The Brazilian Association of Sanitary and Environmental Engineering – ABES
Benchmarking visit to Northern California, June, 4th-7th, 2018

Summary

Introduction

A group of 40 top managers from different Brazilian utilities that have been awarded the 2017 Brazil Sanitation National Quality Award – PNQS – visited Northern California in June 2018 to fulfill the international benchmarking phase of that Program. The PNQS award is based on the Brazilian Environmental Sanitation Business Excellence Model MEGSA which includes management processes and triple bottom line (TBL) results evaluation. The application reports and the specific site conditions have been evaluated by volunteers from the PNQS Board of Examiners and scored accordingly. The best ones in each maturity level have won. The award model closely resembles the American all-sectors Malcolm Baldrige National Quality Award MBNQA from the Baldrige Foundation in USA. The PNQS has been conducted annually since 1997 and is the Brazilian Association of Sanitary and Environmental Engineering ABES key strategy to raise the bar in Brazil's water and wastewater utilities management.

Study tour planning

Contacted by the ABES counselor, Mr. Dante Ragazzi, the U.S. Consul in São Paulo, Mr. Tomás Guerrero, invited U.S. Water Partnership USWP, a public-private organization based in Washington DC, led by Mr. Chuck Chaitowitz, to help in building a Study Tour program, firstly aimed at water reuse and productivity solutions, a priority for ABES President, Mr. Roberval Tavares and his council. The Northern California region was chosen to be visited due to its many water availability challenges and related strategies to overcome these challenges.

The PNQS coordinator, Mrs. Rosana Dias, has assigned Mr. Carlos Schauff, the award technical consultant and former World Bank advisor for south-south knowledge exchange projects in Brazil, to represent her in organizing the 4-day agenda with USWP's help. The agenda detailing process began with a draft proposed by Mr. Chaitowitz and Mrs. Paula Kehoe, Director of Water Resources at San Francisco Public Utilities Commission, based on their extensive experience and leadership in the field. Mr. Chris Rich, the USWP International Advisor with long experience in international relations prepared a trial detailed agenda after coordinating the schedules and interests of all involved. This proposed agenda covered recent experiences, findings and regulatory issues, as well as the subject of water reuse, including direct potable reuse, and related technologies.

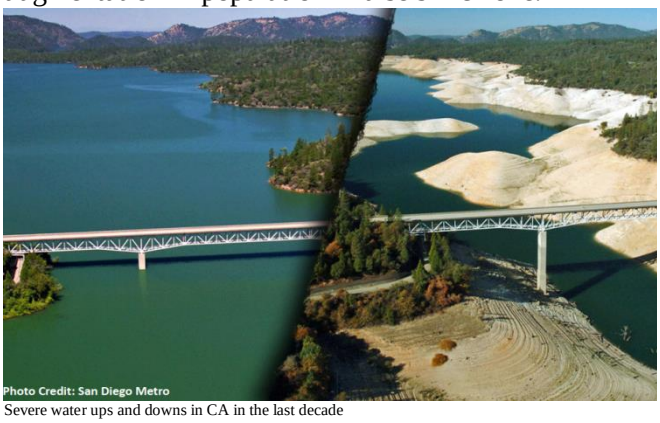
Mr.Chris Rich – US Water Partnership, Mrs. Paula Kehoe - SF Public Utilities Commission and Dr. Max Gomberg – CalEPA, at the pre-visit planning meeting on May, 2018, at Paulas's office

In a pre-visit meet and greet encounter – which is required by PNQS mission planning protocol – hosted by Mrs. Kehoe, along with Dr. Max Gomberg, Climate and Conservation Manager at CalEPA, Mr. Rich from USWP and Mr. Schauff from ABES, the main tour goals were confirmed, the previously planned places and contact people were reviewed and the program's main topics were discussed. Thus, the specific site locations were pre-visited or contacted as well in order to: agree on topics of interest with hosts, organize scheduling and timing, forward information about the group and refine logistics aspects of the program.

