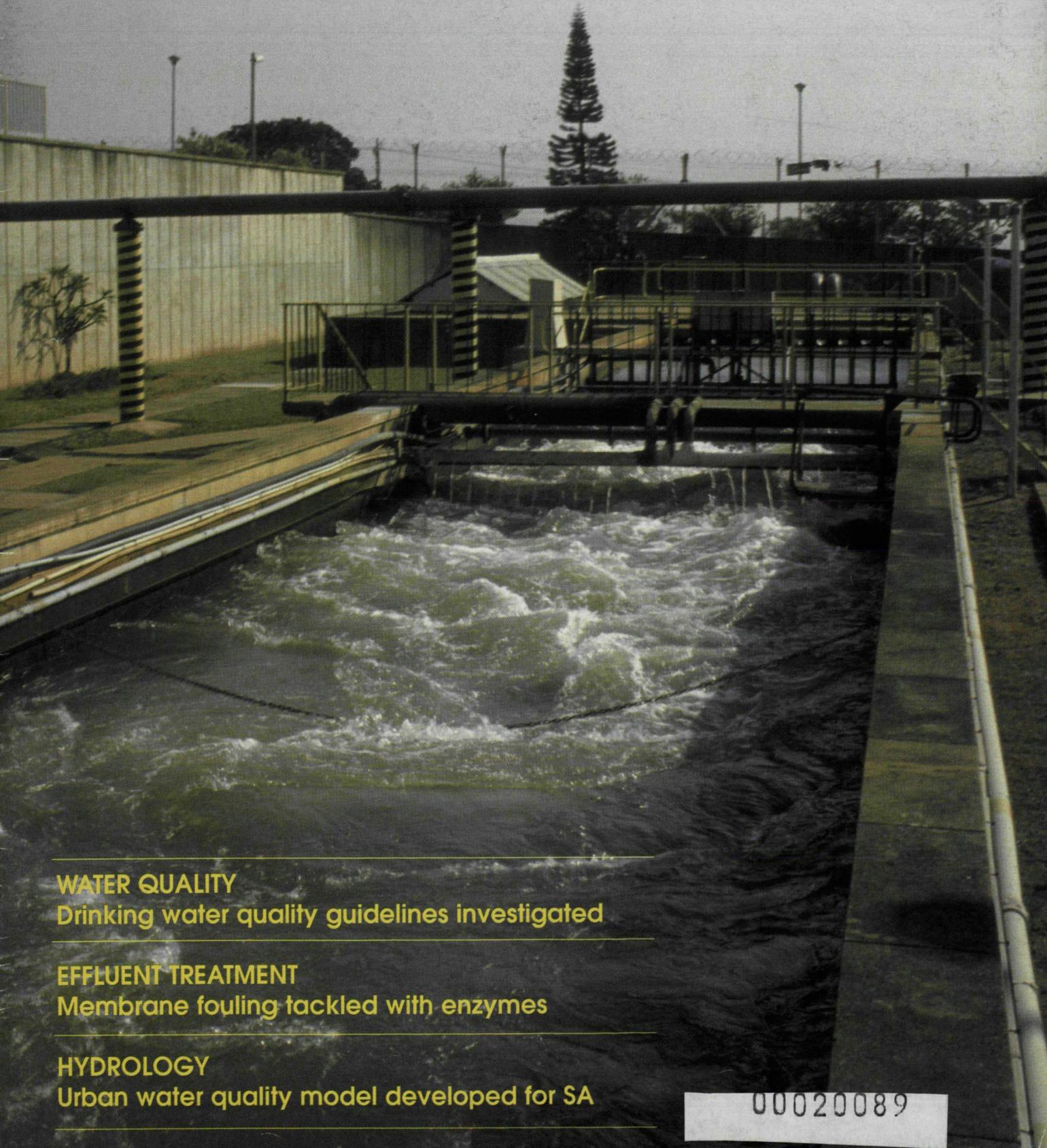


S4 waterbulletin

ISSN 0258-2244

Volume 22 Nr 3

May/June 1996



WATER QUALITY

Drinking water quality guidelines investigated

EFFLUENT TREATMENT

Membrane fouling tackled with enzymes

HYDROLOGY

Urban water quality model developed for SA

00020089

2-Day Hands-on Course



PC-ACRU

Agrohydrological Modelling System



26-27 September 1996

The daily time step *ACRU* system can simulate, with risk analysis, daily/monthly/annual soil water budgets for use in hydrological and agrohydrological applications, including

- * streamflow and peak discharge
- * sediment yield
- * irrigation water supply/demand
- * flow routing and wetlands
- * reservoir yield and off-channel storage
- * crop yield
- * impacts of land use/global climate change
- * extreme value and other statistical output

A two-day hands-on course on the PC version of *ACRU* is being presented by the Department of Agricultural Engineering of the University of Natal on 26-27 September 1996.

COURSE OUTLINE

DAY ONE

Lectures:

Modelling Concepts, *ACRU* Structure, Rainfall, Soils, Potential and Total Evaporation, Land Cover, Streamflow Generation.

Practical:

ACRU Menubuilder and Utilities, Running *ACRU*, Graded Exercises, Output and Interpretation.

DAY TWO

Lectures:

Peak Discharge, Sediment Loss, Irrigation Demand/Supply, Reservoir Yield, Flow Routing, Wetlands, Crop Yield, Extreme Value Analysis.

Practical:

Further Graded Exercises, Specialist Applications, Obtaining Information and Data via the CCWR

COST

R1 250,00 including documentation (*ACRU* Text 552 pp; User Manual 362 pp), *ACRU* Software (including Utilities), lunches, teas and computing facilities. Cost reductions available to *bona fide* postgraduates and WRC funded researchers as well as to participants who have already purchased *ACRU* documentation and/or software.

I wish to participate in the COURSE ON THE PC-ACRU MODELLING SYSTEM 26-27 September 1996

A cheque of R1 250,00 made out to University of Natal is included.

Name:
Address:
Affiliation:
ACRU Software to be licensed to:
Tel:
Fax:
Postal Code:
Occupation:

Please mail to:

Department of Agricultural Engineering
Attention: *ACRU* Course, Prof RE Schulze
University of Natal, Pietermaritzburg
Private Bag X01
3209 SCOTTSVILLE

Tel: 0331-2605489
Fax: 0331-2605818
E-mail: schulze@aqua.ccw.ac.za

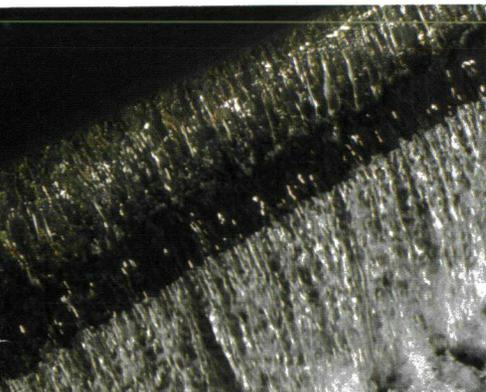
MY MAIN OBJECTIVES IN ATTENDING THE COURSE ARE TO:

OBTAIN AN OVERVIEW
OF *ACRU*'s CAPABILITIES

✓ GET PRACTICAL
EXPERIENCE IN
RUNNING *ACRU*

GET SPECIALIST
KNOWLEDGE OF

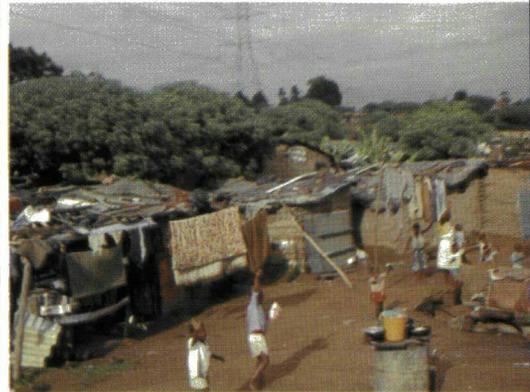
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Cover: Drinking water purification at the Durban Heights Water Works (Photo: Helene Joubert)

SA Waterbulletin is a two monthly magazine on water and water research published by the South African Water Research Commission (WRC), a statutory organisation established in 1971 by Act of Parliament. Subscription is free. Material in this publication does not necessarily reflect the considered opinions of the members of the WRC, and may be copied with acknowledgement of source. Editorial offices: Water Research Commission, P O Box 824, Pretoria 0001, Republic of South Africa. Tel (012) 330-0340. Fax (012) 331-2565. Editor: Jan du Plessis. Asst Editor: Helene Joubert. Ed Secretary: Rina Human. Layout: Chilli Design (012) 345-1155. Colour Separations: Lithotechnik. Printing: Beria Printers.

WATERTALK

at the Feather Market...

Recently some 560 delegates from all over Southern Africa met at the Feather Market Centre in Port Elizabeth for the biennial conference of the Water Institute of Southern Africa (WISA). This highlight occasion on the South African water calendar, where people meet to exchange information and views, to discuss ideas and research, all centering around water, water and more water, was opened by the Minister of Water Affairs and Forestry, Professor Kader Asmal. His opening address underlined the fact that there are no simple answers to the South African water scene where water management and allocation have become a veritable tightrope balancing act.

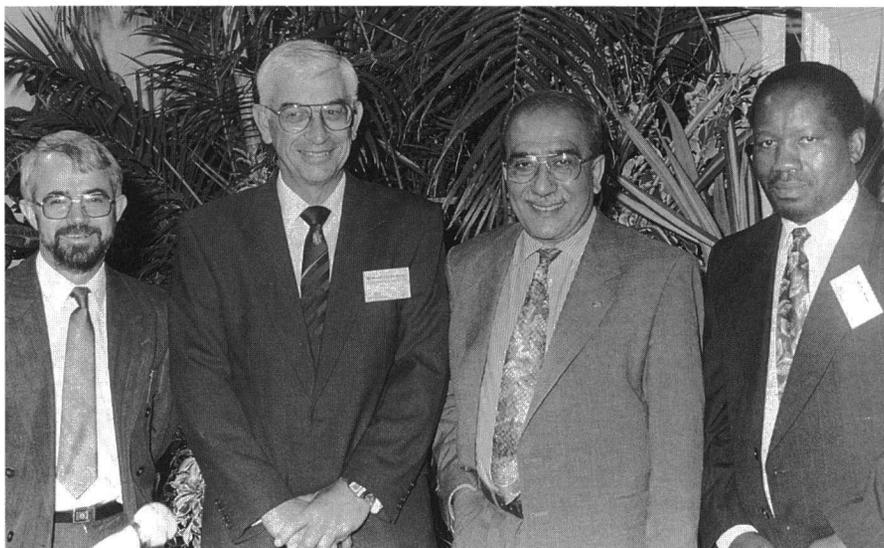
The conference brought many who are actively involved or contributing to the water scene in South Africa together to hear and discuss what is happening.

In the opening plenary session Mr Mike Muller, Deputy Director-general of the Department of Water Affairs discussed the present Water Law review, while Mr Barry Jackson from the Development Bank of Southern Africa, gave delegates an overview of the process of developing and reviewing the proposed White Paper on National Sanitation Policy, on behalf of the National Sanitation Task Team.

Water management and water treatment were the main themes in various water fields, while community water supply and sanitation, as well as health related aspects of water, and geographical information systems were also scrutinised during three days of paper and poster presentations.

It was exciting and most encouraging to have "water friends" coming from overseas and delegates from neighbouring countries to attend the WISA conference.

It was a privilege to have Mr Pierre Giacasso, President of the International Water Supply Association (IWSA) present a paper on the challenges of water



Mr Chris Dickson (Chairman: Organising Committee), Mr Wouter van der Merwe (past President of WISA), Professor Kader Asmal, Minister of the Department of Water Affairs and Forestry, and Mr M Msiwa (City Engineer of Port Elizabeth) welcomed delegates and opened the WISA '96 conference proceedings.



Incoming President of WISA, Dr Steve Mitchell (Water Research Commission), receiving the President's medallion of office from the outgoing President, Mr Wouter van der Merwe (Department of Water Affairs and Forestry).

Right: Mr Barry Jackson (Development Bank of Southern Africa), Mr Mike Muller (Department of Water Affairs and Forestry) and Mr Pierre Giacasso (President: International Water Supply Association) delivered papers at the opening plenary session.



supply, giving a global perspective to the WISA conference. He pointed out that water utilities are facing a changing world and have to adapt themselves to new conditions. Today, water supply is not sufficient in the world: a third of the population has no access to safe water. The growth of population, urbanisation and industrialisation will also increase the demand for water. Accordingly water must be considered as an economic good which has to be paid for by all its users. Furthermore, Mr Giacasso said "Water utilities need to improve their performance in the areas of public relations, maintenance, training and customer services. The IWSA aims to promote international exchange of technical, scientific and managerial experience and expertise and thereby to assist water utilities in attaining these goals."

Dr Steve Mitchell, President of WISA, in closing the conference proceedings, said that because of South Africa's chronic water shortages both researchers and practitioners in the South African water field have over the years been innovative and developed new technology. Some of this technology has now been exported to countries on which South Africa depended in the past for expertise and technological development.

However, he also pointed out that top class technology is useless without trained people to manage it... "we need to ensure that the technology we already have in place, as well as that which we develop in future, should be accompanied by the necessary education and training of appropriate skills within the water industry to properly manage and protect water, the critical resource which could limit the nation's full development if it is not managed properly."

The conference organisers are to be commended for a well orchestrated conference. The exhibition hall and the technical tours complemented the conference programme, and a delightful venue certainly contributed to the success of this conference.

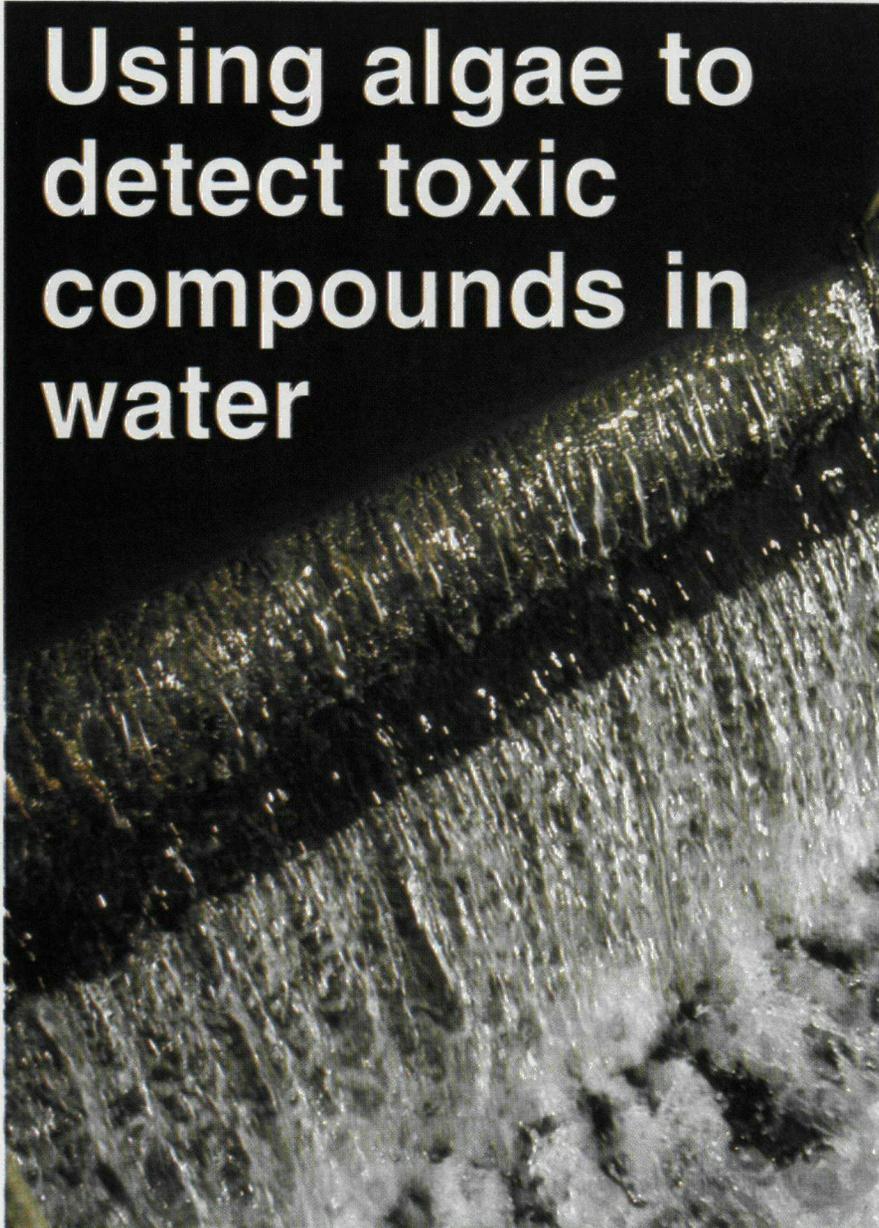


Ladies leading research together at WISA: Bettina Genthe (CSIR, Stellenbosch), Martella du Preez and Dr Rivka Kfir (CSIR, Pretoria), Annatjie Oelofse (Water Research Commission) and Dr Elsie Meintjies (Rand Water) are all involved with research on health-related aspects of water.



