2003 has been a productive year for EDS. Our activities and ranks are growing. Interchange between an expanding Europe and our neighboring regions of the Middle East and North Africa (MENA) and the shared Mediterranean Basin are ever closer.

Our emphasis has been on goal-oriented research which could lead to technological advances of desalination and water purification systems while lowering costs and increasing availability. Our programs include conferences, workshops and facilitation of training courses. Besides serving as bases of information exchange, these activities have constituted meeting points of scientists and engineers from all sectors of the desalination field where friendly collaborations have been initiated. The assistance of the EC has been crucial in boosting our events and keeping registration fees low enough for participation of those from low income countries enabling their needs and accomplishments to be heard.

Since we initiated the series of conferences in North Africa in collaboration with Maghreb countries, we have seen the growth of participation in both directions — more from North Africa are also attending the series, Desalination and the Environment, held in Europe, and more participants from Europe are participating in the Strategies series of North Africa. It is a two way street. Furthermore EDS conferences in Europe have concentrated in the Mediterranean basin — Las Palmas, Cyprus, Malta where there is considerable desalination experience.

And it is already since the beginning of modern desalination time of the application of the technology that Europe and the Gulf have collaborated. Today the EDS/WSTA workshops are bonding yet more through the close technical and philosophical relationship between our Gulf colleagues and Europe.

We realize that there is an abundance of conferences and that we are cluttering this list. The first conferences in desalination took place in Europe (1962) initiated by Prof. Delyannis in Greece and repeated 7 times until 1980 in meetings on Fresh Water from the Sea which were later organized jointly with IDEA (International Desalination and Environment Association), the forerunner of IDA. There was also the conference in Washington in 1965. We appreciate that desalination has come to be recognized as a major topic on its own with many meetings of minds and souls. We keep aware of the world around us and establish collaborations. Perhaps one day we will all get together in one big event…

Some of our members are involved in the various visions, missions and roadmaps which are cropping up all over. Everyone needs desalination, and government and non-government organizations have begun to address this need and call upon us to participate in recommending ways forward.

Jan Schippers  
President

Miriam Balaban  
Secretary General

### ELECTIONS TO THE NEW BOARD 2004–2006

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 20</td>
<td>Call for nominations of candidates</td>
</tr>
<tr>
<td>March 20</td>
<td>Nominations close</td>
</tr>
<tr>
<td>March 30</td>
<td>Ballots to members</td>
</tr>
<tr>
<td>April 30</td>
<td><strong>Deadline for return of ballots</strong></td>
</tr>
<tr>
<td>May 15</td>
<td>Announce new board</td>
</tr>
<tr>
<td>May 30</td>
<td>Last meeting of the old board and first of the new board in Marrakech</td>
</tr>
</tbody>
</table>

Nominate your candidate now — even yourself!
This year the EU goes from 15 countries to 25. EDS is following by strengthening our cooperation with our neighbouring countries to answer the growing need for desalination and water reuse and the need for cooperation everywhere. It is just over 10 years since EDS was set up under the joint presidency of myself and Bengt Hallmans. At that time the interest was oriented mainly towards the European countries, which is where our initial membership lay, and in creating a strong independent European voice in desalination. Things have moved on since then. There is more desalination activity on the south side of the Mediterranean than on the north — perhaps EDS should reflect this change.

The falling cost of desalination has resulted in much increased cooperation around the Mediterranean. Over the last three years EDS has focussed its attention on the North African region by organising a series of conferences to discuss ways to alleviate regional water problems on the shores of our common water basin in close cooperation with local organizations and individual experts. The series of meetings on “Desalination Strategy in South Mediterranean Countries” which took place in Tunisia (2000) and in Egypt (2002) have grown, and now we look towards a major event in Morocco 30 May – 2 June 2004. Many of these countries are actively developing in desalination.

We strongly encourage and warmly welcome our colleagues from all around the Mediterranean (including Jordan) to join EDS, and old and new members to stand as candidates for election to the new board to ensure strong representation of the non-EU Mediterranean countries.

The Mediterranean environment and desalination
Also of note is that our conferences in the series “Desalination and the Environment” have taken place in the heart of the Mediterranean — Las Palmas, Cyprus and Malta. EDS welcomes these partnerships of organizations and individuals who are playing a role and those who wish to join us.

During 2002 and 2003 there have been a number of meetings organised by United Nations Environmental Programme (UNEP) concerning desalination and the environment in the Mediterranean region. Some very useful work has been done laying down guidelines which may eventually be enforced. Those involved in desalination in the Mediterranean should learn about their concerns and be aware of what is going on and participate in these deliberations.
This conference on desalination and the environment was devoted to fresh water for all. With limited and depleting natural sources of water, desalination can supplement some of the critically lacking amounts of water needed for sustainability.

Research scientists, decision makers, engineers, managers and operators from water companies, industries, government departments, consulting firms, research institutes and universities from 41 countries around the Mediterranean and elsewhere gathered to share their knowledge on how to provide fresh water for the world’s growing population. Over 140 oral and poster presentations were offered and an exhibition was run concurrently with the conference.

This was a return to Malta after the 1991 conference. It is significant that this conference was held in Malta where 55% of the water is provided by desalination. As early as 1881 there was a seawater distillation plant whose building still stands today. Seawater desalination by RO technology was introduced in Malta in 1982 when the plant at Ghar Lapsi was built. This marked the start of a successful programme of plant construction and operation that supplemented the scant natural water supplies. RO plants active in Malta are Ghar Lapsi, Cirkewwa and Pembroke. Technical visits were made to these plants.

From his bright presence in Malta with his wife Patti, who would have expected that Paul Simon’s appearance in our conference would be one of his last. How privileged we were. Sadly he passed away December 9, 2003.

Paul Simon was a great man. We know him as the champion of desalination in the United States and that he passed the Water Desalination Act of 1996 which enabled funding from the US government. But in the same way, he was a leading voice for many worthy causes for which he had foresight, and with the courage of his convictions stood steadfastly by them.

He was known, loved and respected for his vision, political courage and integrity and plainspoken charm. He was an unabashed liberal and maintained a spotless reputation for 50 years in the world of Illinois and national politics, and what was perhaps less known, for his role in world politics in his search for peace and plenty for all peoples. Paul was a son of a minister and the brother of a minister, but in his political, policy and journalist roles, he practiced and fought for all that he preached. He wrote 17 books.


