



International Association of Hydrogeologists

AUSTRALIAN NATIONAL CHAPTER

NEWSLETTER

Vol. 11 No. 1 MAY 1994

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FROM THE PRESIDENT

Recently I attended an International Symposium in USA on Deep Well Injection of Hazardous and Industrial Wastes. It was a most stimulating time as researchers, industry practitioners and regulators shared their experiences and visions for the future. This event provided an ideal forum for not only sharing practical problems but also was opportunity for increasing trust between the various groups who traditionally can have adversarial relations.

It is of interest to know that the USEPA is trying not to be overly prescriptive in its control demands for this well established method of disposal.

There was also a substantial group of scientists and engineers from Russia who were able at last to release detailed data in an uncensored form.

Australia has much to learn and gain from this technology in the areas of modelling, monitoring, well design, geochemical reaction processes and hydraulic behaviour. Australia has only one hazardous liquid waste injection well (Class I of USEPA Classification) located at Kwinana near Perth. However there are 220 deep wells (Class II) injecting brine back into the Barrow Island oil well field. In addition there are gas and water flooding injection wells to stimulate secondary oil recovery in the Cooper and near by Tirrawarra Basins on the Queensland - South Australia border.

In the past there has been some resistance by Australian regulatory agencies and waste managers to consider seriously this strategy. Their decisions have been generally based on a fairly thin understanding of the technology involved and the depth of expertise/experience in numerous countries overseas. The USA has been injecting brine into oilfields since 1930 and they currently have 170,000 successful wells operating. The large chemical company Dupont began its first injection well in USA in 1949 and this well is still functioning. Similar confidence in the technology is expressed in Canada and Russia especially.

The USEPA currently believes that deep well injection of wastes has a considerably lower risk and is more environmentally friendly and cost effective than some surface disposal and treatment systems.

This Symposium also demonstrated the considerable value of international exchange and people to people contact which can most helpful in building relationships and may cause quantum like jumps to occur in our Science.

With this in mind I encourage each of us to make every effort to attend Water Down Under in Adelaide 21-24 November 1994. There will be over 400 papers to select from the groundwater and surface water themes! I would especially urge those of you who are in contact with students to explain the heavily subsidised registration fees and also that some relatively cheap accommodation is available in caravan parks in the suburbs of Adelaide. For details, full-time students only, may contact one of the Conference organisers Genny Blanchard on (08) 388 6164.

On another matter, over the past few months the National Executive has been dealing with the issue of certification of professionals. This matter is being vigorously debated and discussed in a number of professional organisation currently (eg Soil Science Society of Australia and others). The Institute of Engineers Australia has been moving actively in this direction for some time.

I have also been also representing IAH on a National Working Group that is aiming to develop an internationally recognised Scheme for Environmental Auditor Certification. Contaminated land/groundwater are a sub set of this scheme. We are also discussing the issues involved in Certification of groundwater professionals with our International Headquarters. In our next Newsletter we will report fully on both certification issues; groundwater specialists and environmental auditors.

SELECTION OF THE NEXT NATIONAL EXECUTIVE

A presentation of the process by which the national executive will be determined for 1994-1998.

The National Executive has been a responsibility that has in the past been "handed on" at the discretion of the incumbent executive. There has been a defacto rotation scheme in place, where the responsibility has been shared around. If we analyse the history of the rotation, and compare it with site of the international congress, then it is apparent that no state has held the national executive and hosted the congress in the same period of time. This is fully understandable, as the workload of one tends to exhaust the willingness to undertake the other, and at least a 4 year "breather" is necessary.

We have therefore determined that a ballot process is in order to assist in the determining of the next national executive. All states have the opportunity to apply, and there should be a process whereby the membership will have a major say in the selection.

