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Aqua Australis

NEWSLETTER OF THE HYDROLOGICAL SOCIETY OF SOUTH AUSTRALIA

RESPONSE TO THE NATIONAL WATER INITIATIVE: ACHIEVABLE, BUT…

Media Release, Centre for Desert Research

The main objectives of the National Water Initiative – more efficient water use and delivery, and consumption-based pricing in water supply systems – are potentially partially achievable in remote Aboriginal settlements. The report of the *Response to the National Water Initiative* project shows they could be less dependent on regional water supplies by improving the water efficiency of houses and by using roof and large-scale ground-based rainwater harvesting.

The study of four small South Australian Aboriginal communities has shown, however, that the settlements will continue to require greater resourcing and support.

They should also remain covered by a continuing State-wide Community Service Obligation - an essential element in South Australia's equity, social justice and regional policy, which includes State-wide water pricing.

The National Water Initiative itself also makes allowance for uneconomical services which need to be supported to meet social and public health obligations

The study assessed the potential impact of increased water costs at Nepabunna, Yarilena, Scotdesco and Davenport communities by:

- Conducting an economic appraisal of water costs to householders
- Identifying how to cut their water costs and at the same time promote water conservation, more efficient water use and sustainability of the water resource
- Discussing with the communities the level of service delivery they would be prepared to pay for.

It makes a significant contribution to policy on essential service delivery at a time of increasing water shortages.

The report shows that water use in the four settlements is 'mostly modest' and poor housing design and leaky infrastructure preclude further savings.

It makes specific recommendations for each of the four, among them suggestions for environmentally appropriate new housing design, including passive temperature control to reduce the reliance on heavy water users such as evaporative air-conditioning, improved monitoring systems to assess the extent of water loss and improved infrastructure.

It notes, however, that the levels of poverty and other factors in the four settlements put some of the recommendations beyond their reach.

While one community was able to gain a Commonwealth Community Water Grant, which is clearly one way of financing water savings strategies, the others may lack the resources to complete the applications.

The report concludes that remote settlements clearly have a responsibility to support the viability and sustainability of their water supply through efficient water use, but needed improved support to achieve it.

It says additional subsidies would need to remain in place to ensure 'Aboriginal Wellbeing' and the onus will be on the policy makers and advisors to government to ensure this occurs.

Dr Meryl Pearce and Assoc Prof Eileen Willis recently launched their research report which looked at the ability and willingness to pay for water in remote Aboriginal communities in South Australia.

The research report entitled "A response to the National Water Initiative from Nepabunna, Yarilena, Scotdesco and Davenport Aboriginal settlements" by Pearce et al. is available for download at:

http://www.desertknowledgecrc.com.au/publications/research.html

THE SIGNIFICANCE AND LAG-TIME OF REGOLITH FLOW: AN EXAMPLE FROM A SMALL, EPHEMERAL CATCHMENT WITH CONTRASTING SOIL TYPES IN THE ADELAIDE HILLS, SOUTH AUSTRALIA

Erick Bestland, Sam Milgate, David Chittleborough, John VanLeeuwen, Markus Pichler and Lesja Soloninka

The importance of deep throughflow, here termed "regolith flow", in a small (3.4 km2) gauged catchment in the Adelaide Hills S.A. was investigated by detailed hydrochemical analysis of soil water and stream flow during autumn and early winter rains.

In this Mediterranean climate with strong summer moisture deficits, several significant rainfalls are required to generate soil throughflow and stream flow [in ephemeral streams]. During Autumn 2007, a large (127 mm) drought-breaking rain occurred in April followed by significant May rains; most of this precipitation occurred prior to the initiation of stream flow in late May.

These early events, especially the 127mm event, had low (depleted) stable water isotope values compared with both later rains and average winter precipitation. Thus, this large depleted early rain event provided an excellent natural tracer. During the June and July rainfall events, daily and sometimes, twice daily stream and soil water samples were collected and analysed. Results from major and trace element, water isotope, and strontium isotope analysis clearly demonstrate that a large component of this early April and May rain was stored and later pushed out of deep soil or regolith zones.

This pre-event water was identified in the stream as well as identified in deeper soil horizons due to its different isotopic signature which contrasted sharply with the June-July event water. Based on this data, the regolith and throughflow system for this catchment has been re-thought.

The catchment area consists of about half sandy and half clayey soils. Regolith flow is now thought to be dominated by the sandy soil system not the clayey soil system. The clayey duplex soils had rapid response to rain events and saturation excess overland flow. The sandy soils had delayed soil throughflow and infiltration excess overland flow.