Scientists and engineers in Europe and the GCC have a long association in developing desalination technology which helps tap the most significant source of water to augment scarce water supplies. The opportunity to apply results of research carried out in Europe arose back in the 1950’s when arid water-scarce countries in the Gulf decided to build desalination plants on a large scale. The scale-up itself offered experimentation into serious developments of this technology and lowering costs through energy saving breakthroughs. Now research is also taking place in the GCC where research centers are being expanded as well as in Europe.

The second of three joint workshops planned on behalf of the European Commission considered steps forward through joint research projects.

WSTA and EDS have collaborated in meetings and exchange of information at respective conferences over the years as well as in joint efforts in developing desalination to a viable technology. The workshops represent another step in strengthening this collaboration.

The meeting in Amsterdam with 30 participants furthered discussions begun in 2002 in L’Aquila, Italy, EDS headquarters. It was hosted by the Netherlands Water Partnership* and was held at Elsevier, Publishers of the Desalination journal. Enjoyable evenings included one on the Amsterdam canals where discussions continued and good cheer prevailed.

A visit to the UF and RO Water treatment plant in Heemskerk of the PWN Water Supply Company, North Holland took place the day following the workshop.

Introduction
The World Bank has initiated the project “Seawater and Brackish Water Desalination in the Middle East, North Africa and Central Asia” The objective of the project is to improve the understanding of World Bank staff and World Bank clients in the Middle-East and North Africa (MENA) and Central Asia (CA) regions of recent changes in the Desalination Market. The project is financed by the Bank Netherlands Water Partnership Program and is managed by the World Bank.

Scope of the project
The technical aspects of desalination are fairly well known, comparatively little is known about the institutional framework for desalination within the broader context of the water and power policies in the individual countries, and how various approaches for private sector participation affect the prospects for desalination. This will be assessed in the project.

Furthermore the possible social impact shall be assessed of passing on the relatively high costs of desalination fully or partly to water users, including the poor, in the less affluent countries of MENA and CA.

The study is expected to build on the knowledge gained with desalination, in particular with the recent introduction of PSP in desalination in developed countries in particular the United States, the Mediterranean Countries and Gulf Countries. The study will attempt to adapt this experience to the local circumstances in the countries in MENA. In CA, with its unique setting, it will focus on the analysis of the existing institutional arrangements and how the PSP can participate in the operation, and perhaps the funding, of small-scale desalination plants.

Desalination
For the purpose of this study, desalination will include any process which removes salt from sea water or brackish groundwater. It excludes the desalination of treated industrial and municipal wastewater. The study will focus on small desalination plants (<500 m³/d). A limited analysis may be done for medium size (500–20,000 m³/d) and large-scale desalination plants (20,000 m³/d or more).

Messages
At the closure of the Inception Workshop of the project held in December 2002 in the Netherlands eight messages were formulated that will form the basis for the work of the consultant in this study.

1. Reliability
Desalination is a very reliable source of fresh water supply, independent of climatologic conditions, well capable of tackling drought conditions and closing the supply gap.

2. Environment and Energy
It is a common misunderstanding that desalination is very energy intensive and has severe adverse environmental impacts, particularly through brine.

3. Affordability Desalination
Desalination in coastal areas for public water supply becomes more and more affordable, which can be further enhanced by smart tariff setting and cross-subsidies. Away from the coast, transmission costs make desalination usually much less affordable.

4. Water Supply Management
Desalination, but also other non-conventional water resources, triggers actions to reduce unaccounted-for losses. It stimulates improvements in drinking water production and delivery efficiencies.

5. Water Demand Management
Desalination stimulates water demand management, if properly priced and supported by effective legal and policy measures and public awareness campaigns.

6. Institutional Framework
Proper institutional, legal and policy frameworks can only be developed and sustained if sufficient human capabilities are developed.

7. Private Sector Involvement
The Private Sector plays a crucial role in desalination, in increasing the efficiency of water supply operations, and in catering for badly needed investments in the desalination sector.

8. Research and Training
Research, training, and capacity building needs to be extended, following the anticipated growth of the desalination market.

Contribution to the discussion
As a reader of the EDS Newsletter you are an expert in one of the interested fields concerned with Desalination. Therefore we should like to invite you to participate in the discussion that was started on these topics at the closure of the Inception workshop of the project.

We very much like to receive comments on these messages from as many people as possible who are active in the desalination market.

(Continued on page 6)
In the context of the Hashemite Kingdom of Jordan’s National Water Strategy, momentum is building up within Governmental institutions, universities and the private sector to harness desalination to bridge Jordan’s demand/supply gap. On August 18 and 19, 2003, the U.S. Agency for International Development (USAID) sponsored a seminar at the Dead Sea to examine challenges and opportunities; Camp Dresser & McKee International Inc. (CDM) and the Middle East Desalination Research Center (MEDRC) designed and executed the program with speaker support from the World Bank. As the primary stewards of Jordan’s water resources, the Ministry of Water and Irrigation (MWI), and its utility and irrigation branches, the Water Authority of Jordan (WAJ) and Jordan Valley Authority (JVA) respectively, provided a focal point for future action. Other participants included key Jordanian government agencies, universities, foreign donors and the private sector, as well as the Royal Hashemite Court.

The goal of the seminar was to catalyze dialogue between these parties and highlight the need for preparing the foundation for a targeted approach. With proper planning, desalination can augment Jordan’s domestic, agricultural and industrial supply, while benefiting the environment and alleviating stress on existing sources. International specialists delivered general presentations, while Jordanian experts presented case studies, future projects and lessons learned; a panel session provided for additional questions and answers; and, working groups discussed approaches to strategic planning, financing, role of the private sector and capacity development. MWI provided an interesting angle to the main discussion with their presentation on the much-debated Red-Dead Conveyance Project; information on the desalination component in this scheme, proposed to protect the Dead Sea, was provided by MEDRC highlighting needed early research. It is worth noting that MEDRC’s perspective, enhanced by lessons learned from their recent Operational Audit of WAJ desalination plants, and efforts towards establishing a center for training in desalination practice in Aqaba, were critical to developing an effective seminar program and helped the discussion remain grounded in sustainable and realistic approaches.