This article is to announce that the election process has begun, and that all state executives who are interested in putting forward a team, are invited to do so. The process is as follows:

- All states who wish to put forward a team, must do so before the deadline of the next newsletter (22nd August 1994). Each state may put up only one team, and that team must be endorsed by the state executive. By inference, each state putting forward a team must have a viable state executive. The team members proposed for the national executive may be members of both executives.
- A national executive team must have the following members:

President
Vice President
Treasurer
Secretary
Editor

The roles of Treasurer and Secretary may be combined, but be warned that the workload is substantial (and getting worse). An optional state liaison member may be necessary for states where the national and state executives are combined (as is presently the case in NSW)

- A one page "ticket" should be prepared for inclusion in the next newsletter, explaining your case for why the membership of IAH would be best served by your state having the national executive. Pen Pictures of proposed key members should be included. This is to reach Robert Carr by the copy deadline.

- A ballot paper will be included in the newsletter, along with the "tickets". All financial members will be entitled to vote. The polls will close 2 weeks before the international congress
- The results of the voting will be combined with the present executive's best judgement to provide an outcome which will be of greatest benefit to the membership. We are aware that the larger states membership votes may swamp the parochial voting of states with smaller memberships, but there is the other side of the coin that enthusiasm for the task should not be a disbenefit.

The final decision will be 'leaked' before the congress, and the new executive announced at the congress.

We encourage smaller states to strongly consider the benefits of putting up a ticket, as it can help galvanise the group and provide a real focus for the future. The larger states have the resources to do an excellent job, and is also a point of focus for the membership.

We look forward to a healthy election!

Robert Carr
National Secretary

NATIONAL COMMITTEE NEWS

TREASURER'S ANNUAL REPORT

The groundwater industry around Australia continues to thrive with 1993 another growth year for the Australian Chapter of IAH.

Financially, IAH Australia was in a good position with over \$17000 in the bank as at the 31st of December 1993 and has a net asset worth of about \$5000. This balance covers most member's 1993 subscriptions and some arrears for previous years (about \$13000), however at the time of writing this newsletter some 36 subscriptions are still outstanding. Please check your records, see the list below, or contact the Treasurer if you are unsure as to whether your 1993 subs have been paid or not. Thankyou to everyone else for paying their 1993 subs so promptly. The balance also included a few outstanding liabilities totalling about \$1500. Members will also note that we made a small loss of \$1112 for 1993 however this can be explained by higher publication costs and distribution of \$980 in funds to State Branches.

In March this year an amount of \$9090 (11187DM - exchange rate DM 1.23) representing 226 subscriptions was remitted to the United Kingdom to cover the 1993 memberships and the arrears collected during 1993. As part of the new financial arrangements with the International body, 10% of all the subscriptions collected can be retained by each National body. This amounted to 1243DM for IAH Australia. Moneys for 1993 have been distributed on a proportional basis to each active State Branch for state activities. Amounts for other states are held in trust.

Currently the Australian Chapter has 282 members made up as follows:

- * 246 fully paid up members for 1993 and 1994
- * 36 members in arrears for 1 year (last paid 1992)

New Members

The number of new members continues to increase. Thanks to all those actively signing up new members and promoting IAH. The following new full members and student members are welcomed :

Mr S Nield (WA)	Mr M Talbot (Qld)
Miss S Cody (WA)	Mr R Virtue (Qld) - student
Mr S Dektyarev (Qld)	Mr G McMahon (Qld) - student
Mr M McGann (O/S)	Mr M Hayter (NSW)
Mr D McCarthy (SA)	Mr M Andrews (SA)
Miss J Anderson (NSW)	Mr M Robertson (Qld)
Mr J Anning (NT)	Mr G Humphyreys (NT)
Mr D Skidmore (WA)	Mr G Campbell (WA)
Mr C Perly (NSW) - student	Miss D Thomas (Vic)
Mr C Daniels (Vic)	

(NOTE. Those who joined after 1 July 1993 are financial members for 1994 as this is the first year they will receive publications from overseas).