A pulse of macropore throughflow was observed in the sandy soils three days after a rainfall event. The macropore water was a mixture of pre-event and event water, demonstrating the lag-time and mixing of the water masses in the sandy soil system. By contrast, the clayey soil horizons had no obvious pre-event water, demonstrating the quicker response and shallow flow through of the clayey soil system. Thus, the sandy terrain has a greater vadose zone storage and greater lag time of through-flow than the clayey terrain.

INVESTIGATIONS OF NDMA FORMATION BY CHLORINATION OF MODEL COMPOUNDS

Dean Richards, Glen Shaw, Wasantha Wickramasinghe, Neil Holling & Geoff Eaglesham

This study has demonstrated that there is the potential for formation of NDMA from the chlorination or chloramination of various nitrogenous biological molecules. The potential of a wide range of amino acids to act as precursors for NDMA formation was examined. The amino acids that were shown to be precursors were: arginine, phenylalanine, histidine, tryptophan, tyrosine and l-glutamine.

Purines and pyrimidines were also investigated in terms of their potential as precursors. It was found that uracil and guanine were positive as precursors for NDMA formation. Interestingly, the cyanobacterial toxin, cylindrospermopsin, was also found to act as a precursor for NDMA formation when chlorinated. Cylindrospermopsin structurally contains a uracil moiety in its molecule, which could be site of attack in NDMA formation. Experiments using chloramination additionally found that glycine, threonine, urea and the cyanobacterial toxin, microcystin-LR were precursors for NDMA formation. Microcystin-LR is a cyclic heptapeptide consisting of 7 amino acids including arginine and a structurally unique aromatic acid, ADDA.

Mixes of amino acids were found to form NDMA more rapidly than when chlorinated singly. The situation of complex mixtures of amino acids and other precursors such as uracil, urea and cyanobacterial toxins in source waters is often encountered. The addition of dimethylamine or trimethylamine to the chlorination mixtures did not increase the number of amino acids that were shown to be precursors.

Research into the development of a suitable analytical method for NDMA in disinfected drinking waters has culminated with a sensitive validated method utilising solid phase extraction combined with ammonia positive chemical ionization gas chromatography-mass spectrometry. This method is now established and is commercially available in Queensland Health Scientific Services.

A limited survey of NDMA presence in Australian disinfected waters indicated that, with a few exceptions, the waters surveyed did not contain detectable levels of NDMA. These results however need to be regarded as indicative only as they utilised analytical methodology in development at the time. It is recommended that further, more extensive surveys be conducted using the latest sensitive analytical methods.

A full copy of this report is available at:

http://www.waterquality.crc.org.au/publications/report52_NDMA_formation_chlorination.pdf

TOOLS TO DETECT ESTROGENIC ACTIVITY IN ENVIRONMENTAL WATERS

Frederic DL Leusch

The occurrence of estrogenic endocrine disruptors in water is of international concern because of potential adverse health effects on wildlife and humans. Chemical analysis and quantification of estrogenic compounds in water is problematic due to the great range of compounds with endocrine activity. Also, the ultra-low concentrations that can cause biological effects make it clear that additional methods are needed for this type of analysis.

Bioanalytical methods have become increasingly popular and are seen as a possible screening tool for measuring estrogenic activity in water. Bioassays generally have significantly lower detection limits than chemical methods, provide an integration of potency and dose and, most importantly, require no prior knowledge of the specific chemical nature of a sample. Several *in vitro* bioassays have emerged over the past decade to test the estrogenicity of environmental samples.

There are, however, concerns about their reproducibility, robustness, interlaboratory variability and their ability to integrate into a regulatory framework based on individual chemicals. The full report describes an international effort to evaluate the performance of five *in vitro* bioassays to assess estrogenic activity in a variety of water matrices (http://www.edctoolbox.info).

Spiked artificial (tap water spiked with known estrogenic chemicals such as hormones, alkylphenols, phthalates, pesticides and phytosterols) and real samples from sewage, river, groundwater and drinking water were tested.

The results indicate that the ER-CALUX and E-Screen assays in this study successfully detected estrogenicity in environmental water samples even at very low levels of estrogenicity (from 0.1 to 320 ng/L EEq). The estrogenic activity measured in these bioassays could be correlated to the predicted estrogenic activity based on comprehensive chemical analysis (GC/MS, GC/ECD, and HPLC/MS/MS), suggesting that either of these two bioassays could be used as initial screening tools to detect estrogenicity in environmental water samples.

