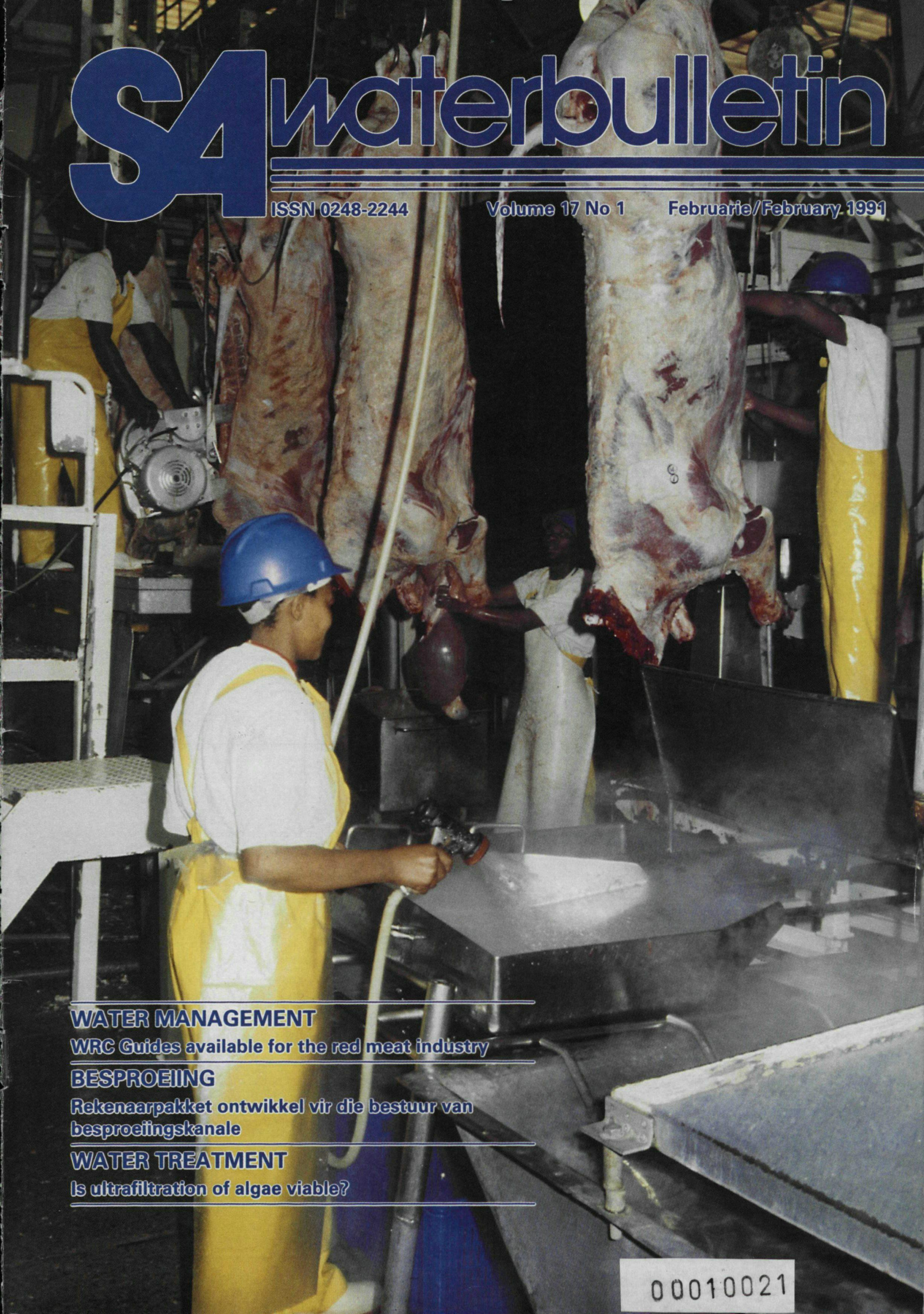
SA waterbulletin

ISSN 0248-2244 Volume 17 No 1 Februarie/February 1991



WATER MANAGEMENT
WRC Guides available for the red meat industry

BESPROEIING
Rekenaarpakket ontwikkel vir die bestuur van besproeiingskanale

WATER TREATMENT
Is ultrafiltration of algae viable?

Water Institute of Southern Africa 1991

BIENNIAL CONFERENCE & EXHIBITION

VENUE AND DATE

World Trade Centre, adjacent to Jan Smuts Airport 13-16 May 1991.

OBJECTIVE

To present an informative series of papers and exhibits of interest to a multidisciplinary audience concerned with the water environment.

OUTLINE OF PROGRAMME

The opening plenary session will include papers by prominent members international water institutions.

Some 50 papers will be presented in parallel sessions covering: water quality and monitoring • rural and informal communities • potable water treatment and distribution • industrial effluent treatment • water in the mining industry • membrane separation •sewage treatment • nutrient removal • eutrophication • corrosion and microbiological aspects training.

TOURS

A selection of technical tours is offered on 16 May when delegates may visit one of the following:- Rand Water Board Works, Johannesburg Northern Wastewater Purification Works or SASOL 2 & 3 at Secunda. An interesting programme has also been arranged for accompanying persons.

RESEARCH STANDS AND POSTERS

A poster stand with a base and shelf, if required, will be made available free of charge to researchers at Universities and Technikons for exhibiting or demonstrating their work. Facilities for poster papers are still available.

EXHIBITION

The venue has extensive facilities for exhibitors. To date a number of research organisations, government departments and commercial firms have undertaken to hire stalls. Additional space is still available for potential exhibitors.

ENROLMENT

A registration fee of R425 (members) and R495 (non-members) entitles delegates to a volume of extended abstracts, teas, lunches, tours, social events.

SOCIAL EVENTS

A "Meet and Greet" function sponsored by SA Cyanamid and a banquet sponsored by the Rand Water Board.

DIRECTORY & BUYERS' GUIDE

An updated edition of this publication which provides advertisers with a means of reaching people directly involved in the water industry will be made available to delegates.

ENQUIRIES

Mrs Margie Dawson or Mrs Susie van Biljon Tel: (011) 728-4303, Fax: (011) 483-1253 or write to WISA, P O Box 1948, Parklands, 2121.

POSKAART

Posseël

Mnr J Botha
Dept Chemiese Ingenieurswese
Universiteit van Pretoria
PRETORIA
0002

Byvoegsel tot *SA Waterbulletin* Februarie 1991

UP GEGRADUEERDES

Wateromgewingsleer/Waterbenuttingsingenieurswese

Naam:.....

Posisie:.....

Werksadres: .....

.....

Posadres: .....

Kwalifikasies verwerf: .....

.....

.....

☐ Stel belang in Alumnivereniging ☐ Stel belang in rekords ☐ Wil reünie hou

POSKAART

Posseël

Prof Hans van Leeuwen
Dept Chemiese Ingenieurswese
Universiteit van Pretoria
PRETORIA
0002

Byvoegsel tot *SA Waterbulletin* Februarie 1991

KORTKURSUS

BEDRYF VAN DRINKWATERSUIWERINGSAANLEGTE

Ek stel belang om die kursus by te woon: ☐ 19-23 Augustus 1991
☐ 16-20 September 1991

☐ Ek wil graag nadere besonderhede hê

Naam:.....

Posisie:..... Tel:.....

Werksadres: .....

.....

Posadres: .....

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Handtekening: ..... Datum:.....

WISA-MTD

(WISA MEMBRANE TECHNOLOGY DIVISION)

One Day Membrane Applications Mini-Symposium and Technical Visit

The WISA-MTD will present a one day mini-symposium on membrane applications in industry (with emphasis on the energy related industries) combined with a visit to the Lethabo power station, one of the world's largest coal fired power stations. Lethabo also has the largest tubular reverse osmosis plant (9 Ml/d) for cooling water recovery and reuse.

Date: 22 October 1991

Time: 08h30 for 09h00

Venue: Engineering Investigations (ESKOM) Rosherville

Fee: R35 for WISA-MTD members
R55 for non-members includes automatic membership of WISA-MTD

The fees include lunch and all refreshments.

Persons interested in doing a presentation or requiring further preliminary information to contact the following:

Dennis Aspden — (011) 800-4659

Herman Wiechers — (011) 800-4270

Gerrit Lok — (011) 626-3440

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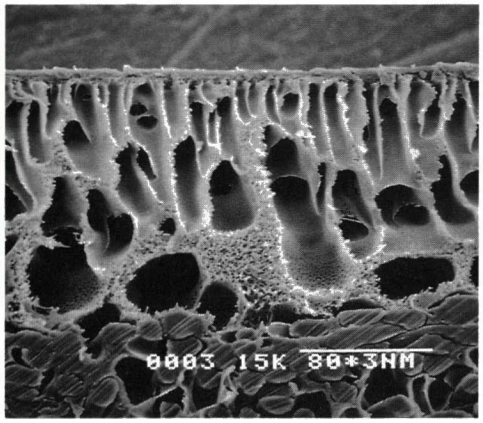

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Contents

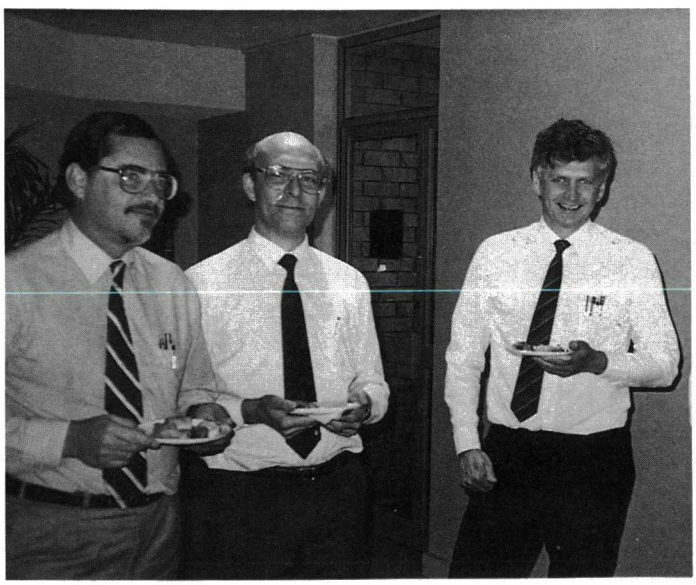
SA Waterbulletin is a two monthly magazine on water and water research published by the South African Water Research Commission (WRC), a statutory organisation established in 1971 by Act of Parliament. Subscription is free. Material in this publication does not necessarily reflect the considered opinions of the members of the WRC, and may be copied with acknowledgement of source. Editorial offices: WRC, P O Box 824, Pretoria, 0001, Republic of South Africa. Tel: (012) 330-0340. Fax: (012) 70-5925. Editor: Jan du Plessis. Asst Editor: Helene Joubert, Ed Secretary: Rina Human, Typesetting: Type Technique, Colour separations: Lithotechnik, Printing: Creda Press, Cape Town.

MUNICIPAL WASTE-WATER MANAGEMENT STRATEGIC PLANNING WORKSHOP FOR RESEARCH MASTER PLAN

A series of five one-day strategy planning workshops were held at the WRC from 12 – 16 November 1990 to identify and prioritise various research goals in the field of Municipal Waste-water Management. These workshops were run as a follow-up on the first workshop, held in March 1990, during which the main thrust areas (main goals) for future research on sanitation-related effluents were devised and their relative priorities established. Each one-day workshop in November 1990 was devoted to one of the main thrust areas in order to determine research goals and priorities in each of the main areas which are as follow:

* Development of affordable and acceptable technologies for developing communities
* Development of treatment strategies and technologies to address diffuse pollution
* Development of improved, acceptable and affordable high technology
* Improve sludge handling and utilisation
* Recovery of resources from sewage and slugde

From the findings of the March and November workshops a draft master plan for future research on municipal waste-water management has been drawn up. After ratification and finalisation of the draft master plan by the newly-formed Co-ordinating Research and Development Committee for Municipal Waste-water Management, the master plan will be made available to the country's research community.



Mr C J Breyer-Menke (AECI), Mr Gerhard Offringa (WRC) and Mr André Gerber (Watertek, CSIR), having a lunch-break during a workshop session.

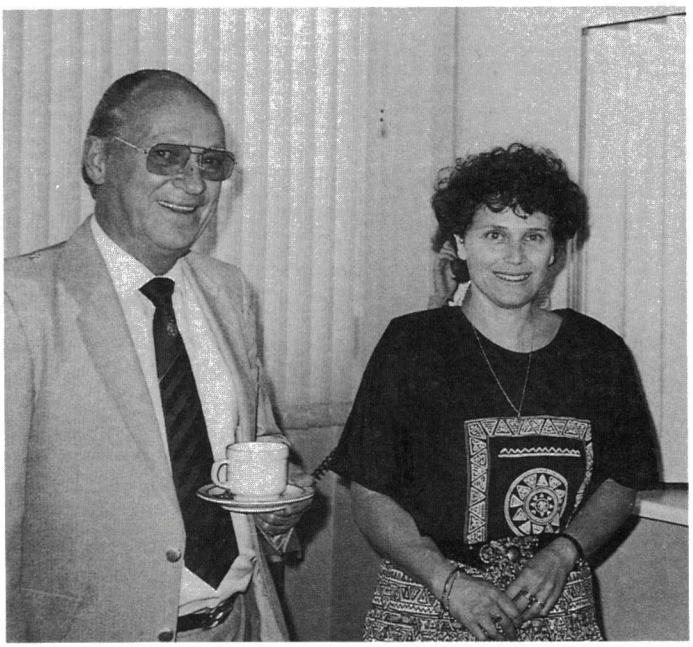
Some of the participants at the workshop, Mr Fred Kolby (Stewart, Sviridov & Oliver), Mr John Slim (Port Elizabeth Municipality) and Dr Terry Watson (Foodtek, CSIR)

WORKSHOP DETERMINES RESEARCH NEEDS

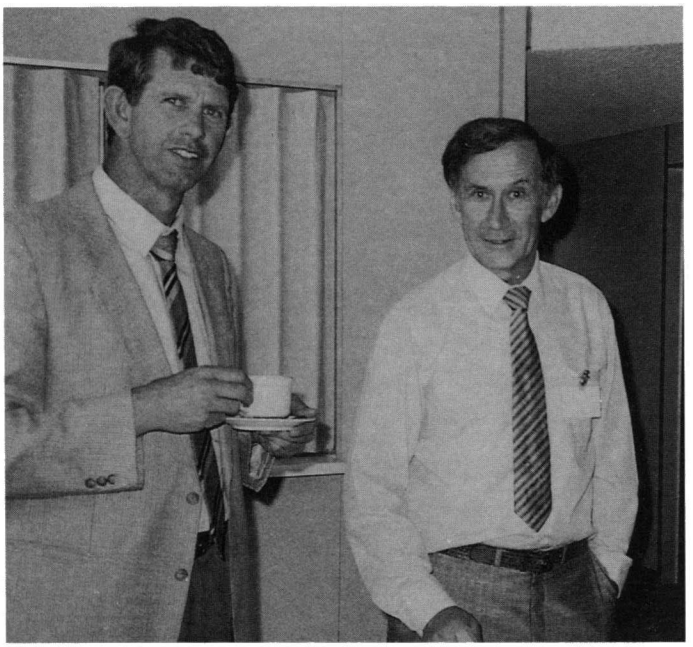
The Co-ordinating Committee for Health Related Water Quality recently held a two day strategy session at the Water Research Commission. The main aim was to determine research needs and priorities in this field.

