. Thermax conducts membrane autopsies to recover membrane performance. This is an important step in understanding membrane health and the reasons for reduced performance. Thus, the repetition of such events in the future can be avoided.

These customised services play a vital role in ensuring smooth operations and reducing the risks of operational failures and losses. Customers can achieve and sustain desired performance from existing assets by utilising these services.



Treatability/Pilot Testing for Wastewater Treatment



Evaluation of mechanical equipment by the Thermax team



Plant audit at a Thermax customer site

About the Author

Anupam Pathak is the Process Engineer at R&D, Thermax Ltd. He has experience in Technical audits/evaluations for STP, ETP, WTP, Recycle ZLD. He is involved in Product development- applications of efficient technologies in water and wastewater treatment.

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COOLING WATER TREATMENT & MANAGEMENT: EXPERIENCE OF A FERTILIZER & CHEMICAL COMPLEX

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



The function of a Cooling Tower (CT) is to dissipate heat from industrial process systems with Water as a heat transfer medium. A cooling tower uses a combination of heat and mass transfer (evaporation) to cool the water flowing through the tower, in which the heat transfer accounts for 20 - 30% of the total heat dissipated and remaining 70 - 80% of total cooling results from evaporation of recirculating water. The water lost by (i) evaporation, (ii) tower drift, (iii) leaks in the system (unintentional blowdown), and (iv) intentional blowdown is replaced with makeup water.

During the course of heat dissipation, the cooling tower water (CW) concentrates its ions, which can have detrimental effects to the cooling water system in terms of corrosion, scale, microbiological fouling, foam etc. As given below, the cooling water chemistry plays a significant role in causing undesirable effects.

- pH: Acidic water leads to corrosion and alkaline nature is scale forming, hence this indicator is very important in a cooling tower.
- Alkalinity and hardness: They control the potential of calcium carbonate scale.
- Chlorides: It can be corrosive to metals, particularly SS, causing stress corrosion.
- Hardness: It contributes to scale in the cooling tower and on heat exchangers.

- Iron: When combined with phosphate, iron can foul equipment.
- Organic matter & process leaks: They promote microorganism growth, which can lead to fouling, corrosion, and other system issues such as foaming.
- Silica: It causes hard scale deposits.
- Sulfates: They can be extremely corrosive like chlorides and can form scales.
- Total Dissolved Solids (TDS): These contribute to scaling, foaming, and/or corrosion.
- Suspended Solids (SS): These undissolved contaminants can cause scaling, biofilm, and/or corrosion and can harbor bacteria.
- Microbes: Growth of bacteria and algae result in biofouling on the cooling system surfaces thus resulting in heat exchange efficiency loss. There is also a risk of Microbial-Induced Corrosion.
- Ammonia: Ammonia together with Dissolved Oxygen can be very corrosive to yellow metals such as Copper and Brass.

While corrosion can be controlled by maintaining pH of cooling water on slightly alkaline side and ensuring thorough passivation layer of corrosion inhibitors on the metallurgy of equipments, control on the scale formation can be achieved by one or more of the following strategies:

1. Limit the concentration of critical ions by maintaining them below such levels, which are necessary for scale formation.
2. Reduce alkalinity with acid to remove carbonate and bicarbonate by converting them to CO_2 . Since the carbonate level is controlled, the potential for calcium carbonate formation is restricted.
3. Alter system design or operation viz. increasing cooling water velocity, air rumbling in heat exchanger inlet water to dislodge and remove scales and deposits, modifying the exchanger design to take water on the tube side for higher water velocity, changing the metallurgy of the heat transfer surface.
4. Apply chemical inhibitors. There are several types that act in distinctly different ways to control deposits.

Medium and large cooling towers are treated with both scale inhibitors and corrosion inhibitors, usually but not always, contained in a single or two liquid formulations. Inhibitor products are usually fed on a continuous basis to maintain inhibitor concentration in recirculating water. For microbial control, it is common to use an oxidizing biocide as a primary biocide and a non-oxidizing biocide as a secondary biocide. Oxidizing biocides are either fed continuously at a low level or periodically at a higher level. Non-oxidizers are dosed as needed and only when oxidizing biocides are not effective.

In view of foregoing facts and varied dimensions of operating CW systems, CW treatment and management is not only a science but it is more an art. This paper aims at highlighting some of the experiences and knowledge gained by a large-scale fertilizer & chemical complex while operating 16 CW systems during last more than 40 years.

COOLING WATER SYSTEMS:

Starting from 2 induced draft open recirculating cooling water systems for fertilizer plants in 1981, the referred complex kept on adding CW systems for new manufacturing plants in fertilizer / chemical / power sectors to reach to 16 CW systems. Also, capacity of many cooling towers was enhanced for increased production of its on-going products. The recirculation rates of these cooling towers range from 300-500 M³/Hr to 40,000 M³/Hr and make up water rates range from 50 M³/Day to 9,000 M³/Day. Depending upon tower capacity and heat load, the number of cells in cooling towers range from 3 to 14.

The make-up water used for cooling purposes is river water which is treated for removal of turbidity, organic matter and microbial load. Typical quality of make up water is given in Table 1.

Table 1. Make up water quality

Parameter	Unit	Typical range
pH	-	7.0 - 7.5
Conductivity	Micro mhos / cm	250 - 300
Alkalinity as CaCO ₃	ppm	100 - 120
Total Hardness as CaCO ₃	ppm	90 - 130
Turbidity	NTU	1 - 2
Total Dissolved Solids	ppm	150 - 200
Chlorides as Cl	ppm	15 - 25
Soluble Silica as SiO ₂	ppm	15 - 20
Aluminium as Al	ppm	0.1 - 0.2
Viable Bacterial Count	Number / ml	< 100
Sulphate Reducing Bacteria	MPN / 100 ml	< 10
Sulphate as SO ₄	ppm	15 - 20
Calcium as CaCO ₃	ppm	50 - 70
Magnesium as CaCO ₃	ppm	40 - 60
Ortho Phosphate as PO ₄	ppm	0.1 - 0.2
Zinc as Zn	ppm	BDL
Iron as Fe	ppm	< 0.1

COOLING WATER TREATMENT:

Starting with package treatment chemicals provided by an overseas water treatment expert company in very infant stage of the unit, cooling water treatment has seen many shifts with ever increasing knowledge base among its own people and development of Indian water treatment companies in early 80's. All throughout these years, however, the complex has broadly relied upon conventional treatment program based on Phosphates - Zinc - Polymer in conjugation with Chlorine as oxidizing biocide and a few non-oxidizing biocides.