The KBluc assay was very similar to the ER-CALUX, but these conclusions are based on a more limited dataset, and should be considered critically. The YES performed well with highly polluted environmental samples (such as sewage samples) but its relatively high detection and quantification limits meant that it was unable to measure low-level estrogenicity (eg ground and river water). With artificial samples, the performance of the YES assay was also significantly affected by octylphenol. The MELN assay tested in this study provided good qualitative data, clearly identifying low and high estrogenic activity in the samples. However, accurate quantification was more problematic, possibly due to matrix interference from complex matrices (such as sewage) in this assay.

This study shows that some bioassay techniques are now sufficiently advanced that they can be used either as a cost-effective first-pass detection system or in combination with standard analytical methods to measure estrogenic pollutants in environmental waters. Standardization of bioassay data analysis was identified as a crucial step forward towards accurate bioassay-derived estrogenicity measurements.

A full copy of this report is available at:
http://www.waterquality.crc.org.au/publications/GWRC_tools_estrogenic_activity2008.pdf

REUSE WATER FOR RIVERLAND REGION

Environmental Management News, www.emn.net.au.

United Utilities Australia has officially commissioned a $14 million effluent treatment and reuse scheme for the Berri – Barmera Council in South Australia's Riverland. It means 100% of effluent generated in the two towns is now being treated and is available for reuse.

Capital funding was also provided by Constellation Wines which is using the scheme as a disposal and treatment path for winery wastewater and the Berri Barmera Council. Both the SA and Federal Governments also contributed to the scheme.

Effluent is collected from approximately 4000 septic tank connections and carried to two new treatment plants. An existing treatment facility has also been upgraded to handle wastewater from Constellation Wines' production facilities.

Three new effluent pumping stations along with 32km of new pipelines and pumping systems for reuse water have also been provided with the entire scheme designed to allow for easier transfer of treated effluent across the network. The scope makes it possible for other potential contributors of wastewater or end users of treated water including industries requiring process water, to join in the future.

At this stage the scheme will produce 600ML of Class B standard treated effluent p.a, which will initially be mainly used in the irrigation of two golf courses, including Berri Golf Course, a large council park and a permanent field days site.

A percentage of the reuse water has also been allocated to irrigate crops. Trials have been conducted to assess the viability of irrigating *Arundo donax* (giant reed) with treated winery wastewater. The reed can be used in paper production and power generation.

UPCOMING EVENTS

Workshops and Courses

Short Course in Integrated Catchment Management

22 September - 6 October 2008

Adelaide, SA

This 2-week short course is offered by the University of Adelaide in partnership with the CRC. The course provides students with an understanding of the ecological and hydrological processes governing catchment systems, and concepts for the assessment and management of catchment systems.

Field practicals and site visits are conducted in the Bradbury catchment and Parafield stormwater harvesting system in order to gain skills for the monitoring, assessment and management of natural and urban catchments. Laboratory practicals are conducted for the chemical, physical and biological analysis of soil, water and vegetation samples, and data analysis by GIS.

http://www.waterquality.crc.org.au/workshops.htm

ozwater'09

Melbourne Convention & Exhibition Centre
Melbourne, March 16 - 18, 2009

Ozwater is organised by the industry for the industry, where the issues that drive the industry are discussed and future directions decided. Ozwater 09 will address the wide ranging issues that face the water industry today. These include major national water reforms, climate change and its impacts, technological advances and the challenges of human resources to name a few. The theme for Ozwater '09 is 'from challenges to solutions' where the conference will address some of the important issues that impact on our industry. The Ozwater 09 Conference will feature inspirational international and national keynote speakers, numerous invited speakers, scientific and technical papers, case studies, workshops and poster sessions.

http://www.ozwater09.com.au/

excellence IN INDUSTRIAL WATER

17 & 18 November
Luna Park, Sydney

Presented by WME Media, Excellence in Industrial Water is the first dedicated event to the Industrial Water Industry and its users in Australia.

Designed specifically with industrial water managers, senior management and CEO's from a range of industries in mind, attendees will leave equipped with everything they need to know how to make their water operations more efficient, more effective and more environmentally conscious.

With lower water levels and state government action looming, this is a not to be missed event for anybody involved in, interested in, or responsible for industrial water management.