Through the combination of expert presentations and interactive working groups, participants generated a series of preliminary recommendations for action. Consensus emerged for the following critical success factors:

- Development of a broad-based national expert working group, or “roundtable”, under MWI leadership, to develop and sustain desalination efforts in the context of the integrated water resources management and the national Water Master Plan;
- A formal desalination-focused training program in Jordan, to build local human resources to meet the long-term sector needs and position Jordan as regional leader; and,
- Integrated involvement by the Jordanian private sector (manufacturers, vendors, contractors, engineers, investors), that appears well positioned to meet the demands of design, installation, operations and maintenance of most types of facilities.

We hope that we will receive many reactions and that we will have a fruitful and interesting discussion on the topic of desalination. Many people in the regions of the study but also outside thereof should benefit from our common efforts.

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It is part of our cultural heritage to consider water an inexhaustible resource always available in unlimited quantities. Unfortunately times are changing and it has gradually become impossible to consider water as a granted commodity as we did in the past.

Statistics show that water availability per person has been halved in the last fifty years and water scarcity has now become a pressing issue also outside the traditionally "water stressed areas" of the Middle East and North Africa.

Population increase, industrial-agricultural development and, luckily, improvement in living standards are the main drivers of the gradual depletion of water resources and for the alteration of the "fresh water" "wastewater balance" in the planet. Simply we are surrounded by less fresh water and by more wastewater with an increasing tremendous pressure on the environment.

While natural resources are getting scarcer; "new water" or desalinated water becomes cheaper. In many cases the cost of traditional water supply has become break even with desalination and water re-use water costs and since one decade this "new water situation" has modified our perception of the value of water. Somehow, in fact, we have been used to paying for water according to its "cost" and not according to its value, a concept extremely penalizing for desalination and water re-use technologies.

We are now gradually reaching a new understanding of the water value whereby one cubic meter of water taken from a natural source has a much greater value than one cubic meter of water produced from a wastewater treatment plant. Despite the fact that the cost of each resource is getting closer to the other, there is a social value in natural water resource, and this value has to be protected by an enforced legislation.

The whole desalination community does not want to wait until the remaining water resources on the planet are extinguished to keep pace with the continuously altered water/wastewater balance. Technology is tremendously improving offering options, which could not have been conceivable one decade ago.

We have to keep pace with the market to turn a severe wastewater/fresh water balance into a full fresh water planet.

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A 4-DAY INTENSIVE COURSE ON RO, NF AND MEMBRANE FILTRATION TECHNOLOGY FOR POTABLE WATER APPLICATIONS
Lecturer Mark Wilf, Ph.D.
February 14–17, 2005, L'Aquila, Italy

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 feedwater for RO 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.

Registration fee:
Till November 15 € 1,900 After November 15 € 2,000
The fee includes the course material, 5 nights accommodation, transportation to/from airport, lunches, coffee, dinners.

Contact: balaban@desline.com

A 4-DAY INTENSIVE COURSE ON THERMAL DESALINATION PROCESSES AND ECONOMICS
Lecturer Corrado Sommariva, Ph.D.
July 12–15, 2004 L'Aquila, Italy

Topics include information about desalination technology, starting with basic concepts of water chemistry and desalination mass and energy balance. This is followed by detailed evaluation of two major desalination methods; MSF and MED distillation. The technology description includes theoretical principles of the process, principles of desalination system operation, system design, evaluation of the economics of the process.

Registration fee:
Till June 15 € 1,900 After June15 € 2,000
The fee includes the course material, 5 nights accommodation, transportation to/from airport, lunches, coffee, dinners.

Contact: balaban@desline.com
DESALINATION IN CYPRUS
THE PROCEDURE TO DECIDE AND GET APPROVALS AS APPLIED PROBLEMS AND QUESTIONS
Nicos X. Tsiourtis
Technical Consultant on Desalination, Nicosia, Cyprus

Cyprus is a semi arid country suffering from water scarcity with average annual water availability of around 410 m³ per capita, less than a third of the threshold minimum of 1500 m³ per capita, set by the United Nations for a sustainable unhindered development. Of this quantity about 38.5% is coming from groundwater, which is a steady supply, 11.5% comes from recycled and desalinated water and the remaining 50% is surface water impounded in surface reservoirs. All groundwater has been developed in the 1960’s and almost all surface water resources are developed. The cost of the development of the undeveloped surface water is relatively high since all good dam-sites have been developed and the environmental requirements increase the cost.

The diminishing groundwater resources and the irregular and continuously reducing surface supplies over the last 15 years have created great water shortages, which forced the Government to revise its water plans. The new plans provided for the construction of seawater desalination plants of a total capacity of approximately 40 MCM for providing potable water for the main cities of the island, the acceleration of construction of the domestic effluents re-use plants, the development of the free running surface water resources (very small quantities), the adoption of more stringent water demand methods, and the promotion of water saving methods. During the years 1991–1992 and 1996–2000, due to the serious water shortage caused by repeated prolonged drought events, the Government approved and implemented water cuts to domestic water supplies up to 20–30% of the normal demand and to irrigation supplies up to 70% of the normal demand, prohibiting in many cases the cultivation of annual crops and reducing the water supplies to permanent crops up to 40%. The water shortages affected adversely the country’s economy, the social life and to some extend the environment since nature was deprived from the water supplies. Water supplies for domestic use was rationed, supplied every other day, and farmers were forced to reduce irrigation water to permanent crops and to reduce the areas cultivated with annual crops, leading to reduced incomes.

Desalination has the advantage of increasing the reliability of supply (Reliability of supply is approaching 100%) and for increasing the volume of supply of water in the supply side of the Water Balance sheet, with minor environmental effects on the marine environment at the point of brine discharge and for increasing the gas emissions to the atmosphere because of increased power production. With the advantages very well understood and positively rated and with the environmental effects being relatively minor the Government decided to proceed with the implementation of the desalination program thus increasing the availability of water at a much higher reliability of supply than the natural water resources.

