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Newsletter of the Water Research Commission



Waves In Southern Africa

In May 2004, during the Biennial WISA Conference, Mr Jay Bhagwan of the WRC was inaugurated as the new President of WISA (Water Institute of Southern Africa). After six months as President, Yuven Gounden spoke to him about his new role.

Describe your experiences in the past few months as president of WISA?

WISA as a voluntary non-profit institution provides many challenges which are quite unique to such an organization. You have to manage and grow its services and benefits that it provides, as well as keep the organization relevant and at the cutting edge of knowledge sharing. You learn that as a volunteer you are responsible for managing the interests of all its members. The experience thus far has been challenging and rewarding, especially where you have a situation of taking the Institute from being static to being dynamic, and responding to the needs of its members which become more diverse than those of just scientists and academics. My experience thus far has been most rewarding, especially in managing a common vision and recognizing the voluntary inputs and efforts undertaken by members in making WISA a relevant body.

What challenges do you foresee for WISA?

Mainly, WISA needs to grow its membership to involve and include a more diverse and multidisciplinary group of professionals, specialists and practitioners. More emphasis needs to be placed on attracting the youth and those from previously disadvantaged backgrounds. Associated with this is the need to grow the services and support it offers, and that relates directly to improving WISA's operational capacity and finances. Spreading the aspect of volunteerism on which the activities of WISA are based is one of the key challenges. Furthermore, WISA needs to continuously carve a niche in contributing to the building of the much needed capacity and competencies in the water sector towards meeting present and future water management challenges.

Are there any plans to address these challenges for WISA in terms of defining new priorities?

Yes, WISA members, through its management structures of the Board and Council, have recognized the need for WISA to respond to these challenges. A strategic plan has been developed and approved by the Council of WISA which sets out the path for the transformation of WISA. The plan is now in its implementation phase and we will see a much improved WISA in the near future.

Jay, the WRC wishes WISA well in its endeavours to grow and develop to meet the challenges of the future.

Annual Report Handover

On 5 October 2004, the WRC intended handing over the 2003-2004 Annual Report to the Minister of Water Affairs & Forestry, Honourable Minister Buyelwa Sonjica in Goodhope Chambers, Parliament. Unfortunately, The Minister could not attend the function and the CEO of the WRC, DR Rivka Kfir, handed the report to the Western Cape Regional Director of DWAF, Mr Rashid Khan. Dr Kfir presented highlights of WRC projects for the financial year and the report was well received.

Dr Kfir (WRC) handing over the Annual Report To Mr R Khan (DWAF)

Minister Sonjica visits the WRC

Minister Sonjica chatting to Reshmili and Ndala at the WRC

On 20 September 2004 the Minister of Water Affairs & Forestry, Ms Buyelwa Sonjica , officially visited the WRC. The WRC Executive presented the *Modus Operandi* of the WRC and informed the Minister about WRC goals and objectives. Thereafter, the Minister addressed staff members and interacted with them.

The WRC @ the SALGA Conference

The South African Local Government Association (SALGA) held its Second National Conference at the Cape Town International Convention Centre from 26-30 September 2004. The theme was "Ten Years of Democracy - Towards a Decade of Accelerated Local Delivery."

On 27 September the Minister of Water Affairs and Forestry, the Honourable Ms Buyelwa Sonjica, addressed the delegates on *Building Partnerships to Accelerate Delivery*. On 29 September the President of South Africa, The Honourable, Mr Thabo Mbeki, addressed delegates. Other speakers included Minister S Mufamadi, Executive Mayor N Mfeketo (City of Cape Town), Executive Mayor O Mlaba (SALGA) and Father S Mkhatshwa (Chairperson: SALGA).

The WRC exhibited at this conference. Delegates placed orders for WRC reports and were delighted at the fact that the WRC has such a wide knowledge base, especially as far as matters concerning Local Government are concerned.

The Winners!

The WRC ran a competition coinciding with the launch of the career guide *Water @ Work*. The prize was a trip to a water facility for the winner and 50 friends. The prize was awarded per province. Thus far, the Western Cape, the Northern Cape and the Eastern Cape have undertaken their trips. Nowawe High (Eastern Cape), Esselen Park Secondary (Western Cape) and Boitshoko Intermediate (Northern Cape) have undertaken their trips. The reports suggest that the learners enjoyed the learning experience tremendously and have shown great interest in pursuing a career in the water sector.

