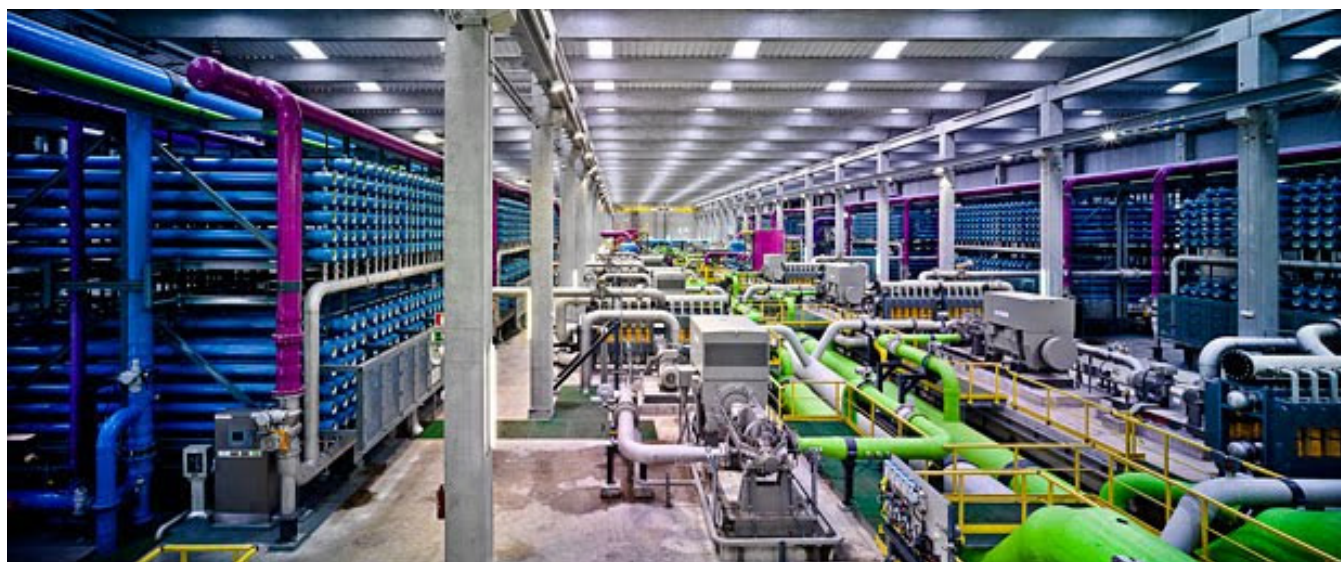


International Training Program **Membrane Desalination and Water Reuse**

5-8 March 2013, Republic of Malta

This training program covers both theoretical and practical aspects of the use of reverse osmosis membrane technologies for seawater desalination and water reuse. The program focuses on selection, design and operational monitoring of RO desalination and water reuse plants and is useful for water treatment plant designers and operators.



Program Outline

Day 1: Desalination and Water Reuse Fundamentals

Overview of Desalination and Water Reuse Technologies (Voutchkov & Lazarova)

- Introduction to Desalination and Water Reuse
- Desalination and Water Reuse – Status and Trends
- Desalination and Water Reuse – Benefits and Challenges
- Alternative Desalination and Water Reuse Technologies

Reverse Osmosis Fundamentals (Voutchkov)

- RO Separation – Basic Principles
- Key Performance and Design Parameters
- RO System Components

Planning for RO Desalination Plant (Voutchkov)

- Key Desalination Plant Components
- How to Determine Plant Site Size and Location?
- Source Water Quality Characterization
- Choosing Product Water Quality – Issues and Considerations

Planning for Membrane Water Reuse Plants (Lazarova)

- Key Steps of Water Reuse Planning
- Market Assessment and Identification of End-Users
- Engineering Issues in Water Reuse Planning
 - Choosing Product Water Quality
 - Assess Existing Wastewater Treatment and New Reclamation Schemes (Centralized, Decentralized and Satellite Systems, Storage and Distribution)
 - Select Best Available Technologies: Advantages and Disadvantages of Membranes
- Specific Issues in Water Reuse Planning: Public Participation and Outreach

Seawater Intakes *(Voutchkov)*

- Source Water Quality Issues and Considerations
- Subsurface Intakes
- Open Ocean Intakes
- Selection of Intake
- General Design Guidelines

Pretreatment for Desalination and Reuse

(Voutchkov & Lazarova)