The implementation of the desalination program followed a carefully agreed procedure, which included the following steps.

a) Re-evaluation of the water needs and water availability to decide whether desalination was a real need.

b) Selection of a number of potential sites fulfilling a number of criteria related to

i) to environmental considerations (outside and away from areas classified as environmentally important areas or conservation areas, away from inhabited areas cities or villages, or other areas that might be affected by the desalination facilities),

ii) to economic criteria (plant to be closed to good quality raw seawater resources, closed to power supply, and closed to the brine discharge point),

iii) to public acceptance and iv) fulfilling certain poleodomic and rural planning considerations.

c) Following the selection of the suitable sites a preliminary environmental and siting study would follow to select one or two most suitable sites.

d) For the selected one or two sites a full Environmental Impact Assessment Study (EIAS) should be carried out by an independent consultant approved by the Government and with the consent of the nearby communities and the NGO (Environment movement sand parties).

e) The study should be presented to all concerned parties for evaluation and approval.

f) The final selection of the site depends on the approval of EIAS by all concerned.

Although the steps cover all requirements of the project and satisfy the demands of the environmentalists and of the affected communities it is not in any way covered by any law or regulations nor is related to time limits for every step. This gives the chance to the opposing parties to drag the process in any length in such a way even to kill the project.

During 1996 and 1999 the Cyprus Government succeeded to get approvals (with some opposition) for the construction of two desalination plants, which were constructed and put into operation, the first (Dhekelia Plant with a nominal capacity of 40,000 m³/d) in April 1997 and the second (Larnaca Plant with a nominal capacity of 52,000 m³/d) in May 2001 (see Fig. 1). In both cases the outlined steps were followed, others in a brief manner and others in detail. The decision was “helped” mainly by the great need of water because at the time the island was facing an acute water shortage, which was caused by the prolonged...
droughts events. Both Plants provide domestic water for Nicosia and Larnaca towns and for the rural areas around the towns as well for the villages and municipalities in the Famagusta non-occupied\(^1\) areas. The third desalination plant was planned for the Limassol area with an original nominal capacity of 20,000 m\(^3/d\) with option to be increased to 40,000 m\(^3/d\) to be operational by the beginning of 2005, providing around two years for the issue of tenders, award, construction and power supply. Although the procedure started in November 2001 with a target date to get final approvals for issuing tender documents in August 2002 and although steps a-e have been completed, the process is on hold because of reactions by the affected communities and the environmentalists. The environmentalists have succeeded to persuade the affected communities and the Parliament Environment Committee that desalination will have an adverse effect on the marine environment and will affect adversely the development of surrounding region.

In the case of the effect on the marine environment it has been proven in two cases in Cyprus that the effects are negligible since the affected area is minimized during construction by following the recommendations of the Environment Committee. The outfall pipe should be installed without using explosive materials, the discharge point is located outside the Poseidonia Beds and deep enough to achieve high dilution of the brine and the design and operation of the plant shall be made such as to avoid the discharge of high concentration of metals and other hazardous materials that are used during the flashing of the membranes and backwash of the filters.

In the argument of the environmentalists that the desalination process shall increase the emission to the atmosphere of additional green house gases it can be stated that for the production of the domestic water demand of one person corresponds to the consumption of 1kWh/d, which corresponds to 10% of the total consumption of electric energy per capita per day. This also corresponds to travel of one kilometer by a family car. The above indicate that the power required to produce the amount of water required for one person is minimal compared to other consumptions, needless to say that the supply of potable water is a basic need which must be satisfied.

In conclusion it can be said that a legal framework must govern the procedure for the implementation of desalination plants. The legal framework must provide for the steps that must be followed by the responsible entity to safeguard the permits all bound by time periods in which those concerned must submit their comments, objections and suggestions. Although the present procedure as outlined above covers all steps, it does not set time limits for decisions to be taken, something which leaves the whole process without an end.

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\(^1\) In 1974 Turkey invaded Cyprus and since then it occupies 37% of the islands area defying UN resolutions to withdraw.

Fig. 1. Major Waterworks including desalination plants.
MEMBRANE MARKET DEVELOPMENT
IN RUSSIA INSPIRED BY THE LATEST MALTA MEETING

Alexei Pervov
President, WATERLAB, Russia

Membrane technology is probably the only technology whose development could hardly be predicted. All techniques that yesterday seemed to be very attractive and promising, today are ignored. And vice versa, what yesterday was defined as dead-end research, today is widely applied and considered as the most advanced one.

Reverse osmosis, hollow fiber RO, antiscalants, etc. were demonstrated at the Malta desalination meeting ten years ago. Today nearly all membrane companies sell ultrafiltration. The wide distribution of RO, the scale of UF industrial development is impressive. There is a decrease of membrane prices and a decrease of energy consumption due to power recovery.

Today we can outline new fields of membrane application: solution of traditional problems of drinking water supply — reduction of colour when treating surface and groundwater.

Recently [1] we have reported our success in the RO promotion for food industry applications. The Russian vodka production boom gave a strong impetus to the manufacture and sales of RO units that inspired the purchase of American membranes, accessories and chemicals. Just as the Gulf countries promoted business development of seawater desalination, new Russian capitalists are boosting a promising branch of the water market.

During the last years the membrane market has been constantly transferring from desalination processes towards colour removal and surface water treatment. Though UF is effectively applied in large-size municipal water supply systems, there is no a chance for such an expensive project in the nearest future. Similar to the Emirates, Russia suffers from the same lack of quality drinking water. Especially all Siberia and northern regions have ground-water with exceedingly high colour values up to 200 degrees! Few municipalities can afford colour removal being limited by clarification and flocculation processes. Attempts are undertaken to introduce ozone and sorption combined with chemical clarification. Russian oil and gas “sheikhs” seem to be possible customers for nanofiltration and ultrafiltration membranes for small- and medium-size units for drinking water production. Many oil/gas production companies have employees, living in small communities located in the production regions that lack drinking water. Membrane units seem to be the best solution of this problem.

Moreover, large northern cities also suffer from low quality tap water, as municipal water supply systems in many cases cannot successfully remove colour. Citizens can afford expensive cars, expensive apartments and expensive equipment but cannot afford clear water in their bath and their shower, not to mention water for cooking. To provide a solution, individual point-of-entry membrane units are developed to provide high quality water for apartments, buildings or a district.

