Mnr HM du Plessis

SA waterbulletin

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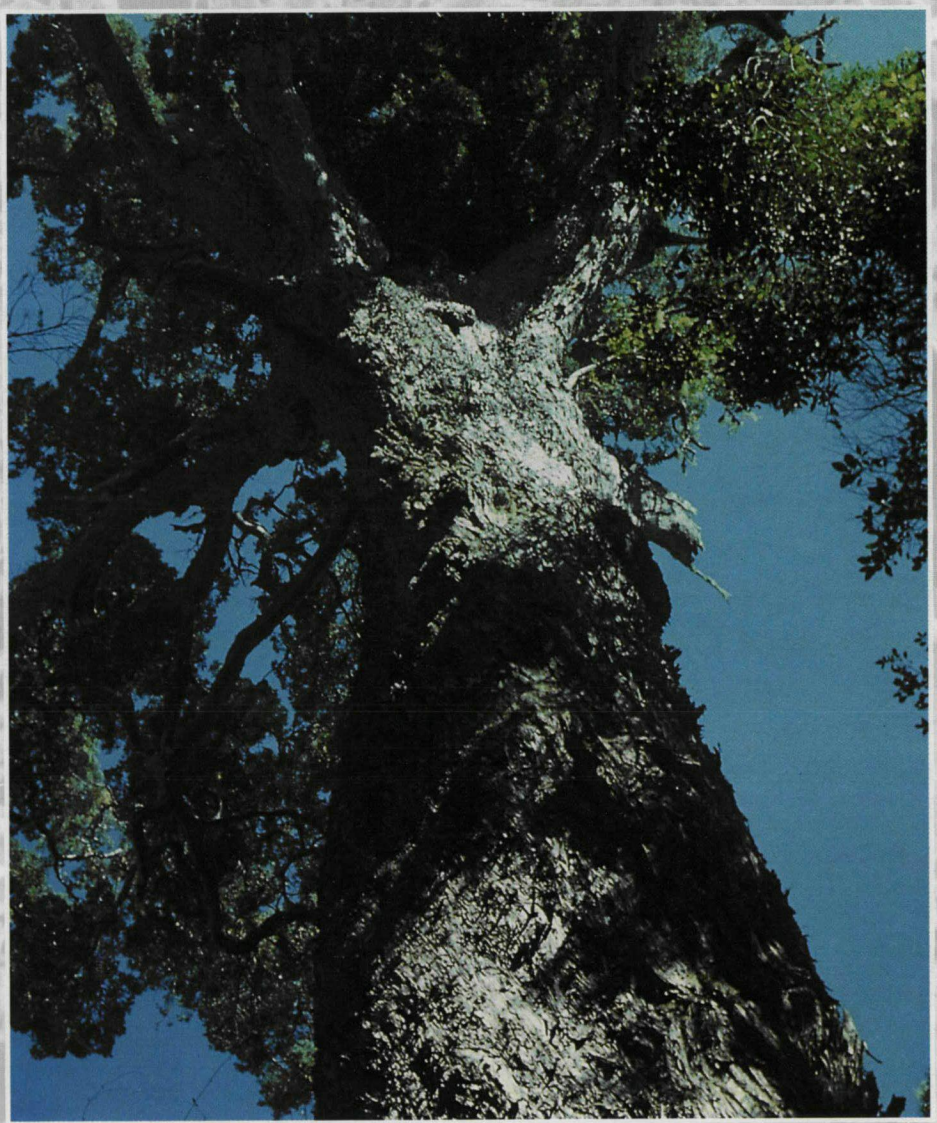


HYDROMETEOROLOGY

Scientists unlock climatic secrets hidden in wood anatomy

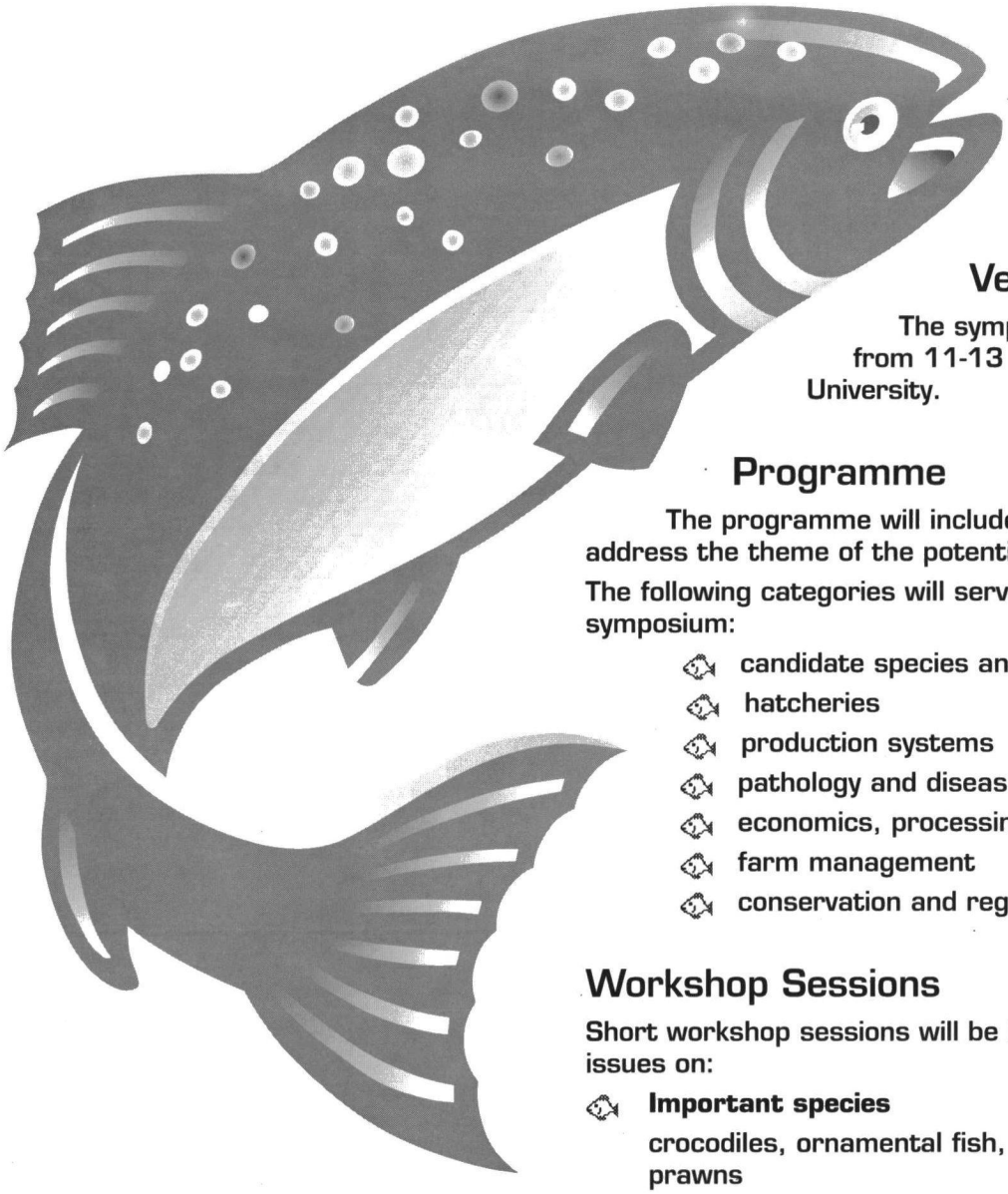
SLUDGE

WRC reports on chemical characterisation of municipal sludges

DRINKING WATER

Contaminants in food and water studied

Aquaculture 1990



Convened by Aquaculture Association of South Africa

Venue and date

The symposium will take place from 11-13 July 1990 at Stellenbosch University.

Programme

The programme will include speakers who will address the theme of the potential of aquaculture species.

The following categories will serve as a framework for the symposium:

- candidate species and genetics
- hatcheries
- production systems
- pathology and diseases
- economics, processing and marketing
- farm management
- conservation and regulatory aspects

Workshop Sessions

Short workshop sessions will be held to discuss topical issues on:

- **Important species**
  crocodiles, ornamental fish, catfish, tilapia, trout, prawns
- **Other subjects**

Enquiries should be directed to:

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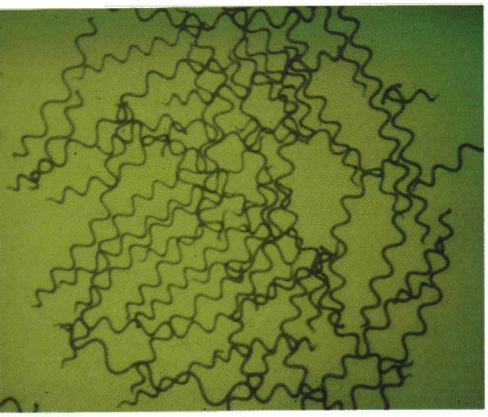

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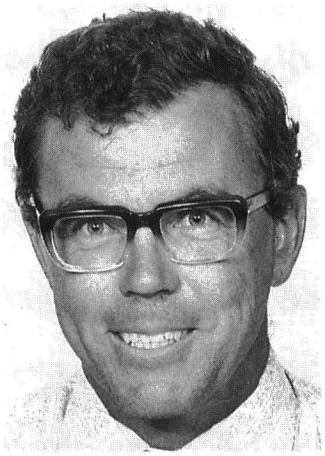
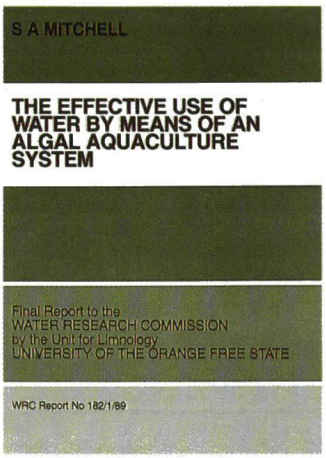
Inhoud

Cover: Wood anatomy, the key to climate patterns of yesteryear.

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, PO Box 824, Pretoria, 0001, Republic of South Africa. Tel: (012) 33-00340. Fax: (012) 70-5925. Editor: Jan du Plessis. Asst Editor: Helene Joubert, Ed Secretary: Rina Human, Colour separations: Lithotechnik, Design: Nicola Kuyper, Printing: Creda Press, Cape Town.



Dr SA Mitchell



Algal culture offers a method whereby nitrogen may be reclaimed from waste streams in a form which is acceptable as a protein supplement in the feed for livestock.

A WRC sponsored research project carried out by Dr SA Mitchell of the Unit for Limnology at the Unversity of the Orange Free State demonstrated that the filamentous alga Spirulina can be used to reclaim usable nutrients from agricultural waste.

In another experiment he used fairy shrimps (*Streptocephalus macrourus*) to graze on microalgae algae and to convert them into animal protein which is easily harvested.

Unfortunately production systems for both Spirulina and fairy shrimps are not economic under present conditions.

The final report on this research project entitled The effective use of water by means of algal aquaculture system is now available from the Water Research Commission.

Algae produce stock feed supplements from waste waters

Protein for inclusion in stock feed comes from a variety of sources, but the major sources over the past decades have been soy-bean oilcake and fish-meal.

Soy-bean oilcake is a renewable resource, and as such the supply is predictable within the limits imposed by such factors as the vagaries of the weather.

However, the fish from which fish-meal is made is a harvested resource. But many of the world's major known fish stocks are no longer large enough to give yields as high as they did during previous decades, and it has proved very difficult to impose adequate legislation on nations fishing in international waters.

On the other hand, the world is faced with an increasing population, and most people prefer animal protein to plant protein. This increasing demand for animal protein has led, amongst others, to the development of intensive live stock production units. A requirement of such units is the provision of a totally balanced diet for the livestock. The bacterial digestive processes of ruminants such as cattle, sheep and goats enable these animals to utilise a variety of nitrogen sources, including urea, to supply the required protein.

However, monogastric animals (primarily chickens and pigs) are not able to manufacture their own protein, and so must be fed a diet which contains balanced quantities of the amino acids. Some amino acids essential to animals are not found in any significant quantity in plant proteins, therefore a certain amount of animal protein must be included in their diet. Thus, the demand for a suitable source of animal protein (currently fish-meal) will increase with the increasing demand for meat.

In South Africa there was concern over the protein availability in the country in the late 1960s, but it was thought that with continued attention to agriculture and fishing, South Africa would be able to supply the protein necessary for the estimated 42 million people by the year 2000 without having to resort to using single cell protein. However, South Africa has since then become a net importer of protein.

Dr J Siertsema of the Protein Advisory Committee estimated that the total requirement of fishmeal protein for the 1985/1986 season would be 111 000 t (i.e. 186 000 t fish-meal) and for oilcake protein 128 000 t (i.e. approximately 290 000 t oilcake). This makes a total protein requirement of 239 000 t. However, the protein availabe from local sources is 76 000 t of fish-meal and 72 000 t oilcake, giving a total shortfall of 91 000 t which had to be imported in 1985/1986. In Dr Siertsema's opinion, a good season could reduce the shortfall from 91 000 t to approximately 60 000 t.

Projections from available data show that the shortfall of protein in South Africa could be in the order of 400 000 t by the end of the century.

The projected shortfall of protein necessitates the investigation of alternate sources of protein for inclusion into stock feeds. One option is the industrial scale production of SCP (single celled protein). However, it may take twenty years for the technology to develop to a point where it will make an impact on the demand. As an intermediate measure, there is a possibility of exploiting further fish stocks off the west coast of southern Africa. The estimated useful life of this stock is approximately twenty years. However, this source can only be relied on in the medium term and as long as there are no major political changes in the region.

WASTES

No provision has yet been made for reclaiming usable nutrients from wastes. Waste streams from human or animal sources are too dilute for the economical production of yeast or bacteria, but they do contain nutrients which can be recycled. It is estimated that approximately 70 per cent of the nitrogenous compounds fed to pigs was lost either through spillage or excretion, and that if approximately 30 per cent of this could be recycled as algal protein, then some 20 per cent of the total protein requirement of the swine rations could be supplied by waste grown algae. This would reduce the units' dependence on outside sources of protein, much of which is obtained at an energy loss.

For instance, the Japanese blue water fishing fleet runs at an overall efficiency of energy landed (whole fish) to energy expended (fossil fuel) of only 4 per cent. This inefficient use of finite fossil fuel resources is justified by the return in terms of essential amino acids contained in the fish.

If the algae grown in a wastewater system was harvested by filter-feeding invertebrates, and these in turn were harvested for inclusion in stock feed, then not only would the dependance on the harvest of natural fish stocks be reduced, but the provision of the essential amino acids would be less dependant on the inefficient use of fossil fuel. In fact the harvesting of solar energy by the algae during photosynthesis would render this process much more energy efficient than fishing.

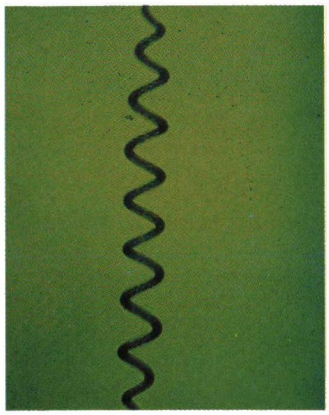
ALGAL CULTURE

The technology of algal mass culture has been much improved since the early 1950s when a production of 17,5 lb acre/a (ca. 11,5 g dry mass/m^2/d) was the norm. Production estimates of between 15 and 25 g/m^2/d are now general, with some figures exceeding this for limited periods. However, the reality of the situation is that, in spite of the high production rates, high protein content and other apparent advantages of algae, the only currently commercially viable large-scale production units are used to supply the health food or tropical fish food markets, both of which are limited in size and command a high price. However, the general production of algae in mass culture is still thwarted by high production costs and at present the greatest potential is where algae are produced as by-products in industrial operations, waste treatment or fine chemical production.

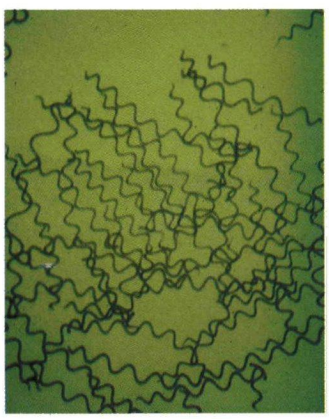
UOFS

The culture of filamentous algae such as Spirulina began at the University of the Orange Free State in mid 1983 using a defined medium (Zarouk's medium) in facilities designed for the culture of unicellular microalgae such as Chlorella and Scenedesmus. It was found that Spirulina could be grown successfully when agitated by a paddle-wheel, but that due to filament breakage, it was destroyed when agitated too vigorously. The algae was produced in blue plastic 'Portapools' of various diameters at a culture depth of ca. 1 m. These cultures were not agitated, and were harvested once weekly by

Female fairy shrimp, Streptocephalus macrourus *(lenght approximately 17mm). Note the eggs in the egg sac.*



A single filament of Spirulina *(length approximately 150 microns).*



Spirulina *filaments.*

pumping the entire culture through a net of 112 µm mesh size into an empty pond. Producing Spirulina in this way was costly because the medium was priced at ca. R16/m3 in 1983, and the cultures were prone to invasion by unicellular algae.

During the search for an organism that could be used as a means to recover nutrients from waste waters, it was shown that Spirulina grew well in brack water to which animal wastes had been added. It was also shown that it was to the Spirulina's advantage to be grown in polyculture with filter feeding invertebrates. These filter feeding invertebrates consumed the competing microalgae, and allowed the Spirulina to grow as a clean culture. Filter feeding invertebrates such as the brine shrimp Artemia and the waterflea *Moina micrura* were able to live successfully in Spirulina cultures while the Spirulina density was low, but rotifers such as *Brachionus plicatilis* and *Hexarthra fennica* were the only organisms able to live successfully in dense Spirulina cultures. Therefore the development of a system for the recovery of wastes from intensive livestock units could, once the technology has been adequately developed, enable the enterprise to produce a protein supplement at a lower price than the conventional supplements.

Researchers have shown that a system comprising Spirulina, (a filamentous algae), and filter-feeding invertebrates (rotifers) was able to recover from heavy infestations of unicellular microalgae.

When this system became infected by microalgae the rotifer numbers increased rapidly to a point where the algae was consumed faster than the reproduction rate of the algae. Rotifer breeding ceased at about the time the unicellular algae disappeared from the culture and their numbers fell to low values before building up again to the steady state (ca. 1 to 2 individuals/mℓ for *Brachionus plicatilis).* The Spirulina output lagged a little after the unicellular algal numbers had been reduced before it returned to a steady state.