After having faced some glitches in performance of CW systems with overseas treatment program within 4-5 years of initial plant operation, the unit switched to in-house CW treatment program based on Ortho Phosphate, Poly Phosphate, Organo Phosphonate, Zinc, Polymeric Dispersant, Sulfuric acid and Chlorine gas. These chemicals were dosed individually and their levels in recirculating water were checked on a daily basis. For effective administration of dosing, unit also formulated its own single liquid formulation which incorporated all treatment chemicals, which rendered the dosing quite easy, since maintenance of a single liquid could sustain requisite levels of all the corrosion & scale inhibitors.

The era of in-house treatment continued for almost 15 years. With availability of specialized water treatment expert industries in India who not only provide treatment programs but also take care of monitoring with guaranteed performance at a lower cost than in-house treatment, the complex took a step-wise leap towards handing over CW treatment to third party expert companies one system after another. All 16 CW systems were then being handled by a third party with unit's own supervision and control on dosing of chemicals for more than last 2 decades.

During > 40 years of operation of various CW systems for fertilizer, power, chemical and petrochemical plants, the referred unit has never faced major down-time on account of problem in CW system. A close eye on water chemistry, levels of inhibitors and biogrowth through own Laboratory and Independent Cooling Tower Cell and ever pro-active approach of management have helped in sustaining highest possible production levels without hurdles on cooling tower side.

CORROSION & SCALE CONTROL:

The CW treatment chemicals used for corrosion and scale control consisted of following ingredients :

- Blend of zinc and ortho phosphate
- Polymeric dispersant
- Organo phosphonate
- Sulfuric acid

MICROBIAL CONTROL:

The microbial control was achieved through a host of chemicals to avoid

resistance development. A bio-dispersant was continuously maintained in CW to prevent colonization of the microbes.

Oxidizing biocides:

- Chlorine gas
- Chlorine dioxide
- Bromine release compound (for specific CT)

Non-Oxidizing biocides: To avoid immunity development, following 3 types of non-oxidizing biocides were selected for giving a shock treatment, when Chlorine and Chlorine Dioxide were not found effective.

- Quaternary Ammonium compound
- Dichlorophene
- Thiocarbamate

The procurement planning of all these chemicals was planned by CT cell and executed by Materials Management Dept based on available inventory. Upon receipt of supply at Central Chemical Store, all treatment chemicals were bound to undergo quality control tests at unit's own laboratory. On the basis of QC findings Vs product specifications, it was the independent and neutral decision of Laboratory Dept to declare 'acceptance' or 'rejection' of the chemicals. Central Stores would issue the chemical for use only upon having authorization of Laboratory Dept.

MONITORING OF COOLING WATER CHEMISTRY AND KEY INDICATORS:

Desired levels of various ions in CW were cautiously fixed in consultation with experts (Table 2) so as to minimize chances of corrosion and scale formation. Having known the significance of appropriate monitoring of CW chemistry, the unit had been undertaking exhaustive analysis of all the cooling waters through its own laboratory at a much higher frequency:

- pH and residual chlorine analysis on 2 or 4 hourly basis
- Daily analysis of inhibitor concentration and requisite dosing of treatment chemicals.
- Complete analysis of all cooling waters twice or thrice in a week to know about higher blow down, cycles of concentration, and alarming levels of other scale forming ions.
- Total viable bacterial count once every week
- Sulfate reducing bacteria count once in a fortnight
- Corrosion rate measurement through placement of Mild Steel & Stainless-Steel coupons once every month at CW supply header, CW return header and CT basin.
- Calculation of Cycles of Concentration on weekly and monthly basis to check adherence to desired COC.

Moreover, the CW contractor company used to undertake spot analysis on need basis. Oxidation Reduction Potential (ORP) measurement was also carried out on need basis to know about biofouling. With due attention and vigilance on analytical side, the deviations on CW chemistry were very negligible.

PHYSICAL OBSERVATION OF HEAT EXCHANGERS

During each annual turn-around of plants, the heat exchangers were

Table 2. Desired characteristics of Cooling water

Parameter	Unit	Value
pH	-	6.8 - 7.5
Conductivity	Micro mhos / cm	2000 max
Total Hardness as CaCO ₃	ppm	800 max
Turbidity	NTU	15 max
Chlorides as Cl	ppm	250 max
Soluble Silica as SiO ₂	ppm	125 max
Viable Bacterial Count	Number / ml	< 1,00,000
Sulphate Reducing Bacteria	MPN / 100 ml	< 150
Ortho Phosphate as PO ₄	ppm	5 - 6
Zinc as Zn	ppm	0.5 - 1.0
Iron as Fe	ppm	1 max
Organo phosphate as PO ₄	ppm	0.3 - 0.6
Corrosion rate	mpy	3 max

opened for physical inspection in presence of water treatment expert company, respective plant in-charge, Maintenance dept, CT cell and Laboratory. Photographs were taken and observations recorded. Samples of scale, sludge, fouling material were collected and analysed by Laboratory. Water jet cleaning of exchanger tubes was performed. Wherever necessary, sulfamic acid cleaning was done till iron pick up came to a stable level.

SCALE / SLUDGE ANALYSIS

The collected samples were thoroughly analysed for various metal oxides. Loss on Ignition at elevated temperature provided idea about organic or inorganic nature of scale and sludge. The detailed analysis was used to derive clues about corrosion, scale formation, metal pick up, phosphate deposition etc. Required changes in chemical treatment were accorded based on chemical analysis and physical observation of exchangers.

CYCLES OF CONCENTRATION

Water being a precious and scarce natural resource, it is highly pertinent to save as much water as possible. Operating cooling towers at higher COC serves dual purposes of (i) water conservation and (ii) lower down treatment cost since chemicals are not lost through blow down water. The unit has been striving to reduce CW blow down by increasing cycles of concentration of CW without much adverse impact on cooling tower performance. Commencing with 3-4 cycles of concentration in initial years, the complex had targeted 5-6 cycles of concentration on Silica base. Due to constant vigilance, the unit had been successful in operating all cooling towers at 5-7 COC.

CORROSION RATE

For determining corrosion rate through metal strips (coupons) of MS and SS, specially designed corrosion coupon stands were housed in supply header and return header of all 16 CW systems. Clean and pre-treated coupons were exposed in the CW for each cycle of 1 month and corrosion rates determined on the basis of metal weight loss of coupons. Against target of < 3 mpy corrosion rate, the treatment and effective monitoring

have helped unit in achieving < 1 mpy corrosion rate on a consistent basis on MS coupons.

CHALLENGES FACED

During > 40 years, there were several challenges in the way as far as make up water, CW performance, process leaks, atmospheric ingress are concerned. During the course, non-chemical treatment was also experimented to keep pace with ever developing technology. These experiences and the ways of overcoming these challenges have been briefed hereunder.