Mr Piet Odendaal (centre), Executive Director of the Water Research Commission, with "water friends" Professor David Newsome (left) and Caryll Stephen (right) from the Foundation for Water Research, Great Britain.

Using algae to detect toxic compounds in water



“Although effluent standards are at present based only on chemical and physical parameters, the results obtained from the monitoring of effluents and receiving waters may indicate the desirability of biological parameters.” This is the view of two researchers from the Department of Botany and Genetics at the University of the Orange Free State.

The researchers, JA van der Heever and JU Grobbelaar, say in a report to the Water Research Commission that bioassays (a procedure that uses living organisms to estimate potential chemical toxic effects) are necessary in water pollution evaluations because chemical and physical tests alone are not sufficient to assess potential effects on aquatic biota.

The researchers say both biological and chemical evidence is needed to assess risk to ecosystems effectively. The ability to detect the compound does not ensure that biological effects can be predicted and the failure to detect a released chemical does not preclude its effects. Different kinds of aquatic organisms are also not equally susceptible to the same toxic substances.

AIMS

In an investigation funded by the Water Research Commission, the researchers used physiological indicators of algae to determine the presence of toxic substances in waste water. They also compared the response of algae to commonly used zooplankton toxicity tests and tried to develop a bioassay method which is cost effective and reliable.

Five different basic procedures were evaluated with six known toxic substances, namely copper, cadmium, mercury, atrazine (an organochloride), gusathion (an organophosphate) and phenol, as well as tertiary treated municipal sewage effluent. *Selenastrum capricornutum*, *Chlorella vulgaris* and *Daphnia pulex* were used as test organisms. The conventional EC50 value was used to indicate toxicity.

PROCEDURES

The following procedures were used:

☐ **Algal Growth Potential (AGP):** This method has been in use for many years to indicate biostimulation and toxicity. Although it is time consuming it was used as a reference for comparative purposes.

☐ **¹⁴C-uptake rates by algae:** This method is based on the techniques used to measure phytoplankton primary productivity. From the ¹⁴C-uptake rates different algae and conditions could be compared and the presence of inhibiting factors determined, over a relatively short period.

☐ **Oxygen evolution rates:** Photosynthetic rates could also be measured in terms of oxygen liberation and uptake rates using a micro oxygen chamber. The presence of inhibitors will influence oxygen liberation rates.

□ *In vivo* chlorophyll *a* fluorescence:

Not all the light that reaches photosystem II is used for photosynthesis and part is released as fluorescence. (The *in vivo* fluorescence yield is produced primarily by two processes. Excitation energy will be lost as heat and it will also find its way to special chlorophyll molecules, the reaction centres, where it is used to remove an electron from the orbital system and drive it to a more electrically negative system. In all photosynthetic algae there are two types of reaction centres, namely photosystem I and photosystem II.) The quantity of light which is released as fluorescence depends on several factors among which the existence of fluorescence quenchers and the overall physiological condition are the most important. By exposing algae to toxic substances, the fluorescence peaks will vary according to the effect that the substance might have on the physiological condition of the algae. These reactions are extremely rapid and it should be possible to detect toxic substances within minutes.

□ **Zooplankton toxicity tests:** Various invertebrates are used in toxicity tests and although easy to perform, they are time consuming. *Daphnia pulex* was used as test organism and the results also served as control for the algal toxicity tests.

RESULTS

Four different parameters were used to determine algal growth rates as part of the algal growth potential procedure in the presence of potentially toxic compounds, namely cell numbers, dry weight, chlorophyll *a* measured fluorometrically and spectrophotometrically. Copper, cadmium and atrazine were found to be highly toxic to algae, whilst mercury, phenol and gusathion, an insecticide, indicated little or no toxicity. The results showed that the time of exposure was very important, where on the one hand the algae adapted to the toxin indicating a lower toxicity, or on the other hand long exposures indicating high toxicity. The depletion of nutrients or the inability to distinguish between living and dead cells could influence long-term exposures, which would have a direct bearing on the interpretation of results. The researchers recommend short-term

exposures and selection of the appropriate growth parameter for maximum sensitivity.

The major advantage of using *in vivo* chlorophyll *a* fluorescence is that measurements could be made within seconds and with relative ease. However, only one of the substances that was tested influenced chlorophyll *a* fluorescence markedly, namely the herbicide atrazine. It was concluded that heavy metals (at concentrations tested) and treated sewage effluent had no effect on *in vivo* fluorescence.

JA VAN DER HEEVER
JU GROBBELAAR

THE USE OF ALGAE IN BIOASSAYS TO DETECT THE PRESENCE OF TOXIC COMPOUNDS IN NATURAL WATERS

Report to the
WATER RESEARCH COMMISSION
by the
DEPARTMENT OF BOTANY AND GENETICS
UNIVERSITY OF THE ORANGE FREE STATE

WRC Report No 393/1/95

A short term small volume ^{14}C -assimilation algal toxicity test using *Selenastrum capricornutum* as test organism, proved to be a potentially valuable method. Generally, the sensitivity of the method increased with increasing exposure time to toxins. It was found that the method complied with the prerequisites of an acute test, because in most instances toxicity could be detected within a 30 minute exposure.

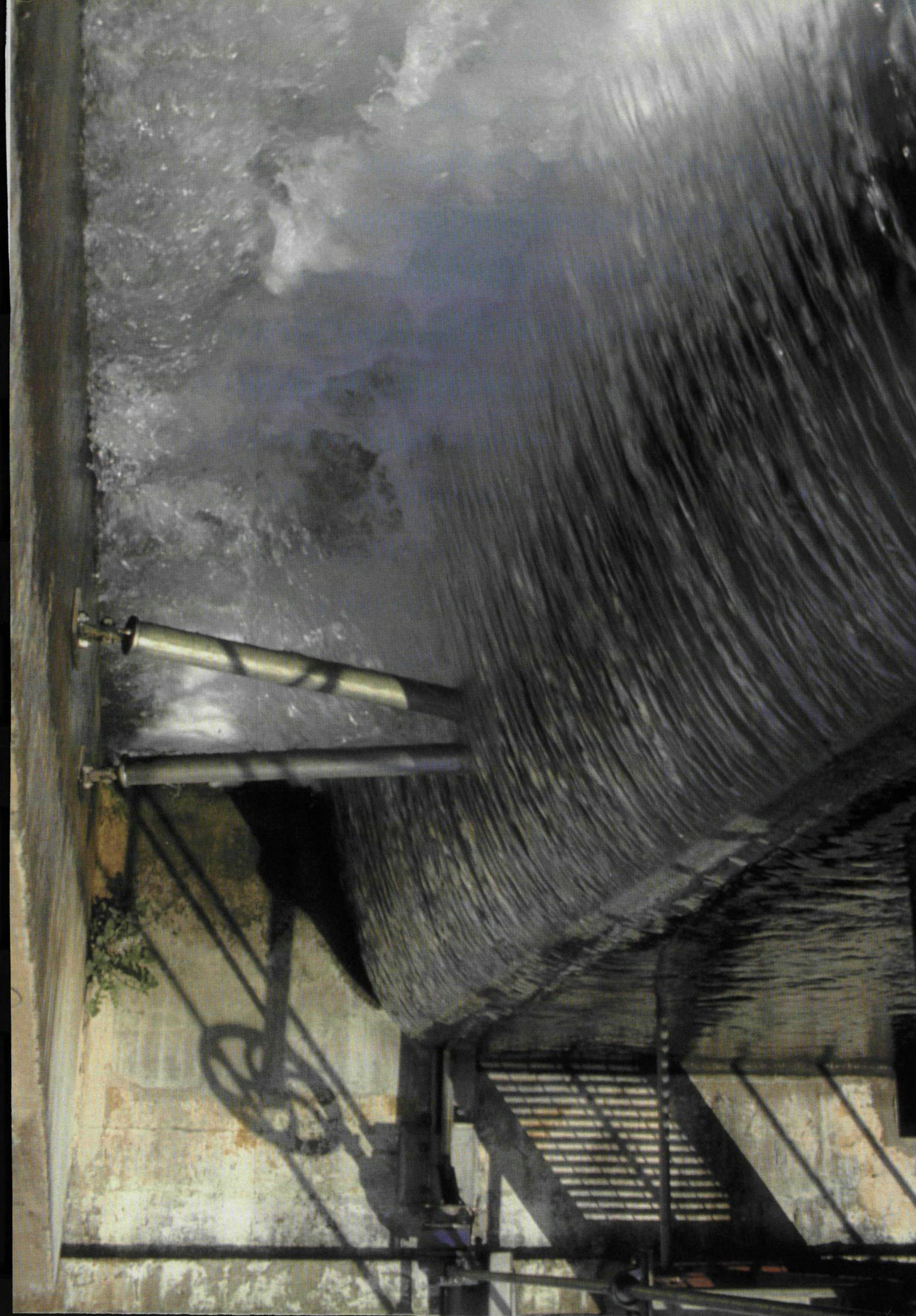
Oxygen production using either *Selenastrum* or *Chlorella* as indicator organisms to assess the presence of toxic compounds, was measured in a

small volume oxygen chamber. It was shown that the heavy metals mercury, cadmium, copper and atrazine influenced the photosynthetic rates but the organophosphate gusathion had no effect. The oxygen evolution assay may be useful as a rapid preliminary screening method for the presence of toxic substances.

The acute toxicity of selected toxic substances were evaluated using *Daphnia pulex* as test organism. The herbicide, atrazine, had no effect, whilst copper, cadmium, mercury, gusathion and phenol showed variable response. Gusathion proved to be the most toxic of all the substances with LC50 values of 0.005 and 0.003 mg per litre after 24 and 48 h exposure, respectively. The daphnid method was found to be reliable, repeatable and suited for the determination of water quality limitations.

When comparing the results from the algal assay procedures with that of the *Daphnia* mortality test the researchers found that the responses to the different compounds varied markedly between the different assay methods. Gusathion could only be detected with the *Daphnia* test, whilst atrazine could only be detected with the algae. The researchers concluded that much more research was needed before all the possibilities of using algae as test organisms were exhausted.

Copies of the report entitled **The use of algae in bioassays to detect the presence of toxic compounds in natural waters** (WRC report 393/1/95) are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US \$15).



Researchers look at parasites in South African drinking water

A team of researchers from the Division of Water Technology at the CSIR in Pretoria have studied the occurrence of protozoan parasites in South African source and drinking water and evaluated the various water treatment processes to determine their efficacy in the removal of these parasites.

In a project funded by the Water Research Commission the researchers, M Gericke, B Bateman, F Rapholo, J Mashakana, V Maharaj, CA Hilner and R Kfir, also tried to develop, evaluate and apply concentration and detection methods for waterborne protozoan parasites, such as *Giardia* and *Cryptosporidium*.

The third objective of the research project was to evaluate commonly used indicator organisms for their ability to indicate possible contamination by protozoan parasites.

BACKGROUND

Giardia and *Cryptosporidium* are waterborne parasites which have been identified in many parts of the world as the most frequently occurring intestinal parasites and as the most common causes of water-related diarrhoea. These parasites cause acute, sporadic gastroenteritis in otherwise healthy people, particularly children, in both developed and underdeveloped countries, and in travellers, most of whom are adults. They can cause potentially fatal infections in the immunocompromised.

Contaminated water supplies have been shown to be a route for such infections and most of the reported outbreaks have

Drinking water: the end product of water purification works where raw water is treated to provide clean and healthy drinking water.

been as a result of a breakdown in water treatment processes. *Giardia* cysts and *Cryptosporidium* oocysts are known to be highly resistant to environmental stress and can withstand extreme environmental conditions. Cysts and oocysts were also found to be more resistant to certain water purification processes than other bacterial indicators.

In recent years urban and rural settlements along waterways have become common in South Africa. Such settlements are often informal and have no infrastructure, resulting in increased levels of pollution of drinking water sources. Studies in other parts of the world have indicated that contamination of surface water by domestic sewage coincides with increased levels of parasites. In South Africa, very little information is available on the prevalence of these parasites in the population and in water sources.

RESULTS

The research team say in their final report to the Water Research Commission that to evaluate the applicability of various enumeration techniques for protozoan parasites, different systems for the concentration of 10l and 100l samples were compared, using water samples seeded with *Giardia muris* cysts. All experiments were carried out using *Giardia muris* cysts isolated and purified in the researchers' laboratory. The cysts concentration in the seeded samples was kept very low to allow for the simulation of levels which may occur in polluted surface or drinking water.

Initial experiments compared the recovery of *Giardia* cysts after concentration of 10l samples by either membrane filtration or ultrafiltration. Similar recoveries were obtained after the processing of seeded water samples using ultrafiltration (recoveries ranged between 2,7 per cent and 25,5 per cent) and membrane filtration (recoveries between 4,5 per

cent and 23 per cent). According to the researchers the ultrafiltration method has the advantage of co-processing the same water sample for the analysis of enteric viruses and protozoan parasites, thus reducing the cost of analysis significantly.

The researchers say it is very important to concentrate large volume samples, especially for drinking water, where low numbers of parasites are expected. Risk assessment studies, assessing fitness for use of both drinking water and recreational water, have also indicated the need for evaluating large volume samples for the detection of protozoan parasites.

Cuno wynd cartridge filters are the most commonly used for concentrating large volume samples for the enumeration of protozoan parasites. Cuno wynd filters were evaluated and recoveries ranging from 1,6 per cent to 46 per cent were obtained, which is similar to that reported in the literature.

Due to a shortage in the supply of Cuno wynd filters in South Africa, a comparative study evaluating the Cuno wynd filter against the more readily available Cuno wound cartridge filter was initiated. A set of experiments was done in which *Giardia* cysts were seeded into 100l phosphate buffered saline and filtered using both the Cuno wynd and Cuno wound filters. Results showed recoveries ranging from 31 per cent to 43 per cent, with an average recovery of 37 per cent for the Cuno wynd filters. Recoveries ranging from 33 per cent to 67 per cent with an average recovery of 55 per cent were recorded for the Cuno wound filters. The concentration procedure using AMF Cuno wound cartridge filters proved effective and practical for the enumeration of protozoan parasites as indicated by the higher recovery rates recorded. The researchers say the recovery range found for the Cuno wound filters was relatively narrow and

consistent recovery rates were obtained. The wound filters did not clog as rapidly as the wynd filters, which is an advantage when surface water samples are processed. They say it should also be noted that the Cuno wound filters are cheaper which leads to a significant cut in the cost per analysis. Based on these results the Cuno wound filters were used in all further studies of this investigation.

PURIFICATION WORKS

The occurrence of *Giardia* cysts and *Cryptosporidium* oocysts in South African raw and treated water was investigated by studying source and treated water obtained from the following water purification works: Potchefstroom, Parys, Goldfields Water (Balkfontein), Wallmannstal, Western Transvaal, Rietvlei, Schoemansville, Temba, Rand Water and Umgeni Water. Samples were collected throughout the year at all the plants to allow for seasonal variation.

The researchers say that raw water samples taken at all the water purification works tested positive for cysts and oocysts and only a small percentage of raw water samples were free of protozoan parasites. The average levels of *Giardia* cysts detected in surface water samples varied between 0 and 197 cysts/100l and the average *Cryptosporidium* oocyst levels varied between 10 and 198 oocysts/100l.

On the other hand, all the final treated water samples evaluated in the study were free of *Cryptosporidium* oocysts, while only one treated water sample showed the presence of *Giardia* cysts (4 cysts/100l).

The efficacy of water treatment plants in removing protozoan parasites from source water was evaluated by studying water from two purification works, Temba and Schoemansville, at different stages of treatment with special emphasis on flocculation, sand filtration and final chlorination.

At Schoemansville all the raw water samples tested positive for the presence of *Giardia* cysts, with concentrations ranging between 10 and 400 cysts/100l. The cysts were effectively removed by flocculation and sand filtration and no *Giardia* cysts were detected in any of the treated water samples. *Cryptosporidium*

oocysts were observed in 41 per cent of the raw water samples, but were removed effectively and none of the treated water samples contained oocysts.

Seventy per cent of the raw water samples collected at Temba water works contained *Giardia* cysts, which were effectively removed during treatment. *Cryptosporidium* oocysts were found in 67 per cent of the raw water samples. All the final water samples tested negative for the presence of both *Giardia* cysts and *Cryptosporidium* oocysts.