The nutrient requirements of the Spirulina grown in an agricultural waste medium have been determined. Using full strength Zarouk medium as control, it was found that solid waste produced by the animals on intensive livestock units at 1 g/ℓ could replace all the nutrients in the Zarouk medium except for bicarbonate and nitrate. Under continuous light in the laboratory, addition of up to 2 g/ℓ sodium bicarbonate stimulated growth, but further additions had little effect. In the same way, increasing the quantity of sodium nitrate from 0 to 0,25 g/ℓ resulted in increased growth, but further increases had little effect. When these experiments were repeated in 0,5 m^3 cultures out of doors, the concentrations at which growth showed little further response were 0,5 g/ℓ sodium bicarbonate and 0,05 g/ℓ sodium nitrate respectively.

Research showed that if urine was used in conjunction with solid agricultural wastes, there was enough nitrogenous compounds to support growth at a rate where further additions of nitrogen made little difference. Therefore, in a farming situation where all the waste produced by the animals would be available, the addition of further nitrogen sources would not be necessary.

This project was therefore aimed at extending the technology of waste-water treatment by microalgae to produce an easily harvested end product which may be used as a protein supplement in stock feed. While waste water may be effectively treated by microalgae to remove dissolved solids, the algae must be removed from the effluent before the effluent will conform to the required effluent standards for total suspended solids. Harvesting the algae by flocculation, centrifugation or any other such method renders the process too expensive. This project investigated the possibility of using organisms that were large enough to be harvested easily to treat the waste water. A dual approach was adopted:

- In the first place the filamentous alga Spirulina was used in a single step treatment system. As this alga requires brack water, its use is envisaged in areas of the country where there are sources of underground water which are too saline for conventional agriculture.
- The second possibility investigated was treating the waste water with microalgae and then using filter-feeding micro-organisms to graze on the microalgae to remove the total suspended solids and at the same time convert it into animal protein which is easily harvested.

The micro-organism investigated during this project was the fairy shrimp *(Streptocephalus macrourus),* although others such as rotifers or cladocerans will perform the same function.

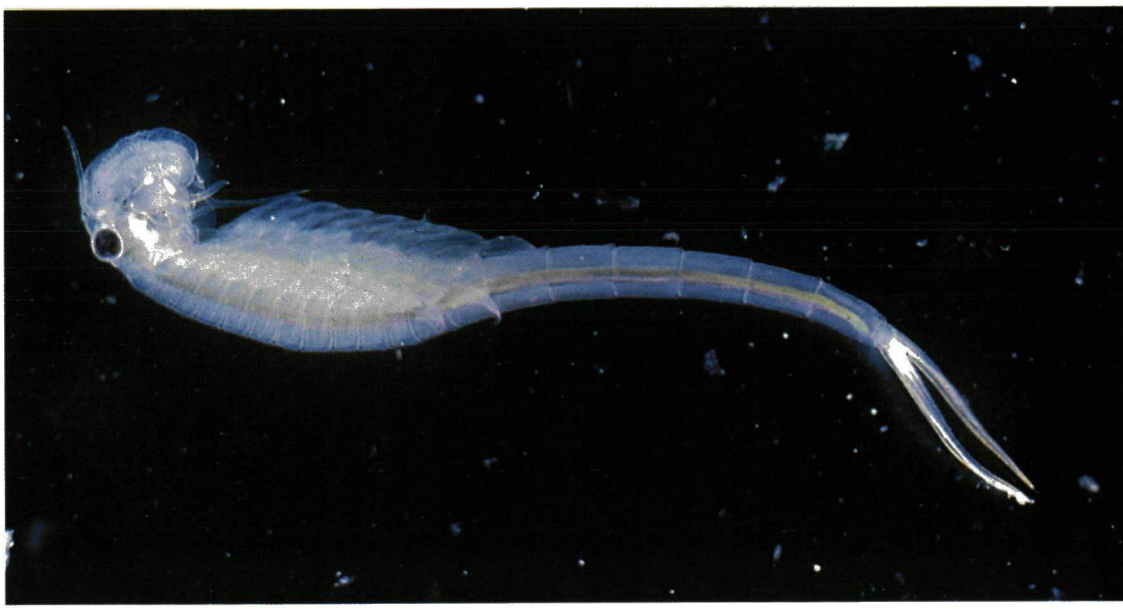
However, *Streptocephalus macrourus* (Anostraca), the fairy shrimp is the most efficient of all the organisms investigated because it can be kept in higher densities than the other organisms and is capable of using the food more efficiently than the other organisms. Studies have shown that anostracans are able to survive and grow at higher densities than organisms from permanent waters, and this factor was to be a key to the success of the fairy shrimp in mass culture. Organisms may be grown successfully at densities of 1 500/l, giving a mean daily production of approximately 120 mg/l/d dry mass when fed only algae. This production is substantially higher than reported in the literature for other organisms.

RESULTS

- Experimental work has indicated that the small scale mass polyculture of Spirulina/rotifers is technically fea-

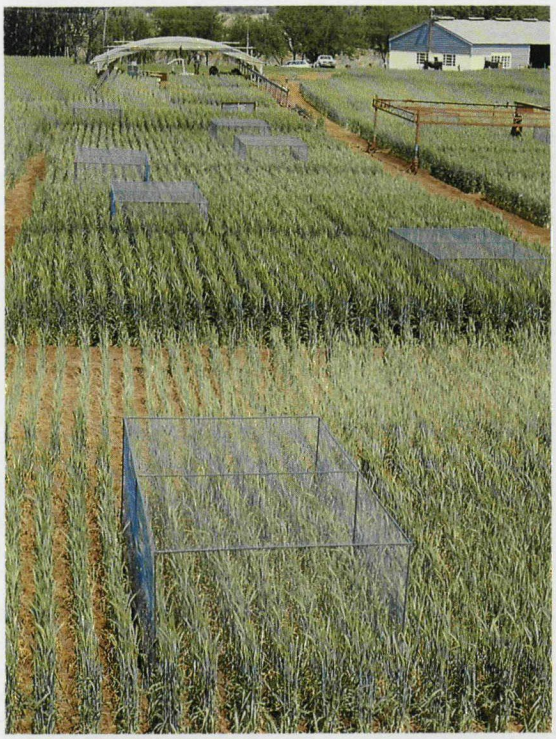
sible, and will maintain production with a minimum of skilled supervision provided certain management criteria are met. Currently, at the value of the harvest of a stock feed, the Spirulina produced by the unit would cover up to 97 per cent of the running costs at a production of 15 g m^2/d. Therefore under the current price structure the Spirulina production system is not viable, and will not become so until either the price of the product increases substantially or the culturing technology improves to a point where a higher production may be predictably obtained.

- More than 95 per cent of the total phosphate contained in the waste is made available to the algae by the anaerobic fermentation. However, nitrogen is rapidly lost from the system during the fermentation.
- Aeration at the rate of 42,5 ℓ/m^2/h is sufficient to maintain culture stability. The supply of this quantity of air requires a unit of approximately 10 kW/ha.
- Spirulina will grow well in water in which the dominant anion is sulphate, but the presence of even small quantities of calcium will depress growth at all concentrations of NaCl except the optimum (10 g/ℓ). Low concentrations of calcium will stimulate growth slightly at ca. 10 g NaCl/ℓ.
- The optimum pH of 9,5 for the rotifer *Brachionus plicatilis* falls within the optimum pH range of Spirulina.
- The fairy shrimp, *Streptocephalus macrourus*, were fed daily on rations estimated as a proportion of their own dry mass. Those fed at 0,11 and 0,21 of their dry mass daily showed considerable mortality as a result of starvation. Those fed at 0,32 of their dry mass daily showed little mortality, but also a very low growth rate. However, they did give a good growth efficiency. Organisms in the treatment fed at 0,47 of their dry mass daily gave a growth rate comparable to those receiving 0,7 of their dry mass daily, and a growth efficiency comparable to the treatment receiving 0,32 of their dry mass daily. However, in one experiment, the mortality of shrimps fed 0,7 was higher than that of organisms fed at lower rations, so too much food may be detrimental to survival.
- The best results for both production and growth efficiency were obtained when the organisms were fed dry algae (estimated mass) at 0,47 of the estimated dry mass of the organisms daily. The nearest levels above and below this that were tested were 0,32 to 0,70. Therefore a daily ration of dry alga of approximately 0,5 of the estimated dry body mass will give the best results in terms of growth efficiency, production and survival.
- Between densities of 10 to 400/ℓ, the production increased linearly. Optimal production was achieved at 1 000/ℓ, although higher productions were achieved by more dense cultures. However, the mortality in the dense cultures was unacceptably high, and at 4 000/ℓ mortality was over 95 per cent so it is apparent that at this density the organisms do suffer density dependant mortality. The statement that the organisms from temporary waters do not suffer density dependant mortality holds true to the point that these organisms can survive at densities which those from permanent waters could not, but there is a limit to the density that even these organisms can tolerate. However, these organisms are able to live in much higher densities than organisms from permanent water.
- Fairy shrimps can produce at over 100 mg dry mass/l/d in mass culture under a range of culture densities and feeding regimes. The mean maximum recorded productivity was 168 mg/ℓ/d which came from the culture at a density of 4 000 organisms/ℓ before the mortality began. However, in the batch culture treatments, organisms at a density of 400/ℓ gave a mean daily productivity of 95 mg dry mass/ℓ/d. This indicates a substantial reduction in productivity per individual at the higher densities.
- The production of fairy shrimps as a protein supplement for stock feed is not economic under present conditions.
- A place where fairy shrimps or some other invertebrate production may be used is to clear algae and/or bacteria from a waste stream. Currently algal production is not used for the treatment of wastes because the cost of removing the algae. However, if the waste stream containing the algae and/or bacteria was passed through a reactor containing suitable invertebrates, these would remove the suspended solids from the waste stream, which would then be fit for discharge into waterways.



Mail fairy shrimp, Streptocephalus macrourus *(length approximately 20 mm).*

Copies of this report, no 182/1/89 are available from the Water Research Commission. To order, please complete the postcard in this Bulletin.



Gewasgebaseerde besproeiing-skedulering toon groot voordele

LINKS: Proefpersele wat by die NIGB se Roodeplaat-proefterrein buite Pretoria volgens die gewaswaterstatus-benadering besproei is.

Besproeiingsmasjiene is gebruik om persele te besproei. Die masjiene is in staat om besproeiingswater baie akkuraat en eweredig toe te dien.

Navorsers van die Navorsingsinstituut vir Grond en Besproeiing (NIGB) te Pretoria het onlangs 'n besproeiingskeduleringstegniek getoets waar die waterstatus van koring gebruik is om te bepaal wanneer die koring besproei moet word.

Die navorsers, mnre AA Nel en FJ Dijkhuis, sê besproeiingsbestuur of skedulering gaan normaalweg om die beantwoording van twee vrae, naamlik, wanneer moet 'n gewas besproei word en hoeveel water moet toegedien word?

Die meeste besproeiingskeduleringstegnieke wat tans gebruik word, is op 'n grondwaterbalans gebaseer aangesien dit 'n relatief eenvoudige wyse is om die grondwaterstatus te beraam. Sodra die grondwaterstatus 'n drumpelwaarde bereik, dui dit die nodigheid van 'n besproeiing aan. Die drumpelwaarde word gedefinieer as die grondwaterstatus net voor opbrengsverlagende waterstremming by die gewas intree.

'n Duidelike verband tussen die grondwaterstatus en die gewaswaterstatus bestaan egter nie omdat atmosferiese toestande ook 'n invloed op die gewas se waterstatus het. Aangesien dit primêr die gewas se waterstatus (of die minimum waterstatus wat bereik word,) is wat graanopbrengs beïnvloed, is dit teoreties die geskikste parameter om die behoefte aan 'n besproeiing aan te dui.

Die waterstatus van 'n gewas toon 'n daaglikse siklus met 'n minimum wat gedurende die middag, gewoonlik tussen 12:00 en 14:00, bereik word. Dit is gevolglik ook die tyd wanneer die eerste sigbare tekens van waterstremming voorkom.

Die bepaling van die waterstatus van 'n gewas soos deur die blaarwaterpotensiaal aangedui, is relatief moeilik en vereis gesofistikeerde instrumente, 'n mate van vaardigheid om metings te neem en 'n kundige om dit te interpreteer. Hierdie struikelblokke is deels daarvoor verantwoordelik dat metodes van skedulering wat op die blaarwaterpotensiaal berus nog nie toepassing gevind het nie.

VERGELYKING

'n Eenvoudige lineêre vergelyking waarmee die blaarwaterpotensiaal van koring vanuit die grondwaterinhoud en weersveranderlikes beraam kan word, is vir die Roodeplaat-navorsingspersele buite Pretoria deur mnr Nel en 'n voormalige navorser van die NIGB, mnr Pedro Berliner, ontwikkel.

Gereelde beramings van die blaarwaterpotensiaal deur middel van die vergelyking maak die moeitevolle meet van die gewas se blaarwaterpotensiaal gedurende die middag oorbodig.

Met die ontwikkeling van die tegniek was dit egter nog onduidelik of daar 'n goeie verband tussen die drumpelpotensiaalwaarde en graanopbrengs, waterverbruik of die spitswaterverbruik bestaan. Vervolgens is 'n besproeiingsproef gedurende 1988 uitgevoer waartydens die vergelyking gebruik is om die blaarwaterpotensiaal van koring by Roodeplaat te beraam. Sewe besproeiingsbehandelings is toegepas deur te besproei sodra die beraamde blaarwaterpotensiaal vooraf gekose drumpelpotensiaalwaardes bereik het. Die drumpelwaarde is so gekies dat 'n reeks blaarwaterpotensiale wat wissel van geen stremming tot baie stremming voordat besproei is, bereik is. Die seisoenale waterverbruik, spitswaterverbruik wat gedurende die seisoen voorgekom het, asook die graanopbrengs, is noukeurig bepaal.

RESULTATE

Verrassende resultate is verkry. Die vergelyking was geskik om die blaarwaterpotensiaal onder die Roodeplaatse klimaatstoestande te beraam. Graanopbrengs, waterverbruik en die spitswaterverbruik het almal hoogs betekenisvolle funksies van die drumpelpotensiaal wat toegepas is, getoon. Die implikasie hiervan, indien resultate hulself oor jare en kultivars sou herhaal, is dat daar vir 'n spesifieke graanopbrengs-waterverbruik-kombinasie besproei kan word. So sal dit moontlik wees om besproeiings te skeduleer vir spesifieke doelwitte soos hoogste opbrengs, hoogste waterverbruiksdoeltreffendheid of die mees ekonomiese opbrengs wat tussen eersgenoemde twee punte geleë is. Met dié proef is drumpelpotensiale vir die beste waterverbruiksdoeltreffendheid en maksimum opbrengs ook verkry. Voorts toon die resultate duidelik dat die graanopbrengs as funksie van waterverbruik 'n afplattingsfase bereik. Dit beteken dat 'n te nat behandeling of te gereelde besproeiing nie 'n hoër opbrengs as 'n effens droër behandeling lewer nie, maar dat die waterverbruik heelwat hoër is.

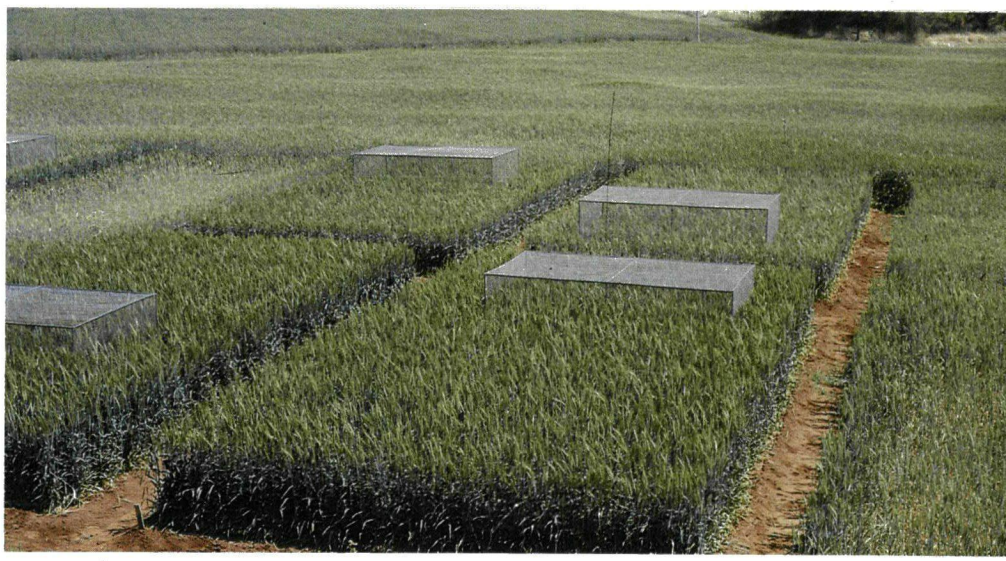
Volgens die navorsers behoort hierdie metode van skedulering die laagste moontlike besproeiingsfrekwensie te verseker. Dit het die teoretiese voordeel dat dit verdampingsverliese vanaf die grondoppervlak, wat elke keer voorkom wanneer die grondoppervlak deur besproeiing benat word, tot 'n minimum beperk. Die opbrengs-waterverbruikverhouding van die proef stem ooreen met of oortref die beste historiese resultate van die Roodeplaat-proefterrein, wat die teorie ondersteun.

WATERBALANSMODEL

Die navorsers is van mening dat die vergelyking baie maklik by 'n waterbalansmodel geïnkorporeer kan word. Sodoende sal die nuut ontwikkelde vergelyking 'n antwoord kan verskaf op die vraag: Wanneer moet besproei word? terwyl die waterbalans weer 'n antwoord kan verskaf op die vraag: Hoeveel besproei moet word ?

'n Verdere voordeel van so 'n gekombineerde model is dat dit slegs weersveranderlikes as insette nodig het en indien dit tydig vanaf 'n outomatiese weerstasie verkry kan word, sal dit die behoefte aan 'n besproeiing dadelik toon.

Tot dusver is die werk nog net vir koring by Roodeplaat gedoen en moet ondersoeke na die toepasbaarheid van die benadering vir ander gewasse en lokaliteite nog uitgevoer word.



Draadhokke is in die persele geplaas om 'n oesbare gedeelte van die koring teen moontlike hael- of voëlskade te beskerm. Die oesbare gedeelte is gebruik om die opbrengs van die koring te bepaal.

Report released on the inorganic chemical characterization of SA's municipal sewage sludges

Mr R Smith

Mrs H Vasiloudis

The results of an investigation carried out by the Division of Water Technology (DWT) of the CSIR on the inorganic chemical contaminants and nutrients in South African sewage sludges have been released by the Water Research Commission in the form of a final report.

