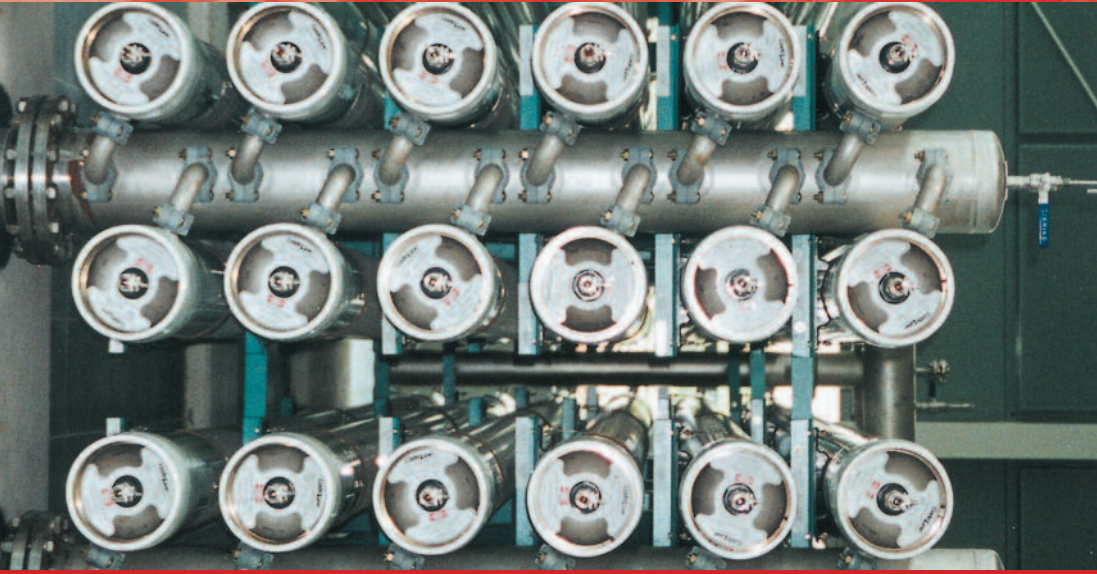


OCTOBER 5 - 9, 2009
UNESCO-IHE
DELFT, THE NETHERLANDS



SHORT COURSE ON
MEMBRANE TECHNOLOGY IN
DRINKING & INDUSTRIAL WATER
TREATMENT



Supported by the
European Desalination Society

UNESCO-IHE
Institute for Water Education





COURSE DESCRIPTION & OBJECTIVES

The purpose of this short course is to provide practical knowledge on the design and operation of membrane processes (MF,UF&RO) in the water industry. Specific membrane related problems such as membrane fouling, scaling and cleaning are dealt with in detail, including pre-treatment options and the latest developments in monitoring and controlling fouling.

MF/UF process design schemes for the treatment of drinking water, and membrane bioreactors in waste water treatment (MBR) applications will be covered. The course also includes computer aided design of brackish/seawater reverse osmosis systems, pre-treatment and post-treatment options for membrane systems and comparisons of membrane and thermal desalting systems. A visit to the world's largest integrated membrane plant (Water Supply Company of North Holland) is also included in the course.

A VISIT TO THE WORLD'S LARGEST INTEGRATED MEMBRANE PLANT IN NORTH HOLLAND

The Water Supply Company North Holland (PWN) is the world's largest integrated membrane system. Reverse Osmosis and Ultrafiltration are the key elements of this treatment plant, which has a capacity of 18 million m³/year (13 mgd). Reverse osmosis is applied with the aim of removing salinity, hardness, synthetic organic compounds, micro-organisms etc. The most important functions of ultrafiltration are the removal of micro-organisms and to provide adequate pre-treatment for the reverse osmosis plant.

ABOUT UNESCO-IHE

The UNESCO-IHE Institute for Water Education conducts scientific research and provides post-graduate education and training in the fields of water, the environment and physical infrastructure. UNESCO-IHE is a platform from which knowledge is transferred to all parts of our changing world. The institute is committed to developing and strengthening the reservoir of human resources and to improving the quality of life of all communities. In many developing countries, UNESCO-IHE is a 'partner in action' in problem-driven research, education and capacity building operations.

COURSE LECTURERS



Prof. Jan Schippers, PhD is a member of the Water Supply Group at UNESCO-IHE and professor at Wageningen

University. He has extensive professional experience in drinking and industrial water supply projects in Morocco, Qatar, Libya, Gabon, Cape Verde, Namibia, Uzbekistan, France and many other countries. Prof. Schippers is the past president of the European Desalination Society and chairman of scientific and programme committees of numerous international conferences and workshops of IWA and EDS.



Prof. Gary Amy, PhD is Professor of Water Supply and Sanitation at UNESCO-IHE as

well as professor at the Technical University of Delft. He has more than 25 years experience in drinking water treatment and wastewater reclamation and reuse. His research interests include membrane fouling and micropollutant rejection.