Learners from Nowawe High (Eastern Cape) going on their field trip

The WRC in Parliament

On 6 October 2004 the WRC Executive presented the WRC roles and functions to the Parliamentary Portfolio Committee on Water Affairs & Forestry as well as the Select Committee on Land & Environmental Affairs. The programme also included impacts of research in the four key strategic areas (KSAs) as well as the dissemination of water-related information in the fifth KSA. There were also slots for question and answer sessions and informal interactive discussion. The Committee is now aware of the WRC as a formidable knowledge base and a potential advisory body.

He Makes Sense of Rands!

Mbongeni Mkhatshwa is the WRC's new financial officer. He hails from Kanyamazane, Mpumalanga. Mbongeni completed a BComm degree at the University of Transkei. He then served his internship with Fisher, Hofman PKF, an accounting and auditing firm in Cape Town. He also served a stint with Sizwe Ntsaluba VSP until he joined the WRC on 28 October 2004.

A warm and cordial Mbongeni has great ideas to refine the financial machinery at the WRC and hopes to make it stakeholder-friendly and efficient. "I am looking forward to the challenges ahead and am proud to be a part of the WRC. It is evident that the WRC is a well-structured organization," says Mkhatshwa. He also enjoys the team spirit that exists at the WRC. "I must thank the WRC staff for making me feel welcome. A special word of thanks to my colleagues in the Finance and Administration Department who are supportive and extremely helpful," says this enthusiastic 27-year old man.

When he is not balancing the books, Mbongeni relaxes by working out at the gym, reading financial publications and newspapers, listening to music or enjoying the great outdoors. Mbongeni, the WRC wishes you well and we welcome you as part of the WRC family.

Farewell Melissa

On 28 January 2004 Melissa Potgieter joined the WRC as a financial officer, employed in a temporary capacity. Melissa provided an efficient service until her resignation at the end of October 2004. Ms Potgieter has started her own accounting practice. Melissa, The WRC thanks you for your loyal service and wishes you well for the future.

What's New

Report No 1146/1/04 (Contractor: Durban Metro and WSSA) Lessons and experiences from the Ethekwini pilot shallow sewer study

WRC studies conducted with the support of Ethekwini communities have shown that the shallow-sewer system, which has been implemented successfully in Brazil, Greece, Australia, the US, India, and become the norm in Pakistan, can be an effective low-cost solution to the contentious problem of sanitation provision in low income and informal settlements in South Africa. The technology is also well-suited to community-upliftment projects in high-density settlements. The concept involves relaxation of the design parameters of conventional sewerage systems, allowing for shallower pipe-laying depths, smaller-diameter pipes and flatter gradients. The concept also includes the empowerment of communities to construct, operate and manage sewerage systems through acquisition of the necessary technical and organisational skills. This system reduces the operational load on service providers. The Ethekweni trials showed the cost of installing such systems to be about half the cost of full water-borne sewers. The systems have generally been well-received by participants.

Report No 825/1/03 (Contractor: Umgeni Water) Development of a rapid test kit for *Cryptosporidium* and *Giardia*

An economical system for detecting *Cryptosporidium* oocysts and *Giardia* cysts in water concentrates using the SIA based on the enzyme-linked imminoenzymatic assay (ELISA) was developed. A multiple solid-phase SIA test that combined liquid and solid phases for laboratory and field use was optimised for use with water samples of varying turbidity. Three methods commonly used for concentration of the oocysts and cysts, combined with an immuno-fluorescence assay for detection, were evaluated and compared with the IMS and SIA detection techniques. Multiphase SIA was found to be cost effective and simple and produced optimal colour reactions when the primary and secondary antibody slides were in solid phase at the optimal dilutions and the substrate used was provided as a liquid. A simple low-cost spectrophotometer was constructed, but initial evaluation of the system showed that the instrument was not sufficiently sensitive. The project has nevertheless provided a base for further development and optimization of the simple low-cost spectrophotometer for reading of SIA slides and an SIA colour chart correlating colour intensity with (oo)cysts concentration as a guide to the direct visual qualification of (oo)cysts in samples.

Report No 892/1/03 & 892/2/03 (Contractor: ARC)
The selection and calibration of a model for irrigation scheduling of deciduous fruit orchards &
Deficit irrigation studies to improve irrigation scheduling in deciduous fruit orchards

Improved irrigation scheduling could reduce water wastage in deciduous fruit orchards in the Western Cape. Scheduling requires water budgeting, which in turn, requires, among others, evapotranspiration (ET) estimation, which is estimated by mathematical models from meteorological, soil and crop-related data. Several ET models being used in SA were developed for annual crops. They are therefore not applicable to fruit trees where partial or total wetting of the soil surface under irrigation occurs and makes an estimation of water use from meteorological data more difficult. The project was aimed at validating a Soil Water Balance (SWB) model and its reliability in irrigation scheduling for fruit trees when linked to a weather station. Output parameters indicated reasonable agreement predicted to measured soil water deficit. The use of an irrigation scheduling model such as SWB, that utilizes the dual crop co-efficient approach, has the potential to improve irrigation water management of orchards based on meteorological data. Furthermore, development of separate water balances for trees and cover crops under full surface irrigation in the SWB model could enable more realistic simulations of water deficits. Knowledge gained from the study has helped to improve the practice of regulated deficit irrigation of deciduous fruit trees.