Membership now totals 282 (current financial members plus those in arrears for 1992). Distribution on a State by State basis is WA(76), VIC(59), NSW(57), QLD(40), NT(15), SA(14), ACT(7),

TAS(0) and OVERSEAS(14). There are currently 334 people on the National Committee's Newsletter circulation list.

Financial Statement

The Australian Chapter's Statement of Income and Expenditure for 1993 is shown below :

STATEMENT OF INCOME AND EXPENDITURE FOR YEAR ENDED 31.12.93
(SUBSCRIPTION YEAR 1993)

	DOLLARS (\$)
INCOME	
Membership Subscriptions	
1990 (in arrears) - 1	55.00
1991 (in arrears) - 1	60.00
1992 (in arrears) - 31	1855.00
1993 (at \$55) - 3	165.04
1993 (at \$60) - 177	10620.00
1994 (in advance at \$60) - 22	1320.00
1994 (in advance at \$75) - 1	75.00
Advertising	100.00
UN Software Distribution	591.00
Bank Interest	
Cheque Account	65.60
Savings Investment Account	326.45
	-
TOTAL INCOME	15233.09
LESS EXPENDITURE	
Remittance of Subscriptions to UK	10199.31
AWWA Journal	167.00
AGSO Journal (Aquifers at Risk)	2500.00
IAH Newsletter Production	975.30
Postage	706.35
Envelopes, Paper and Sundries	24.35
UN Software Distribution	576.64
IAH Fees returned to State Branches	980.00
IAH Fees retained in trust - SA	50.00
- NT	60.00
- ACT	20.00
Rejected new members cheque	62.00
Government Charges	24.58
	-
TOTAL EXPENSES	16345.53
NET SURPLUS (LOSS) FOR THE YEAR	(1112.44)
Add BALANCE FROM LAST YEAR	18777.23
ACCUMULATED FUNDS ON HAND (as at 31.12.93)	17664.79

ACCUMULATED FUNDS ARE

Represented by -

ASSETS

Cash at Bank - Savings Investment Account	15489.20
(less IAH moneys in trust for SA, NT, ACT)	-130.00
Cheque Account	2286.84
Cash on Hand	18.75

TOTAL ASSETS 17664.79

LESS LIABILITIES

Subscriptions to the UK (at 1:1.23 exchange rate)	10833.33
IAH Australia Publication Prize	250.00
'Aquifers at Risk' journal postage and packaging	1305.57

TOTAL LIABILITIES 12388.90

NET ASSETS 5275.89


Honorary Treasurer

10 May '94
Date

1994 Subscriptions

The 1994 subscriptions are now due. An individual 1994 subscription form is enclosed with this Newsletter. If there is no application form with this Newsletter you are either a new member who has paid for 1994 or an existing member who has paid in advance.

The Executive has decided to bring the call for subscriptions early by about 4 months to get it into the 1993/94 financial year for taxation purposes and to avoid a large workload for the incoming Executive later in 1994.

As explained in the December 1993 Newsletter, the fees for 1994 have increased to \$75 for individual members due to increases advised by the International body. The National body's expenses are not expected to increase substantially during the coming year, even though the exchange rates continue to fluctuate substantially.

Unique IAH Membership Number

Each IAH member now has a unique membership number allocated by the International body. Your number is shown on the enclosed invoice. Please quote this number in any correspondence to avoid any confusion amongst members with similar names.

Members in Arrears

The following members are in arrears for 1993. The treasurer would appreciate if the fees (\$60) could be forwarded as soon as possible.

In arrears for 1993 -

Armstrong, Basocak, Best, Blake, Boyd, Boyes, Brinkley, Bulman, Calvert, Cock, Corpuz, Dale, Davidson, Doyle, Evans (PA), Gates, George, Hall, Harman, Hirschberg, Joyce, Lewis, Lucas, Mackie, Martin (MW), McAvan, Milne-Holme, Panasiewicz, Potts, Rayner, Salas, Scott, Strudwick, Tyson, Willgoose, Zaar.

