

All future planning applications for reservoirs by water authorities would need to be accompanied by evidence of a proper leak detection programme if they were to stand any chance of being accepted — Mr Tom King, Minister of Department of Environment, United Kingdom, December 1981.

Water savings:

WRC LOOKING AT LEAKS

The Water Research Commission (WRC) recently initiated a project to carry out research into leak detection in water supply distribution systems in the Republic of South Africa. For this purpose, the necessary sophisticated equipment is to be obtained and information gained overseas by a WRC senior adviser will be utilised for establishing, on a small scale, a methodology for conducting a leak detection and repair programme.



The project will run for a period of one year starting from August 1, 1983. At the conclusion of the project a manual on leak detection and repair programmes for use under South African conditions will be prepared.

Research will be carried out by the National Building Research Institute of the CSIR under contract to the Commission.

Two "open days" will be arranged to enable interested parties to observe the leak noise correlator in operation and the leak position excavated.

According to Mr Charles Chapman, senior adviser of the Water Research Commission, the adage "out of sight, out of mind" is probably in no other area of human endeavour more applicable than to the subject of leaks in water mains buried below the surface of the

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Mr HC Chapman, senior adviser, WRC, sounding a valve for leak noises.

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Leaks

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ground. Lack of attention to leak detection cannot be tolerated in today's world of costly energy and limited resources.

"The once rich kingdom of the Queen of Sheba was ultimately forfeited when its water system fell into disrepair because she or her counsellors failed to bring into perspective the cost-benefit factors of a maintenance programme," he said.

Surveys¹ carried out in Britain during the mid-1970's revealed that an average 24 per cent of all the water so expensively collected, treated and pumped into supply by the water authorities, never reached the consumers.

Water lost from distribution systems in Britain were as follows:

Northwest	38 per cent
Welsh	35 per cent
Southwest	30 per cent
Yorkshire	29 per cent
Thames	Not available (London 29 per cent)
Severn Trent	27 per cent
Wessex	27 per cent
Southern	25 per cent
North Umbrian	22 per cent
Anglian	21 per cent

The worst case was Liverpool with a mean water loss of 57 per cent and a peak of 75 per cent in the Kensington supply zone. Loss here was 55 litres per property per hour.

Invariably, leak detection programmes carried out all over the world have indicated very favourable cost/benefit relationships. Even in the case of Westchester², a suburb of New York City, where three such exercises were carried out over a period of only six years, the third exercise still indicated a positive cost/benefit ratio.

In Boston, Massachusetts, in addition to approximately 1 700 visible leaks repaired annually, a leak detection programme identified a further 600 leaks, which accounted for losses of four Ml/d. In seven towns and cities in India leakages of over 30 percent were reduced to below 10 percent and costs were recovered within a period of six to twelve months. But

it is not only the cost of water that constitutes the benefit. In supplying water, the resources of manpower, materials, machinery, money, time and water are mobilised to conserve, abstract, heat, store, convey, distribute and administer water supplies.

percent the most common, what then is the figure for South African towns and cities?

Some feelers were put out informally to determine the extent to which the problem had been tackled locally and the results were confusing to say the least.

How leak detection works

Because of the pressure in a pipeline, water escaping from a pipe through a leak creates a noise. Transducers are mounted on either side of the leak at convenient points on the pipeline such as valves, hydrants or stoptaps. The transducers detect and convert noise vibrations into electrical signals which are transmitted either by cable or radio to the correlator for processing. The correlator delays one signal progressively with respect to the other and measures the similarity between the two signals until the two signals 'match'. From this difference in travel time, the correlator calculates the position of the leak.

Background noises such as traffic noise, pump noise, electrical installations, do not affect the process, which can therefore be used at any time during the day or night.

South Africa

With the advent of the severe drought in South Africa which entered a crisis period in 1983, the question was raised: "If cities and towns overseas, notably in the USA, Europe and India are experiencing actual water losses from the distribution network of up to 75 percent, with between 25 and 35

Of some twenty local authority engineers and water department officials who were approached, all felt that total unaccounted-for-water (UAW) was in the region of nine to eleven percent. This term "unaccounted-for-water" comprised three components:

- Water which reaches the consumer but which is not

Benefits of leak detection

- Water saved. This implies higher income per unit of water entering the distribution network.
- Energy saved as treatment and distribution costs are reduced.
- Money saved by tackling leaks at source, rather than simply pumping more water into the system and out through leak holes, will pay dividends in reduced need for additional capital expenditure for new facilities and reduced damage to property, roads etc.
- Capacity saved, thus deferring new facilities.
- Capital expenditure deferred.
- Confidence in and knowledge of the supply system are gained enabling better business judgements to be made which are liable to public scrutiny.
- Added confidence on decision whether to repair or replace.
- Metering reviewed and improved. Leak detection demands a review of consumer and bulk meter accuracy.
- Improved control of the distribution system. Leak detection programme demands a review of the entire distribution system and the updating of all records.
- Discovery of unauthorised connections.
- Improved public relations between supplier and consumer.
- Possibility of reduced tariffs to consumers.

measured due to faulty metering.

- Unmetered supplies such as fire hydrants, municipal parks and gardens, street washing, and some construction activities.
- Water which actually escapes from the network through defects either in the pipework or the fittings.

Estimates of hidden leaks (leaks which do not appear on the surface and also those leaks which appear on the surface, but at some distance from the leak position) in South African towns and cities varied from one percent to about five percent. Reasons given for these low figures compared to overseas reports were:

- The very dry nature of our, especially highveld, soils. Even a very small leak will permeate to the surface whereas overseas a wet patch will merely blend in with the surrounding wet conditions.
- Due to the harsh South African climate, an underground leak will cause grasses and other vegetation to identify the existence of a leak by unseasonal greenness and thereby attract the attention of the water inspector.
- Underlying rock formations in South Africa prohibit leakage water from travelling downwards into the soil.
- The majority of mains overseas are laid beneath the road surface thus preventing leakage water from surfacing in the immediate vicinity of the leak.
- Many of the cast iron pipes in use overseas are more than 100 years old and in some instances even older wooden pipes are still in service.

Other reasons were that static pressures in South Africa tended to be higher than those overseas, causing the surrounding soil to be eroded to a much greater extent in the event of a leak. This erosion invariably extends to the surface. Also, all South African consumers are metered, thus permitting the preparation of accurate water audits.

These above reasons are obviously very speculative. While

Leak sizes and losses

A leak does not have to be very large to be significant as the following table calculated for a pressure of 5 bar (500 kPa or 75 psi), indicates:

Actual leak size		Litre per		m ³ per	
mm	dia	minute	hour	day	month
0,5	•	0,33	20	0,48	14,4
1,0	•	0,97	58	1,39	41,6
1,5	•	1,82	110	2,64	79
2,0	•	3,16	190	4,56	136
2,5	•	5,09	305	7,30	218
3,0	•	8,15	490	11,75	351
3,5	•	11,3	680	16,3	490
4,0	•	14,8	890	21,4	640
4,5	•	18,2	1 100	26,4	790
5,0	•	22,3	1 340	32,0	960
5,5	•	26,0	1 560	37,4	1 120
6,0	•	30,0	1 800	43,2	1 300
6,5	•	34,0	2 050	49,1	1 478
7,0	•	39,3	2 360	56,8	1 700

some will be valid in certain areas, almost all are vulnerable to sound counter argument, and the only conclusion therefore is that in South Africa we simply do not know what the magnitude of losses from water networks is.

Leak detection

While leak detection and repair programmes are fairly common overseas, very little has been done in South Africa in this regard and all local authorities rely almost entirely on tell-tale surface wetness to detect and locate leaks. Preliminary enquiries indicate that this state of affairs exists mainly due to two reasons:

- the non-availability of the expensive specialized electronic detection devices locally, and,
- a lack of knowledge and expertise on precisely how to implement a leak detection and repair programme under local conditions.

To rectify this situation the Water Research Commission has initiated the leak detection research programme in collaboration with

the NBRI in a selected area to demonstrate the operation of the equipment, the planning and conduct of a leak detection and repair programme and the cost/benefit relationships of such a programme.

References

- ¹Pearle F; *Tapping the lost gallons flowing under our streets* Mun. Jour. 30 July 1982.
- ²Moyer E.E. *et al*; *The economics of leak detection and repair — a case study*. Jour. Am Wat. Works Ass. January 1983.

Instituut gestig

'n Europese waterinstituut is onlangs in Varese (Italië) met die hulp van die Europese Kommissie gestig in 'n poging om waterbestuur- en -bewaringsbeambtes op te lei.

Die hoofdoel van die instituut is om die verskeie EEK-lidlande te help om die probleme spruitende uit die aanwending van gemeenskaps-wetgewing op waterbestuur te oorkom. Dit sal ook vir nie-lidlande van belang wees.

WNK-jaarverslag**Hoogtepunte van 1982**

Prototipe waterherwinningsaanleg, Kaapse Vlakte. Bedrae bestee aan waterherwinningsnavorsing het gedaal van sowat 63% van die totale besteding in 1972 tot 15% in 1982 — 'n aanduiding dat resultate reeds toegepas word.

'n Gids oor waterherwinning, visbiomonitering, voedingstofverwydering by geaktiveerdeslykaanlêe, die bekamping van mineralisasie — hierdie is enkele van die aktiwiteite van die Waternavorsingskommissie wat in sy jongste jaarverslag as hoogtepunte van die jaar aangedui word.

Die jaarverslag, wat die gebeure van 1982 in oënskou neem, is onlangs ter tafel gelê en dek die tien vernaamste gebiede wat deur die werksaamhede van die Kommissie bestryk word, naamlik waterherwinning, grondwater, die wateromgewing (waaronder eutrofikasie), munisipale afvalwater, nywerheidsuitvloeiels, ontsouting, waterverbruik (waaronder droë verkoeling en waterbesparing), besproeiing, oppervlakhidrologie en reënvalstimulering.

Aan die einde van 1982 onders-teun die WNK 65 projekte waarvan 15 gedurende dié jaar geïnisieer is. Dit bly steeds die beleid om krities na nuwe navorsingsvoorstelle te kyk om te verseker dat projekte in nasionale belang en van hoë prioriteit sal wees.

Die vyftien nuwe projekte wat gedurende 1982 geïnisieer is, weerspieël dan ook duidelik sommige van die knelpunte in die

waterhuishouding van die Republiek. So kan as voorbeelde genoem word 'n projek vir die evaluering van die impak van fosfaatbeperk-ing op die trofiese stand van Suid-Afrikaanse damme; navorsing oor die behandeling en wegdoening van munisipale slyke; twee nuwe projekte oor nywerheidsuitvloeiels; navorsing oor mem-brane vir tru-osmose en ultrafiltrasie; waaktoetsing van die virologiese gehalte van herwonne water ('n uiters belangrike aanvullende bron van water in die toekoms); neerslag, dreinering, weermodifikasie; geskikte besproeiingsmetodes, streeksgrondvogtekorte, besproeiing van koring, en die ontsouting van mynwater.

Die WNK se verslag meld voorts dat tegnologie-oordrag weer eens benadruk is en dat geslaagde besoekdae gehou is waartydens tegnologie vir die behandeling van munisipale en nywerheidsuitvloeiels aan 'n groot aantal belangstellendes uit die plaaslike owerheid- en die nywerheidssektor gedemonstreer is.

In 'n opsomming van die finansiële besteding aan navorsing oor die afgelope elf jaar van die Kommissie se bestaan, word daarop gewys dat die relatiewe besteding

aan spesifieke navorsingsterreine metterjare sekere veranderinge ondergaan het. So, byvoorbeeld, is 63% van die navorsingstoekenning van 1972 aan navorsing oor die herwinning van water bestee teenoor 15% in 1982, terwyl navorsing oor reënvalstimulering in 1976 2% van die toekenning ontvang het, teenoor 23% in 1982.

Die verslag meld dat dit belangrik is om te beseft dat 'n verlaging in die relatiewe geldelike toekenning nie noodwendig op 'n laer prioriteit vir die bepaalde gebied as sodanig dui nie, maar dit kan ook wees dat suksesvolle resultate nou in die praktyk toegepas word sodat die behoefte aan nuwe navorsing afge-neem het.

Die relatiewe besteding aan die verskillende terreine van navorsing word hieronder grafies weergegee. Die uitbeelding links verteenwoordig dié besteding per jaar aan 'n besondere navorsingsterrein as persentasie van die totale besteding van daardie jaar. Die persentasiegram regs weerspieël die besteding aan daardie navorsingsterrein oor die 11 jaar van die Kommissie se bestaan as persentasie van die totale besteding aan alle terreine oor daardie tydperk.

CAPE CLOUDS STUDIED

The Department of Transport's Weather Bureau in collaboration with the Water Research Commission (WRC) conducted from 4 July to 5 August a preliminary investigation of the clouds in the Cape winter rainfall region to try and determine the potential for rainfall stimulation in the area.

The objective of the programme was to measure the liquid water content as well as the size, number and distribution of ice particles and vertical velocities in all types of clouds in the South-western Cape.

The WRC through the Company for Research on Atmospheric Water Supply (CRAWS) contracted the Nelspruit-based Cansas International Corporation (CIC), who are involved in the Commission's rainfall stimulation project in the Eastern Transvaal, to participate in the Cape cloud study.



Mr Graeme Mather

For the field exercise CRAWS made their Learjet available which is fitted with laser measuring equipment and a special "airborne" computer, while CIC provided a crew experienced in weather modification flying. The pilots were Graeme Mather, Fritz van der Westhuizen and Rob Parsons and a technician, Ian Ross.

The Weather Bureau flew one research aircraft, and Aero Commander, which also has an FSSP (a one-dimensional forward scatter-

ing spectral probe) and 2DC probes (two-dimensional cloud particle size probes) plus new heated humidity sensors.

The Weather Bureau's personnel component comprised one pilot, two instrument technicians and two meteorologists.

The teams operated from the DF Malan Airport in Cape Town and had access to a 20 cm radar as well as an aircraft weather radar.

Speaking from their base at the airport's control tower, one of the pilots and managing director of CIC, Mr Graeme Mather, said the Cape clouds differ very much from those in the Eastern Transvaal.

"The major difference," he said, "was that the Cape clouds consist of the maritime type of cloud, while in Nelspruit you normally have the continental type of cloud — a cloud which typically forms over the interior of a continent."

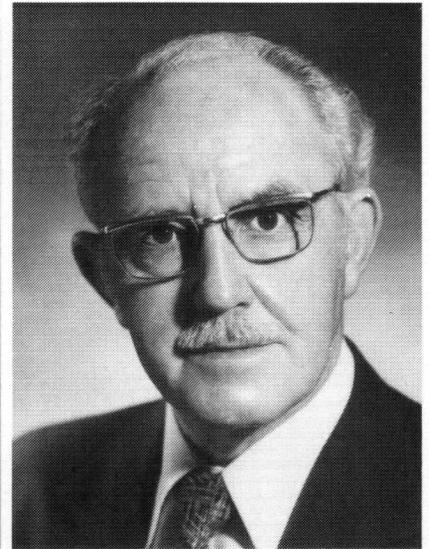
According to Mr Mather the continental airmass is quite different from a maritime airmass in terms of its cloud condensation nuclei (CCN) content. "The continental cloud has many more cloud condensation nuclei than the maritime clouds. But the maritime clouds have got nuclei with a larger size spectrum."

"These larger nuclei, we think, are salt crystals," he said. He said the larger nuclei in maritime clouds give rise to an efficient rainfall process which can be described as a "warm" process.

"This means precipitation-sized droplets develop and grow large enough to fall as raindrops before the cloud reaches 0°C temperature, while in the Nelspruit area the clouds have to reach temperatures a lot colder than 0°C to rain. This happens because of the absence of these large nuclei and can be described as the 'cold' process," Mr Mather said.

He said the aircraft covered an area with a radius of about 100 to 200 km from Cape Town and that the teams obtained enough cloud data to "get a fairly good overall picture".

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HENZEN HERAANGESTEL

Dr MR Henzen, Voorsitter van die Watnavorsingskommissie (WNK) is vanaf 1 Augustus 1983 vir 'n verdere tydperk van drie jaar in hierdie amp aangestel. Dr Henzen, wat ook die Hoof- uitvoerende beampte van die Kommissie is, beklee die pos reeds sedert 1979 toe hy die leisels by die uitredende dr Gerrie Stander oorgeneem het.

Terselfdertyd is aangekondig dat die lede van die Watnavorsingskommissie vir die volgende driejaartermyn die volgende is: Mnr JF Otto (Direkteur-generaal van Omgewingsake en Ondervoorsitter van die WNK); mnr JG du Plessis (Adjunk-direkteur-generaal, Departement van Omgewingsake); dr CF Garbers (President; WNNR); dr DW Immelman (Direkteur-generaal van Landbou); dr JP Kriel (voormalige Sekretaris van Waterwese en tans konsultant); prof DJ Schoeman (dekaan van die Fakulteit Ingenieurswese aan die Universiteit van Pretoria); en dr N Stutterheim (o.m. Voorsitter van die Raad van die Universiteit van die Witwatersrand). Mnr JG Brand (stadsingenieur van Kaapstad) is 'n gekoopteerde lid van die Kommissie.