Nanofiltration with low rejection (50% and less) proved to be very promising for colour removal. But the attitude towards the efficiency and reliability of membrane behavior, subjected to high molecular organics, is rather contradictory. Some specialists are convinced that organics create a severe fouling problem and suggest removal during pretreatment, some suggest NF membranes (Hydranautics and Koch) and some recommend efficient organic cleaners.

The safe operation of NF membranes during high colour water treatment must be assured. Fig. 1 shows molecular mass distribution provided by chromatographic screening of typical northern groundwater, circulated in a test loop through an NF module. As can be seen, the NF membrane rejects all molecules with a molecular weight higher than 50–60. The research was undertaken to reveal the mechanism of organics accumulation on NF membranes [2]. Fig. 2 shows (a) dependence of mass accumulation...
The plots indicate that low-molecular organics (fulvic and humic acids) do not accumulate on the membrane surface. At first they form a thin adsorption layer that finally rejects organics. After accumulation of 2000 mg per 1 m² of membrane, the accumulation rate dramatically decreases (Fig. 2b). For this groundwater sample, safe operation of the NF membrane unit could be provided without fear of organics influence on the membrane performance.

For a number of cases colour removal from surface and groundwater ultrafiltration could be used in combination with flocculation pretreatment. For certain cases UF and NF processes could seem competitive. Fig. 3 shows the comparison of the unit capital and operational costs for NF and UF depending on water colour for groundwater treatment. For high colour, NF seems more economically efficient (Fig. 3a). For surface water treatment with high colour and turbidity, a combination of UF and NF processes seems to be more efficient, providing higher quality than UF with coagulation pretreatment (Fig. 3b). The curves, yielding unit costs have junction points corresponding to the optimum colour amount. NF is efficient for all colour values to the right of the junction point, and UF could be effectively used for values to the left of the junction point.

The ultrafiltration process for removal of iron and organics from groundwater and colloidal matter from surface water is a subject for investigation. Optimization of UF operational parameters is developed to determine optimum backpulse time and filtration time, corresponding to maximum water recovery (Fig. 4). The models developed are verified for a number of applications both for iron removal from groundwater and surface water clarification, based on home-made UF spiral wound backwashable CA and composite membranes and polysulphone capillaries.

Northern water is characterized by low TDS and low hardness with variable dissolved organics. For many cases low molecular organics could be removed by NF membranes. Meanwhile, often the use of NF contradicts with hygienic WHO standards when “dissolving” water with very low TDS. As is known, low pressure NF membrane rejection is very dependent on pressure, so by varying pressure and recovery, different product water compositions can be obtained. The software is developed to predict the product composition achieved in our installations tailored with home-made NF membranes OPMN-type (polyvinyl alcohol). The program also predicts penetration of small amounts of fluoride, iron, low molecular organics into the product water [2] and is very helpful to demonstrate the predicted chemical composition of the product water when doubts upon NF applicability appear. Another reason for doubt when NF is
used for water treatment is high operational costs consisting of chemical (antiscalant) addition and cleanings. To reduce the costs connected with antiscalant handling and dosing, a solid-state inhibitor and dosing cartridges are developed, which can be easily replaced after 2–3 months of operation. A typical 200 l/h NF wall-mounted system is shown in Fig. 5 (using an easy-to-replace inhibitor dosing cartridge and Hydranautics FREE membrane). To reduce the membrane equipment costs, cartridge type membrane vessels are used, manufactured from polypropylene tubes and welded end-plugs (Fig. 6), similar to Hydranautics FREE membranes. Cartridge-type membrane units, consisting of membrane blocks, pump blocks, antiscalant cartridge block can be easily mounted and easily transported. A cartridge-block type unit producing 5–8 m³/h is shown in Fig. 6.

It is noteworthy that calcium carbonate and other possible

Fig. 4. Optimization of UF operational parameters: (a) decrease of product flux with time (backflush duration is 30 s); (b) dependence of product and backwash water volumes on operational time; (c) optimum filtration time values (backflush duration is 30 s); (d) optimum backwash duration.

Fig. 5. A 200 l/h NF wall-mounted system.

Fig. 6. A cartridge-block type unit producing 5–8 m³/h.

(Continued on page 14)
The Center for Renewable Energy Sources (CRES) in Greece in cooperation with two Greek companies, Photovoltaic and Advice successfully work on autonomous seawater desalination driven by renewable energy sources. The project is entitled "Design and Development of an Autonomous Desalination System with Photovoltaics and Wind Generator". The project was partially financed by the Greek Ministry of Development within the Operational Programme for Competitiveness, Measure 4.3, PAVET 2000, Third Community Support Framework. The project started on October 2001 and has a 24-month duration.

The aim of this project is the design and development of a pilot autonomous hybrid power supply system to drive a seawater reverse osmosis (RO) desalination unit for the production of potable water. The system has been installed at CRES Wind Park at Lavrio, Attiki.

The use of both PVs and the small wind generator presents several advantages such as high reliability, low maintenance requirements, simple structure, low transportation cost and short construction time. The desalination technology used, reverse osmosis, is the most technically feasible and most applicable technology concerning the coupling with PV and wind power supply systems.

The hybrid RO system mainly consists of 4 kWp PVs, Siemens SM110; a 900 W Wind Generator, H40 WHISPER; a 130 l/h seawater RO unit, a battery bank of 1850 Ah/100h and two inverters of 1.5 kW and 3 kW each nominal power. The PV array is separated in three sub-arrays of 12 modules each, each one connected to a charge controller (3 controllers in total). PV array has an adjustable tilt during the year (2 positions,) according to the solar altitude. The wind generator (WG) has its own charger, which controls the voltage from the generator and prevents battery overcharging. A uniquely designed resistor bank is used as load dumping. A circuit breaker to stop the wind generator is also included.

The energy produced from both PVs and WG drives the RO unit. A battery bank of 1850 Ah/100h is used as energy buffer and mainly to provide stable power to the RO unit.

Two inverters are used in order to convert the DC voltage from the battery bank to AC to the main load (RO). An inverter (I) of 1.5 kW drives the booster pump and the flushing pump during the flushing process, and also is able to provide electricity to other auxiliary loads. A second inverter (II) of 3 kW drives the high-pressure pump of the RO unit. In order to be able to examine the performance of the power supply system the following measurements are taken. All the data are recorded in a data logger.