Confirmed Speakers:

- **Ian Kiernan**, Chairman and Founder, **Clean up Australia**
- **Debra Wilson**, Water Project Manager, **Coles retail development**
- **Mr. Chris Stevens**, Sustainability Manager, **Diageo Australia**
- **Dr. Paul J Williams**, Head of Sustainable Development, **Nalco Company**
- **David Hicks**, Performance Manager, **Norske Skog**
- **Mohan Seneviratne**, Independent Consultant
- **Dr. Peter Holt,** Principal Consultant, Sustainable Water Management Services, **Energetics**
- **Charlie Foxall**, Environment & Safety Manager, **Fosters Yatala Brewery**
- **John Newton**, Group Sustainability Manager Australasia, **Amcor**
- **Prof. Tony Priestley**, Deputy CEO, CRC for Water Quality & Treatment, **CSIRO**
- **David Pryor**, National Engineering Manager, **P&N Beverages**
- **Stephen Hale**, Director, **Impact Employee Communications / EcoImpact Sustainability Communications**
- **Joe Croke**, Environment Manager, **Cadbury Schweppes**
- **Greg Johnson**, National Sustainability Manager, **Stockland**
- **Guetner Hauber-Davidson**, Managing Director, **Water Conservation Group Pty Ltd**

The 2-day event features;

- Best practice case studies from some of Australia's leading industrial water users – Find out what they did, what it cost and what it achieved
- Lineup of nationally and internationally renowned speakers
- The latest solutions for water supply, security, monitoring, reuse, recycling and much more
- Exhibition featuring the newest technologies in industrial water management
- Ample opportunity to network, discuss problems and solutions with your peers, potential clients and suppliers.

http://www.resourcefulevents.com/page/excellence-in-industrial-water

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http://www.hydsoc.org

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MEDIA WATCH

SPC Ardmona is using an advanced hydro-optic disinfection water treatment

When the chlorine dioxide dosing plant at SPC Ardmona's Shepparton plant was at the end of its accurate working life, the company took the chance to look at other ways to treat both the wash down water for its food processing equipment and the water used to convey up to 1,000 tonnes of produce a day.
http://www.wme.com.au/categories/water/july8_08.php

Murray-Darling outrage on Paroo water diversion

The Federal Government is being urged to intervene to find out what is happening to the Murray-Darling Basin's last free-flowing river. The Queensland Government is facing accusations that it has allowed a large dam and diversion channels along the Paroo River.
http://www.abc.net.au/news/stories/2008/08/15/2336253.htm

SA irrigators to get 6pc of their water

Water allocations for Murray irrigators in South Australia will increase from 2 per cent to 6 per cent from September.
http://www.abc.net.au/news/stories/2008/08/15/2336064.htm

Glenelg to Adelaide Parklands Recycled Water Project

Final report of the Public Works Committee available online at:
http://www.parliament.sa.gov.au/NR/rdonlyres/953CF473-BA84-431D-B941-7916E8362CA9/11506/ReportGlenelgtoAdelaideRecycledWater.pdf

Alcoa funds a professor of sustainable water

A new sustainable water management chair at Murdoch University will lead research into ways to improvement management of Western Australia's water resources, including issues such as the impacts of changing rainfall patterns, water capture, water reuse and recycling. The chair, with an initial $600,000 funding from Alcoa, starts in January.

Use of wave power

Michael Ottaviano from Carnegie Corp gave a presentation on the use of wave power to desalinate water and produce electricity at competitive prices using Australian technology, at the Green Water Forum hosted by the Water Industry Alliance.
http://blog.litfuse.com.au/2008/08/26/michael-ottaviano-green-water-forum/

Energy production threatened by limited water

Water management experts say there is growing concern that Australia's shrinking water resources will affect energy production.
http://www.abc.net.au/news/stories/2008/09/02/2353273.htm?section=justin

Recent rain buys time for lower lakes

Flooding with seawater and releasing water from Menindee Lakes are among eight options in a submission to a federal inquiry on water management for the Coorong and lower lakes.
http://www.abc.net.au/news/stories/2008/09/02/2353553.htm

Gippsland Water rates to jump

Gippsland Water is defending a 23 per cent increase in water and sewerage rates this year. Water rates in Gippsland will go up about 70 per cent over the next five years and will be the dearest in Victoria.
http://www.abc.net.au/news/stories/2008/09/01/2351869.htm

Wong acknowledges water challenge

The federal Minister for Climate Change and Water, Penny Wong, says the Commonwealth does understand the impact on irrigation communities of its water buyback plans. the real story, and the real story is we do have to put water back into the river for the long-term.
http://www.abc.net.au/news/stories/2008/09/01/2352017.htm

Mapping the waters of the Murray-Darling Basin

The first ever audit of surface and groundwater resources in the Murray-Darling Basin now being undertaken by the CSIRO is testament to the vital role science plays in addressing our nation's toughest challenges. http://www.csiro.au/news/newsletters/water/0807_water/story06.htm

Understanding surface water – ground water interactions to help manage wetlands

Water for a Healthy Country Flagship scientists are working to provide the knowledge and tools to support the management, protection and restoration of important water ecosystems.
http://www.csiro.au/news/newsletters/water/0807_water/story08.htm