



European
Desalination Society



Genoa University
Department of Chemistry and
Industrial Chemistry

MEMBRANE TECHNOLOGY, PROCESS AND SYSTEM DESIGN

A 3-day intensive course

Lecturer Mark Wilf, Ph.D.

March 3–5, 2010, Genoa, Italy

The seminar topics include practical information about performance and operating conditions of reverse osmosis and nanofiltration technology for brackish and seawater desalting. The program includes introduction to membrane technology, description of commercial membrane elements, illustration of the membrane system design process and overview of systems operation. Calculations of the investment and operating cost of membrane plants, based on design cases will be illustrated. A section of the seminar is dedicated to the modern microfiltration and ultrafiltration technology applied for treatment of potable water and as a pretreatment of feed water for RO systems. Course material also includes information on process and equipment applied in membrane bioreactor (MBR) systems. An overview of commercial MF and UF membrane products will be provided. It will be followed by a description of the implementation process in large membrane treatment plants. The seminar is structured in the form of three seven hour a day sessions of frontal presentation combined with hands-on exercises of calculations of operating parameters and evaluation of process economics. It is expected that knowledge gained during the seminar will enable participants to conduct critical evaluation of feasibility and design parameters of water development projects based on membrane technology and estimation of capital and operating cost. The seminar is directed toward professionals who are familiar with membrane technology, with the objective of providing practical information on commercial products, the design process, operation conditions of membrane systems and economics of the membrane desalting and water treatment applications.



Venue *Hotel Mediterranee*

Via Lungomare 69, 16155 Genoa Pegli, Italy
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The courses will be held in an 18th century building with sea-front accommodation on the picturesque Italian Riviera, just 3 km from C. Colombo Airport and 1 km from the motorway tollgate.



Located in Pegli, near the historical town of Genoa, this former residence of the Lomellini family is sheltered from the winds, enjoying a mild climate in winter and temperate in summer.

The beach is nearby and there is a frequent bus service to the centre of Genoa. There is a nearby port and railway station for making a day trip to the beautiful areas of Portofino and Rapallo.

Lecturer

Dr. Mark Wilf, Director of Membrane Technology for engineering firm — Tetra Tech, California, has planned and will deliver the course. Recognized as a global expert for commercial membrane applications, Dr. Wilf provides technical expertise to the engineering and scientific community worldwide and participates in professional forums defining future directions for membrane technology and application development. This includes reverse osmosis, nanofiltration, ultrafiltration and microfiltration technologies applied for water desalination, potable water treatment, and industrial and municipal wastewater reclamation. Dr. Wilf is active in reviewing research projects and publications being a member of the Editorial Board of the *Desalination* Journal, Advisory Expert to the Middle East Desalination Research Center and peer reviewer to a number of journals on water treatment. Dr. Wilf is regular contributor to professional journals, holds number of patents, wrote chapters on membrane technology to a number of books and recently completed the second guidebook on application of membrane technology to wastewater reclamation (www.desline.com).

PROGRAM

Day 1 Commercial membranes and water chemistry

09:00 Fundamentals of membrane desalination processes

RO process terms

Concept of semipermeable membranes for water – salt separation

Configuration of asymmetric and composite membranes

Membrane types: microfiltration, ultrafiltration, softening, brackish, seawater

Membrane elements configuration: spiral wound and hollow fibers

Membrane elements manufacturing process

Nominal performance and nominal test conditions

Membrane performance

Effect of feed water composition and process parameters on membrane performance

Translation of nominal test data to element performance in field conditions

Effect of feed water composition and process parameters on membrane and system operation

10:45 Coffee break

11:00 Water chemistry of the desalination process

Feed water types and representative water composition

Analytical data required for the desalination process design

Chemicals used in the pretreatment process

The carbonate system, alkalinity calculations

Calcium carbonate saturation indicators, methods of calculation. Saturation limits of other sparingly soluble salts. Scale inhibitors.

13:00 Lunch

14:00 Post treatment

Chemistry of post treatment process

Stabilization of RO permeate

Energy usage in desalination systems

Components of energy use

Configuration of pumping systems including energy recovery devices

Calculation of energy use and energy optimization

16:00 Summary and discussion

Day 2 Feed water sources and pretreatment process

09:00 Pretreatment process configuration

Feed water sources and feed water delivery alternatives
Feed water quality indicators
Pretreatment system configurations

- Brackish desalination systems
- Seawater desalination systems
 - Conventional pretreatment
 - Membrane pretreatment

10:45 Coffee break

11:00 Pretreatment process design

Components of conventional pretreatment systems

- Coagulation and flocculation
- Media filtration
- Dissolved air flotation
- Chemicals dosing systems

Sizing of conventional filtration systems
Operation of conventional pretreatment system
Determination of operating parameters and usage of chemicals

Membrane filtration technology

Fundamentals of membrane filtration technology
Membranes and membrane modules configuration
Membrane filtration system configurations
Sizing membrane filtration systems
Operation of membrane filtration systems

13:00 Lunch

14:00 Membrane application for feed water pretreatment

Membrane filtration applied to wastewater reclamation
Membrane filtration applied to seawater desalination
Determination of operating parameters and usage of chemicals
Comparison of conventional and membrane pretreatment

RO system configuration

RO unit configuration: single stage and multistage concentrate processing, two pass permeate treatment configuration.

16:00 Summary and discussion

Day 3 Desalination system design and economics

09:00 Introduction to desalination system design

- Project specifications
- Process development
- Calculation of membrane performance
- Process and instrumentation diagram
- Bill of materials
- Major equipment components
- System layout

10:45 Coffee break

11:00 Computer projections of RO system performance

- Methods of RO membranes performance calculations
- Algorithm of computer program for performance projection
- Features of commercial computer programs
- Examples of determination of process parameters and performance calculations
- Optimization of system performance utilizing computer calculations

Boron reduction alternatives

- Adjustment of feed water pH
- Two pass systems
- Ion exchange

13:00 Lunch

14:00 Economics of membrane projects

- Components of project cost
- Components of operating cost
- Optimization of project economics for “Turn key” and “Design Built Operate” project delivery methods

Advanced process design

- “Split Partial” two pass permeate processing
- Hybrid system configurations
- Selected aspects of MBR technology

16:00 Summary and discussion

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REGISTRATION FORM

Surname _____ Name _____

Address _____

Country _____ Telephone _____

Fax _____ Email _____

<i>Registration fee:</i>	<i>Till January 25</i>	<i>After January 25</i>
EDS members	€2.300	€2.500
Non-members	€2.500	€2.700

The fee includes 4 nights accommodation, lunches, coffee, dinners, course Workbook and CD, and *Guidebook on Membrane Desalination Technology* by Mark Wilf with chapters by Leon Awerbuch, Craig Bartels, Mike Mickley, Greame Pearce and Nikolay Voutchkov.

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