- Granular Media Filtration
- Micro-Screening
- Membrane Filtration
- Selection of Pretreatment System

Day 2: Desalination and Water Reuse Systems – Design & Costs

Reverse Osmosis System Configuration

(Voutchkov & Lazarova)

- High Pressure Pumps – Type and Applications
- Reverse Osmosis Trains – Alternative Configurations for Desalination
- Reverse Osmosis Trains – Alternative Configurations for Reuse
- Energy Recovery Systems – Type and Applications
- Sizing of Key Components of Seawater RO System

Energy Use in Desalination and Water Reuse

(Voutchkov & Lazarova)

- Water-Energy Nexus and Integrated Resource Planning
- Key Energy Use Components & Factors
- Methods to Minimize Plant Energy Use
- Example of Desalination and Water Reuse Plant Energy Use Breakdown

Seawater Desalination Costs *(Voutchkov)*

- Construction Costs
- O&M Costs
- Total Cost of Water Production
- Example of Desalination Plant Cost Estimate

Water Reclamation and Reuse Costs *(Lazarova)*

- Construction Costs
- O&M Costs
- Total Water Reuse Costs
- Cost Trends and Factors
- Example of Water Reclamation Plant Cost Estimate

Concentrate Disposal *(Voutchkov)*

- Concentrate Disposal Alternatives
- On-shore and Offshore Discharges
- Technologies for Reduction of Concentrate Volume and Beneficial Reuse
- Environmental Discharge Considerations
- Guidelines for Selecting and Designing Concentrate

Disposal System

- Examples of Concentrate Treatment and Disposal in Water Reuse and Desalination Projects

Day 3 – Guided Tour of Malta Desalination Plant and Interactive Workshop

- Guided Tour of Malta's Pembroke Seawater Desalination Plant
- Discussion of Participants' Experiences and Challenges with Desalination and Water Reuse Projects in Workshop Setting
- Interactive Brainstorming Session on Integration of Desalination and Water Reuse in Comprehensive Water Supply Portfolio – Experiences and Lessons Learned *(Lazarova & Voutchkov)*.

Day 4 – Plant Performance Optimization and Troubleshooting

Plant Performance Analysis and Optimization *(Voutchkov)*

- Key Plant Performance Parameters
- Main Steps of Plant Performance Analysis
- Optimization of Plant Design and Operations

Desalination and Water Reuse – Plant Monitoring and Troubleshooting *(Lazarova)*

- Operations Monitoring Methods and Equipment
- Troubleshooting of Pretreatment and RO Systems
- Product Water Testing and Quality Control

Water Reclamation Plant Case Studies *(Lazarova)*

- Milestones in Membrane Applications for Water Reuse
- The First Direct Potable Reuse Facility in Namibia – Challenges and Solutions
- Lessons Learned from the Largest and Most Efficient Water Reuse Operations in the World
- Major Challenges and Solutions for Water with High Fouling Potential - feedback from operation in Spain
- Key Advantages and Main Constraints for RO Application for Industrial Water Reuse

Desalination Plant Case Studies *(Voutchkov)*

- Tampa Bay Seawater Desalination Plant, USA – Challenges and Solutions
- Ashkelon Plant, Israel – the Largest and Most Efficient Desalination Operations in the World
- Fujairah SWRO Plant, UAE – Solutions for Source Seawater with High Fouling Potential

Program Language: ENGLISH
Program Agenda: 9 am to 05.00 pm (each day)



Site Visit – Desalination Plant in Malta: Pembroke Reverse Osmosis Plant is one of three SWRO plants in operation to supply 60% of the whole national water demand. In total the three plants have a permeate capacity of 100,000 m³/day. Pembroke plant is the largest plant with a capacity of 54,000 m³/day. The plant does not operate at full capacity due to lower demand hence only half of the plant was refurbished with new membranes and energy recovery devices. Systems equipped with Pelton and Francis turbines are operated only in emergency cases. Pembroke plant runs with twelve independent systems with single stage configuration at 40% recovery. *(Delegates will visit this on 7 Mar'13)*