DAVID JENKINS VISITS SOUTH AFRICA

During May this year the Water Research Commission brought Professor David Jenkins, a well-known USA expert in the field of sanitary engineering, to South Africa to conduct a series of three one-day courses on sludge bulking control in Pretoria, Cape Town and Durban.

The courses were attended by 173 engineers, plant superintendents and research and development personnel interested in sludge problems, and to date two treatment plants in the Transvaal had instituted programmes for bulking control by return activated sludge (RAS) chlorination based on the methods described in the courses. (See separate articles.)

Professor Jenkins also presented a paper at the Biennial Conference of the Institution of Water Pollution Control (IWPC) in East London entitled "Causes and Control of activated sludge bulking".

While in East London *SA Waterbulletin* spoke to him about his work and his sojourn in South Africa.

David Jenkins is a Professor of Sanitary Engineering at the University of California, Berkeley. He holds a B.Sc degree in Applied Biochemistry from the Birmingham University (1957) and a PhD in Public Health Engineering from the University of Durham, King's College (1960).



Professor David Jenkins

His major research interests are in the general areas of biological wastewater treatment process fundamentals, and design and operation in water and wastewater chemistry. Specific current areas of research are into the factors that cause poor solids separation in the activated sludge process. Of special interest is his work on activated sludge bulking which has been conducted at Berkeley over the past 10 years. In this area Professor Jenkins and his research group at Berkeley have determined the relationship between organic loading and dissolved oxygen concentration in bulking at low dissolved oxygen concentration. This work in activated sludge was given fundamental foundation and verification by conduct of pure mixed culture experiments which demonstrated that the causative filamentous organisms in low dissolved oxygen (DO) bulking grew faster at low DO's than typical floc forming organisms from activated sludge. Additional work has demonstrated the effect of aeration basin configuration on activated sludge bulking at low organic loadings. The use of small initial aeration basin compartments (or "selectors") has been demonstrated on the laboratory pilot plant and at full-scale level to rectify bulking problems at low organic loadings. Design criteria for selectors are currently being studied.

Work has also been in progress for several years on the metabolism of various filamentous organisms that cause bulking. The use of chlorine for bulking control has been popularized, refined and applied at many waste treatment plants, both domestic and industrial, in the USA and in Europe. Current research is investigating the mechanism of filamentous organism control by chlorine. Recently work has been initiated on the control of foaming caused by the growth of the filamentous organism *Nocardia* in activated sludge.

Asked about further needs in the field of bulking control research Professor Jenkins summarised the following three research directions:

- further characterization of the metabolism/physiology/ecology of the filamentous organisms that cause activated sludge bulking so that rational methods of bulking control can be devised in the form of improved design and operation
- research into the growth characteristics and surface properties of *Nocardia* that contribute to the production of severe foam/scum problems in activated sludge, and
- research into the mechanism of bioflocculation. "This is important because most waste treatment processes rely on flocculant growth or growth in biofilms," Professor Jenkins said.

Impressions gained in South Africa?

Professor Jenkins said that poor activated sludge settling is a significant problem in the Republic.

"RAS chlorination is not a commonly used technique for bulking control, as it is in the USA. In the USA, Cl_2 is used commonly for effluent disinfection so that it is available already in waste treatment plants and can be readily used for bulking control," he said.

He said activated sludge settling and *Nocardia* foaming problems occur in biological phosphorus removal plants as well as conventional activated sludge plants.

"It would be interesting to determine whether RAS chlorination could be used in biological

Clouds

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"We hope to have the data of the joint venture analysed and processed and a report ready for the Commission within six months," Mr Mather said.

The field programme was coordinated by a senior Weather Bureau scientist, Mr Roelof Brintjies.

The Chairman of the WRC and two Commission members recently visited the project in Cape Town.

phosphorus removal activated sludge plants without compromising the phosphorus removal."

Professor Jenkins said it would also be interesting to determine whether the filamentous organisms causing bulking problems in the Republic's activated sludge plants are similar to those causing problems in the USA and Northern Europe.

20th ANNUAL LSSA CONGRESS HELD IN DURBAN

"Wetlands in Perspective" was the theme of the 20th annual congress and workshop of the Limnological Society of Southern Africa which was this year held from 4-7 July at the University of Natal in Durban.

In his opening address Professor Brian R Allanson, President of the Society, referred to 1983 — the International Year of the Wetlands, and said that the Limnological Society created the ideal forum within which to examine the impact such a year could have upon these fragile components of Southern Africa's aquatic resources.

He said he believed it was due to the genuine concern for the future of wetlands that the International Year had been brought into being.

"The report of Goodham and Niering on North American wetlands is but one of many objective assessments of ecological and environmental status which has brought this international effort into existence.

"They recognise that North America (excluding Alaska) has lost more than half of the original estimate of 127 000 000 acres by dredging, infill and pollution," he said.

Speaking on the importance of wetlands Professor Allanson said that while it was true that the North Americans, and in particular

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Desalination

Symposium on new developments

Desalination: new developments and industrial applications will be the subject of a symposium on 27 October 1983. The symposium, arranged jointly by the Water Research Commission, the National Institute for Water Research and the Institute of Water Pollution Control, will be held at the CSIR Conference Centre.

The keynote address is to be delivered by Mr JG du Plessis, Deputy Director-General of the Department of Environment Affairs, and ten papers will be presented viz

* *RO and UF research in self-sufficiency and competitiveness* — RD Sanderson, EP Jacobs and M Hurndall

* *Applications of membrane technology to industrial effluent treatment and water recycling* — GR Groves *et al*

* *Operating experiences of reverse osmosis plants treating Rand Water Board water* — JP Leger

* *Operating experience with reverse osmosis at ESCOM* — GL Dalton and KH Hall

* *Gemineraliseerde aflope — waarheen?* — F von Reiche

* *Ion exchange processes for chemical recovery combined with water desalination* — BA Hendry

* *Electrodialysis used for desalination of waste water in an ESCOM power station* — J Melzer and D van Deventer

* *An evaluation of the electro-dialysis reversal process (EDR) for the desalination of brackish water from Omaruru delta* — EA de Villiers, GR Botha and PF Hamman

* *Disposal of saline waste waters at Sasol II and III* — JN Marriott and JJ Brand

* *Treatment of industrial effluent by vapour compression concentration (VOC) at the Afprene (Karbonchem) factory at Newcastle Natal* — PJ Woollam and J Joughin.

The registration fee of R20,00 entitles delegates to summaries of papers, morning and afternoon tea or coffee, lunch and the cocktail party. Papers may be ordered at R2,00 per paper, payable in advance with registration.

Applications to attend are to be directed to the Chief Director, NIWR, PO Box 395, Pretoria, 0001.



The Mayor of Durban, Councillor Mrs Sybil Hotz, pictured with some of the overseas delegates at the recent LSSA congress. From left to right: Ms Karen McKee (Louisiana State University, USA), Mr Bernard Patten (University of Georgia, Athens), the Mayor of Durban, Professor Brian Allanson (LSSA President), Dr Irving Mendelsohn (Coastal plant ecologist, USA), Dr Clive Howard-Williams (DSIR, New Zealand) and Christian Leveque (France).

LSSA

(From page 9)

Canada, had something like 40% of the world's freshwater store, the largest area of freshwater swamp occurred in Africa. Coupled with this was the other relevant fact that mangrove swamps dominated 75% of the world's coastline between 25°N and 25°S latitude. Equally important were the world's barrier/lagoonal coastlines with North America possessing 34% of such coastline, Asia 22% and Africa 9%, and also the fact that $2 \times 10^6 \text{ km}^2$ or 1,3% of the world's land surface was occupied by freshwater swamps and marshes.

Professor Allanson said that such statistics alone expressed the relevance of wetlands to the planet's freshwater areas, and apart from their very real significance to the biological events which occur within them and at their interfaces with dryland, they often reflected the condition of the water table and could act as regions where groundwater was recharged.

"As Howard-Williams, a limnologist from the Department of Scientific and Industrial Research (DSIR) in New Zealand, has indicated, wetlands should be considered as integral parts of the water stores of the Earth, not merely evaporation basins or mammoth compost heaps," Professor Allanson said.

Some of the eminent overseas visitors who took part in the workshops included Dr Clive Howard-Williams from New Zealand, who spoke on "Wetlands and watershed management", Dr Irving Mendelsohn and Ms Karen McKee, two coastal plant ecologists from Louisiana State University, USA, who delivered a joint paper on "Louisiana's eroding coast: management alternatives", and Mr Bernard Patten from the University of Georgia, Athens, USA, who discussed the "Indirect effects in a reservoir ecosystem"

Tumi Tomasson (Reykjavik Iceland) enjoying a drink with Mr Colin Archibald, NIWR, Durban.



The HRI team: Bossie Bosman, Nico Rossouw, Sue Young, Lindi Rossouw, Mike Silberbauer, Annelize Hanekom and Charel Bruwer.



Diana and Mike Coke, Nature Conservation, Natal, Dr Chris Appleton, Medical Research Council, Durban, Helmut and Dallas Kröger, LSSA organising committee.



RAPID TECHNOLOGY TRANSFER

Sludge bulking is a very common problem experienced to a greater or lesser extent at nearly all South African activated sludge plants and local authorities have long sought a satisfactory cost-effective means to deal with this problem, or where possible, to design plants in which bulking will not take place.

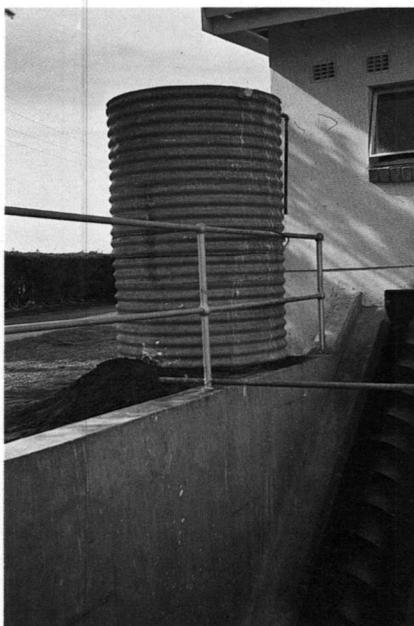
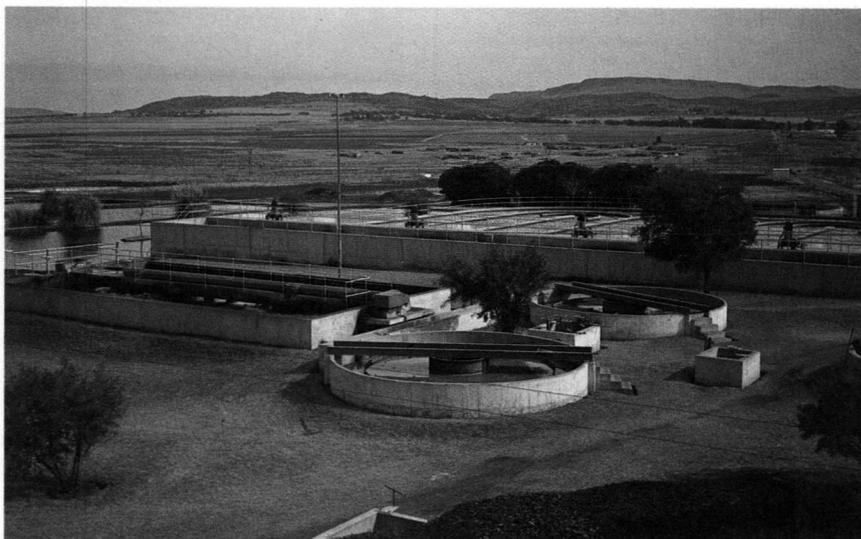
One of the topics Professor David Jenkins from the USA dealt with during his recent visit to South Africa was the rapid solution for sludge bulking, that is, the careful application of chlorine to destroy the filamentous organisms which give rise to bulking.

This technique has already been tried by both the City Councils of Heidelberg and Pretoria (as the following articles illustrate) and will in the near future be tried by the City Council of Port Elizabeth. *Indeed a case of rapid technology transfer!*

SLUDGE BULKING IN HEIDELBERG

In May this year the sewage works personnel of Heidelberg were faced with a problem of solids carry-over at their Carousel plant's final clarifier. The problem manifested itself during periods of high flow at midday and lasted for two to four hours. Suspended solids concentration in the effluent was particularly high during these periods. The plant superintendent Mr Frans Jordaan immediately tried to take corrective action. However, none of the standard techniques for improving clarification helped. He reported the matter to the city engineer, Mr Dan Claassen, and together they discussed the matter with their consulting engineers, Meiring and Partners, in order to come to some practical solution for the problem.

As an interim measure temporary ground storage dams were constructed to impound the polluted effluent to ensure that it did not reach the Blesbokspruit. In addition two approaches were tried to solve the problem on the process side. Firstly, the aerators were switched off to make the whole reactor anaerobic and hopefully killing the filamentous organisms which caused the bulking. Unfortunately, however, the water in the plant started smelling so badly that after two days it was necessary to again start aerating. Secondly, high volumes of sludge were wasted in an attempt to remove the bulking organisms from the reactor. However, this also did not solve the problem.

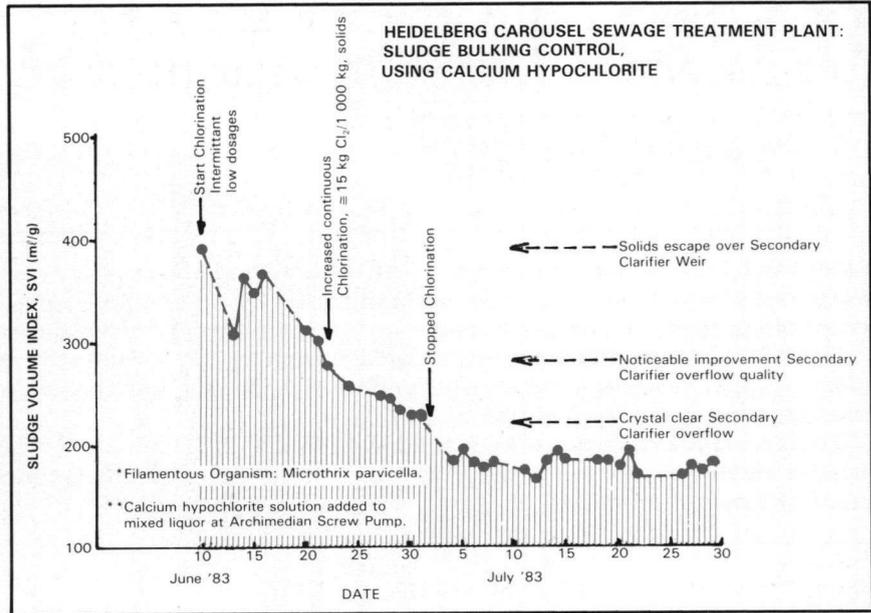


Above: In the foreground Heidelberg's Simplex works — the oldest working activated sludge works in the RSA. In the background, Heidelberg's Carousel plant, also the oldest working plant of this type in the RSA.

Left: Calcium hypochlorite dosage tank and dosing pipe from which the chemical solution is drop-fed to the return sludge on the Archimedian screw pump.

Dr James Barnard of Meiring and Partners then suggested the use of calcium hypochlorite as a means for controlling the bulking. This idea originated, amongst others, from his attendance of a recent course organised by the Water Research Commission and presented by Professor David Jenkins of the University of California, Berkeley, USA, which dealt in-depth with sludge bulking and its control. Prof Jenkins spoke with such conviction of the universal application of chlorine for effectively dealing with sludge bulking that it was felt appropriate to try it at the Heidelberg plant. Mr Jordaan obtained a suitable dosing tank for making-up calcium hypochlorite as well as dosing equipment to feed the chemical solution into the return sludge streams at the Archimedian screw pumps (see photograph).

As can be seen on the accompanying graph this treatment was very successful. Continuous addition of calcium hypochlorite at a rate of about 15 kg chlorine per 1 000 kg Mixed Liquor Suspended Solids (MLSS) per day ($\equiv 6\text{c/k}\ell$ effluent) for a period of about 20 days resulted in the plant returning to normal operation, i.e. no solids carry over even during peak flows. Typical analyses of the effluent before, during and after the problem of solids carry over had been corrected with the use of calcium hypochlorite are given in the accompanying Table. Nitrification



was lost during the period of solids carry-over and chlorination. Whether this was due to the loss of solids or the killing of the nitrifying bacteria by chlorine is not certain at this stage. However, when normal operation was re-established, the MLSS built up to a satisfactory level and nitrification again took place.