The project, which started in July 1982 and came under the sponsorship of the Water Research Commission in January 1986, had four aims, according to the researchers, R Smith and H Vasiloudis:

- To carry out a literature study on the inorganic chemical contaminants and nutrients commonly found in sewage sludge, their beneficial and adverse effects apropos the use of sewage sludge as supplementary 'fertilizer' for agricultural land, and the analytical methods used for their determination.
- To investigate and test the most suitable of these methods for eventual incorporation in a laboratory manual for the determination of inorganic chemical contaminants and nutrients in sewage sludge.
- To sample a countrywide range of South African municipal sewage sludges on a four-times-per-year basis and to analyse them for the presence of the most common inorganic chemical contaminants and nutrients.
- To use the analysis results, in conjunction with previous related work conducted by the DWT, and with reference to limits laid down by various overseas countries, to prepare a set of suggested guidelines for the application of disinfected sewage sludge to agricultural land in this country. These results would also provide a fairly universal indication of the quality of South African sewage sludges with respect to their inorganic chemical contaminant and nutrient content.

DO YOU HAVE PROBLEMS WITH THE PURIFICATION OF WATER?

ARE YOU CONCERNED ABOUT THE QUALITY OF SOUTH AFRICA'S DRINKING WATER?

Then you should attend the session

BIOLOGY OF WATER PURIFICATION

of the SASAS Congress, University of the Orange Free State, Bloemfontein to be held on Tuesday 3 July 1990

All persons interested in water treatment and the quality of South Africa's drinking water are invited to attend the congress. Come and enjoy the company of those who take water treatment seriously! *Come and share your worries, woes and joys in water treatment with others! In this way we can all make a contribution towards a common and better understanding of one of our major national problems.*

As the quality of water becomes increasingly threatened due to population increase, urbanisation and industrialisation, water purification problems intensify. The Bloemfontein meeting will be an important and timely gathering of all persons involved with water treatment.

The annual congress of the South African Society of Aquatic Scientists (SASAS), will be held in the Medical Faculty of the UOFS from 2 to 4 July, 1990. The program will include a number of plenary sessions (of which the BIOLOGY OF WATER PURIFICATION will be one), as well as workshops and poster displays. Social functions will include a dinner and two or three less formal gatherings (e.g. braai or cocktail party).

The following topics will be discussed in more than ten papers during the BIOLOGY OF WATER PURIFICATION session on Tuesday 3 July 1990.

- The stimulation, coordination and financial support of water purification research.
- Financial aspects of the treatment of algal and inorganic suspensoid-laden waters.
- Case studies of algae and water purification problems at different localities in the Transvaal, Natal and Orange Free State.
- The effect of different oxidants, dissolved air flotation and slow sand filtration on the removal of algae and inorganic turbidity in raw water.
- Taste and odour problems, in potable water and impoundments.
- Problems associated with algal poisons in potable water sources.

A workshop entitled MANAGEMENT REQUIREMENTS AND RESEARCH NEEDS FOR WATER PURIFICATION will follow on the paper session.

Persons interested in attending this timely meeting should complete the post card in this bulletin and post it immediately to the organisers or contact Professor AJH Pieterse, Chairman: Local Organising Committee, Department of Botany, University of the Orange Free State, PO Box 339, BLOEMFONTEIN, 9300. Tel: (051) 401-4241. Fax: (051) 401-2425.

WISA MINE WATER GROUP

OPEN DAY AT RUSTENBURG PLATINUM MINE

The WISA Mine Water Group will be holding an Open Day at the Rustenburg Platinum Mine under the auspices of the Water Institute of Southern Africa, the South African Industrial Water Association, Rustenburg Platinum Mine and Rustenburg Base Metal Refinery.

DATE: 8 June 1990

VENUE: Rustenburg Platinum Mine Recreation Club

COST: R50,00 per person

Programme

9:00 – 9:30 "Overview of the Water Management at Rustenburg Mine" by Rustenburg Platinum Mine.

9:30 – 11:00 SESSION ON SULPHATE REMOVAL FROM MINE WATER.

9:40 – 9:50 "Why Remove Sulphate from Mine Water?" by HNS Wiechers, COMRO.

9:50 – 10:00 "Barium Sulphide Process" by D Bosman, Anglo American Corporation.

10:00 – 10:10 "Barium Carbonate Process" by C Buckley, Pollution Research Group, University of Natal.

10:10 – 10:20 "Biological Sulphate Removal Process" by J Maree, Division of Water Technology, CSIR.

10:20 – 10:30 "Ion Exchange Process" by D Everett, JCI.

10:30 – 10:40 "SPARRO Process" by RW Busby, COMRO.

10:40 – 11:00 DISCUSSION.

11:00 – 11:30 TEA.

11:30 – 12:00 "Water Management at the Rustenburg Base Metal Refinery" by J Gowland.

12:00 – 12:30 WISA MINE WATER TECHNICAL DIVISION.

- "Background the need for Division" — HNS Wiechers, Chairman WISA Mine Water Group.
- "WISA Philosophy on Technical Divisions" — PE Odendaal, WISA President.
- Vote to form Division.
- Election of Committee.

12:30 – 14:00 LUNCH.

14:00 – 18:00 Visit to Rustenburg Base Metal Refinery to view Brine Concentrator Facility. (Please note that a maximum of 50 delegates can be accommodated on this visit.

Enquiries should be directed to the WISA Secretariat at Tel no: (011) 728-4303 or Fax no: (011) 728-5444.

DIE WATERINSTITUUT VAN SUIDER-AFRIKA

TWEEDE TWEEJAARLIKSE KONFERENSIE/ UITSTALLING

13 – 16 MEI 1991

WORLD TRADE CENTRE
KEMPTON PARK

EERSTE AANKONDIGING en UITNODIGING VIR REFERATE

Posbus 1948, Parklands 2121
Tel (011) 728-4303

Byvoegsel tot *SA Waterbulletin:* Maart 1990

REFERATE

Word gevra oor enige aspek van die multidissiplinêre wetenskappe wat verband hou met die bestuur en behandeling van water en afvalwater insluitende:

- Drinkwaterbehandeling en -verspreiding
- Vastestof/vloeistof-skeidingstegnologie
- Nywerheids- en mynwaterbehandeling
- Bestuur van die wateromgewing
- Aerobiese/Anaerobiese behandelingstegnologie
- Opvoeding en opleiding
- Bestuur van riviere en waterbronne

Sinopsis

Seleksie van referate vir die konferensie sal gebaseer word op 'n sinopsis bestaande uit 'n titel en 'n kort oorsig (300 woorde) wat die Sekretaresse teen **31 Julie 1990** moet bereik. Daar is geen beperking op die aantal titels/ sinopsisse wat voorgelê mag word nie, maar elke outeur sal beperk word tot die aanbieding van slegs *een* referaat.

Suksesvolle Outeurs

Sal versoek word om teen 15 Februarie 1991 die volgende in te lewer:

- Twee A4 bladsye (maks.) uitgebreide opsomming vir voorgeskrewe formaat. Dit sal opgeneem word in 'n gebinde volume wat *voor* die konferensie aan afgevaardigdes beskikbaar gestel sal word.
- 'n Volledige referaat nie langer as 12 A4 bladsye nie in voorgeskrewe formaat. Die referate sal in 'n kongreshandleiding opgeneem word wat *na* die konferensie te koop sal wees.

PLAKKAATREFERATE

Sal verwelkom word.

TAAL

Afrikaans of Engels kan gebruik word, maar daar sal geen vertaaldiens beskikbaar wees nie.

OORSESE BESOEKERS

Die presidente van verskeie vooraanstande oorsese institute wat met water gemoeid is, is uitgenooi om die konferensie by te woon.

SOSIALE GELEENTHEDE

Maandag	13 Mei	Aand Groet en Ontmoet
Dinsdag	14 Mei	Banket
Woensdag	15 Mei	Aand vry vir eie vermaak
Donderdag	16 Mei	Opsionele ná konferensie toere

REGISTRASIE

			Opmerking
• **AFGEVAARDIGDES:**	WISA-lid	R425	1
	Nie-lid	R495	2
• **DAAGLIKSE TARIEF:**	WISA-lid	R185	2
	Nie-lid	R215	2
• **AANBIEDERS VAN REFERATE**			
Mits referate teen 31 Januarie 1991 ontvang is		R275	1
• **STUDENTE/AFGETREDE LEDE**		R225	2
• **METGESELLE**		R225	3
• **BANKETGASTE**		R 80	

Opmerking:

1. Sluit in: sinopsis van referate, banket, middagetes, tee, tegniese toere en toegang tot uitstallings.
2. Sluit in: slegs sinopsis van referate, middagete/tee en toegang tot uitstallings. Banket uitgesluit.
3. Sluit toere en banket in.
4. Gedrukte en gebinde eksemplare van die volledige stel referate sal **na** die konferensie teen R110 stuk bestel kan word.

Penalisering vir registrasie na 16 April 1991 — 20%

KANSELLASIES

'n Bedrag van 50% sal van toepassing wees op alle kansellasies wat na 3 April 1990 ontvang word.

PROGRAM VIR METGESELLE

Sal gereël word indien genoegsame belangstelling dit regverdig.

TEGNIESE TOERE

'n Verskeidenheid toere na nabygeleë installasies sal op Donderdag, 16 Mei 1991 onderneem kan word.

UITSTALLING

Die lokaal is spesiaal ingerig vir hierdie doel en alles moontlik sal gedoen word om die grootte, oppervlakte en die professionele aanbieding van die stalletjies te verhoog.

PARKERING

'n Groot area vir gratis parkering is beskikbaar.

HOTELLE

Die Airport Holiday Inn, Airport Sun en City Lodge is maklik per motor bereikbaar.

THE WATER INSTITUTE OF SOUTHERN AFRICA

2nd BIENNIAL CONFERENCE/ EXHIBITION

13 – 16 MAY 1991

WORLD TRADE CENTRE
KEMPTON PARK

FIRST ANNOUNCEMENT and CALL FOR PAPERS

PO Box 1948, Parklands, 2121
Tel (011) 728-4303

Supplement to *SA Waterbulletin:* March 1990

PAPERS

Are invited on any aspect of the multidisciplinary sciences associated with the management and treatment of water and waste water including:

- Potable water treatment and distribution
- Solid/Liquid separation technology
- Industrial and mining water treatment
- Management of the aquatic environment
- Aerobic/anaerobic treatment technology
- Education and training
- Management of rivers and water resources

Synopses

Selection of conference papers will be based on synopses comprising a title and a brief outline (300 words) which must reach the Secretary by **July 31 1990.** Any number of titles/synopses may be submitted but an individual author will be limited to presenting only *one* paper.

Successful Authors

Will be requested to submit by February 15 1991:

- Two A4 (max.) page extended abstract in prescribed format. This will be included in a bound volume for presentation to delegates *before* the conference.
- A full paper not exceeding 12 A4 pages in a prescribed format for binding into conference manual which will be for sale *after* the conference.

POSTER PAPERS

Will be welcomed.

LANGUAGE

Either English or Afrikaans may be used but there will be no translation service.

OVERSEAS GUESTS

The Presidents of several prominent overseas water related institutions have been invited to attend.

SOCIAL EVENTS

Monday	13 May	Evening Meet and Greet
Tuesday	14 May	Banquet
Wednesday	15 May	Evening free for private entertainment
Thursday	16 May	Optional Post Conference Tours

REGISTRATION

			Note
• **DELEGATES:**	WISA member	R425	1
	Non-member	R495	1
• **DAILY RATE:**	WISA member	R185	2
	Non-member	R215	2
• **PRESENTERS OF PAPERS**			
Provided papers received by January 31 1991		R275	1
• **STUDENTS/RETIRED MEMBERS**		R225	2
• **ACCOMPANYING PERSONS**		R225	3
• **BANQUET GUESTS**		R 80	

Note:

1. Includes synopses of papers, banquet, lunches, teas, technical tours and entry to exhibition.
2. Includes synopses of papers lunch/teas and entry to exhibitions only. Banquet not included.
3. Includes tours and banquet.
4. Printed and bound copies of full set of papers will be available on order **after** the conference at a price of R110.

Penalty for registration after 16 April 1991 — 20%

CANCELLATIONS

A fee of 50% will apply to all cancellations received after 3 April 1990. Substitutions can be made at any time.

PROGRAMME FOR ACCOMPANYING PERSONS

Will be arranged if the demand warrants.

TECHNICAL TOURS

A selection of tours to nearby installations will be available on Thursday 16 May 1991.

EXHIBITION

The venue is custom designed for this purpose and every endeavour will be made to increase the size, scope and degree of professional presentation of the stands.

PARKING

An extensive area of free parking is available.

HOTELS

The Airport Holiday Inn, Airport Sun and City Lodge are readily accessible by car.

The treatment and disposal of sewage sludge is frequently the most costly phase of municipal waste-water treatment, and also presents environmental, health and aesthetic problems. The sludge may be disposed of by any of the following means:

- Application, in raw or composted form, to agricultural land.
- Burial in sanitary landfill sites.
- Disposal at sea.
- Incineration.

Although the properly designed disposal of sewage sludge to sea is unlikely to have any direct effects on public health when adequate dilution is provided for, careful selection of the disposal site is advisable in order to avoid any detrimental effects on the marine environment, in particular on accumulator organisms such as mussels and oysters.

Incineration will avoid many of the problems associated with the disposal of sludge to land or sea, but it requires considerable capital outlay, while operating costs are relatively high, and careful control is necessary in the removal of the resulting ash, dust and scrubber water and on chimney emissions.

The application of sewage sludge to agricultural land, often being the least expensive disposal alternative, has the added benefit of soil-conditioning properties, and valuable nutrients such as nitrogen and phosphorus, and to a lesser extent, potassium, calcium, magnesium, and certain trace elements, are also utilized. In many overseas countries it is being used increasingly for this purpose. Burial in landfill sites, although unproductive, often has economic advantages, and may avoid many of the risks associated with land application. Since many sludges will contain toxic substances in concentrations higher than those found in typical soils, their continued use could lead to adverse crop and food chain effects, due to plant uptake of certain trace metals and of other contaminants which may be present in the sludge, not only in organic and inorganic chemical form, but also in the form of pathogens. Contamination of ground water could also result from toxic substances leached from the sludge.

It is therefore essential that sludges destined for agricultural applications be adequately monitored for the presence of these contaminants. To this end, countries such as the UK, USA and Canada have carried out countrywide chemical analyses of their sewage sludges and based on the results obtained, have subsequently established suitable guidelines for the application of this material to agricultural land.

Since the chemical nature of sewage sludge varies widely, and sludge in many parts of South Africa may not be contaminated with hazardous compounds to the same extent as in highly industrialised countries abroad, the National Institute for Water Research (NIWR), now the Division of Water Technology (DWT) of the CSIR proposed that a similar exercise be carried out in this country, rather than merely adapt existing

Table 1: Maximum permissible contaminant concentrations (mg/kg, dry basis) in sewage sludges for application to agricultural land (overseas)

Contaminant / Country	Cd	Cr	Cu	Pb	Ni	Zn	Hg	As	Se	Mo
Belgium	10	500	500	300	100	2 000	10	10	25	-
Denmark	8	-	-	400	30	-	6	-	-	-
Finland	30	1000	3000	1200	500	5000	25	-	-	-
France	20	1000	2000	800	200	3000	10	-	100	-
Germany	20	1200	1200	1200	200	3000	25	-	-	-
Netherlands	10	500	600	500	100	2000	10	10	-	-
Norway	10	200	1500	300	100	3000	7	-	-	-
Sweden	15	1000	3000	300	500	10000	8	-	-	-
Switzerland	30	1000	1000	1000	200	3000	10	-	-	20
Canada*	20	-	-	500	180	1850	5	75	14	20
EEC-recommended	20	750	1000	750	300	2500	16	-	-	-
EEC-mandatory	40	-	1500	1000	400	3000	-	-	-	-
Lowest recommended value	8	200	500	300	30	1850	5	10	14	20
Highest recommended value	40	1200	3000	1200	500	10000	25	75	100	20
Mean of recommended values	19	795	1430	690	235	3485	12	32	25	20
Median recommended value	20	1000	1100	675	200	3000	10	10	46	20

* Canada: Values apply to sludges and sludge-based commercial products containing <5% nitrogen

overseas guidelines. The analysis results obtained would also provide useful 'baseline' information on the concentrations of the various contaminants and nutrients present in a wide range of South African sewage sludges, and would assist in assessing the suitability of individual municipal sludges for agricultural and horticultural use.

In this regard, it should be noted that the Department of National Health and Population Development in South Africa stipulates that sewage sludges destined for agricultural and horticultural use be disinfected to remove pathogenic organisms.

RESULTS

Twelve major inorganic chemical contaminants (cadmium, chromium, copper, lead, nickel, zinc, mercury, molybdenum, arsenic, selenium, boron, fluoride) were identified as being commonly present in sewage sludge and suitable analytical methods were developed and tested for their determination, as well as for the determination of the nutrients previously mentioned. Samples of air-dried sludge were collected from 77 South African sewage works and analysed for both inorganic chemical contaminants and nutrient content.

The results obtained, as well as providing valuable information on the chemical quality of South African sewage sludges, were used in conjunction with related work previously conducted by the National Institute for Water Research, and with reference to limits laid down by various overseas countries, to prepare a set of suggested guidelines for the application of disinfected sewage sludge to agricultural land in South Africa.

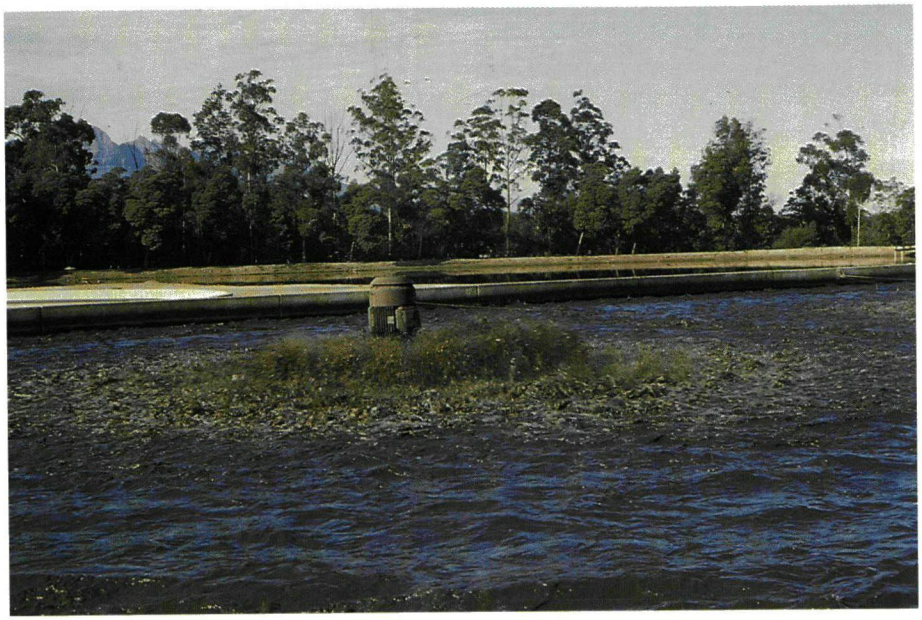
GUIDELINES

It is advisable that the application of sewage sludge to agricultural land should be strictly controlled in order to minimise the risks associated with this practice. Guidelines in existence in many overseas countries at the commencement of this project were reviewed (Table 1). It can be seen from this table that there are, in many cases, significant differences in the guidelines laid down by the various countries.