The user sectors which received attention are the following: domestic, recreational, irrigation, aquaculture and industrial; as well as the following sources which were identified: raw water (surface water), potable water (treated surface water), ground water, waste water and sea water.

Once the master research plan has been developed, high priority research projects can be addressed and funded.

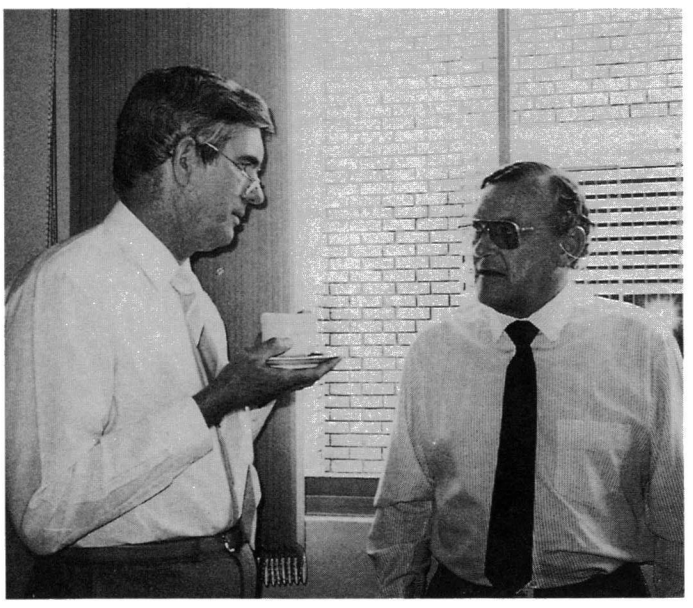


Mr Fred Vivier (Dept National Health and Population Development) and Dr Rivka Kfir (Watertek, CSIR).



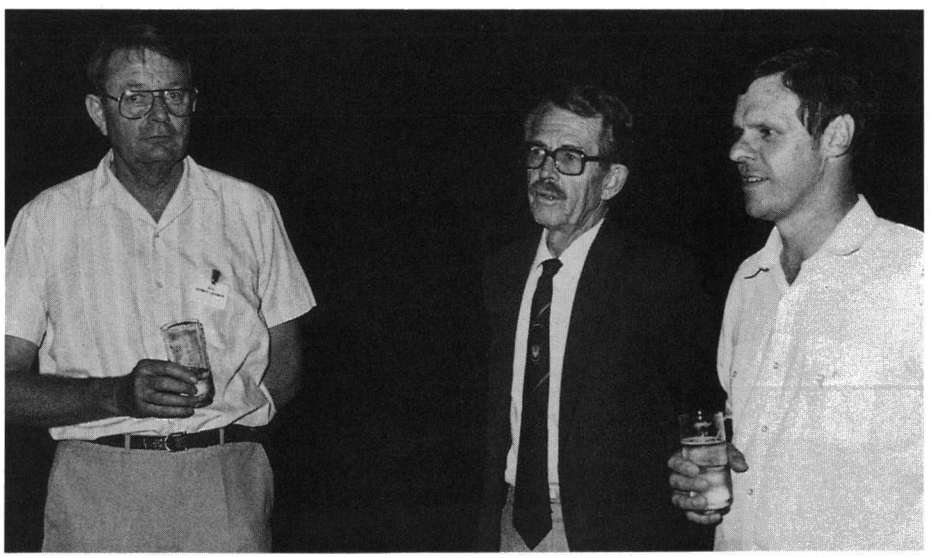
Dr John Geldenhuys (Rand Water Board) and Dr Thys Pieterse (Water Research Commission).

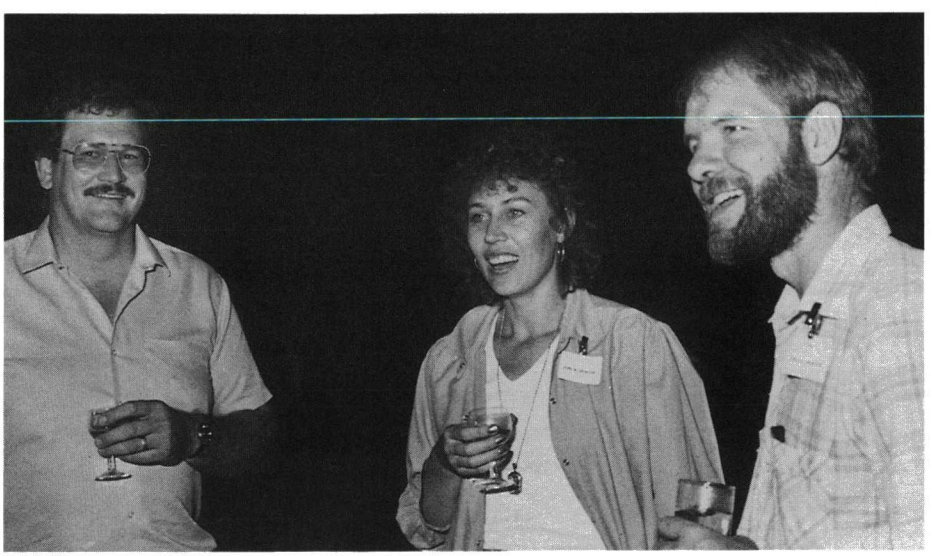
Colleagues in conversation at the workshop, Dr Elsie Meintjies and Dr Peter Ashton, both from Watertek, CSIR.



Prof Willie Grabow (Virology, UP) and Dr Pieter Thiel (Medical Research Council) having a word over a cup of tea.

NISSAN supports *Rivers Research*





NISSAN has shown their support for the Kruger National Park Rivers Research Programme which is under the auspices of the National Parks Board) by donating a 4x4 vehicle to the research programme.

The KNP hosted a weekend visit to the Park along with a superb braai at the Jakkalsbessie Camp for representatives of Nissan and various other organisations and government departments involved in the programme and the funding of the research. Those dedicated persons in the background who initially saw the need for this research and initiated the beginnings of the Rivers Research project were also participated in this pleasant weekend visit.

Mr Dave Manley (Director, Manufacturing Supplies) of NISSAN presented the 4x4 vehicle to the Rivers Research Programme at the braaifunction. This support from NISSAN is highly appreciated by the researchers and the research community.

Top: Dr Piet van Wyk (National Parks Board) left, with Mr Dave Manley (NISSAN) at the 4x4 truck donated to the Rivers Research programme.

Middel: From left to right, Mr Sidney Gerber (Dept Environment Affairs), Dr Piet van Wyk (National Parks Board) and Dr Willem Gertenbach (Chief Research Officer, Kruger National Park)

Left: At the Braai, Mr Fred van Zyl (Dept. Water Affairs) left, enjoying the company of Dr Freek Venter (Kruger National Park) and his wife Rinza.

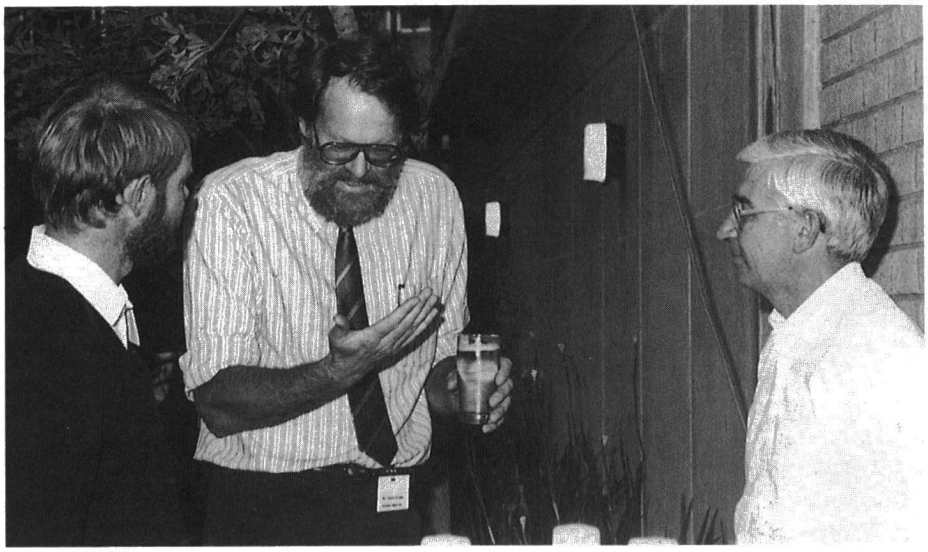
Rivers Water Quality Workshop

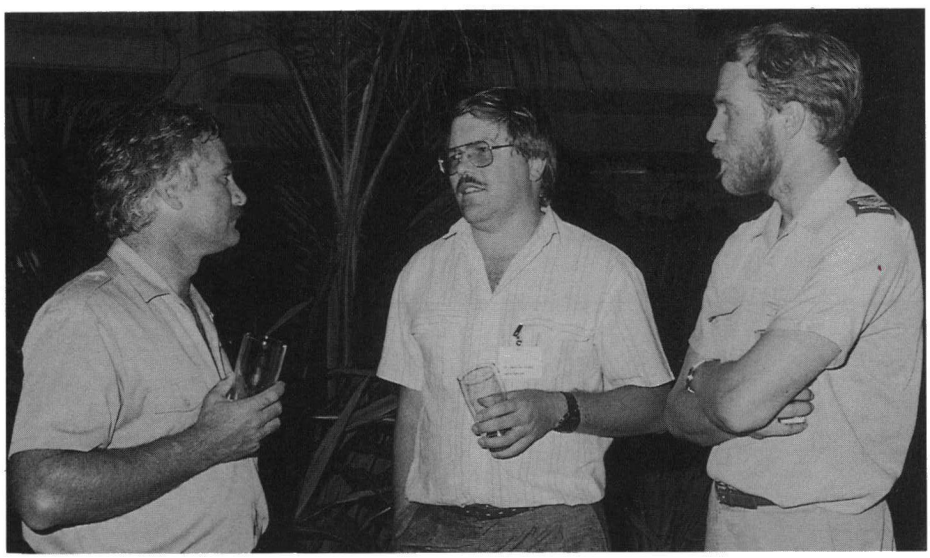
The Rivers Research programme held a Workshop on Water Quality Requirements/Guidelines for the Kruger National Park rivers during October 1991. The workshop was aimed at collating all available water quality data with a view to defining water quality manament objectives for the KNP;

From reports delivered at the workshop it was concluded that a) there is a great lack of knowledge on biota/water quality interactions as well as a paucity of published data on this subject, and b) currently there are no criteria available to determine the fitness for use of the river water inside the KNP.

At the workshop, however, delegates attempted to identify preliminary water quality guidelines; and priority research areas were established simultaneously.

A report on the proceedings of the workshop are being compiled by Watertek (CSIR) and will be available at the end of March 1991.





Top: Mr Charel Bruwer (Dept Water Affairs) centre, explaining his point of view to Dr Freek Venter (KNP) left, and Mr Wouter van der Merwe (Dept Water Affairs)

Middle: The "bushdoctors" conferring over a beer. Dr Andrew Deacon (KNP), Prof Hein du Preez (RAU), and Mr Ian Russel (NPB).

Right: Dr Henk van Vliet (HRI) enjoying the company of Dr Jane Harris (Watertek, CSIR) at the Rivers Water Quality Workshop braai.

Rekenaarstelsel verbeter bedryf van watervloei in besproeiingskanale

'n Navorsingspan by die laboratorium vir stelsels aan die Randse Afrikaanse Universiteit het onder kontrak met die Waternavorsingskommissie 'n gerekenariseerde bestuursprogram ontwerp wat suksesvol gebruik kan word om die bedryf van besproeiingskanaalstelsels te optimaliseer.

Die rekenaarpakket wat oor 'n tydperk van meer as vier jaar ontwikkel is, het getoon dat dit die verliese in verspreidingskanale tot 'n minimum kan beperk en die bedryf van kanaalsisteme kan vergemaklik. Volgens die finale verslag wat die Waternavorsingskommissie oor die ontwikkeling van die stelsel gepubliseer het, is die nuwe rekenaarprogram 'n groot verbetering op die tegnieke wat tans aangewend word om besproeiingskanaalstelsels te bestuur. Tans word alle prosedures, wat wissel van die berekening van insethidrograwe tot die samestelling van waterrekenings, met die hand uitgevoer. So 'n handstelsel laat ruimte vir foute aangesien dit tydrowend is en selde voldoende gekontroleer kan word.

Die nuwe rekenaarpakket van die WNK sal die bestuurder van 'n besproeiingskema asook die personeel van die waterkantoor wat vir die waterverdeling verantwoordelik is, in staat stel om bedryfsverliese te verminder en die algemene produktiwiteit van die skema te verhoog.

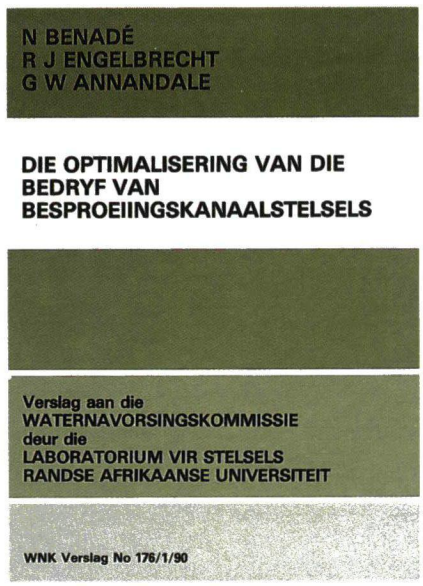
Die optimaliseringstelsel maak gebruik van rekenaarprogrammatuur, monitorstasies en 'n kommunikasiestelsel.

SIMULASIE MODEL

Die rekenaarprogrammatuur bestaan uit 'n simulasiemodel en 'n waterkantoordatabasis. Die simulasiemodel wat die ongestadigde, nie-uniforme vloei van water in kanaalstelsels simuleer, vergemaklik die berekening van looptye en maak dit moontlik om alternatiewe bedryfsprosedures met mekaar te vergelyk.

Die waterkantoordatabasis vergemaklik die hantering van wateraanvrae en waterrekeninge. Navrae deur kliënte kan vinnig beantwoord word, maand- en jaarverslae kan maklik opgestel word, insethidrograwe kan vinnig bereken of herbereken word en wateraanvraagdata is onmiddellik beskikbaar vir gebruik in die simulasiemodel.

Die simulasiemodel is prakties getoets aan die hand van vloeitoestande in die linkerbankkanaal van die Loskop-besproeiingskema.



Vloeitoestande in die kanaal is oor die tydperk van 28 September tot 7 Oktober 1989 in die eerste 42 km van die kanaal gesimuleer. Die geometrie van die kanaal is verkry vanaf planne van die Departement van Waterwese. Die loslating uit die dam aan die begin van die kanaal is met behulp van 'n telemetriese meetstasie bepaal. Die onttrekkings langs die kanaal is bepaal vanaf die waterverspreidingsverslag wat opgestel word deur personeel van die Departement op Groblersdal. Daar is voorsiening gemaak vir syferingsverliese van 0,5 ℓ/ s per 1000 m^2 benatte area.