M GERICKE
BBATEMAN
F RAPHOLO
J MASHAKANA
V MAHARAJ
C A HILNER
R KPIR

OCCURRENCE OF PROTOZOAN PARASITES IN SOUTH AFRICAN SOURCE AND TREATED WATER

Report to the
WATER RESEARCH COMMISSION
by the
DIVISION OF WATER TECHNOLOGY, CSIR

WRC Report No 451/1/95

As a result of the high cyst and oocyst concentrations detected in South African source waters, the researchers say that care should be taken to ensure that treatment plants are functioning effectively. *Cryptosporidium* outbreaks have been reported where water has undergone treatment, including coagulation, sedimentation, sand filtration and chlorination, but due to poor operational practices oocysts were not inactivated or removed. It is also important to test the final treated water from small plants and facilities where sand filtration is not used for the presence of protozoan parasites.

According to the report there is at present no simple test that can be used routinely to evaluate the occurrence of protozoan parasites in water. It was therefore decided to determine whether cur-

rent microbial indicators of water quality, such as total and faecal coliforms, can be used to give an indication of the presence of protozoan parasites in water. Water samples were collected at the Schoemansville and Temba water purification works and tested for the presence of routinely used indicators: total coliforms and faecal coliforms, including standard plate counts. Raw water, after flocculation and sand filtration as well as the final water were evaluated for the presence of indicator organisms. All stages of treatment were included to compare the survival of the indicator organisms throughout the process with the behaviour of the protozoan parasites.

In this study the parasites were completely removed, while the coliforms were still present after treatment. The researchers say in most cases the bacterial indicators were present in high numbers in the raw water samples, while no *Giardia* or *Cryptosporidium* could be detected. From the results obtained it can be seen that total and faecal coliforms are not good indicators of the presence of protozoan parasites in water. The researchers say that these findings are in agreement with results obtained by other researchers, who also demonstrated that coliforms are inadequate indicators of the presence of pathogens, especially viruses and parasites.

The researchers say the suitability of *Candida albicans* and *Clostridium perfringens* as indicators was also investigated. Water samples at the four different stages of treatment were collected at the Schoemansville and Temba water works. From the results obtained in the study it is clear that these organisms are inadequate indicators of the presence of protozoan parasites in water, as both *Candida* and *Clostridium* survive the treatment process better than the parasites. Therefore, only direct monitoring can be relied on for determining the presence of *Giardia* and *Cryptosporidium* in water.

Copies of the final report titled **Occurrence of protozoan parasites in South African source and treated water** (WRC report 451/1/95) are obtainable free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US\$ 15).

- (e) **Subjects for 1998 (Module 1):**
 WWG 780 Water Quality Management
 WCH 780 Water Chemistry
 WWS 780/787 Water Purification
 WWB 780/787 Water Treatment

1.4 MASTERS DEGREE

- (a) **Admission requirements:** As for the honours degree.
- (b) **Course requirements:** The course requirements are determined by the candidate's present degree.
- (i) A candidate with a BEng or BSc degree must pass at least 128 units, of which 64 units as for the honours degree. The remaining 64 units may be made up of a dissertation, as described in 1.4(c).
- (ii) A candidate with an honours degree in water utilisation must pass at least 64 units by completing an approved dissertation, as described in 1.4(c).
- (iii) All M- and PhD-candidates must attend scheduled research seminars.

(c) **Dissertation:** A written dissertation and at least one peer-reviewed publication based on research by the candidate, and an examination based on the dissertation and the study field must be passed. The subject must be selected in consultation with the lecturer acting as supervisor.

1.5 DOCTORATE

Candidates in possession of an appropriate MEng or MSc degree or an equivalent qualification will be accepted for doctoral study. Candidates with an appropriate honours degree and an acceptable publication record will also be considered. A doctorate may be granted by virtue of research making a substantial contribution to science and engineering, and which is presented for evaluation as follows:

- a thesis and at least 3 peer-reviewed publications, for a PhD degree; or
- a thesis composed of an acceptable number of internationally recognised publications on a particular and/or closely related subject, for a DEng degree.

Candidates are in both cases required to pass an examination based on the thesis and the study field.

1.6 COURSE FEES: (The following are approximate amounts, calculated on the assumption that the 1997 fees will be c. 10 % higher than the 1996 fees).

Degree	1st year	2nd, 3rd & 4th year
BEng(Hons)/BSc(Hons)	R 7 480	R858
MEng/MSc after honours	R 6 050	R858
MEng/MSc after BEng/BSc	R12 100	R858
PhD	R6 490	R858
DEng	R2 200	-
Non-degree purposes : R840 registration + R930 per subject		

1.6 FINANCIAL SUPPORT

Bursaries and loans for post-graduate study are available at UP; details may be obtained from Student Administration (012/420-2846). External research funds may be mobilised, provided that the subject is selected in consultation with the supervisor in good time (at least 6 months before registration). In such cases a salary may be paid to full-time students.

1.7 ACCOMMODATION

Accommodation at the University during block weeks can be arranged. Contact Mr R G Luus (012)420-2745.

2. SHORT COURSES

(a) **General Program**

Two short courses are scheduled for 1997. Additional short courses can be arranged upon request. The scheduled short courses are presented over 5 day periods and certificates are awarded by the University to participants who completed the courses successfully. Short courses are aimed at managers, engineers, scientists and technicians who are involved in water and wastewater management and technology.

SHORT COURSE 1 : 19-23 MAY 1997

OPERATION OF ACTIVATED SLUDGE PLANTS

Course contents:

- (a) Philosophy and principles of biological sewage treatment
- (b) Sewage flow and chemical composition
- Sewage treatment steps - theory and practice:
 - Physical:
 - sieving
 - grit removal
 - primary settling
 - carbon removal
 - carbon removal & nitrogen oxidation
 - carbon & nutrient removal
 - disinfection
 - (b) Biological:
 - anaerobic & aerobic
 - drying & land spreading
 - filter press
 - irrigation
 - (c) Chemical/biological:
- Sludge handling:
 - Treatment
 - Disposal
- Operational data: Data processing, bookkeeping and reporting
- Laboratory work - theory and practice:
 - Secondary settling: sludge volume index and flux curves
 - Flow patterns and characterisation
 - Microscopy
- Computer applications and discussions

SHORT COURSE 2 : 6-10 OCTOBER 1997

OPERATION OF SMALL WATER PURIFICATION AND SEWAGE PLANTS

Course contents:

- Water quality : health aspects, quality guidelines vir human consumption, raw water quality
- Water sources: protection of sources, development of water sources, ground water, surface water, economy
- Technology: small-scale use of conventional processes, packaged units, slow sand filters, distribution, quality protection
- Sanitation: different approaches, on-site and off-site, dry systems, water-borne systems
- Small sewage plants: rotating biological contactors, pond systems, small-scale conventional systems

(b) **Registration**
 Please return the reply slip if you wish to register for the course(s).

(c) **Course fees for 1997**
 The fee for Short Course 1 is R3 100 without, and R3 400 with handbook* and computer programme**. The fee for Short Course 2 is R3 100 (14 % VAT inclusive in all fees). For both courses notes, tea, coffee and lunches are included. Accommodation is not included in the fee.

*Metcalf & Eddy: Wastewater Engineering - Treatment - Disposal - Reuse, 3rd Edition.
 **P L Dold, et al: Activated Sludge System Simulation Programs

INTENTION TO REGISTER FOR POST-GRADUATE STUDY/SHORT COURSES:

Complete the following form and:

- Fax or mail to: The Head, Water Utilisation Division, Dept of Chemical Engineering, University of Pretoria, 0002, Pretoria. Fax no (012) 43-6683. or
- Send the required information by e-mail to: dtol-h@fanella.ee.up.ac.za or
- Complete the form on the Division's homepage on Internet at: <http://www.up.ac.za/academic/chemeng/water.html>

Post-graduate studies:

I intend to register in 1997 for the following course (Please mark where applicable).

BEng(Hons)		BSc(Hons)		MEng	
MSc		PhD			

Short courses:

I intend to register in 1997 for the following short course(s).

- Short course 1 : Operation of activated sludge plants
- Without handbook and computer program
 - With handbook and computer program

Short course 2 : Operation of small water purification and sewage plants

Personal details:

NAME: MR/MRS/MISS:

POSTAL ADDRESS:

.....

TEL: (. . .) FAX: (. . .) E-MAIL:

ACADEMIC QUALIFICATIONS: (Degree, institution, year completed, major subjects)

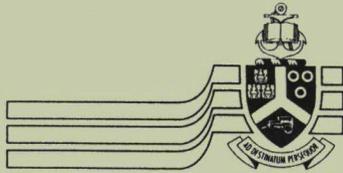
.....

EMPLOYER:

.....

CURRENT POSITION:

.....



University of Pretoria

DEPARTMENT OF CHEMICAL ENGINEERING

WATER UTILISATION DIVISION

1997

POST-GRADUATE TRAINING

IN

WATER UTILISATION

BEng(Hons) & BSc(Hons)
MEng, MSc & PhD

1997

SHORT COURSES

- OPERATION OF ACTIVATED SLUDGE PLANTS
19-23 May 1997
- OPERATION OF SMALL WATER PURIFICATION AND
SEWAGE PLANTS
6-10 October 1997

Hierdie brosjure is ook in Afrikaans beskikbaar

The Water Utilisation Division exists by virtue of the Chair in Water Utilisation Engineering which is sponsored by Rand Water. The Division offers the following training programmes:

- post-graduate training in water utilisation on a regular basis for engineers and scientists; and
- short courses in treatment plant design and operation and other subjects on an *ad-hoc* basis for a wider audience.

The course requirements, contents, and study arrangements are briefly summarised in this brochure, as a supplement to the official yearbook. Contact prof W A Pretorius (012/420-3566), prof C F Schutte (420-3571) or mr J Botha (420-3568) for more information. If you consider enrolling for any of these courses, please complete the attached reply slip.

1. POST-GRADUATE PROGRAMME

The post-graduate programme is aimed at the BEng(Hons), BSc(Hons), MEng, MSc en PhD degrees, with the main objective to promote multidisciplinary expertise in, and research on water and wastewater technology and water quality management.

1.1 ENROLMENT

- (a) **Intention to register:** The abovementioned reply slip is required only for this Division's records. It does not replace the official application for University admission and registration.
- (b) **Application for admission:** If you wish to register for post-graduate study, but have not been registered at UP in the previous year, you must apply for admission. It must be done as soon as possible, but can also be done when you register. Application forms are available at Academic Administration: Engineering (012/420-2142) and an application fee of R30,00 is payable. Students registering for non-degree purposes must also apply for admission.
- (c) **Registration:** All students must register annually. Registration takes place on 21 January 1997 (during the first block week) at 14:45 in lecture room 2-4, Water Utilisation Building, UP South Campus. The registration fee is then payable.
- (d) **Registration requirements:** Please refer to the Faculty of Engineering Yearbook as well as the Post-graduate Information Brochure of the Department of Chemical Engineering.

1.2 GENERAL REQUIREMENTS

Degrees must be completed within four years after the first registration. Any subject may only be repeated once.

Students who are registered for a Masters degree must register the subject of their dissertation within the first study year. Otherwise their registration will be changed to the Honours degree in the second year.

1.3 HONOURS DEGREE

- (a) **Admission requirements:** A BEng degree or a BSc degree with at least Mathematics I, Physics I and Chemistry I is required.
- (b) **Structure:** The honours course is presented over a period of two years part time study. Eight subjects (8 units each) are presented over this cycle by the Division of Water Utilisation.
Module 1 consists of 4 subjects in which the focus falls on the water environment and purification and treatment of drinking water.
Module 2 also consists of 4 subjects with the focus on wastewater characteristics and treatment. Module 1 is not a prerequisite for module 2, so that students may start their studies in any calendar year.

- (c) **Course requirements:** At least 64 units must be passed, of which 40 must compulsorily be the following subjects (8 units each): WCH 780, WWS 780/787, WMB 780, WAE 780 and WAR 780/787. The remaining 24 units may be selected from the other subjects in Module 1 or 2 or from approved post-graduate subjects in other departments. The study arrangements for subjects in other departments differ from the block week arrangements and the head of the department concerned must be consulted in this regard.

1997 : Module 2 : Wastewater			
First semester		Second semester	
WMB 780 - Water Microbiology WAN 780/787 - Industrial Wastewater		WAE 780 - Unit Processes WAR 780/787 - Sewage Treatment	
Block week 1	20-24 January	Block week 1	30 June - 4 July
Research seminar	25 January		
Block week 2	17-20 March	Block week 2	1-5 September
Examination	5-6 June	Examination	6-7 November
Research seminar	7 June	Research seminar	8 November

1998 : Module 1 : Water purification and treatment (provisional)			
First semester		Second semester	
WWG 780 - Water Quality Management WCH 780 - Water Chemistry		WWS 780/787 - Water Purification WWB 780/787 - Water Treatment	
Block week 1	19-23 January	Block week 1	29 June - 3 July
Block week 2	16-19 March	Block week 2	31 Aug - 4 Sept
Examination	4-5 June	Examination	5-6 November

(d) Contents of subjects for 1997 (Module 2):

WMB 780 Water Microbiology

Introduction to the microbiological world: essential biochemical concepts, classification of most important groups, chemical composition and food requirements. Microbiological ecology of soil and water. Microbiology of biological purification processes: aerobic, anaerobic and phototrophic. Quantification of microbial growth: kinetic growth models.

WAN 780/787 Industrial Wastewater

Mass and energy balances. Water systems and general housekeeping. Optimisation of water usage. Minimisation of waste generation. Mine water: minimisation and treatment of acid mine drainage. Treatment processes: oxidation/reduction, chemical precipitation, neutralisation, membrane processes, active carbon adsorption, ion exchange. Treatment and disposal of brines. Case studies.

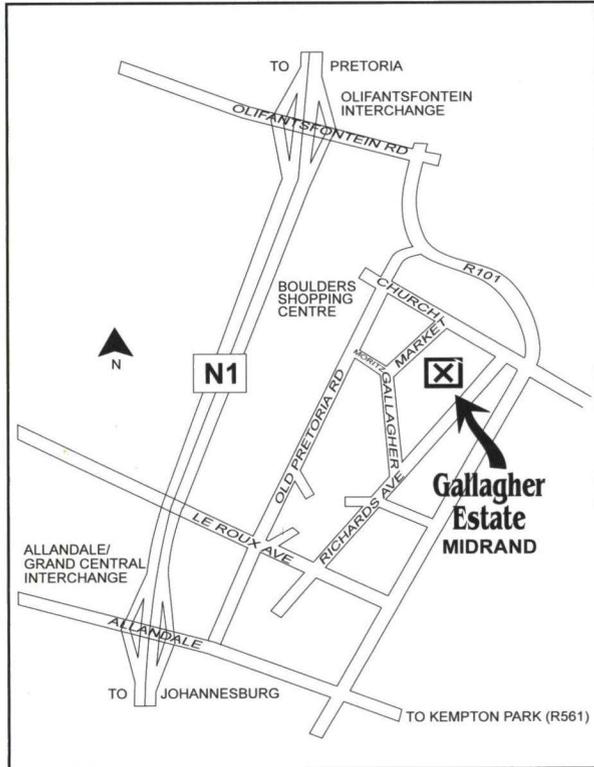
WAE 780 Unit Processes (for wastewater treatment)

Flow measurement. Flow and load balancing. Screening: bars, screens and micro-screens. Mixing. Sedimentation: discrete, flocculent, zone and compression settling. Flotation. Filtration. Chemical precipitation. Gas transfer and aeration. Disinfection. Sludge thickening. Sludge dewatering: linear screens, centrifugation, belt and filter presses, and vacuum filtration. Sludge drying and incineration: heating and heat transfer. Sludge pumping: rheology.

WAR 780/787 Sewage Treatment

Composition of sewage: chemical, physical, biological. Basic biochemical principles of sewage purification: carbon-, nitrogen, phosphorus- and sulphur removal. Modelling of ideal reactors: suspended and attached cultures. Plant design and operation. Wetland systems, oxidation ponds, trickling filters and combinations. Activated sludge: batch and nutrient removal processes. Anaerobic processes: sludge digestion and high rate rising bed and packed bed processes.

Road map to Gallagher Estate



A TML REED EXHIBITION

For further information
contact
(011) 886-3734



CONFERENCE INFORMATION

The following organisations are participating in or organising a series of conferences, seminars, workshops and other events during AFRIWATER.