In 1984, there were no guidelines in existence in South Africa for the application of sewage sludge to agricultural land and the National Institute for Water Research prepared a set of suggested guidelines for the Department of National Health and Population Development, based largely on results of a survey on the concentrations of heavy metals in sewage sludges in the Cape Province. Limits were suggested for cadmium, cobalt, chromium, copper, mercury, molybdenum, nickel, lead and zinc, in the case of 'Type D' sludge (i.e. pasteurised, heat-treated, irradiated, lime-stabilised, fumigated or composted sludge) produced for unlimited use on land at a maximum application rate of 8 dry tons/hectare/year (Table 2).

In formulating the suggested guidelines listed in Table 3 cognisance was taken of the following:

- Existing overseas guidelines (Table 1 - see page 10 please).



TOP: Aerobic stabilisation of sewerage sludge before composting.
BOTTOM: Sludges of acceptable chemical content can be composted for agricultural use.

Table 2:

Maximum metal content in Type D sewage sludge

Metal	Maximum metal content (mg/kg dry sludge)
Cadmium	20
Cobalt	100
Chromium	2750
Copper	750
Mercury	10
Molybdenum	25
Nickel	200
Lead	250
Zinc	2750

- Guidelines proposed by the National Institute for Water
- Research for the Department of National Health and Population Development (Table 2).
- Results obtained from the analysis of sludges from the 77 South African sewage works co-operating in this project.

In addition to those contaminants for which maximum limits were established for the Department of National Health and Population Development (Table 2), maximum permissible concentrations were proposed for arsenic, selenium, boron and fluoride, while a recommended range was proposed for pH value. No criteria were suggested for cobalt as this metal is not generally included in existing guidelines for sludge uitlization.

Of the 77 sludges characterized, 45 were found to have met the suggested guidelines, while another 16 were over the suggested maximum permissible concentrations in the case of one contaminant only. The remaining 16 sludges exceeded the suggested maximum permissible concentrations for two or more contaminants.

ORGANIC CONTAMINANTS

A parallel project, on the organic contaminants found in sewage sludges, was carried out by the NIWR/DWT, under the sponsorship of the Foundation for Research and Development (FRD), between 1986 and 1989.

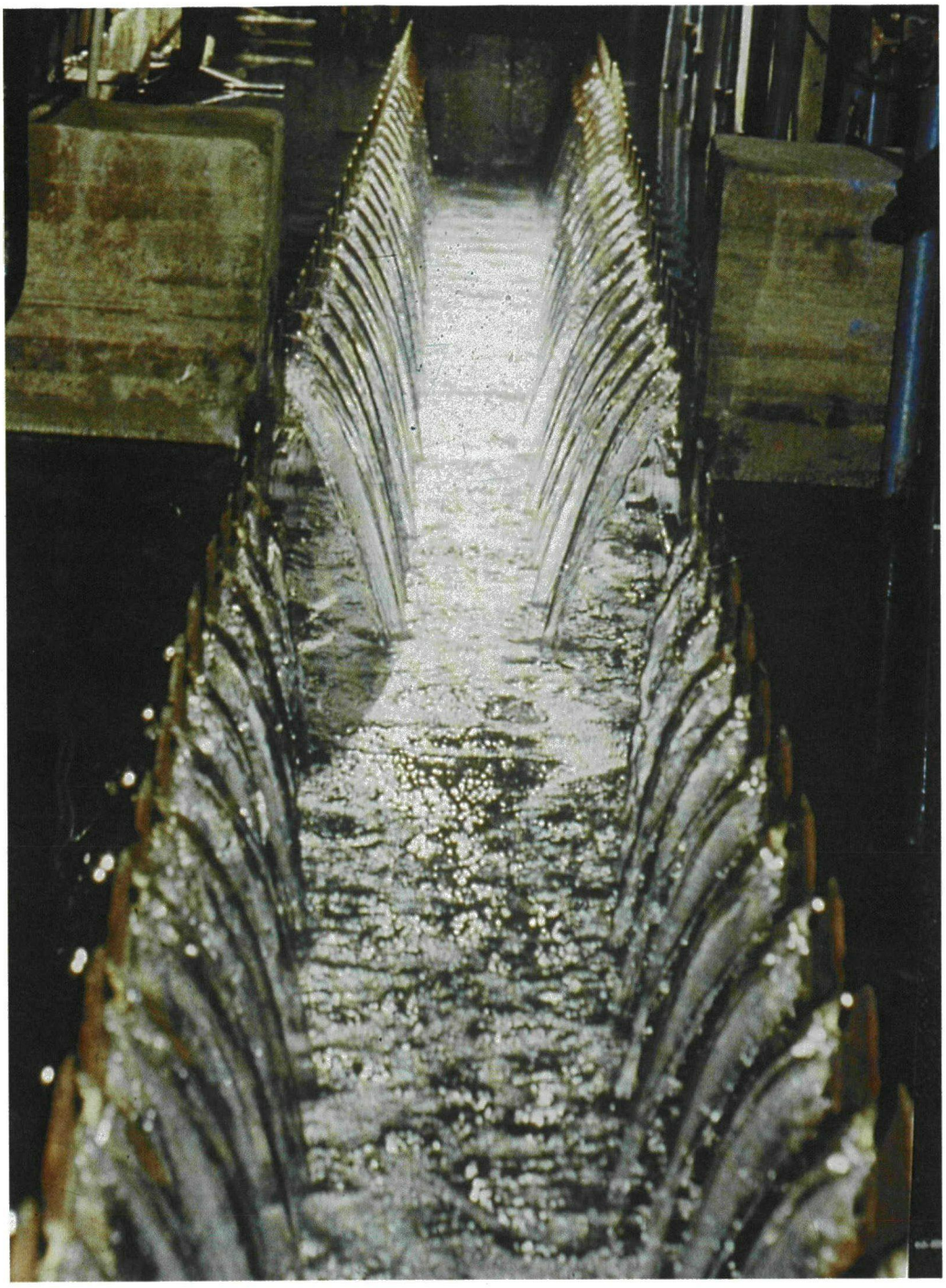
Table 3:

Proposed South African guidelines for maximum permissible concentrations of inorganic chemical contaminants in sewage sludges for land application

Contaminant	Maximum permissible concentration (mg/kg, dry basis)
Cadmium	20
Chromium	1 500
Copper	1 000
Lead	750
Nickel	300
Zinc	3 000
Mercury	10
Arsenic	15
Selenium	15
Molybdenum	20
Boron	80
Fluoride	400
pH (pH units)	5,8 - 7,8

Dried sludge.

Copies of this report, No. 180/1/89, are available from the Water Research Commission. To order, please complete the postcard in this Bulletin.



Product water (clear water) from high rate tube settler.

COMRO improves high-rate underground settling

Underground settling at rates up to thirty times that of conventional underground settlers has been achieved in full-scale field trials of a newly developed settling tube technology.

COMRO (Chamber of Mines Research Organization) has recently completed a 120 ℓ/s high-rate underground settling field trial successfully at a gold mine in the Carletonville area. Settling rates of up to 100 m/h and settlers upflow rates of up to 60 m/h were obtained using settling tubes retrofitted to an existing underground settler. This is better than an order of magnitude improvement on standard underground settlers which operate at settling and settler upflow rates between 1 and 10 m/h. The heart of this process is the use of 'settling tubes' which allow optimum flocculation under widely varying process conditions.

Settled clear water with a suspended solids level below 50 mg/l was consistently produced as shown in the diagram. Under optimum operating conditions (good neutralisation and flocculation), clear water suspended solids levels below 5 mg/ℓ were obtained. This high quality water was produced under highly fluctuating flow conditions, i.e. upflow rates between 10 and 110 ℓ/s, and with the feed water suspended solids varying between 200 and 40 000 mg/ℓ. This is unlike conventional underground settlers which generally perform satisfactorily only under reasonably steady flow conditions.

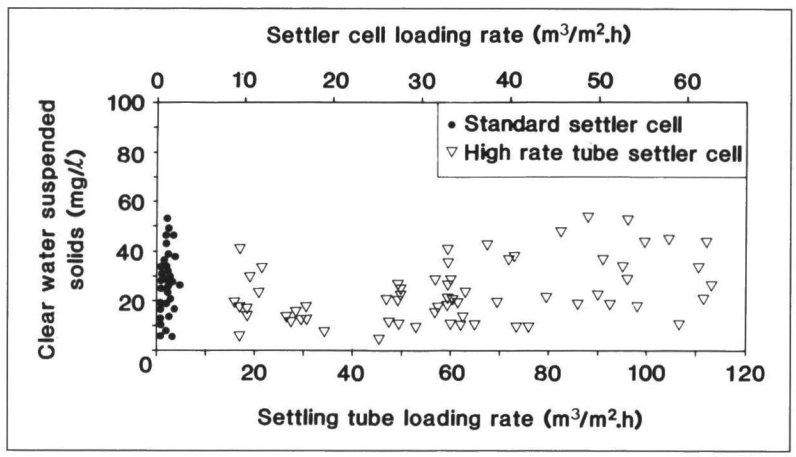
This newly developed settling technology has major advantages for the mining industry. The settling tubes can easily be retrofitted to existing overloaded underground settlers. By using this technology when developing new underground settlers, installations and excavations are possible which are up to 25 times smaller than for many conventional settlers, thereby resulting in significant cost savings. The ability of the high-rate settling tubes to accept widely fluctuating flow rates removes the need for expensive dirty water surge dams.

The high-rate settling tube technology was originally developed by a local water treatment company — Water Renovation (Pty) Limited — for use in the purification of industrial effluents and process waters. COMRO, together with this company, evaluated, developed and modified the original technology to meet the specific requirements and conditions of the mining industry.

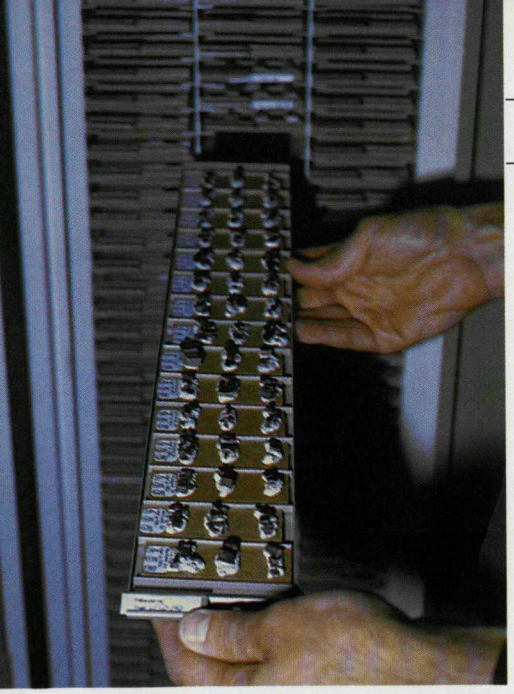
The technology was first refined in an 18 month pilot plant study at a Witwatersrand gold mine. During the pilot plant phase, the settling tubes were closely observed and monitored while being subjected to a range of typical mining-environment conditions were necessary to overcome the problem. The performance of the settling tubes under different operating conditions was evaluated and allowed the determination of the operating limits of the process.

Upon completion of the pilot plant study, this technology was tested at full scale in a collaborative study between COMRO and a mine in the Carletonville area. Full-scale settling tubes were retrofitted to an existing underground settler for evaluation in a nine month field trial. The field trial was also closely monitored and brought to light the need for further settling tube modifications in order to overcome practical problems experienced with the original design. The need for adhering to simple, but essential principles, in the operation of underground settlers was also strongly highlighted during the field trial.

The result of COMRO's extensive pilot plant studies and field trials, is a settling technology which has been extensively evaluated and specifically tailored to meet the difficult conditions encountered in underground settling. By using this technology and adopting a system approach to underground settler design, a reliable and efficient settling operation, capable of dealing with real underground conditions can be designed for any South African gold mine.



Effect of settling tube loading rate on clear water quality.



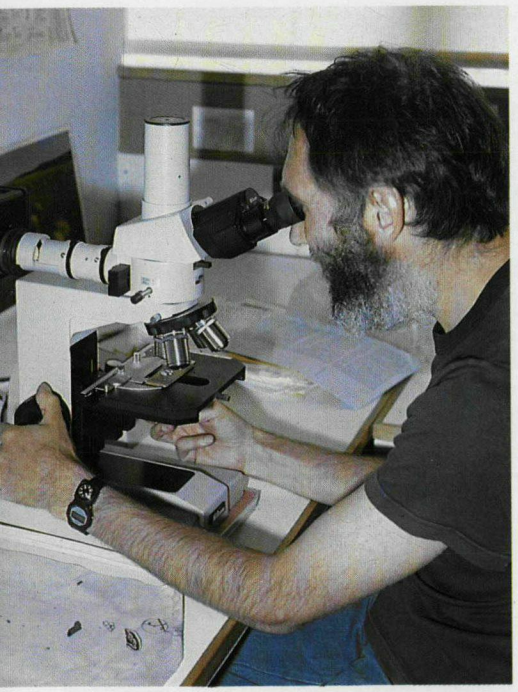
Charcoal samples from archaeological excavations catalogued and kept in the reference collection of the SA Museum.

Wood anat records rai and clima

The Water Research Commission is presently supporting a res structing the climatic history of the past 2000 years of the summ

In order to improve the available knowledge of the annu attempts have been made in South Africa and abroad, to rel rings (dendrochronology) of trees that are several hundred y had limited success.

A new approach is being pioneered by the South African M relationship between annual rainfall and some characteristi been shown to be far more sensitive to variation in rainfall.



LEFT: Mr Scholtz looking at a cross-section of charcoal, using a standard light microscope.
BELOW: Charcoal from an archaeological excavation.

Wood anatomy, reflecting the climate under which it was formed, shows a better correlation with climatic change than does tree growth rings. A comparative analysis of the wood anatomy of fossil wood (charcoal) and fresh wood from selected sites will form the basis of this unusual project headed by Mr Anton Scholtz of the Palaeobotany section of the SA Museum in Cape Town.

According to Mr Scholtz the research project has two main aspects; one aspect entails the quantitative analysis of the wood anatomy of identified pieces of fossil wood (charcoal) from dated archaeological deposits. The other aspect comprises the analysis of the relationship between wood anatomy and climatic variables in the present day environment.

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earch project aimed at recon-
r rainfall region in South Africa.

variability of rainfall, several
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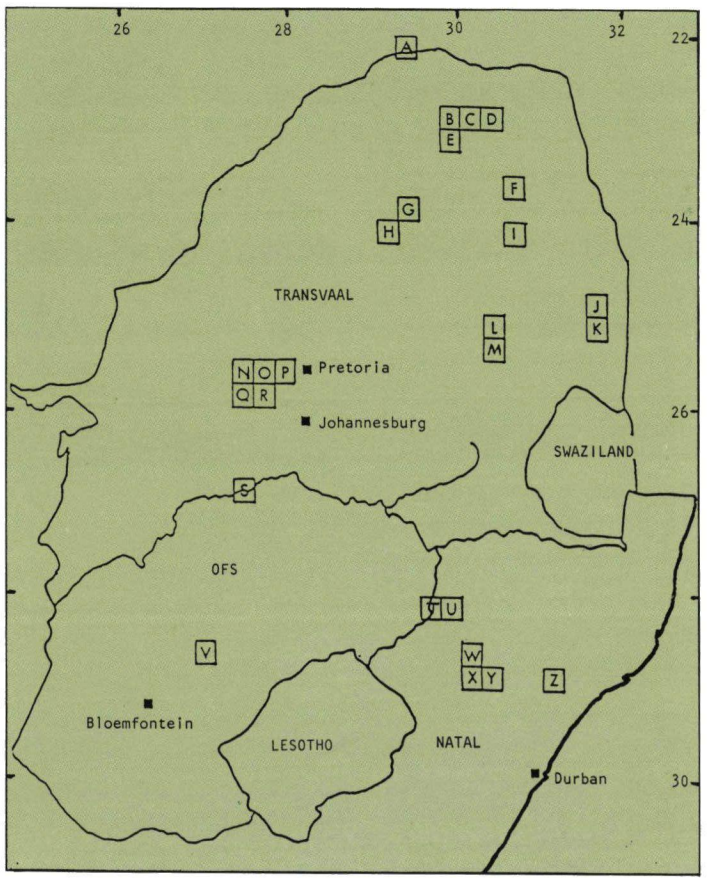
ears old. These attempts have

seum involving a study of the
s of wood anatomy that have

LOCATION OF ARCHAEOLOGICAL SITES



A Mapungubwe
B Vhuneyla
C Dzata
D Tayhatshena
Manavhela
Begwa

F Eiland
G Pietersburg
Game Reserve
H Ficus
I Harmony
Village
J, K Sites in Kruger
National Park

L Klingbell
Sterkspruit
M Klipspruit
N Kruger Cave
O Broederstroom
P Afsaal
Q Olifantspoort
R Cedarbergkloof

S Buffelshoek
T Mgede
U Nkupe
V Doornpoort
W Mabhija
X eSinhlonhlonweni
Y Mbabane
Z Ndondonwane

CHARCOAL

Charcoal is virtually always recovered from archaeological excavations. This charcoal is actually fossil wood preserved in this particular form and it holds information about the climatic conditions prevailing during the lifetime of the trees from which the wood came.

In an archaeological excavation there are often a number of archaeological layers. In any one such a layer charcoal of a specific time period is found. Thus charcoal from these different layers represents fossil wood of different time periods from the same area. The charcoal in these layers can be studied for changes in the wood anatomy that will indicate changes in the climate of that particular area.

Although the wood has undergone charring in a fire, the anatomical structure and internal proportions of the original wood have been retained. Through experimental firing of fresh wood it has been determined that the wood shrinks by approximately 25 per cent. "But the internal proportions remain the same," says Mr Scholtz.

For the actual study of the fossil wood anatomy a piece of charcoal is notched and then snapped to get a clean break and visual section. A section obtained in this manner will not be as flat as a microtomed section but a good image can nevertheless be obtained with a scanning electron microscope (SEM), which has a greater depth of field than a light microscope.