Main lessons

The Northern California region is facing severe ups and downs in water supply availability and flow due to climate change associated with changing levels of

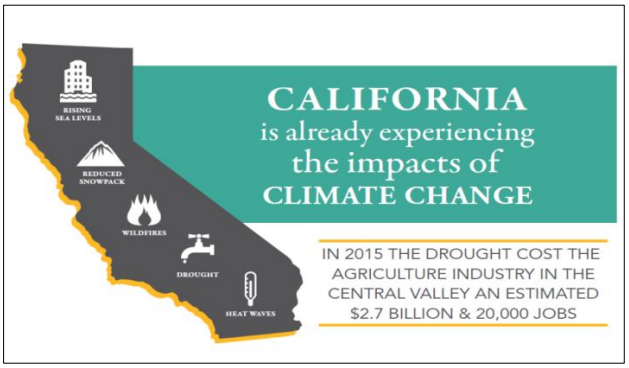
precipitation, an increase in salt water infiltration into aquifers due to sea level rise and simultaneous augmentation in population in a seismic zone.



Severe water ups and downs in CA in the last decade

Many integrated measures are being taken at the city, county, state and national levels, involving a network of water and infrastructure agencies, legislators, regulators, research centers and private partners projects.

For instance, the diminished snowpack in the Sierra Nevada mountains in recent years has decreased natural water storage capacity and the gradual release of snow melt into watersheds. Instead, rainfall makes its way quickly to the ocean, requiring new approaches in flood control, storm water management and treatment, wastewater recycling and reuse, and resource recovery technologies.



Climate Change: Staggering economical losses in CA

In the wastewater part of the equation, for example, "reuse water, energy, fertilizers and community health information are the main resources that can be mined out from the wastewater ore" emphasized to the Brazilian visitors Dr. Sebastien Tilmans, Director of the Codiga Resource Recovery Center labyard at Stanford University. CR2C was included in the tour at ABES' request, thanks to Dr. Gomberg's mediation and the kind invitation from Dr. Newsha K. Ajami, Director of Urban Water Policy at Stanford Woods Institute for the Environment.

Is became evident to the group as well that cultural changes must accompany technological ones, before public acceptance of direct potable reuse water for homes and businesses. Dr. Hossein Ashktorab, manager at the Recycled and Purified Water Unit at the Silicon Valley Advanced Water Purification Center, emphasized the term "purified water" to replace "direct potable reuse." He is leading a public relations program within the community to promote purified water for home use.


Carlos Schauff, PNQS Technical Consultant and mission planner, calls for a group toast with purified water from the Silicon Valley Advanced Water Purification Center. Rosana Dias, PNQS Coordinator, enjoys at the front seat

Many lessons have been illustrated through the accomplishment of the final agenda, among them some are summarized in the next page.

Group visit to the CR2C Stanford University

When	What/Where	Some Lessons Learned
Monday June 4th S.Fco. & Daly City	Northern CA water environment & infrastructure, water shortage emergency projects and Q&A (presentation at Oceanside Treatment Plant) By Mrs. Paula Kehoe Director of Water Resources San Francisco Public Utilities Commission San Francisco Water Power Sewer	• 85% bay area water is sourced at the Sierra snow storage through Hetch Hetchy reservoir (hydroelectric powerplant) dated 1900 • Integrated basin resource management is vital – 83 ongoing projects in many fields, like wastewater resource recovery • Referendum decision making more often for projects approval and for inexorable tariffs raising • Communication flow to communities is emphasized enhancing cultural change • Psychological barriers on direct potable water (DPR) distribution not yet overcome • Reuse water applied in irrigation and waterbeds replenishment so far • Demand control has been key in the water shortage crisis, including fines on excess consumption • Strategies for the future: DPR, desalinization, underground reservoirs, data management  Mr. Chris Rich, US Water Partnership, open statement to the group at Oceanside plant
	Oceanside Treatment Plant overview, tour and Q&A By Mr. Wyman Fong W6 Senior Operations Specialist Oceanside Treatment Plant San Francisco Water Power Sewer	• SF has separated drainage and sewage systems, storm water is also tank buffered and treated • Exclusive pressurized firefighting water lines in SF city • Resource recovery structure is being expanded and modernized: reuse water, energy & fertilizers will be commercial outputs and plant will have one operator • Reuse water irrigation lines to customers: golf courses and parks • Underground disguised storage and facility and odor control at SF zoo at the beach • Sand is a big issue for equipment and goes to landfills, as awareness public campaigns to avoid sand in the sewage • Full marine lab due to strict environmental regulations on offshore draining • High per capita consumption – 170L/inhab/day • Water losses 8% • Average cost per 4-people household, water supply & wastewater &stormwater treatment, very expensive: $250/month