Report No 1161/1/03 (Contractor: University of Cape Town) River rehabilitation: Literature review, case studies and emerging principles

The project focused on physical aspects of river degradation and rehabilitation. Physical degradation of aquatic ecosystems can be due to both physical disturbance and hydrological manipulation. Successful rehabilitation is based on three main activities: environmentally sensitive river maintenance actions, soil bioengineering and measures to mitigate the effects of hard engineering practices. Natural recovery of the river channel, without interventions is an option where time and space allow, and where limitations, such as excessive water abstraction, are not present. Five methods of stabilizing stream banks are vegetation alone, vegetation with structural control, vegetation and structural control with bank shaping, structural control alone, and bioengineering methods. Three case studies have shown that channel morphology is largely determined by high flows: hydraulic biotopes change as discharge change; floods enhance the diversity of riparian and aquatic plants; and channelization is usually followed by an upstream migration of bank erosion, which in turn, is followed by bank collapse particularly during the wet season.

Report No 952/1/04 & 952/2/04(Contractor: CSIR)
Biomarker assays for the detection of sub-lethal toxicity in the aquatic environment- A preliminary investigation, &
Biomarker assays for the detection of sub-lethal toxicity in fish: Operational manual

The project focused on using biomarkers as sub-lethal endpoints in a laboratory fish test employing tilapia (*Oreochromis mossambicus*), to complement the acute (lethality) tilapia test developed for local use. Assays for the following biomarkers were established and optimised: protein; AChE; ethoxyresorufin-O-deethylase (EROD); glucose; glycogen; delta-aminovulinic acid dehydratase (ALA-D); LDH; glucose-6-phosphate-dehydrogenase (G-6-P-DH); pyruvate kinase (PK); heat shock protein (Hsp 70) and osmotic ion analyses. The control results showed that, although values were low, all the biomarkers were present at measurable levels in the fish homogenate. The exposure studies showed that biomarkers were affected by the test chemicals. Biomarkers were induced or inhibited. Sufficient evidence was obtained that biomarkers could be applied as sub-lethal measures of toxic activity in laboratory toxicity tests.

Report No 1124/1/03 (Contractor: Rand Water) Evaluation of powdered activated carbon (PAC) for the removal of taste and odour causing compounds from water

Most waterworks treating waters characterised by eutrophication are not equipped to remove taste and odour causing substances due to the high cost, the intermittent nature of the problem or an insufficient level of technology. The most commonly used method of removal of geosmin or 2-MIB from water is the use of activated carbon. The physico-chemical properties of the ten PAC samples used in the evaluation were characterised in terms of moisture content, ash content, bulk density, particle size distribution, nitrogen intrusion, mercury intrusion, tannin number, iodine number, methylene blue number, geosmin adsoption and 2-MIB adsorption. It was found that water quality does affect the ability of PAC to adsorb geosmin; 2-MIB with best results were obtained for deionised water and worst results for water containing a relatively high concentration of suspended solids. The water treatment process also affected adsorption with lime having little effect, polyelectrolyte having a relatively minor effect, and sodium silicate being significantly inhibitory to geosmin and 2-MIB adsorption.

Report No 924/1/03 (Contractor: Chris Swartz Eng) Characterisation and chemical removal of organic matter in South African coloured surface waters

There is a need for a more fundamental characterisation of natural organic matter (NOM) in South African coloured waters for classifying the coloured surface water sources, and for using this to establish the treatability of the different classes of coloured water. Investigations revealed that differences between the waters lie in the amount rather than the nature of the organic content, which appears to be very similar in all the supplies; most of the organic matter has a high UV absorbance, indicating a high aromatic content; DOC, UV absorbance, COD and, less accurately, colour can all be used to estimate the amount of humic materials present in the water. Optimum coagulation pH values are 4.6 for ferric salts and 5.6 to 5.8 for aluminium sulphate.