Make up water contamination by sea water: Due to low flow in river from where water is drawn, there were occasions of heavy ingress of sea water in the river water due to high tide of sea, which is 40 km far from water source. The chloride level went as high as 200–250 ppm from usual value of 15-20 ppm. Though tidal effect is a fortnightly event taking place on 'full moon' and 'no moon' days, the effect of contamination of river water by sea water continued for longer period, as beginning and end of tide was taking place before and after 3-4 days of 'full moon' or 'no moon' days. Cooling tower operation with observance of 250 ppm limit of Chloride was very difficult, leading to drop in COC from 5-6 to 1-2.

To combat the situation, CW treatment program was enhanced by few more treatment chemicals which could take care of higher Chloride in CW. Molybdate and Pyro Phosphate inhibitors along with high-power stress polymeric dispersant were additionally dosed. With confidence development, limit of Chloride was raised up to 700 ppm at occasions. The annual average Chloride concentration remained around 500 – 550 ppm in each CW. However, the subsequent plant shut down did not show signs of much deterioration on heat exchanger surface, which provided boost to combat tidal effect in future using enhanced CW treatment program.

Methanol leakage: A lot of foam generation was observed in one of the CTs of a chemical plant. The viable and sulphate reducing bacteria were found flourishing. Heat exchange was also remarkably reduced in a critical exchanger located at elevated height. Such abnormal behaviour was suspected because of ingress of some process stream due to exchanger leak. However, the process parameters indicated no signs of any leakage. The situation of excessive foam and reduced heat transfer was tackled by repetitive removal of foam by physically scrapping for the time being, since heavy blow down was not able to get rid of the foam from CT basin. CW operation was handled with heavy chlorination and frequent dosing of non-oxidizing biocides on rotation basis during this critical period.

As no change in abnormality was noticed for days together, the plant parameters were minutely observed and some unconventional tests of CW were carried out by Laboratory. The combined knowledge could help in identifying methanol leakage from process side. After isolation and maintenance of the leaky equipment, the problems of foam, heavy bio growth and reduced heat transfer were gradually resolved.

Ammonia leakage: In one of the fertilizer plant CT, there were random incidences of ammonia leakage, during which chlorine demand of CW got increased leading to high build-up of Chloride concentration, which curtailed COC of CT. Moreover, growth of nitrifying bacteria caused ammonia oxidation into nitrates and low pH. Under such circumstances, chlorination frequency was reduced and application of non-oxidizing biocides was enhanced. Occasionally, sodium hypochlorite solution was added to save costly biocides. Due to drop in CW pH, it became necessary to discontinue dosing of sulfuric acid at occasions. The modified treatment was continued as long as ammonia levels were higher.

Contamination by fertilizer dust: During certain period of year, there were occasions of ingress of fertilizer dust into some cooling towers which are in vicinity of fertilizer plant. The ingress of fertilizer dust built TDS level of CW. Also, bacterial growth increased since fertilizer dust feeds the microbes. Many a times, algal boom was experienced, which not only reduced heat transfer but supported bacterial growth underneath. Extent of this problem could be reduced by covering complete top deck of the CTs.

Non-chemical treatment: With advent of non-chemical treatment for environmental protection and low cost, non-chemical treatment based on magnets and ultra-low frequency electromagnetic waves were tried in some of the cooling towers on experimental basis. The basic principle of these types of treatment is that they energise water molecules and other constituents in such a way that hard scales do not form. Due to process leaks and other typical observations in cooling towers of process plants, these treatments were supplemented with chemicals for some period of time. Long standing experience for these novel treatment programs could not be built.

Inconsistency in chlorination: In medium sized CTs, there were issues with availability of required level of residual chlorine, when chlorine gas was directly fed into CT basin. There were incidences of either no residual chlorine or very high level of residual chlorine. Since high chlorine level causes delignification of wood, it was necessary to maintain 0.2-0.5 ppm level. After installing a system to generate chlorine-rich water and its charging at low rate into CTs could eliminate the problem of inconsistent residual chlorine levels.

CONCLUSION

CW treatment and management is a complex subject which needs to be tactfully handled. CW is an auxiliary but very important service for a process plant. Satisfactory performance on CW system is, therefore, a must for process plant to operate efficiently. The best available treatment program is also likely to fail in fulfilling the expectations, if proper and timely attention is not given. The essence of success of CW systems lies in strict and vigilant monitoring of the treatment program. Close coordination among Process Plant, CT cell and Laboratory on day-to-day basis proved to be effective in deriving optimum efficiency of CW systems in the referred complex.

About the Author

Dr. Mayur J. Kapadia, MSc, PhD, is a former Add General Manager & Laboratory Head of GNFC Ltd - a large sector chemical & fertilizer manufacturing company located at Bharuch, Gujarat, India. He possesses professional industrial experience of > 38 years in the fields of Quality Control of Chemicals / Fertilizers / FMCG products, New Laboratory Set up, Cooling Water Management, ISI certification, Technical Education, Research, Effluent Treatment, Supplier development, Cost Reduction and Administration. He has to his credit technical suggestion awards, 18 publications in journals / magazines and >10 presentations in conferences. He is a technical expert for recruitment / promotion interviews, external examiner for Ph D / CBSE board. He is presently a member in technical committee of Bureau of Indian Standards rendering immense contribution for establishing and improvising various Indian Standards. He has been assisting various organizations for process trouble-shooting, report preparation, publication and training purposes.

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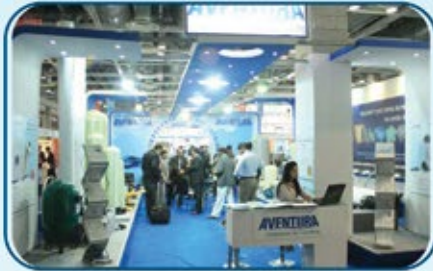
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“

An excellent platform to showcase our products and also build relationships with existing customers

Neeraj Saxena
Howden

“

We are participating for the first time in north India and would like to be a part of the show next year

Mrunal Pawar
Watson – Marlow

“

Best place to generate quality business leads and meet with water community

Daksh Malhotra
Everest Blowers

“

Expo is an opportunity to exchange technology, new researches, development programs around the world under one roof

Manjay Verma
VA Tech Wabag

“

Best place to meet quality visitors, generate leads, meet authorities under one roof

Pitush Narang
Membrane Group

“

We liked the involvement of Government organizations in all the events

Siva Kumar
Pepsico

“

The expo is good, I am happy with the good number of visitors on my stall

Vishal Singh
Deerfos Membrane

“

The hungarian experts found the business meetings during the exhibition extremely useful and forward - looking

Dr. Hilda Farkas
Embassy of Hungary

“

I am very much happy with the expo, I got good numbers of Visitors at stall. Many people attended the expo. It was highly organized

Zon Wei
Shanghai Kent

“

We got the exposure to best- practices of outside India. Focus was on easy and practical solutions like sludge- cutter pumps, innovation sewage treatment for suburban areas.

PK Agarwal
UP - Jal Nigam

“

I am very happy with the expo. We got more than 100 enquires which is great for us. Also, I appreciate the good quality of visitors here in the expo and that came to our stall as well.