When	What/Where	Some Lessons Learned
		 Mr.Wyman Fong briefs the reporting group of the day at Oceanside plant lab
	Daly City Wastewater Treatment Plant overview and reuse water, tour and Q&A By Mr. Gregory Krauss Chief of Wastewater Operations Daly City Wastewater Treatment Plant Department of Water and Wastewater Resources	• Daly city has separated drainage and sewage systems, storm water is also tanked and treated • Underground disguised storage under a baseball field and dimensioned for high and lows in storm water flow • Full odor control – parks, housing and businesses in the neighborhood • 30% of reuse water flows through 4km irrigation lines to golf courses and city green areas • 70% flows to the ocean through one 19th century brick gallery line and one through forced 36¨ pipeline • CalEPA standards certified lab
Tuesday June 5th San José Stanford	Advanced water purification overview, productivity, tour and Q&A By Mr. Marcos Gutierrez Office of External Affairs and Dr. Hossein Ashktorab, Recycled and Purified Water Unit Manager Silicon Valley Advanced Water Purification Center Santa Clara Valley Water District	• Highly automated water purification plant after a tertiary standard wastewater facility treatment ($76 Mi investment) • Chlorine and Ammonia added to the intake pipeline to the water purification plant in order to reduce bacteria • Purified water by membranes, osmosis & UV in a sequence • Delivery for agriculture and industrial use • Re-mineralizer demo device for human probe • Will refill the waterbed as well • Brine from osmosis still an issue • Staff: 4 people, day. No one at night  Visiting group at Silicon Valley Advanced Water Purification Center

When	What/Where	Some Lessons Learned
	Wastewater resource recovery technology research and Q&A By Dr. Sebastien Tilmans Director of Operations CR2C The William and Cloy Codiga Resource Recovery Center (CR2C) labyard Stanford University	• Asset recovery, commercial and low cost technologies development • Private business partnership for innovation testing and developing technologies: • Compact container plant, low energy membrane treatment efficiency assurance test • Low energy membrane filtering with carbon cleaning biofilm device development • Storm water treatment for waterbed and surface water replenishment developing • Wastewater mobile lab for community health monitoring • Future: Commercial extraction of methane from wastewater for energy, methane to biodegradable plastics, methane to prebiotics for fishing industry, exploit other wastewater value  Dr. Sebastien Tilmans brief the reporting group of the day at CR2C Stanford University labyard
Wednesday June 6th Oakland	Environmental Protection Agency USA - Potable reuse water regulation By Dr. Bruce Macler Regulation specialist EPA 9th region (Presented at EBMUD water Treatment Plant)	• EPA stimulates direct or indirect potable reuse due to water shortage, treatment costs, purple pipe net costs, source diversification, unique set of drinkability parameters. EPA guidance in 2012 and 2017. • Highly visible rejection, few successful projects • Different types of potable reuse water have different requirements: Direct (agriculture, irrigation, consumption) and Indirect (ground and surface bodies recharge) reuse • No prohibitions or direct requirements governing recycling: Clean Water Act governs discharge of wastewater and Safe Drinking Water Act governs quality/safety to consumer • States may have restrictive regulations. Like CA that has: • CA Water Code Title 22 specifies treatment and operational requirements by use: irrigation, impoundments, cooling, other purposes • Broad range in treatment requirements and numeric criteria, directed by level of human exposure; mostly address microbial pathogen • All unit processes have associated controls ("reliability features") • Regional Water Quality Control Boards have jurisdiction over recycling plants and issue permits • Criteria for groundwater recharge for indirect potable reuse established in 2014 • Criteria for surface water augmentation for indirect potable reuse established in 2016 • Very low reductions parameters for pathogens Giardia and Cryptosporidium - 99,99999999% (10-log); Enteric viruses (99.9999999999%) (12-log); <1/10000 infection/year
	EBMUD water Treatment Plant overview and reuse	• Focus: Reuse water for industry, biogas, energy production • Large diameter interceptors collect wastewater from 680000 consumers:

When	What/Where	Some Lessons Learned
	water, tour and Q&A By Dr. John Hake, P.E. Senior Operations Engineer EBMUD Water Treatment Plant East Bay Municipal Utility District (Oakland)	average 2,1m³/s, peak 30,6 m³/s • Main challenge: peak management: • Primary treatment max 14 m³/s (máx • Secondary treatment max 7,3m³/s • Wastewater treatment labor: 2,5 employees/week • Resource recovery program • Low (75 trucks/day) and high (50 trucks day) strength waste separated intakes: 11 Mw cogeneration capacity • Drivers are trained to unload at outside different type bays, barcode control, no volume inspection • 130% need of energy production, surplus sold to Port of SF • 12 years to reach this efficiency with more efficient power generation turbines • Waste contaminants major issue to direct waste from landfills to anaerobic digesters • Reuse water: irrigation, construction sites, commercial use, fill station  Dr.John Hake, EBMUD, welcomes reporting group of the day
	U.S. Water sector companies event with the San Francisco Chamber of Commerce By Ms. Jolynn Vallejo San Francisco Chamber of Commerce	• EARTHTEC, David Hammond • SUEZ, Bob Holt, Ariel Lechter • Clean Water Technology • CORSAN Brazil – International bid website announcement for wastewater solution  Mrs. Jolyinn Vallejo welcomes companies at SF Chamber of Commerce

When	What/Where	Some Lessons Learned
Thursday June 7th Sacramento	California State Water Resources Control Board Overview By Dr. Gita Kapahi	• 9 Regions (generally acc. watershed), 2000 employees • Divisions: Water Quality – surface, ground, ocean; Water rights – permits, licenses, and registrations; Drinking water – oversight of 7,500 Public Water Systems; Financial assistance –loans and grants; Office of enforcement – Legal and investigative staffs and Supplemental Environmental Projects (trade for up to 50% of penalty cost); • Environmental Laws And Regulations: Clean Water Act; Porter-Cologne Water Quality Control Act; CA Environmental Quality Act (CEQA); Anti-degradation Policy; Ocean Plan; Trash Policy; Sustainable Groundwater Management Act (SGMA) • Other water board resolutions: Climate Change Resolution; Conservation Targets; Human Right to Water; Recycled Water Policy
	Funding of Recycled Water Projects in CA By Christopher Stevens and Michael Downey	• Water Recycling Funding Program (WRFP): • Clean Water State Revolving Fund (CWSRF) – Began funding in 1989, Loans & Loan Forgiveness, Construction Projects • Voter Approved State Bond Funds – Grants & Loans: Construction Projects, Grants: Planning, Research • Challenges Associated with Water Recycling Projects: 1) Typically not technical; 2) Financing agreement terms: Tight schedules, Existing debt, Existing capital improvements; 3) Water Rights: Effluent to resource, Increased competition for water, Downstream user Rights; 4) Increased Demand for State Revolving Fund: Competition for funds within the division, WIFIA  Several CalEPA Divisions programs have been explained to the visiting group
	Water Quality's Recycled Water Activities By Claire Waggoner	• Recycled water from municipal sources: Non potable reuse (Agriculture, Irrigation, Industrial) and Potable reuse (Groundwater recharge, reservoir augmentation) • Allowable potable reuse: Disinfected Tertiary: Indirect potable reuse – groundwater percolation; Full adv. treatment Rev.Osmosis+Oxidation: Indirect potable reuse in groundwater injection and Direct potable reuse in reservoir augmentation. • CA 2015 recycled: 880mi m3/year; 2030 goal: 3000mi m3/year • Barriers for recycling: Monetary, Regulation, Geographic variability, Technical, Data, Public perception • Recycled Water Policy Purpose: Promote the use of recycled water while protecting public health and water quality through consistent streamlined permitting of recycled water projects • Proposed Amendment to the Recycled Water Policy: Narrative goal decrease municipal, Wastewater discharged to the ocean, Require reporting of production and use, Identify groundwater basins where salt