- pyranometer to measure the solar radiation
- anemometer to measure the wind speed at the required height
- voltage sensors at the battery bank
- current sensors at the exit of the W/G, PV, at the battery bank and
- power transducers at the exit of the two inverters

The RO unit operates in a closed water circuit since no seawater is available at the site where the system has been installed. The seawater for the unit is achieved by mixing fresh water from the water distribution network with salt in a water storage tank of 2 m³.

A booster pump of 0.45 kW drives the feed water with a pressure of around 1.5 bar to the pretreatment system (see Fig. 1). This is supplied from the 1.5 kW Inverter (I) at 24 Volt. The pretreatment system for the particular application is very simple and consists of a carbon filter for water dechlorination and a 5 cartridge filter for polishing-filtration, to remove only very small amounts of materials. A positive displacement high-pressure pump of 2.2 kW pressurizes the feed water at a pressure of 58 bars to the RO membranes. This is supplied from the 3 kW Inverter (II) at 24 V. A frequency converter converts the 3-phase frequency of the high-pressure pump motor to 1-phase. For the high-pressure pump, a 3-phase motor is used since low inrush currents characterize these motors. Additionally, the high-pressure pump includes a pulsation damper for smooth operation.

For the RO module system, 2” FilmTec, SW30-2540 spiral wound membranes are used. Two pressure vessels connected in series with one membrane of 2” diameter each, are used to desalinate 37,000ppm TDS seawater to fresh water of around 230 ppm TDS salinity. The hourly product water capacity is of around 130 l. The unit operates at a recovery ratio of 15%. The brine exit from the membrane is transferred to the water storage tank.

An amount of the produced water is stored at a flushing tank having a capacity of 0.1 m³. This is used to flash the membranes with fresh water at every shut down of the RO unit by the use of a small pump of 420 W. The tank is also elevated so that flow due to gravity insures complete flushing of the membranes under all circumstances.

In order to be able to follow the performance of the unit, record keeping, preferably on a daily basis, is required. Sensors and control systems such as flow, conductivity, pressure meters and temperature switches, having 4–20 mA output are included. The measurements are as follows:

- Pressure gauge before and after the high-pressure pump
- Temperature of the feed water

The work performed within the project is entitled "Design and Development of an Autonomous Desalination System with Photovoltaics and Wind Generator". The project was partially financed by the Greek Ministry of Development within the Operational Programme for Competitiveness, Measure 4.3, PAVET 2000, Third Community Support Framework. The project started on October 2001 and has a 24-month duration.

Eftihia Tzena, Marios Sigalas

aCenter for Renewable Energy Sources, Greece, bPhotovoltaic, Greece
Conductivity of the product water

Flow rate of the product water

The above signals are also input to the data logger.

A monitoring and control system concerning the optimum operation and cooperation of the RES hybrid system and the RO unit is under development. Several strategies based on the measurements as well as on operational principles of autonomous systems will be followed. Main operational parameters will be displayed on a PC screen for demonstration purposes.

The up to now measurements provide a 5 h daily operation during winter. The continuation of the measurements will provide the opportunity for more results and decisions to be taken for system’s optimization.

The final success of this hybrid desalination pilot project is vital for areas with water scarcity problems and lack of electricity. At the end of the Hybrid RO project, we will be able to design, develop and provide complete and economical attractive solutions for water production and electricity generation by RES, for remote areas characterized by lack of potable water and an electric grid.

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A new consideration for membrane market development in Russia inspired by the latest Malta Meeting

(Continued from page 13)

Sparingly-soluble salt formation do not often occur in NF modules treating northern waters with low hardness (less than 1 meq/l). As was previously reported [4], low rejection of NF membranes (about 50%) does not provide suitable conditions for supersaturation and crystal formation [4].

Calcium carbonate formation remains a problem of membrane operational stability and should be handled using our experimental tools [3].

Following our research experimental tools we are collecting innovations in membrane production and membrane system design to breakthrough the enormous Russian Siberian water market.

References


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At present, pumps having flow rates up to 900 m³/h and heads between 600 and 900 m are used in sea water desalination plants (Fig. 1).

Ring-section centrifugal pumps present an optimal solution for these operating data. For cost reasons, ring-section centrifugal pumps are preferred. As these machines must operate 6000 to 8000 hours per year, the following must be fulfilled:

- In order to keep energy costs low, optimal efficiency of the pump is required.
- The Q-H characteristics of the hydraulic system have to be stable in order to ensure parallel operation of several pumps with the least problems possible.
- The NPSH of the pump must be low in order to prevent damage caused by cavitation. It may be necessary to use special suction impellers.
- The aim is to have service intervals of 5 years. This means that, if possible, they coincide with the regular maintenance cycles of desalination plants in order to avoid unscheduled production interruptions.
- Wear parts, such as shaft seals, bearings, and casing wear rings have defined service lives and should therefore allow quick exchange.
- Due to the fact that, as a rule, no instruments are provided for the early failure detection, an availability of 95% is expected.

To summarise, operating costs, reliability, and availability must be at an optimum. Therefore, the life-cycle costs cannot be disregarded.

As the above-mentioned marginal conditions also apply to boiler feed pumps without restriction, our collective experiences in research, development and operation of boiler feed pumps can be transferred directly to ring-section pumps for sea water desalination plants. That which complicates matters further with regard to these machines is that temperature shocks must be taken into consideration. Since 1985 more than 4000 pumps of the type series HG have been sold. In addition to this are 400 customised barrel casing pumps with motor power outputs of up to 42,000 kW (Fig. 2).

Here we would like to point out some trends in the development of boiler feed pumps. The literature hereto can be procured from the KSB Marketing Department (info@ksb.com).
- Jointly with the VDMA (German Machinery and Plant Manufacturers’ Association) and Prof. Dr. Stoffel of the Technical University Darmstadt, studies were made to find out which maximum efficiencies can theoretically be achieved. [1]
- In [2] the development of hydraulic systems with maximum efficiencies and modern suction impellers for high circumferential speeds is described.
- Because the operating life of wear parts such as mechanical seals and bearings depend on the smooth operation of the pump, special impellers and diffusers were developed which show very minor hydraulic imbalances. Rigid bearing brackets with high natural frequencies have a supporting effect. These and further measures to improve the smooth operation are also clearly specified in [2].
- In [3], B. Brecht, U. Bruhns, and J. Schill discuss life-cycle costs.