Siddharth Singh
Micro Transmission Systems

“

Training was very good and its very comprehensive guide about sewage water treatment. I would suggest a new training topic on Raw/Effluent Water Treatment for Oil Gas Industry

Kaushik Das
ONGC Petro Addition Ltd.

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BACK WASH WATER RECOVERY FILTER BY NEERWAY PROJECTS PRIVATE LIMITED IN RO SYSTEM

By Sachin Maurya (Business Head), Neerway Projects Private Limited



Back washing of MGF & ACF are necessary in RO system, but drainage excess of water is not necessary, NEERWAY Disc filter are most suitable system for water recovery from MGF & ACF Reject.

Many Industries are under water crises and looking for new proven technology for reducing water waste. Thus creating an edge in the water and waste water treatment for the industries NEERWAY has

successfully installed Disc based filtration technology system along with auto flushing control for no manpower requirement. This state of art technology is now a days most demanding in to bottling plant where every water drop are countable.

Many leading bottling plant Company using Disc filter for same purpose and system which automatically clean itself with reduced water reject utilizing less space. Disc filter emerged as an appropriate solution for such house. Disc Filters are fully automatic, equipped with automation for backwash based on pressure differential and time both, without any

axillary sources/pumps. Units are modular type, skid mounted, ready to installation on site and are available with all accessories like Inlet, outlet and drain headers, multiport valves, control panel etc.

Backwash reject water is less than 2% based on water quality and are capable of efficient backwashing even at pressure as low as 2.5 Bar, The design and position of product are convenient for maintenance, cleaning and supervising the component for service, replacement any repair whenever necessary.

Each filter module is equipped with automatic control system (panel), solenoid valves, inlet and outlet pressure gauges, differential pressure system for filtering and backwashing operations, drain pipe with provision for manual back flushing arrangement.

For efficient installation at project site, the inlet and outlet manifolds are provided with flanged cone connections which also facilitate maintenance.

Filter element consists of especially designed Grooved Discs which provides required degree of filtration. Filtering element thickness and designs are appropriate for working upto water temperature of 60°C, and quality material of elements are appropriate for cleaning.

The filtration cycle arrangements are on continuous production basis and design of panel and programming on individually/cycle performance

basis. Whenever one filtration module goes into backwashing mode, the other filtering element modules will provide enough backwash water for cleaning. Backwash Cycle is based on sequence basis i.e. only one filter shall backwash at a time to provide regular supply of water without interruption.

The construction materials of the filtration system are heavy duty, long lasting and suitable for filtering raw water with higher concentration of biodegradables. Filter body are suitable grade Polyamide with fiber glass for avoiding algae formulation during outdoor installation. Fiber grade are effective for handling higher temperature of water up to 60°C. Filtering element rings construction of Poly Propylene and filtering elements frame are heavy duty, suitable for working up to 8 bar working pressure.



About the Author

Sachin Maurya is business head of Neerway Projects Private Limited. He is a master's in business administration from Dr. A.P.J. Abdul Kalam Technical University with entrepreneurial skills and 14 years of field experience. He has good industrial and institutional network for business implementation all over India.

Neerway Projects Private Limited (NPPL) are an ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 certified leading EPC company and **Importer & Exporter of state-of-art technological water products in overseas market for advancement in water infra management.** NEERWAY has produced and offered broadest range of innovative water & irrigation products to industries, municipal water, farms, golf courses, commercial developments and homes.

To know more about the contributor of this case study, you can write to us. Your feedback is welcome and should be sent at: deepak.chaudhary@eawater.com

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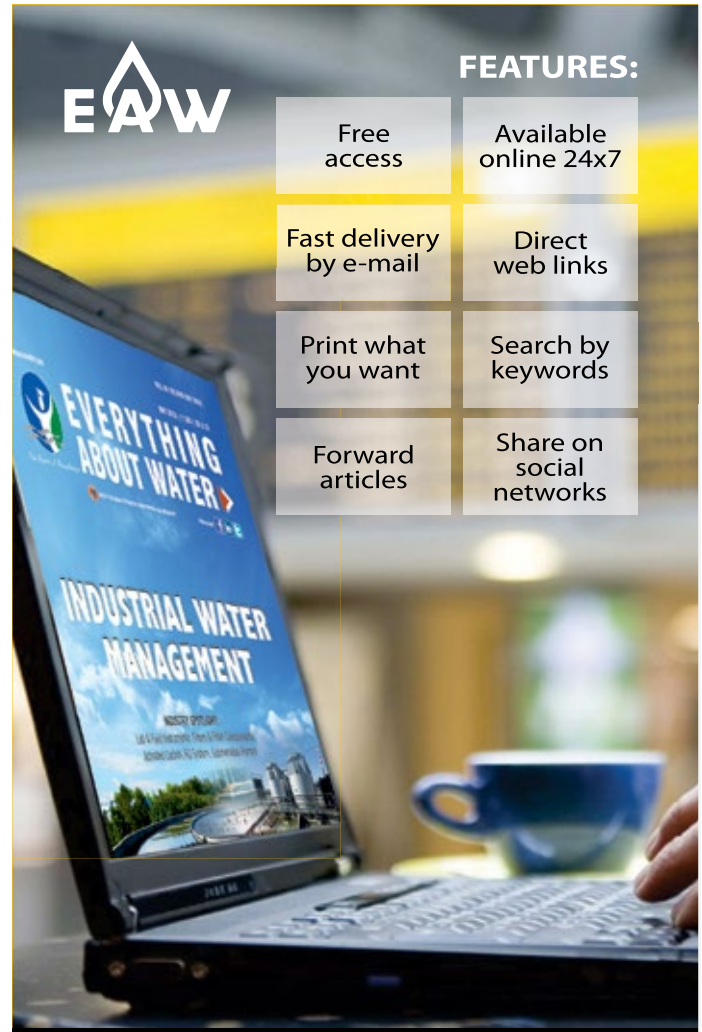
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SIBF SYSTEM - AN IDEAL SOLUTION FOR FOOD PROCESSING WASTEWATER TREATMENT & REUSE

By Navin Singh & Rahul Babar, Energy Tech Solutions Pvt. Ltd.



Introduction

India is the second largest food producer in the world. There is a huge demand for processed foods with changing lifestyle, urbanization and rising family incomes. The food processing industry in India was valued at INR 19.50 trillion in 2020 and is expected to reach INR 34.86 trillion by 2025, expanding at a compound annual growth rate of 12.31% between 2020 and 2025. This industry belongs to 'the sunrise sector' and is one of the fastest growing sectors in India and world over. The Ministry of Food Processing Industries has launched various schemes like Prime Minister Kisan Sampada Yojana (PMKSY), Production Linked Incentive Scheme for Food Processing Industry (PLISFPI) to further boost the sector.