Program Instructors

Nikolay VOUTCHKOV



Mr. Nikolay Voutchkov is a registered professional engineer and a board certified environmental engineer (BCEE) by the American Academy of Environmental Engineers. He has over 25 years of experience in planning, environmental review, permitting and implementation of large seawater desalination, water treatment and water reclamation projects in the US and abroad. *Mr. Voutchkov* has extensive expertise with all phases of seawater desalination project delivery: from conceptual scoping, pilot testing and feasibility analysis; to front-end and detailed project design; environmental review and permitting; contractor procurement; project construction and operations oversight/asset management. *Mr. Voutchkov* is President of Water Globe Consulting – a private company specialized in providing expert advisory services in the field of seawater desalination and reuse. For over 11 years prior to establishing his project advisory firm, *Mr. Voutchkov* was a Chief Technology Officer and Corporate Technical Director for Poseidon Resources, a private company involved in the development of the largest seawater desalination projects in the USA. In recognition of his outstanding efforts and contribution to the field of seawater desalination, *Mr. Voutchkov* has received a number of

prestigious awards from the International Desalination Association, the International Water Association and the American Academy of Environmental Engineers. He is one of the principal authors of the American Water Works Association's Manual of Water Supply Practices on Reverse Osmosis and Nanofiltration and of the World Health Organization's Guidance for the Health and Environmental Aspects Applicable to Desalination. *Mr. Voutchkov* has published over 40 technical articles in the field of water and wastewater treatment and reuse, and is co-author of several books and manuals of practice on membrane treatment and desalination. He wrote books on "Seawater Pretreatment", "Desalination Plant Concentrate Management" and "Desalination Cost Assessment and Management", which are published by Water Treatment Academy.

Dr. Valentina LAZAROVA



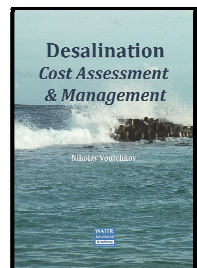
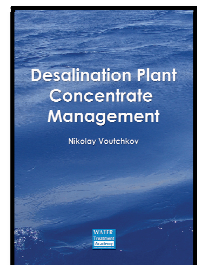
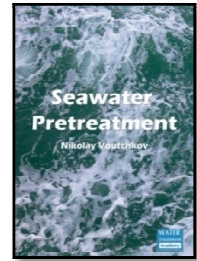
Dr. Valentina LAZAROVA is a senior expert and technical advisor for support to operations of Suez Environment, France. She has Master of Science Degree in Sanitary Engineering and a Ph.D in Environmental Engineering and is a Research Fellow (University Professor degree) and holds Certification of Professorship in Process Engineering from the French Ministry of Education. Dr. Lazarova is an international expert with over 25 years of research and practical experience in the field of wastewater treatment and reuse. Her career started as designer and project manager of wastewater treatment plants, followed by academic and long-term interdisciplinary research experience, and culminating as senior technical expert. The multidisciplinary extensive expertise of Dr Lazarova includes planning, design and operation of wastewater treatment and reclamation plants, advanced treatment technologies (membranes, disinfection, biofilm reactors), energy efficiency audits, water quality monitoring, risk assessment, aquifer recharge, as well as odor characterisation, control and treatment. Her main professional activities encompass review and/or preparation of international bids, feasibility studies, technical audits and technical assistance to plant designers and operators, master plan development, optimisation of capital investment and operation costs of

wastewater treatment and reuse plants worldwide (France, French Polynesia, Algeria, Australia, Bolivia, China, Chile, Italy, Hong Long, Macao, Mexico, Middle East, Morocco, Latin America, South Africa, Tunisia, the UK and the USA). Dr. Lazarova is acting also as independent expert and technical advisor for many international projects and organisations, including the European Commission, IWA, WHO, USEPA, WERF. Currently, she is chairing the IWA Water Reuse Specialist Group. She has published over 200 technical and scientific papers in the field of wastewater treatment and reuse, holds 7 patents, and has contributed to and edited a number of books, such as "Irrigation with recycled water: agriculture, turfgrass and landscape", "Water-Energy Interactions in Water Reuse" and "Milestones in Water Reuse; The Best Success Stories".

Desalination Books for Delegates

Following three books written by *Nikolay Voutchkov* will be given to all the participants who join this program. These three books are published by Water Treatment Academy (TechnoBiz Communications Co., Ltd.)