A totally new concept was realised during the development of a feed pump without oil-lubricated bearings. Contamination of feed water/drinking water by lubricating oil no longer is an issue. There have been sufficient experiences with water-lubricated bearings. In the past materials such as bronze, rubber, carbon, ceramics, hard metal etc. were used. In an extensive series of tests, a material combination for boiler feed pumps was determined. The construction and testing of a prototype followed. This pump operated approx. 6000 h and during that time was stopped 6000 times and re-started. The water temperature was 120°C, the test set-up is shown in Fig. 3.
Following the successful conclusion of trials, the type series HGM 1994 was released for sale. In the meantime, 1300 pumps have been sold.

The lists of references for the type series HG and HGM are available.

For two reasons it was then clear that a pump for seawater desalination be designed (see Fig. 4). The mechanical and hydraulic part, as shown above, is available. We were able to have recourse to the developments of our own foundry for the very complex materials suitable for seawater and brackish water. Under the name NORIDUR [4], a ferritic-austenitic, special stainless cast steel was developed which has very high resistance to corrosion, perfect resistance against intercrystalline corrosion, and thus intercrystalline stress corrosion in many acidic media. Included in the application range are: chemical process engineering, pumping of sewage, environmental technology, offshore engineering, seawater desalination etc. KSB pumps made of this material were also produced for multistage flash (MSF), multiple effect distillation (MED), and reverse osmosis (RO) plants. This is also standard material for borehole injection pumps.

The prototype testing of the new pump type series HGM-RO was concluded in 2002 and is now available on the world market. A detailed description of the pump is supplied in [5].

References


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AN INTENSIVE ONE-DAY COURSE: MEMBRANE DESALINATION TECHNOLOGIES IN PRACTICE

The practical training course is designed for Middle-East, Mediterranean and South European Region membrane-based water desalination plant operators, engineers and managers for one full day, with a second day as an option if there is enough interest.

Major subjects of discussion will primarily focus on brackish and seawater desalination utilizing reverse osmosis and other integrated membrane technology applications, and include: feed water sources, chemistry and quality evaluation; pretreatment requirements; membrane system design, operation and performance monitoring; membrane types, materials and configurations; membrane process integration; RO desalination plant operation optimization and troubleshooting techniques; membrane fouling identification, early-warning monitoring and prevention; practical biofouling control and prevention guidelines; and innovative membrane technologies and software applications; RO plant case histories; practical plant design, O&M guideline.

The course will be conducted by Eng. Mohamed Amin Saad, MASAR Technologies, Inc.

Each trainee will receive a comprehensive, state-of-the-art course CD-Rom including session agenda, full session presentations slide show, selected technical papers and publications, etc.


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http://www.masar.com/euromed2004course.html
The conference will take place in the Grand Hotel Miramare in Santa Margherita on the Portofino coast of the Liguria region and in La Spezia. The Miramare, one of the first Grand Hotels on the Ligurian coast, was founded in 1903. In 1933, from the panoramic terrace of the Miramare and for the first time in history, Guglielmo Marconi transmitted telegraphic radio and telephonic radio signals to a distance of 150 km, thanks to microwaves of 60 cm. The hotel became the scientist’s headquarters where he lodged in suite number 105. This suite still bears his name today. In 1951, The International Conference for the “Pool of Coal and Steel”, presided over by De Gasperi and by the French First Minister Plevin, from which the European Economic Community (EEC) was eventually formed, took place at the Miramare. In 1971, the Emperor of Ethiopia, Haile Selassie, made one of his two stops at the hotel during his official visit to Italy, and in 1945 they specially created a honeymoon suite for Laurence Olivier and Vivien Leigh.

Santa Margherita is one of the most elegant of seaside towns. A masterpiece produced by the simple and sophisticated culture of Liguria. It boasts a long-standing tradition of hospitality. Around Santa Margherita there are whole constellations of beauties hidden amidst the green and the blue.

A workshop and banquet will be held in La Spezia, a nice town wedged in an enchanting gulf in the Ligurian Eastern Riviera, sheltered at the ends by two castles centuries old, which overhang the tourist villages of Lerici and Porto-venere. It can be easily accessed from either Pisa and Genoa airport.

One day sightseeing trips by boat can be organized to visit the unique “Cinque Terre” (Five Villages), with their terraced vineyards and enchanting fishing villages.

The area of La Spezia is also central to several industries and firms involved in the desalination business, such as: Fisia Italimpianti, Reggiane Belleli, Energy WTD, Termomeccanica Group, etc., who will provide support to the event as well as the Chambers of Commerce in the two regions.
Back to L’Aquila where this series was started in 1996. The conference will give an overview of the most recent developments in membrane technology. The event will bring together research scientists, engineers, managers and operators from water supply companies, industries, government departments, consulting firms, research institutions and universities.

Increasingly well-attended meetings in this series have been held in L’Aquila, Amsterdam, Paris and Mulheim, and now we are returning to L’Aquila. We have many welcoming hosts for future meetings in this series (in conjunction with IWA and AWWA), so we look towards the future in 2006 in Cranfield, 2008 in Toulouse and 2010 in Trondheim!

The theme, Membranes in Drinking and Industrial Water Production, includes the treatment of groundwater, river, lake and sea water, filter backwash water, industrial and domestic wastewaters with membrane processes: reverse osmosis, nanofiltration, ultrafiltration, microfiltration and electrodialysis.