For any food processing industry, water is extensively used as a raw material for production as well as cleaning. The wastewater generated from a food industry is challenging to treat because of high variations in quality and quantity depending on the products manufactured. Also, seasonal variations are observed in many industries as per the harvest season and public demand. The wastewater tends to have high amounts of organic carbon, nitrogenous organics, inorganics, nutrients, suspended and dissolved solids. Thus, the BOD and COD levels are higher (generally

in thousands of mg/l) compared to domestic wastewater. The wastewater can cause severe environmental pollution if it is let out untreated or partially treated. Therefore, it is mandatory to treat the wastewater to satisfy the norms set by CPCB and state pollution control boards before discharge / reuse.

Treatment technologies

The technologies adopted for treating the food processing wastewater are a combination of anaerobic / aerobic as well as physico-chemical processes. They include: flotation, coagulation, sedimentation, filtration, adsorption, membranes, primary settling, secondary activated sludge, anaerobic digestion.

Nowadays, technologically advanced liquid/solids separation screens are used to reduce biochemical oxygen demand (BOD) loads, total suspended solids (TSS) and total Kjeldahl nitrogen (TKN) levels. The reduction of fat and protein content from high-strength wastewaters upstream reduces the amount of chemical and biological processing needed to be done downstream in wastewater treatment plant. Energy consumption, treatment chemicals and manpower demand is considerably higher in WWT compared to upstream screening. After screening the wastewater is passed through a fat trap or a Dissolved Air Flotation (DAF) unit to remove the fat, oil and grease. The wastewater is then further treated aerobically through activated sludge process. Depending on the end use and the discharge norms, further tertiary treatment is decided.

Natural treatment systems are also implemented for treatment of food processing wastewater considering the benefits of huge energy savings and low O & M costs. Land application of wastewater, lagoons and pond systems, constructed wetlands are some of the natural treatment systems which are in vogue. From the sustainability point of view, these systems can help in conserving chemicals and energy, in addition to meeting the regulatory norms.

Solid Immobilised Bio-Filter (SIBF) system is a type of constructed wetland system which has been successfully used for food processing wastewater treatment.

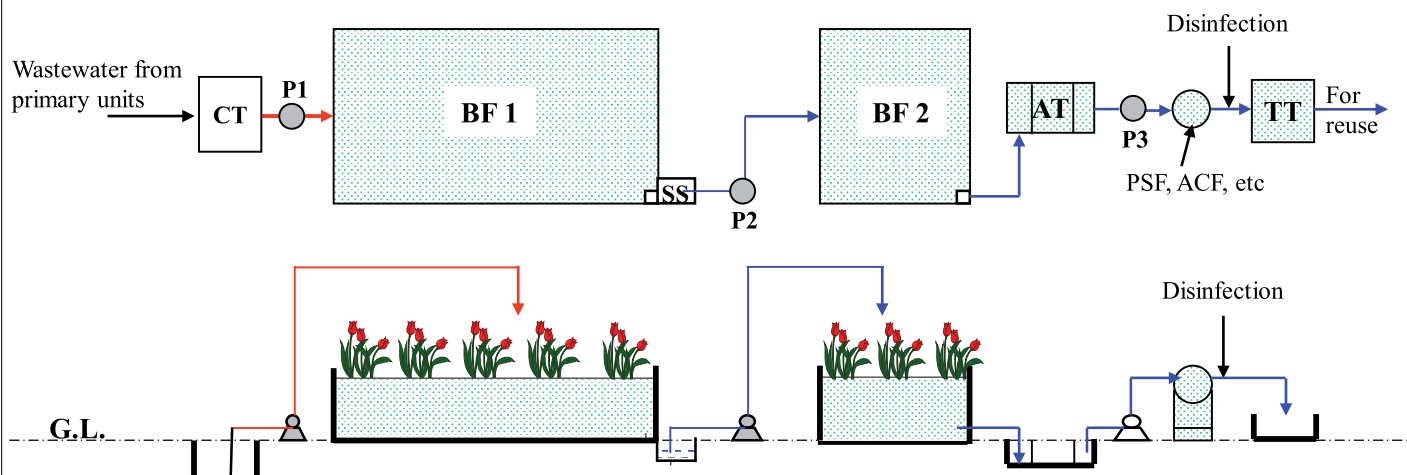
ABOUT SIBF SYSTEM

SIBF system is a natural, sustainable method of wastewater treatment based on ecological engineering. The treatment is achieved through the ecosystem developed for the specific requirement. There is about 95% recovery of the wastewater as treated water. The treatment cost works out to about Rs. 8/- per 1,000 litres of wastewater treated. SIBF System is entirely different from conventional STPs/ETPs & other similar looking natural methods such as Root zone / Reed bed system, Dewats, Phytoid, SBT, Ecosan, etc. Some of these systems have been converted into SIBF System. Many SIBF installations for various wastewaters like slaughterhouse waste water, hospital / residential / ashram / institutional / sweetmeat factories / pharma industry wastewater have been successfully implemented.

The salient features of the SIBF system are:

- Eco-friendly treatment system - Eliminates drawbacks of conventional STP
- Landscaping - The total STP looks like a beautiful garden, thus adds to landscaping.
- Capital cost- Less than conventional treatment systems
- Tax benefit - 100% depreciation benefit
- Energy conserving - Saves 80 - 90% of energy costs over conventional treatment methods
- Easy to operate - Requires very low operating skill
- Very low operating cost - Attributed to low energy and low skill requirement
- Provides value-addition - Re-usable treated water at very low operational cost, hence, a practicable approach towards groundwater recharge by using the treated water for gardening / irrigation throughout the year

Typical hydraulic flow diagram for SIBF system



Legend:

ST/BT – Septic tank / Baffled tank

CT – Collection tank

BF1 - Biofilter 1

SS – Side sump

BF2 - Biofilter 2

AT – Alum tank

PSF – Pressure Sand filter

ACF – Activated Carbon Filter

TT - Treated water tank; (as required)

P - Pumps



- Canna plants (flowering plants)

Note: Biofilters may also be constructed in the amenity space, above parking area or on the podium. This area looks like a beautiful garden due to flowering Canna plants!

Figure showing the typical hydraulic flow diagram of SIBF system

The wastewater is treated through a three-stage process (refer flow diagram above).

1. Primary treatment: Depending on the type of wastewater, this treatment involves screening, oil / fat removal, equalization, etc. After this, the wastewater is collected in the collection tank.
2. Secondary treatment: From the collection tank, the wastewater is pumped to biofilter 1. The wastewater flows vertically downwards through the ecosystem layer of aerobic bacteria - plants in the biofilter. The impurities in the wastewater are trapped and stabilized in this layer. The water from biofilter 1 is collected and pumped into biofilter 2 for second stage biofiltration.
3. Tertiary treatment: The treated water after two stage biofiltration is given tertiary treatment for polishing. This water is passed through alum tank followed by pressure sand filter and activated carbon filter. Finally, the treated water is disinfected and reused.