Report No 1070/1/04 (Contractor: DIT) The development of small-scale ultrafiltration systems for potable water production

The major focus of the project was to develop a system using locally produced capillary ultrafiltration membranes that would be sustainable for use in rural and peri-urban areas. A design and a strategy for operation and maintenance have been developed, which go a long way towards meeting the criteria for sustainability. The system design is very simple, and uses locally produced capillary ultrafiltration membranes. The other hardware components are also easily available locally. The strategy for operation and maintenance combines on-site monitoring by the user community with a regional approach to membrane cleaning and mechanical maintenance. This reduces the requirements for high technical skills, while still promoting community ownership of the units. The capillary ultrafiltration system has demonstrated that "high-tech" water treatment technologies can be made sustainable in developing economy conditions, and is expected to have a major impact on water provision in rural and peri-urban South Africa.

Report No 1166/1/04 (Contractor: University of Stellenbosch) Real-time observation of fouling in membrane filtration by non-invasive ultrasonic techniques

Membrane fouling is the single most critical problem limiting the wider application of water and effluent treatment by membrane filtration. The project aimed to "visualise" the growth of a fouling layer on a membrane surface using advanced ultrasonic wave technology. A novel method for the detection, measurement and characterization of fouling layers on membranes, while located within their modules, has been developed. The method is based on the use of differential ultrasonic waves. It enables the detection of fouling on a (membrane) surface within 15 seconds of initiation thereof. This project highlights the growth in sophistication of the ultrasonic technique to enable the non-invasive measurement of fouling on membranes in-situ before there is even a trace of flux decline. A commercial monitoring unit, based on the method, is being developed in conjunction with a German firm, which may be used on any membrane plant as a simple way to monitor the condition of membranes in practice.

(continued on p 4)



Report No 1059/1/03 (Contractor: ARC) Predicting the impact of farming systems on sediment yield in the context of integrated catchment management
In this project modelling tools, WEPP and ACRU were used in predicting the impacts of farming practices and management on sediment yield. The study sought to improve methodologies used to predict the impact of selected land uses on sediment yield in South Africa. The study focused on the behaviour and ways of managing agricultural lands through the use of modelling tools. Simulations were done in the study catchments for varying land use practices. Both models were applied in each catchment. The findings showed that the WEPP Model generated better results on the impact of agricultural practice. The ACRU model had the advantage of having readily available datasets for the selected catchments. This study also identified the need to develop approaches which integrate the biophysical environment and the socio-economic environment.

Reports can be ordered at orders@wrc.org.za

Course Announcement

The Unilever Centre for Environmental Water Quality is presenting the following course: ***Introduction to Managing Environmental Water Quality.***
The course will be held on 24-28 January 2005 at Resource Quality Services Training centre, DWAF, Roodeplaat Dam, Pretoria.
For more information contact: Dr Heather Davies-Coleman 046- 622 2428; heather@iwr.ru.ac.za

The WRC @ the Stander Evening

The Biennial Stander Evening was held on 21 October 2004 at the CSIR Conference Centre in Pretoria. The event commemorates the contributions of the late Dr Gert Johannes Stander, first Director of the National Water Research institute at the CSIR and first Executive Director of the WRC. Dr Stander was recognized internationally as one of the world's leading experts in the field of water research. A founder member of the International Association of Water pollution Research, he became its first president in 1969, and the first to hold this position for four consecutive terms of office, until 1976.

The main guest speaker was Prof George Ekama, professor in Water Quality Engineering at UCT. Prof Ekama has been at the forefront of development in BNR research and implementation,

***From left to right**: Ms Eustina Musvoto, Mr Jay Bhagwan, Ms Jenny Huang, Dr Shafiek Adams and Prof George Ekama*

system kinetic modelling, filamentous bulking, secondary settling tanks and systems design optimization. The topic of his talk was *Practical and Theoretical Developments in Wastewater Treatment*.

It is traditional practice for young, innovative researchers to share the stage with eminent researchers such as Prof Ekama. This year was no exception: Ms Jenny Huang (University of KwaZulu-Natal) spoke about *The Application of CFD Modelling in Water and Wastewater Treatment*; Dr Shafick Adams (University of the Western Cape) addressed the audience on *Groundwater Recharge: A Crucial Component for Determining Groundwater Sustainability*.

This prestigious event was well attended and the audience was enthralled by the calibre of the distinguished speakers.

Open Day @ the WRC

On 13 October 2004 the WRC hosted its Research Expo 2004. The day saw the WRC showcase its latest research outputs in the form of posters, models, videos and presentations. The function was well-attended and culminated in a cocktail function at 18:00.

The *Knowledge Review* was launched which reflected WRC research outputs during the 2003-2004 financial year.