- Water Institute of Southern Africa
- Anaerobic Processes TD, WISA
- Membrane Technology TD, WISA
- Community Water Supply & Sanitation TD, WISA
- Nutrient Removal TD, WISA
- SA Chemical Institute
- SA Industrial Water Association
- SA Society of Aquatic Scientists
- SA Valve & Actuator Manufacturers' Association
- SA Institution of Civil Engineers (Urban Div.)
- Borehole Water Association
- Swedish Trade Council
- French Water Technologies for Africa

For further information on the
conference contact

Cilla Taylor - Conference Planners

Tel: (012) 631 681

Fax: (012) 631 680

AFRIWATER

Name: _____

Company: _____



Publications read regularly

- Chemical Processing SA
- Chemical Technology
- Engineering News
- EPM (Environmental Planning & Management)
- Mining Mirror
- Municipal Engineer
- Mining World
- New Equipment News
- SA Coal, Gold & Base Minerals
- SA Instrumentation & Control
- SA Water Bulletin
- Vector
- Water, Sewage & Effluent
- Which Industrial
- Other (please specify)

Industry Sector employed

- Automotive
- Central Government
- Construction & Building
- Consultancy
- Food & Beverage
- Iron & Steel
- Local Government
- Manufacturing/ Engineering
- Mineral Processing
- Mining
- NGO
- Pulp & Paper Industries
- Petrochemical
- Power Generation
- Pharmaceutical
- Textile & Clothing
- Water Board
- Other (please specify)

Area of interest

- Chemical Dosing & Usage
- Computer Applications & Solutions
- Consulting Services
- Environmental Monitoring
- Filters
- Groundwater & Boreholes
- Industrial Effluent Treatment
- Information Systems
- Irrigation
- Laboratory Equipment & Techniques
- Leak Detection
- Meters
- Pipes & Fittings
- Plant Design/ Construction
- Pollution Control
- Process Instrumentation & Control
- Pumps
- Sludge Treatment
- Training & Education
- Utility Management
- Valves & Actuators
- Waste water Treatment
- Other (please specify)

VISITOR TICKET

Please complete this before your arrival at the exhibition, please print clearly.

Title:

First Name:

Surname:

Position:

Company:

PO Box:

Town:

Postal Code:

Country:

Tel:

Fax:

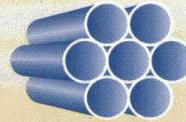
Cell:

Email:

A R5,00 donation towards the WISA Bursary fund will be asked for upon entering.

Please ensure that I receive information on membership of The Water Institute of Southern Africa. (Please tick box).

PLEASE COMPLETE REVERSE.



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AFRIWATER

INTERNATIONAL AFRICAN WATER,
WASTE & ENVIRONMENTAL
TECHNOLOGY EXHIBITION



Invitation to visit

2 - 5 September 1996

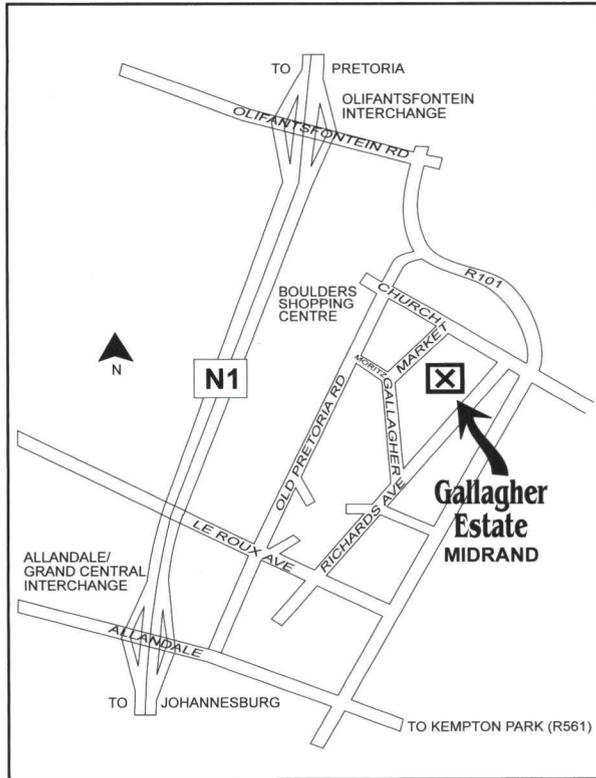
Gallagher Estate, Midrand

Times: 10h00 - 18h00 Monday 2nd
09h00 - 18h00 Tues 3rd - Thurs 5th



TML REED
EXHIBITIONS (PTY) LTD

Road map to Gallagher Estate



A TML REED EXHIBITION

For further information
contact
(011) 886-3734



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Tel: (012) 631 681

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AFRIWATER

Name: _____

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- SA Coal, Gold & Base Minerals
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- Water, Sewage & Effluent
- Which Industrial
- Other (please specify)

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- Central Government
- Construction & Building
- Consultancy
- Food & Beverage
- Iron & Steel
- Local Government
- Manufacturing/ Engineering
- Mineral Processing
- Mining
- NGO
- Pulp & Paper Industries
- Petrochemical
- Power Generation
- Pharmaceutical
- Textile & Clothing
- Water Board
- Other (please specify)

Area of interest

- Chemical Dosing & Usage
- Computer Applications & Solutions
- Consulting Services
- Environmental Monitoring
- Filters
- Groundwater & Boreholes
- Industrial Effluent Treatment
- Information Systems
- Irrigation
- Laboratory Equipment & Techniques
- Leak Detection
- Meters
- Pipes & Fittings
- Plant Design/ Construction
- Pollution Control
- Process Instrumentation & Control
- Pumps
- Sludge Treatment
- Training & Education
- Utility Management
- Valves & Actuators
- Waste water Treatment
- Other (please specify)

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Fax:

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A R5,00 donation towards the WISA Bursary fund will be asked for upon entering.

Please ensure that I receive information on membership of The Water Institute of Southern Africa. (Please tick box).

PLEASE COMPLETE REVERSE.



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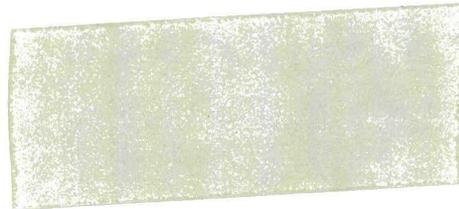
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AFRIWATER

INTERNATIONAL AFRICAN WATER,
WASTE & ENVIRONMENTAL
TECHNOLOGY EXHIBITION



Invitation to visit

2 - 5 September 1996

Gallagher Estate, Midrand

Times: 10h00 - 18h00 Monday 2nd
09h00 - 18h00 Tues 3rd - Thurs 5th



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EXHIBITIONS (PTY) LTD



**DIVISION OF WATER, ENVIRONMENT
AND FORESTRY TECHNOLOGY CSIR**



The WATER RESEARCH COMMISSION



WISA WATER CARE DIVISION

Invitation to Register

Seminar/Workshop

on

TREATMENT OF COLOURED WATER FOR POTABLE USE

21-23 OCTOBER 1996

VENUE:

**Mossgas Conference Centre
Santos Beach
Mossel Bay**

OBJECTIVES

Organic colour in surface water supplies is found worldwide and these waters constitute a sizeable portion of the total water sources being treated for potable use. Unlike with most of the turbid surface waters, many problems are experienced with the treatment of coloured water. Amongst the more serious problems are the high chemical dosages required for colour removal, difficulty in controlling dosages because of variability of raw water quality, high aluminium residuals in the final water, the formation of disinfection by-products when these waters are chlorinated, the production of large volumes of sludge with poor dewatering characteristics, and corrosion and aggression affecting storage systems and distribution network. There is a need for information on the design, operation and control of colour removal treatment plants, and for transferring this information successfully to the end-user.

The object of this seminar/workshop is to bring scientists, engineers, plant owners, managers and process controlling personnel together to provide an overview of the treatment of coloured water and of research that has been done in this field, and to provide plant managers and process controllers the opportunity to discuss the problems experienced at their particular plants, in order to address these in the form of guideline documents and identification of research needs. The workshop thus includes a strategic session to develop a strategy for further research on the treatment of coloured water for potable use.

FORMAT OF SEMINAR/WORKSHOP

SESSION I: Recognized scientists and engineers have been invited to provide an overview of the treatment of coloured water: origin, occurrence and nature of organically coloured water; reasons for treating coloured water; treatment options; design considerations; recent developments; and guidelines for design and operation of treatment plants.

SESSION II: A number of plant managers and/or process controllers will provide short overviews of their treatment plants and problems that are experienced, with the view of stimulating discussion and generalising and prioritising problem areas.

SESSION III: A strategic planning session will be held which will be facilitated by the Water Research Com-

mission. During the structured session priority areas to be addressed will be discussed, based on the needs expressed by the delegates and speakers, both in the current session and during the previous two sessions. A strategy for further research on the treatment of coloured water for potable use will be developed which will be made available to all concerned subsequent to the seminar/workshop.

SESSION IV: Two full-scale treatment plants, treating water with some of the highest colour levels in the world, will be visited.

PROGRAMME

MONDAY 21 OCTOBER 1996

16:00 - 19:00 Registration and Meet and Greet

TUESDAY 22 OCTOBER 1996

07:00 - 08:00 Registration

SESSION I

08:00 - 08:30 Opening
Water Research Commission
CSIR Environmentek
WISA Water Care Division

08:30 - 13:00 Presentations by invited speakers
(30 min. plus 10 min. discussion time)

SPEAKERS AND TOPICS:

MR. I. MORRISON - Consultant (Cape Town City Council)

An Overview of Treatment Options for Colour Removal

MR. I.K. REID - Ninham Shand Inc.

Design Considerations in the Treatment of Coloured Water

PROF. R.E. LOEWENTHAL - University of Cape Town
Stabilization of Soft Waters

MR. H.A. DE VILLIERS - Consultant (Stellenbosch Univ./Environmentek)

Nanofiltration and Ozonation: Alternative Approaches to Colour Removal
(H.A. de Villiers and G. Juby)

DR. E.P. JACOBS - Stellenbosch University

Ultrafiltration. A viable Option for the Removal of Colour from South Cape Waters?

(E.P. Jacobs, A. Martins, P. Swart and H.A. de Villiers)

MR. C.D. SWARTZ - Consultant (Environmentek)

Guidelines for the Design and Operation of Colour Removal Treatment Plants

13:00 - 14:00 Lunch

SESSION II

14:00 - 17:00 Presentations by plant managers and/or process controllers (15 min. plus 5 min. discussion time)

CONTRIBUTIONS BY:

- Overberg Water
- George Municipality
- Plettenberg Bay Municipality
- Cape Town Municipality
- Mossel Bay Municipality
- Joubertina Municipality
- Knysna Municipality

Evening: Social Function

WEDNESDAY 23 OCTOBER 1996

SESSION III

08:00 - 10:30 Strategic planning session on coloured water treatment

SESSION IV

11:30 - 12:30 Visit Kleinbrak Water Treatment Works, Mossel Bay

12:30 - 13:30 Lunch at Kleinbrak

14:30 - 16:00 Visit George Water Treatment Works

REGISTRATION

The registration fee will be R200 per person. A reduced fee of R140 per person will be applicable for treatment plant process controllers and for organisations registering 3 or more of their personnel for the seminar/workshop.

Participants will be responsible for their own travel and subsistence costs. Block bookings at hotels and guest houses have been made. Registration fees covers the meet and greet function, teas, coffees, 2 lunches, social function, excursion and workshop documentation.

The venue can accommodate 100 persons.

ACCOMMODATION

Block reservations have been made at the following hotels and guest houses:

SANTOS PROTEA HOTEL

- Single R190 per person
- Double R260 per person
- R130 per person sharing

HOTEL RIVIERA

- Single R129 per person
- Double R86 per person sharing

CAPE ST. BLAIZE HOTEL

- Single R159 per person

MOSSSEL BAY GUEST HOUSE

- Single R130 per person

HUIJS TE MARQUETTE

- Single R165 per person

THE BAY TAVERN

- Single R110 per person

Rates are per night bed and breakfast and inclusive of VAT

Accommodation is also available in De Bakke Chalets which sleeps up to 5 persons at a cost of R150 per chalet per night (bed only)

Further information on the workshop, accommodation or travel arrangements can be obtained from:

C.D. Swartz
P.O. Box 745
6500 MOSSSEL BAY
Tel.: (0444) 911242
Fax: (0444) 7960

REGISTRATION FORM

SEMINAR/WORKSHOP ON

TREATMENT OF COLOURED WATER FOR POTABLE USE

21-23 October 1996
Mossel Bay

Please fill in and return with remittance to:

Workshop Secretariat
P.O. Box 745
6500 MOSSSEL BAY

(cheques to be made out to CSIR Environmentek)

NAME: _____

ORGANISATION: _____

ADDRESS: _____

TEL.: _____ FAX: _____

ACCOMMODATION RESERVATION:

(indicate 1st, 2nd and 3rd choices)

(Monday and Tuesday Tuesday only)

- Santos Pretoria Hotel ___ Hotel Riviera ___
- Cape St. Blaize Hotel ___ Huijs t. Marq. ___
- Mossel Bay Guest House ___ The Bay Tavern ___
- De Bakke Chalets ___
- Will arrange own accommodation ___

If more than one person of your organisation wishes to attend, please copy this application form for them to fill in

KURSUSINHOUD

- (a) Filosofie en beginsels van watersuiwering.
(b) Rouwatereienskappe.
- Watersuiweringstappe - teorie en praktyk:
 - Koagulasie** - destabilisasie
- vermenging
- flokkulasie.
 - Verheldering** - besinking
- flottasie
- filtrasie.
 - Ontsmetting** - chlorering
- ander metodes.
- Slykhantering : behandeling en disponering.
- Laboratoriumwerk - teorie en praktyk:
 - Bedryfsveranderlikes.
 - Vloeikarakterisering.
- Gehaltebeheer en bedryfsrekords.
- Dataverwerking en rekenaartoepassings.

Navrae Kursusinhoud : Mnr. J. Botha (tel: (012) 420-3568)

TAAL

Kursusaantekeninge is in Engels en lesings word in Afrikaans en Engels aangebied, met bespreking in die deelnemer se verkose taal.

INSKRYWINGSVOORWAARDES

- Onvoorsiene omstandighede kan meebring dat 'n ander spreker mag optree as dié aangedui op die brosjure.
- SKRIFTELIKE** kansellasies sal sonder penalisering aanvaar word tot 7 dae voor aanvang van die kursus. **PLAASVERVANGERS SAL AANVAAR WORD.**
- Sou u nalaat om **SKRIFTELIK** te kanselleer, is u verantwoordelik vir 'n 20% kansellasiefout.
- Indien **GEEN SKRIFTELIKE** kennisgewing van u ontvang is nie, is u verantwoordelik vir 'n 30% kansellasiefout.
- Die kursuskoste sluit aantekeninge, oggend- en middagtee sowel as middagetes in.
- In die geval van onvoldoende inskrywings behou LGI (Edms) Bpk die reg om die kursus te kanselleer. Applikante sal ingelig en onmiddellik terug betaal word.
- 'n Beperkte aantal inskrywings sal aanvaar word, in volgorde van datum waarop inskrywing ontvang is.
- Laboratoriumwerk word op die deelnemer se eie risiko gedoen.

INSKRYWINGSVORM : K9665

Faks asseblief voltooi die inskrywingsvorm en pos fotostaat saam met betaling (Koste R2 223-00 14% BTW ingesluit).

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Posbus 30536
Sunnyside 0132

Faks inskrywing na: (012) 342-4151
Navrae: (012) 43-6625/342-6460

* Afdeling Waterbenutting
Tel: (012) 420-3566 *
Faks: (012) 43-6683 *

BEDRYF VAN WATERSUIWERINGSAANLEGTE

DATUM: 16 - 20 September 1996 KURSUS NO: K9665

TJEKS BETAALBAAR AAN : LGI (EDMS) BPK

AFGEVAARDIGDE

Titel: _____ Voorletters: _____
Noemnaam & Van: _____

LGI STUUR BEVESTIGING VAN INSKRYWING AAN:

Tel No: () _____
Vir aandag: _____
Faks No: () _____

KURSUSGELD BETAALBAAR DEUR:

Maatskappy Self

Maatskappynaam: _____

Posadres: _____

Poskode: _____

FAKTUUR:

Vir aandag: _____

Rekening Dept Tel: () _____

Ek het die inskrywingsvoorwaardes, soos uiteengesit in die brosjure, gelees en ek gaan daarmee akkoord.

HANDTEKENING

DATUM



University of Pretoria

Faculty of Engineering
WATER UTILISATION DIVISION

THE 2ND PRESENTATION OF:

OPERATION OF WATER TREATMENT PLANTS

DATE: 16 - 20 SEPTEMBER 1996
VENUE: BUILDING 2, SOUTH CAMPUS
UNIVERSITY OF PRETORIA
LECTURERS: PROF. W.A. PRETORIUS
PROF. C.F. SCHUTTE
MR. J. BOTHA

Directed at managers, engineers, scientists, technicians and supervisors involved in water treatment.

In co-operation with:



CENTRE FOR CONTINUING EDUCATION

Registration Number 85/04377/07

University of Pretoria
Department of Chemical Engineering

Divison of Water Utilisation

REGISTRATION FOR SHORT COURSES

Short Course 1

Short Course 2

Name.....Title.....

Company.....

Address.....

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Tel.....Fax.....

* LGI to send confirmation to:

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* LGI to send invoice to:

Name.....Tel.....Fax.....

Address.....

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Please **Fax** the complete registration form to LGI at Fax: (012) 342-4161

and

Mail the completed registration form along with your payment to:

LGI (Pty)Ltd, Box 30536, Sunnyside 0132.