The photographic image obtained by means of the SEM is placed on a digitising tablet and a number of anatomical variables (e.g. vessel diameter, number of vessels per mm^2) are measured by computer and fed directly into a databank in the computer. The data thus obtained and stored will be used to form the basis of the rainfall reconstruction.

To interpret this data obtained from the fossil wood in terms of rainfall and climate, it is necessary to turn to fresh wood and present day rainfall and climate records to find the correlations between wood anatomy and climate. This aspect of the research project requires extensive field and laboratory work as well as data capturing on computer.

FRESH WOOD

For the wood anatomy - climate relationship analysis fresh wood had to be collected from the summer rainfall area. Mr

Scholtz says that the initial idea was to identify wood from the archaeological record and then to collect fresh wood samples of the species identified in the archaeological record. However, with too many unidentified pieces of charcoal in the archaeological collection of the museum the research team had to set out and collect adequate samples of whatever fresh wood was commonly available at each site along a climatic gradient.

CLIMATIC GRADIENT

Fresh wood samples were collected from the vicinity of the archaeological sites as well as from other areas, along a climatic gradient, in the summer rainfall area. The climatic gradient ranges from wet to dry and hot to cold. Sites in the Drakensberg represent a cold and wet climate. The most northern site at the Limpopo river represent a warm, dry climate. The sites along the climatic gradient also range from Kimberley, which is hot and dry, to the eastern Transvaal as well as northern and central Natal. Northern Natal represents a warm, subtropical climate.

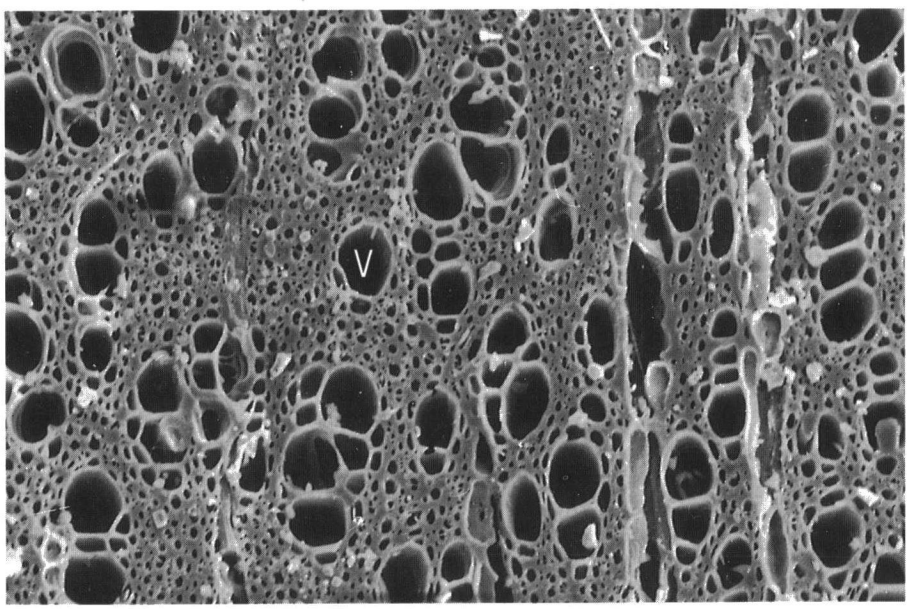
3 000 SAMPLES

At each site least five different trees of a particular species were sampled. From each tree at least three different branches of varying diameter, ranging from small and thin to medium thick branches, were taken. In all some 3000 individual wood samples were collected in order to study the anatomy of the fresh wood, and to get an overview of species commonly found across the range of the climatic gradient.

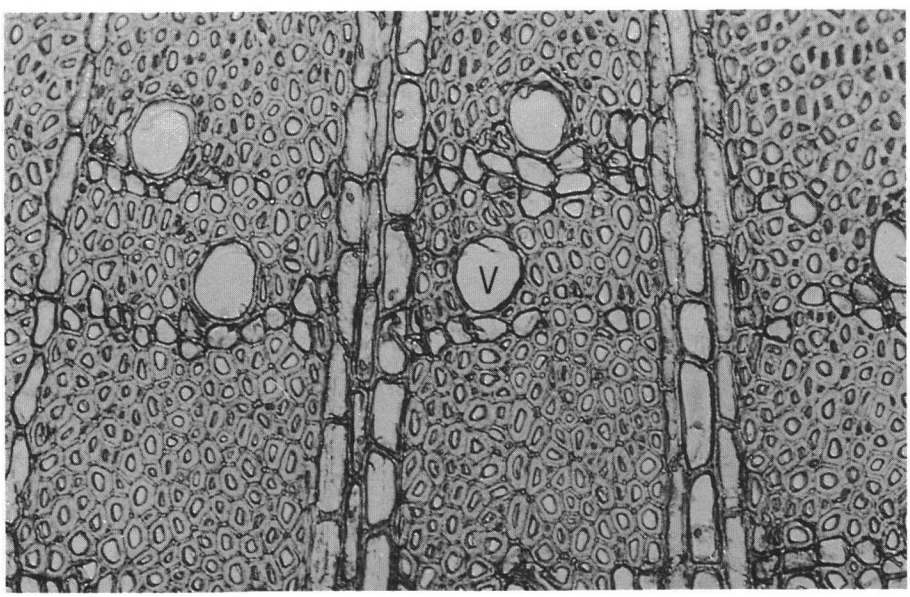
These samples are catalogued and curated for future reference. The museum keeps both a dry and a "wet" collection of the wood samples. The wet collection comprises a comprehensive collection of thin sections of each wood sample, preserved in a solution of a alcohol, glycerol and water. The samples in the wet collection retain the proportions and exact size of the fresh material.

The thin sections necessary for studying wood anatomy, are obtained by cutting thin (15 - 25 µm) cross-sections with a microtome. These thin sections are stained with saffranin, a biological stain, to accentuate the anatomy of the wood. The stained and mounted sections can be studied and photographed under a standard light microscope. The microscope image of the thin sections can be projected onto the digitising tablet of a small computer for measuring the dimensions and distribution of various plant cells. However, colour slides of the thin sections taken under the microscope and projected by an inverted slide projector give a brighter colour image on the digitising tablet.

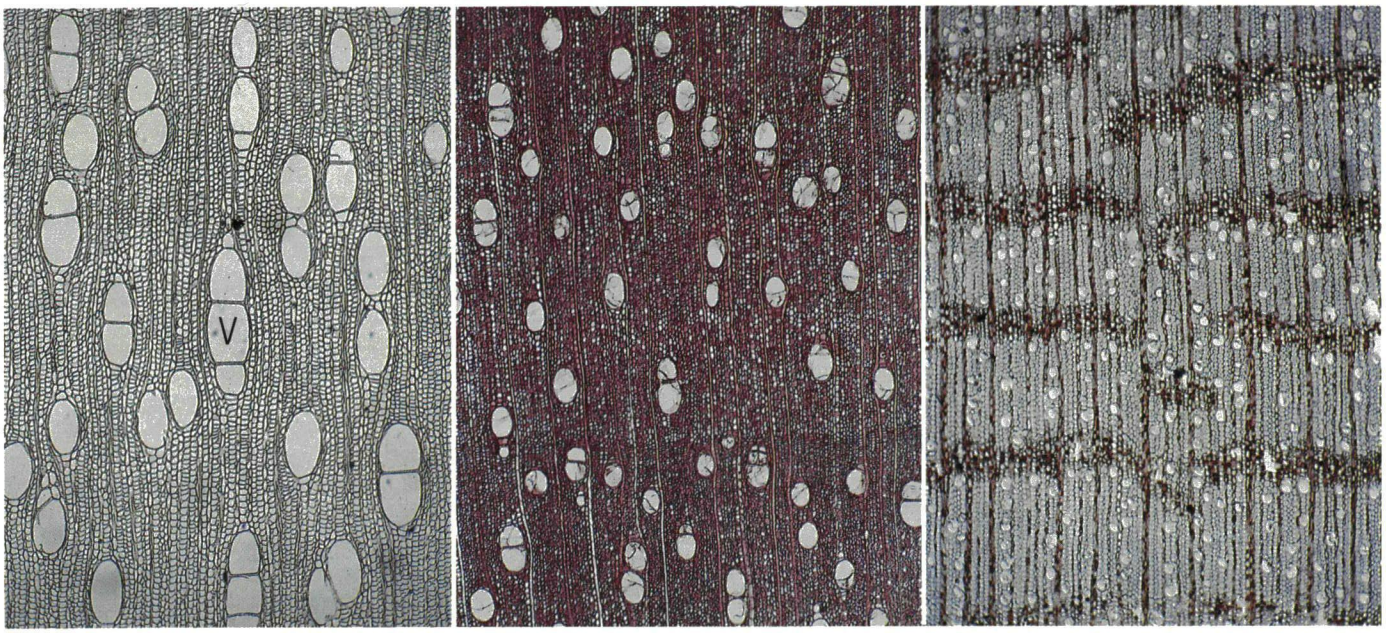
A cross-section of charcoal (Morph. type 1) under the scanning electron microscope (SEM).



A cross-section of fresh wood (Protea nitida) *under a light microscope.*

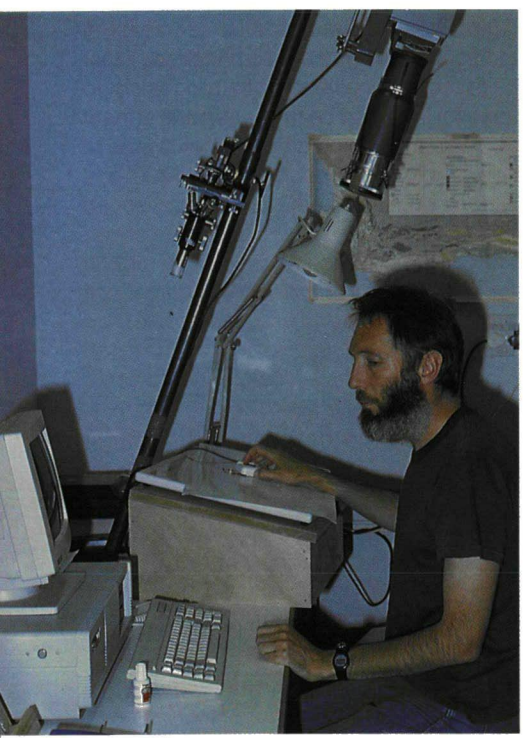


Some of the fresh wood samples collected by the research team during a recent field trip in the summer rainfall area.



Macaranga capensis (5X) *Rhus chirendensis (5X)* *Maytenus acuminata (5X)*

Cross-sections of different tree species clearly showing variation in size and frequence of the vessels (V). Trees growing in warm, wet areas usually have few but large vessels, while trees growing under cold and/ or dry conditions have a large number of small vessels.



Mr Anton Scholtz at the apparatus he constructed whereby colour slides of cross-sections are projected onto the digitising tablet from which measurements are relayed to the computer.

VASCULAR SYSTEM

The vessels are the main water transporting elements in a plant and form the plant's vascular system, or "plumbing".

Most information regarding the correlations between wood anatomy and rainfall can be gleaned from measurements taken of the vessel system. Radial as well as tangenial vessel diameters of each vessel are measured. According to Mr Scholtz the radial vessel diameter appears to be particularly sensitive to ecological factors such as rainfall.

Other wood variables being studied are maximum and minimum vessel sizes, size range and mean diameter of vessels, as well as total vessel area and the number of vessels per cm^2, etc. If necessary measurements of fibres and parenchyma cells are also taken. At least 50 vessels of each piece of wood are measured. Measurements are relayed directly from the digitising tablet to the computer.

CORRELATIONS

The wood anatomy variables obtained by measurements are to be correlated with climatic variables, e.g. mean annual precipitation, mean precipitation of the wettest month, annual moisture index, etc.

From these basic variables indices can be constructed and these may prove to correlate more closely with climatic variables than the wood anatomical variables themselves. Thus, for instance, an index called "vulnerability" which is obtained by dividing the mean vessel diameter by the number of vessels per mm^2, is often used by ecological wood anatomists and has proved to be a sensitive indicator of a plant's ability to withstand drought stress.

Presently Mr Scholtz and his research team are busy with the mammoth task of analysing the anatomy of wood samples collected from sites distributed along the climatic gradient in the summer rainfall area. The analysis is done by means of a digitiser linked to a computer. Owing to the development of an efficient data capturing system it has become feasible for them to attempt to obtain the number of observations required in order to achieve reliable correlations between wood anatomy and climate. Once having acquired a knowledge of these correlations they hope to begin a reconstruction of the climatic history of the summer rainfall area.

Chemical contaminants in SA's food and water studied

A study on the health implications of chemical residues in food and water has been completed by a researcher from the faculty of Medicine at the University of Cape Town.

In a final report on the study presented to the Water Research Commission, Dr HO Fourie, says the objective of the project was to obtain estimates of the intake of pesticide residues by South Africans via food and water consumption and to correlate such data with acceptable daily intakes.

Comparison of such results with the legal limits set for pesticide residues in food, says Dr Fourie "will disclose whether the individual or population is subjected to chronic exposure and whether current regulatory practices are adequate to protect all consumers."

According to the report it was found that the annual intake of pesticides in South Africa results in a dose of approximately 250 mg/m^2 which compares favourably with consumption rates of other developed countries.

Food intake data was calculated from 24-hour dietary recall studies. Over a period of one year residues of only four compounds were present in 33 composite, ready-to-eat foods, consisting of 5 538 foodstuffs sampled country-wide, and representing 142 different food items categorised into eleven food groups. The residues found were well within acceptable levels and compared favourably with those found in the diets of developed countries.

In this report Dr Fourie draws the conclusion that possible chronic exposure due to agricultural chemical contaminants does not exist and emphasises a sound regulatory policy towards the use of these chemicals in South Africa.

Copies of the report, WRC report no 173/1/89, are available from the Water Research Commission. To order please complete the postcard in this Bulletin.

Chemicals are indispensable substances for the survival of mankind and for the continuation of all forms of life. They make up the air we breathe, the food we eat and the energy we use. However, if not used correctly and responsibly, chemicals can have a very serious detrimental effect on man and the ecology.

The effect of chemicals on the health of man depends on their chemical and physical properties, the duration and frequency of exposure, accumulation and metabolism and the ability of the human being to offer resistance.

Poisoning due to the use of pesticides is to be expected in South Africa, as in most other countries in the world. In the handling of pesticides, statistics show South Africa to be vulnerable to an appreciable number of deaths and poisoning cases. There could be a number of reasons for this phenomenon, two of these probably being ignorance and negligence on the part of officers in charge of handling pesticides, and perhaps the most important, the use of unskilled labour in applying and handling pesticides. It is believed that the South African agricultural industry represents both the First and Third World and should thus be ideally suited for investigating acute intoxication due to chemicals used in the agricultural industry, as well as chronic exposure to residues of agricultural products in the diet of South Africans.

Dietary intake studies provide the information needed to assess potential health problems and the exposure of a population to chemical residues in the diet and environmental pollutants.

The consumption of "contaminated" food and beverages constitutes only a variable part of total food and water consumption. Likewise, cooking and preparation of foods may change the concentration of contaminants. Individual food preparation habits and the choice of various foods and beverages are thus of the utmost importance.

WATER

Water must always be included in the dietary intake study. Not only is water *per se* consumed, but it is used for cooking and for making beverages. It is used in the reconstitution of dehydrated foods and in the cooking of food which is typical of that used by the population group under study. As an example, in a typical USA total diet, beverages including water (but excluding water used for cooking and with evaporated milk powder, as well as beer, wine, ale etc.), forms 22,5 per cent of the total diet. When carbonated and non-carbonated soft drinks, beer, ale and orange juice are included (but cooking excluded), water forms 40 per cent of their diet.

Intake of drinking water varies significantly between communities and amongst individuals. Should the intake of water *per se* be calculated from the literature, it would amount to approximately an average of 1,2 litres per day (0,1 to 9,8) for adults, and 800 ml/day for babies and small children. For healthy people the water intake from all sources closely matches the amount lost by the urine, faeces, etc., maintaining a state of equilibrium. Amongst individuals this varies widely, but on average amounts to 2,5 litres per day.

All food derived from living or dead material contains water. Foods, such as fruit and vegetables, can be regarded as living organisms until cooked. For many fresh foods derived from animals (milk, meat, fish, eggs) the water content ranges from about 65 to 87 per cent, the highest content being in meat, poultry, fish, fruit, leafy brassicas, potatoes. However, in meat and fish the water content depends greatly on the fat content, e.g. herring (fatty) holds more water than cod or haddock. Water makes up from two to nearly seven times the quantity by weight of dry solids present and in fruit and vegetables, 75 to 98 per cent is water. Some foods (sugar, chocolate and cooking oil) contain less than 1 per cent water; starches, flour and biscuits contain from 5 to 15 per cent. The water content of foods which come directly from animals, such as milk and eggs, is fairly constant because the functioning of these products in their natural state requires close control of this component. In others, e.g., fruit and vegetables, there is less close biological control; thus much depends on various factors, such as weather and species. The water content of apples varies from 75 to 85 per cent, of potatoes from 65 to 85 per cent, of spinach from 85 to 95 per cent. The water content of plant tissues changes after harvesting because of physical water losses and metabolic changes. Water losses in foods stored in contact with air, such as fruit, potatoes and eggs, depends on storage temperature, humidity and air movement.

ORGANIC CONTAMINANTS

The significance of trace concentrations of organic contaminants in drinking water to public health is largely inconclusive and controversial, since there is a general paucity of information concerning human health effects from which to draw conclusions. Exposure to such toxic organic compounds in drinking water is only a small percentage of the total exposure to these substances. Other routes of intake include food and air. A survey of pesticide levels in water in the United Kingdom revealed that even in the worst case the human intake of organochlorine insecticides from drinking water would not exceed 0,5 per cent of the total dietary intake of such substances. Polynuclear aromatic hydrocarbons (PAH) ingested from drinking water may only amount to 0,1 per cent of the intake from food sources. Many medical preparations contain a relatively large proportion of chloroform; a few spoonsful of such medicines is equivalent to a lifetime ingestion of chloroform from drinking water. The toxicity of a compound could depend upon its mode of ingestion (whether food or water, etc.) and also on whether or not it is adsorbed on particles. Perspective is therefore required in evaluating the problems posed by trace amounts of organic compounds in water.

METHODS

It was not the object of this study to make food intake assessments. It was the aim of this project to derive intakes of contaminants, and therefore all available data on food consumption patterns in the Republic of South Africa have been used to develop a sampling program.

Food intake data were calculated from 24-hour dietary recall studies which had been undertaken in the Cape Peninsula and three rural towns.

Normally, the 24-hour recall method is only suitable when several 24-hour recalls per person are undertaken. However, it has been established that a single 24- hour recall within a large population does reflect reliable average long-term intakes since the group mean values obtained by this approach do not vary significantly on a day-to-day basis.