Maria Kennedy, PhD is a Associate Professor in Water Supply Technology at UNESCO-IHE. She is a board member of the

European Desalination Society. She has 15 years of research experience and currently specialises in research and development in the field of membrane technology. Her research areas of interest include membrane fouling (indices), scaling and cleaning and modelling of membrane systems. She has been involved in international training projects in Israel (West Bank), Jordan, Oman, St. Maarten and Yemen in the field of desalination and water reuse.

PROGRAMME 2009

MONDAY, OCTOBER 5

- 08:30 *Registration & Coffee*
- 08:45 *Opening*
- 08:50 *Introduction to membranes in drinking & industrial water production*
- 09:30 *Basic principals of MF/UF technology*
- 11:00 *Coffee Break*
- 11:30 *Overview of MF/UF membrane elements, modules and systems*
- 13:00 *Lunch (UNESCO-IHE Restaurant)*
- 14:00 *Membrane fouling in MF/UF systems*
- 16:00 *Coffee Break*
- 16:30 *MF/UF membrane cleaning: air/water flushing, backwashing and chemical cleaning*
- 18:30 *Discussion Session*
- 19:00 *Dinner (UNESCO-IHE Restaurant)*

TUESDAY, OCTOBER 6

- 08:00 *Hybrid UF/MF systems: coagulation -microfiltration (C-MF), PAC -ultrafiltration (PAC-UF)*
- 10:00 *Coffee Break*
- 10:30 *New insights in disinfection & membrane integrity*
- 12:00 *Costs of MF/UF systems*
- 13:00 *Lunch (UNESCO-IHE Restaurant)*
- 14:00 *Basic principals of Membrane Bioreactors (MBR) & applications in wastewater treatment: module configuration, process schemes and chemical & energy consumption*
- 16:00 *Coffee Break*
- 16:15 *Basic principals of RO technology*
- 18:30 *Dinner (UNESCO-IHE Restaurant)*

WEDNESDAY, OCTOBER 7

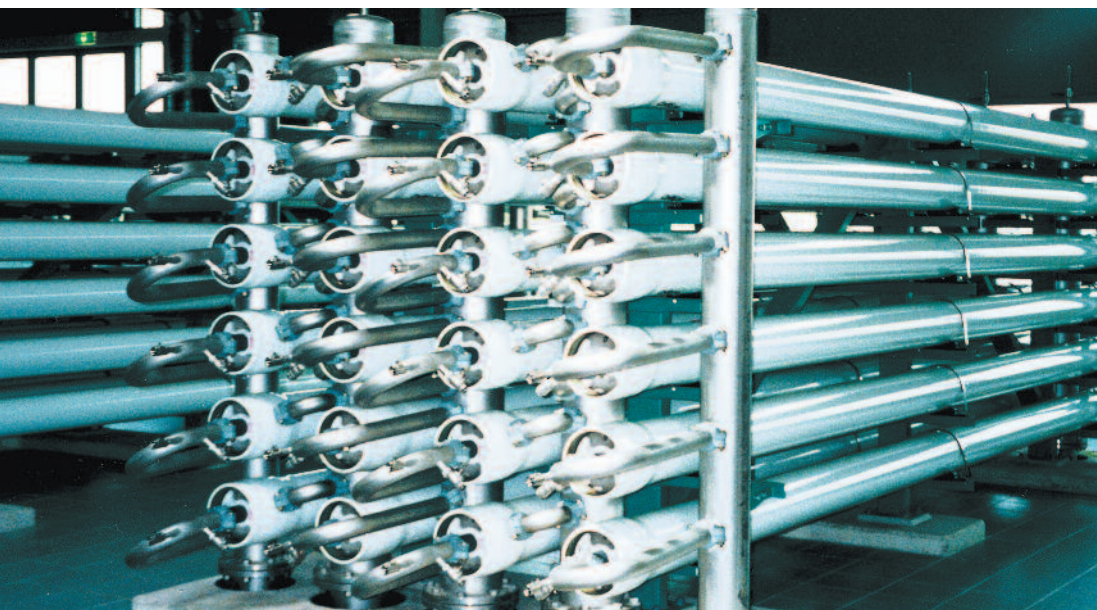
- 08:30 *Overview of RO/NF membrane elements and energy consumption*
- 10:15 *Coffee Break*
- 10:30 *RO system configuration & design: product flux, salt passage, NDP, array staging*
- 12:00 *Lunch (UNESCO-IHE Restaurant)*
- 13:00 *Fouling in SWRO & BWRO systems*
- 15:00 *Coffee Break*
- 15:30 *Scaling in SWRO & BWRO systems*
- 17:00 *Pre-treatment options for RO and NF systems*
- 18:00 *Discussion Session*

THURSDAY, OCTOBER 8

- 08:30 *Post-treatment options for RO and NF systems*
- 10:00 *Coffee Break*
- 10:30 *Full scale membrane plants*
- 11:30 *New developments in SWRO*
- 12:30 *Lunch (UNESCO-IHE Restaurant)*
- 13:30 *Plant design calculations: BWRO & SWRO Systems*
- 14:30 *Computer aided design of a SWRO plant*
- 16:00 *Computer aided design of a BWRO plant*
- 18:00 *Visit to Amsterdam*