NB: Cheques to be made payable to LGI (Pty)Ltd.

Evaluating faster methods for detecting bacterial bugs

Two researchers, B Genthe and M du Preez, from the Division of Water Technology at the CSIR recently evaluated the latest methodologies for enumerating bacterial indicators in drinking water. They tried to establish whether more rapid and practical methods exist which may be used as an alternative to the conventional membrane filter methods, described in the SABS Standard Methods.

The researchers say in their final report submitted to the Water Research Commission there is a generally recognised need for methods that permit rapid estimation of the bacteriological quality of water. Small utilities with only moderately trained personnel and developing communities will benefit from rapid and simple detection methods for assessing the bacteriological quality of potable water. Rapid, simple methods can be invaluable during emergencies involving water treatment plant failure, line breaks in a distribution network or other disruptions to water supply caused by disasters.

BACKGROUND

Detection of indicator bacteria are of primary importance in the assessment of the microbiological quality of drinking water. In particular coliforms and *E. coli* are used as indicators of faecal pollution in water and as criterion of operational parameters in the water supply industry. Two basic procedures are used for the enumeration and detection of indicator bacteria from drinking water. These procedures include the multiple tube fermentation method which provides a most-probable-number analysis after growth of coliforms in liquid medium, while the membrane filter technique enumerates total coliforms on the surface of agar by providing a colony forming unit per 100 ml count. Presently, the duration to obtain a negative result (a water sample containing no coliform bacteria) is 24 hours. A complete analysis for total coliforms and faecal coliforms, which requires confirmation procedures, can require 72 hours for a final result.

METHODOLOGY

The Researchers say that new media based on the Defined Substrate Methodology have been developed for direct and simultaneous detection of coliforms and *E. coli* without confirmation. Defined Substrate Methodology utilises two indicator substrates, namely, o-nitrophenyl- β -D-galactopyranoside and 4-methylumbelliferyl- β -D-glucuronide, which are combined to simultaneously detect total coliforms and *E. coli*. Total coliforms produce the enzyme β -galactosidase, which hydrolyses o-nitro-phenyl- β -D-galactopyranoside (ONPG) and thereby releases o-nitrophenol, which produces a yellow colour. *E. coli* produces the enzyme β -glucuronidase, which hydrolyses 4-methylumbelliferyl- β -D-glucuronide (MUG) to form a fluorescent compound.

The American detection methods Colilert and Colisure, which incorporate both MUG and ONPG, can be used in a most-probable-number analysis or as a presence-absence test to assess the bacteriological quality of drinking water. The researchers therefore compared these

methods with the conventional membrane filter technique for the detection of coliform bacteria and *E. coli*.

To obtain a variety of isolates representative of both target and non-target isolates, the study was done using primary sewage effluent. Organisms were stressed by exposure to chlorination similar to those in drinking water treatment facilities. To determine the specificity of the proposed tests, the false positive and the false negative error were calculated.

RESULTS

The results showed that the American Colilert presence-absence method was equivalent to the reference method (membrane filter technique) for the detection of total coliforms and *E. coli*. Simultaneous detection of coliform bacteria and *E. coli* within 24 hours, without having to perform additional confirmatory tests, was possible using the Colilert method.

The American Colisure method, however, yielded unsatisfactory results which compared poorly to the membrane filter method. The researchers say statistical analysis of the data showed no significant difference between the Colilert and the membrane filter methods in detecting total coliforms and *E. coli* in water samples. They therefore recommend that a Defined Substrate Methodology method such as Colilert be included as an acceptable method for the identification of both total coliforms and confirmation of *E. coli*.

B GENTHE
M DU PREEZ

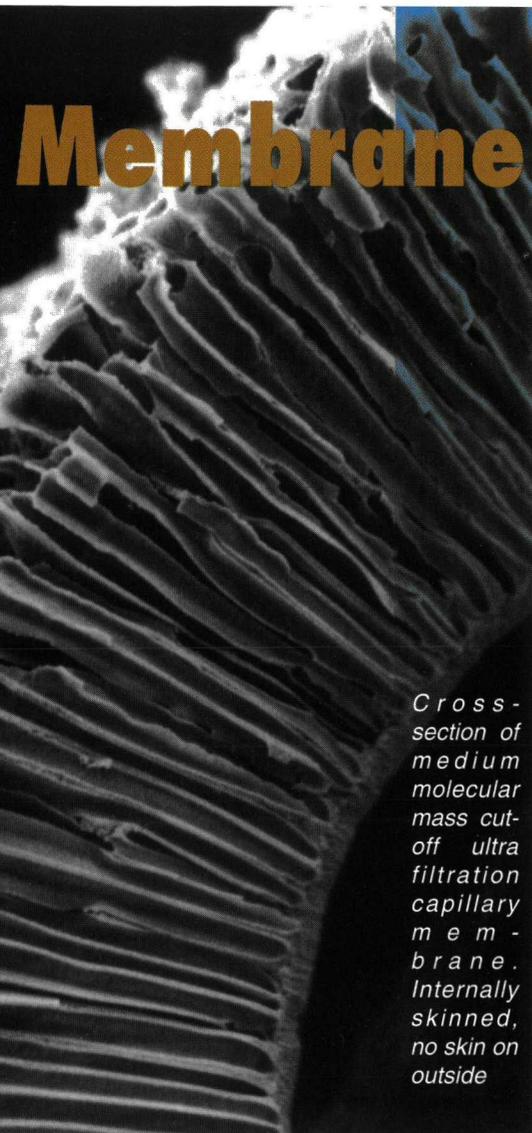
EVALUATION OF RAPID METHODS FOR THE DETECTION OF INDICATOR ORGANISMS IN DRINKING WATER

Report to the
WATER RESEARCH COMMISSION
by the
DIVISION OF WATER TECHNOLOGY, CSIR

WRC Report No 610/1/95

Copies of the report titled **Evaluation of rapid methods for the detection of indicator organisms in drinking water** (WRC Report 610/1/95) are obtainable free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US\$ 10).

Membrane fouling tackled with enzymes



Cross-section of medium molecular mass cut-off ultrafiltration capillary membrane. Internally skinned, no skin on outside

Copies of the report **The development of characterising and cleaning techniques to classify foulants and to remove them from ultra- and microfiltration membranes by biochemical means** (WRC report 531/1/96) are available from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US\$ 25).

The production of large volumes of effluent, with an extremely high chemical oxygen demand, by biologically related industries such as abattoirs, wool scouring processes, paper and pulp industries and egg processing plants is a world-wide phenomenon.

According to researchers at the University of Stellenbosch it has been reported that in South Africa 300 registered abattoirs use approximately 7 million m³/year of potable quality water and produce about 6 million m³/year of effluent to municipal sewers: an effluent rich in protein and lipid material. The woolscouring process produces 0,5 million m³ of a highly polluting dark slurry with an obnoxious odour and complex composition. This effluent contains wool fat (lanolin), suint, protein, sand and clay.

The researchers, P Swart, A Maartens, and AC Swart from the Department of Biochemistry and Dr EP Jacobs, from the Institute for Polymer Science, say that these industries are currently faced with the challenge to substantially reduce the discharge of conventional and toxic pollutants to the receiving environment without reducing economic viability or competitiveness. One method to achieve this goal is to concentrate pollutants and recycle wastewater with the aid of ultrafiltration. Ultrafiltration is a membrane separation process, conservative in energy requirements and low in operating and maintenance costs, which can remove up to 90 per cent of the chemical oxygen demand and reduce the potable water requirement of an industry, such as an abattoir, by 25 per cent.

PROBLEM

A major problem is, however, that the materials found in these effluents adsorb

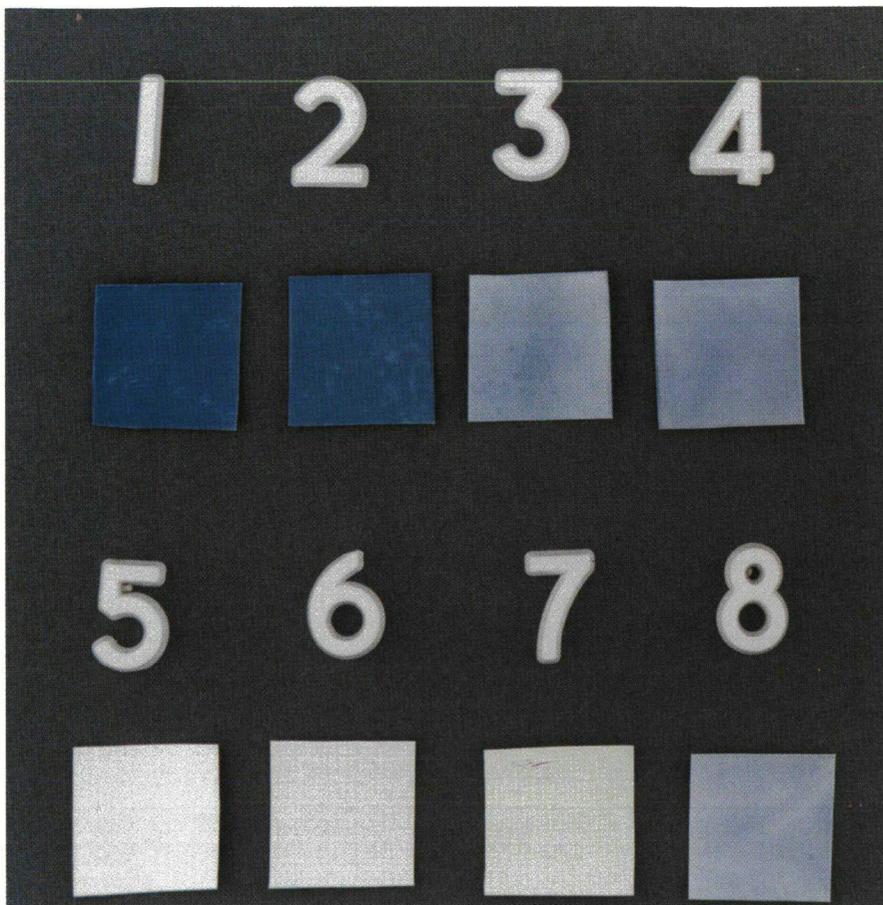
onto the membranes which subsequently leads to membrane fouling. Fouling, characterised as an "irreversible flux decline" of water through a membrane, causes an increase in membrane cleaning costs, process down-time, as well as membrane damage due to the effect of the harsh conventional cleaning chemicals often used. In fact, fouling and inefficient cleaning are the main reasons why ultrafiltration has not yet fulfilled its promise as an efficient and economical method for waste water treatment.

The researchers who investigated the possibility of removing foulants from membranes by biochemical means, say in their report to the Water Research Commission that although membrane technology has made great advances recently, the cleaning of fouled membranes has been neglected. Processes which would minimise fouling, such as effluent pre-treatment, operational conditions and membrane characteristics, have been extensively researched and developed.

The researchers say this lack of information about the nature and extent of foulants adsorbed onto membranes, as well as the non-availability of appropriate cleaning agents, lead to the use of powerful chemical cleaning agents to restore transmembrane flux. These methods, however, caused severe membrane damage which influenced membrane characteristics such as morphological properties (pore shape, pore length, pore density and pore size distribution) as well as the chemical and electrical surface properties.

ENZYMES

In South Africa a different approach to membrane cleaning has been introduced by the Institute for Polymer Science, with the introduction of enzymes as cleaning agents. As biocatalysts, enzymes are



A novel rapid staining method was developed to determine protein adsorption onto membranes. The above photograph illustrates colour development of proteins adsorbed onto membranes during fouling. Treatment of the membranes indicated above were: Membranes 1 and 2: fouling followed by staining; membranes 3 and 4: fouled then cleaned and stained. Membranes 5 and 6 are unused and unstained; membrane 7 is fouled but unstained; and membrane 8 is an unused but stained reference membrane.

highly specific for the substrates they react with and in the type of reactions that they catalyse. Unlike chemical cleaning methods, these enzymes cause no further pollution or membrane damage. Enzymes are, however, considered to be expensive reagents and this fact can have a negative influence on their application in cleaning regimes for membranes fouled by biological effluents. Modern molecular biology and genetic engineering, however, enables one to produce many proteins economically and on a large scale in foreign hosts. This technology can also be applied to enzyme production for membrane cleaning once the relevant enzymes have been identified.

RESULTS

The researchers say the following conclusions may be drawn from the results

obtained in their study of abattoir and wool scouring effluent:

□ Proteins and lipids are important foulants in abattoir effluent, while protein and wax (lanolin) are the most prominent foulants in wool scouring effluent. The content of these foulants in the effluent vary significantly from hour to hour and from day to day. This variation in effluent composition renders the use of model foulants and model solutions, to characterise fouling in the abattoir and wool scouring effluents, unserviceable and therefore real effluents were used in fouling experiments.

□ Protein and lipid analysis, developed in this study, proved to be reliable and sufficiently sensitive to determine the nature and amount of these materials adsorbed onto membranes during the fouling period. Results from lipid and protein analysis indicate that multilayer

adsorption occurs. The lipids adsorb first and this first layer of lipid material provides an ideal surface for further adsorption of proteins and lipids. In addition to the conventional protein determination methods, a novel rapid staining method was developed to determine protein adsorption onto membranes. These techniques were also effectively used to determine the efficiency of foulant removal in cleaning experiments.

□ Dynamic contact angle measurements have not previously been used to characterise membrane fouling in abattoir and wool scouring effluent. It was, however, found, that the information obtained from this technique was not only useful in characterising membrane surface characteristics, but also of value in the assessment of cleaning efficiency. Changes in the contact angle correlated well with changes observed on the membrane surface after foulant adsorption.

□ Transmembrane flux measurements of clean water can be seen as the ultimate method to characterise the effect of fouling on membrane permeability. The decline of the clean water flux through statically fouled membranes followed the same pattern as the flux decline observed in an actual ultrafiltration process. A rapid flux decline was observed within the first hour of fouling, followed by a more steady decline in the following for hours until a steady state was reached. These results indicate that in future fouling experiments, two to three hours of fouling will be sufficient and that static adsorption studies could be used as an inexpensive method to characterise foulants and to develop cleaning regimes for real ultrafiltration processes.

□ Enzymes specific for protein and lipid hydrolysis were used to clean membranes fouled in abattoir effluent. Cleaning experiments, evaluated for their potential to remove lipids and proteins, clearly indicated that specific enzymes and enzyme detergent mixtures can effectively remove foulants adsorbed onto ultrafiltration membranes. Enzymes alone, and together with specific detergents, produced good cleaning results. These results could, however, only be obtained with a sound knowledge of the nature of the foulants.

□ The experience gained in effluent and membrane analysis from the abattoir industry was transferred to wool scouring effluent. In wool scouring effluent lanolin is the main lipid foulant and the enzymes that could remove lipids from polysulphone membranes fouled in abattoir effluent, could not remove the lanolin.

An esterase, with greater specificity towards ester bonds, was used instead of the lipases which successfully removed lipids from abattoir fouled membranes. The cleaning agent containing an esterase was the most efficient for the removal of foulants and subsequent flux restoration on membranes fouled in wool scouring effluent.

□ Results obtained during this investigation show that enzymes, as highly specific biocatalysts, are extremely useful and effective components of cleaning mixtures for biologically fouled membranes. In order to use these catalysts effectively it is, however, very important to know the exact composition of the

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THE DEVELOPMENT OF CHARACTERISING AND CLEANING TECHNIQUES TO CLASSIFY FOULANTS AND TO REMOVE THEM FROM ULTRA-AND MICROFILTRATION MEMBRANES BY BIOCHEMICAL MEANS

Report to the
WATER RESEARCH COMMISSION
by the
DEPARTMENT OF BIOCHEMISTRY
UNIVERSITY OF STELLENBOSCH

WRC Report No 531/1/96

foulants deposited on the membrane. The researchers say a novel yeast expression system was developed for the economical and facile expression and purification of proteins in yeast. This system combines the secretory ability of yeast with the use of affinity purification of the expressed protein in a single step.

The researchers say that future studies will concentrate on refining the system and adapting it for the production of specific enzymes that will form part of future cleaning regimes in high yield. Other organisms will also be investigated for enzyme production.

A literature survey of the composition of black liquor derived from the paper and pulp industry, showed that this effluent was considerably more complex and of a totally different nature to the abattoir and wool scouring effluent.

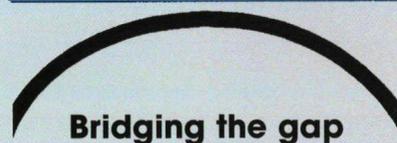
Time constraints and the complexity of the paper and pulp effluent led to the registration of a follow-up study funded by the Water Research Commission, in which specific attention will be given to the effluent from the paper and pulp industry and the potential membrane foulants that it might contain.