This successful application of chlorine control for sludge bulking has given the personnel of the sewage treatment plant at Heidelberg considerable confidence in this technique. At this plant the Sludge Volume Index (SVI) is now monitored on a daily basis. When it exceed a certain pre-set value calcium hypochlorite will be dosed

to control bulking. In future the problem will be dealt with as soon as it appears and possibly the high chemical dosages used during the above case, i.e. 15 kg chlorine per 1 000 kg sludge per day may not be necessary, or at least not for extended periods.

The personnel of the Town Council of Heidelberg and their consultants are to be congratulated on their rapid application of the technology presented at the sludge bulking course in May this year. Such rapid technology transfer and successful application augurs well for wastewater treatment and pollution control in general in the RSA. — **Dr Herman Wiechers, Senior Adviser, WRC.**

TYPICAL ANALYSES FOR HEIDELBERG'S RAW SEWAGE AND FINAL EFFLUENT

Analysis	Before Sludge Carry Over (11/5/83)		During Sludge Carry Over (29/6/83)		After Successful Chlorination (27/7/83)	
	Raw	Final	Raw	Final	Raw	Final
pH	7,6	7,1	7,5	7,7	8,2	7,2
Suspended Solids (mg/ℓ)	286	5,6	141	23*	171	10,8
Chloride (mg/ℓ)	137	130	125	168	133	132
Ammonia (mg/ℓ as N)	76	2,6	70	55**	81	16
Nitrate (mg/ℓ as N)	0,0	3,3	0,0	5,5	0,0	3,3
COD (mg/ℓ) (24 hour composit)	864	80	864	192	688	56

* Relatively low suspended solids during low flow periods of day due to solids captive effect of filamentous organisms

** Nitrification process almost completely lost during sludge bulking period

CHLORINATION AS A CONTROL MEASURE FOR BULKING SLUDGE AT THE DASPOORT SEWAGE TREATMENT PLANT, PRETORIA.

The design of the Daspoort plant provided for a 40 Mℓ/day conventional activated sludge plant, comprising primary settlement, high rate surface aeration and final settlement.

Units are in three modules each having two Dortmund tanks for primary sludge removal with three aeration tanks each divided by separation walls into three compartments. The total design aeration period is 12 hours. Keeping in mind the need to remove nutrients it was decided to use this conventional process to endeavour to reduce both nitrate nitrogen and phosphorus by bringing into the sewage the return activated sludge and passing the mixture through an anoxic/anaerobic zone. The first compartment of each basin was used with the aerator switched off thus creating an anoxic/anaerobic zone with a retention time of 4 hours. Because of the poor settling characteristics and poor compactability the sludge is recycled at a rate of 1:1.

NITROGEN AND PHOSPHORUS REMOVAL

The average nitrogen and phosphorus removals for the last two years were averaged at 62% and 65% respectively.

SLUDGE BULKING

With the incorporation of an anaerobic zone of 4 hours retention time and the total aeration period cut down from 12 to 8 hours sludge bulking problems were encountered from time to time. The sludge volume index (SVI), stirred SVI and a microscopic investigation were used to try and detect the onset of bulking at an early stage. Since the 15th June 1983 the settling of the sludge became very unstable. Filamentous organisms became dominant and sludge was lost over the weirs of final clarifiers particularly at peak flows.



Final clarifier with thick surface scum, before chlorination.



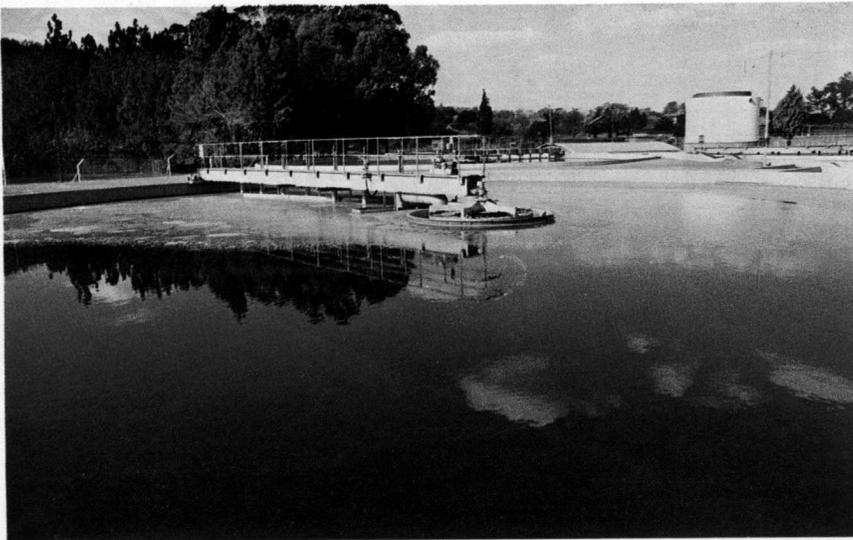
Final clarifier with thick surface scum, after chlorination — scum starting to break up.

CHLORINATION

Chlorine was applied into the return sludge sump of the Archimedian screw pump. The chlorine was dosed at a rate of 6 kg/h which corresponded with a dosing rate of 9,6 mg/ℓ or an average dosing of 0,002 g per kg of dry solids. The chlorination on one unit was stopped after seven days when it became evident that most of the filamentous growth was broken up into shorter threads.

(To page 14)

The University of Cape Town, under the auspices of the Water Research Commission, is carrying out a survey of the nature and extent of the problem of sludge bulking in the RSA. It would therefore be appreciated if any of SA Waterbulletin's readers who experience problems with sludge bulking would fill in the questionnaire on page 15 and return it to Dr G Ekama of the University of Cape Town.



have to be considered, which worked out at 0,38 c/m³/d. The chlorine dosage could be reduced marginally if the return activated sludge is chlorinated at a low suspended solids concentration — **Nick Thirion, Chief Chemist, Daspoort Sewage Works, City Council of Pretoria.**

Final clarifier after successful chlorination and manual cleaning of surface.

SLUDGE

(From page 13)

During the time of dosing the SVI's improved steadily as can be seen from Figure 1. Units 9 and 10 of the same plant were chlorinated after Unit 11 for 3 and 4 days respectively. During the time of dosing the SVI has improved steadily as can be seen from Figure 1. Afterwards it became evident that Unit 11 had been overdosed because the oxidation of ammonia nitrogen had dropped considerably and was much higher than before dosing. A comparison of the analytical results of the different units are given in Table 1. The chlorine must have effected the nitrifiers which are sensitive organisms.

SCUM

The scum on the final clarifiers was converted from a spongy brown mass to a thin but more dense blackish layer of sludge which is easier manageable. Before chlorination only two tanks could be manually cleaned per day while six tanks could be cleaned twice a day after chlorination.

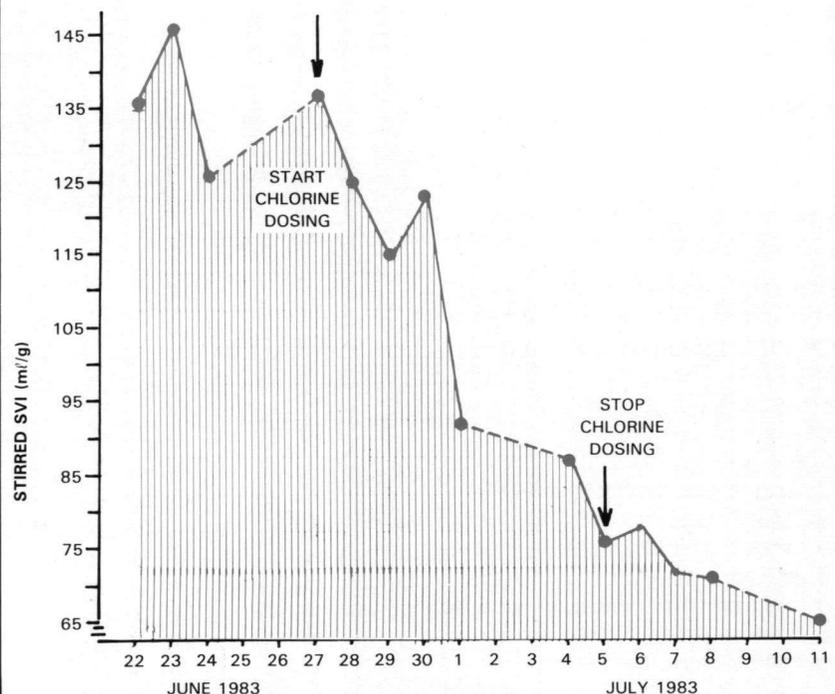
COST

At most sewage works chlorination is an integral part of the purification process and therefore only the cost of the chlorine will

CHEMICAL ANALYSIS OF THE FINAL EFFLUENT FROM THE DIFFERENT UNITS OF THE DASPOORT ACTIVATED SLUDGE PROCESS

	UNIT 9	UNIT 10	UNIT 11
NH ₄ — N before chlorination	8,8	9,7	12
after chlorination	12,0	7,3	21
NO ₃ — N before chlorination	8,0	3,7	3,8
after chlorination	8,9	6,1	3,3
Period of chlorination — days	3	4	7

FIGURE 1:
THE EFFECT OF CHLORINATION ON SLUDGE BULKING AT DASPOORT PTA



QUESTIONNAIRE ON ACTIVATED SLUDGE BULKING AND FOAMING

by
UNIVERSITY OF CAPE TOWN

**Department of Civil Engineering
(Water Resources and Public Health Engineering)**

Research in collaboration with the Water Research Commission of South Africa

1. OBJECTIVE

The Institute of Water Pollution Control (South African Branch) has indicated that there are many activated sludge plants in South Africa that experience sludge bulking or foaming problems. In response to this motion, the University of Cape Town, in collaboration with the Water Research Commission, is undertaking an investigation into sludge bulking and foaming problems. This investigation will be conducted in three phases; (i) assessment of the extent and severity of the sludge bulking and foaming problems in South Africa, (ii) identification of the micro-organisms that are the principal causes of sludge bulking and foaming in South Africa, and (iii) demonstration of remedial and preventative strategies for controlling sludge bulking and foaming at selected activated sludge plants. This questionnaire is the first phase of the investigation. In the second phase, a second questionnaire will be distributed to those willing to participate in the investigation requesting further information and a sludge sample. The sample will be used for micro-organism identification purposes and the results will allow identification of the micro-organisms that are the principal causes of bulking and foaming in South Africa. Furthermore, with the information in the questionnaire, an attempt will be made to link the conditions in the plant to the type of micro-organisms that cause bulking and foaming. In the third phase, certain activated sludge plants will be selected where bulking and foaming remedial and preventative methods will be tested and demonstrated.

2. GENERAL NOTES ON COMPLETING QUESTIONNAIRE

- 2.1 Please return completed questionnaire within two weeks.
- 2.2 If you have any difficulties in completing the questionnaire, please do not hesitate to call Dr George Ekama (tel. 021-698531 ext 198) for clarification of questions.
- 2.3 Information in the questionnaire will be treated as confidential.

3. GENERAL INFORMATION

3.1 Name and address of treatment works: _____

Post Code _____ Tel: _____ (include area code)

3.2 Name of plant superintendent: _____



3.3 Person completing questionnaire:

Name _____ Position _____
Tel: _____ (include area code)

3.4 Date questionnaire completed: _____

4. TYPE AND SIZE OF TREATMENT PLANT

4.1 Average dry weather flow: design _____
(please specify units). present _____

4.2 What type of activated sludge plant is it? (Give its name and describe briefly)

5. SLUDGE BULKING AND FOAMING PROBLEMS

5.1 Do you have a sludge bulking problem?
 YES NO

5.2 If yes, indicate the severity of your problem
 minor difficult manageable impossible

5.3 Do you have a problem with sludge scum or foam?
 YES NO

5.4 If yes, indicate the severity of the problem
 minor difficult manageable impossible

6. CLOSURE

We wish to thank you for your cooperation in completing this questionnaire.

6.1 Would you be willing to participate in our investigation and complete the second, more extensive questionnaire?
 YES NO

6.2 Please return completed questionnaire to:

Dr George Ekama
Department of Civil Engineering
University of Cape Town
Rondebosch 7700
Cape

Tel: (021) 69-8531 Ext. 198.



AKADEMIE VEREER STANDER



Prof FC Fensham, Voorsitter van die Suid-Afrikaanse Akademie vir Wetenskap en Kuns, oorhandig hier aan dr GJ Stander die MT Steynmedalje vir Natuurwetenskaplike en Tegniese Prestasie. Dr DJC Geldenhuys, hoofsekretaris van SAAWK kyk toe.

'n Voormalige voorsitter van die Waternavorsingskommissie, dr GJ Stander is onlangs deur die SA Akademie vir Wetenskap en Kuns vereer toe die MT Steyn-medalje vir Natuurwetenskaplike en Tegniese Prestasie aan hom toegeken is.

Die toekenning het geskied by 'n bekroningsplegtigheid wat op Potchefstroom gehou is, en die huldigingswoord is deur dr GG Cillié, hoofdirekteur van die Nasionale Instituut vir Waternavorsing van die WNNR, gelewer.

Dr Cillié het dr Stander as die doyen van waternavorsing in Suid-Afrika bestempel en gesê dat hy 'n leidende rol gespeel het in die ontwikkeling van gepaste tegnologie vir die optimale benutting, bewaring en hergebruik van water.

'Dr Stander het op al hierdie gebiede 'n leidende rol vervul en hy kan vandag terugkyk op 'n lewe van toegewyde diens aan die waterywerheid van Suid-Afrika, terwyl hy ook diep spore op die internasionale watergebied getrap het,' het dr Cillié gesê.

Hy het ook verwys na die aandeel wat dr Stander in die ontwikkeling van waternavorsing gehad het as eerste direkteur van die Nasionale Instituut vir Waternavorsing van die WNNR.

'Hy het die navorsing geïnisieer wat die NIWN in samewerking met die Munisipaliteit van Windhoek gedoen het en wat teen die einde van 1968 gelei het tot die inwerkingstelling van die wêreld se eerste aanleg vir die herwinning van rioolwater vir direkte hergebruik. Dit,' het dr Cillié gesê, 'was bepaald 'n deurbraak van wêreldformaat.'

Benewens talle toekennings van lande soos die VSA, Wes-Duitsland, Frankryk, Israel en ook sy eie land, het drie universiteite hier te lande hom met ere-doktorsgrade vereer, naamlik Potchefstroom, Kaapstad en die Oranje-Vrystaat.

Dr Stander het ook die besondere eer te beurt geval om vir vier agtereenvolgende termynne van twee jaar elk as president van die 'International Association on Water Pollution Research and Control' gekies te word . . .

Hulde aan voormalige Stadingenieur

Mnr EJ Hall, voormalige stadsingenieur van Johannesburg, tree uit nadat hy twee agtereenvolgende dienstermyne as Kommissielid gedien het. In 'n onderhoud met *SA Waterbulletin* het die Voorsitter van die WNK, dr Henzen, hulde gebring aan die voortreflike bydrae wat mnr Hall aan die WNK en die Republiek op die gebied van water gelewer het.



Mnr EJ Hall

'Mnr Hall was 'n gewaardeerde lid van die Kommissie, nie net vanweë sy insig en wye ervaring nie, maar ook omdat hy as stadsingenieur van die grootste stad in die land 'n intieme kennis van die nypende probleme van plaaslike owerhede ten opsigte van watervoorsiening en rioolwaterbehandeling na Kommissieberaadslagings kon bring.

'Kommissielede word aangewys op grond van hulle besondere ervaring en kennis van 'n gespesialiseerde gebied rakende water en waternavorsing, en in hierdie opsig het mnr Hall 'n besondere bydrae kon lewer,' het dr Henzen gesê.

FOSFAATVERWYDERING MET SUUR MYNWATER

'N Volskaalse eksperiment die afgelope twee jaar by die Rondebult-rioolwatersuiweringswerke, Germiston, het getoon dat suur mynwater doeltreffend gebruik kan word om fosfate uit riooluitvloeiels te verwyder.

Die eksperiment is uitgevoer deur mnr PH (Hayter) van der Merwe, hoofskeikundige van Germiston en mev ND Basson, senior skeikundige by die Rondebult-werke, in samewerking met mnr JP maree van die Nasionale Instituut vir Waternavorsing by die WNNR.

In dié spesifieke ondersoek het die dosering van ongeveer 20 mg/l yster (Fe) konstant 'n uitvloeiels gelewer met 'n fosfaatwaarde van minder as 1 mg/l.

Van groot betekenis is die feit dat die suur mynwater in 'n hoofvoerriool wat na Rondebult toe dreineer, ingebloei is. Sodoende is die koste vir die lê van 'n spesiale pyp na die rioolwerke bespaar.

Die totale koste vir dié fosfaatverwydering is bereken as minder as 0,1 c/m³ rioolwater behandel. Dit vergelyk goed met die huidige koste van konvensionele chemiese behandeling wat op meer as 1 c/m³ beraam word.