Verdampingsverliese is nie in ag geneem nie omdat dit gewoonlik baie klein in verhouding met die syferingsverliese is.

Die uitvloei-deurstroming aan die onderpunt van die kanaal is daarna gesimuleer en vergelyk met die werklike deurstroming wat met 'n telemetriese meetstasie gemeet is. Die gemete en die gesimuleerde waardes het baie goed ooreengestem en het getoon dat die model 'n goeie weerspieëling van vloei in besproeiingskanale is. Die kwaliteit van die resultate is egter afhanklik van die kwaliteit van die invoerdata. Akkurate resultate kan nie verwag word indien die invoerdata nie akkuraat is nie.

WATERVLOEI

Die tipe watervloei wat in 'n oop kanaal voorkom, kan geklassifiseer word in terme van die verandering van die vloeidiepte oor tyd en afstand. Indien tyd as kriterium gebruik word, kan die watervloei as gestadig geklassifiseer word wat impliseer dat die vloeidiepte nie met tyd verander nie, of ongestadig, wat impliseer dat die vloeidiepte wel met tyd verander. Indien afstand as kriterium gebruik word, kan vloei geklassifiseer word as uniform, wat impliseer dat die vloeidiepte nie met afstand verander nie, of nie-uniform wat weer beteken dat die vloeidiepte wel met afstand verander.

Die berekening van gestadigde vloei is relatief eenvoudig en kan maklik met die hand uitgevoer word, terwyl die van ongestadigde vloei heelwat meer kompleks is en moeilik met die hand uitgevoer word. Die koms van die hoëspoed digitale rekenaar het aanleiding gegee tot die ontwikkeling van rekenaarmodelle om hierdie berekeninge vinnig en akkuraat uit te voer. Die meeste van hierdie rekenaarmodelle is egter vir gebruik op hoofraamrekenaars ontwikkel. Alhoewel hoofraamrekenaars oor 'n groot geheuekapasiteit en hoë berekeningspoed beskik, maak die hoë implimenteringskoste die gebruik van hierdie rekenaars minder aantreklik.

Die koms van die persoonlike rekenaar het toegang tot 'n rekenaar teen 'n relatiewe lae koste moontlik gemaak. Die aantal ongestadigde vloeimodelle beskikbaar vir gebruik op hierdie rekenaars is egter baie beperk.

Mnr Nico Benade van die Laboratorium vir Stelsels (RAU) by die dataregistreerder by die sluis in die linkerbank hoofkanaal by Loskop Staatswaterskema. Die dataregistreerder monitor die sluisopening asook die waterdiepte voor die sluis.

Tot dusver is daar slegs een IBM versoenbare program bekend wat spesifiek vir die berekening van ongestadigde, nie-uniforme vloei in besproeiingskanale ontwikkel is, naamlik die Utah State University Hydraulic Model. Hierdie program is egter nie baie buigsaam nie en ook nie besonder geskik vir gebruik onder Suid-Afrikaanse toestande nie.

TOEPASSINGS

Die rekenaarprogram wat deur die Suid-Afrikaanse navorsingspan ontwikkel is, kan vir verskillende doeleindes gebruik word, onder andere vir die bedryf van besproeiingskemas, vir personeelopleiding, vir die ontwerp van nuwe kanale sowel as vir die analise van bestaande kanale.

Die program maak dit moontlik om verskillende bedryfsprosedures teen mekaar op te weeg en sodoende die onbenutte volume water aan die eindpunt van die kanaal te minimaliseer. Die program is veral nuttig om looptye na aftappunte te bereken. Deur van die berekende looptye gebruik te maak is dit dan moontlik om hierdie onbenutte volume water te minimaliseer en sodoende die doeltreffendheid van die bedryfsprosedure te verhoog. Die program maak ook beter verliesbeheer moontlik. Deur die program te gebruik, kan 'n goeie aanduiding van die verdamping- en syferingverliese langs 'n kanaal verkry word. Daar kan dan meer akkuraat vir hierdie verliese gekompenseer word in die loslatings by die bopunt van die kanaal. Die bedryfsprosedure kan ook geoptimaliseer word deur die sluisopeninge te bereken wat konstante waterdiepte in die kanaalsisteem sal veroorsaak.

Kanaaloperateurs kan, omdat die model soos 'n fisiese kanaal reageer, op die model in plaas van op 'n werklike kanaal opgelei word. Die simulasie kan redelik vinnig gedoen word en 'n groot verskeidenheid toestande kan gesimuleer word. 'n Kanaaloperateur kan dus binne 'n kort tydperk ondervinding in 'n wye reeks vloeitoestand en bedryfsprosedures opdoen en opleiding kan geskied sonder om die normale bedryf van 'n werklike kanaal te beïnvloed. Enige foute wat gemaak word, het ook nie 'n nadelige invloed op die bedryf van die kanaal nie.

Die program kan ook gebruik word vir die ontwerp van nuwe kanale. Dit stel die ontwerper in staat om vloeisnelhede en vloeidieptes maklik en vinnig te bereken. Snitkeuses word ook vergemaklik omdat snitte sonder moeite verander kan word. Kontrolestruktuurontwerp word vergemaklik aangesien die vloeitoestande in die kanaal maklik bepaal kan word. Stukrommes kan ook met die program bereken word. Bestaande kanale kan met die program geanaliseer word, byvoorbeeld, vir die bepaling van die kapasiteit van die kanaal. Voorts kan die program gebruik word in die soektog na metodes om die kapasiteit van die kanaal te verhoog.

Afskrifte van die finale navorsingverslag oor die ontwikkeling van hierdie rekenaarpakket, getiteld **Die optimalisering van die bedryf van besproeiingskanaalstelsels** (WNK-verslagnr 176/1/90) is gratis verkrygbaar vanaf die Waternavorsingskommissie, Posbus 824, Pretoria 0001.

TOEKOMSTIGE ONTWIKKELING

Die rekenaarprogram is tans nog nie kommersieel beskikbaar nie. Die simulasie en databasis funksioneer nog onafhanklik van mekaar en die WNK het dieselfde navorsers genader om die twee programme te integreer en verfyn. Die nuwe navorsingsprogram, getiteld *– Die daarstelling van 'n gekonsolideerde rekenaarsagteware pakket vir die bestuur van 'n besproeiingskema,* sal teen Desember 1992 afgehandel, wees.

Dien voorstelle vir navorsingsprojekte nou by WNK in

Ten einde die WNK in staat te stel om sy begroting vir 1992 vroegtydig en na wense te beplan, moet die voorstelle vir waternavorsingsprojekte wat u organisasie vir finansiering gedurende 1992 aan die WNK wil voorlê, die WNK voor 31 Mei 1991 bereik.

Sodanige voorstelle moet die volgende inligting bevat:

- Titel van die navorsingsvoorstel
- Naam (of name) van verantwoordelike navorser(s)
- Instansie wat voorstel indien
- Doelstellings met die navorsing
- Kort motivering vir navorsing (met verwysing na toepassings en moontlike voordele) (maksimum een en 'n half bladsye)
- Termyn van navorsing
- Kort samevatting van werkprogram (maksimum een 'n half bladsye)
- Begroting vir elke jaar met inbegrip van volgende:
  - Salarisse van navorsingspersoneel wat uit projekfondse besoldig word
  - Ander lopende uitgawes
  - Uitgawes ten opsigte van kapitaalgoedere

Alle voorstelle sal gesamentlik na 31 Mei 1991 oorweeg word, waarna u van die uitslag in kennis gestel sal word. Indien u voorstel aanvaar word, sal daar verder met u onderhandel word met die oog op die voorbereiding van 'n finale en meer gedetailleerde navorsingsprojekvoorlegging. Tydens hierdie fase sal daar uit die aard van die saak noue skakeling tussen die betrokke WNK-navorsingsbestuurders en die indiener van die voorstel wees. Uiteindelik sal hierdie finale voorlegging tydens 'n vergadering van die WNK oorweeg en 'n aanbeveling oor die finansiering daarvan aan die Minister van Waterwese gemaak word.

Vroeë voorstelle sal verwelkom word ten einde genoeg tyd te laat om enige onduidelikhede op te klaar.

Submit research proposals to WRC now

In order to enable the WRC to plan its 1992 budget properly and timeously, the proposals for water research projects which your organisation may want to submit to the WRC for funding during 1992, should reach the WRC before 31 May 1991.

Such proposals should include the following information:

- Title of the research proposal
- Name (or names) of the researcher(s) in charge
- Name of organisation which submits the proposal
- Research objectives
- Short motivation for research (referring to applications and possible advantages) (maximum one and a half pages)
- Duration of research
- Short resumé of work programme (maximum one and a half pages)
- Budget for every year including the following:
  - Salaries of research personnel to be renumerated from project funds
  - Other running costs
  - Capital equipment costs

All the proposals will be considered jointly after 31 May 1991, after which you will be informed of the result. Should your proposal be accepted, there will be further negotiations with a view to the preparation of a final and more detailed research project proposal. During this phase there will naturally be close cooperation between the WRC research manager concerned and the research proposer. Eventually this final proposal will be considered at a WRC meeting in order to make a recommendation to the Minister of Water Affairs.

Early submission of proposals will be welcomed, in order to allow enough time to resolve any uncertainties.

GUIDELINES PUBLISHED FOR WATER MANAGEMENT IN THE RED MEAT INDUSTRY

Two new guides on water and waste-water management in the red meat industry have been released by the Water Research Commission. The Guides are based on the results obtained in a survey done by a firm of consulting engineers on water usage in the red meat abattoir industry. The survey formed part of the National Industrial Water and Waste-water Survey (NATSURV) aimed at the establishment of norms for water intake and waste-water disposal of all classes of the South African industry.

The data presented in these guides have been collected from detailed surveys conducted at twelve abattoirs, covering the full range of slaughter capacity. Additional data were collected telephonically from many more abattoirs.

Copies of the new Guides, NATSURV 7: *Water and waste-water Management in the Red Meat Industry*, and *A Guide to Water and Waste-water Management in the Red Meat Abattoir Industry* (TT 45/90) are available free of charge from the Water Research Commission.

The abattoir industry can be divided into two distinct categories, namely, red meat, which includes the processing of beef, mutton and pork; and white meat, responsible for processing poultry. This Guide deals only with the red meat industry.

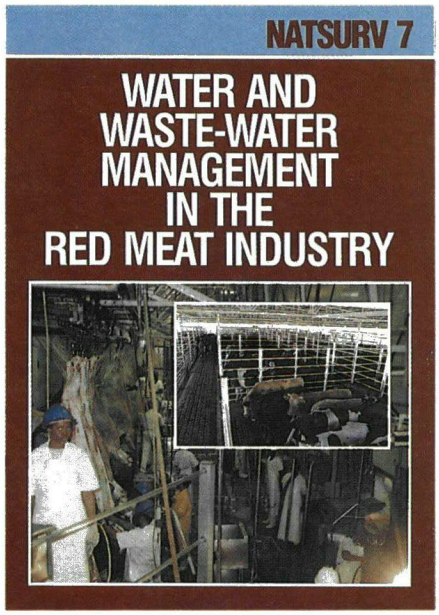
South Africa's red meat processing is carried out by a total of 285 abattoirs, which provide approximately sixty per cent of the local meat by mass, with poultry. The Guide NATSURV 7, deals only with the red meat industry.

All red meat abattoirs are required to be registered with the Abattoir Commission who grade each abattoir according to the maximum daily slaughtering capacity that their facilities allow. The annual water consumption of the red meat industry is in the region of 5,8 million m^3. Waste water from an abattoir will contain the following pollutants: blood, animal trimmings, fat, paunch content, urine and faeces. Each of these contribute to a high organic load as well as a considerable quantity of suspended matter. The industry discharges approximately 4,9 million m^3 of waste water each year containing about 22 600 t of chemical oxygen demand (COD) and 7 000 t of suspended solids (SS).

CATTLE UNITS

To enable direct comparisons to be made between abattoirs where more than one animal species is slaughtered, calves, sheep, goats and pigs are counted in terms of cattle units. Cattle units form the basis of comparison throughout the abattoir industry and must therefore be clearly defined. There are several ratios in use, the one chosen in any particular instance depends on the purpose of the calculation being performed. Those in most frequent use are based on: cost through the abattoir, cost through the slaughter floor, hanging space requirements, animal mass and water use.

Since the ratios for sheep, for example, vary from five animals per cattle unit to fifteen animals per cattle unit, it is clear that the correct ratio must be established before a fair comparison can be made. None of the ratios mentioned above are wholly relevant to water use, so that to compare the water efficiency of various abattoirs a new definition of cattle unit had to be determined during this survey. Detailed work at abattoirs where the same staff slaughter each species strictly by rotation has led to the derivation of cattle units based on water use.



SPECIFIC WATER INTAKE

The survey has found that the mean specific water intake is 1,36 m^3 per water-related cattle unit (wrcu) for A grade abattoirs and 2,04 m^3 per wrcu for other grades.

A-grade abattoirs are considered separately from the other abattoirs in the Guide. The reason for this is the marked difference in output and water consumption between A-grade abattoirs and the other grades. A target specific water intake of 1,1 m^3 per wrcu for A grade abattoirs and 1,75 m^3 per wrcu for other grades is proposed in the Guide.

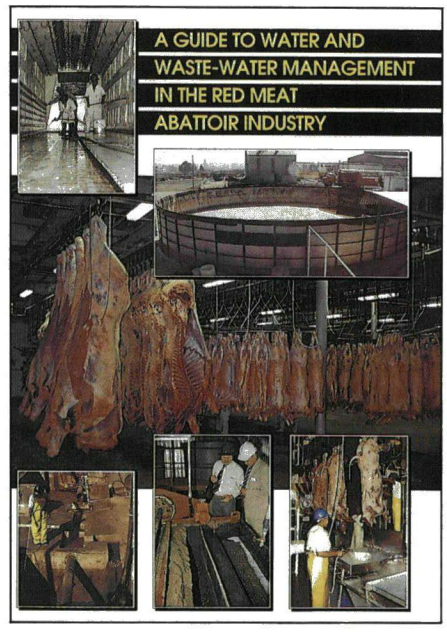
It can be seen that, on average, large abattoirs are more water-efficient than smaller ones. However, it is also interesting to look at the range of specific water intake for the two groups. For A-grade abattoirs the range of water intake was found to be 0,71 to 2,88 m^3 per wrcu, while for the other grades the range was found to be 0,70 to 4,71 m^3 per wrcu. It is important to consider that small abattoirs often operate on a stop/start basis and do not have the personnel available for intensive water management exercises.

WASTE-WATER

Waste-water volumes are typically 80 to 85 per cent of the water intake, giving an annual waste-water discharge for the industry of approximately 4,9 million m^3.

The average specific pollution load for A-grade abattoirs was found to be 5,2 kg COD per water-related cattle unit and 1,6 kg suspended solids per wrcu. For other grades these figures were 8,5 kg COD per wrcu and 1,4 kg suspended solids per wrcu.

Target pollution load figures of 4,0 kg COD per wrcu and 1,0 kg suspended solids per wrcu for A-grade abattoirs are proposed. Figures of 5,0 kg COD per wrcu and 1,0 kg suspended solids per wrcu are proposed for other abattoirs.