IAH membership rules state that memberships in arrears for two years will lapse. Hence the following members who have not paid since 1991 are deemed to have resigned -

Hearne, Maltby, Phillips, Rivera, Bolger, Briese, Hair, Kevin, Martin (KD), Page, Rowston, Shoebridge, Ventriss, Young.

Address Changes

Members are reminded to send any changes of address to me at the following address :

JB ROSS
IAH Treasurer Fax (02) 5022105
c/- Groundwater Technology (Aust) P/L,
17 Forrester St,
KINGSGROVE, NSW. 2208

IAH - Australian Capital Territory

Australian Geological Survey Organisation

In August 1992 the Federal Minister for Primary Industries and Energy, Mr S. Crean and the Minister for Resources, Mr A. Griffiths, announced a number of changes to the operational and administrative arrangements for the Bureau of Mineral Resources, Geology and Geophysics (BMR), including a change of name to the **Australian Geological Survey Organisation (AGSO)**, and an external review.

The Review of AGSO, chaired by Dr S.M. Richards, (Managing Director of Aberfoyle Ltd, Member of the Australian Mining Industry Council and a Board Member of CSIRO), was to examine the composition, structure and administrative, and funding arrangements, and reporting and accountability to Government. This Review followed closely on the extensive 1988 Woods Review, which led to the re-structuring and re-arrangement of BMR's organisational structure, its direction and program. The Report on the Review of AGSO, and its Recommendations were released by the Federal Government in May 1993.

The Federal Government responded to the Recommendations of the Richards Review of AGSO during the 1993-94 Budget in August 1993, and the Government decisions have been implemented during 1993-94 by the new Director of AGSO, who was appointed in July 1993.

The Government decided that: - AGSO is to build a vigorous, client-driven national geoscientific mapping effort to encourage economically and environmentally sustainable management of Australia's minerals, energy, soil and water resources.

The Government also decided that AGSO will remain the Government's chief adviser on geoscientific issues and the premier geoscientific mapping agency; AGSO will continue to be part of the Commonwealth Department of Primary Industries and Energy; AGSO will give attention to coordinating Commonwealth, State and private geoscientific mapping, improve effectiveness, efficiency and accountability to clients, external funding and commercial opportunities, and respond to the needs and priorities of both industry and public sector clients, and complement traditional values of scientific excellence with higher levels of entrepreneurship, flexibility and outward orientation. AGSO will establish and maintain a Strategic Plan, an Annual Operating Plan, and a priority setting process, and maintain its professionalism and scientific reputation.

AGSO will raise, as a minimum external funding target, 30 percent of its 1994-95 budget appropriation, to be achieved in 1995-96. AGSO will acquire a new building, and some additional funding, particularly for the Rig Seismic (offshore capacity), and the National Geoscience Mapping Accord, and the development of a new mapping accord for land and environmental geoscience (the National Environmental Geoscience Mapping Accord), National Geoscience Information System and to solve data storage problems of industry data.

Hydrogeology in the Australian Geological Survey Organisation

Hydrogeological activities in the Australian Geological Survey Organisation are carried out in the Environmental Geoscience and Groundwater Program, with Mr C.J. Simpson as Chief. The need to maximise national and regional benefits of groundwater research and investigations, and to provide a source of high level scientific and technical groundwater advice to government has led to mutual agreement by AGSO, CSIRO and State Water Agencies responsible for groundwater activities, to meet and develop such an accord through a National Groundwater Scientific Consultative Group, which will meet at least once a year.

The AGSO Groundwater Projects and Project Leaders are:

- | | |
|---|-------------------|
| - Murray-Darling Basin Hydrogeology | Mr W.R. Evans |
| - Australian Groundwater Quality Assessment | Dr J. Bauld |
| - Great Artesian Basin Hydrogeology | Dr M.A. Habermehl |

Activities during 1993-94 include:

Murray-Darling Basin - The Murray Basin 1 : 250 000 Hydrogeological Map Series will be completed by mid-1994, when 27 maps will have been published in a period of 6 years by the joint work of NSW Department of Water Resources, Vict. Rural Water Corporation, SA Department of Mines and Energy, and AGSO.