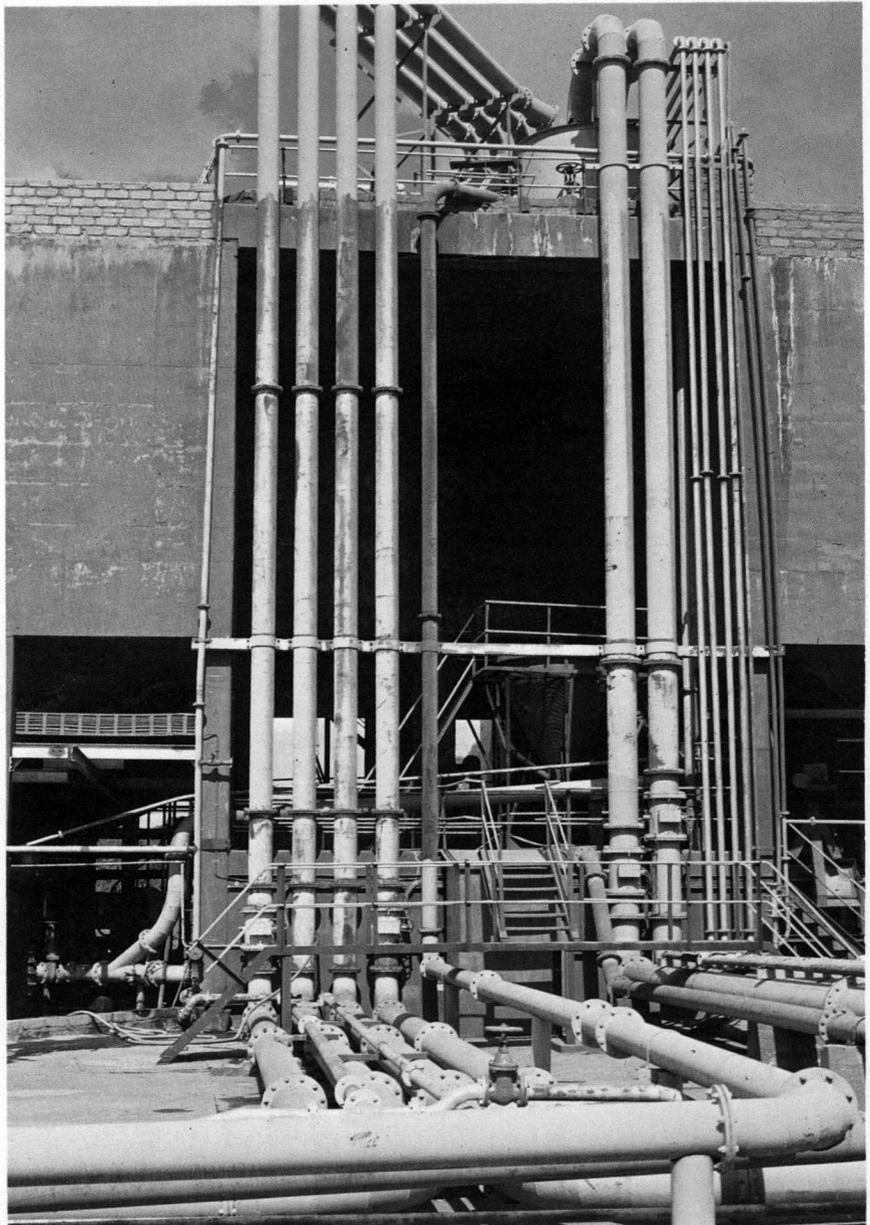
Volgens mnr Van der Merwe sal hierdie metode van fosfaatverwydering by Rondebult gebruik word wanneer die beperking van 1 mg/l op die konsentrasie oplosbare ortofosfate in riooluitvloeiels in 1985 van krag word, mits "die ysterinhoud van die mynwater nie verder afneem nie."

Voor die eksperiment by Rondebult aangepak is, het die Nasionale Instituut vir Waternavorsing (WNNR) reeds verskeie *ad hoc*- en laboratoriumondersoeke gedoen om die gebruik van suur mynwater vir fosfaatverwydering te toets. Die resultate was telkens belowend. Kommer is egter uitgespreek oor die moontlike uitwerking van ysterslykneerslae op die sypelbedmedia. 'n Literatuurstudie is gedoen en daar is tot die gevolgtrekking gekom dat nêrens waar yster- of aluminiumsoute op biologiese sypelbeddens gedoseer is enige nadelige uitwerking van die soute

op die sypelbedmedia aangeteken is nie.

'n Tweede *ad hoc*- ondersoek is by die Springboksteenkolmyn tussen Witbank en Bethal gedoen deur mnr JP Maree van die NIWN in samewerking met mnr DJ Bosman van die Anglo American Navorsingslaboratorium. Dié

rioolwerke bestaan uit twee sypelbeddings wat in serie bedryf word. Die suur mynwater was in hierdie geval afkomstig van reënwater wat deur die mynhope gesypel het. Die yster in die water was teenwoordig in die Fe³⁺ vorm en die water het 'n pH-waarde van ongeveer 3,0 gehad.



ERPM se hoëdigheidslykaanleg aan die Oos-Rand.

Die meng van hierdie water met die rou rioolwater het weer eens bevestig dat doeltreffende fosfaatverwydering moontlik was sonder enige nadelige uitwerking op die nitrifikasieproses in die sypelbeddings.

Rondebult

Die Rondebult-rioolwatersuiweringswerke van die Germistonse Stadsraad het 'n hoofafvoerriool wat ongeveer een kilometer van die ERPM-goudmyn se Suidwes Vertikale Skag verbyloop. By die myn se hoëdigheidslykaanleg naby die skag word elke dag nagenoeg 33 000 m³ suur mynwater na die oppervlakte gepomp. Hierdie water bevat gemiddeld 617 mg/l yster (Fe). Om dié mynwater by Rondebult te kry het die Stadsraad in Maart 1981 'n pyplyn met 'n deursnee van 200 mm en 1 km lank vanaf die myn na die hoofafvoerriool aangelê.

Volgens mnr Van der Merwe het hulle met die lê van die pyplyn 'n belangrike les geleer: die pyplyn moet verkieslik lugdigte mangate hê en geen turbulensie veroorsaak nie.

“Anders word die ferro-yster in die mynwater geoksideer tot ferrihidroksied — wat 'n roesrooi aanpaksel in die pyp vorm.”

As die ferro-yster eers in die hoofriool is, is daar geen oksidasie nie, want die rou rioolwater is so te sê anaërobies, sê mnr Van der Merwe. Die vloeiempo van die mynwater word deur middel van 'n verstelbare klep in die pyplyn gereguleer. Mnr van der Merwe sê Rondebult het egter geen beheer oor wanneer die myn water pomp nie.

“Soms word aan die pompe gewerk en dan staan hulle vir drie tot vier dae en kry ons geen mynwater nie.”

Die uitwerking van die suur mynwater op die behandelde rioolwater is gemoniteer deur gereeld monsters op verskeie plekke in die werke te neem. Die syfers wat verkry is, is vergelyk met die syfers wat verkry is voordat met die dosering begin is. Die monsters is elke dag ontleed vir pH, CSB, Ortofosfaat, NH₄⁺ en NO₃⁻. Een keer per week is die totale opgeloste vaste stowwe (TOVS), alkaliniteit en yster (Fe) ook bepaal.

Die doelstelling was om bene-



Rondebult-rioolwatersuiweringswerke naby Germiston.

wens fosfaatverwydering, ook van te stel wat die uitwerking van die suur mynwater is op nitrifikasie, CSB-verwydering, die moontlike verlaging in pH-waardes en die volume sekondêre slyk.

'n Probleem, volgens mnr Van der Merwe, is dat die ysterinhoud van die suur mynwater tans besig is om af te neem.

“Die gemiddelde ysterinhoud

van die water by die aanvang van die eksperiment was tussen 600 en 700 mg/l yster (Fe). Die yster is nou af na 300 mg/l en laer. As die yster verder sou daal na, byvoorbeeld, 100 mg/l sal die eksperiment misluk,” sê mnr Van der Merwe.

Hy sê die pyplyn is te klein om die hoeveelheid suur mynwater

(Na bladsy 20)

ERPM-mynwater — Gemiddelde analise

pH waarde	Geleiding mS/m	TOS mg/l	Zn mg/l	Cu mg/l	Fe mg/l
5,5	418	7 886	3,1	0,3	617



Die groen pyp, heelregs, lei suur mynwater na 'n hoofafvoer-riool wat na Rondebult dreineer.

Fosfaatverwydering met suurmynwater

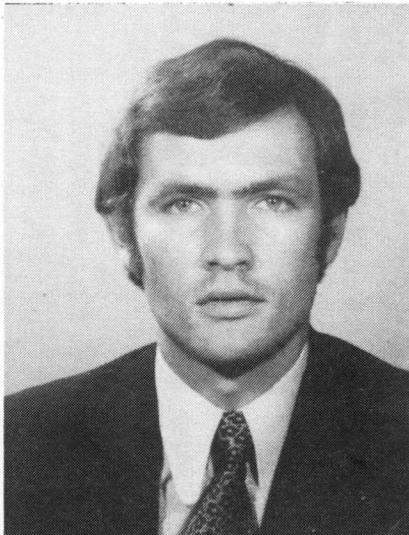
(Van bladsy 19)

wat dan benodig sal word, te hanteer.

"Die pyplyn is min of meer gebaseer op tien persent van die rioolvloei wat beteken dat die pyplyn ongeveer vier megaliters per dag kan hanteer. As die ysterinhoud van die water gehalveer word, sal ten minste ses tot sewe megaliter mynwater per dag benodig word. En hiervoor is die pyp te klein," sê mnr Van der Merwe. Dit sal ook beteken dat die werke hidroulies oorlaai word.

Die rede vir die afname van die yster in die mynwater is volgens mnr Van der Merwe nie heeltemal duidelik nie. Hy sê amptenare van die myn beweer dat die ysterinhoud vroeër jare nog hoër was, tot 1 500 mg/l.

"Hulle teorie," sê mnr Van der Merwe, "is dat die water wat vroeër gepomp was baie langer as die huidige water in kontak met die piritiese rotsformasies was."



Mnr JP Maree, NIWN

RESULTATE

Fosfaatverwydering

Fosfaatverwydering het progressief toegeneem deur die primêre en sekondêre behandelingstadia, tot dat altesaam 90% van al die fosfate verwyder was. Die finale konsentrasie in die uitvloeisel was 0,7 mg/l as P.

Hierteenoor was die totale fosfaatverwydering sonder suurmynwater slegs 30%.

'n Dosering van 15 mg/l yster (Fe) kon nie die fosfate in die finale uitvloeisel laer as 1 mg/l kry nie. Toe die ysterdosering egter vermeerder is na 17,5 mg/l het die P-waardes weer tot onder 1 mg/l gedaal.

Uitwerking op die ammoniakkonsentrasie in die uitvloeisel

Voor die toevoeging van suurmynwater het die ammoniakwaardes gewissel tussen 7 en 15 mg/l. Nadat ongeveer 30 mg/l Fe

gedoseer is, het die ammoniakwaardes gedaal tot tussen 3 tot 4 mg/l. met die toevoeging van 45 mg/l yster (Fe) het die ammoniakwaardes skerp gestyg tot 16 mg/l en sodoende die vereiste beperking van 10 mg/l as N oorskry. Dit word beskou as 'n aanduiding dat nitrifikasie geïnhibeer is.

Totale opgeloste stowwe (TOS)

TOS-waardes in die uitvloeisel het normaalweg gewissel tussen 700 mg/l en 1 000 mg/l. Met die toediening van suurmynwater het die TOS gestyg tot ongeveer 1 500 mg/l.

Fosfaatverwydering

Monsterpunt	Met SMW (17, 5 mg/l Fe)		Sonder SMW	
	P mg/l	% Verwydering Kumulatief	P mg/l	% Verwydering Kumulatief
	6/10/81		2/9/81	
Rourioolwater	6,3		6,3	
Primêre besinking	4,4	30		
Primêre sypelbeddings	1,9	70		
Sekondêre sypelbeddings	0,8	87		
Finale uitvloeisel	0,7	±90	4,5	< 30

CSB-waardes deur die Werke

Monsterpunt	Met SMW (15 mg/l Fe)		Sonder SMW	
	CSB mg/l	% Verwydering Kumulatief	CSB mg/l	% Verwydering Kumulatief
	19/10/81		7/10/81	
Rourioolwater	2 010		992	
Primêre besinking	1 490	25	913	< 10
Primêre sypelbeddings	239	88	177	82
Sekondêre sypelbeddings	157	92	110	89
Finale uitvloeisel	118	94	98	90

Yster (Fe)-verwydering

Monsterpunt	Fe-konsentrasie mg/l		% verwydering kumulatief
	29/8/81		
Rourioolwater	14,0		
Primêre besinking	9,3		33
Primêre sypelbeddings	7,5		46
Sekondêre sypelbeddings	4,7		66
Finale uitvloeisel	2,2		84

Fosfaatverwydering met suurmynwater

CSB-verwydering

Die toevoeging van suur mynwater het die vermindering van CSB deur die stadia van suiwing aanmerklik verbeter. Die meeste CSB-verwydering het in die primêre syfelbeddings plaasgevind.

pH-waardes

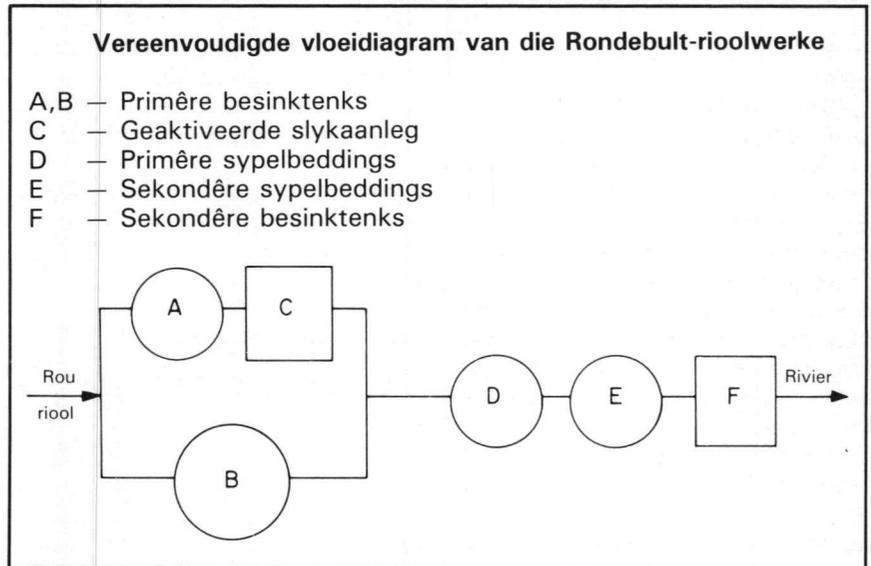
Voor die dosering van suur mynwater het die pH toegeneem met die vloei van die water deur die syfelbeddings. Dit was teenstrydig met wat verwag is. Moontlike redes vir 'n verhoging in die pH-waardes kan miskien verduidelik word aan die hand van die seisoenale invloede en toestande van organiese oorbelaasting.

Nitrifikasie

Voor die toevoeging van suur mynwater asook gedurende die periode toe met 30 mg/l yster gedoseer is, was die nitraatwaardes in die omgewing van 3 tot 5 mg/l as N. 'n Daling tot 2 mg/l en laer in nitraatwaardes het voorgekom gedurende die periode van oormatige ysterdosering. Dit kan, volgens die navorsers geïnterpreteer word as 'n inhibering van nitrifikasieproses.

Uitwerking op die slykvolume

Prakties is daar geen betekenisvolle vermeerdering in die volume van



die sekondêre slyk opgemerk nie. Die dosering van suur mynwater om 30 mg/l yster in die rou rioolwater te verkry, voeg nagenoeg 1 000 kg yster daaglik by tot die sisteem. Dit verteenwoordig ongeveer 5% van die massa van al die vaste stowwe wat die werke elke dag bereik.

Koste

Die jaarlikse koste vir die projek beloop altesaam R10 240,00.

Mnr PH van der Merwe, hoof-skeikundige, Germiston, en dr HNS Wiechers, WNK, kyk na die ysterpresipitaat in een van die primêre besinktenks.

Hierdie bedrag is saamgestel uit die instandhouding van die vloeiometer en die pyplyn (R500,00 per jaar), arbeid en vervoer van personeel om monsters te neem, chemiese analyses te doen en die vloei van die suur mynwater te kontroleer (R6 500,00 per jaar) en die delging van die kapitaalbedrag van R32 800 oor 'n tydperk van twintig jaar teen 'n jaarlikse rentekoers van 9,75% (R3 240,00 per jaar).

Gebaseer op 'n vloei van 37 Ml/d word die behandelingskoste bereken teen 0,076 c/m³ rioolwater behandeling.