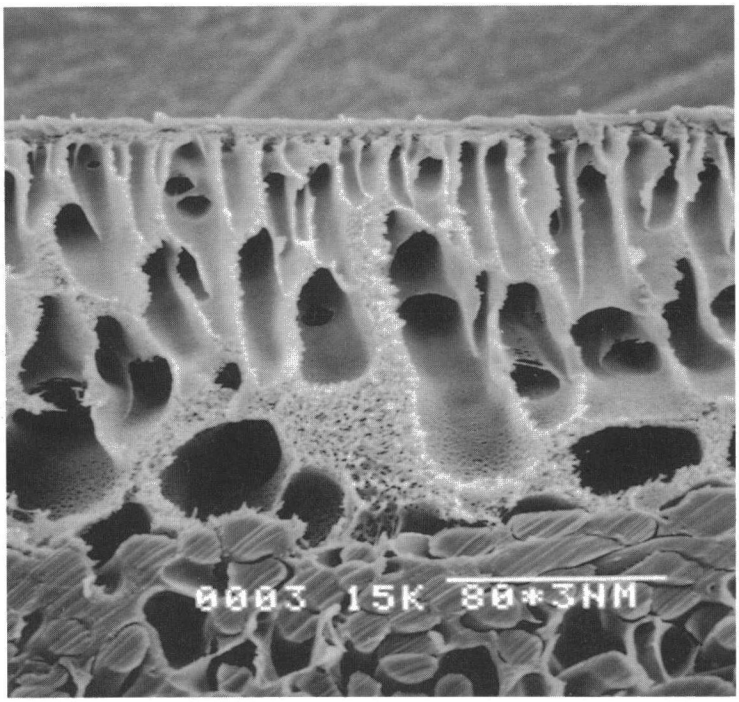
For a free copy of this Guide, NATSURV 7: Water and Waste-water Management in the red meat industry, write to the Executive Director, Water Research Commission, P O Box 824, Pretoria 0001.

REMOVAL OF ALGAE FROM WATER BY ULTRAFILTRATION

– Is it feasible?

Research funded by the Water Research Commission on the removal of algae from water by ultrafiltration has shown that ultrafiltration in combination with ultraviolet sterilisation and ozonation can substantially reduce the overall operating costs at water treatment plants as well as obviate the problems associated with the formation of trihalomethane precursors in conventional water treatment processes.

The research project was carried out by Heinz Strohwald of the firm Mebratek in Noorder-Paarl, Western Cape, which manufactures tubular membrane systems and self-contained modular ultrafiltration units. Copies of the final report entitled *Removal of algae from water by ultrafiltration* (WRC Report No 337/1/90) are available free of charge from the Water Research Commission, P O Box 824, Pretoria 0001.



The widespread occurrence of algae in natural waters and the problems associated therewith, have received increased attention recently. Research efforts are being devoted to the elimination of algae in potable water supplies and to more efficient means of removing substances which can pose health hazards.

The presence of algae in water bodies is not only aesthetically offensive but can also lead to the release of toxins and varying water quality. The abundant growth of algae in dams and lakes is ascribed mainly to the discharge of phosphate and nitrogen rich effluents and treated sewage into such water bodies.

Apart from aesthetic objections, the eutrophication of water resources also has considerable financial implications, such as the damage to property and boats and the detrimental effect on recreational activities. From a water purification viewpoint, the formation of undesirable trihalomethane precursors requires sophisticated and expensive treatment methods for their removal, such as dissolved air flotation, activated carbon adsorbtion and ozone treatment.

An efficient economical treatment for the removal of algae from water would thus not only enable reduction of algal concentrations, but would also have beneficial effects on downstream water purification users.

Since the pore size of the ultrafiltration membranes is in the sub-micron range, complete separation of algae from water is possible.

This eliminate algae carry-over associated with dissolved air flotation and prevents the formation of chlorhalogens during post chlorination due to the reaction between chlorine and

algae. The recent development of a locally manufactured low-cost, tubular ultrafiltration system, makes this concept economically viable.

No effort was made to involve particular strains of algae, but rather to utilise an easily accessible local source of water that was known to be infested with algae. Availability and proximity to the test site were the major factors in this regard.

Two sources of algae infested waters were selected; Zeekoeivlei in the Cape Flats near Muizenberg and the Noord-Agter Paarl irrigation dam. Both were found to contain substantial concentrations of green and blue-green algae.

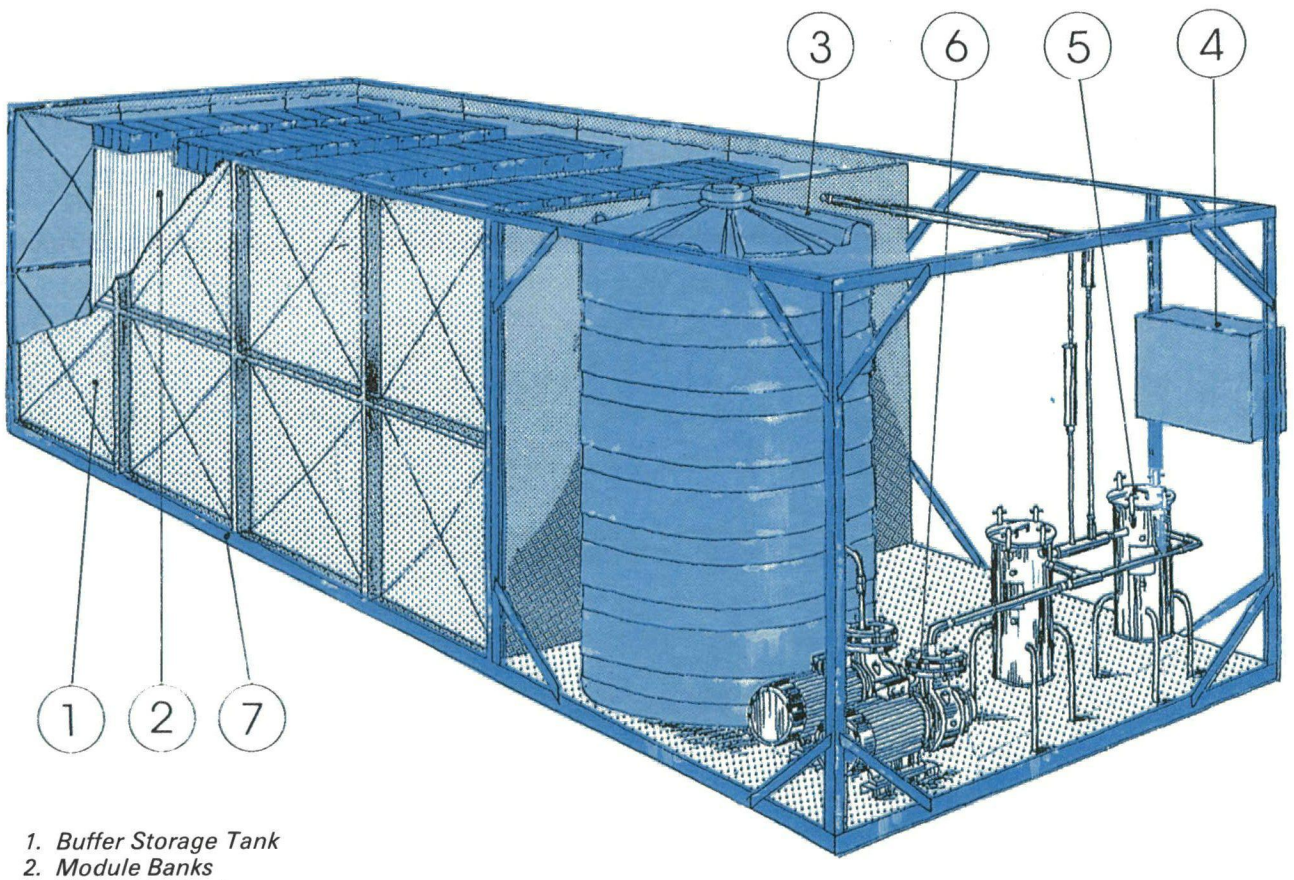
The presence and concentration of algae were determined by the chlorophyll-a test and turbidity measurements. Analysis was performed by the Stellenbosch branch of the Division of Water Technology, CSIR. Total solids determinations were made using a micro-processor controlled microwave oven fitted with a microbalance.

UF SYSTEM

The ultrafiltration (UF) system comprised a batch tank, feed pump and UF module.

A batch tank of relatively large capacity and UF module with a small membrane area were chosen to simulate high feed-volume-to-membrane-area conditions (3 600 ℓ/m^2) and to achieve long space times (110 – 220 min). Long space times were considered necessary in order to simulate the condition where "fresh" feed water is in continuous contact with the membrane. The UF membrane was of the MEMTUF type, having a tube diameter of 9 mm, a membrane area of 0,6 m^2 and which was fitted with membranes of 40 000 molecular mass cut-off (MMCO). No prescreening or temperature control was done and feed pressure was usually limited to a maximum of 300 kPa. A bypass pipeline was fitted to enable variation of the feed flow velocity inside the membrane tubes.

A typical MEMTUF unit



1. *Buffer Storage Tank*
2. *Module Banks*
3. *CIP Buffer Tank*
4. *Motor Control Panel*
5. *Filters*
6. *Feed & Transfer Pumps*
7. *Frame*

TABLE 1 Various routes for water treatment when applied to the control of algae

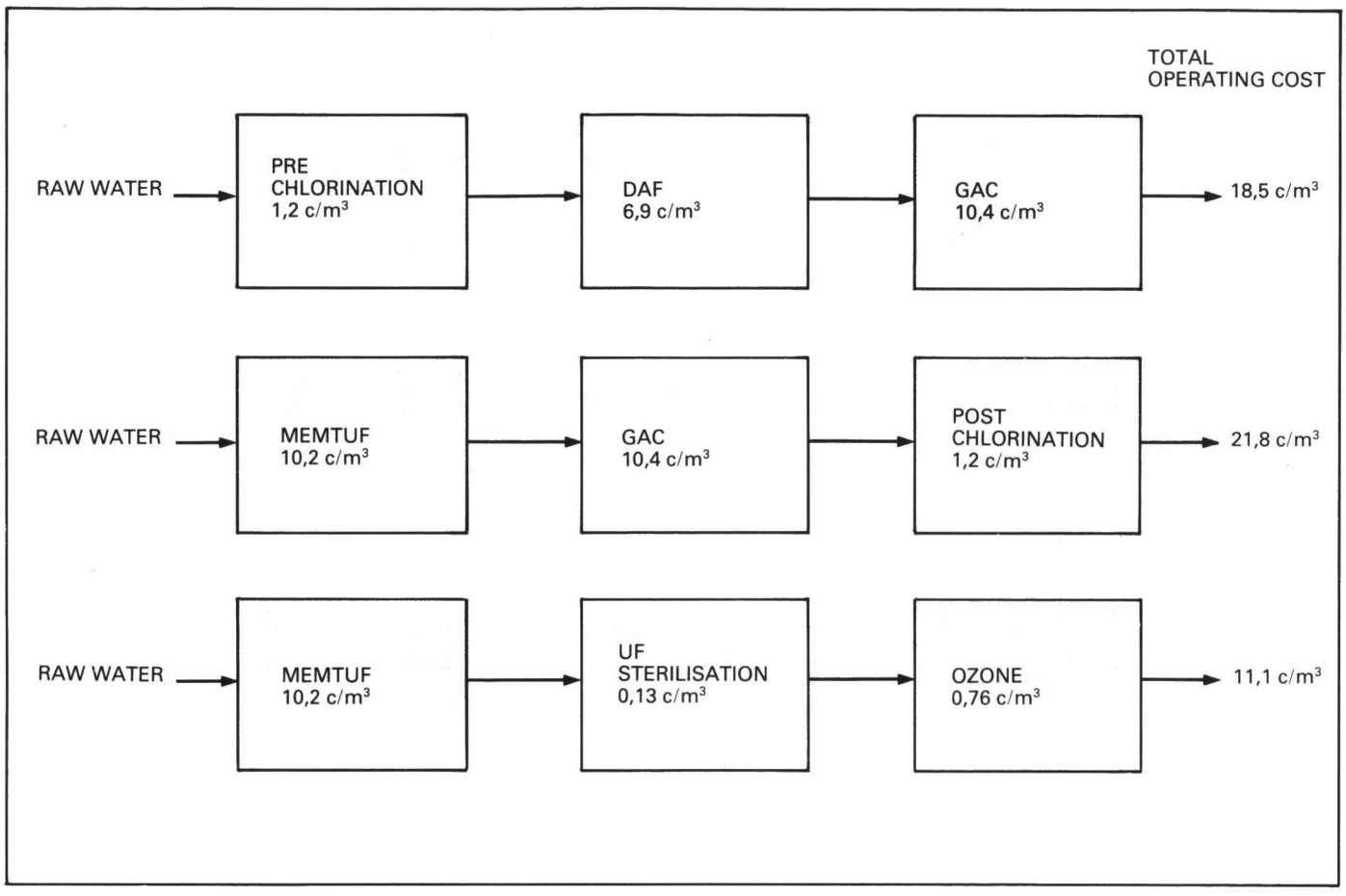


TABLE 2: Cost comparison for various algal control measures

MEASURE ADOPTED		TOTAL COST	SPECIFIC COST
		R/Year	c/m³
UV Sterilisation*		1 043 900	0,13
Ozonation*		6 102 800	0,76
Chlorination*		8 395 000	1,2
Microscreening*		41 572 000	5,8
DAF*		50 370 000	6,9
Activated carbon*	PAC	63 250 000	8,6
	GAC	83 110 500	10,4
MEMTUF	3 year life	81 906 000	10,2
	5 year life	61 831 000	7,7

All costs are based on a capacity of 2 200 000 m³/d

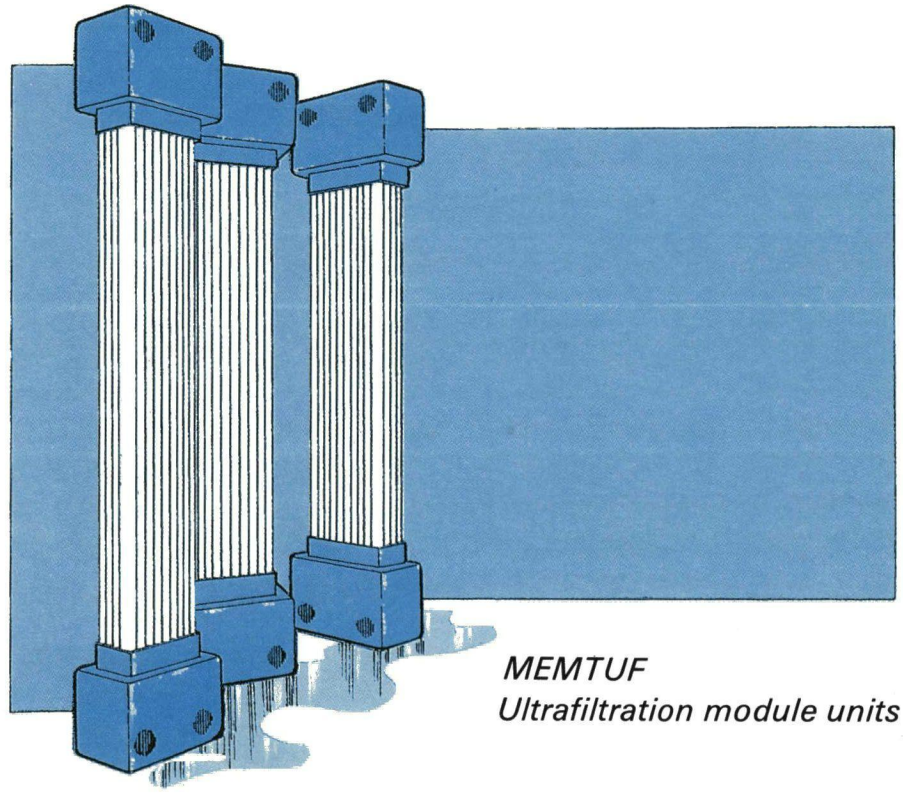
** Costs reported in the literature have been adjusted for inflation at an annual rate of 15%*

Various mechanical and chemical means of membrane cleaning were investigated. The MEMTUF unit was generally removed from the system during chemical cleaning so as not to contaminate the algal suspension in the batch tank.