When	What/Where	Some Lessons Learned
		and nutrient management plans are needed, Streamline permitting, Update CEC monitoring requirements • Monitoring issues - among others: Antibiotic resistant bacteria and antibiotic resistance genes
	Update on Onsite Non-potable Water Systems & Regulations for Direct Potable Reuse of Recycled Water By Mark Bartson	• Regulatory framework: No national standards or guidelines for onsite water reuse systems; Typically, states and local public health agencies are responsible for developing approaches; Many states allow for single residence use of roof runoff and graywater • Risk-Based Framework for the Development of Public Health Guidance for Decentralized Non-Potable Water Systems • A combination of reverse osmosis (RO) treatment and an advanced oxidation process (AOP) will accomplish the water quality objective with respect to organic contaminants of emerging concern (CECs) • A combination of reverse osmosis (RO) treatment and an advanced oxidation process (AOP) will accomplish the water quality objective with respect to organic contaminants of emerging concern (CECs) • The reservoir will enhance the reliability of a surface water augmentation project by mixing each portion of the recycled water flow, including any off-spec recycled water, with a large volume of water that meets the water quality requirements for a surface water source. • Indirect Potable Reuse Environmental Buffer: Reliable, Provide benefits such as attenuation of chemical, peaks, Robust pathogen barrier, Response time • DPR Framework: Risk Management Approach, Research to fill knowledge gaps, Stakeholder outreach, Not a regulatory document  A Q&A session has followed every CalEPA presentation
	Storm Water (SM) Management Strategy By Dr. Annalisa Kihara	• Rethinking SM management: • Natural landscape SM destiny: 50% percolation, 30% evapotranspiration, 20% undersurface interflow, 10% surface flow away • Urban SM destiny: 75% surface flow to pipes, 15% evapotranspiration, 5% undersurface interflow, 5% infiltration • Urban SM mobilizes many contaminants • Conventional management devalues storm water • Addressing: • Regulation: EPA's National Urban Runoff Program • Clean Water Act Section 402 - Point Sources: National Pollutant Discharge Elimination System Permits • CA Water Action Plan calls for multi-benefit SM solutions • Strategy to optimize resource management from SM (STORMS) • Change the perspective of storm water from a nuisance or hazard to a valuable water resource

When	What/Where	Some Lessons Learned
		• Implementation Committee • 9 objectives, 23 projects – 12 years to completion: Promote Storm Water Capture and Use, Eliminate Barriers to Storm Water Capture and Use, Develop Guidance for Alternative Compliance Approaches, Develop Watershed-Based Compliance and Management Guidelines and Tools, Implement Senate Bill 985, Eliminate Barriers to Funding, Storm Water Program "Open Data" , Urban Pesticides Amendments, • Opportunities for Source Control and Pollution Prevention
	Response to Climate Change Dr. Max Gomberg	• CA has a unique hydrology in precipitation, dry-wet seasons, supply and demand mismatch, water delivery infrastructure, unprecedented conditions and impacts of climate change: communities water shortage, land fallowed, diminishing crop, fish & wildlife impacts, wildfires • Green gases 2030 targets: mitigate greenhouse gases emissions: cap energy emissions, slash super-pollutants – dairies, landfills, refrigerants, cleaner freight and goods mobility, double building efficiency, cleaner and renewable fuels, renewable power • Increase resilience of water: Conserve and use water efficiently, Diversify water supply, Manage groundwater for sustainability, Support healthy soils, Restore and protect forest health and ecosystems, Protect vulnerable populations  Dr. Max Gomberg addresses visiting group at CalEPA

Conclusion

It has become clear to the Brazilian visiting group, after this amazing study tour, that the era of wastewater treatment is fading out, giving room to a new commercial and environmental friendly resource recovery approach for wastewater, integrated to larger efforts in infrastructure renewal and developing innovative solutions to deal with natural water cycle changes, were recycling is an important part.

A closing Benchmarking Mission Report Seminar has been conducted at St. Francis Drake Hotel in SF prior to return to Brazil

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Revised by Chris Rich (U.S. Water Partnership)