Three approaches, based on food consumption data were available for the estimation of the daily intake of a contaminant:

- Total diet ("Market Basket") studies;
- selective studies of individual foodstuffs; and
- duplication portion studies.

Only one of these approaches (total diet or "Market Basket") was used.

The market basket approach entails table-ready prepared foods of a defined total diet consumption. Food commodities are combined in food group composites in proportions based on consumption data, and each group analyzed separately for the different contaminants selected. Such analyses allow calculations for each composite group — which will reflect the distribution of contaminants amongst composite groups — as well as for the diet as a whole.

Sampling sites chosen were representative of all the geographically important cultural regions within the country. These were the major cities from the four provinces including six rural towns.

Sampling was done during the months of July, October and January/February, from supermarkets and butcheries normally available to the public.

A standard shopping list was developed describing the food item and quantity to be supplied. The 142 food items were arranged according to the following 11 food classes:

Food class	Number of items
1. Vegetables	13
2. Fruit	8
3. Meat, meat products and poultry	24
4. Cereals	33
5. Eggs	1
6. Fish	6
7. Soup	7
8. Fat and oils	3
9. Milk and milk products	18
10. Sugars and sweets	12
11. Beverages	17
TOTAL	142

Sampling was done on the same day at the 13 locations and samples were transported by air, under refrigerated conditions, to the analyzing laboratories in Cape Town. Thus for each sampling, 1 846 food items from the 13 locations were sampled, which totalled 5 538 food items for the three calendar periods.

One of the laboratories was established as a kitchen facility. On receipt of each batch of 1 846 samples, samples were categorized and prepared for consumption. Samples to be prepared as ready-to-consume foods, were processed according to a pre-prepared cookbook to standardise all methods used, which consisted of typical, normal household recipes consistent with cultural habits. Mixing, blending and homogenization of samples were done carefully to obtain representative samples. Although all possible care was taken not to contaminate any samples, equipment and containers used were those typical of a South African kitchen so that normal contamination or loss of contaminants, if any, would be reflected in the analytical results. Prepared samples were frozen in large mouth glass containers until analysis could be done.

Analyses were done at the Chemical Health Laboratories of the Department of National Health and Population Development in Cape Town. After food preparation and composition into the 11 groups, each group was analyzed separately by multi-residue procedures, covering a wide range of contaminants. All samples, composite and individual, were analyzed for organochlorine, organophosphate and polychlorinated biphenyl (PCB) residues, cadmium and lead.

RESULTS

Residues were found in eight (73 per cent) of the diet groups, with no residues found in soups, sugars and beverages. DDT, dieldrin and dicloran were present in seven groups, while the organophosphate mercaptothion was only present in cereals. It is somewhat surprising to find residues of mercaptothion in grains and not in fruit and vegetables as this compound is extensively used on the latter, although the maximum residue levels allowed in fruit and vegetables are much lower (2 to 4 mg/kg) than in grain (8 mg/kg). It is also surprising to find mercaptothion residues at a concentration of 0,05 mg/kg in ready-to-eat cereals.

FACTS ABOUT THE INTERNATIONAL ASSOCIATION OF HYDROLOGICAL SCIENCES

(Largely from the IAHS Yearbook 1987-91)

The International Association of Hydrological Sciences (IAHS) is the oldest and foremost of the international non-governmental organisations dealing with hydrology and water resources including glaciology. It was established in 1922 to bring together individual hydrologists to promote the science that involves them. It is one of the more active of the seven associations which together form the International Union of Geodesy and Geophysics (IUGG).

IUGG, which was set up in 1919 to promote and coordinate physical, chemical and mathematical studies of the Earth and its immediate spatial environment, meets in General Assembly once every four years. At General Assemblies the Union's scientific and business activities are conducted and the President and other Officers of the Union are elected. The present President and Secretary General are Professor VI Keilis-Borok (USSR) and Professor P Melchior (Belgium).

IUGG is itself one of the 20 scientific unions which are grouped within the International Council of Scientific Unions (ICSU), the international non-governmental scientific organisation which was set up in 1931 to encourage international scientific activity for the benefit of mankind. ICSU meets once every two years in General Assembly to conduct its scientific and business activities and to elect its officers, a past Secretary-General being Professor JCI Dooge (Ireland), one of the Past-Presidents of IAHS.

AIMS

The aims of IAHS include the promotion of the study of hydrology, the provision of means for discussion, comparison and publication of results of research, and the initiation and coordination of research that requires international cooperation. To fulfil these aims the Association organises general assemblies, symposia and workshops in various parts of the world, publishes the proceedings of these meetings (the well-known red cover hydrological publication), and special monographs. It also publishes the Hydrological Sciences Journal, contributes to a wide range of international initiatives and generally fosters activities and collaboration in hydrology and water resources.

ASSEMBLIES AND SYMPOSIA

The IAHS meets once every four years in General Assemblies. The last one has been in Vancouver (1987) and the next one will be held in Vienna in August 1991. At the General Assemblies the Association holds symposia, considers its past and future programmes, the regulation of the Association and elects its office bearers.

The Association held its First Scientific Assembly at Exeter, UK in 1982 and in May 1989 Baltimore was the site of the Third Scientific Assembly. At these assemblies a pattern of several symposia, workshops and working group meetings has established itself.

In the years between assemblies, the Association organises specialised symposia, it co-sponsors symposia in partnership with other bodies and it supports the symposia other bodies organise which are concerned with hydrology and water resources. The symposia the Association organises itself are usually by one of the Association's Commissions.

THE STRUCTURE OF IAHS

The Association is headed by a President (presently Dr V Klemes of Canada), who is supported by a Secretary-General (presently Mr JJ Colenbrander of the Netherlands) and a number of other office-bearers. It does its work through its Assemblies, its National Committees and its Scientific Commissions.

There are six Scientific Commissions within the Association, each dealing with a specific area in hydrology.

Most countries which are members of IUGG have a National Committee for the IAHS. In South Africa as in many other countries the National Committee is made up of representatives on the different Scientific Commissions. Present chairman of the SA National Committee (SANCIAHS) and national representative is Mr E Braune.

THE INTERNATIONAL COMMISSIONS OF THE IAHS

International Commission on	Present President	SA Representative
Surface Water (ICSW)	Prof HJ Liebscher, Federal Republic of Germany	Prof RE Schulze
Ground Water (ICGW)	Dr SM Gorelick, USA	Dr BD Bredenkamp
Continental Erosion (ICCE)	Prof DE Walling, UK	Dr A Rooseboom
Snow and Ice (ICSI)	Prof V Kotlyakoir, USSR	Prof DC Midgley
Water Quality (ICWQ)	Dr RA Gras, France	Prof D Hughes
Water Resources Systems (ICWRS)	Prof U Shamir, Israel	Prof WJR Alexander
Remote Sensing and Data Transmission (ICRSDT)	Mr JW Trevett, UK	Mr H Maaren

The Association also has individual members who are named by National Committees of the member countries from amongst those hydrologists with established reputations who have played or are playing a substantial part in IAHS activities. To date South Africa has five such individual members. Otherwise, affiliation of IAHS is by country through payment of a national annual subscription to IUGG, which is made in our case through the ICSU secretariat within the CSIR.

R A BAGNOLD

On the occasion of a recent overseas visit, Mr Charles Chapman, research manager at the Water Research Commission, had the rare opportunity to attend a one day symposium on 'Sediment transport by wind and water'. What made the occasion special was the presence of the guest speaker, 93 year old Brigadier Ralph Bagnold well-known author, explorer and pioneer. Those who have studied the phenomenon of sediment transport will readily recognise the name.

In this article, based on a paper: *THE LIFE AND SCIENCE OF R.A. BAGNOLD*,* Mr Chapman reveals more about this interesting scientist.

It is said that, "old soldiers never die, they simply fade away". What the eventual fate of scientists may be, is uncertain, for, as long as there are questions to be answered, it is unlikely that they will find the time to even consider retirement.

Such a scientist is the inimitable Brigadier Ralph Bagnold who for 60 years has been making significant practical and theoretical contributions to the sciences of fluid mechanics, hydraulics and the physics of sediment transport. Now, almost 94, he is probably best known for his pioneering work describing the physics of wind blown sands.

Between stints in the army, he completed an honours degree at Cambridge before being stationed in Egypt where he and fellow officers explored the vast unmapped depths of the desert using the Model T Ford for transport.

It was out of necessity that they invented the recondensing radiator system, as the Model T could not carry sufficient topping-up water for the radiators in use at the time which expelled steam directly to atmosphere. Another ingenious invention was the very dependable 'sun compass' which later became standard issue to Egyptian survey geologists and geographers.

After retiring from the army for the first time in 1935 he published an exciting chronicle of his desert explorations called *Libyan Sands* (Bagnold 1935) and followed this in 1941 with his second book entitled *The Physics of Blown Sand and Desert Dunes* which is considered a classic still today.

His desert experience was put to good use after re-enlisting in 1939 when he established the exclusive, self-contained, Long Range Desert Group (LRDG) whose exploits are legendary. These exploits, which created frequent havoc for enemy supplies and aircraft up to 1300 km inside hostile territory, were the subject of an official dispatch by General Wavell in 1941.

Bagnold retired with the rank of Brigadier in 1944 and spent a few years as Director of Research for Shell Oil. Thereafter he devoted his efforts to tackling the physics of the movement of all granular materials in any fluid. His goal was to derive an explanation based on the physical principles of hydraulics, fluid mechanics and particle physics and thus eliminate the empiricism dominating the difficult problem of describing the transport of solids in water.

A series of papers were published on the topic by the U.S. Geological Survey the most significant being *An Approach to the Sediment Transport Problem from General Physics* (Bagnold, 1966). In the field of oceanography, he studied the motion of sand on beaches and in the nearshore zone (Bagnold, 1963). The Brigadier also described the hydraulics of submarine density currents (Bagnold, 1962), while in geography, his desert explorations throughout Libya and the Sinai earned him the Founder's Gold Medal from the Royal Geographical Society.

Brigadier Bagnold enjoyed a distinguished international scientific stature as evidenced by his election to Fellowship of the Royal Society of London in 1944, and to the Imperial College of London in 1971. He received the G.K. Warren Prize from the U.S. Academy of Sciences in 1969, the Penrose Medal from the Geological Society of America in 1970, the Wollaston Medal from the Geological Society of London in 1971, an honorary DSc from the University of East Anglia in 1972, the Sorby Medal from the International Association of Sedimentologists in 1978, and the David Linton Award from the British Geomorphological Research Group in 1981. He was also decorated by the Throne for his invaluable service to his country.

The conception and production of a variety of practical scientific instruments have been entirely incidental to his various exploits. The "desert-sun compass," the "instant-reading, multi-tube manometer," and the "piezo-electric pressure gauge," are but a few examples of his creativity (Bagnold, 1953).

Indeed it was a great priviledge for me to personally meet with such a grand scientific personality.

* Robert C. MacArthur, Maurice J Kenn, Colin R. Thorne, Jeffrey B. Bradley.

Hydraulic Engineering: Proceedings 1988

National Conference of the Hydraulic Division of the American Society of Civil Engineers, held at Colorado Springs, 8 - 12 April 1988.

AWARDED

Dr Sue Walker of the Soil and Irrigation Research Institute.

The DF Retief floating trophy for the best paper in the category scientists under the age of 40 was awarded to Dr Sue Walker of the Soil and Irrigation Research Institute at the recent South African Crop Production Congress. Dr Walker reported on her WRC supported research work on the determination of water requirements of certain seasonal crops at Roodeplaat as a function of soil, plant and atmospheric factors. This research commenced in 1976 and Dr Walker is the fifth scientist awarded the trophy for a paper based on this research.

MAGNETIC WASTE-WATER TREATMENT PROCESS

Pilot tests for water contaminated with heavy metals are planned for a new magnetic waste-water treatment process developed by Smit Transformatoren B.V. (Nymegen, The Netherlands). It meets phosphate emission standards for Switzerland, FRG, The Netherlands, and Denmark which become effective in 1995. According to International Water Report (12487) a company official said the high-gradient magnetic separation technique lowers phosphate levels to under 1 milligram per litre, compared to 1 to 2 mg/ℓ for conventional chemical precipitation. In trials of the technique, loadings of 6 mg/ℓ were cut to 0.4 mg/ℓ.

Chemical Engineering (6/89) reports that

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. . . copy/copies of: *Inorganic chemical characterization of South African municipal sewage sludges* by R Smith and H Vasiloudis. (WRC Report no. 180/1/89).

. . . copy/copies of: *An estimation of the health implications of chemical contaminants in food and water — a total diet ("Market Basket") study* by H O Fourie. (WRC Report no. 173/1/89).

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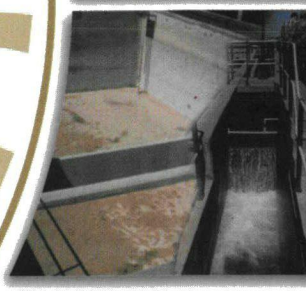

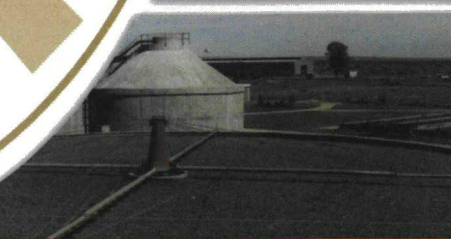

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OPTIMIZATION OF POTABLE WATER PURIFICATION PLANTS

Cost
R 3 600 per candidate (R3 300 if paid by 31 May 2002)

Dates
10 - 14 June 2002

Course contents:
Optimization of the following unit processes:

- Pretreatment
- Chemical dosing
- Coagulation
- Flocculation
- Settling
- Filtration
- Disinfection
- Stabilization

OPERATION OF ACTIVATED SLUDGE PLANTS

Cost
R 3 600 per candidate (R3 300 if paid by 25 October 2002)

Dates
4 - 8 November 2002

Course contents
- Sources of wastewater
- Composition of wastewater
- Process description and microbiology
- Types of activated sludge processes (conventional, extended aeration, nutrient removal, etc.)
- Operational aspects:
  - Control of dissolved oxygen
  - Sludge age, etc.
- Operational problems:
  - Bulking
  - Scum
  - Rising sludge
  - Sludge
- Laboratory support
- Disinfection

WATER QUALITY MANAGEMENT IN THE NEW MILLENNIUM-QUO VADIS

Cost

R 5 000 per candidate (R4 600 if paid by 24 May 2002 and 1 November 2002 respectively)

Dates

4 - 7 June 2002
12 - 15 November 2002

Course contents

- Pollution Control versus Water Quality Management
- What a Water Quality Manager needs to know about the:
  - National Water Act
  - National Environmental Act
  - Minerals Act
- Licensing Procedure
- Reserve Determination
- Integrated Water Resource Management
- Catchment Management Agencies
- Background to Catchment Management
- Basic Water Quality Chemistry
- Discussion on a selection of water quality related matters. (Students to submit a relevant topic when they register for the short course i.e. water quality problems experienced in the workplace,...)
- Case Study

Target Group

- Industries managing effluent and or waste
- Local Councils
- Environmentalists
- Water Quality Managers

BASIC CHEMICAL ANALYSIS OF POTABLE WATER

Cost

R 4 200 per candidate (R3 800 if paid by 31 May 2002)

Dates

10 - 14 June 2002

Course contents

- Review of chemical terms and principles
- Introduction to laboratory techniques
- Sampling
- Data processing
- Chemical calculations
- Determination of physical parameters
  - pH
  - Temperature
  - Conductivity
  - Turbidity
  - TDS
- Principles of titration
- Alkalinity (OH^-; CO_3^{2-}; HCO_3^-)
- Chloride (Mohr)
- Sulphate
- Hardness (Ca^{2+}, Mg^{2+}, total)
- Basics of colorimetry/spectrophotometry
- Phosphorous (PO_4^{3-}; Total phosphate)
- Fluoride
- Nitrate
- Colour
- Chlorophyll A
- Chlorine (Free chlorine, total chlorine)
- Basics of atomic absorption spectrometry
- Determination of trace elements
- Basics of ion-chromatography
- Laboratory flocculation tests (Jar tests)
- Interpretation of results

BOILER AND COOLING WATER TECHNOLOGY

Cost

R 3 800 per candidate (R3 400 if paid by 10 May 2002 and 4 October 2002 respectively)

Dates

20 - 24 May 2002
14 - 18 October 2002

Course contents

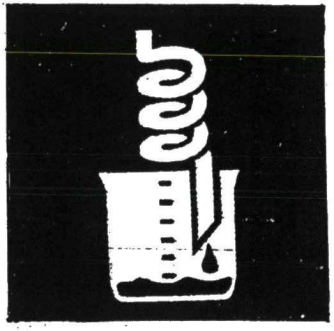
- Pretreatment processes
- Boiler water systems
- Boiler water treatment
  - Plant layout
  - Dissolved oxygen
  - Basic boiler water analysis
  - Inhibitors
  - Boiler corrosion
  - Boiler water carry-over
  - External treatment
  - Steam pressure classifications
  - Steam sampling and analysis
- Cooling water systems
  - Cooling tower designs
  - Cleaning and passivating
  - Basic cooling water analysis
  - Calculations
- Corrosion control
  - Corrosion concepts
  - Influencing factors
  - Passivation
  - Construction materials
  - Inhibitors
  - Measurement
  - Bacteria
  - Micro-organisms
  - Polymers

Target group: Plant operators, Laboratory supervisors, Chemical analysts, Chemical technicians

TECHNIKON PRETORIA

DEPARTMENT OF CHEMISTRY AND PHYSICS

FACULTY OF NATURAL SCIENCES



SHORT COURSES 2002

DEPARTMENT OF CHEMISTRY AND PHYSICS
DEPARTEMENT CHEMIE EN FISIKA

SHORT COURSES / KORTKURSUSSE : 2002

	Short course *Kortkursus*	Date *Datum*	Cost before discount *Koste voor korting*	Cost after discount *Koste na korting*
1.	Atomic Absorption Spectroscopy * *Atoomabsorpsiespektroskopie* *	20 - 24 May *20 - 24 Mei*	R3350.00	R2680.00
2.	Advanced Atomic Absorption Spectroscopy * *Gevorderde Atoomabsorpsie - spektroskopie* *	As arranged *Soos gereël*	R1100.00/day *R1100.00/dag*	On site on request *Op perseel op aanvraag*
3.	Chemical Principle Level 1 #* *Chemiese beginsels Vlak 1* #*	27 - 31 May *27 - 31 Mei*	R1600.00	1280.00
4.	Chemical Principles Level 3 #* *Chemiese Beginsels Vlak 3* #*	27 - 31 May *27 - 31 Mei*	R800.00	R640.00
5.	Basic Gaschromatography * *Basiese Gaschromatografie* *	3 - 7 June *3 - 7 Junie*	R3350.00	R2680.00
6.	I.C.P. - O.E.S * *I.G.P. - O.E.S.* *	10 - 14 June *10 - 14 Junie*	R3840.00	R3200.00
7.	Statistical Quality Management * *Statistiese Kwaliteitsbestuur* *	17 - 21 June *17 - 21 Junie*	R1600.00	R1280.00
8.	Basic H.P.L.C * *Basiese H.P.L.C* *	4 - 8 November	R3350.00	R2680.00
9.	Chemical Method Validation * *Chemiese Metode Validasie* *	11 - 12 November	R950.00	R760.00
10.	Chemical Principles Level 2 #* *Chemiese Beginsels Vlak 2* #*	11 - 15 November	R1600.00	R1280.00
11	Chemical Principles Level 3 #* *Chemiese Beginsels Vlak 3* #*	11 - 15 November	R800.00	R640.00

VERY IMPORTANT BAIE BELANGRIK

DUE DATE FOR DISCOUNT

The due date for discount is before or on the day the short course starts. No exception will be made, therefore apply timeously so that all documentation can be completed in time. IT IS TO YOUR ADVANTAGE.