The membranes were subjected to various cleaning agents in order to determine their effectiveness.

Mechanical means of membrane cleaning was effected by sponge balls and stop/start operation. During sponge ball cleaning a sponge ball was passed through the membrane tubes in order to remove deposits from the membrane surface. Stop/start operation entailed the on/off switching of the feed pump. The cleaning action was effected through relaxation of the membrane tubes during the off cycle and resultant turbulance at start-up, which removed deposits from the membrane surface.

After cleaning, the MEMTUF unit was characterised by recording the water flux at set conditions. The water flux figure provides an indication of how effectively the foulants have been removed from the membrane. A water flux figure similar to that of the virgin membrane indicates that the membrane is free of foulants.



MEMTUF
Ultrafiltration module units

RESULTS

One of the most important criteria indicative of the feasibility of ultrafiltration to process any feed water is flux stability. Solids and solutes in the feed solution can fould the membrane through adsorption, and if the resulting flux decline cannot be reversed then the use of ultrafiltration to process that specific feed water is impractical.

No severe membrane fouling was experienced as evidenced by the relative stability of the flux figures and the relative constancy of the system pressure drop. The flux data showed a sharp initial decline and subsequent stabilisation. This is in accordance with the behaviour of non-fouling media for which the rapid initial flux decline can be attributed to the formation of the dynamic boundary layer.

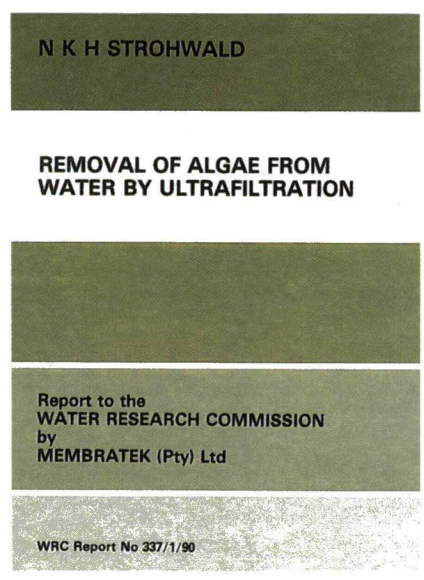
The chemical cleaning agents which were investigated were restricted to a detergent (Biotex) and a bleaching agent (JIK) in the form of a sodium hypochlorite solution. Chemical solutions were circulated through the MEMTUF module for a predetermined period and flushed out thoroughly with tap water after completion.

The flux averaged at 70,5 litres per square metre per hour (LMH) with a standard deviation of 19,4 LMH.

Specific cost figures for various algal control measures are given in Tables 1 and 2. It can be seen if the assumed membrane lifetime is three years then the costs for a MEMTUF system is comparable to that of a treatment system incorporating granular activated carbon (GAC). If the membrane lifetime is five years the cost is comparable to that of a powdered activated carbon (PAC) system.

Ultrafiltration would not be a viable replacement for dissolved air flotation or microscreening in a conventional treatment process. The capital costs for PAC and MEMTUF compare well when the costs for PAC are adjusted to present day values. The cost for the MEMTUF system was calculated as R246 142 000 while the figure for PAC after adjustment for inflation comes to R230 million.

No figures for DAF and ozonation could be obtained while the capital cost for UV sterilization was estimated to be R30 800 000.



Copies of this report (WRC Report No 337/1/90) are available free of charge from the Water Research Commission, P O Box 824, Pretoria 0001.

WNK-gids bevorder waterbestuur in die eet-oliebedryf

Die Waternavorsingskommissie het onlangs die sesde gids in die NATSURV-reeks oor water en afvalwaterbestuur in die Suid-Afrikaanse nywerheid gepubliseer. Die jongste gids handel oor die eet-oliebedryf en is gratis verkrygbaar vanaf die WNK.

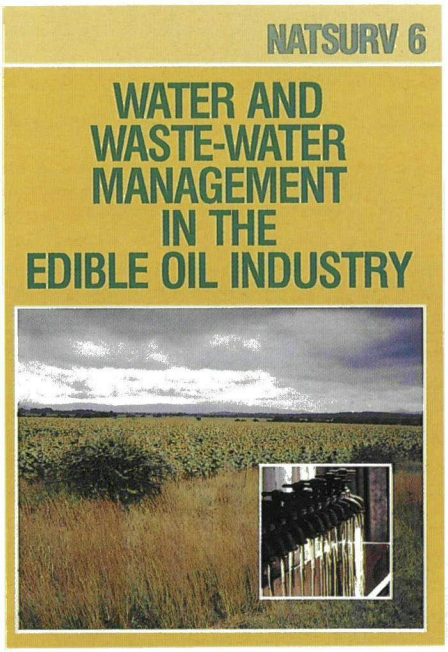
Vorige gidse wat reeds in die reeks gepubliseer is, het onder andere gehandel oor water en afvalwaterbestuur in bierbrouerye, die metaalafwerking-, koeldrank- en melkbedryf.

Die NATSURV-reeks het ontstaan vanweë 'n behoefte aan riglyne in die Suid-Afrikaanse nywerheid vir die vermindering van waterinname en afvalwaterwegdoening.

Die Waternavorsingskommissie het in samewerking met die Departement van Waterwese 'n firma raadgewende ingenieurs gekontrakteer om 'n nasionale opname van die waterverbruik en afvalwaterbestuur in alle sektore van die Suid-Afrikaanse nywerheid te doen. Die konsultante het 75 verskillende nywerheidsgroepe in Suid-Afrika gedentifiseer waarvan die eet-oliebedryf een is.

Daar is sestien verwerkingsaanlegte vir eet-olie in Suid-Afrika wat elke jaar gesamentlik sowat 250 000 eetbare olie produseer en meer as 1,5 miljoen m^3 water verbruik.

Die NATSURV-opname het bevind dat die spesifieke waterinname (SWI) van die fabrieke wissel tussen 2,1 en 3,1 m^3/t vir maalwerk en 3,2 en 4,6 vir die raffineringsproses.



'n Teiken SWI syfer van 2,0 m^3/t vir vermaling en 3,0 m^3/t vir raffinering word in die verslag voorgestel. 'n Mikpunt van 5,0 m m^3/t word aanbeveel vir aanlegte waar al die produkolie op die terrein gemaal en geraffineer word.

Die navorsers sê die spesifieke besoedelingslas by die aanlegte het gewissel tussen 4,3 en 13,8 kg chemiese suurstofbehoefte (CSB) en 10,1 en 24,8 kg totale opgeloste vaste stowwe (TOVS)/t olie geproduseer. Hulle sê mikpunte van 7 kg CSB en 12 kg TOVS/t olie lyk redelik binne die bereik van die nywerheid, mits al die produkolie weer eens op die terrein van die aanleg gemaal en geraffineer word.

Daar is twee duidelik afgebakende stadia in die produksie van geraffineerde groente-olie: ru-olie produksie wat in 'n oliemeule plaasvind en die verwerking van die olie wat in 'n raffinadery gedoen word. In Suid-Afrika word die twee prosesse normaalweg op dieselfde terrein uitgevoer. Visolies en diervette word waar nodig, aangekoop. 'n Tipiese eet-olie aanleg stort sowat 35 persent van die inkomende water na gebruik weer in die riool. Die oorblywende 65 persent word òf in die talle verkoelingstelsels verdamp òf verlaat die fabriek as deel van een van 'n aantal neweprodukte soos margarine, grondboontjiebotter en mayonnaise.

Die uitvloeisels wat in die riool gestort word, bevat hoë organiese en anorganiese ladings met aansienlike hoeveelhede vet, olie, natrium, sulfate, fosfate en ander besoedelstowwe. Hierdie uitvloeisels word hoofsaaklik deur munipale afvalwateraanlegte behandel.

Die nuwe WNK-gids bevat voorstelle oor hoe om die waterverbruik in 'n eet-olie aanleg te verminder. Aangesien ongeveer 65 persent van die water wat die aanleg inneem in die ketels en vir verkoelingsdoeleindes gebruik word, lê die grootste potensiaal vir waterbesparing by hierdie prosesse.

Voorstelle vir verbeterde uitvloeiselbehandeling is ook in die gids ingesluit. Die navorsers sê vet en olie in die uitvloeisel beteken 'n verlies aan bemarkbare eet-olie en dit is dus belangrik vir die bestuur om die vet-inhoud tot

Sunflowers are amongst the most commonly grown oil bearing crops in South Africa.

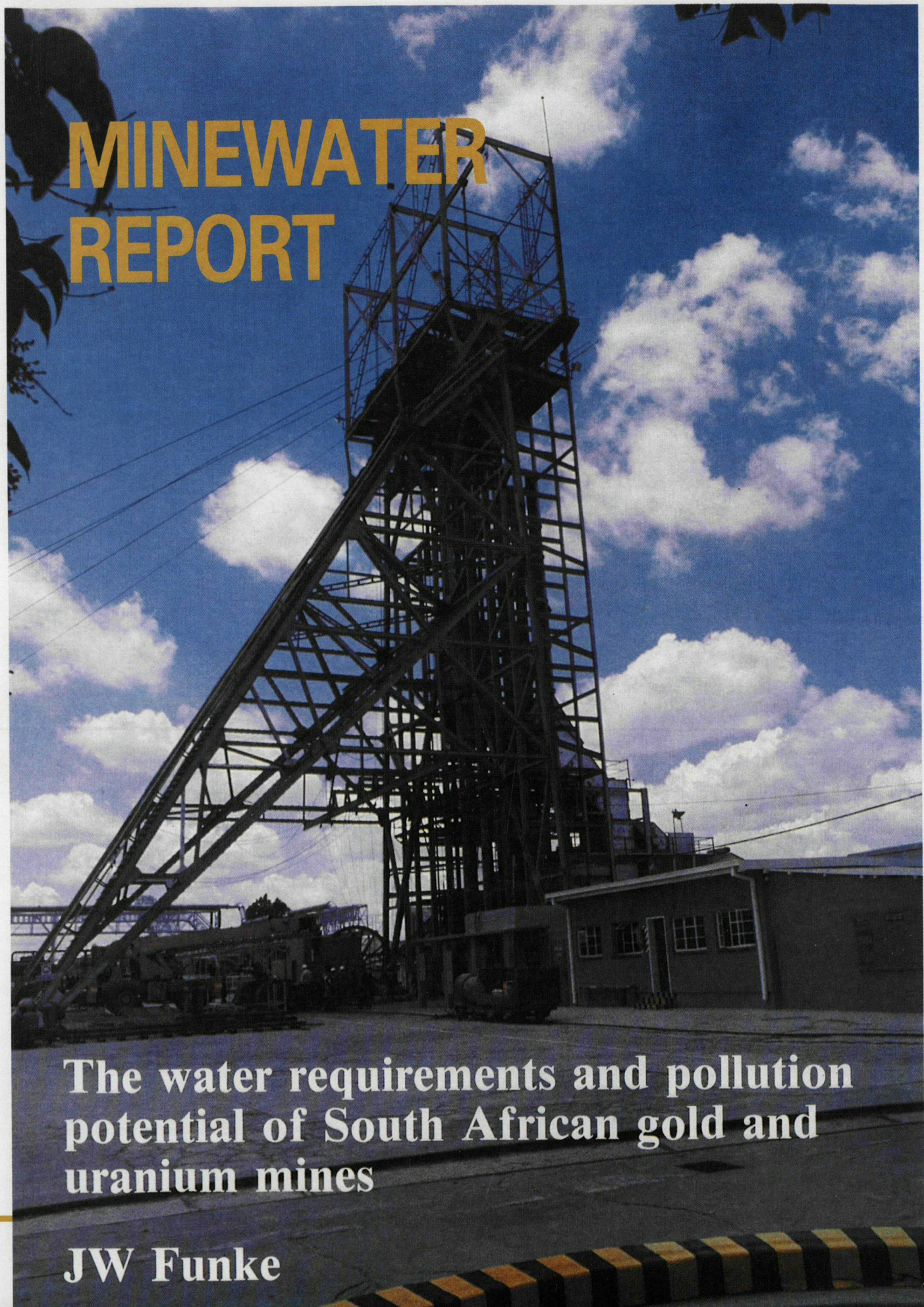
die minimum te verminder. Metodes om dit te doen word in die verslag uiteengesit. Die navorsers sê raffinadery-uitvloeisel kan doeltreffend behandel word deur 'n kombinasie van sifting, die suursplitsing van olie-emulsies, die afskepping van vette en olies en uiteindelik neutralisasie. Biologiese metodes vir die behandeling van uitvloeisels word ook aan die hand gedoen. 'n Bakterie kultuur is bv ontwikkel wat in aerobiese omstandighede vette van hierdie tipe uitvloeisels sal verteer en eet olie aanleg in Suid-Afrika bedryf 'n geaktiveerde slyk behandelingsaanleg as 'n afrondingseenheid aanvullend tot 'n opgelostelugflottasie-eenheid. Probleme wat met die bedryf van so 'n aanleg ondervind word, ontstaan vanweë skokladings van bv seepstortings wat van tyd tot tyd voorkom.

Anaerobiese behandeling van bio-afbreekbare uitvloeisels, veral van die voedsel en drankbedryf, ontvang op die oomblik wêreldwyd aandag. Navorsingswerk word in Maleisië gedoen oor die toepassing van die tegnologie vir die behandeling van uitvloeisels van groente-oliemeule. Uitvloeisels van palmoliemeule verskil baie van die uitvloeisels wat in Suid-Afrikaanse olieaanlegte voorkom. Tog behoort die anaerobiese behandeling van uitvloeisels ondersoek te word, veral as hoogs bio-afbreekbare uitvloeisels vanaf nabygeleë bronne beskikbaar is.

Nog 'n metode van uitvloeiselbehandeling wat in die verslag genoem word, is membraantegnologie. Die proses van tru-osmose wat van baie dun sintetiese of natuurlike membrane gebruik maak, mag moontlik geskik wees vir die behandeling van uitvloeisels met hoë totale opgeloste vastestowwe soos suurwater. Hierdie tegnologie kan veral gebruik word in gebiede waar bv streng standaarde toegepas word wat betref die sulfaatinhoud van uitvloeisels en waar eet-olieaanlegte tans sulke uitvloeisels met tenkwaens wegry om elders daarvan ontslae te raak.