CASE STUDIES

Two case studies of the SIBF system for food processing industry are given below:

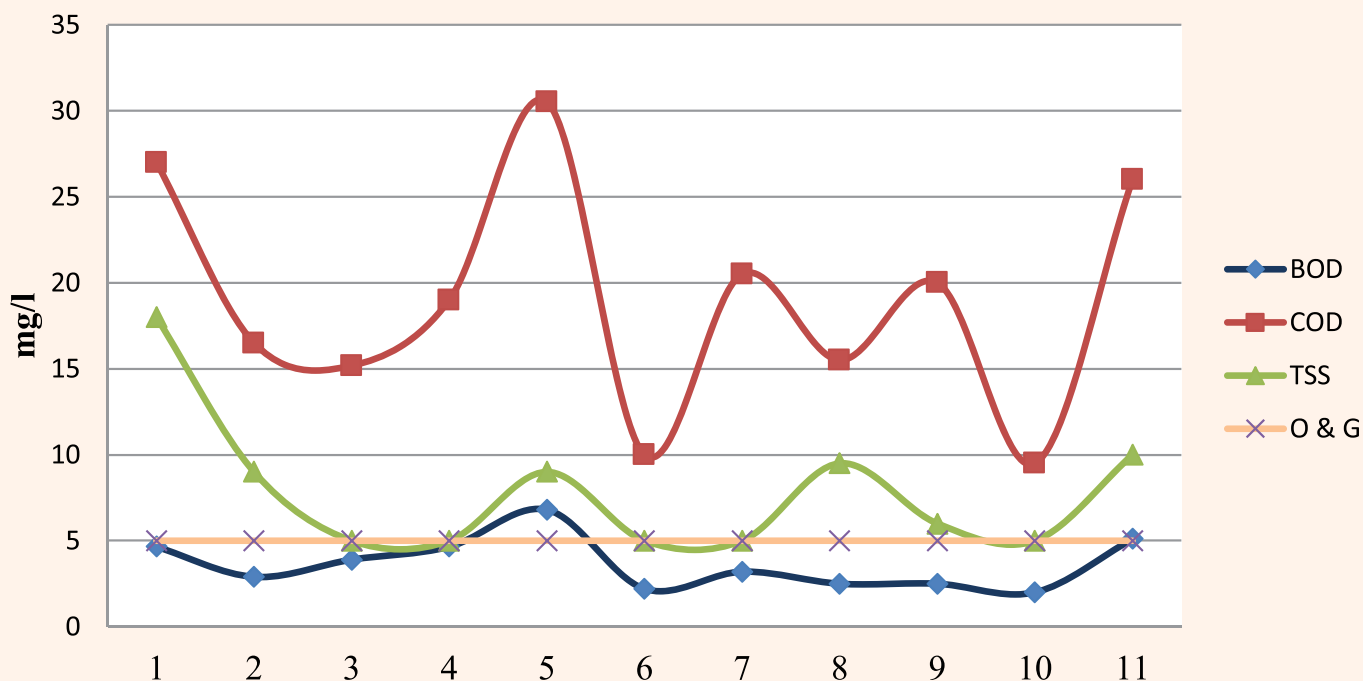
Case study I: SIBF system at a slaughter-house

The slaughter-house at **Zorabian Chicks Pvt. Ltd.** processes about 12,000 poultry birds per day. The ETP of 1,50,000 litres per day capacity was set up in the year 2007 and it was expanded to 2,50,000 litres per day in 2017. The wastewater generated during the processing has high pollution strength as it is laden with proteins and fats from meat, fat, blood, skin and feathers, and mixed with grit and other inorganic matter. The primary treatment comprises of screens (coarse and fine), fat trap and collection tank. Secondary treatment is done in two stage biofilters. Tertiary treatment has alum tank, pressure sand filter and activated carbon filter followed by disinfection unit.

The final treated water is being used to grow organic vegetables and for landscaping in the company premises. The O & M cost is only 10% that of a conventional treatment plant (ASP), thereby, generating huge savings for the company. The ETP has been giving consistent performance since the past 15 years.

The graph below gives the performance of the system (BOD, COD and TSS).

Performance graph showing final treated water parameters at ZCPL



Graph sourced from Energy Tech Solutions Pvt. Ltd, Pune



Raw wastewater from slaughter-house



Final Treated water from the ETP



SIBF system at ZCPL



Reuse of treated water in organic farming

Case study II: SIBF system at a Sweetmeat factory

SIBF system of 50,000 litres per day capacity has been set up in 2017 at Ranje near Pune for **M/s. Chitale Bandhu Mithaiwale**. The factory produces sweetmeats (mainly bakarwadi, chiwda and cashew sweets). The wastewater is generated from the cashew wash water and the cleaning of processing equipment after every cycle. Also, a separate STP of 50 KLD has been installed for treating the domestic wastewater. The treated water is being reused for the plantations and the lawns in the factory premises. The wastewater characteristics have huge variations due to production of different products as per market demand. But, these are taken care of by the sturdy SIBF system.

Conclusion

The Indian food processing industry is one of the largest in the world in terms of production, consumption, export and growth prospects. It is a 'sunrise sector' and is expected to grow at a phenomenal rate in the

coming decades. Food processing wastewaters tend to have higher BOD and COD values, hence, require proper treatment before disposal.

The Solid Immobilised Bio-Filter (SIBF) is a natural and eco-friendly wastewater treatment system housing a sturdy ecosystem. This system is very suitable to handle the wastewater generated from food industries. Two case studies have been presented above to show that this system is beneficial to the clients due to very low O & M costs as well as consistent performance in spite of fluctuating flows (which would be very difficult to manage in a conventional ASP based treatment plant). The annual O & M cost is very low and also skilled labour is not a requirement for the operation of the SIBF system. The system gives good quality treated water for reuse, which conforms to the pollution control board norms. Organic farming is being done using the treated water.

SIBF system holds great promise in the future for treatment of the challenging wastewater generated from food processing industries. Also, it can be an integral part of the circular economy for water.



SIBF system at Chitale Bandhu Mithaiwale



Reuse of treated water for landscaping

About the Author

Rahul Babar holds a Masters degree in Environmental Engineering from VJTI, Mumbai University. He is working as Director - Operations in the firm Energy Tech Solutions Pvt. Ltd., based in Pune.

Navin Singh holds a Masters degree in Environmental Engineering from VJTI, Mumbai University. He is working as Director - Projects & Planning in the firm Energy Tech Solutions Pvt. Ltd., based in Pune.

About the Company

Energy Tech Solutions Pvt. Ltd. offers consultancy in waste management and pollution control since 1996. The company has been instrumental in setting up the natural & sustainable wastewater treatment system - SIBF system.