KEERDATUM VIR KORTING.

Die keerdatum is voor of op die dag waarop die kortkursus 'n aanvang neem. Geen uitsonderings sal gemaak word nie. Doen dus vroegtydig aansoek sodat al die nodige dokumentasie betyds afgehandel kan word. DIT IS TOT U VOORDEEL.

Only when you have passed Chemical Principles Level 1 you can enroll for Chemical Principles Levels 2 & 3 simultaneously. The cost for levels 2 & 3 will then be R1800.00 provided payment of your fees is before or on the due date for Level 2. If not, cost will then be R2400.00. You are still free to enroll for each level separately as shown on the table.

Slegs na u Chemiese Beginsel Vlak 1 geslaag het, kan u gelyktydig inskryf vir Chemiese Beginsels Vlakke 2 & 3. Die koste sal dan R1800.00 wees vir Vlakke 2 & 3 indien die inskrywingsgeld voor die keerdatum van Vlak 2 inbetaal is. Na die keerdatum sal die koste R2400.00 beloop. U kan nog steeds vir elke vlak afsonderlik inskryf soos uiteengesit in bostaande tabel.

** Notes only in English

** *Notas slegs in Engels.*

Enquiries / ***Navrae*** **Alicia de Lange,**
Tel. :(012) 318-6282
Fax :(012) 318-6286

SHORT COURSES 2002

APPLICATION FORM

FAX TO:	Mrs. AM de Lange,Tecnikon Pretoria, Department Chemistry and Physics. Fax:- 012 - 318 - 6286
Name of Short Course	
Date of Short Course	
First Names	
Surname	
Company	
Company Address	
Occupation	
Tel. No.	(W)
	(H)
Cell Number	
E - Mail	
Postal Address	
Postal Code	
VehicleReg. No.	
Contact Person / Supervisor.	

Post the Application Form to:

Mrs. A.M. de Lange
Department of Chemistry and Physics
Technikon Pretoria
Private Bag X680
Pretoria
0001

Or alternatively E - mail: dlangeam@techpta.ac.za

Should you wish to be on our mailing list kindly complete the above form omitting the short course and date. For further information you could visit our Website at

http://www.techpta.ac.za

IMPLEMENTATION OF A LABORATORY QUALITY SYSTEM

Cost

R 5 200 per candidate (R4 800 if paid by 17 May 2002 and 11 October 2002 respectively)

Dates

27 - 31 May 2002
21 - 25 October 2002

Course contents

- The need for a quality system
- Basic Quality Principles
- ISO Laboratory Quality Systems:
  - Overview of SABS 0259: 1990
  - Overview of ISO 17025: 1999
- Quality Policy Statement
- Quality Documentation
  - Quality Manual
  - Standard Operating Procedures
- Implementation of the Quality System
- Management Responsibility
- Reviews and Assessment
- Continuous Improvement

Target group: Quality control technicians, Quality control scientists, Quality co-ordinators, Quality managers, Laboratory supervisors, Chemical analysts, Chemical technicians

BASIC
CHEMICAL ANALYSIS OF
WASTEWATER AND INDUSTRIAL EFFLUENTS

Cost

R6 000 per candidate (R5 500 if paid by 1 November 2002)

Dates

11 - 20 November 2002 (1 1/2 weeks)

Course contents

- Review of chemical terms and principles
- Introduction to laboratory techniques
- Sampling
- Data processing
- Chemical calculations
- Determination of physical parameters
  - pH
  - Temperature
  - Conductivity
  - Turbidity
  - TDS
- Principles of titration
- Alkalinity procedures
- Chloride (Mohr)
- Sulphate
- COD
- OA
- Settleable solids / suspended solids / total solids
- SVI (MLSS)
- Phosphorous (PO_4^{3-}; Total phosphate)
- Nitrite-nitrogen
- Chlorine (Free chlorine, total chlorine)
- Kjeldahl digestions
- NH_3 (NH_4^+)
- TKN

FUNDAMENTALS OF COAL ANALYSIS

Cost

R3 000 per candidate

Dates

6 - 8 November 2002

Course contents

- Introduction
- The uses of coal
  - steam coals
  - coking coals
- Proximate parameters of coal
- Analytical methods
- Basic quality control
- Reporting of results

Target group

Coal analysts, graduates-in-training, coal plant operators.

CHARACTERIZATION OF COAL

Cost

R2 400 per candidate

Dates

25 - 26 June 2002

Course contents

- Introduction
- South African coal fields
- The modern coal data base
- Quality control in the coal laboratory
- Important properties of coal
- Coal utilization

Target group

Coal analysts, supervisors, coal technicians.

OPERATION OF BIOLOGICAL FILTERS

Cost

R4 300 per candidate

Dates

3 - 7 June 2002

Course contents

- Sources of wastewater
- Composition of wastewater
- Process description and microbiology
- Types of biological filters
- Operational aspects: (Loading rates, recycle rates, etc.)
- Operational problems
- Disinfection
- Anaerobic digestion of waste sludge

ACCOMMODATION

HOTELS

Acton & Mcintosh
1010 Dashing Centre, Hildastreet, Hatfield (012) 342-8297

Arcadia Hotel
515 Proes Street, Arcadia (012) 326-9311

Orange Court
540 Vermeulen Street, Arcadia (012) 326-6346

Cresta Pretoria Hotel
230 Hamilton Street, Pretoria (012) 341-3473

Holiday Inn
Beatrix Street, Arcadia (012) 341-1571

Protea Hotel Capital
Van der Walt Street 390 (012) 322-7795

GUEST HOUSES

Kosmos Guest Hostel and NZASM Guest House
Rissik Street, Pretoria (012) 341-0890/3977

La Maison
235 Hilda Street (012) 430-4341

Meintjieskop Guest House
145 Eastwood Street, Arcadia (012) 342-0738

mechanically and biologically pretreated waste water is treated further with lime, a flocculant polymer, and magnetite. Phosphates precipitate and the particles are attracted by an electromagnetic field to a stainless steel mesh until the magnet is shut off and the unit is backwashed. The lime-phosphate product is expected to be recyclable.

SULPHATE CONTROL P-RELEASE FROM SEDIMENTS

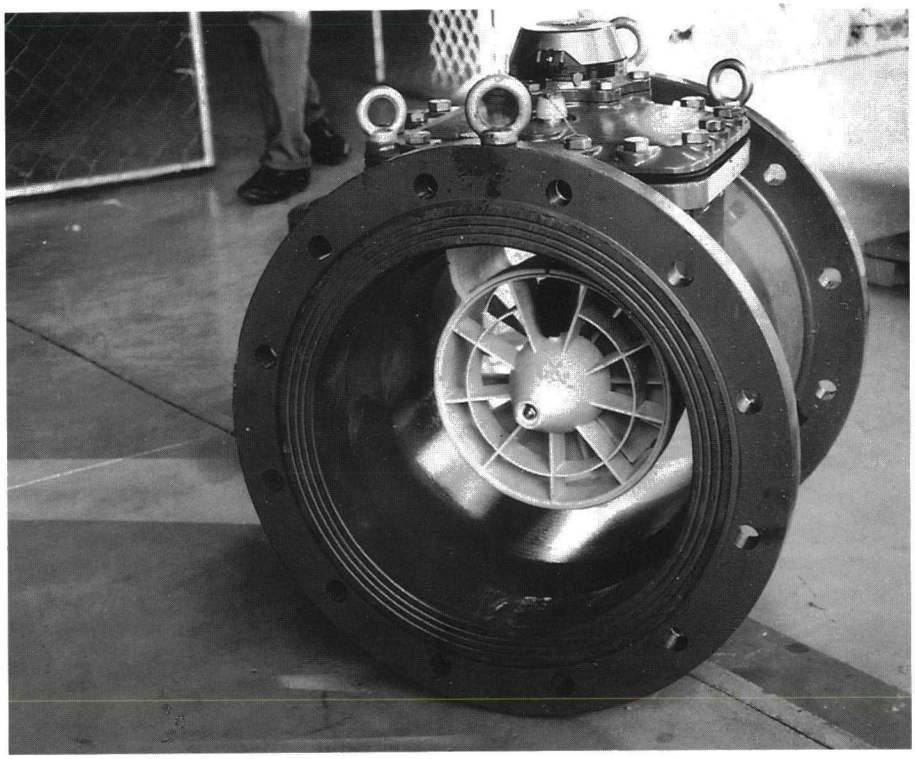
The sulphate concentration of waters has been found to be an important variable controlling phosphorus release from sediments, which in turn affects the health of aquatic systems according to researchers working in collaboration with the Institute of Ecosystem Studies at the New York Botanical Garden, reporting on their study of 23 different aquatic systems.

Their data showed that relative phosphorus release (RPR) and sulphate concentration of water are related, independently of whether bottom waters are oxygenated or not. Although the mechanisms are not yet known, evidence indicates that sulphate additions can inhibit P binding by sediments.

In addition, while aquatic systems with low sulphate concentrations have low RPR, systems with only slightly elevated sulphate concentrations have significantly elevated RPR, particularly under anoxic conditions. This finding could alter the current scientific view of lakes affected by acidic deposition. If changing atmospheric sulfur inputs can alter the sulphate concentration in surface waters independent of how the watershed neutralises acid, the P cycle of even so-called "insensitive" lakes may be affected.

Water Newsletter 3121 161189

TURBINE WATER METERS WITH ANALOG OUTPUTS



The Meinecke large-bore turbine flow meter.

The advantage the turbine meter has over many other types is its repeatable accuracy over a wide flow range. The Meinecke WP turbine water meter, from Liquid Meters, can be supplied for up to 800 mm diameter pipework and will meter flow rates between 320 and 6 000 m^3/h to $\pm$ 2 per cent, error. Intermittent flow rates of up to 12 000 m^3/h are possible.

The 800 mm WP will start to register at a flowrate of 60 m^3/h. Standard meters are rated for a maximum temperature of 50 °C and 16 bar pressure. Hot water meters for temperatures up to 130 °C, and higher pressures are also available. An outstanding feature of this meter range is its compact design. The face-to-face dimensions of the 800 mm WP is only 600 mm, with the actual turbine rotor located in the meter body.

Very few meter users are aware that it is possible to transmit analog signals from a mechanical meter. It is possible to connect pulser sensor units to standard WP meter registers, without any modification to the meter head. Thus, remote readouts can be obtained for totalisation, rate-of-flow indication, analog output for chart recording or telemetry, and data-logging.

Enquiries: Liquid Meters, PO Box 758, Isando. 1600. Tel: (011) 975-1171, (021) 73-3048, (031) 29-1112.

CONTROL OF EFFLUENT PH

A self-contained pH controller, with a selection of pH sensors, is now available from Action Instruments. The Signet MK 710A controller, with an MK 712 pH sensor will monitor and control pH values from O to 14 pH to an accuracy of 0,1 pH (or 10 mV). Temperature compensation is automatic, from 0 up to 100 °C. The instrument can be used for a variety of applications, from pulp and paper manufacture through to the treatment of industrial and municipal waste.

The controller is microprocessor based, provided with dual alarm contacts (SPDT 3A at 250 VAC), proportional control, and is easy to calibrate. Isolated, or non-isolated 4-20 mA outputs can be specified.

The MK 712 sensor is fitted with 316 stainless steel guards to protect the glass electrodes from the process flow, and a unique earthing system protects against electrical noise interference. Titanium or Hastelloy C guards are also available. The sensor is also available with built-in, or remote preamp, depending on the application. Other compatible sensors are the stainless steel wet-type MK 718 series with CPVC double junction electrodes, and the new Mz 2700 series for in-line or submersible applictions.

Enquiries: Charley Lai, Action Instruments SA (Pty) Ltd, PO Box 62313, Marshalltown, 2107. Tel: (011) 493-7056.

BIOLOGICAL METHODS USED FOR TOXIC DISCHARGES

The Environmental Protection Agency (EPA) in the United States of America has proposed new biological measurements and test procedures for analysing pollutant discharges into navigable waters. Until recently, agency programs for controlling toxic discharges were based largely on effluent limitations for individual chemicals. Because data on the toxicity of substances to aquatic organisms are available for only a limited number of compounds, effluent limitations on specific substances do not necessarily provide adequate protection for aquatic life. In such situations, it is often more feasible to examine the whole effluent toxicity and instream impacts using biological methods.

Under the proposal of the EPA, the Clean Water Act "List of Approved Biological Test Methods" would be adding methods for measuring mutagenicity and the toxicity of pollutants in effluents and receiving waters, for monitoring viruses in wastewaters and sludges; and updating citations to microbiological methods.

Water Newsletter 301289

WANTED: WATER RESEARCH SOFTWARE

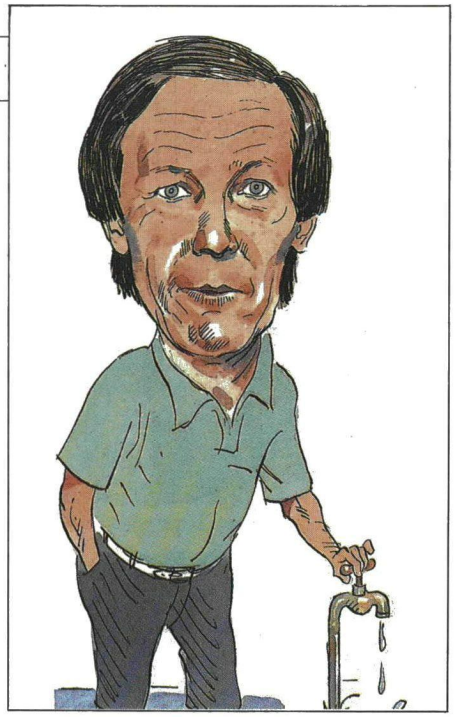
CCWR-RSWN

The Computing Centre for Water Research (CCWR) is compiling a list of software which may find application in the field of water. The perception of the need for such a list has arisen out of requests to the CCWR to develop a catalogue of computer programs and models available to researchers in South Africa.

If you have appropriate software which is in either the public or commercial domain and which you would like listed by the CCWR please write to:

The Manager
Computing Centre for Water Research
c/o University of Natal
PO Box 375
PIETERMARITZBURG
3200

Kindly supply a one line description of the software, the location of the software itself and the location of the reference containing a fuller description of the software.



BARNARD VEREER

Dr James Barnard, die bekende Pretoriase ingenieur wat internasionale roem verwerf het met sy revolusionêre proses om stikstof en fosfor biologies te verwyder uit rioolafloop, is einde verlede jaar saam met die Minister van Nasionale Gesondheid en Bevolkingsontwikkeling, dr Rina Venter, as Pretorianer van die Jaar bekroon.

Die toekenning word jaarliks deur die Pretoriase dagblad, die Transvaler en Volkskas Bank aan 'n Pretorianer gedoen wat 'n uitsonderlike bydrae tot die vooruitgang en verryking van die gemeenskap gelewer het.

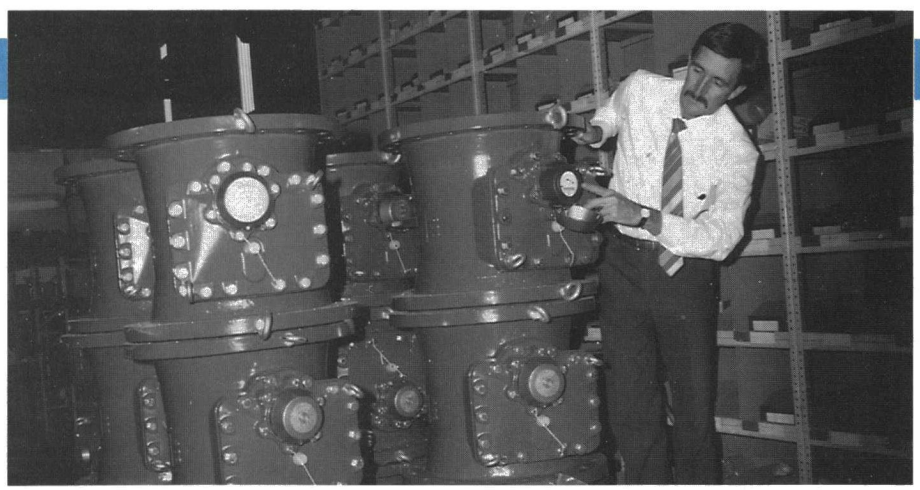
INSTANT MILLIONAIRE

On Tuesday 20 February 1990, Richard Farrell, product manager at Liquid Meters, a company in the Fluid Group, became an instant millionaire by winning the jackpot of R2 623 746,35 at Sun City.

Earlier that day Richard set out for Bospoort Dam to have a look at one of the Company's Meinecke magnetic flowmeters used for monitoring the water flow for Rustenburg Municipality. He dropped in at Sun City for lunch and like all good engineers interested in electronic devices could not resist adding a few coins to the Dream Machine.

"When the winning 'sevens in a line' came up, I simply couldn't believe it," he said. " I was about to pull the handle again, but the chap next to me yelled: 'You've won - you've got it!".

From that point on, life for Richard became rather confused. A chopper was sent to his home in Henley on Klip to fetch his wife Carmen, and they were invited to spend a couple of nights as guests of Sun City to help them adjust to the idea of being millionaires twice over. Sun City also offered to fly them over to Mauritius for a few days holiday, to keep out of the way of the press.



Richard Farrell, product manager, counting Meinecke induction flow meters in the stores at Liquid Meters. Now, he's counting money.

Richard, age 49, has no intention of quitting Liquid Meters. "There's too much to do," he said.

He has five children ages from seven through to 24. His wife, Carmen, is a sales manager for a photo-copying company.