'n Gratis eksemplaar van die gids kan bestel word by die Waternavorsingskommissie. Skryf aan die Uitvoerende Direkteur, WNK, Posbus 824, Pretoria 0001.

Die gids sal nie alleen van waarde wees vir die nywerheid self nie, maar ook vir ander belangegroepe soos munisipaliteite, bestuurders, navorsers en konsultante in die water- en uitvloeiselvelde.



MINEWATER REPORT

The water requirements and pollution potential of South African gold and uranium mines

JW Funke

The upgrading of sewage water from mine hostels, water recovery from the moisture contained in ventilation upcast air, radioactivity surveys on underground mine water and investigations into mine water and effluent circuits are some of the many recommendations contained in a report released by the Water Research Commission on the water requirements and the magnitude and consequences of pollution by the South African gold and uranium mines.

The report, written by Mr J W Funke, a specialist consultant to the Water Research Commission, describes in some detail the remedial measures taken by the mines to reduce the pollution load and the intake of good quality water with low total dissolved solids (TDS). New developments which are taking place are also dealt with, such as the use of particulate ice for mine cooling, the production of slurry ice from high TDS mine water for simultaneous cooling and desalination and the introduction of energy-saving hydropowered drills and hydrolift mine cooling systems. Chapters on the environmental impact of mine water and radioactivity are included, while areas requiring further investigation or research are defined. Copies of the report, WRC Report KV9/90, can be ordered free of charge from the Water Research Commission, P O Box 824, Pretoria 0001.

The forty larger active South African gold and uranium mines annually dispose of approximately 120 million t of milled and processed ore and about 30 million t of waste rock. The 36 small mines in the Eastern Transvaal mill and process roughly 1,1 million t of ore per annum, while about 90 million t per annum of low-grade sand dumps and slimes dams are reprocessed for the recovery of gold, uranium and pyrite.

The tailings from these operations are deposited as slimes or used as backfill material for worked-out stope areas underground.

About half of the total water intake by the South African Gold mines consists of low total dissolved salt (TDS) river water, either abstracted directly by the mines or supplied by water boards such as the Rand Water Board, the Western Transvaal Regional Water Co near Orkney and the OFS Goldfields Water Board at Balkfontein. The mines also use low quality minewater which is pumped to the surface and has a high TDS, for dust suppression, stope cleaning, fire fighting as well as other processing tasks like ore washing and milling, gold and uranium leaching, pyrite flotation, sulphuric acid production and the disposal of tailings.

CORROSIVITY

The most objectional properties of mine service water are in general corrosivity, a tendency towards scale formation, large volumes of suspended solids and high temperatures.

Corrosion and blockage by scale formation pose a severe problem, particularly in the OFS gold mines. Dissolved oxygen is apparently a major factor of corrosion by mine water with a pH higher than 5. Chloride is regarded as the main culprit for pitting corrosion of stainless steel.

According to the Funke report the replacement of corrosive-sensitive mild steel pipes by e.g. epoxy or glass-fibre-coated mild steel or by plastic material corrosion-resistant pipes might be cost-effective in spite of the higher costs for piping, since installation costs constitute the far higher cost factor, accounting for about 75 per cent of the total costs for an underground piping network.

To obtain sufficient volumes of water is not a decisive cost factor for most mines. The major cost factors are the replacement of corroded pipes and equipment and the increase in power use to compensate for the reduced heat transfer at refrigeration plants or for pumping through scaled up pipes as well as the use of water treatment chemicals. The cost to the gold mining industry because of poor quality water is estimated to be in the order of R150 to R300 million per year.

IMPROVING WATER QUALITY

Drilling and blasting creates dust which must be suppressed by water sprays. The inadequate removal of the abrasive solids in underground settlers is regarded as the major water quality problem at a number of mines. Most settlers cannot cope with the rapid and extreme fluctuations in hydraulic and solids load rates. To improve solids removal and consistently obtain clear water for low-tolerance equipment such as hydro-powered rockdrills, the Chamber of Mines' Research Organisation (COMRO) is developing and testing new equipment such as high-rate settlers and floating media filters.

A 1 Mℓ/day demonstration plant incorporating unit processes for neutralization, settling, filtration, desalination by slurry precipitation and recycle reverse osmosis and disinfection is to be built on surface to treat 13 ℓ/second of mine waste water pumped from underground. All unit processes have been tested on pilot-plant scale to prove their practical feasibility.

SEWAGE WATER

A large reservoir of low TDS water is available on the mines in the form of treated sewage. The upgrading of this water is presently one of the cheapest ways of augmenting the supply of good quality water on a large scale or alternatively of saving on fresh-water intake. The volume available may be sufficient at many mines to operate sensitive hydro-power equipment such as rockdrills.

Desalination of high TDS mine water by membrane processes such as electrodialysis or reverse osmosis has not been introduced on a large scale, but has been demonstrated on pilot scale to be technically feasible for non-scaling sodiumchloride type OFS mine water. Freeze desalination in combination with mine cooling by slurry-ice has the potential for producing desalinated ice from mine water, regardless of the composition and salinity of the feed water.

Fan drift condensate from ventilation upcast air is of similar or better quality than river water. The economic feasibility of recovering fan drift condensate on a large scale by cooling the hot upcast air has not yet been investigated.

Aquatic Invertebrates under the Microscope

Participants to the Workshop on the identification of aquatic invertebrates. Front row: Ms H Barber, Mrs N Rayner, Prof D Frey, Dr F de Moor, Mr B Wilmot, Dr B Brain, Dr M Scott and Prof P McCafferty. Middle row: C Palmer, M Hymer, M–P Hensell-Howard, A Hanekom, C Thirion, T Mosala, P Scotny, C Todd, D Wessels. Back row: N Mtwa, B Curtis, B Fowles, Dr J O'Keeffe, Dr L Taylor, S Pollard, P Scott, K Soxujwa.

During a three month visit to the Albany Museum in Grahamstown by a world specialist on Ephemeroptera systematics (Prof W P McCafferty from Purdue University, Indiana USA) the opportunity to run a workshop on the identification of a number of aquatic invertabrate groups seemed too invaluable to miss. Mrs N Rayner from Natal University offered to contribute her knowledge on Copepoda to the workshop and Dr C K Brain from the Transvaal Museum offered an illustrated lecture and demonstration on the preparation and photography of Rotifera and testate Amoebae. The week before the workshop was run Prof D Frey from Indiana University, who was visiting the Albany Museum and examining our Chydoridae (Cladocera), offered to give a lecture on Cladocera and this was incorporated into the programme. Besides the imported expertise the Albany Museum has expertise on several aquatic insect groups (Odonata, Mr B Wilmot; Trichoptera, Drs M Scott and F de Moor; Simuliidae, Dr F de Moor; and rapidly acquiring expertise on Ephemeroptera, Ms H Barber).

So a workshop organised at the Museum from 13 to 16 November 1990 and altogether 25 people attended the three and a half day session. Altogether 180 pages of documentation comprising introductory notes, preliminary identification guides, illustrated keys and tables of species and their distribution records were compiled.

After an opening address by the Director of the Albany Museum the rest of the first morning was devoted to introductory lectures outlining collecting techniques and highlighting, with illustrations, the characters commonly used to identify the various aquatic animals. Problematic features for each of the groups were also discussed and the systematic placement of the various groups was outlined. The afternoon session of the first day was devoted to a collecting excursion; the delegates were shown various collecting and preservation techniques in Howisons Poort Dam and in the Berg River near Grahamstown.

On the second day delegates under the guidance of Mr B C Wilmot examined dragonflies (Odonata) produced from the Albany Museum's collections and attempted to put names to unidentified material they had brought to the workshop. Dr C K Brain then delivered an illustrated talk covering the philosophy of collecting and studying live invertebrates using Rotifera as an example. Delegates were able to make prepara-

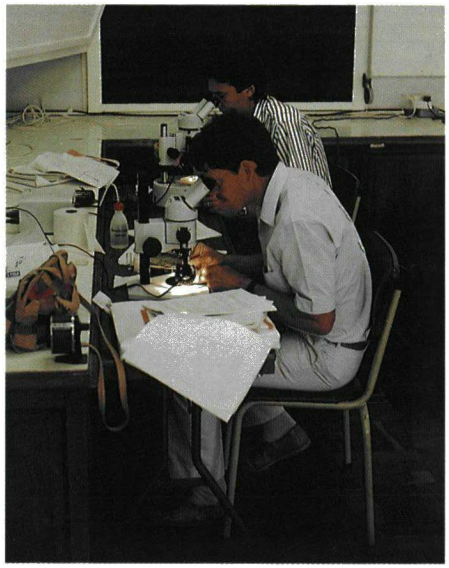
tions and examine live material collected the previous day. Photomicrography was also demonstrated in this session. The afternoon session was devoted to the dissection, preparation and identification of Copepoda and slides of prepared material were studied and discussed, with Mrs N Rayner providing advice and sharing her expertise.

The morning of the third day was devoted to the identification of Ephemeroptera and Prof Patrick McCafferty shared his knowledge and expertise with the delegates by delivering a detailed lecture on the characters used and emphasising the importance of an understanding of the phylogeny of the group. Miss Helen Barber assisted with the identification of these animals. Unfortunately Grahamstown had an electrical power failure and fine microscopic work was restricted for part of the morning. In the afternoon Trichoptera were covered with Drs Marjorie Scott and Ferdy de Moor Showing the delegates characters in the more than 50 species of Trichoptera larvae put out for study. As electricity was still wanting an emergency petrol generator was installed and it was possible to carry on in true third world fashion identifying animals to the thump of a noisy generator. Delegates had brought in specific material and this was also handled during the course of the day.

On the final day Dr Ferdy de Moor briefly introduced Simuliidae then had delegates look through prepared material discerning important characters often overlooked or misunderstood. At 12:00 a brief closing talk was delivered and delegates departed for their respective destinations.

IDENTIFICATION KEYS

The sessions held during the workshop clearly illustrated that there are some serious shortcomings with people using identification keys to determine what animals they are looking at. One of the main problems is what could be called the "locked key syndrome". People restrict their observation of animals to the small number of characters which enable them to identify the species known by the specialist. The specialist has chosen these characters because he finds them clearly distinguishable and easily found and they hence provide the fastest way of separating the different species. People will now look at animals taking in only the key described characters and will not look at features of the animal as a whole. When a new undescribed species is found these selected characters may, however, not be suitable for separating it from the other known species. Most frequently a new species is then erroneously placed in one of the other previously known species. The importance of good identification thus lies in looking at a number of features in a systematic way and hence discovering where there are consistent differences (in characters perhaps not recorded in the keys used) between individual specimens. Such specimens would then deserve further attention and could prove to belong to an undescribed species. Other problems with keys lie in the fact that character descriptions are frequently misinterpreted or not understood. As soon as one follows a wrong dichotomy in a key you are altogether lost and can quite easily come up with the wrong species which further down will fit the limited key description. People also tend to read into a key what they assume to be a correct description of a character.



Microscope work in full swing – inspecting little "watergoggos" for identification.

Dr Bob Brain's talk on rotifers clearly identified what biologists need to do. Study the whole animal, its behaviour, its habitat and what it does while it is still alive. Once dead and preserved only a limited number of morphological and other characters remain available for study thus severely limiting the potential for correctly identifying the animal to species level. Prof Patrick McCafferty also pointed out that it is essential for people attempting to identify animals to have a knowledge of their systematic grouping and their phylogeny and fossil history. Once a phylogenetic understanding of the group of animals one is dealing with is grasped, it becomes much easier to look for important diagnostic characters. Such characters will manifest themselves in species forced to adapt to a changing environment. As knowledge of the world fauna of a particular group is gained it becomes evident that certain families have more species in some regions than others. Some specializations common in one family with numerous genera and species in a region may be emulated in another region by species in another family where the first family is scarce in species. As an example Leptophlebiidae in Australia and South Africa have taken up the functional ecological roles of Heptageniidae from the northern hemisphere. A knowledge of the phylogeny and behaviour of the animals one is trying to identify sharpens a person's ability to distinguish different species in a large group.

Both delegates and tutors benefited from the interaction and exchange of ideas at the workshop. It is hoped that the workshop will spawn a greater interest in the diverse and little known fauna of our rivers. It should also lead to a greater sharing of our knowledge on the local aquatic fauna and help to resolve some of our systematic problems more rapidly.

ACKNOWLEDGEMENTS

Financial assistance to cover organisation and running expenses was provided by the FRD Rivers Forum, Rhodes University and The Directorate of Cultural Affairs (Eastern Cape). Special thanks are extended to FRD and the Anglo American and de Beers Chairman's Fund for providing funding which made Prof McCafferty's three-month visit possible.

SCHULZE RECEIVES SAIAE GOLD MEDAL AWARD

Professor Roland Schulze

Professor Roland Schulze, a well-known researcher and hydrologist from the University of Natal, has received the South African Institute of Agricultural Engineers' (SAIAE) gold medal for outstanding service.

In a citation read at the presentation ceremony Professor Schulze is described as an exceptionally hard working and gifted member of the SAIAE who is continually and energetically seeking solutions to real problems facing the agricultural engineering profession in southern Africa.

Hydrological Models

His influence in the teaching of undergraduate agricultural engineers and in developing the post graduate school in the soil and water area of Agricultural Engineering at the University of Natal has been profound. In addition to this teaching and research commitments he has also developed close and meaningful links with practicing agricultural engineers. His hydrological models and research reports are used daily by engineers throughout southern Africa. Through his work and its relevance to other engineering disciplines and the pure sciences he has also contributed considerably to raising the esteem of the agricultural engineer in the eyes of these professions.

South African Agricultural Engineering expertise has been promoted in the international community by his research, consultation and lecturing in Canada, USA, Europe, UK, South America and several African countries. He is a member of several prestigious International Institutes and has served on a number of International Committees. He is currently a member of the International Geosphere Biosphere Programme Committee which is dealing with the question of global climate change. He was recently the only member from the African continent to be invited to contribute towards a new international "Handbook of Hydrology" to replace the 1964 classic by the late Ven te Chow.

Professor Schulze's record of academic research achievements is considerable. To date he has published no fewer than 178 papers, reports, books, conference proceedings and consultation reports.

WATERBENUTTINGS INGENIEURS BY UP VERHUIS

Die Afdeling Waterbenuttingsingenieurswese het na die **nuwe** Suidkampus van die Universiteit van Pretoria verhuis, d.i. waar die ou Brandstof/Steenkoolnavorsingsinstituut geleë was. Prof At Pretorius, prof Hans van Leeuwen en mnr Johann Botha en hulle voltydse nagraadse studente het nou pragtige ruim nuwe kantore en laboratoriums wat spesiaal vir hulle ingerig is. Alle deeltydse kursusse en kortkursusse sal in die gebou aangebied word.

Die gebou is aan die suidekant van Lynwoodweg geleë teenoor die Administrasiegebou (Skip) van die Universiteit van Pretoria. Die ingang is vanaf Universiteitsweg en Afdeling se kantore is in die eerste gebou op linkerhand. Kommunikasie is tans moeilik weens oponthoud met die installasie van telefone. Daar is egter tydelik 'n radiotelefoon met die nommer 420-3566 en fakse kan nog steeds na 43-2816 gestuur word.