Dit is minder as een-tiende van wat dit tans kos om chemikalieë soos FeCl₃ te koop, aldus mnr Van der Merwe.



Fosfate verbied

Switserland is die eerste Europese land wat 'n verbod op die gebruik van fosfate in waspoeiers gaan plaas.

Die verbod, aangekondig deur dié land se Departement van Omgewingsake, is 'n poging om die waterkwaliteit in Switserse mere te herstel en om visse te beskerm. Die verbod sal binne die volgende drie jaar in werking tree en 'n bekamping teweegbring van ongeveer eenderde van die fosfor wat die mere bereik.

IWPC

SA's POLLUTION CONTROL TIGHTENED

"The successful handling of a wealth of issues in South Africa's water affairs such as effluent standards, sludge utilisation, synthetic detergents, mineralisation, eutrophication, health aspects, disinfection, reclamation of effluents, nutrient removal, etc., can be attributed to resolutions formulated at IWPC conferences, which were followed up by memoranda to the appropriate authorities."

This was said by the Minister of Environment Affairs and Fisheries, Mr Sarel Hayward, when he paid tribute to the achievements of the Institute of Water Pollution Control (SA Branch) in his opening address at the Institution's Biennial Conference in East London, in May, this year.

The Minister also announced the expansion of the Directorate of Water Affairs which, he said, are faced with problems of water supply and an acceleration of pollutants in water courses because of the serious drought in the country.

Minister Hayward said that the Pollution Control Division of the Directorate had been grouped in a newly established Water Quality Branch. The staff complement of the Pollution Control Division had been increased by recruiting professional staff from abroad.

"Pollution control monitoring through a computerised data bank will be introduced shortly and a new section for the regulation of wastes, not controlled by any other Act, had been started. The section for special investigations, including biological problems, had also been revived, while the newly established section for the registration of water care works and operating personnel, and for the implementation of the new regulations, would serve as a valuable adjunct to the sections dealing with water-use and effluent permits issued in terms of the Water Act," the Minister said.

Minister Hayward referred to the present drought and said that whilst it is accepted that no wastage and/or pollution of water can be tolerated at any time, its importance must be stressed during crises periods.

"The industrial user will have to account for every drop of water used and recycling will have to be encouraged as far as practicable. Dry

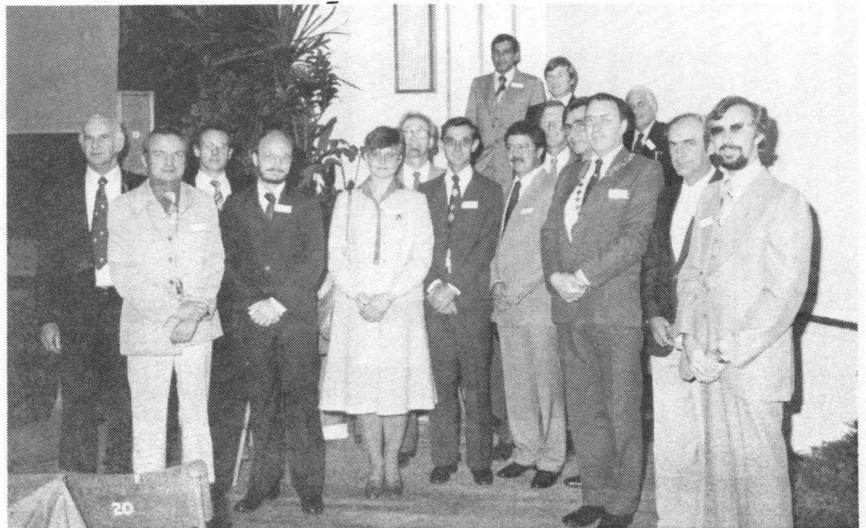


The Minister of Environmental Affairs and Fisheries, the Honourable SAS Hayward, second from left, pictured with Professor D Jenkins, Mr WS Smith, IWPC president, Mr Errol Spring, Mayor of East London, and Mr Gerrit Botha, chairman of the South African branch of the Institute.

or semi-dry methods for cleaning and transporting of raw materials and by-products should be preferred," he said.

He said that the planning and development of new water-borne sewerage schemes had to be carefully considered in times like these, particularly in areas where there were no assured water supplies.

"The ventilated and improved pit latrine or "VIP" would probably be the answer for many areas, in which case bath and kitchen effluents could be utilised for watering vegetable gardens and orchards. Where water-borne schemes are in operation, the effluents should be used optimally, for instance for the irrigation of



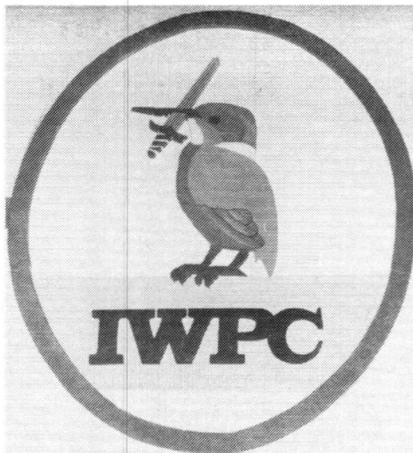
Some of the delegates who delivered papers at the IWPC conference in East London.

crops in accordance with accepted health criteria, rather than by evaporation or discharge into the sea," Minister Hayward said.

The Institute President, Mr WS Smith from the Anglian Water Authority in Britain, spoke in his president's address on recent developments in the United Kingdom water industry.

He said that advances in closed circuit T.V. in recent years had been developed to such an extent that even the condition of smaller public sewers could now be investigated without costly excavation. Wide-spread use of this technique had demonstrated many potential sewer failures. At the same time, techniques had been developed for sewer renovation 'in-situ' as a cost effective alternative to excavation and replacement. The major systems used in the U.K. for renovation included slip lining with pre-fabricated panels and the 'in-situ-form' system using a resin impregnated terylene sock.

Mr Smith said that one of the most novel innovations in sewerage in the U.K. had taken place within the last two years with the installation of vacuum



sewerage systems as an alternative for conventional pumping stations and rising mains. The essence of the process is that the sewage runs by gravity from properties through conventional pipes into a small collection sump. When the level of sewage in this sump reaches the designed top water level, it triggers a sensor which activates a controller which opens the valve allowing entry to the pipe under vacuum. This valve is held open for a pre-set period allowing the sewage to be sucked from the sump along with a small volume of air. The controller then closes the valve and the sewage moves down

the vacuum main at a velocity of approximately 5 metres per second and is delivered to the collection tank at the central station. From this central station, conventional pumps discharge into an existing sewer or directly into the treatment works.

The main advantage of this system, Mr Smith said, lay in the ease of construction and inexpensive capital costs. For example, only narrow trenches were required and the vacuum system was laid at a minimal depth of 1 metre. Infiltration was virtually eliminated and considerable flexibility of the pipe run was achieved. This could be a very great advantage where the ground conditions were either hard rock or subject to highwater tables. It was also of advantage in urban areas where the ground below the surface could be a maze of other services such as gas, water electricity and telephone cables. In the typical installations installed so far in the U.K., the capital savings were found to be as much as 30% compared with conventional pumping schemes. Running costs appeared to be not significantly greater than conventional schemes, according to Mr Smith.

GREEN JOINS COMMISSION

George Clifford Green, has been appointed on the 1st June 1983 as senior adviser, responsible for irrigation research projects at the Water Research Commission in Pretoria.

Vis floereer in vuil water

Britse wetenskaplikes het 'n vis geteel wat teen waterbesoedeling bestand is — dermate dat die vis sal voortleef in water wat met nywerheidsafval besmet is.

Bioloë aan die Universiteit van Lancaster het gesê dié forel wat na 'n driejaarlange ondersoek geteel is, het 'n besondere weerstand teen hoë suurgraad wat veral in riviere en mere teenwoordig is.

In Europa en Noord-Amerika het tallose visse reeds weens waterbesoedeling gevrek.

Mr Green was born on the 4th November 1940 in Dewetsdorp in the Orange Free State and matriculated at the Krugersdorp High School.

In 1960 he obtained his B.Sc in Physics and Chemistry at the University of the Witwatersrand. Two years later he obtained his B.Sc (Agric.) Hons and in 1966 his M.Sc (Agric) — cum laude) at the University of the OFS.

He started his career in 1963 at the Department of Agricultural Technical Services in Nelspruit. Eleven years later he changed from the Citrus and Subtropical Fruit Research Institute to the Soil and Irrigation Research Institute in the same department.

He was appointed deputy director at the Department of Agriculture and Fisheries in 1979 responsible for matters regarding soil and irrigation.



Mr George Green

Mr Green is a member of the Soil Science Society of Southern Africa; the International Soil Science Society and the South African Society for Crop Production. He is a council member, assistant editor and gold medal recipient and recipient of the D F Retief floating trophy of the latter society.

What role can industry play in conserving our water supplies and what other methods except restrictions are available to prevent unemployment, lower productivity and the ultimate closure of businesses? This article attempts to answer these questions and to give a prognosis of what could be expected of industry with respect to water conservation and pollution abatement.



At the Beacon Sweets and Chocolates factory in Durban, the factory's water consumption was reduced from 8 400 kℓ/week to 4 200 kℓ/week by recycling all steamtrap water, cooling water and vacuum pump seal water. Pictured above are some of the holding tanks.

WATER CONSERVATION AND INDUSTRY

At the opening session of the bi-annual conference of the Institute of Water Pollution Control at East London on 16 May 1983, the Minister of Environment Affairs and Fisheries said: "The industrial user will have to account for every drop of water used and recycling will have to be encouraged as far as practicable. Dry or semi-dry methods for cleaning and transportation of raw materials and by-products should be preferred." The writing is on the wall. Let us consider the various methods industry could apply to keep their house clean.

Common water saving measures

Here we will consider those obvious methods which are applied by water conscious and well managed factories. They may be common-sense measures but it is surprising how many plant managers ignore them. Some of the information in this and the following section is extracted from a paper entitled "Water conservation and reclamation in industry" by Funke, and is obtainable from the Water Research Commission.

Water metering

The majority of factories rely on the meter readings of the main municipal water meter for their water charges. Consequently the Plant Manager cannot obtain factual information on how much water is used where and when. He, therefore, is unable to take sensible action and how best to solve the problem. The obvious first step for water conservation is therefore:

- **Install water meters for each wet section of a factory:**

Example: A factory in Durban reduced its water intake by

30% simply by installing meters in each section of the factory and by setting up a programme of daily meter readings. Competition between various process sections with an economic incentive for the highest percentage reduction in water usage was encouraged.

Steam raising

High quality potable water is required for steam generation which is an expensive commodity in any factory. Although on the average only 4% of the water intake is used for steam, savings of steam and therefore water can be affected by:

- Making use of heat-exchangers and insulation of heated equipment in order to reduce the demand for steam
- Collect and return steam condensate as boiler make-up water

Process water

Quality requirements vary from absolute pure water for the electronics industry, soft potable water for the food processing industry, water, free from manganese and iron, for the textile industry, etc. In numerous operations, however, water quality is not a primary con-

sideration e.g. for floor and equipment washing, or for the production of cardboard. Therefore do not use high quality water where only low quality is required.

Many machines in industry have not been designed with water conservation in mind, therefore optimisation with respect to water usage and the installation of subsidiary equipment such as spray washing and squeeze rollers could substantially reduce water usage.

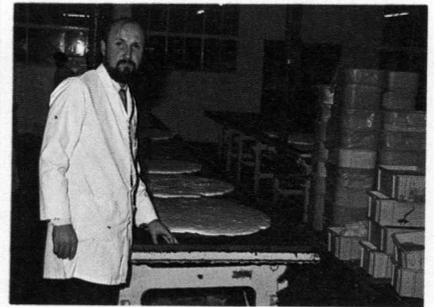
A major reason for large volumes of water wasted is the full supply flow of water to idle machines or during tea and lunch breaks and for grade change. Water should only be applied to operating machines. Therefore:

- Do not use high quality water for low quality requirements.
- Optimise the water use of wet processing machines.
- Favour the low-water-low-energy usage machines when considering new equipment.
- Connect the water supply to the drive mechanism of the large water consumers.

Equipment and floor washing

Possibly the largest source of water wastage particularly in the

food processing industry, is hose-pipes used for the cleaning of equipment and floors being left running for hours and during the night. Various measures can be taken to counteract this unnecessary wastage such as:



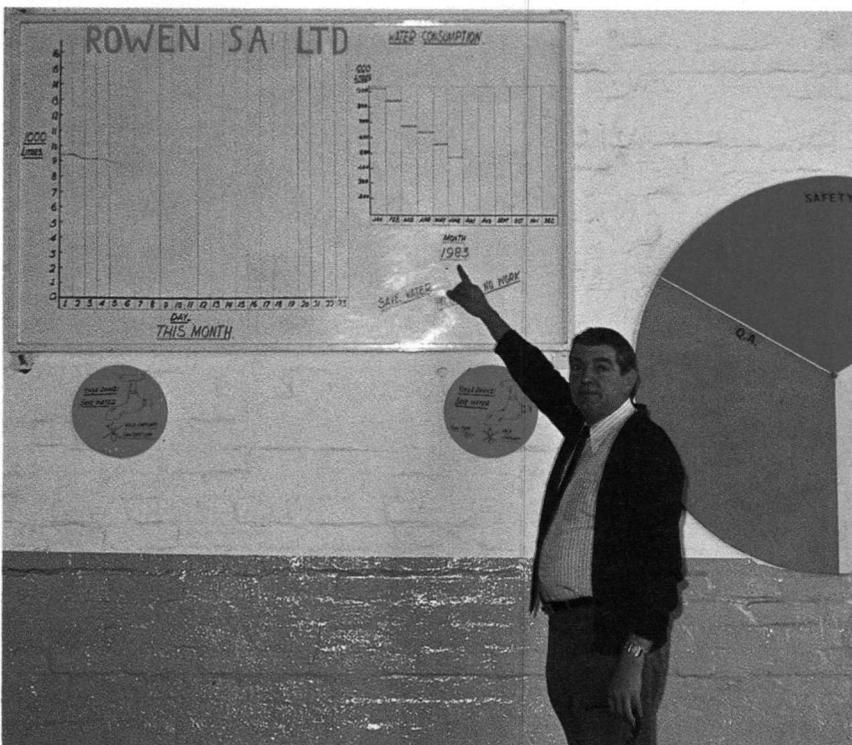
Mr Bill Spotswood, factory director at the Beacon Sweets and Chocolate factory.

- Employ dry cleaning of floors with squeegees.
- Cover and block off some or all drains.
- Remove all hosepipes and supply buckets for washing purposes.
- Provide one metered high pressure main for all hosepipes.
- Install a time switch to provide water to high pressure main at certain times only.
- Fit every high pressure hose and tap with an automatic shut off valve.

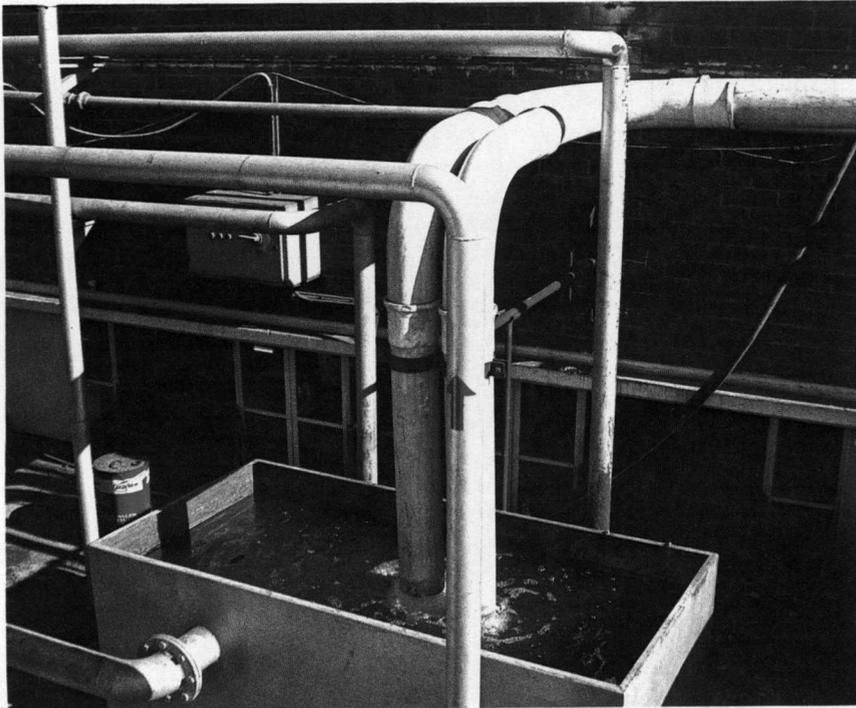
Training programmes

For a factory to be really successful with a water savings campaign, it is essential that the staff be encouraged to save water by including an awareness section into the normal training programmes, or by having special lectures on the subject. A very effective method is by using video to show simple methods of saving water in the factory and at home. The judicious placing of placates and reminders to save water in strategic places constantly reminds workers to do so Therefore:

- Place water saving notices in strategic places in the factory.
- Encourage staff to save water by way of an active training programme.