To know more about the contributor of this article, you can write to us. Your feedback is welcome and should be sent at: deepak.chaudhary@eawater.com



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AVOID RESIDUAL OZONE IN YOUR SWIMMING POOL

With the advent of greater awareness of toxicity of chlorine among pool owners and users, it has become norm for requesting pool builders, ozone manufacturers, and other pool accessories suppliers to provide system that is chemical free. More often pool builders, in their obligation to their clients, promise the clients chemical free

Many fly by night sellers of ozone systems have taken advantage of this and have started to communicate that when you use ozone, you do not need chemicals such as chlorine. This is not correct, since a good pool maintenance schedule will always comprise of addition of various other chemicals to the pool to bring about stabilisation of the pool chemistry. You cannot avoid this. Ask any water chemist and he will vouch for this.

With ozonated pool, the promise of NO CHLORINE in the pool is not correct. World over there are standards of residual chlorine with or without ozone and this has NEVER CHANGED SO FAR. Chlorine is required to perform disinfectant property where ozone cannot. This is the truth

What happens when you use residual ozone to replace Chlorine addition? First of all we need to know the following facts about ozone

1. Ozone is a toxic gas and need to be handled well. When ozone is dissolved in the water, the ozone in the water can be stripped and this stripped ozone accumulates on the surface of the water. This ozone is inhaled by the swimmer. On prolong inhalation this can lead to epithelial cell damage of the lungs.
2. Small amounts of ozone such as 0.05 ppm

as claimed by many ozone manufacturers are not sufficient to treat the water in the pool. Why because the pool is continuously contaminated by body oils, sweat, saliva, bird droppings, and to top it all 0.42 grams of faecal matter by all adult swimmers on an average. These are undisputed facts. This small amount of ozone cannot handle these contaminations and only residual chlorine can.

3. Measurement of ozone residual in the water is an expensive process and we can never control the residual even if we claim it is only 0.05 ppm.

Then why use ozone at all?

Chlorine is used only to perform residual disinfectant property in the pool water. All other anti bacterial effects, any viral effects, odour and taste removal, iron and manganese removal, reduction of pseudomonas and legionella in the pool, clarity to pool water, removal of bio films and keeping the pipes and the tanks clean are all wonderful properties of ozone

Can you ever have a chlorine free pool: The answer is YES. Instead of chlorine, we can use bromine disinfection which is as good as chlorine and lesser toxic the chlorine. When you use bromide salts in the pool, bromine is liberated in the pool by ozone (HOBr) and this acts in the same way as chlorine. After action bromine is again converted to bromide salts. This Bromine disinfection is quite popular abroad

In indoor pools, that have acclimatized environment, you can use ozone and can avoid residual chlorine, provided the dose of ozone is

appropriate. Also if the bather load is very high, perhaps even residual chlorine may be required even in indoor pools

The risk of using residual ozone goes beyond health. Most pool owners/users are high net worth individuals, well informed and health conscious. Using ozone residual in the pool will lead to legal complications, against the pool builder, pool maintenance person, pool owner and also the ozone supplier. This is best avoided if we stick to accepted pool treatment process.

Claims that chlorine free pools are following German and Australian standards is totally wrong as both Australian and German standards require complete removal of ozone before it enters the pool and maintaining residual ozone at 0.5 ppm. Few unsuspecting clients in India have fallen in prey to this chlorine free concept which is just not safe for the swimmers. It is suggested to any client that he verifies these standards before accepting any such proposal from ozone manufactures to ensure that what he gets is totally safe for his and his family's health.

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Authority

Defence Research And Development Organisation
Address: Cce (R And D)East, Napier Road, Hastings, Kolkata - 22, Pincode 7000225
City: Kolkata
Location: Kolkata | West Bengal | India

Bid Open Date: 17 June 2022
Tender Value: 6.12 Lac
Doc Collection Date: 16 June 2022

Competition: Domestic Competitive Bidding
FTID: 220530435240

2. Construction And Commissioning Of Decentralized Sewage Treatment Plant For Dtea School Situated At B1 Janak Puri Under Ace (M)-8

Authority

Delhi Jal Board
Address: Office Of The Addl. Ce (M)-08 Oht Beriwalla Bagh, Subhash Nagar, Pincode 110058
City: New Delhi
Location: Delhi | Delhi | India

Bid Open Date: 08 June 2022
Tender Value: 9.69 Lac
Doc Collection Date: 08 June 2022

Competition: Domestic Competitive Bidding
FTID: 2205304215500

3. Construction Of 0.60 Mld Capacity Sewerage Treatment Plant (Stp) With Construction Of Compound Wall, Pathways And Laying Of Underground

Swg Pipelines From Last Manhole To Stp For 2bhk Housing Project At Bachupally In Sy.No 186/2 In Bachupally (M) Of Quthb

Authority

Municipal Corporation
Address: 3rd Floor, Municipal Building.
City: Hyderabad
Location: Hyderabad | Telangana | India

Bid Open Date: 13 June 2022
Tender Value: 1.33 Crore
Doc Collection Date: 13 June 2022
Competition: Domestic Competitive Bidding
FTID: 2205304154910

4. Supplying Installation Testing And Commissioning Of 10 Kld Sewage Treatment Plant In Hawabill Nest Resort At Shaheed Dweep

Authority

Municipal Corporation
Address: Ee, Eandm, Division, Apwd, Prothrapur, Port Blair, Pincode 744105
City: Port Blair
Location: Port Blair | Andaman & Nicobar | India

Bid Open Date: 16 June 2022
Tender Value: 9.86 lac
Doc Collection Date: 16 June 2022
Competition: Domestic Competitive Bidding
FTID: 2205304259630

5. Tender For Common Effluent Treatment Plant Laboratory Size Common Effluent Treatment Plant Laboratory Size

Authority

Ministry Of Labour And Employment
Address: Iti Khargam, Pincode 396040
City: Chikhli

Location: Chikhli | Gujarat | India

Bid Open Date: 16 June 2022
Doc Collection Date: 16 June 2022
Competition: Domestic Competitive Bidding
FTID: 220530490140

6. Loharu Town Up Gradation Of Sewage Treatment Plant (Stp) Of 3.50 Mld Capacity Based On Moving Bed Bio Reactor (Mbbr) Technology To Tertiary Treatment Located Near Cremation Ground In Loharu Town

Authority

Public Health Engineering Department
Address: Phed-Siwani, Pincode 127201
City: Loharu
Location: Loharu | Haryana | India

Bid Open Date: 16 June 2022
Doc Collection Date: 16 June 2022
Competition: Domestic Competitive Bidding
FTID: 22053046980

7. Construction Of Sequence Batch Reactor Sewage Treatment Plant (Stp)- 90 Kld (Maintenance Of One Year Included) At Dmv Including Pump House And Sedimentation Tank Under Sse/W/Dmv

Authority

Northeast Frontier Railway
Address: Pincode 782447
City: Lumding
Location: Lumding | Assam | India

Bid Open Date: 20 June 2022
Doc Collection Date: 20 June 2022
Competition: Domestic Competitive Bidding
FTID: 2205304142920

8. Construction Of Sequence Batch Reactor Sewage Treatment Plant (Stp)- 90 Kld (Maintenance Of One Year Included) At Scl Including

Pump House And Sedimentation Tank Under Sse/W/Scl

Authority

Northeast Frontier Railway
Address: Pincode 782447
City: Lumding
Location: Lumding | Assam | India

Bid Open Date: 20 June 2022
Doc Collection Date: 20 June 2022

Competition: Domestic Competitive Bidding
FTID: 2205304143040

9. Construction Of Sequence Batch Reactor Sewage Treatment Plant (Stp)- 90 Kld(Maintenance Of One Year Included) At Lumding Including Pump House And Sedimentation Tank Under Sse/W/Ws/Lmg.