The promising results obtained in this investigation show that enzyme based, biologically oriented cleaning regimes hold a great promise for the restoration of ultrafiltration membranes fouled in bio-

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by Prof Johannes Haarhoff

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by Mr Frans Stoffberg

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(registration 17h00)

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Water supply - a groundwater perspective	3 September (full day) Borehole Water Association
Swedish water and environmental technologies seminar	3 September (full day) Swedish Trade Council
Chemistry and water purification	4 September (full day) SA Chemical Institute (S. Tvl Branch)
The role of toxicology in water quality management	3 September (full day) Southern African Society of Aquatic Scientists (SASAQS)
Membrane processes and education	4 September (full day) Membrane Technology Division of WISA
Anaerobic treatment of industrial effluents	4 September (afternoon) Anaerobic Processes Division of WISA
Nutrient removal	5 September (full day) Nutrient Removal Technical Division of WISA
French water technologies for Africa	4 & 5 September (two full days) French Embassy on behalf of ACTIM
Industrial water	5 September (full day) SA Industrial Water Association (SAIWA)

For further information please contact:

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Cilla Taylor, Conference Planners
PO Box 82, Irene 1675
Tel: (012) 63-1681 Fax: (012) 63-1680

EXHIBITION DETAILS:
Sue Philipson, TML Reed Exhibitions
PO Box 56182, Pinetown, 2123
Tel: (011)886-3734 Fax: (001) 789-6497



Drinking water quality guidelines investigated

The Water Research Commission has released the results of an investigation into the microbial guidelines and standards which are used in different parts of the world to determine whether water is safe for human consumption. International guidelines including the World Health Organisation (WHO), the European Community (EC), USA, Canadian, Australian, Japanese and Israeli guidelines were examined and compared to the specifications and recommended guidelines in South Africa.

The research was carried out by B Genthe and R Kfir from the Division of Water Technology at the CSIR.

According to the report the objectives of monitoring microbial water quality are to ensure the protection of public health. The issues surrounding monitoring of microbial water quality are vast and in this study they have been addressed in three major categories, namely, microbiological, water quality and sampling issues.

Microbiological issues

include the justification of the utilisation of indicator organisms, which indicator organism to test for, collection and preservation of samples, examination procedures and confirmation steps. The researchers say the question of the utilisation of specific indicators in water quality guidelines is the major issue to be addressed in formulating water quality guidelines. Choosing an indicator is directly related to the objective set for water quality monitoring. As microbial



drinking water quality guidelines aim at ensuring both the protection of human health and the evaluation of the treatment efficacy, more than one indicator organism is often needed. The coliform group of bacteria has been used more than any other indicator group for monitoring drinking water because it addresses both health and treatment efficacy objectives. Although the total coliform group can only remotely indicate human health risk, the group includes faecal coliforms and more specifically *E. coli*, which

originates from faecal matter. Secondary indicators (heterotrophic plate counts, faecal streptococci, *Clostridium*, *Pseudomonas aeruginosa*, and *Aeromonas*) are generally not included in guidelines, but are commonly used for supporting data. Because the potential presence of pathogens in water cannot be predicted solely by faecal indicators it may, under certain circumstances, be necessary to monitor for the presence of pathogens. In general it is recommended that water intended for human consumption should not contain any pathogens, which include protozoan parasites, enteric viruses and pathogenic bacteria such as *Salmonella*, *Shigella*, *Vibrio cholera*, *Yersinia* and *Campylobacter*.

Water quality issues

dealt with in this study include the significance of the presence of indicators, statistical parameters for indicator presence, protection of public health in relation to indicator levels, steps required following unsatisfactory samples and interpretation of results.

The researchers say the significance of the presence of indicator organisms is inconclusive as inadequate information is available regarding the margin of safety with respect to any coliform count with which to set a standard. Research does not support a quantitative relationship between coliform density and pathogen density and the potential for outbreak of water-borne diseases. Most guidelines are based on water quality considerations with little direct relation to human health. However, it is still recognised that coliforms are the best available indicators of microbial quality.

Sampling issues

were addressed by the researchers, and include the time period for water quality evaluation, sample number and frequency, site selection, sampling time and additional samples. Initially sampling numbers and frequency were not specified as guidelines were expressed as absolute levels of safety. Presently

though, this approach has been altered in most guidelines. The basic aim of a sampling programme is to ensure that the quality of the water sampled represents the quality of the water supply. It is necessary to ensure that the sampling programme will detect contamination, if it occurs.

The researchers say that the majority of guidelines and standards recommend that the frequency of sampling be dependent on the size of the population served. This principle is based on the assumption that as the population size increases, so will the size and the complexity of the system and thus the chances of contamination. The fraction of samples which is permitted to be positive is also specified (usually 5 per cent of samples in a month or year). The researchers say that the use of the principle of frequency of sampling based on population served, is empirical and devoid of any mathematical basis. Examination of larger samples (200 - 1 000 ml) has been suggested and would be statistically more meaningful and reduce the risk of failure to detect low levels of coliforms.

Sites for sampling need to be chosen with care to allow for samples which represent a large area covered by a distribution system. It has been recommended that the best approach for the selection of sampling locations for monitoring the microbial water quality in the distribution system is stratified random sampling, but this approach is rarely practised due to practical problems.

WHO STANDARDS

The researchers say the most lax of all international guidelines and standards are those of the World Health Organisation (WHO) which have been devised to accommodate Third World countries. The WHO states that the adoption of too stringent drinking water quality standards could limit the availability of water supplies that meet those standards. This is a significant consider-

ation in regions of water shortage, such as South Africa.

Guidelines should not only address high quality purified potable water, but also be appropriate for areas in which only localised purification schemes and limited infrastructure for water supply are available. However, the researchers say only water supplied to the consumer should be evaluated as drinking water. To develop guidelines for communities where no water supplies are available and surface water is used, will require an holistic approach to surface water management in which pollution sources are well managed.

SA GUIDELINES

The latest guidelines published for South Africa are those of the Department of Water Affairs and Forestry (1993). Of the South African guidelines, the SABS specifications is the most commonly used by water authorities and municipalities, even though the three tiered system of Aucamp and Vivier (1990) has been accepted in principle by the Department of National Health. The researchers say in the report that it is important that an official joint South African guideline for microbial drinking water quality is accepted on a national level. In a developed country the objectives of monitoring water microbial quality are to ensure protection of public health and at the same time to evaluate the efficacy of the water treatment processes.

The SABS specifications address the protection of human health under the assumption that such treatment purification process is provided. This will be suitable in urban areas where conventional purification processes are available. These guidelines are based solely on limits for indicator organisms which will facilitate water of high quality as long as conventional treatment processes are functioning well. Unfortunately, many

parts of South Africa do not fit this description which limits the applicability of these guidelines.

Considering the WHO (1984) statement that the adoption of too stringent drinking water standards could limit the availability of water supplies meeting such standards, the researchers say this is a significant consideration in South Africa. "It will therefore not be suitable for South Africa to adopt the 'Coliform Rule' of the

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R KFIR

STUDIES ON MICROBIOLOGICAL DRINKING WATER QUALITY GUIDELINES

Report to the
WATER RESEARCH COMMISSION
by the
DIVISION OF WATER TECHNOLOGY, CSIR

WRC Report No 469/1/95

USA which requires monitoring based on the presence or absence of coliforms in a sample." Even though this rule does not require quantifying the coliform density and thus appears to be a more simple rule, the researchers say it has been calculated to be twenty times more stringent than the rule based on maximum contaminant levels, and is thus not suitable for the South African situation.

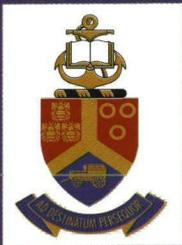
CONCLUSION

The researchers say the South African guidelines should be revised, particularly with regards to the inclusion of limits for pathogens such as enteric viruses and protozoan parasites. The guidelines of the Department of Water Affairs and Forestry have included coliphages as indicators of enteric viruses, but mention the limitations on their usefulness as viral indicators as well as advising that the guideline should be considered as extremely tentative.

The researchers believe that the present indicator organisms recommended in the SABS specifications are adequate for the routine monitoring of drinking water, but if problems are suspected then additional tests should be specified. For example, testing for the presence of *Vibrio cholerae* and *Salmonella spp.* in areas where non-point source pollution occurs and examination of water for *Aeromonas spp.* and *Pseudomonas*, depending on the type of water and distribution system. The researchers also believe that water should be examined for the presence of enteric viruses and protozoan parasites, such as *Giardia* and *Cryptosporidium* on a routine but less frequent basis (for example, monthly).

The researchers say meaningful statistical descriptions of data processing needs to be addressed in South African guidelines. Statistical aspects of water quality monitoring, for instance the monitoring frequency and data analysis, ie central tendency and variability. The monitoring frequency should be re-examined in the light of the available data, demonstrating that there is very little benefit from a statistical point of view for taking more than 150 samples per month or fewer than 50 samples per month. The principle of frequency of sampling based on population size has been criticised because it lacks any mathematical basis.

Copies of the report summarising the results of the investigation, titled **Studies on microbiological drinking water quality guidelines** (WRC report 469/1/95) are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US\$ 10).



University of Pretoria

Department of Chemical Engineering

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Researchers evaluate the ADUF effluent treatment process

Anaerobic digestion of industrial waste waters containing high concentrations of soluble and colloidal organic carbon has become an accepted method of treatment in recent years. This is attributable to the vast amount of research and development work that has been done to commercialise the concept, to stricter environmental regulations and enforcement policies and to the increasing cost and decreasing availability of energy.

In designing high rate anaerobic digestion systems for soluble organic wastes, two of the essential features that must be incorporated are biomass concentration and biomass retention. High rate operation entails short hydraulic retention times with maximum contact between the active biomass and the feed substrate. In the older, fully mixed anaerobic digestion systems, these requirements nearly always resulted in the loss of active biomass in the treated effluent from the digester, which reduced the efficiency of the process and frequently led to digester overloading and subsequent failure. To maintain a maximum active biomass concentration in a digester at the short hydraulic retention time required for economic operation, various system designs have been advocated. These designs either attempt to retain the biomass in the digester by immobilisation on a retaining medium, by modifying the sludge to prevent its loss from the system or by capturing the biomass lost from the digester in the treated effluent and by returning it to maintain a high concentration in the digester.

In recent years attention has been directed towards the use of membranes for biomass separation in biological treatment processes. A number of treatment systems have been developed overseas, employing solids retention in the treatment system by using membranes. Independent pilot-scale research into the use of locally manufac-

tured ultrafiltration membranes for solid-liquid separation in the anaerobic treatment of wine distillery waste was commenced in 1987 at the Distiller's Corporation in Stellenbosch and continued at the Paarl sewage works during 1988. Significant differences, relative to overseas practice, in ultrafiltration membrane design, support modules and integration with the digester system prompted the development of what has come to be known as the ADUF process (Anaerobic Digestion Ultra Filtration) for the treatment of organic industrial effluents.

JH NELL
A KAFAR

THE EVALUATION AND IMPROVEMENT OF THE ANAEROBIC DIGESTION ULTRAFILTRATION (ADUF) EFFLUENT TREATMENT PROCESS

Report to the
WATER RESEARCH COMMISSION
by the
DIVISION OF WATER TECHNOLOGY, CSIR

WRC Report No 365/1/95

The ADUF process has been evaluated on pilot-scale on a number of organic waste effluents and at least two full-scale plants in South Africa have been adapted to incorporate the ADUF concept. A number of problems have arisen with some of these applications of the ADUF technology and there are still some unanswered questions that should be addressed. Some of these have been

identified and in an attempt to find practical solutions that would allow the ADUF process to attain its full potential an evaluation was launched under the guidance of a Steering Committee, which was chaired by the Water Research Commission.

The original aim of the evaluation was to address:

- Digester and overall plant design;
- The reasons for the relatively poor performance of the anaerobic digestion process when coupled to the ultrafiltration process;
- Changes in the digester sludge characteristics caused by rapid pumping through the membrane system at relatively high velocities and the possible accumulation of biological debris and indigestible solids in the sludge;
- The effect of various feed substrates on the performance of the ADUF system.

TEST APPARATUS

Three laboratory-scale anaerobic test units were designed and constructed. Two of these were identical ADUF units, comprising 72 litre digesters (50 litre operating volume) equipped with ultrafiltration modules containing twenty 9 mm outer diameter tubes, 400 mm long, connected in series. Polyethersulphone membranes with a molecular mass cut-off of 20 000 to 80 000 were used. The modules were designed to operate at low pressures of up to 400 kPa, with continuous applied inlet pressures of 150 to 250 kPa normally used. Variable speed Mono pumps were used to circulate the sludge from the digesters through the ultrafiltration units. The third digester had a total volume of 30 litres, an operating volume of 25 litres and employed an inclined cylindrical settling tank for sludge recovery. Special gas meters were constructed for the test units. This anaerobic digestion/settling unit would allow a direct comparison to be made between the two technologies.

It was foreseen that operating a laboratory-scale ADUF system would be fraught with problems. Scale effects make it impossible to realistically reproduce full-scale ADUF operation on a laboratory unit with a total anaerobic digester capacity of 50 litres.

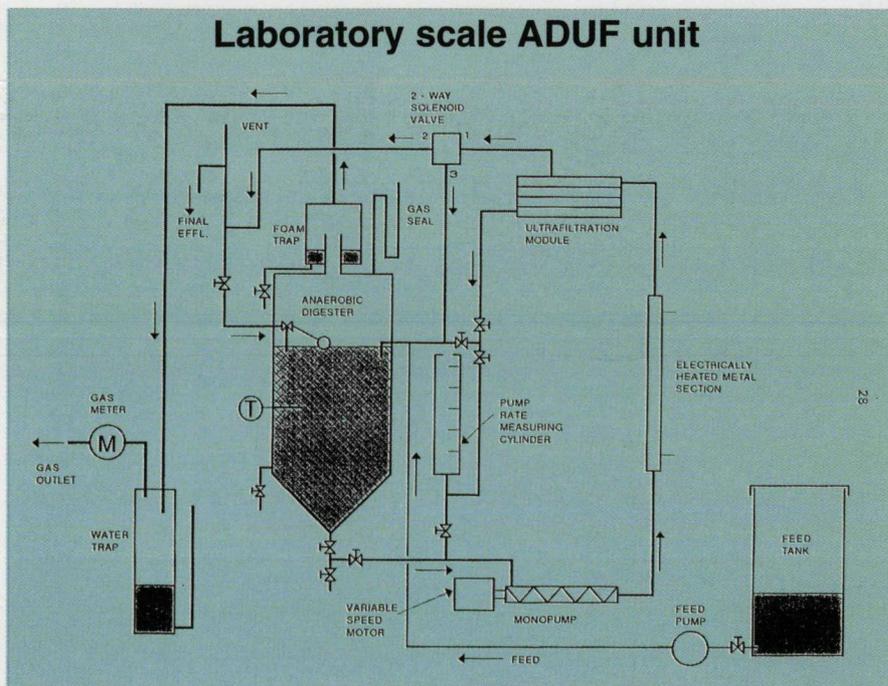
The main problem results from the minimum linear flow velocity through the ultrafiltration membrane tubes which is required to prevent excessive concentration polarization at the membrane surface with subsequent fouling layer build-up. The smallest available tubular ultrafiltration membranes which are suitable for passing relatively viscous digester sludge have an outside diameter of 9 mm, with an average internal diameter of about 8,7 mm. This gives the tube an effective internal cross-section of 0,5945 cm². To maintain a linear velocity of 2 metres per second across the membrane surface in a single tube (eg a single pass series train) would require a pumping rate of 7,13l per minute through the membrane tube. Assuming that a 50l digester is coupled to this ultrafiltration array, it would mean that the entire contents of the digester is pumped through the ultrafiltration unit once approximately every seven minutes, or 8,5 complete digester turnovers per hour.

It was thought that the excessive pumping rate may affect the sludge characteristics due to mechanical damage of the sludge structure and may cause short-circuiting of some undigested or partly digested feed substrate into the ultrafiltration module, which would probably result in a poor quality final effluent.

RESULTS

The tests were run for 268 days. During the first 221 days the feed substrate used was spent wine waste. During the next 25 days the units were run on blends of spent wine waste and beer and beer brewery effluent and eventually on pure beer brewery waste for the final 23 days. The test was stopped at this stage as the finances had been exhausted and the indifferent results obtained did not warrant extending the test any further.

Numerous breakdowns and other problems occurred during the test. The generation of large quantities of foam in the ADUF digesters caused severe problems and restricted the space and biological load rates that the units could handle. The foam often clogged the gas pipes,



water traps and meters and resulted in loss of solids from the ADUF systems.

The overall performance of these laboratory-scale units was poor. Although all three units maintained a COD reduction of more than 98 per cent while operating under steady state conditions (not during periods of instability), the load rates that could be maintained were poor. The ADUF units averaged a space load rate of approximately 2,5 kg COD/m³/day, whereas larger pilot and full-scale ADUF plants have operated at rates of 11 to 15 kg COD/m³/day at hydraulic retention times of less than one day. The biological (or sludge) load rates were equally poor, averaging less than 0,15 kg COD/kg volatile solids/day, whereas other larger units have attained 0,5 to 0,7 kg COD/kg volatile solids/day.