Mr Reg Piper, Safety and Loss control officer at the Rowan (SA) plant, Durban, pointing out water savings achieved to date at the factory.



At Rowan water was saved by recycling spot welding machine cooling water. Through the installation of water metres in specific sections of the factory and the regular monitoring and display of consumption figures, staff were also successfully motivated to effect considerable water savings.

(From page 25)

Additional water saving measures

The foregoing common water saving measures can be affected simply by better management and a minimum capital outlay. The following additional water saving measures might cost some capital outlay or rearrangement of process sequences or drainage channels. Under the existing government pressure to reduce the water usage by industry with 20% or more in the PWV complex, every industrialist should seriously look at all possible additional measures to save water.

Cooling waters

In many industries cooling water is by far the largest component of the daily intake. Most industries use fresh, non-saline water for cooling. There is often no need why water of potable quality should be used for cooling. Purified process effluent with sometimes simple primary treatment could just as well be used for cooling purposes. Furthermore, it has been proven that once-

through cooling systems are not as effective as recirculating systems. Therefore:

- Once-through cooling has to be eliminated;
- All cooling water has to be recirculated via a natural draft or mechanical cooling tower.

Example: In electricity generation where cooling water requirements can easily be assessed, the demand is as follows:

- once-through cooling: about 250 l/Kwh
- open recirculation, natural or forced draft cooling tower: 2,1 to 4,5 l/Kwh
- air cooling, final trim cooling with water: 0,5 l/Kwh

Rinse waters

Rinsing water, especially in the electroplating industry often accounts for the bulk of the water requirements. It has been shown that the flow through volumes required for a once through, two-tank and three-tank counterflow rinsing system for a nickel plating bath containing 70 g/l of Ni are respectively 26 250, 280 and 0,62 l/h. Therefore:

- Employ two-stage or three-stage counterflow rinsing for reducing water intake.

Cascading water use

The cascading principle of water use whereby the same water is used sequentially in a series of processes having diminishing water quality requirements is well known but unfortunately not always practiced. The following examples will illustrate this point:

- In a potato chips factory water was added at the washer, scrubber, polisher and shuffler/sliver remover. By returning effluent from the last process back to the polisher then to the washer and then to the scrubber, the total daily water intake of 210,6 kl was reduced to 82 kl i.e. a saving of 61% without any effect on the product quality.
- A washing range at David Whitehead & Sons textile factory in Tongaat consisted of a nine compartment counter current system. The washing of VAT prints required water to be added to the washing range at 5 different points, resulting in a water flow rate of 30 m³h⁻¹. Investigations revealed that the process consisted of three stages, an initial rinse, a soaping section and a final rinse stage.

By the installation of two pumps, 2 side tanks and sundry pipe work, effluent from the final rinsing stage was cascaded to the initial rinse stage. This resulted in a drop in flow rate from 30 m³h⁻¹ to 6 m³h⁻¹, i.e. a saving of 80%.



A spot welder in action.

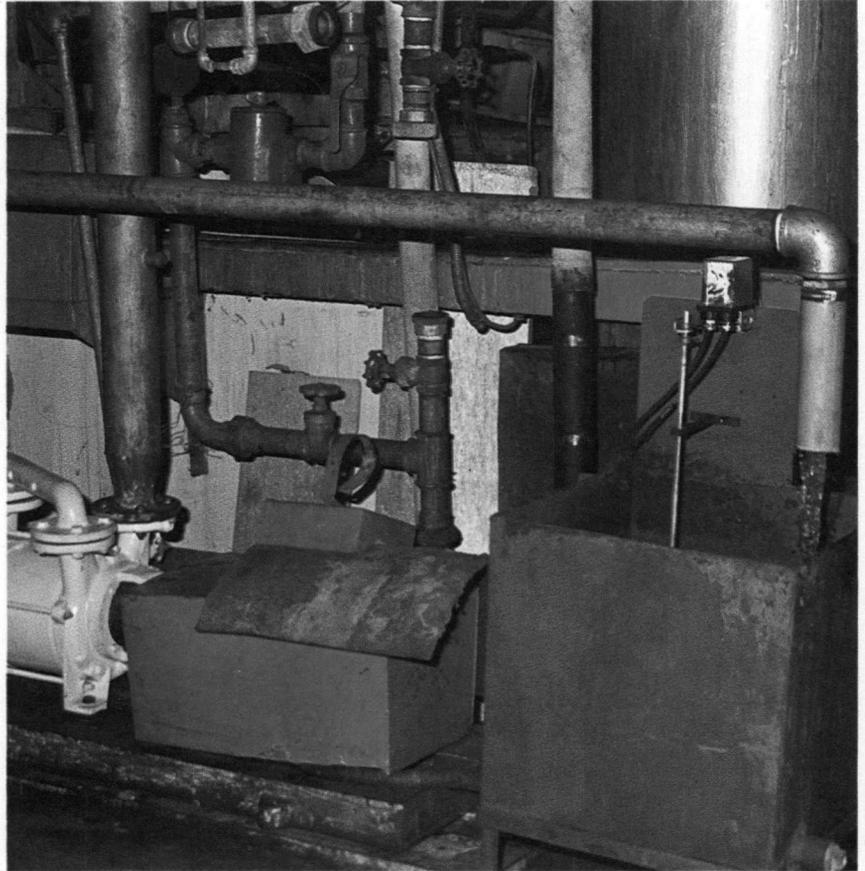
Advanced water saving measures

The introduction of advanced water saving measures may require a considerable capital outlay but management seldom acknowledge the fact that proven or properly researched technologies, making use of modern separation techniques, more often than not have considerable short payback times due to savings in water, energy and chemicals. Moreover, whenever a by-product is produced by any such effluent treatment processes, it is possible that they may be classified as manufacturing processes in which case they may well be considered for initial and tax allowances together with other related benefits — an incentive that should not be regarded by management too lightly.

A few examples in this category should prove the point:

- The Beacon Sweets & Chocolates factory in Durban reduced its water intake from 8 600 m³/week to 4 200 m³/week (i.e. 49%) during 4 months from February 1983 by:
 1. Returning the steam trap condensate to the boiler.
 2. Returning the slab cooler water to the boiler.
 3. Collecting the vacuum pump (14 in total) seal water, cooling it in a forced draft cooling tower and returning it back to the vacuum pumps. The capital cost to install additional equipment was R100 000 with a payback time of under two years.
- At the David Whitehead & Sons textile mill in Tongaat recycling of once-through cooling water has achieved a saving of an incredible 30% of the total factory water intake. A further 50% saving in two other processes amounted to a total saving of 436 Mℓ/annum or 46% of the total water intake. At a water cost of R0,12/m³ this has a capital pay-back time of only 9 months.

The same factory envisage the implementation of a closed loop treatment/recycle system for the sizing/desizing ef-



fluents. This will require slight process changes but the saving in water costs, chemicals, energy and effluent changes result in payback times varying from 0,7 to 1,9 years, depending on the type of washing range, fabrics produced and total production. These figures are based on annual capital charges of 25%, including both depreciation and interest rates.

- Another example of a closed loop treatment/recycle system is the one at Ninian and Lester, Pinetown, for printing and dyeing effluents from their textile mill. This process has recently been developed by the University of Natal and has considerable potential. Dyehouse effluents are treated with membrane separation techniques to produce a water of higher quality than the intake water and is then recycled back to the dyehouse. The estimated savings per day amounts to R215 for raw water, R75 on effluent charges and R78 on heat costs i.e. a total of R368/day. The payback time for such a system is estimated at less than three years.

Beacon Sweets anticipate a saving of R60 000 per year due to water savings measures.

BLOOSKOLOM

In die Mei-uitgawe van SA Waterbulletin het die drukkersdruifel die kol drie keer raakgeskiet, tot groot verleentheid vir die redaksie.

Op bladsy 16 was daar 'n kinkel in die kabel deurdat gekonstateer is dat 1 kilowatt-uur benodig word om 'n huisgloeilamp van 100 watt vir een uur te laat brand. Dit behoort tien uur te wees (as daar geen verdere kortsluitings voorkom nie).

Erger was miskien die verdamping van die water uit die HF Verwoerddam. Op bladsy 14 moet gestaan het: Die Randwaterraad verskaf gemiddeld daaglik 2 000 Megaliter (nie kubieke meter nie) water aan die PWV-kompleks (wat is drie nulle nou tussen vriende!) Die daaglikse verdamping uit die Verwoerddam is dus ongeveer gelyk aan 'n dag se water behoeftes in die PWV-gebied.

UCT:

Scientist's contribute to South Africa's water knowledge

The University of Cape Town recently rewarded two South African water scientists for their work in the water field.

Mr RE Loewenthal, senior lecturer at UCT, received a Ph.D for his research on carbonate chemistry in high salinity waters, while Mr HA Nicholls from the City Council of Johannesburg received an M.Sc for his study on biological nitrogen and phosphorus removal in large waste water plants.

Mr Loewenthal was educated at the Belfast High School in Eastern Transvaal (matriculation 1959) and the University of the Witwatersrand (B.Sc — Civil Eng. 1968).

From 1971 to 1973 he was a post-graduate student under Professor G van R. Marais at the University of Cape Town where he obtained his M.Sc (Eng.) with distinction in 1973.

Afterwards he lectured for more than a year in water treatment at the University of New South Wales in Sydney, Australia, and returned to South Africa in 1975 to lecture at the University of Cape Town in water and wastewater treatment.

Mr Loewenthal has published a number of papers pertaining to stabilization, Ca CO₃ precipitation and dissolution kinetics. He also wrote a book on carbonate chemistry in aqueous systems His latest work to be published is a book called *Chemistry of highly saline waters*.

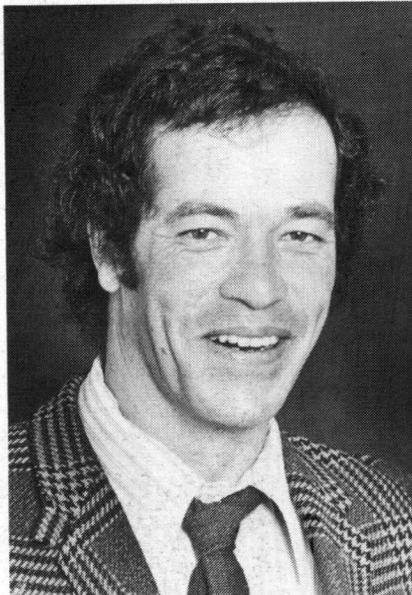
Mr Loewenthal is married with three children.

He said the research he has done on Carbonate Chemistry in high Salinity waters is divided into two sections:

- (a) Chemistry of principal ions comprising most highly saline waters i.e. Na⁺, K⁺, Ca²⁺, Mg²⁺, SO₄²⁻, Cl⁻, and
- (b) pH and weak acid systems in highly saline waters.

- **Chemistry of principal ions:**

The research extends the hydration theories of Stokes-Robinson-Glueckauf to mean and single ion activity determinations in binary and mixed electrolytes containing any mixture of the ions K⁺, Na⁺, Ca²⁺, Mg²⁺, Cl⁻ and SO₄²⁻ up to an ionic strength of about 5 (approximately twice that of the salinity of the Dead Sea). The work has important application in many of the desalination processes where kinetics invariably are in part dependant on the activities of ionic species.



Dr RE Loewenthal of the University of Cape Town.

- **Chemistry of weak acid systems:**

The research applies the extended hydration theory to the carbonate and proton species in highly saline water. Allows:

- (i) a link between operation pH and measured pH:
- (ii) prediction of pH control in highly saline waters, and

- (iii) prediction of carbonate mineral solubilities in these waters.

Conditioning diagrams (a modified Deffeyes type diagram and modified Caldwell Lawrence type diagram) are developed for rapid chemical dosage estimation in the control of pH and carbonate mineral precipitation/dissolution in these waters — an important aspect in prevention of precipitation fouling in desalination processes.

★ ★ ★ ★ ★

- **Harold Arthur Nicholls** was born in Johannesburg on 2 April 1942. He matriculated at the Rossevelt High School in 1959, after which he joined the City Council of Johannesburg in the Laboratory and Technical Services Branch of the City Health Department. In 1964 he received a diploma in Chemical Technology from the Witwatersrand Technical college and in 1967 a BSc (Ind Chem) from the University of the Witwatersrand. After obtaining his degree he was appointed to the position of Chemist in the above branch. His present position is Senior Professional Officer in charge of the laboratory at the Northern Sewage Purification Works.

Mr Nicholls is a member of the Institute for Water Pollution Control and an associate member of the SA Chemical Institute.

He is married with two sons.

- **Biological nitrogen and phosphorus removal in large plants**

Full-scale implementation of biological excess removal by means of the activated sludge pro-

cess commenced in South Africa at the Johannesburg Alexandra Plant in 1974. Originally the plant was designed to operate in the nitrifying extended aeration mode, but by switching off some surface aerators around the common inlet point for the influent and underflow recycle, an anoxic zone was created to induce denitrification. This operation modification worked very successfully. Later, additional aerators were switched off to create an anaerobic-anoxic zone at the head of the aeration basin, in this manner attempting to induce the prerequisite conditions for excess biological uptake of phosphorus as put forward by Barnard (i.e. by stimulating P release under anaerobic conditions). This revised operational procedure was not successful due to difficulties experienced in controlling mixing in the anaerobic-anoxic zone.

Goudkoppies

However, the experience gained from this investigation together with research findings at laboratory and pilot scale level at the National Institute for Water Research, the University of Cape Town and Johannesburg instilled sufficient confidence into City Council staff to proceed with the design of the 150 Ml/d Goudkoppies plant, initially for nitrogen removal and to subsequently modify it to a 5-stage Phoredox process for both nitrogen and phosphorus removal. Before the plant was commissioned (1976) it was necessary to proceed with extensions to the Northern Works and these were also based on the 5-stage Phoredox process.

All the Johannesburg activated sludge plants were comprehensively monitored to determine their performance under cyclic flow and load conditions. The data collected from the Goudkoppie plant were particularly comprehensive and exhaustive.

Concomitant with the monitoring program extensive research into the single stage nitrification/denitrification excess phosphorus removal process was being undertaken by the three agencies mentioned earlier. Of particular interest was the development by the University of Cape Town of a

general kinetic model of the single sludge activated sludge process that described carbonaceous degradation, nitrification and denitrification behaviour under cyclic flow and load conditions.



Mr HA Nicholls of the Technical Services Branch of the City Health Department, Johannesburg.

This dissertation *Biological Nitrogen and Phosphorus Removal in Large Plants* critically evaluates the predictions of this model against the observed responses on the Goudkoppies and Northern Works.

As new information and hypotheses on the mechanism of excess biological removal became known from the three agencies, checks were made on the above works to test compliance against observed performance. Particular attention was given to the University of Cape Town's hypothesis that a certain minimum concentration of readily biodegradable COD in the anaerobic zone was necessary to stimulate phosphorus uptake. Consideration was also given to the Johannesburg group's belief that any deficiency in the readily biodegradable COD in the influent sewage could be supplemented by permitting thickened raw sludge to ferment under acid conditions and returning the liquid phase directly to the anaerobic zone.

The principle findings from these investigations are briefly as follows:

- 1 The general model predicted the observed response of the large-scale plants with remarkable accuracy.
- 2 The readily biodegradable COD hypothesis for excess phosphorus removal appears to be supported by the observed phosphorus removal response of the Goudkoppie and Northern Works.
- 3 Oxygen and nitrate entering the anaerobic reactor via the influent or the recycle from the final clarifiers enable facultative anaerobic bacteria or denitrifiers to metabolise some or all of the readily biodegradable COD available. This situation does not permit an adequate release of phosphorus and uptake in the subsequent aerobic process is detrimentally affected.
- 4 From (3) above evidently the nitrification-denitrification behaviour of a plant can have a crucial effect on its propensity for excess phosphorus removal. In terms of the kinetics of denitrification as developed by the University of Cape Town, the denitrification contribution per unit of volume of the secondary anoxic reactor is very minor compared to that of the primary anoxic reactor. This was verified on both the Goudkoppies and Northern Works.
- 5 The difficulties experienced in obtaining adequate denitrification at the Goudkoppies and Northern Works suggest that the Phoredox process, in which the nitrate concentration in the underflow recycle is the same as in the effluent, limits this process to TKN/COD ratios less than some upper limiting value. It also suggests that alternative process configurations, such as the University of Cape Town process, in which the nitrate discharge to the anaerobic reactor can be controlled independently of the concentration in the effluent, have advantages over the Phoredox system when the limiting TKN/COD ratio is exceeded.