Gemeenskapsdiens

Behalwe nagraadse opleiding (honneursprogramme) en navorsing (magister en doktorale studie) wil die afdeling hom toenemend toelê op gemeenskapsdiens deur kortkursusse aan te bied. Behalwe die kortkursus wat in hierdie uitgawe van die SA Waterbulletin geadverteer word, sal daar in die loop van die volgende paar jaar ook kortkursusse in Rioolwatersuiwering en in Nywerheidsafvalwatersuiwering aangebied word.

OUD STUDENTE WORD GESOEK

Die Afdeling Waterbenutting van die Departement Chemiese Ingenieurswese aan die Universiteit van Pretoria wil graag kontak maak met al 120 van sy gegradueerdes sedert 1970. Die gedagte is om 'n reünie te hou, 'n alumnivereniging te stig en in gereelde kontak te bly.

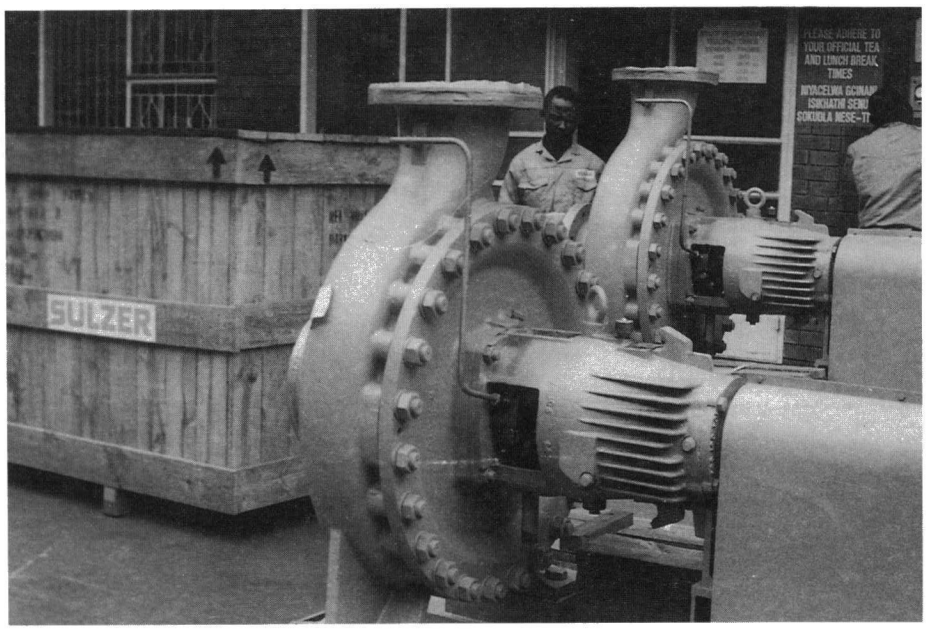
Wees asseblief so vriendelik om u besonderhede op die poskaart in hierdie Bulletin in te vul en aan te stuur. Bring die kennisgewing ook asseblief onder die aandag van mede-alumni.

SULZER PUMPS RIGHT FROM THE START

Seven Sulzer pumps, five ZA 300–400 and two AZ 150–400 will be installed in 1991 in the main processing plant of De Beers' new Venetia Diamond Mine near All Days in the Northern Transvaal. The pumps, with a total capacity of 1 296 m^3/h at heads of up to 58 meters will be used as process pumps in the diamond recovery plant.

Water from the Limpopo, pumped by temporary installations located at the river banks, will be transported about 30 km to the mine's site, where the Sulzer pumps in the processing plant will ensure the water supply to the main treatment plant.

Right: Sulzer pumps similar to the pumps supplied to Venetia Diamond Mine.



ESTABLISMENT OF A WISA TECHNICAL DIVISION FOR NUTRIENT REMOVAL

A Technical Division for Nutrient Removal has been established under the auspices of WISA.

The objectives of the Technical Division will be:

- ☐ To act as a communication channel between public authorities, plant personnel, industry, consultants and research organisations.
- ☐ To document, collect, discuss and disseminate information on all aspects of sewage treatment and nutrient removal from sewage.
- ☐ To initiate open meetings, demonstrations, plant visits, workshops and training sessions in the sewage treatment field.
- ☐ To identify research needs.

The scope of interest of this Technical Division will cover the following:

- ☐ All aspects of nutrient removal from waste waters
- ☐ Focus specifically on municipal sewage but nutrient removal from industrial waste waters is not excluded because quite often these are discharged to sewers.
- ☐ Biological nitrogen and phosphorus removal from municipal sewages in nitrification denitrification (ND) biological excess phosphorus removal (BEPR) activated sludge (NDBEPR) plants.
- ☐ Chemical P removal either from trickling filters or in NDBEPR plants for P removal augmentation.
- ☐ Problems encountered in NDBEPR plants such as sludge bulking and secondary clarifier design and operation.
- ☐ BEPR augmentation by acid fermentation.
- ☐ Operation and control of NDBEPR plants.
- ☐ Aspects of P rich sludge handling from NDBEPR plants (overlap with the Sludge Management Technical Division).

The first open day was held at Midrand on 26 February 1991. During the meeting the following persons were elected to the Committee:

- Dr S A Mitchell (Water Research Commission) was elected Chairman in place of Mr G Offringa, who was resigned.
- Mr A R Pitman (Johannesburg City Council)
- Mr M Grove (Roodepoort City Council)
- Mr A S Louw (Boksburg City Council)
- Mr A Gerber (CSIR)
- Mr S Palmer (Lever Brothers)
- Dr J Barnard (Meiring & Barnard)
- Mr Alexander (Scott & De Waal)
- Mr H Basson (AWTP)
- Mr J de Haas (Umgeni Water)
- Dr J Barnard (Dept of Water Affairs & Forestry)

Dr J Barnard (Meiring & Barnard) opened the inaugural meeting with a lucid overview of nutrient removal world wide. This was followed by a discussion on nutrient removal and the new receiving water quality objectives by Dr J Barnard (Dept of Water Affairs & Forestry). The final talk of the afternoon was on the future of nutrient removal by Dr M Wentzel (UCT).

Application for membership

Should you be interested to apply for membership of the Technical Division, please contact Dr. M C Wentzel at at UCT, Tel. (012) 650-2583.

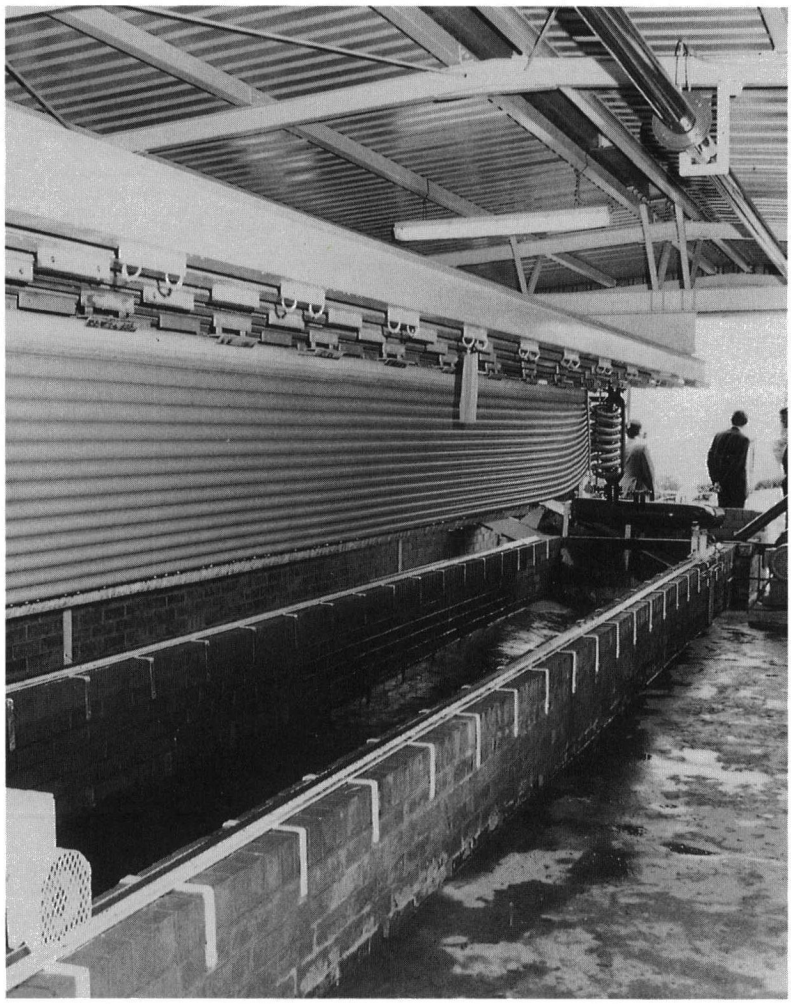
S A DEVELOPED FILTER PRESS SOLD OVERSEAS

A South African tubular filter press developed with a grant from the Water Research Commission is being successfully marketed overseas with the first unit already installed in a British water treatment plant.

The press, which filters out solids from sludge in water treatment works, can also be used in the mining and other industries. The units cost from R500 000 to R1 500 000 depending on their size. Mr Ian Buchan, design engineer at Umgeni Water in Natal, says research and development of the process is still continuing, although the prototype erected at the HD Hill water treatment works in Pietermaritzburg three years ago, is performing exceptionally well. The press has several advantages over the conventional method using chemicals. It is fully automated and self-cleaning and requires a minimum of operator supervision. There is considerable saving on operating costs and the use of expensive polymer chemicals. The unit is modular and compact, requiring less space than existing filtration. It treats waste sludge resulting from treatment of raw water. Slurry is fed under pressure into porous fabric tubes. The liquid filters through the tube walls to be returned to the head of the water works, while solids are deposited in a thin cake on the internal walls of the tube. A roller cleaning device dislodges the layer which is transported out of the tubes, drained and conveyed to a hopper for use as landfill. The cake can be worked by spade and has a solds concentration of about 30 per cent.

The HD Hill prototype was constructed under a joint agreement between the Water Research Commission, Umgeni Water and the University of Natal.

International patents have been granted with HTW Hi-Tech Water NV holding the sole licence. The sub-licencee in SA is Explochem Water Treatment.



The locally developed filter press in operation at the HD Hill water treatment works at Pietermaritzburg.

FISHLIT information service available to the public

An up-to-date information service on all aspects of fish called FISHLIT has been developed in the library of the JLB Smith Institute of Ichthyology at Rhodes University, Grahamstown, and is now available to members of the public.

The computerised bibliographic database was developed by the Institute's librarian, Mrs Margaret Crampton, in co-operation with the Division of Information Services at the CSIR.

FISHLIT offers information on fisheries and fish processing, aquaculture, theoretical ichthyology, aquatic conservation, pollution and ecology as well as aquarium fish.

FISHLIT, which grows at the rate of approximately 500 keyword indexed articles a month, now has more than 24 000 references on fish available to the user. Monthly information updates are offered as well as on-line literature searches on the whole database to provide reference lists on specific topics.

For more information contact Mrs Crampton at the JLB Smith Institute of Ichthyology in Grahamstown at telephone 0461 – 27124.

HYDROLOGISTS AND SACNAS

SACNAS (the SA Council for Natural Scientists) was launched in 1982 and the act on Natural Scientists has gone through various stages of development from Act 55 of 1982 to Act 46 of 1990. A new act will go before Parliament in 1991 and in principle technologists will be included in the act. The exemption for registration of public servants has been lifted. And all the time the hydrologist may have wondered what the act had to offer to him or her.

The matter has been clearly explained by the President of SACNAS, Dr H S Hofmeyer. SACNAS, through the act, has created the structural framework for the development of statutory scientific professions. The responsibility for the development and definition of such professions rests with the professional societies of which SANCIAHS can be considered an example. The fundamental goal of the act is to protect the community against non-professional conduct and at the same time allow the recognised professional to reap an appropriate compensation for his expertise and maintenance of professional standards. So what should the hydrological community do? An appropriate example has been set by the Geological Society of South Africa together with the SA Institute for Engineering Geologists, the S A Geophysical Association and the newly constituted SA Institute of Geotechnologists. They formed a Professional Affairs Committee (PAC) for the Earth Sciences. It is generally accepted that hydrology falls within the group of earth sciences. From the relevant documentation it appears that "Earth Sciences" includes all branches of geology, geohydrology, hydrology, geophysics, geochemistry, and engineering geology. (I have wondered if soil science and pedology should not be listed here as well.)

One of the projects that this PAC is working on, is the development of guidelines for training programmes of earth scientists-in-training. Before we as SANCIAHS can even think of starting to do such things we need a much clearer definition of a hydrologist. What distinguishes a hydrologist from a civil engineer, an agricultural engineer, a geohydrologist, etc. Following recent trends in the USA, hydrology should be seen as the science studying the soil-plant-atmosphere continuum because this is where the heart of hydrology beats. Following this lead it has recently been decided that the IAHS will expand and form a new committee for the soil-plant-atmosphere continuum.

Understanding the statistics of flow regimes can probably be mastered by a large group of non-hydrologists. But the interaction between solar radiation, greenhouse effects, evaporation and rootzone processes and streamflow is not such common knowledge. Irrigation scheduling and forest plantation management have probably more hydrology in common than is generally agreed. Especially if we focus on integrated catchment management (ICM) the role and expertise of the hydrologist becomes indispensable.

But ICM is still a dream and as long as the general public, the state and service councils in South Africa manage our soil-and water resources without explicitly insisting on the input of registered hydrologists we have to market and sharpen our hydrological science.

From your secretary,

China and Brazil sign earth resources satellite agreement

The Peoples Republic of China and Brazil have signed and agreement to work in a joint programme for the development and construction of two Earth resources satellites. Both countries are members of COSPAR, the ICSU Committee on Space Research. The satellites will be used for applications in agriculture, forestry, geology, hydrology, geography, cartography, meteorology and environmental studies.

As reported in the COSPAR Bulletin, China will invest 45 million US dollars, or about 30 percent. The Brazilian Institute for Space Research (INPE) will develop a data collection system, power supply and a computer for handling onboard data manipulations and the altitude and orbit control subsystems. The Chinese, through the Chinese Academy of Space Technology (CAST) will be responsible for testing and managing the project.

The first of the two satellites is scheduled to be launched by the end of 1992, by a Chinese Long March rocket from the Shanxi launching base, in the Peoples Republic of China. The second one will be launced in 1992, and both will have a life span of two years. The China-Brazil Earth Resources Satellite (CBERS) will be placed in a sun-synchronous orbit at an altitude of 778 km.

URBAN HYDROLOGY: a multidisciplinary perspective

by Timothy R Lazaro

A basic guide to all aspects of urban hydrology, ranging from overall planning to details of analysis and control. This is a completely updated and new edition and should be of particular interest to urban water resource engineers and urban water resource planners.