VISITING SCIENTISTS AT THE ALBANY MUSEUM'S DEPARTMENT OF FRESHWATER INVERTEBRATES

In November and December 1989 aquatic scientists in Grahamstown and Cape Town were fortunate in having Dr Koen Martens from the Royal Belgian Institute of Natural Sciences, Brussels, for an extended visit. Dr Martens, or Koen as everyone who met him was soon on a first name basis, is a world specialist on African inland water Ostracoda which are commonly known as seed or mussel shrimps. They are small Crustacea (from less than 1 mm up to 8 mm long) commonly found in temporary bodies of water such as rain filled pools, puddles and pans but are found in all types of inland water bodies such as rivers and lakes as well as in the sea.

Research on Ostracoda serves several purposes. Ostracoda form an important component of pond ecosystems, they serve as fish food and from their abundance and species composition give a good indication of the potential of economic fish production in lakes. In lake and marine sediments, fossil seedshrimps are the major indicators of palaeoclimatic conditions. Fossilised marine species are used by the oil industry to date layers of sediments on the sea bed and thus make predictions of exploitable oil deposits possible. One of the fundamental bases of scientific research is, however, to protect nature and the environment. Here again ostracods form an important component of the fresh and brackish inland water ecosystems in that they are an essential part of the biological successions of species, part of the food chain and are important indicators of the conservation status of water bodies.

At present Dr Martens is writing a book on the 500 or more species of Ostracoda known from the inland waters of the African continent. During his visit to the Albany Museum he examined the holdings of the National Freshwater Invertebrate Collection naming all unnamed material and selecting material to take back to Belgium for more in depth study. He made some very interesting discoveries finding the unknown males of *Sclerocypris tuberculata*, the females of which were described from Lake Chrissie by Methuen in 1910. As there had been very good rains around Grahamstown in October and early November 1989 there were many temporary pools of water present and impoundments were full again after several years of less than average rain. These conditions were ideal for collecting ostracods and from a number a collecting trips, conducted jointly with Albany Museum staff around the eastern Cape and with the University of Cape Town staff around the western Cape, some very interesting ostracod material, including several new species were collected. In all there are more than 150 known species in southern Africa and Dr Martens considers these to represent only slightly more than 50 per cent of the ostracod fauna of this region.

During Koen's visit a one day mini workshop on the collection, preservation, identification and study of Ostracoda was run at the Albany Museum. The workshop was attended by researchers from the Institute for Freshwater Studies of Rhodes University, the JLB Smith Institute of Ichthyology and the Departments of Freshwater Invertebrates and Ichthyology of the Albany Museums. The morning session consisted of an introductory lecture followed by an excursion to Thomas Baines Nature Reserve where samples of benthic invertebrates were collected from a large temporary pool. Material collected was taken back to the Museum where Dr Martens demonstrated the sorting of ostracods from the composite samples taken and then showed everyone the intricacies of dissecting the 1 mm long creatures to enable exposure of important features for identification.

The visit by Dr Martens was an extremely valuable one and besides making the National Collection available for international research it allowed a number of people to become familiar with one of the many groups of freshwater invertebrate animals.

MAYFLIES

From September to December this year Professor WP McCafferty, a world expert on Ephemeroptera (Mayflies) from Purdue University, Indiana, USA, will be visiting various research institutes, universities and museums.

He will be conducting research, teaching and do some collecting with museum staff. He will be stationed at the Albany Museum and we are hoping to put together a workshop on the collection, rearing, preparation and identification of mayflies at the Albany Museum. We would be interested to hear from any people who may like to learn some more about this ecologically important but much neglected group of insects. Anyone interested should write to: Dr FC de Moor, Curator of Freshwater Invertebrates, Albany Museum, Somerset Street, Grahamstown. 6140.

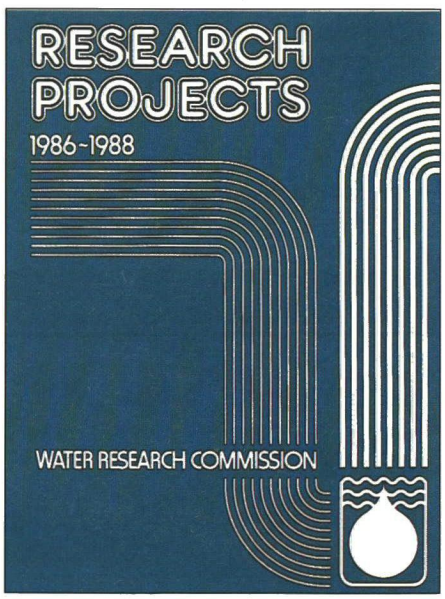
Dr Koen Martens, world specialist on African inland water Ostracoda, collecting specimens.

WNK - NAVORSINGSPROJEKTE 1986 - 1988

Saamgestel deur Drinie van Rensburg

Hierdie publikasie gee 'n oorsig van die navorsingsprojekte wat die WNK gedurende die tydperk 1986 tot 1988 finansieel ondersteun het en toon terselfdertyd die wye spektrum van wateraangeleenthede waarby die WNK betrokke was deur die koördinering, bevordering en selektiewe finansiering van waternavorsing in Suid-Afrika.

Hoewel daar in die Kommissie se jaarverslae oor WNK-projekte gerapporteer word, word elke individuele projek nie afsonderlik toegelig nie. In hierdie publikasie word meer tegniese besonderhede oor 140 navorsingsprojekte gegee en bestaande sowel as afgehandelde projekte is ingesluit. Die inligting is in sewentien hoofstukke vervat wat elk oor 'n afsonderlike navorsingsveld handel, naamlik, hidrometeorologie, oppervlakhidrologie, grondwater, besproeiing, versouting, eutrofikasie, munisipale afvalwaterbehandeling, rioolslyk, seestorting van uitvloeisels, nywerheidsuitvloeisels, waterbehandeling en -herwinning, drinkwatergehalte en gesondheidsaspekte , ontsouting, landelike en stedelike watervoorsiening, waterbesparing by kragsentrales, sosio-ekonomiese gevolge van waterbeperkings en navorsingsteundienste.



Elke projekinskrywing bestaan uit die titel van die projek gevolg deur die projeknommer, die kontraktant, die navorsingsperiode, die doel van die projek, 'n bondige beskrywing en verslag oor die projek asook 'n lys van die publikasies wat uit die navorsing voortgespruit het.

Dié verslag is die derde een in die reeks wat verskyn en is gratis by die Waternavorsingskommissie verkrygbaar. Eksemplare kan bestel word van die Bibliotekaresse, mev Tineke van der Schyff, die WNK, Posbus 824, Pretoria. 0001. Telefoon (012) 330-0340.

This publication is also available in English. To order, please write to the Librarian, Mrs Tineke van der Schyff, WRC, PO Box 824, Pretoria. 0001. Telephone (012) 330-0340.

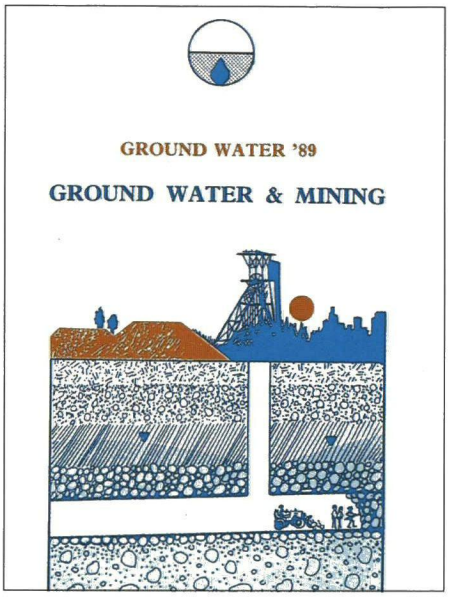
WATER AND SANITATION DIRECTORY FOR KWAZULU

by P Alcock

One of the major problems involving upgrading work in KwaZulu as well as black areas in Natal and especially the rural and peri-urban areas, is the lack of knowledge of other individuals or organisations also active in planning, research and project implementation. This directory is an attempt to bridge such a gap by providing details of 31 aid agencies and government bodies, as well as two small engineering consulting firms, who are in some way concerned with domestic water and sanitation mainly in non-urban black areas. Firms manufacturing items of water or sanitation equipment are not listed. None of the major engineering consulting firms (largely involved with contract work in urban KwaZulu) are listed.

The degree of practical involvement of the various organisations outlined in the directory varies, with some bodies such as the Department of National Health and Population Development providing an advisory service only. The KwaZulu Department of Agriculture and Forestry by contrast, undertakes numerous water projects in non-urban areas of KwaZulu. The people listed within each organisation serve as points of contact and the list of names is not claimed to be exhaustive for a specific agency. The overall aim of the directory is to encourage contact between different bodies some of whom may not be aware of each other's existence.

Copies are available from the compiler, P Alcock, Development Studies Research Group, Department of Economics, University of Natal, Pietermaritzburg. 3201.



GROUND WATER '89
GROUND WATER AND MINING

Proceedings of the 5th biennial symposium of the Ground Water Division of the Geological Society of South Africa.

Copies of the proceedings are available from the Treasurer, Ground Water Division, PO Box 7015, Pretoria. 0001. Cost: R35,00 each.

IRRI-INFO BEHAAL SUKSES

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SOUTHERN AFRICA

GROUNDWATER

A short course entitled An introduction to Ground Water will be held at the Schonland Research Centre, University of the Witwatersrand, Johannesburg, from 21 to 23 May 1990.

Enquiries: Mr AG Reinders (012) 330-0340, Mr R Meyer (012) 841-2440 or Mr AC Johnstone (011) 803-5726.

WASTE LOAD ALLOCATION

A short course on waste load allocation is to be held from 13 to 15 June 1990, in Pretoria, at the WRC. Lectures will be given by Dr Ray Whittemore from Tufts University, Massachusetts, USA, as well as Drs Dirk Grobler and Jane Harris. Topics will include water quality management, waste load allocation, water quality modelling required for waste load allocation investigations and some applicable case studies of waste load allocation in RSA.

Enquiries: Ms H Joubert, Water Research Commission, PO Box 824, Pretoria. 0001. Tel: (012) 330-0340.

WATER SUPPLY

A seminar on water supply and sanitation will be held in Transkei from 26 to 27 June 1990.

Enquiries: The Conference Co-ordinators C 126, CSIR, PO Box 395, Pretoria. 0001.

SASAS

The annual congress of the Southern African Society of Aquatic Scientists (SASAS) will be held from 2 to 4 July 1990 at the University of the Orange Free State, PO Box 339, Bloemfontein. 9300.

Enquiries: Prof AJH Pieterse, Chairman, Local Organising Committee, Department of Botany, UOFS, PO Box 339, Bloemfontein. 9300.

AQUACULTURE 1990

A symposium convened by the Aquaculture Association of South Africa will be held from 11 to 13 July 1990 at Stellenbosch University. The theme of the programme will be: The potential of aquaculture species.

Enquiries: Mr CE Britz, BUCE, Carnegie Building, Stellenbosch University, Stellenbosch. 7600.

WATER QUALITY

A short course on the design of water quality monitoring systems will be held from 13 to 17 August 1990 at the CSIR Conference Centre in Pretoria.

Enquiries: Miss Helene Joubert, Water Research Commission, PO Box 824, Pretoria. 0001. Tel (012) 330-0340.

IRRIGATION

A South African Irrigation Symposium will be held from 4 to 6 June 1991, at the Elangeni Hotel in Durban.

Enquiries: The Organising Committee: Irrigation Symposium, PO Box 824, Pretoria. 0001.

OVERSEAS

WATER DEVELOPMENT

An international symposium on the development of small scale water resources in rural areas will be held in Khon Kaen, Thailand, from 21 to 25 May 1990.

Enquiries: SITRA Co, Ltd, 158 Emmanual Building, Rachdapisek Road, Bangkok 10310, Thailand.

WASTE DISPOSAL

The IFAT 90 International Trade Fair for Waste Disposal will be held in Munich, FRG, from 22 to 26 May 1990.

Enquiries: Munchener Messe - und Ausstellungsgesellschaft, mbH, Messeglaude, Postfach 12 10 09, D-8000 Munchen 12, FRG.

WASTEWATERS

The 3rd Symposium on forest industry wastewaters will be held in Tampere, Finland, from 6 to 8 June 1990.

Enquiries: Prof M Viitasaari, Tampere University of Technology, PO Box 527, SF 33101, Tampere, Finland.

WATER RESOURCES

The 8th international conference on computational methods in water resources will be held in Venice, Italy, from 11 to 15 June 1990.

Enquiries: Prof G Gamlolati, Dipartimento di Metodi e Modelli Matematici, Universita degli Studi, Via Belzoni 7, 35 131 Padova, Italy.

SEWAGE COLLECTION

A conference on innovative cost-effective sewage collection and treatment systems will be held from 11 to 13 June 1990 in Sao Paulo, Brazil.

Enquiries: Dr SAS Almeida, Multiserre, Av President Wilson 210, 9th Floor, 20030 Rio de Janeiro, RJ Brazil.

WATER RESOURCE SYSTEMS

A symposium on water resource systems application will be held in Winnipeg, Canada, from 12 to 15 June 1990.

Enquiries: International Symposium on Water Resources Application, Civil Engineering Department, University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada.

ACTIVATED SLUDGE

A short course on activated sludge process control will be presented at Colorado State University, Fort Collins, Colorado, from 25 to 28 June 1990.

Enquiries: Thomas G Sanders, Program Leader, Environmental Engineering, Department of Civil Engineering, Colorado State University, Fort Collins, Colorado 80523. Fax (303) 491- 7727. Tel (303) 491-6222.

URBAN STORM DRAINAGE

The 5th international conference on urban storm drainage will be held from 23 to 27 July 1990 in Osaka, Japan.

Enquiries: Prof T Sueishi, Department of Environmental Engineering, Osaka University, 2-1 Yamada-oka, Suite 565, Japan.

IAWPRC

The IAWPRC's Biennial '90 international conference and exhibition on water pollution control will be held in Kyoto, Japan, from 29 July to 3 August 1990.

Enquiries: IAWPRC Biennial '90, 1 Queen Anne's Gate, London SW 1H 9 BT, England.

REMOTE SENSING

A conference on remote sensing and water resources will be held in Enschede, the Netherlands from 20 to 24 August 1990.

Enquiries: Convention Bureau Twente, PO Box 1003, 75 00 BA Enschede, The Netherlands.

Call for papers

Southern African irrigation symposium

4 to 6 June 1991
Elangeni Hotel, Durban

Theme

Irrigation research and development in Southern Africa: past progress, present standing and future challenges.

Call for papers

Intending contributors are invited to submit abstracts of papers or posters on any topic relevant to the theme of the symposium.
Abstracts will be used for selection purposes only and should be 200 - 300 words long. To facilitate selection, the abstract should concisely state the rationale, aims, methodology as well as the main results and/or conclusions of the work reported.

Deadlines

For receipt of 200 - 300 word Abstracts: 30 June 1990

For receipt of Extended Abstracts: 31 December 1990

For receipt of full-length manuscripts: 30 April 1991

Correspondence and enquiries

All correspondence and enquiries should be addressed to:

The Organising Committee
Southern African Irrigation Symposium
PO Box 824
PRETORIA
0001
RSA
Tel: (012) 330-0340.
Fax: (012) 70-5925

short course

An introduction to Ground water

DATES:

21 to 23 May 1990

WHERE:

Schonland Research Centre, University of the Witwatersrand, Johannesburg.

ORGANISED BY:

Ground Water Division of the Geological Society of South Africa.

COST:

R500, includes teas, lunches, course notes and cocktail function.

WHO SHOULD ATTEND:

- Civil engineers
- Mining engineers
- Geologists and engineering geologists
- Water supply engineers
- Contractors in water supply and dewatering
- Geotechnical engineers

Avoid disappointment by registering early as numbers will be limited.

COURSE OBJECTIVE:

The course is an introduction to ground water and will cover ground water terminology, ground water flow and occurence, aquifer definition, drilling and borehole construction, test pumping and evaluation, ground water chemistry and tracers, water resources and dewatering.

COURSE PRESENTERS:

- Mr JR Vegter,
- Prof BTL Verhagen,
- Mr RJ Connely,
- Miss KL Morton.

CONTACT FOR FURTHER INFORMATION:

- AG Reynders
  Tel: (012) 330-040
- R Meyer
  Tel: (012) 841-2440
- AC Johnstone
  Tel: (011) 803-5726

IAWPRC

INTERNATIONAL ASSOCIATION ON
WATER POLLUTION
RESEARCH AND CONTROL

IAWPRC SPECIALIST GROUP ON APPROPRIATE WASTE MANAGEMENT TECHNOLOGIES FOR DEVELOPING COUNTRIES

The first IAWPRC specialised conference on Alternative Waste Treatment Systems was held at Massey University, Palmerston North, New Zealand in May 1988. The conference was attended by some 140 researchers and practitioners with interest in cost effective on-site waste treatment systems. Following the discussions on appropriate waste management technology with emphasis on resource recovery, it was suggested that an international network be established to promote development of appropriate waste management technologies for application in particular in developing countries. The concept was discussed at a meeting of the IAWPRC's representatives from developing countries during Brighton Conference in July 1988 and it was agreed that a new specialist technical group within IAWPRC would be developed. The structure, objectives and membership of this specialist technical group are outlined below.

NAME OF THE GROUP

Specialist Technical Group on Appropriate Waste Management Technologies for Developing Countries.

SUBJECT AREAS

- Low-cost and on-site treatment systems:
  - Research and Development.
  - Design, Operation and Control.
- Resource recovery from wastes:
  - Production of food, fodder and other useful products.
  - Nutrient recycling.
- Waste minimisation and waste exchange.

TERMS OF REFERENCE

Promote the concept of appropriate technology approach to waste management.

Establish a link between institutions, practitioners and research groups with expertise in low-cost on-site treatment and waste recycling systems, and develop collaborative research and development.

Establish information exchange through a newsletter, which may be upgraded to a journal.
Organise the specialised conference series initiated in 1988.

Develop links with multilateral agencies to identify, develop and implement projects in developing countries.

WORKPLAN

Based on the discussions at the Alternative Waste Treatment Conference in May 1988 and the Brighton Conference in July 1988, the following work plan is proposed:

Collect information on the status of appropriate waste management technologies in various countries through a questionnaire.

Establish a data base of experts, institutions, facilities and projects relating to low-cost on-site treatment and resource recovery.

Organise the second specialised conference in 1991.

The next meeting of the group is proposed to be held at the Kyoto Conference later this year.

For further information and application for membership, please contact the chairman, Dr Rao Bhamidimarri, Massey University, Palmerston North, New Zealand.
Tel: 64-63-69- 099,
Fax: 64-63-505612.