The Murray Basin groundwater modelling of the Lachlan Fan and the Ivanhoe Block are being completed, and the isotope hydrology study, mainly ^{36}Cl , continues. The Murray Basin groundwater discharge zone study provided an understanding of controls on the distribution of concentrated brines under groundwater discharge zones (Nulla Spring Lake) and below saline waste water disposal basins. A deep drainage study was carried out near Deniliquin to assess the regional groundwater leakage between the Shepparton Formation and the Pliocene Sands aquifer.

Compilation of the Darling River Catchment Hydrogeological Map continued, and is carried out jointly by NSW-DWR, QDPI-WR and AGSO.

Australian Groundwater Quality Assessment - The project aims to assess contamination of groundwaters underlying key areas of irrigated agriculture, and other priority catchments, by agrichemicals (including insecticides, herbicides, fungicides and fertilisers) and microbes of public health significance.

Agreements have been reached with several State agencies on priority catchment areas for AGSO groundwater quality assessment investigations during 1993-96. Field sampling programs, incorporating agreed catchments have thus far been undertaken in the Goulburn-Broken catchment, the Burdekin Delta, the Mt Lofty Ranges catchment and the Logan-Albert catchment. Earlier sampling was carried out in the Shepparton East, Padthaway and Deniliquin areas. Reports and papers are in preparation.

Great Artesian Basin - The AGSO ORACLE GAB hydrogeological database of waterbore data from QDPI-WR, NSW DWR, SADME and NTPWA, and AGSO datasets, and the ARC/INFO GIS have been completed. The GIS pre- and post-processor for the GAB groundwater model is being completed, and the model geometry and input data are being prepared. Digitising

of wire-line logs from waterbores in the GAB is complete, and a digital package of wire-line logs and well data is being prepared. The GAB model and the logs support the GAB Bore Rehabilitation Program, carried out by the State Water Authorities.

The Review of the GAB Monitoring Network continued, and work was carried out on the regional hydrochemistry, and isotope hydrology studies, including radio-active (^3H , ^{14}C and ^{36}Cl) and stable environmental isotopes to determine the groundwater origin and residence times, and flow-rates in the GAB, and on recharge (jointly with QDPI-WR) and discharge projects. Sampling and thermoluminescence analyses of spring deposits were undertaken to improve earlier dating of the spring deposits by carbon-14 and U/Th techniques. Monitoring of springs in the SW part of the GAB continued.

A hydrochemistry and isotope hydrology study was carried out for NSW DWR in the Macquarie Marshes area to delineate the leakage from artesian aquifers.

The Cape York Peninsula Groundwater Investigation to assess the nature, extent and availability of groundwater resources is carried out jointly with QDPI-WR, and field sampling for hydrochemistry and isotope hydrology, and remote sensing analyses, bore census, drilling of test and observation holes, and data compilation, analyses and interpretation was undertaken.

A new AGSO groundwater project - Groundwater in Aboriginal Lands by Mr G. Jacobson is starting. Hydrogeological assessment work on four islands in the Torres Strait has been carried out.

Monitoring of the lake levels of Lake George and Lake Bathurst between Goulburn and Canberra continued, as part of the Environmental Geoscience Climate Change project. Hydrographic data on Lake George has been collected since about 1820, and monitoring has been carried out by BMR/AGSO since the early 1950s.

A hydrogeological study of the Lake Bathurst Drainage Basin has been completed.

SOUTH AUSTRALIAN NEWS

The change in Government brought about by the State election late last year, has resulted in some big changes in the water industry. The function of water resources management and responsibility for the Water Resources Act have transferred from the Engineering and Water Supply Department (EWS) to the Department of Environment and Natural Resources (DENR). Consequently, the former Water Resources Branch of EWS is now called the Water Resources Group in DENR under Bryan Harris. The proposed merger of EWS and the Electricity Trust (ETS&A) to form WETS&A, or alternatively, the Department of Zap, Taps and Crap, has been canned.