Randwaterraad

Kosteberekening van water sal moet verander, sê Minister

"Daar sal beslis veranderings moet kom ten opsigte van die kosteberekening van water. Dit het hoog tyd geword dat water, soos ander kommoditeite, as 'n waardevolle bemarkbare produk beskou moet word en dat die hele tariefstelsel drasties hersien word," het mnr SAS Hayward, Minister van Omgewingsake en Visserye, by geleentheid van die opening van die kanaalstelsel tussen Vaaldam en die Randwaterraad se suiweringswerke en pompstasie by Zuikerbosch gesê.

Min Hayward het gesê daar is nie 'n kitsoplossing vir die land se ewigdurende droogteprobleem nie. Die tradisionele manier om dié probleem te bowe te kom, was om telkens meer water te skep, hetsy deur die bou van damme; die slaan van meer boorgate of die oordrag van water uit ander gebiede.

"Die probleem is egter dat die beste damterreine reeds ontwikkel is, watertafels sak onrusbarend in sommige gebiede — en die Tugela lê honderde kilometer van die PWV-gebied. Dit kos ook al meer om nuwe bronne te skep," het hy gesê.

Die vermoë van die mens om water optimaal te benut na gelang die waarde van water gestyg het, het volgens die Minister nie toegeneem nie, maar hy het dit toegeskryf aan die bestaande wetlike en administratiewe instellings wat nie meer ten beste toegerus is om die nuwe waterprobleme te hanteer nie.

"Die meeste van ons instellings en die toepaslike wetsoriënterings het tot stand gekom toe water goedkoop en volop was en mense daardie goedkoop, volop water sou gebruik om 'n gebied te ontwikkel."

"Die toenemende ekonomiese waarde van water in die algemeen is nie weerspieël in die verbruiker-

koste nie, en as die werklike waarde van water in ag geneem sou word, sou die aanwending en gebruik van water baie meer pryseffektief gewees het," het hy gesê.

Die Minister het ook verwys na Artikel 12 (4) (c) van die Waterwet wat te make het met die verkryging van 'n permit om water vir nywerheidsdoeleindes te gebruik en waarby die Minister verplig is om by oorweging van die aansoek, behoorlik in ag te neem of dit nie in die openbare belang, of met die oog op desentralisering van nywerheidsondernemings, of weens die aard van die afvalwater, afloop of afval wat deur die werking in die betrokke onderneming sal ontstaan of die metode wat vir die suiwer-

ing van sodanige afvalwater, afloop of afval, toegepas sal word, wenslik sal wees om bedoelde onderneming elder as op die plek in die aansoek vermeld, te stig nie."

Hy het gesê sommige gebiede in die land en veral in die PWV-gebied het reeds hulle groeipotensiaal oorskry en nyweraars sal die moontlikheid om weg te beweeg van die middelpunt van die Suid-Afrikaanse ekonomiese aktiwiteite, na gebiede waar water meer gereedlik beskikbaar is, ernstig moet oorweeg.

Ten slotte het Minister Hayward gesê waterbesparing kan toegepas word deur òf rantsoenering òf tariefpryse om die ware waarde van water tot die mens te laat deurdring.

The Vaal Dam — Zuikerbosch raw water augmentation scheme

A R60 million canal and pipeline system that covers a distance of some 30 km and which will improve the efficiency of water supply to the area controlled by the Rand Water Board was officially opened on May 5, 1983 by the Minister of Environment Affairs and Fisheries, the Honourable S.A.S. Hayward M.P.

The Rand Water Board is responsible for supplying potable water to an area that has its boundaries at Bethal in the East, Pretoria in the North, Rustenburg in the West and Sasolburg in the South. Its total area of responsibility is 17 000 square kilometers and it supplies some six million people.

The system that comprises a concrete lined canal of a top width of 13 m and a depth of 4 m with a length of 20 km and having a capacity of 2 000 Mℓ a day

together with a pipeline of 8,5 km in length with a diameter of 3,5 m and a capacity of 2 000 Mℓ a day provide the connection between the Vaal Dam and the Zuikerbosch pumping station.

In addition to the pipeline and canal, a coffer dam, tunnels, an outlet tower, variable level draw-off control gates, emergency gates, canal siphons, farm road bridges and an infrastructure to accept water at the pumping station have been created.

Construction of the outlet works commenced towards the end of 1979 and the installation of the pipeline and construction of the canal in its terminal reservoir began during the second quarter of 1980. It is expected that all work on the project will be completed towards the end of this year at a total cost of R60 million.

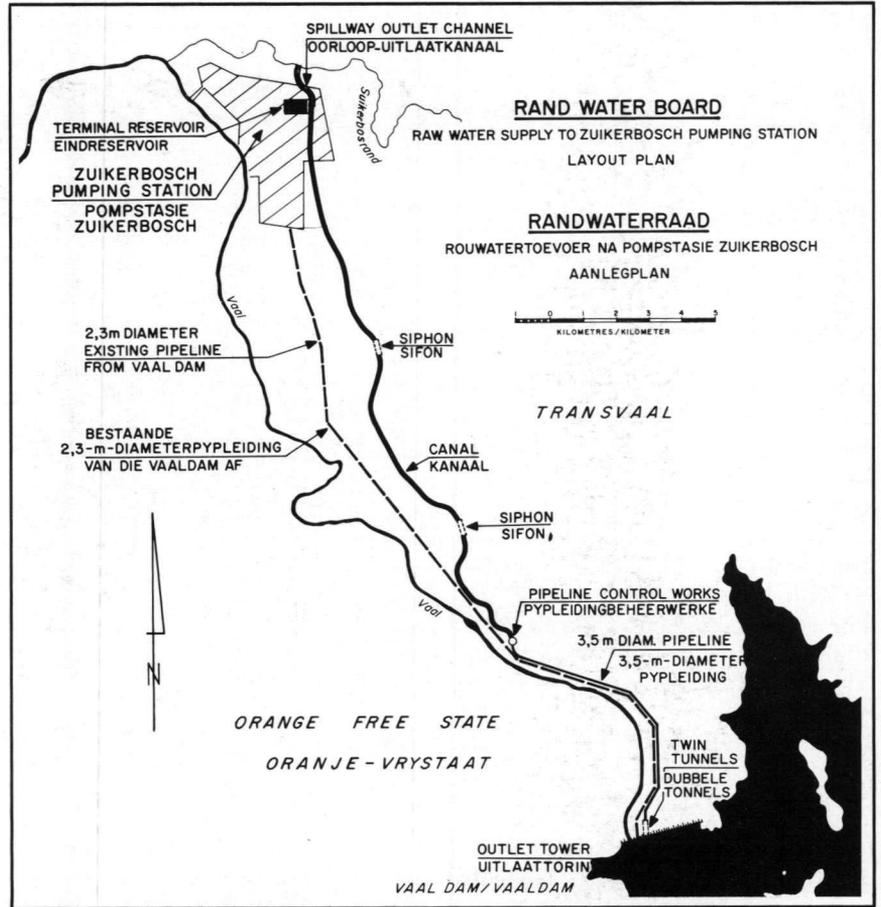
A major advantage of the new system is that water will be fed directly to the pump station and will not need to be raised up from the Vaal Barrage. The positive effect on costs will be dramatic — current estimates of the power required to transfer water from the Vaal Barrage to the Zuikerbosch purification and pumping facility are conservatively estimated at R5 000 a day.

Pumping Station

The Zuikerbosch pumping station was commissioned in July 1954 to supplement the supply of potable water to the consumers that are supplied by the Rand Water Board. Initially, the raw untreated water was obtained by pumping from an intake station at the Barrage and the value of the gravity system was perceived at that time. A Vaal Dam-Zuikerbosch pipeline was installed with a capacity of 800 Ml a day. Subsequently, further supplementation of the untreated water supply was brought about by the replacement of four of the six pumps in the intake station by larger units to provide the existing nominal intake capacity of 1 145 Ml a day. Estimates prepared during 1975 indicated that it would be necessary to further increase the capacity of the system by 1980 and after an investigation again showed that a gravity system was more economic than raising the water from the Barrage, provision was made under Stage II of the big Additional Water Supply (1970) Scheme for a new raw water supply comprising a small weir and a combination of pipeline and a canal from the Vaal Dam area to Zuikerbosch.

In April 1977, the Board reaffirmed that the supplementation system take the form of a canal from the Vaal Dam and resolved that discussions be held with the Department of Water Affairs for authority to construct the canal system including a new outlet works for the Vaal Dam.

These discussions led to the submission in August 1977 of a formal application to the Department of Water Affairs for permission to



construct a canal with a capacity of 2 000 Ml a day to be supplied to a separate outlet from the Vaal Dam. Ministerial approval was granted in December, 1978, subject to the Board continuing to abstract at least 1 100 Ml a day from the Barrage after the new system was put into service.

In October 1978, the Board resolved to construct the raw water supply system comprising an outlet works at Vaal Dam, a steel pipeline 8,5 km long over the rough terrain that forms the right bank of the Vaal River, the pipeline control works and the canal with terminal reservoir at Zuikerbosch pumping station. In view of the Board's experience in the design and installation of pipelines, it was decided that it would be responsible for the 3,5 m diameter Vaal Dam-Zoekfontein pipeline. The Department of Water Affairs required that its construction division construct the outlet works in conjunction with the work involved in improving the stability of the concrete wall at Vaal Dam and providing larger gates to raise the maximum storage level in the dam. At the same time, the firm of Water-

meyer, Legge, Piesold & Uhlmann and Stewart, Sviridov and Oliver in association were commissioned to prepare details of the outlet works, the pipeline control works and the canal with its terminal reservoir.

HIEMSTRA BEKROON

Prof LAV Hiemstra van die Departement Siviele Ingenieurswese aan die Universiteit van Stellenbosch het onlangs die SA Instituut vir Siviele Ingenieurs se toekenning vir verdienstelike navorsing ontvang.

Die toekenning is gemaak op grond van die navorsing wat prof Hiemstra gelei het oor die ontwikkeling van die loophydrogrambegrip in die ontleding van vloedhydrogramme. Dié projek is deur die Waternavorsingskommissie finansiële ondersteun ingevolge 'n kontrak met die Universiteit van Natal toe prof Hiemstra nog aan dié Universiteit verbonde was.

Die Instituut vir Siviele Ingenieurs het bevind dat die praktiese nut van die loophydrogram sodanig is dat dit bekroon behoort te word.

Off the press . . . Off the press . . . off the press . . . Off the press . . .

Post-conference papers published

WATER VIROLOGY

edited by Dr WOK Grabow, NIWR.

This publication was published as a special issue of *Water science and technology* and is one of several dealing with the proceedings of the IAWPR post-conference seminars held in Pretoria on 5 and 6 April 1982.

One of the primary objectives of the seminar on water virology was to find direction and grounds for consensus of opinion regarding many uncertain and rather confusing issues in the field of water virology, and to establish guidelines for future research needs and priorities.

Other volumes are introduced below.

MINE WATER POLLUTION

edited by PE Odendaal, Water Research Commission, RSA

This volume contains the proceedings of an IAWPR post-conference seminar held in Pretoria from 5 to 6 April 1982. It includes reviews, research papers and discussions. Mine water pollution is by no means a recent pheno-

menon. Mines are potential sources of water pollution, with this potential being influenced by a number of factors which vary considerably from mine to mine and from one area to another.

MODERN TRENDS IN SLUDGE MANAGEMENT

edited by JE McGlashan, Water Research Commission, RSA.

The volume opens with an overview of digestion processes, followed by experiences in sludge disinfection in different countries and developments in sludge conditioning and dewatering. Sea and land disposal practices currently in use in various parts of the world are described including relevant legislation and health aspects with particular regard to the use of sewage sludge in agriculture and the effects of metals in sludge. It includes reviews, research papers and discussions of the proceedings of the seminar held in Pretoria from 5 to 6 April 1982.

This publication will be of interest to research workers, chemical engineers, water pollution control personnel, chemists, engineers, operators and technical administrators.

PHOSPHATE REMOVAL IN BIOLOGICAL TREATMENT PROCESSES

edited by Dr HNS Wiechers, Water Research Commission, RSA.

This volume contains the proceedings of a seminar on "Phosphate Removal in Biological Treatment Processes" held in Pretoria in conjunction with the 1982 IAWPRC Biennial International Conference in Cape Town.

The papers in this volume are concerned more specifically with the subject of the removal of phosphate from wastewater, in biological treatment processes. From the papers and discussions it may be seen that the problems of phosphorus removal are being addressed, but that there is some controversy as to the mechanisms whereby excess removal of phosphorus is accomplished, whether the mechanism is a precipitation of inorganic compounds, albeit biologically mediated, or biological through metabolic formation and accumulation of phosphorus compounds in or on the organisms.

Activated Sludge

PRACTICAL COMPENDIUM FOR ENGINEERS

Activated Sludge Process — Theory and Practice, by Jerzy J. Ganczarczyk published by Marcel Dekker Incorporated, New York and Basil, 270 pp. illustrated, U.S. \$59.75.

This book represents an excellent compendium of information for practical application in the design of the activated sludge process for biological waste treatment. Dealing largely with the practical aspects, the book goes through the principles and factors which affect the activated sludge process including many of its

modifications. It examines the aeration process in detail and further goes through the separation and thickening process including the dewatering, utilization and disposal of activated sludge. Many examples of industrial application are cited and then followed by a methodology for process design and a rather unusual feature deals with the operation and maintenance aspects of activated sludge plants. This is an area which is too often neglected by theoretical textbooks on the subject of design and theory.

The text is well supplemented by

useful references and represents a good practical evaluation of the state-of-the-art and for practical purposes, design methodology for the 1980's. This is a very useful book for undergraduate or graduate courses in the field of environmental engineering and is also a very useful reference for practising engineers, consultants and regulators.

(Review by Philip H. Jones, Professor, Department of Civil Engineering, Institute for Environmental Studies, University of Toronto, Toronto, Ontario, Canada M/S 1A4.)

TOERUSTING

Ten einde 'n inligtingsdiens aan ons lesers te lewer, verwelkom die redakteur bydraes vir publikasie (beperk tot ongeveer 300 woorde en een of twee foto's en diagramme) deur vervaardigers en verspreiders van nuwe toerusting en prosesse wat met die bevordering van water-aangeleenthede verband hou.

Sulke bydraes word egter ontvang of gepubliseer met dien verstande dat: (1) die betrokke vervaardiger of verspreider wat die bydrae lewer, verantwoordelik bly vir die inligting of menings daarin vervat en vir aansprake ten opsigte van daardie toerusting en prosesse; en (2) publikasie daarvan nie impliseer dat die redakteur of die uitgewer of die Waternavorsingskommissie die inhoud van so 'n bydrae aanbeveel of daarmee in ooreenstemming is nie.

Lesers wat meer inligting verlang, word versoek om direk met die vervaardigers of verspreiders in verbinding te tree.

Anton Prinsloo
REDAKTEUR



SA Waterbulletin
PO Box/Posbus 824
Pretoria 0001

EQUIPMENT

As an information service to our readers, the editor welcomes for publication contributions (limited to approximately 300 words and one or two photographs and diagrams) by manufacturers and distributors of new equipment and processes related to the promotion of water affairs.

Any such contribution is, however, received or published on the understanding that: (1) the relevant manufacturer or distributor submitting the contribution is responsible for the information or opinions expressed in it and the claims made therein for that equipment or those processes; and (2) its publication does not imply that the editor or publisher or the Water Research Commission underwrites or is in agreement with the contents of such contribution.

Readers who require further information are requested to contact the manufacturer or distributor direct.

Anton Prinsloo
EDITOR



BOREHOLE PUMPS

SUBA have increased their range of submersible borehole pumps from 44 models to 58 models, all based on the multi-impeller design already well established throughout South Africa.

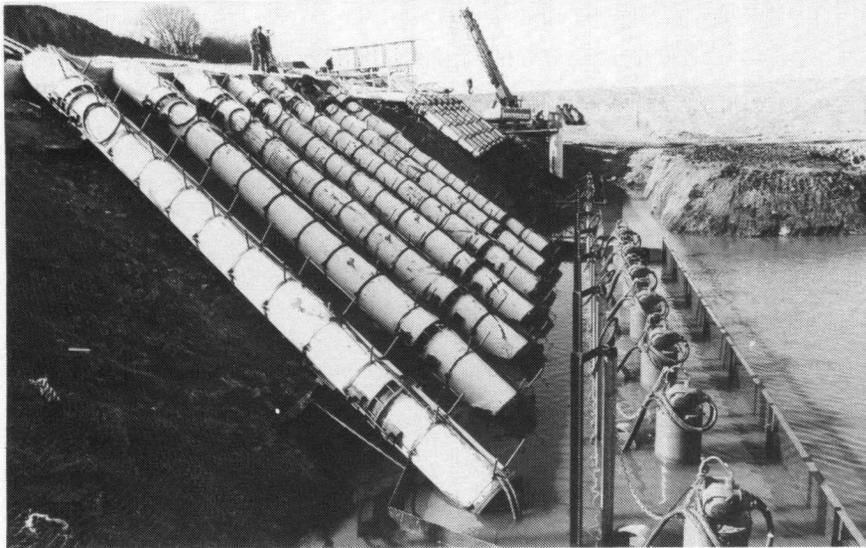
Available in two diameters of 100 and 150 mm respectively, the SUBA series provide a trouble free means of pumping borehole water from depths up to 150 m, and flow rates up to 30 000 l/h. The additional units added to the range now offer a more precise rating for individual requirements.