FRIDAY, OCTOBER 9

- 09:00 *Concentrate disposal in brackish & seawater reverse osmosis systems*
- 10:15 *Coffee Break*
- 10:45 *Comparing membrane and distillation techniques: energy consumption & costs*
- 12:00 *Lunch (Socio Room) & Certificate of Attendance Awarding*
- 12:45 *Technical visit to a full scale UF/RO drinking water plant*



REGISTRATION

Delegates will be registered in the order that the application forms are received. The number of participants is limited. However, the course will be repeated if demand is high enough. Cancellation must be made no later than 2 weeks before the start of the course. Payment should be made no later than 10 days before the start of the course. No refunds will be made for cancellations made later than 7 days before the start of the course.

COURSE FEE

The fee for the course is €2,000 which includes course documentation, coffee, tea, lunch and 2 dinners. The fee does not include accommodation.

INSURANCE

All participants must be covered by health, accident and third party liability insurance from the start of the course. Our student affairs office can arrange this insurance (if necessary) upon registration. The premium for this insurance is approximately €40 (under the age of 40 years).

DELFT & SURROUNDINGS

Delft is a small, beautiful and friendly city with many shops and restaurants along its tree-lined streets and canals. Amsterdam (Schiphol) airport and the port of Rotterdam offer regular and reliable services to destinations around the world. The excellent public transport system offers visitors easy access to locations throughout the country. The cities of Amsterdam, Rotterdam and The Hague are close by, and even the Eiffel Tower and the Tower of London are within easy reach.

COURSE LOCATION

UNESCO-IHE Institute for Water Education
Westvest 7, 2611 AX Delft
The Netherlands
T +31 15 215 17 74
F +31 15 212 29 21
E m.kennedy@unesco-ihe.org
I www.unesco-ihe.org

ACCOMMODATION

Participants are responsible for making their own hotel reservations. To ensure accommodation, reservations should be made 1-2 months in advance of the course.

Hotel de Kok***

Houttuinen 15, 2611 AJ Delft
T / F +31 15 212 21 25
Rooms (single) €76 per night (incl. breakfast)
Rooms (double) €86 per night (incl. breakfast)

Hotel de Vlaming***

De Vlamingstraat 52, 2611 KZ Delft
T +31-15-2132127
F +31-15-2122006
Rooms (single) €100 per night (incl. breakfast)
Rooms (double) €105 per night (incl. breakfast)

Museum Hotel*****

Oude Delft 189, 2611 HD Delft
T +31-15-2140930
F +31-15-2140935
Rooms (single) €111 per night (incl. breakfast)
Rooms (double) €126 per night (incl. breakfast)

Hotel de Plataan***

Doelplein 10, 2611 BP Delft
T +31-15-2126046
F +31-15-2157327
Rooms (single) €88 per night (incl. breakfast)
Rooms (double) €99,50 per night (incl. breakfast)

Coen Hotel***

Coenderstraat 47, 2611 CD Delft
T +31-15-2145914
F +31-15-2126384
Rooms (single) €87 per night (incl. breakfast)
Rooms (double) €107 per night (incl. breakfast)

WWW.UNESCO-IHE.ORG/EDUCATION



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UNESCO-IHE
PO Box 3015
2601 DA Delft
The Netherlands

T +31 15 215 1715
F +31 15 212 2921
E info@unesco-ihe.org
I www.unesco-ihe.org

SC-MEM0609

UNESCO-IHE
Institute for Water Education



APPLICATION FORM SHORT COURSE

UNESCO-IHE, PO BOX 3015, 2601 DA DELFT, THE NETHERLANDS

1 **Short Course on** _____

Date _____

2 **Full name** _____ **male / female**

Official name (as mentioned in your passport) _____

Date, place and country of birth _____

Present citizenship _____

Profession _____

3 **Postal address** _____

Phone _____

Mobile cell _____

Fax _____

E-mail _____

4 **How were you informed of this course?**

Date

Signature applicant



UNESCO-IHE believes that partnerships and networks are of vital and strategic importance in improving access to, sharing and disseminating information. UNESCO-IHE acts as an interface between knowledge centres, as well as public and private sector organizations, individual scientists and professionals. The Institute aims to contribute to the achievement of synergy in the programmes and activities of existing knowledge networks. The Institute encourages all persons involved in the water sector to participate in the dynamic network of partnerships.

UNESCO-IHE provides postgraduate education, training and research in the fields of water and the environment for mid-career and senior professionals from developing countries. Since 1957, the Institute's community of partnerships includes public and private organisations.

The UNESCO-IHE community also includes over 13,400 Alumni active in water sectors worldwide, representing an extensive network of international water professionals of yesterday, today and tomorrow.

Professor Richard A. Meganck, PhD
Rector UNESCO-IHE