Authority

Northeast Frontier Railway
Address: Pincode 782447
City: Lumding
Location: Lumding | Assam | India

Bid Open Date: 20 June 2022
Doc Collection Date: 20 June 2022

Competition: Domestic Competitive Bidding
FTID: 2205304143060

10. Construction Of Boundary Wall At Water Treatment Plant Kolar

Authority

Urban Administration And Development
Address: Office Of The Municipal Corporation Kolar Pariyojna Khand No 01 Mata Mandir Water Works Department Nagar Nigam Bhopal (M.P.), Pincode 462003
City: Huzur
Location: Huzur | Madhya Pradesh | India

T E N D E R S

Bid Open Date: 13 June 2022
Tender Value: 12.90 Lac
Doc Collection Date: 10 June 2022

Competition: Domestic
 Competitive Bidding
FTID: 2205304256760

11. Enquiry For Work Contract For Operation And Maintenance Of One No. Effluent Treatment Plant (Cap-500 Ltr/Day) In 30bedded Hospital For A Period Of 03 Months At Sgtps, Birsinghpur

Authority
 Madhya Pradesh Power Generating Company Limited
Address: The S E (Pnw), Sgtps, Mppgcl, Birsinghpur, Pincode 484552
City: Bandhogarh
Location: Bandhogarh | Madhya Pradesh | India

Bid Open Date: 06 June 2022
Doc Collection Date: 06 June 2022

Competition: Domestic
 Competitive Bidding
FTID: 220530412290

12. Provn Sewage Treatment Plant Of Capacity

Authority
 Military Engineering Services
Address: Hq Ce Chennai Zone Chennai, Pincode 560016
City: Bangalore
Location: Bangalore | Karnataka | India

Bid Open Date: 24 June 2022
Tender Value: 23.57 Crores
Doc Collection Date: 22 June 2022

Competition: Domestic
 Competitive Bidding
FTID: 220530441860

13. Operation And Maintenance

Of Effluent Treatment Plant At Nmoc Mine Under New Majri Sub Area Of Majri Area.

Authority
 Western Coalfields Limited
Name: Staff Officer (Civil), Wcl, Majri Area.
Address: At/Post Kuchana, Tahsil Bhadrawati, District Chandrapur (Ms) 442503.
Location: Chandrapur | Maharashtra | India

Bid Open Date: 10 June 2022
Tender Value: 5.96 Lac
Doc Collection Date: 10 June 2022
Competition: Domestic Competitive Bidding
FTID: 220530229880

14. To Supply Skilled And Unskilled Labours For Operation And Maintenance Of Under Ground Drainage Sewage Treatment Plant And Network Scheme Hingoli Municipal Council.(Second Call)y

Authority
 Directorate Of Municipal Administration
Address: Municipal Council Hingoli, Pincode 431513
City: Hingoli
Location: Hingoli | Maharashtra | India

Bid Open Date: 06 June 2022
Doc Collection Date: 03 June 2022
Competition: Domestic Competitive Bidding
FTID: 2205304221860

15. Providing, Lowering, Laying, Jointing And Testing Of Sewerage Collection Network, Nalla/ Road Crossing, House Service Connection, Construction Of Sewage Pumping Station, Pumping Machinery, Rising Main, Sewage Treatment Plant Capacity 5.5 Mld Based On

Authority
 Directorate Of Municipal Administration
Address: Nagar Panchayat Ardhapur, District Nanded, Pincode 431704
City: Ardhapur
Location: Ardhapur | Maharashtra | India

Bid Open Date: 22 June 2022
Tender Value: 36.67 Crores
Doc Collection Date: 20 June 2022
Competition: Domestic Competitive Bidding
FTID: 2205304226390

16. Design, Engineering, Procurement, Construction, Installation Testing, Commissioning And Trial Run For 3 Months For Sewage Treatment Plant Of 3 Mid Capacity Comprising Of The Coarse Screen, Raw Influent Sump, Pumping Machinery, Rising Main From Comm

Authority
 Haryana Government
Name: Executive Engineer
Address: Executive Engineer
Location: Gurugram | Haryana | India

Bid Open Date: 27 June 2022
Tender Value: 14.95 Crores
Doc Collection Date: 27 June 2022
Competition: Domestic Competitive Bidding
FTID: 220530217670

17. Construction Of Sewage Treatment Plant Of Capacity 1500 Kld

Authority
 Ordnance Factory Board
Address: Ordnance Factory Khamaria-Japalpur(M.P.), Pincode 482005
City: Jabalpur
Location: Jabalpur | Madhya

Pradesh | India

Bid Open Date: 27 June 2022
Doc Collection Date: 27 June 2022

Competition: Domestic
 Competitive Bidding
FTID: 2205304218460

18. Approach Channel Jack Well With Overhead Pump House Approach Bridge Raw Water Rising Main Raw Water Gravity Main Rcc Bpt Water Treatment Plant With Allied Works Pure Water Rising Main Mbr Rcc Sump With Mechanical Work Etc Complete

Authority
 Member Secretary(Wssd), Mumbai
Name: Executive Engineer
Address: E.E. M.J.P. Division Gondia (Rail Toli Gondia)
Location: Gondia | Maharashtra | India

Bid Open Date: 20 June 2022
Tender Value: 198.03 Crores
Doc Collection Date: 20 June 2022

Competition: Domestic
 Competitive Bidding
FTID: 220530231360

19. Complete Repairing And Changing Of Led Street Lighting Fittings At Shankarpur Garage Water Treatment Plant Gust House Area Colony Under Bankola Area.

Authority
 Eastern Coalfields Limited
Location: Paschim Bardhaman | West Bengal | India
Bid Open Date: 15 June 2022
Tender Value: 98 Thousand
Doc Collection Date: 15 June 2022
Competition: Domestic
 Competitive Bidding
FTID: 220530216170

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