A 4-DAY COURSE ON RO AND NANOFILTRATION TECHNOLOGY
Lecturer Dr. Mark Wilf
20–23 October 2003, L’Aquila, Italy

36 students from 17 countries on 3 continents enjoyed intensive training and camaraderie during these 4 days. Dr. Mark Wilf kept all on schedule and responsive to the abundance of information he delivered:
1. Basics of reverse osmosis technology
2. System configuration and performance projections
3. Membrane system design and operation
4. Microfiltration and ultrafiltration technology and the interaction of participants among each other enriched the course. Evenings were enjoyed at L’Aquila restaurants and cafes.
EDS CONFERENCE SERIES

Desalination and the Environment
2005 Santa Margherita–Portofino–La Spezia, Italy
2007 Thessaloniki, Greece

EuroMed
Desalination Strategies in South Mediterranean Countries
2004 Palais des Congrès, Marrakech, Morocco
2006 Izmir, Turkey

Membranes in Drinking and Industrial Water Production
2004 L'Aquila, Italy
2006 Cranfield, UK
2008 Toulouse, France
2010 Trondheim, Norway

EDS all series and all organizations

⇓

2015 The Moon
⇓

2030 Mars

COURSES

June 3, 2004, Marrakech, Morocco
A one-day intensive course on Membrane Desalination Technologies in Practice
Lecturer Mohamed Amin Saad

July 12–15, 2004 L'Aquila, Italy
A 4-day intensive course on Thermal Desalination Processes and Economics
Lecturer Corrado Sommariva

6–10 September 2004
UNESCO-IHE, Delft, The Netherlands
A 5-day intensive course on Membrane Technology in Drinking and Industrial Water Treatment
Lecturers Jan C. Schippers and Maria Kennedy

February 14–17, 2005 L'Aquila, Italy
A 4-day intensive course on RO, NF and Membrane Filtration Technology for Potable Water Applications
Lecturer Mark Wilf

MASTER'S COURSES

August 30–December 17, 2004
University of L’Aquila, Faculty of Engineering, Italy

Academic year 2004–2005
University of Genoa, Faculty of Mathematical, Physical and Natural Sciences
Master on Membranes and Membrane Processes in the Development on Environmentally Friendly Processes
http://www.chimica.unige.it/membrane/master/index.htm

WORKSHOPS

June 16–18, 2004, Lappeenranta, Finland
Fouling and Critical Flux: Theory and Applications
http://www.lut.fi/cst/fouling2004

September 2004
GKSS Research Center, Geesthacht, Germany
International workshop on Membrane Technology
Scholarships are available. Contact: nunes@gkss.de

2005

This will be an eventful year. You can make a round the world tour by just hopping from conference to conference. You can also drop in on conferences on related topics which are devoting sessions to desalination — solar energy, water management, islands, leakage...

EDS
May 2005, Santa Margherita–Portofino–La Spezia, Italy
Desalination and the Environment

ISES
August 8–12, 2005, Orlando, FL, USA
World Congress of the International Solar Energy Society – Bringing Water to the World

ICOM 2005
August 21–26, 2005, Seoul, Korea
International Congress on Membrane Processes

IDA
September 2005, Singapore
International Desalination Association World Congress

WSTA
November 2005, Kuwait
Challenges and Opportunities in Water Management and Security in Arid Countries

A 5-DAY INTENSIVE COURSE ON MEMBRANE TECHNOLOGY
IN DRINKING AND INDUSTRIAL WATER TREATMENT

Lecturers: Prof. Jan C. Schippers, PhD, MSc and Maria Kennedy, PhD
6 – 10 September 2004, UNESCO-IHE, Delft, The Netherlands

The purpose of this intensive course is to provide practical knowledge on process design and operation of membrane technology in water industry. Principles and specific membrane related problems such as membrane integrity, fouling, scaling and cleaning are dealt in detail, including pre-treatment options and the latest developments in monitoring and controlling fouling and scaling. MF/UF process design for the production of drinking and industrial water and membrane bioreactor applications will be covered as well. The course also includes computer aided process design of brackish/seawater reverse osmosis systems, pre-treatment and post treatment options. In addition membrane and thermal desalination systems will be compared, based on energy consumption and costs. A half a day technical visit to world largest Integrated Membrane System for the production of drinking water (Water Supply Company of North Holland) will be part of the course.

Registration fee €1700 includes course material and lunches. The fee does not include accommodation or living expenses.

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DESALINATION STRATEGIES IN SOUTH MEDITERRANEAN COUNTRIES

Cooperation between Mediterranean countries of Europe and the southern rim of the Mediterranean
May 30–June 2, 2004, Palais des Congrès, Marrakech, Morocco

This is the third conference in this series which provides an excellent forum for professionals, scientists and technologists in all aspects of water desalination, to meet and to exchange their ideas and experiences, and to update their knowledge of latest developments in the various aspects of water desalination. The theme “Desalination Strategies in South Mediterranean Countries” was chosen to offer the chance of discussing key elements underlying the policies and strategies governing the optimum use of the various desalination technologies in the region.

Around the Mediterranean there is a growing awareness of increasing demand for water while the natural supply is limited. The situation of the southern countries is dramatically more serious with rapidly increasing populations and much lower rainfall. Different techniques can be used to supplement natural water, among these are desalination technologies that can make potable the brackish and sea water which are plentiful and very available in these regions.

Cooperation between countries of Europe and the southern rim of the Mediterranean, Middle East and the Gulf countries is essential.

In this conference, attention will be focused on the possibility of producing water by desalination for the region of the southern rim of the Mediterranean in a sustainable manner and at a cost that people can afford.

Topics: Challenges and potential of desalination; Water strategies in south Mediterranean countries; New trends in desalination technologies; Distillation/Membrane distillation; Brackish and ground water desalination membranes; Seawater reverse osmosis membranes; Electrodialysis; Desalination in remote areas; Renewable energies – solar, wind, nuclear; Environmental impact of desalination plants; Thermodynamics and desalination plants; Process management of desalination plants; Economics of desalination plants; Water treatment and reuse; Financing and privatization.

The EuroMed meetings are achieving their goal of bringing together Europe and North African scientists, technologists and policy makers. There is an overwhelming number of abstracts which have been submitted from 42 countries for presentation at the meeting in Morocco which promises to be a major event. Fortunately the Palais des Congress is indeed a palatial venue which can accommodate our expanding participation. And Marrakech is a historic city with attractions, so we expect the conference to be a great success.

We hope the success of these meetings symbolizes the strengthening of ties between the North and South Mediterranean and alleviation of water scarcity in the region through shared experience, learning about the water needs and relating research to required technological advances. We are working closely with the Moroccan water company, ONEP (Office National de l’Eau Potable) and look forward to achieving our common goals.

So register early to benefit from a discount in the registration fee and reserve a room in a hotel of your choice.