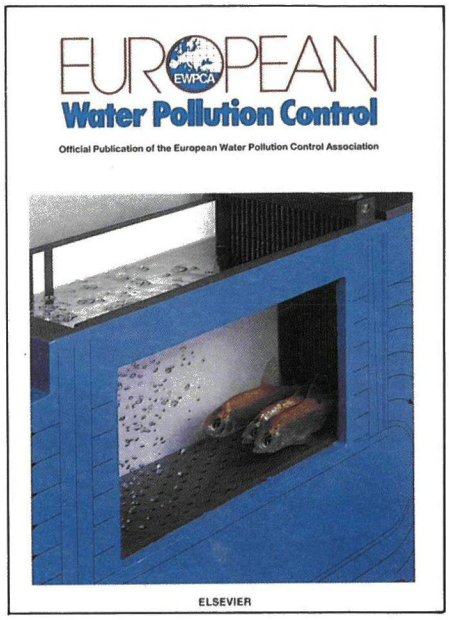
The author outlines and discusses the facets of urban hydrology in language which can be easily understood by scholars of different disciplines. In this manner an appreciation of the roles played by the specialists in the various fields is developed. The book supports the view that problems in urban hydrology can only be adequately solved by utilising a multidisciplinary approach, i.e. that specialists of different disciplines must earnestly work together and seriously attempt to communicate their ideas to one another.

Within the text, urban hydrology is reduced to a simple cause and effect relationship. The first five chapters discuss the causes and effects, the sixth chapter presents a brief review of planning problems, while the seventh chapter deals with structural means of solution.

1990 264 pages, hardcover.
Price: Swiss francs 94
ISBN 0 87762 547 6

Both titles are available from TECHNOMIC Publishing AG, Missionstrasse 44, CH-4055, Basel, Switzerland. FAX: 061/435259.

– NEW JOURNAL –



A new journal – European Water Pollution Control – is published by Elseviers Science Publishers on behalf of the European Water Pollution Control Federation (EWPCA). The bi-monthly journal is interdisciplinary, has a pan-European perspective and aims to give readers the information they need to stay in control of water pollution problems.

Articles are peer-reviewed to ensure high scientific quality and their direct relevance to readers concerned with the problems associated with the control of water pollution. The emphasis of the journal is on applied science – clearly presented.

To subscribe to the new journal, write to Elseviers, P O Box 330, 1000 AH Amsterdam, the Netherlands.

VALVES – PRINCIPLES & PRACTICE

This book is published as part of a series of reference works for engineers involved in the design, construction and operation of fluids handling systems in the mining, procesing, food, petro-chemical, civil and agricultural industries.

Its content comprises technical information on the basic fundamentals of valve operation and construction, with special reference to valve applications, components and ancillary equipment.

200 pages and 300 illustrations.
Price: R128,82 Hardcover.
Available from K Myles and Associates, P O Box 2212, Northcliff 2115.

WATER RECLAMATION: HERE, NOW... AND HOW

Association of Water Reclamation Agencies (AWRA) Symposium 111, October 13 – 14, 1988.
Edited by Benton Price

The eighteen reports in this new volume all relate to projects, practices and issues in California, USA. However, the information will be useful and applicable to all those who are concerned with water reclamation and reuse.

1990 132 pages, softcover.
Price: Swiss francs 43
ISBN 0 87762 719 3

Available from TECHNOMIC Publishing AG, Missionstrasse 44, CH-4055, Basel, Switzerland. FAX: 061/43-5259.

DESIGN OF WATER QUALITY MONITORING SYSTEMS

by Robert C Ward and Jim C Loftis, and Graham B McBride

This state-of-the-art guide gives managers all the essential tools they need to design a water quality monitoring system that gets consistently valid results. Featuring the latest methods of sampling and lab analysis, data handling and analysis, reporting, and information utilisation, it illustrates key concepts with actual case studies of monitoring system design projects. Additional topics include the use of statistics in the design process, plus network design, system design, documentation, and issues in water quality information system design.

Contents: Introduction. Definition of the Monitoring System. The Essential Role of Statistics. Approach to Monitoring System Design. Quantifying Information Expectations. Data Analysis Protocol. Network Design. System Design Documentation. Case Studies. Evolving Issues in Water Quality Information System Design. References. Appendices. Glossary. Index.

1990 225 pages Price: $49,95

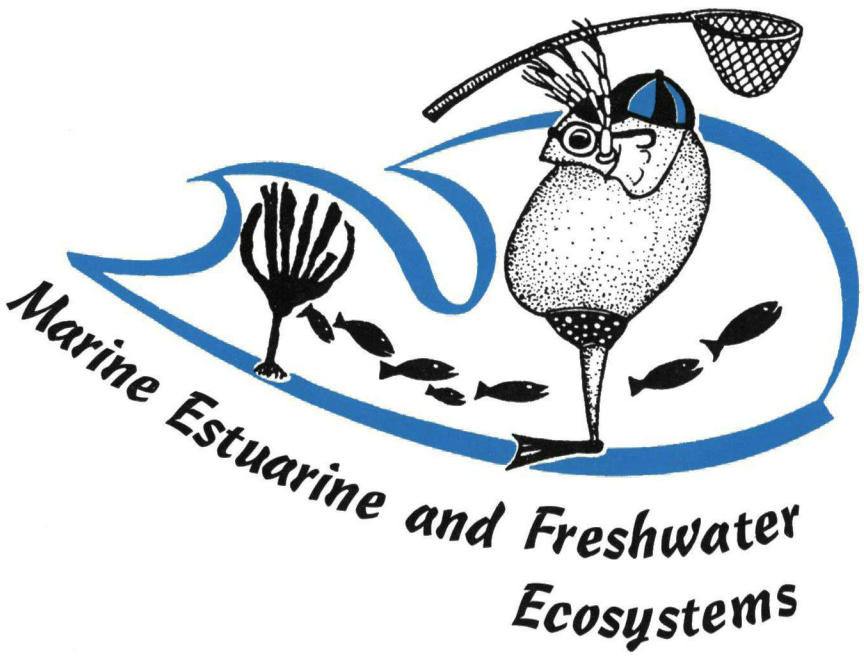
Available from: Van Nostrand Reinhold, Mail Order Department, P O Box 668, Florence, KY 41022-0668 USA.

SOUTHERN AFRICAN SOCIETY OF AQUATIC SCIENTISTS

28th CONGRESS

OCEANOGRAPHY SOCIETY OF SOUTH AFRICA

1st CONGRESS



A conference on marine, estuarine and freshwater ecosystems will be hosted by the J.L.B. Smith Institute of Ichthyology, Rhodes University and Albany Museum from 9 – 11 July 1991. It will constitute a joint congress of the Southern African Society of Aquatic Scientists and Oceanography Society of South Africa.

The objective of the conference is to bring together aquatic scientists and facilitate interaction across the various disciplinary boundaries. Posters and oral papers dealing with any aspect of research in marine, estuarine or freshwater ecosystems will be considered, and workshops on a variety of aquatic topics will also be organized.

Further information can be obtained from:

Dr A.K. Whitfield
Convener: Local Organizing Committee
J.L.B. Smith Institute of Ichthyology
Private Bag 1015
Grahamstown
6140 **Tel: (0461) 27124**

SOUTHERN AFRICA

WISA
MAY 13 – 16

The second biennial conference and exhibition of the Water Institute of Southern Africa will be held at the World Trade Centre in Kempton Park. Invitation to exhibit.
Enquiries: The Secretary, WISA, P O Box 1948, Portlands 2121. Tel. (011) 728-4303.

IRRIGATION
JUNE 4 – 6

A Southern African irrigation symposium will be held at the Elangeni Hotel in Durban.
Enquiries: The Organising Committee, Irrigation Symposium, P O Box 824, Pretoria 0001.

FRESHWATER ECOSYSTEMS
JULY 9 – 11

A conference on marine, estuarine and freshwater ecosystems will be hosted by the JLB Smith Institute of Ichthyology, Rhodes University and the Albany Museum in Grahamstown.
Enquiries: Dr A K Whitfield, Convener, Local Organising Committee, JLB Smith Institute, Private Bag 1015, Grahamstown 6140. Tel. (0461) 27124.

OCEANOGRAPHIC ECOLOGY
SEPTEMBER 8 – 12

A symposium on the Benguela trophic functioning entitled Resource Utilisation from an Ecosystem Perspective, will be held at the University of Cape Town.
Enquiries: The Symposium Secretariat, Oceanography Department, University of Cape Town, Rondebosch 7700.
Tel. (021) 650-2681.

WASTE MANAGEMENT
OCTOBER 22 – 24

An international seminar, workshop and equipment exhibition on environmental waste management technology will be held at the national exhibition centre (NASREC) in Johannesburg.
Enquiries: Seminar Co-ordinators, P O Box 93395, Yeoville 2143. Tel (011) 648-1322/3. Fax (011) 648-1387.

OVERSEAS

IWEM
APRIL 30 – MAY 2

The IWEM 91 Conference – water and the environment will be held in Birmingham, England.
Enquiries: Mrs L Gittens, IWEM, 15 John Street, London WC 1N 2EB, England.

WATER QUALITY
MAY 21 – 24

A conference on the measurement of water quality will be held in Budapest, Hungary.
Enquiries: Dr P Prinz, VITUKI, P O Box 27, H-1453, Budapest, Hungary.

WATER SUPPLY
MAY 25 – 31

The 18th international water supply congress will be held in Copenhagen, Denmark.
Enquiries: IWSA, 1 Queen Anne's Gate, London SW 1 H 9BT, England.

WATERMATEX '91
JUNE 3 – 6

This exhibition will be held in Durham, NH, USA.
Enquiries: Watermatex '91, New England Centre, University of New Hampshire, 15 Stafford Avenue, Durham, NH 03824, USA.

WATER RESOURCES
AUG 12 – 15

A symposium entitled water resources in the next century will be held in Stockholm, Sweden.
Enquiries: Stockholm Water Symposium 1991, c/o Stockholm Convention Bureau, P O Box 6911, S-102 38 Stockholm, Sweden.

WASTEWATER PLANTS
AUG 26 – 30

The 6th IAWPRC conference on the design and operation of large wastewater treatment plants will be held in Prague, Czechoslovakia.
Enquiries: Prof J Wanner, Prague Institute of Chemical Technology, Department of Water Technology and Environmental Engineering, Suchbatarova 5, CS–166 28, Prague 6, Czechoslovakia.

ACID DRAINAGE
SEPTEMBER 16 – 18

The second international conference on the abatement of acidic drainage will be held in Montreal Canada.
Enquiries: Pamela Friedrich, Centre de Recherches Minerales, 1665 Boulevard Hamel, Edifice 2, First Floor, Quebec, Canada G1N3 Y7.

WASTEWATER
SEPTEMBER 24 – 26

An international symposium on wastewater reclamation and reuse will be held in Castell Platja d'Aro, Costa Brava, Spain.
Enquiries: Prof Rafael Mujeriego, Universidad Politecnica de Cataluna, ETS de Ingenieros de Caminos, Gran Capitan S/N, 08034, Barcelona Spain.

GROUNDWATER
OCTOBER 8 – 9

A two-day international conference on groundwater protection will be held in Paris.
Enquiries: Mrs Lavinia Gittins, IWEM, 15 John Street, London WC1 N2 EB.

WATER DISTRIBUTION
OCTOBER 21 – 22

The European specialised conference on managing water distribution systems will be held at the "Centro Affari" in Florence, Italy.
Enquiries: The IWSA Secretariat, 1 Queen Anne's Gate, London, SW1 H9 BT, Great Britain. Call for papers.

ECONOMICS COURSE
SEPTEMBER – DECEMBER

A three months course on economics and management for the water industry will be held by the Developing Countries Unit at the Strathclyde Business School of the University of Strathclyde, Scotland. Tuition and accommodation fees: £6 800.
Enquiries: Dr J Love, DCRU, Department of Economics, Strathclyde Business School, University of Strathclyde, 100 Cathedral Street, Glasgow G4 OGE Scotland, UK.

KORTKURSUS

WATERBENUTTINGSINGENIEURSWESE

UNIVERSITEIT VAN PRETORIA

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Bedryf van Drinkwatersuiweringsaanlegte

(Eerste aankondiging)

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- Aanlegbestuur
- Vloeikarakterisering
- Koagulasie en flokkulasie
- Filtrasie
- Prosesbeheer
- Vermenging
- Besinking en slykhantering
- Ontsmetting en stabilisasie

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Ingenieurs, wetenskaplikes, bestuurders, voorsitters, aanlegopsigters en tegnici

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waterrade, plaaslike owerhede of privaatinstansies wat drinkwater suiwer en voorsien.

Ervare ingenieurs, bestuurders en wetenskaplikes lei kursus.

- Beperk tot 35 kursusgangers per geleentheid
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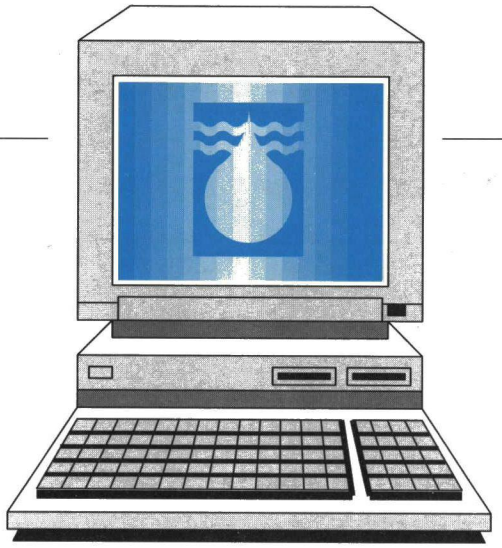
- Koste per kursusganger R800
  (Studiehandleidings, etes en sertifikate ingesluit.)

Belangstellendes moet asb. die toepaslike poskaart in hierdie Bulletin invul en pos aan:
Prof. H van Leeuwen,
Dept, Chemiese Ingenieurswese,
Universiteit van Pretoria
Pretoria, 0002.

Water Research Commission Fellowship for post-graduate training in Numerical Modelling

AN EXCITING AND RELEVANT RESEARCH OPPORTUNITY



BACKGROUND

Weather and climate are the dominant factors controlling the amount of water available in South Africa. Potentially serious effects of climatic variability on the quantity and quality of our water resources can be minimised if we improve our understanding of vital matters such as:

- The variability and predictablity of weather and climate at all scales.
- The links between climatic variability and physical processes on land and in the sea and atmosphere.
- The effect of global warming [greenhouse effect] on regional climates in southern Africa.

The complexity of atmospheric processes is such that existing and newly acquired knowledge can only be integrated and used effectively through numerical models. Modelling of such processes is therefore crucial to the effective management of our water resources and our environment in general. South Africa is critically short of modelling expertise and we therefore invite candidates for training in this exciting and creative field.

WHO MAY APPLY?

persons with:

- A first or higher degree in science, engineering or arts, preferably with mathematical experience, and an inclination to do numerical modelling.
- An aptitude and desire to use computers to simulate processes in nature.
- A concern for the environment and the orderly development and management of water resources

  Additional qualifications in climatology or meteorology and previous experience in modelling will be a recommendation but are not crucial.

NATURE OF THE FELLOWSHIP

- A generous financial package will enable the successful candidate to meet all costs of training to a level determined jointly by him or herself and a panel of advisors appointed by the Water Research Commission.
- An opportunity will be created for part of the training to be undertaken overseas with a suitable institution or specialised modelling group.

OBLIGATIONS

- The successful candidate will be contractually bound to serve as a numerical modeller in a research environment at an approved South African university or other institution. The period of the contract will be equal to the duration of the fellowship.

APPLICATIONS

Applications should include a complete Curriculum Vitae and the names of at least two referees, and be sent to:

The Executive Director
Water Research Commission
P.O.Box 824
PRETORIA 0001
[for attention: Dr GC Green]

The closing date for applications is 15 April 1991.