A very high rate of flux loss occurred on both the ADUF ultrafiltration units. Cleaning procedures with warm water effected a temporary flux increase of approximately 10 per cent. Over the test period total flux decline rates of 3,4l/m²/day and 2,9l/m²/day for ADUF1 and ADUF2 occurred, which were far too high for economic operation, especially if the low load rates that were attained are considered.

There was no indication of any short circuiting of raw or partly digested feed into the final effluent from the ADUF plants. Build-up of intractable solids was also not evident, although this condition may have been masked by the frequent

sludge losses and addition of sludge from the a full-scale digester.

The operation on the beer brewery waste was inconclusive as the waste was very weak during the time that the test was carried out (3 to 6 g/COD) and the duration of the run was too short. The alkalinity in the digesters dropped markedly, as expected, during this phase of the test, as the feedstock consisted essentially of carbohydrates and very little protein. Nitrogen in the form of urea was added to counteract this deficiency, but the test was terminated before a meaningful gain in alkalinity had been established.

During this evaluation using small scale test units, the ADUF process did not perform better than the anaerobic digester equipped with an inclined settling tank with regard to most aspects, except that all suspended solids normally lost in the final effluent were retained in the digester.

Copies of this report titled **The evaluation and improvement of the anaerobic digestion ultrafiltration (ADUF) effluent treatment process** (WRC report 365/1/95) are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US\$ 20). The report was compiled by JH Nell and A Kafaar of the Division of Water Technology at the CSIR in Stellenbosch.



At the SANCIAHS meeting following the Hydrological Symposium in Grahamstown in 1995 it was decided to nominate Prof Des Midgley for the IAHS International Hydrology Prize for 1996. On 30 May 1996 we received the good news from Gordon Young, Secretary General of IAHS, that Prof Midgley had been awarded this prestigious prize! He has been invited to attend the Kovacs Memorial Symposium in Paris on 19 September and will officially receive his award on this occasion.

The General Assembly of IAHS held at Canberra in 1979 endorsed the principle of an International Hydrology Prize awarded annually on an individual basis in recognition of an outstanding contribution to science. The International Hydrology prize is awarded to a person who has made an outstanding contribution to hydrology such as confers on the person universal recognition of his or her international stature.

The contribution should have an identifiable international dimension extending beyond both the country of normal work and the specific field of interest of the candidate;

The contribution may have been made through scientific work, as evidenced by the publication in international journals of scientific literature of a high standard, and/or through practical work, as evidenced by reports of the projects concerned. Preference should be given to candidates who have contributed through both scientific and practical work.

The Prize may be awarded to hydrologists of long international standing or to those who, while having gained such standing only recently, exhibit the qualities of international leadership in the science and practice of hydrology.

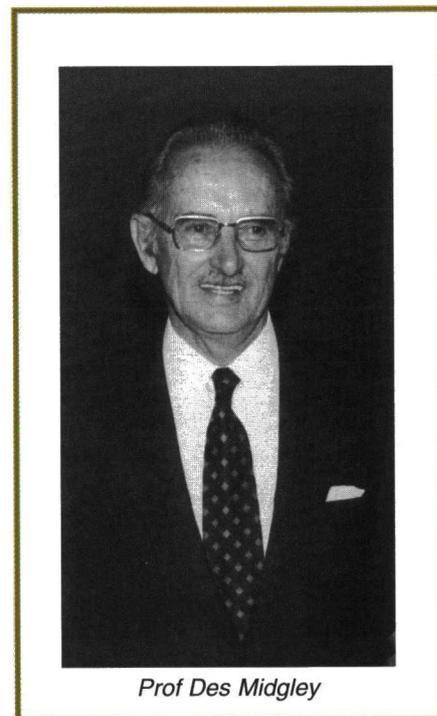
PROF DES MIDGLEY receives the IAHS International Hydrology Prize 1996

Who is Des Midgley?

Professor Desmond C Midgley was born in Durban and educated at Hilton College. He graduated BSc Civil (Engineering) at the University of Natal in 1934 and in 1957 was awarded a Doctorate for a thesis on the Surface Water Resources of South Africa. In 1986 he was awarded an Honorary DSc (Eng) by the University of the Witwatersrand.

He served 21 years in various divisions of the Department of Irrigation (now Water Affairs), interrupted by four years active service during the World War II (mentioned in dispatches).

In 1956 he was appointed to the chair of hydraulic engineering at the University of the Witwatersrand. Following the disastrous 1959 floods in Natal he set up a research team which later became the Hydrological Research Unit (HRU). Under his direction the HRU published design manuals on flood hydrology in the 1970's and on water resources assessment in 1969 and updated in 1981. Mathematical models covering a wide variety of applications were developed in the Unit for simulating the behaviour of river catchments, lakes, swamps, estuaries and flood plains, as well as salinity fluctuations in various hydrological systems. Pertinent among these is the well-known Pitman Catchment Model. The publications of the HRU have been well received in many parts of the world and are widely used in South Africa. In many ways Professor Midgley must be regarded as the "Father of Hydrological Modelling" in South Africa.



Prof Des Midgley

Professor Midgley served for several years on the Prime Minister's Advisory Council and on the Water Research Commission.

He was President of the South African Institution of Civil Engineers in 1968 and of the Associated Scientific and Technical Societies in 1974. He has received the Gold Medal Award of both bodies and was made an Honorary Fellow of the Civil Engineering Institution. He has for many years consulted in hydraulic engineering and hydrology for the mining houses, Eskom and Government departments and many consulting engineering firms.

Professor Midgley retired from the Chair of Hydraulic Engineering in 1977 but continued as full time Director of the HRU until 1981 when he retired from the

Developing an

URBAN WATER QUALITY MODEL

for South African conditions

Storm water runoff from urban catchments has been found in many areas to be a major source of pollution of their receiving water bodies. In the United States of America, for instance, the water quality downstream of approximately 80 per cent of urban areas is determined by the quality of the storm water runoff or diffuse sources rather than point sources of pollution.



A typical catchment with informal settlements in KwaZulu-Natal.

In South Africa urban runoff has been found to contain levels of nutrients, heavy metals, organic material and *E. coli* that would have a significant effect on the water quality of the receiving water body. The Department of Water Affairs estimate that some 40 per cent of the salt loads that enter the Vaal River at the Barrage are generated by storm water runoff from the southern catchments of the Johannesburg metropolitan area.

Currently, South Africa is undergoing rapid urbanisation. The Urban Foundation projected a movement from the rural to the urban areas of some 2,8 million people during the period 1990 to 2000. This coupled with an estimated population growth of two per cent will result in an increase in the population in the urban areas by about 8 million people to give a projected total urban population of 30 million people by the year 2000. The storm water runoff from the resultant expansion and densification of the urban centres, could have a serious effect on their receiving water bodies if not managed correctly. Particular attention will have to be paid to the management of the water quality aspects of the runoff, as much of the urbanisation will take the form of informal or squatter settlements.

PC PROGRAMS

Attention has been given to the management of runoff quantity by using management techniques such as retention ponds, dual drainage and the use of disconnected impervious areas. This special focus on the management of storm water quantity has occurred largely as a result of the development of PC based computer programs which allow the modelling of storm water runoff and the use of management methods.

In a research project funded by the Water Research Commission (WRC) two researchers, TJ Coleman, from the Water Systems Research Group at the University of the Witwatersrand, and DE Simpson, formerly with the Division of Water Technology at the CSIR, developed a water quality model called WITQUAL, for application to South African catchments and conditions.

According to the final report submitted to the WRC the main objectives of the research were as follows:

□ To adapt an existing urban runoff model to include simulation of runoff quality, typically for suspended and dissolved solids, phosphorus and nitrogen forms and selected heavy metals. The model will simulate quality changes during runoff events in a continuous manner from rainfall data and a knowledge of catchment parameters.

□ To incorporate into the model "best management practices" such as diversion of the first flush, detention basins and infiltration to reduce peak flows and improve water quality.

T J COLEMAN
D E SIMPSON

ADAPTION AND CALIBRATION OF AN URBAN RUNOFF QUALITY MODEL

Report to the
WATER RESEARCH COMMISSION
by the
DIVISION OF WATER TECHNOLOGY, CSIR

WRC Report No 299/1/96

□ To use locally collected data to initially develop and improve model concepts and collect new data from suitable catchments to test and validate the model.

The catchments selected were the Shembe and Amanzimnyama catchments in Durban, Natal. The Shembe catchment has as its land-use an informal settlement while the Amanzimnyama catchment has a more commercial and industrial land-use.

However, due to the difficulties in gauging as well as the numerous point sources and spills that occurred in the Amanzimnyama catchment, the report says the model was not applied to this catchment. Only the water quality levels and loads are reported.

RESULTS

The report says the overall modelling package consists of the WITQUAL, WIT-SKM, EDITOR and OUTPUT programs which are linked together by means of databases. The databases are used to store modelling results as well as observed flow, quality and rainfall time series. The package is written in the BASIC language for use on IBM compatible PCs. The method of modules has been used as a discretisation approach as this approach allows for the easy representation of the catchment surfaces, drainage system and storm water management structures. The drainage system can be easily changed to allow for the inclusion of stormwater management structures at any point in the drainage system and the changing of the drainage system of pipes and channels. The modules that can be used to describe the catchment are overland flow, aquifer, pipes, trapezoidal channels and storage modules. An input module has also been added to allow for the addition of flow and a pollutant concentration into a module. This was done to enable the modelling of the dry weather flow found in most urban catchments. Diversion structures are modelled using the storage module. This is done by allowing the spillway and bottom outlet flows to be directed to different downstream modules.

An urban catchment is highly dynamic due to the numerous activities of man in the catchment. For instance, the quality of runoff can be affected by traffic densities, construction activities, solid waste removal practices, the level and maintenance of services and the catchment vegetation and gardening practices. For the complete modelling of all the catchment activities, pollutant pathways, processes and reactions, particularly of the non-conservative pollutant types such as the nutrients, would be a difficult task and would result in an overly complex model.



The areas that have been found to be responsible for large quantities of pollutants are the informal and squatter type settlements that are expanding rapidly around South African urban centres.

SUBPROGRAMS

The approach used in WITQUAL is to provide subprograms which can be used to model particulates, particulate associated pollutants and dissolved pollutant forms. The particulate or suspended solids subprogram is the basis for the model as suspended solids act as the vehicle for the transport of many pollutants from the catchment surfaces. The second subprogram can be used to model the particulate associated pollutant forms as a fraction of the suspended solids. The third subprogram is used to model the dissolved form of the pollutant based on a fraction of the pollutant mass on the catchment that is considered to be soluble. A simple partition coefficient or linear isotherm is used to describe this process.

The general approach is the buildup of material on the catchment surfaces during the dry periods between storm events followed by the entrainment and transport of pollutants from the catchment surfaces during storm events. The

basis of the pollutant transport model is the plug flow simplification of the longitudinal dispersion equation. The suspended solids entrainment from the catchment surfaces uses an approach which compares the available material to the transport capacity of the flow. Material is made available by raindrop impact and flow detachment while an equation is used to determine the capacity of the flow. A mixing tank, assuming partial mixing of the surface runoff and the soil water, is used to describe the entrainment of dissolved pollutants from the soil porewater and the impervious catchment surfaces.

For the channels and pipes, a stream power function is used to estimate the suspended solids transport capacity to determine which of the particles entering a conduit will be deposited. For the conduits no entrainment of dissolved pollutants has been allowed for from the bed material. The routing of pollutants through a storage structure is undertaken using a completely mixed tank approach. The particle settling velocities

and detention time in the dam is used to estimate which of the particles entering the dam will be removed. The particulate form of a pollutant of interest is removed according to the pollutant fraction of the suspended solids. Dissolved pollutant forms are assumed to pass directly through the storage facility.

APPLICATION

The model was applied to the data collected for seven events from the Shembe catchment having an observed pollutograph. The WITSKM model was run for the entire monitored period with unchanged model parameters. The simulation results were used as input to the WITQUAL model. The pollutant types modelled were suspended solids, total dissolved solids and particulate and dissolved phosphorus. The original model runs included the buildup process during the dry periods, however, this was not used for the final runs as the buildup rate turned into a calibration parameter.

The assumption was made that there

was always sufficient material available on the catchment surfaces, that the phosphorus content of the material on the surface was the same before every storm, and that the partition coefficient remained constant throughout the simulation. The only parameters used in calibration were the rainfall and flow detachment parameters applicable to the suspended solids modelling, the phosphorus fraction of the particulate mass, and the partition coefficient. Histograms showing the frequency distribution of the ratio of simulated to observed loads and plots comparing the simulated and observed pollutographs are presented in the report.

The researchers say the model performed reasonably well considering the simplifications made in representing the catchment dynamics and pollutant processes. The results can be considered adequate to examine "what if" management scenarios for urban storm water drainage systems.

CONCLUSIONS

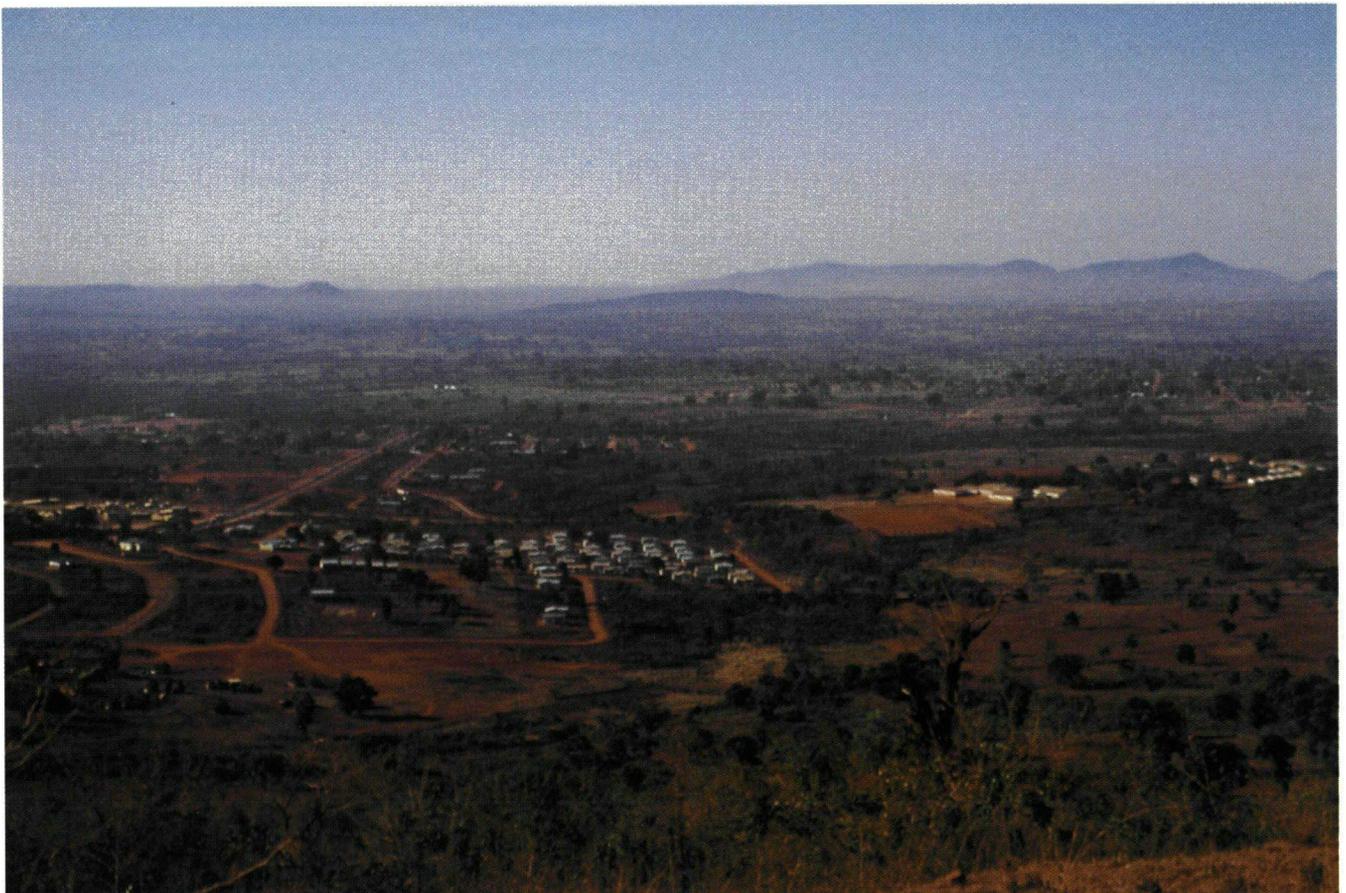
The analysis of the data collected from the catchments showed that the runoff from urban areas is highly polluted with nutrients, heavy metals, organic material and bacteria. The impacts of the runoff on the receiving water bodies could be severe depending on the ability of the receiving water to assimilate the pollutant loads. The results indicate that the stormwater runoff from the Shembe and Amanzimnyama catchments requires careful management.