- 1. Seawater Pretreatment:** Source water pretreatment is an essential component of every seawater desalination plant. This book presents an overview of pretreatment challenges facing most reverse osmosis seawater desalination plants today and provides practical solutions derived from worldwide experience. The reader will find guidelines for selection of pretreatment system configuration based on source seawater quality and for design of the most commonly used pretreatment technologies, such as screening, sand removal, sedimentation, dissolved air flotation, granular media filtration and membrane filtration. The author shares insights on the present and future use of ultra and microfiltration membrane technologies and their advantages and limitations for seawater pretreatment.
- 2. Desalination Plant Concentrate Management:** This book provides an overview of the alternatives for management of concentrate generated by brackish water and seawater desalination plants, as well as site specific factors involved in the selection of the most viable alternative for a given project, and the environmental review requirements and studies associated with their implementation. The book focuses on widely used alternatives for disposal of concentrate, including discharge to surface water bodies; discharge to the wastewater collection system; deep well injection; land application; evaporation; and zero liquid discharge. Direct discharge through new outfall; discharge through existing wastewater treatment plant outfall; and co-disposal with the cooling water of existing coastal power plant are thoroughly evaluated and design guidance for the use of these concentrate disposal alternatives is presented with engineers and practitioners in the field of desalination in mind. Key advantages, disadvantages, environmental impact issues and possible solutions are presented for each discharge alternative.
- 3. Desalination Cost Assessment & Management:** One of the key challenges associated with the wider implementation of seawater desalination worldwide is its relatively high cost. This book provides engineering guidelines for assessment of seawater desalination project construction, operation and maintenance (O&M) costs, and presents practical approaches for cost management using state-of-the art design methods, technologies and equipment. The book describes step-by-step desalination cost estimating procedures and practices. It clearly explains key factors impacting desalination costs and available tools to manage such impacts. It also provides an overview of the main cost-saving features incorporated in some of the best-in-class seawater desalination plants worldwide and shares lessons-learned from the implementation of recent low- and high-cost desalination projects. This book contains example construction, O&M and water production cost estimates for a typical desalination project.



Venue: Republic of Malta

This 4-day program will be held at a Resort Hotel in the Republic of Malta. Exact location of resort will be notified very soon. The Republic of Malta is a Southern European country consisting of an archipelago situated in the centre of the Mediterranean. Malta is internationally renowned as a tourist destination, with numerous recreational areas and historical monuments, including nine UNESCO World Heritage Sites,^[19] most prominently the Megalithic Temples which are some of the oldest free-standing structures in the world.

Program Organizer - Water Treatment Academy



Water Treatment Academy is a division of TechnoBiz Communications Co., Ltd. This academy is an educational and knowledge-based platform for water and wastewater treatment operators and designers. The academy organizes specialized technical training programs and conferences related to water and wastewater treatment. More information on academy services and latest activities can be found at www.watertreatment-academy.org.

Contact Address

Water Treatment Academy
TechnoBiz Communications Co., Ltd.
2521/27, Lardprao Road, Khlongchaokhunsingha
Wangthonglang, Bangkok 10310 Thailand
Tel: 66-2-933 0077 Fax: 66-2-955 9971
Email: training@watertreatment-academy.org

Registration Form – Membrane Desalination and Water Reuse

5-8 March 2013, Republic of Malta

Company Name

Address

Tel..... Fax..... Email.....

Contact Person Cell No..... Email

Participant Names:

Participant 1 Position

Email..... Cell No

Participant 2 Position

Email..... Cell No

Participant 3 Position

Email..... Cell No

Registration Fee/Participant (in Euros)

Before 31 December 2012	Before 20 January 2013	After 20 January 2013
2,000 €	2,200 €	2,500 €

Remark: Payment is required with registration. The registration fee includes training documentation, lunch, refreshments, dinners and 5 night accommodation along with THREE books written by Mr. Nikolay Voutchkov. **Group Registration:** If 3 or more delegates register from the same organization, 10% discount will be offered on the registration fee.

Payment Method

☐ Bank Transfer to

Bank Name : Bangkok Bank, A/C No: 177-0-70727-9

A/C Name : **TechnoBiz Communications Co., Ltd.**

Branch : Ratchada-Latprao Road branch, Bangkok (Swift Code: BKKBTHBK)

(Kindly make payment for all bank charges)

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(5% bank fee applies for credit card processing)

Card Number Cardholder Name

Card Expiry Date Last 3 digits on Signature Panel.....

Signature of Cardholder Date.....

Please send completely filled registration form to



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 Email: training@watertreatment-academy.org Web: www.watertreatment-academy.org
 Contact Person: Sirinthip, Program Coordinator W

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