SUBA submersible pumps are specially designed to deal with borehole water containing grit, sand and sludge usually found below ground. Each pump is fitted with an inducer sleeve, supplied as standard, to ensure efficient cooling of the motor. It also acts as a preliminary coarse-filter.

Provided with either a 220/240 V single phase, or 380 V three phase motor, complete with both overload and lightning protection, the SUBA series is designed with the farmer in mind, by providing long-life, easy-to-install, efficient borehole pumping, backed up with a one year guarantee.

The SUBA range of submersible pumps is complementary to the range of self-priming pumps designed for surface pumping, or dewatering, and provided with petrol or diesel engine.

Enquiries:
SUBA (Pty) Ltd
PO Box 781974
Sandton 2146
Tel (011) 786-9016



PUMPS REVERSE VAAL

Once again, the manoeuvrability and versatility of Flygt submersible pumps have been substantiated when ESCOM placed a two-and-a-half million rand order with Hugh Mellor for 40 type B2250 and 37 type CP 3600 Flygt submersible pumps. These are in service at the new multi-million rand Vaal River Emergency Pumping Scheme, where in the first stages, the course of the Vaal River will be reversed by pumping the water up over seven weirs, situated between the upper reaches of the Vaal Dam and Grootdraai Dam — a distance of about 200 km, and effective height of about 61 m.

Because of the serious drought situation, speed in putting the overall plan into operation was vital. For example, Sasol II and III plants consume 180 million litres a day from the Eastern Transvaal system, and every effort had to be made to avoid disruption.

Key advantage of the submersible pump is that it can be dropped into place, connected into the standard electricity supply, and it is immediately operational. Hugh Mellor were able to complete their total contract within a month or two and installation time on site was practically zero.

Pumping started from the Vaal Dam end over the first weir at the end of June, and as the various intermediate dams fill, the Flygt pumps can be quickly and easily moved from point to point as conditions change daily.

It is anticipated that the first stage of the scheme will be completed by the end of September, by which time the Vaal River will be "flowing" in the reverse direction into the Grootdraai Dam. The Flygt B2250 pumps to 10 m head, at 300 l/s, and the CP3600 to a 10 m head at 1 300 l/s.

The total project is estimated to cost in the region of R33 million, of which R11 million will be spent on what is classed as the temporary section, i.e. the reversal of the Vaal River.

Enquiries:
Hugh Mellor & Co Ltd
PO Box 700
Edenvale 1610
Tel (011) 609-4030

DRY COOLING

A new closed circuit water conserving dry cooling tower designed and manufactured in South Africa is now being marketed by the manufacturers, G Vincent Heat Exchangers (Pty) Ltd.

The SF (staggered fin) heat exchanger system utilised by the tower has two basic standard components — water panel and tube sheet or header — which can be assembled to offer heating or cooling for virtually any application, according to Waddy Jones, national sales manager of Vincent's.

The water panel, made from 18 cr-2mo stainless steel, is rolled, formed into unique corrugation profiles to give extended surface area, easy access for maintenance and exceptionally high heat transfer rates due to turbulent flow paths both internally and externally.

The system embodies an ability to cool fluid without loss of water, with a true counter-turbulent flow between fluid and air.

The arrangement takes maximum advantage of the heat transfer surface, gives the highest value of mean temperature difference and requires the least surface area for a given duty.

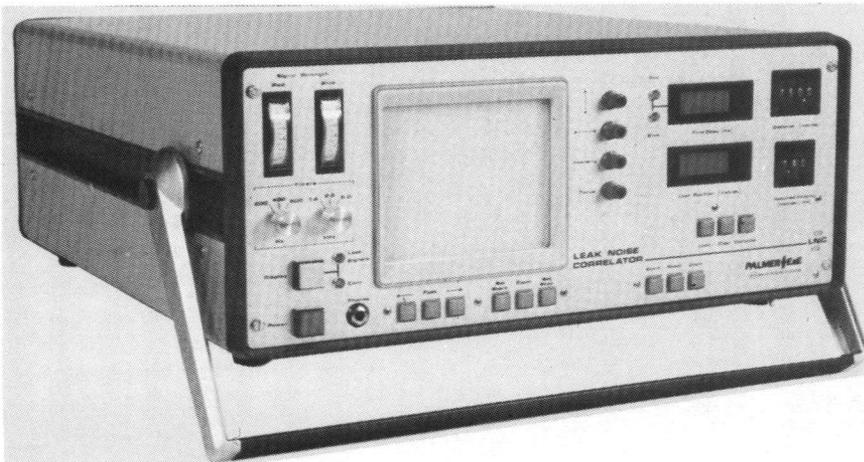
Enquiries:
G Vincent Heat Exchangers (Pty) Ltd
PO Box 10700
Johannesburg
2000
Tel (011) 53-8800

LEAK DETECTION SERVICE

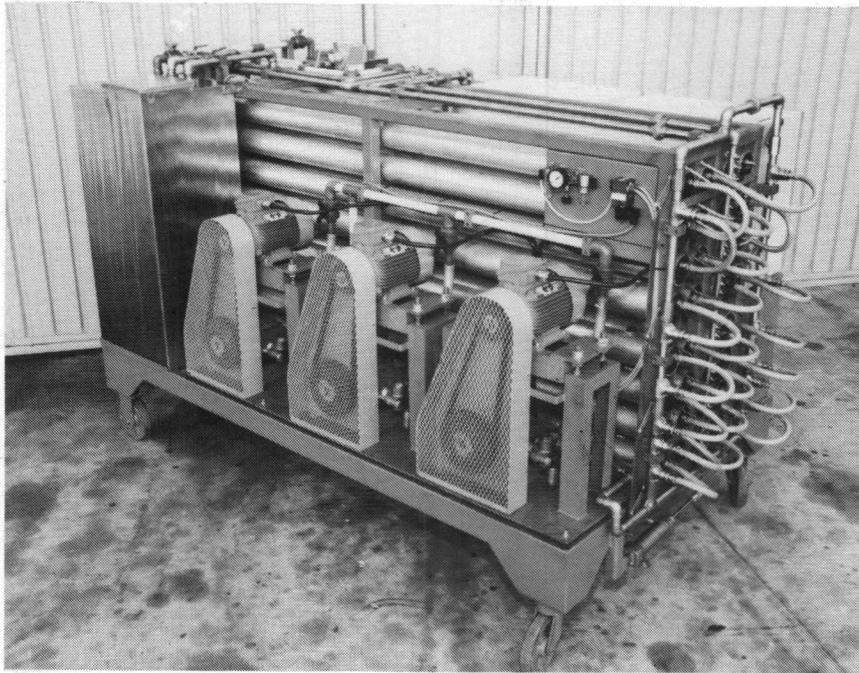
The location of underground hidden leaks in water supply networks has recently become very topical in South Africa largely attributable to the present severe drought situation.

A leak locating service is now available in South Africa through Plessey (SA) Ltd located in Pretoria, covering the whole of the country. This service utilizes the sophisticated electronic Leak Noise Correlator, developed in the UK for the Water Research Centre, and used with success throughout the world.

Enquiries:
F van Rooyen
Plessey SA Ltd
PO Box 2416
PRETORIA
0001
Tel (012) 323-4511



SA DEURBRAAK IN TO



Suid-Afrika het 'n groot deurbraak op die gebied van watersuiwering gemaak met 'n unieke-buistipe Tru-osmose-membraan-stelsel wat deur Bakke Industrieë van die Paarl ontwikkel is.

Die Bakke Membratestelsel is gebaseer op 'n bekende konsep, maar is aangepas vir Suid-Afrikaanse toestande en in so 'n mate verbeter dat dit die ingevoerde konvensionele TO-aanlegte oortref. Die modulêre ontwerp is reeds in Suid-Afrika gepatenteer en patente is ook hangende in ander lande.

TO-modules het 'n plaaslike inhoud van 100% en is spesiaal ontwikkel vir water wat besoedel is. Besoedelstowwe soos organiese materiaal, silika, yster en mangaan kan grootliks van die membraanoppervlak verwyder word deur die buise van tyd tot tyd met 'n sponsbal skoon te spoel. Omdat meer van die membraanoppervlak blootgestel is, word die lastige voorbehandelingsstadium wat by konvensionele aanlegte nodig is, uitgeskakel.

Modules bestaan uit sellulose-asetaat tipe membrane in buise wat deur polimeerplastiekskyfies in posisie gehou en deur 'n metaalmantel omhul word. Dit verlaag die koste van die buistipestelsel tot 'n vlak waar dit met konvensionele spiraalmembraan-stelsels kan meeding.

Elke module bevat 19 buisembrane wat in die fabriek gemonteer en getoets word. Membrane word vervang deur ou modules vir nuwes in te ruil, terwyl die eintlike vervangwerk by Bakke se fabriek gedoen word. Dit skakel die probleme uit wat vervanging in die werksituasie meebring.

Loodsaanlegtoetse in die Benede-Vaalrivier dui op 'n membraanlewe van minstens twee jaar sonder enige voorfiltrasie. In die Vaalriviertoetse is 75% van die water herwin en 95% van die totale opgeloste vaste stowwe uitgehaal.

Membratestelsels kan vervaardig word vir enige moontlike toepassing — vanaf

sowat 25 kl per dag. Loodsaanlegte met mikrorekenaars vir data-insameling en prosesbeheer is ook beskikbaar vir die bestudering van besondere toepassings. Bakke is daarop ingestel om hierdie stelsels ook aan groter instansies soos munisipaliteite, myne en industrieë te verskaf. Bakke-personeel sal ook die nodige ondersteuningsdiens lewer wat sal verseker dat die toerusting behoorlik funksioneer.

Na raming is die behandelingskoste 40c tot 60c per kiloliter water met 'n TOVS van 2 000 mg/l en laer vir aanlegte wat 500 kiloliter of meer per dag kan lewer. Benewens die suiwering van water en afvoerwater kan die stelsel onder andere ook gebruik word om wei te konsentreer en om olie-emulsies en minerale te herwin.

Nog 'n belangrike voordeel is die plaaslike inhoud van die Membratestelsel wat die invloed van invoerbelasting, en skommeling van die rand/dollar-koers tot 'n minimum beperk. Dit skakel ook probleme uit met die beskikbaarheid van onderdele en die verskaffing van diensgeriewe.

Bakke lê baie klem op ontwikkelingswerk. Hulle is betrokke by 'n membraanontwikkelingsprogram in samewerking met die Polimeer Instituut van die Universiteit van Stellenbosch, wat die gebruik van die nuutste ontwikkelings in membraantegnologie in hul toerusting moontlik maak.

Die stelsel word vervaardig by BAKKE se fabriek in die Paarl en is beskikbaar dwarsoor Suider-Afrika.

Navrae:

Johan Barnard of
Skottie Smit
Bakke Industrieë Bpk
Posbus 433
Paarl
7620
Tel (02211) 2-3031

finally . . .

(From page 36)

testinal and urinary tracts of man and beast, and may . . . but then, that would be too ghastly to contemplate):

Beneath this heap of watery batter lies a dude to whom drink did not matter. His last tall glass was milk, or water (Probably the former, not the latter).

The ecstasy and the agony of it all is reflected in

Here died Lester Moore Had three slugs of milk shortly before — no Les, no more.

Skenkings vir WNK reënmeters

Instansies in Nelspruit en omgewing het die Waternavorsingskommissie (WNK) se reënvalstimuleringsprogram tasbaar ondersteun deur geldelik by te dra tot die oprigting van outografiese reënmeters.

Dié reënmeters sal gebruik word by die reënvalstimuleringsprogram in die Nelspruit-gebied.

Mnr Graeme Mather van die Cansas International Corporation het baie van die aanvoerkostes vir die skenkings gedoen.

Verskeie instansies het hulle verbind tot die oprigting van 16 reënmeters teen 'n koste van R1 500 elk. Die grootste skenking wat tot dusver ontvang is, is van SAPPI en het R5 000 beloop.

Voorwaardes waarop die skenking geskied, is dat die fondse uitsluitlik vir reënmeters aangewend word en verder ook slegs in die Nelspruit-omgewing.

Die skenkers geniet dié voordeel dat die bedrae wat vir dié doel aangewend word, van inkomstebelasting aftrekbaar is.

CONFERENCES AND SYMPOSIA

LAKE MANAGEMENT

An International Symposium will be held from 18 to 20 October 1983 in Knoxville, Tennessee USA. Over 60 papers will be read. Enquiries: Dr Wayne L Poppe, Tennessee Valley-Authority, 248 401 Building, Chattanooga, Tennessee 37401, USA.

DESALINATION

A symposium on desalination: new developments and industrial applications will be held on 27 October 1983 at the CSIR Conference Centre, Pretoria.

Enquiries: National Institute for Water Research, PO Box 395, Pretoria 0001, South Africa.

SAICE SEMINAR

Research on economy measures for water used for domestic purposes both indoors and outdoors will be discussed at a one-day seminar to be held at the CSIR Conference Centre in Pretoria on 21 September 1983.

The seminar is being arranged by the Division of Urban Engineering of the South African Institution of Civil Engineers (SAICE) and the cost of attendance will be R20,00 for members of SAICE and R25,00 for non-members.

Enquiries may be directed at Mr GJ Malan at the National Building Research Institute of the CSIR; tel. (012) 86-9211, ext. 2464.

AGRI-TURF IRRIGATION

A large irrigation exhibition and technical conference, will be held from 4 to 7 December 1983 at Denver, Colorado in the USA.

Enquiries: Karen Noyes, Irrigation Association, 13975 Connecticut Avenue, Silver Spring, Maryland 20906, USA.

GROUNDWATER AND MAN

An international conference on Groundwater and Man will be held from 5 to 9 December 1983 in Sydney, Australia.

Enquiries: Australian convention & Travel Services (Pty) Ltd. PO Box 1929, Canberra ACT 2601, Australia.

SOIL SALINITY, IRRIGATION

An international conference on soil salinity under irrigation processes and management will be held from 25 to 29 March 1984 in Dagan, Israel. Also included will be an irrigation equipment exhibition.

Enquiries: Conference Secretariat, PO Box 3054, 61 030 Tel Aviv, Israel.

AFRICAN WATER TECHNOLOGY

The second African Water Technology Exhibition and conference will be held from 9 to 13 April 1984 in Nairobi, Kenya.

Enquiries: International Conferences & Exhibitions Ltd. 6 Porter Street, London W1M 1HZ, England.

SA WATERBULLETIN

SA Waterbulletin is 'n kwartaallikse nuusbrief oor water en waternavorsing wat uitgegee word deur die Suid-Afrikaanse Waternavorsingskommissie (WNK), 'n statutêre organisasie wat in 1971 by Wet gestig is.

Intekening is gratis. Stof in dié publikasie weerspieël nie noodwendig die oorwoë menings van lede van die WNK nie, en mag hergebruik word met erkenning van die bron.

Redaksie: WNK, Posbus 824, Pretoria 0001, Republiek van Suid-Afrika. Tel (012) 28-5461.

Redakteur: Anton Prinsloo
Asst-redakteur: Jan du Plessis.

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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) 28-5461.

Editor: Anton Prinsloo
Asst editor: Jan du Plessis.

finally . . .

Milk galore

The danger inherent in drinking anything but water becomes patently apparent in the latest price hike on good ol' cow juice. Not only are the cows, in a funest dairy suffragette action, yielding less readily unless fed more fodder, but milk has become the rich man's drink. It has attained a certain stature, an esotericism, if you like, as if, having been churned, curdled, separated, pasteurised, soured, sweetened, flavoured, sterilised and bottled by the peasants in the past (not to mention cheesed off), it has suddenly been liberated into the hands, and gullets, without a doubt, of the affluent.

Rumour has it hat in fine restaurants it has become fashionable, if not *de rigueur*, to ask boldly, even brassily, for milk by name, and not to refer to it by that watered-down, metaphorically speaking, euphemism used by the French, *lait*. In doing so, one can enjoy the look of startled adoration from the little blonde thing in the photographic dress (90 per cent exposure) at the next table who is demurely sipping her glass of *Blanc de blanc brut '39* or the *Taittinger '49* simply because she cannot afford milk.

This phenomenon is not geographically isolated, if one can believe our correspondent in Texas who firmly believes in that ultimate ruminant, the double-uddered cow. Two epitaphs discovered in that State bears out the danger of drinking anything else but water — especially, it would seem, milk. (It does not seem of any import that the water, in our case, may have flowed down the Vaal, been bathed or spat in, been used for riverside laundering, may have accommodated something as hideous as a barbel, may have passed through the in-

(To page 35)