Although, where possible, physically based entrainment and routing procedures were used in the development of the model, the model will require calibration using measured data for a particular catchment. The biggest stumbling block in applying the model is the determination of pollutant buildup rates, the nature of the pollutants on the catchment surface in terms of the pollutant fractions and the particle size distributions.

Nonetheless, with calibration, the model produces pollutographs of sufficient accuracy to enable the analysis of stormwater management methods of diversion and particulate settlement in dams as well as the prediction of loads for use in receiving water models.

Copies of the report entitled **Adaptation and calibration of an urban runoff quality model** (WRC Report 299/1/96) are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US\$ 20).

An urban catchment is a combination of water, air, land and man-made systems.



SOUTHERN AFRICA

1996

AFRIWATER

SEPTEMBER 2 - 5

The AFRIWATER Conference and Exhibition will be held at the Gallagher Estate in Midrand.

Enquiries: Nigel Walker Tel: (011) 886-3734 Fax: (011) 789 6497. International code: (+27 11).

MEMBRANES

SEPTEMBER 9 - 11

A seminar on hygienic water re-use and reclamation using membrane techniques will be held in Windhoek, Namibia.

Enquiries: Ed Jacobs, Institute of Polymer Science, University of Stellenbosch, Private Bag X1, Matieland 7602. Tel: (021) 808-3178 Fax: (021) 808-4967 E-mail: epj@maties.sun.ac.za

WATERSUIWERING

SEPTEMBER 16 - 20

'n Kortkursus in die bedryf van watersuiweringaanlegte sal by die Universiteit van Pretoria aangebied word.

Navrae: Professor WA Pretorius, Departement Chemiese Ingenieurswese, Afdeling Waterbenutting, Universiteit van Pretoria 0001. Tel: (012) 420-3566.

MINE WATER

SEPTEMBER 19

A one-day symposium on Radioactivity in Mine Water will be held by the Water Institute of Southern Africa at Randfontein Estates Sports Club.

Enquiries: Andrew McLaren, Gold Fields. Tel: (011) 639-2181 Fax: (011) 834-6770 or Dave Dorling Tel: (011) 414-1606 Fax: (011) 414-0953.

PC-ACRU

SEPTEMBER 26 - 27

A two-day course on the Agrohydrological modelling system will take place at the Department of Agricultural Engineering of the University of Natal. To enrol see advertisement in this Bulletin.

FIDIC '96

SEPTEMBER 29 - OCTOBER 2

The FIDIC annual conference will be held in Cape Town. Theme: The role of the consulting engineering industry in developing countries.

Enquiries: Conference Organisers, PO Box 44503, Claremont 7735. Fax: (021) 762 8606.

ENVIRONMENTAL
MANAGEMENT

OCTOBER 7 - 8

The 2nd Environmental Management, Technology and Development Conference will be held at the Indaba Conference Centre, Fourways, Gauteng.

Enquiries: Lesley Stephenson, Conference Secretary, PO Box 327, WITS 2050. Tel: (011) 716-5091. Fax: (011) 339-7835.

FILTRATION SYSTEMS

OCTOBER 15 - 16

A short course on the Design of declining rate filtration systems will be held at the Rand Afrikaans University (RAU) in Johannesburg.

Enquiries: Professor Johannes Haarhof. Tel: (011) 489-2148 Fax: (011) 489-2466. E-mail: JH@ing1.rau.ac.za

WATERBEHANDELING

OKTOBER 21 - 23

'n Kortkursus oor die behandeling van nywerheids- en verkoelingswater sal by die Universiteit van Pretoria aangebied word.

Navrae: Professor WA Pretorius, Departement Chemiese Ingenieurswese, Afdeling Waterbenutting, Universiteit van Pretoria 0001. Tel: (012) 420-3566.

WATER TREATMENT

OCTOBER 21 - 23

A seminar and workshop on the Treatment of coloured water for potable use will be held in Mossel Bay.

Enquiries: Mr CD Swartz, PO Box 745, Mossel Bay 6500. Tel: (0444) 911242 Fax: (0444) 7960.

POTABLE WATER

OCTOBER 21 - 25

A short course on the optimisation of

potable water purification plants will be held at the Technikon Pretoria, Arcadia Campus in Vermeulen Street: Room 101. Course Fee: R 1 000 per person. Enquiries: Miss MA Coetzee. Tel: (012) 318-6232/4/5 Fax: (012) 318-6233.

ISIAME '96

NOVEMBER 4 - 8

An international symposium on industrial applications of the Mössbauer effect will be held in Johannesburg.

Enquiries: Prof Herman Pollak (Chairman), Mössbauer Laboratory, Department of Physics, University of the Witwatersrand, Private Bag 3, Johannesburg 2050. Tel: (011) 716-4053 Fax: (011) 339-8262.

E-mail:

005KLKS@WITSVMA.WITS.AC.ZA

SOUTHERN AFRICA

1997

METEOROLOGY

APRIL 7 - 11

The 5th international conference on southern hemisphere meteorology and oceanography will be held at the University of Pretoria.

Enquiries: Conference Planners: Amie Wissing. Tel and Fax: (012) 46-0170.

FORESTS

MAY 11 - 17

A workshop with the theme: Forests at the limit: Environmental constraints on forest function, will be held at Skukuza in the Kruger National Park, Mpumalanga. Enquiries: Ms Tisha Greyling, IUFRO Workshop Secretariat PO Box 95823, Waterkloof 0145. Tel: (012) 346-1517 Fax: (012) 46-7909 E-mail: liaison@cis.co.za

SAICE

JUNE 2 - 4

The 2nd international mining and industrial waste conference will be held in Midrand, Gauteng.

Enquiries: Lesley Stephenson, Conference Secretary, PO Box 327, Wits 2050. Tel: (011) 716-5091 Fax: (011) 339-7835.

OVERSEAS

1997

GROUNDWATER

APRIL 7 - 11

An international conference and course on Analytic based modeling of groundwater flow will take place in Nunspeet, the Netherlands.

Enquiries: The Conference Secretariat, MOORGA, Buerweg 51, 1861 CH Bergen, the Netherlands. Tel: +31 7258-99062 Fax: +31 7258 99040

RAINWATER

APRIL 21 - 25

The 8th international conference on rain-water catchment systems will be held in Tehran, Iran.

Enquiries: Mr J Ghoddousi, PO Box 13445-1136, Tehran, IR Iran. Tel: +98 21 6418335 Fax: +98 21 6407214 E-mail: RAIN@NEDA.NET.IR

WATER SYSTEMS

MAY 25 - 28

An IWSA and IAWQ specialised conference on the Upgrading of water and wastewater systems will be held in Kalmar, Sweden. **Call for papers.** Abstract submission: 1 September 1996.

Enquiries: Dr Ulf Lidman, Dept of Natural Sciences, University of Kalmar, Box 905, S 391 29 Kalmar, Sweden. Tel: (46) 480-446235 Fax: 480-446262

ENVIRONMENTAL RESTORATION

JULY 7 - 9

The first international conference on environmental restoration will be held in Ljubljana, Slovenia. Conference themes: river, soil and groundwater contamination, pesticides/PCB/oil pollution, disposal of domestic waste/industrial waste/construction industry wastes and hazardous waste management. **Call for papers.** Deadline for submission of abstracts: 15 September 1996.

Enquiries: Dr Milenko Ros, Slovenian Water Pollution Control Association, Hajdrihova 19, PO Box 3430, SLO-1001 Ljubljana, Slovenia. Tel: +386 61 1760237 Fax: +386 61 125 9244 E-mail: milenko.ros@ki.si

ACTIVATED SLUDGE

JULY 21 - 23

The second international conference on Microorganisms in activated sludge and biofilm processes will be held at Berkeley in California, USA. **Call for papers.** Deadline for receipt of extended abstracts: August 15 1996.

Enquiries: Professor David Jenkins, Microorganisms Conference, Department of Civil & Environmental Engineering, University of California at Berkeley, Berkeley CA 94720-1710, USA. Tel/Fax: 510 527-0672. E-mail: jenkins@ce.berkeley.edu

LARREN '97

AUGUST 25 - 28

An international conference on land reclamation and rehabilitation will be held in Penang, Malaysia. **Call for papers.** Deadline for receipt of abstracts: 15 June 1996.

Enquiries: Larren '97, School of Civil Engineering, Universiti Sains Malaysia, Perak Branch Campus, 31750 Tronoh, Perak, Malaysia. Tel: 605-3676901 ext 5412. Fax: 605-3677440.

IWRA

SEPTEMBER 1 - 6

The 9th world water congress of the International Water Resources Association (IWRA) will take place in Montreal, Canada. Theme: Water resources outlook for the 21st century - Conflicts & Opportunities.

Enquiries: Aly M Shady, Canadian International Development Agency, 200 Promenade du Portage, Hull, Quebec, Canada K1A 0G4. Tel: +1 (819) 994-4098 Fax: +1 (819) 953-3348 E-mail: alyshady@ACDI-CIDA.GC.CA

LANDFILL

OCTOBER 13 - 17

The sixth International Landfill Symposium will be held in Cagliari, Sardinia, Italy.

Enquiries: Ms Anne Farmer, CISA - Environmental Sanitary Engineering Centre, Via Marengo 34 - 09123 Cagliari (Italy). Tel: +39-70-271652. Fax: +39-70-271371. E-mail: cossur@vaxca3.unica.it

WEFTEC '97

OCTOBER 18 - 22

The American Water Environment Federation's 70th annual conference and exposition will be held in Chicago, Illinois USA. **Call for papers:** Deadline: 16 December 1996.

Enquiries: WEFTEC '97 Program, 601 Wythe Street, Alexandria, Virginia 22314-1994 USA. Tel: 1-703-684-2452 Fax: 1-703-684-2471.

OVERSEAS

1996

WASTEWATER TREATMENT

SEPTEMBER 23 - 25

The IAWQ-NVA conference on advanced wastewater treatment, nutrient removal and anaerobic processes will be held in Amsterdam, the Netherlands. Enquiries: Conference Secretariat, Buerweg 51, 1861 CH Bergen, the Netherlands. Tel: +31 725 899062 Fax: +31 725 899040.

WATER QUALITY

SEPTEMBER 26 - 27

The European Water Pollution Control Association in cooperation with the Netherlands Association on Water Management is organising an international conference on The Future Water Quality Management in Europe. The conference will be held in the RAI Conference Centre in Amsterdam, the Netherlands.

Enquiries: The Conference Secretariat, Buerweg 51, 1861 CH Bergen, the Netherlands. Tel: +31 725 899062 Fax: +31 725 899040.

WATER HONG KONG '96

NOVEMBER 11 - 17

The 10th IWSA-ASPAC regional conference and exhibition will be held in Hong Kong.

Enquiries: Technical Sub-committee, Water Hong Kong '96, c/o Water Supplies Department, 48/F Immigration Tower, 7 Gloucester Road, Wan Chai, Hong Kong. (Attention: Ms Daisy S M HO). Fax: (852) 2824 0578 Tel: (852) 2829 4444.

First Announcement

DIVISION OF WATER, ENVIRONMENT AND FORESTRY TECHNOLOGY CSIR
WATER RESEARCH COMMISSION
WISA WATER CARE DIVISION

Seminar and Workshop on

TREATMENT OF COLOURED WATER FOR POTABLE USE

21-23 October 1996

Mossel Bay

PREAMBLE

Organic colour in surface water supplies is found worldwide and constitutes a sizeable portion of the total water sources being treated for potable use. Unlike with most of the turbid surface waters, many problems are experienced with the treatment of coloured water. Amongst the more serious problems are the high chemical dosages required for colour removal, difficulty in controlling dosages because of variability of raw water quality, high aluminium residuals in the final water, the formation of disinfection by-products when these waters are chlorinated, the production of large volumes of sludge with poor dewatering characteristics, and corrosion and aggression of the storage systems and distribution network. There is a need for information on the design, operation and control of colour removal treatment plants, and for transferring this information successfully to the end-user.

The object of this workshop is to bring scientists, engineers, plant owners, managers and operating personnel together to provide an overview of the treatment of coloured water and of research that has been done in this field, and to provide plant managers and operators the opportunity to discuss the problems experienced at their plants, in order to address these in the form of guideline documents and identification of research needs. The workshop thus includes a strategic session to develop a strategy for further research on the treatment of coloured water for potable use.

FORMAT OF THE WORKSHOP

On the first morning of the workshop (Session I) recognized scientists and engineers have been invited to provide an overview of the treatment of coloured water: origin, occurrence and nature of organically coloured water; reasons for treating coloured water; treatment options; design considerations; recent developments; and guidelines for design and operation of treatment plants.

In the afternoon of the first day (Session II) a number of plant managers and/or operators will provide short overviews of their treatment plants and problems that are experienced, with the view of stimulating discussion and generalising and prioritising problem areas.

On the second morning (Session III) a strategic session will be held which will be facilitated by the Water Research Commission. During the structured session priority areas to be addressed will be discussed, based on the needs expressed by the delegates and speakers, both in the current session and during the previous two sessions. A strategy for further research on the treatment of coloured water for potable use will be developed which will be made available to all concerned subsequent to the workshop.

In the afternoon of day two (Session IV) two full-scale treatment plants, treating water with some of the highest colour levels in the world, will be visited.

PROGRAMME OUTLINE

Monday 21 October 1996

16:00 - 19:00 Registration and Meet and Greet

Tuesday 22 October 1996

07:30-08:30 Registration

SESSION I

08:30 - 13:00 Presentations by invited speakers

13:00 - 14:00 Lunch

SESSION II

14:00 - 17:00 Presentations by plant managers and operators

Evening Social Function

Wednesday 23 October 1996

SESSION III

08:30 - 10:30 Strategic planning session/identification of research needs

SESSION IV

11:30 - 12:30 Visit Kleinbrak Water Treatment Works, Mossel Bay

12:30 - 13:30 Lunch at Kleinbrak

14:30 - 16:00 Visit George Water Treatment Works

WORKSHOP ATTENDANCE

A reduced fee for attendance of the workshop will be applicable for plant operators and for organisations registering 3 or more of their personnel for the workshop.

Participants will be responsible for their own travel and subsistence costs. Block bookings at hotels and guest houses have been made. Registration fees cover the meet and greet function, teas, coffee, 2 lunches, social function, excursions and workshop documentation.

The venue can accommodate 100 persons.

Further information on the workshop can be obtained from:

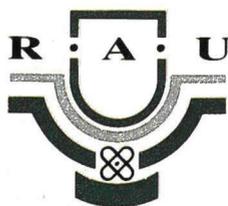
CD Swartz
PO Box 745
6500 MOSSEL BAY

Tel: (0444) 911242

Fax: (0444) 7960

DECLINING RATE FILTRATION

a short practical design course



WHEN: October 15 & 16, 1996

VENUE: Department of Civil Engineering, RAU



BACKGROUND INFORMATION

Declining rate filtration is finding increasing application in the water treatment field as an alternative to traditional constant rate filtration, due to its inherent robustness and simplicity. This is especially true for regions like South America, where access to and maintenance of sophisticated instrumentation and hardware are more difficult. In the last decade, however, it is being applied in countries like the USA, thanks to the solid theoretical framework that has been developed. Declining rate filtration was introduced in South Africa when two new filtration plants were commissioned in 1995 - a small plant at Cullinan and a large plant at Faure.

In order to make this technology accessible to the broader South African engineering community, this design course will be presented over two days at the Rand Afrikaans University. The main presenter of the course will be the internationally renowned filtration expert, Professor John L. Cleasby from Iowa State University in the USA, who was a primary force over the last two decades to establish the principles of design and analysis for declining rate filtration. He will be assisted by Professor Johannes Haarhoff of the Water Research Group at RAU.

The course is primarily presented for the hydraulic and process designers of water treatment plants, but will also prove indispensable to engineering managers at water boards and municipalities who ultimately have to be part of the decision whether declining rate filtration should be adopted in a particular situation or not. An important part of the course will be devoted to practical design examples and assignments which attendees will work through (by hand and with computer based design tools) and a technical background is therefore required. The course will be supplemented with discussions on the relative advantages and disadvantages of declining rate filtration from a process, as well as a practical viewpoint, and a thorough review of the Faure and Cullinan case studies.

Enquiries about course content

Professor Johannes Haarhoff. Tel: (011) 489-2148; Fax: (011) 489-2466; E-mail: jh@ing1.rau.ac.za
Internet: <http://gandalf/~water/home.htm>

Enquiries about enrolment

Mrs Zelna van Aswegen. Tel: (011) 489-2599; Faks: (011) 489-2466; E-mail: zva@ing1.rau.ac.za

Enrolment

Due to the hands-on nature of the course, participation will be limited to the first 30 applicants.

Cost

The total cost is R1 600, which includes comprehensive documentation, design software, computer use, meals and refreshments.