On the front line, EWS/DENR have brought the Waikerie Groundwater Interception Scheme into operation with 14 wells pumping (in addition to the Woolpunda GIS) to the Stockyard Plain disposal Basin, 15 km to the southwest. The Waikerie GIS will intercept just over 100 tonnes/day of salt which was previously being forced into the River Murray by the large water table mound beneath the irrigation area. Looking to the future, a report has been prepared for the River Murray Water Resources Committee on sustainable irrigation and likely impacts on river salinity. A management plan for the Blue Lake, Mt Gambler's unique water supply, has been released for public comment. On Eyre Peninsula in the west of SA, the use of freon to estimate recharge rates to the highly permeable aeolianite aquifers is being investigated with CSIRO.

SADME is currently involved in 5 projects concerned with stormwater recharge on the Adelaide Plains. Stormwater is collected, treated in wetlands and will be injected in wells drilled down through the thick Quaternary clays to the permeable Tertiary limestone. In summer, the water will be pumped up and re-used for irrigation of parklands etc. Artificial and high natural recharge have had a dramatic effect on water levels in the Angas - Bremer Irrigation Area, 60 km southeast of Adelaide in the Murray Basin. A combination of a very wet '92, artificial recharge (using 25 wells) from intermittent creek flows and reduced demand from 13 000 down to 5000 ML, together have led to a recovery of potentiometric levels in the confined Tertiary limestone aquifer from - 4 m to 4.5 m AHD. In the far west of SA, SADME has drilled water supply wells for a joint seismic project with AGSO across the Great Victoria Desert which overlies the prospective but underexplored Officer Basin. Salinities obtained varied from potable to over 100 000 mg/L. At the completion of the program, the wells will handed over to the local Aboriginal communities. The rehabilitation of uncontrolled flowing wells in the GAB continues with 8 wells controlled and 4 new wells drilled in 1993 making a total of 150 controlled since 1977. Only 13 remain to be rehabilitated. The usual method is to install non-corrosive casing which is cemented into place with headworks attached to enable connection with pipelines for distribution.

The Department of Primary Industries have completed the hydrogeological investigations into dryland salinity in five affected catchments. Management options have been recommended for each catchment. Further modelling and recharge mapping projects will be used to encourage the adoption salinity management plans by incorporating them in the property planning process.

CSIRO Division of Water Resources are involved in a number of studies including:- eucalypt dieback on the Chowilla floodplain which involves studying the dynamics of soil water and groundwater levels in response to flooding and river regulation; dryland salinity in the Murray Basin which incorporates commodity prices into a management plan; a joint project to study the potential for salinisation of the limestone aquifer beneath the Mallee Region due to slow downward migration of salt which was previously concentrated in the root zone of the Mallee vegetation before it was cleared; and a study into the movement of salt brines under salt lakes and evaporation basins involving the modelling of density - dependent flow.

Water Search has had a variety of jobs ranging from investigations for groundwater supplies for new mines near The Granites in NT, landfill monitoring, assisting SADME with the preparation of the

NARACOORTE hydrogeological map and testing a groundwater supply for a paper pulp mill (using straw as feedstock) at Balaklava, 90 km north of Adelaide.

AGC-Woodward Clyde is continuing their involvement in contamination assessment and groundwater monitoring at landfill sites in the Adelaide area and the South East. Monitoring and assessment of the Olympic Dam bore field in the GAB is continuing after 10 years of operation and further work will be carried out on an expansion of the water supply. The tailings retention system is also being monitored.

Groundwater Technology has been operating in Adelaide for almost two years and has been involved in several key projects, including:- design and implementation of remediation systems for hydrocarbon contamination of soil and groundwater, design of a permanent bioremediation and contaminated soil processing plant, salinisation study of water storage ponds and also a study of the acid mine drainage at Brukunga. The Adelaide office will soon be relocating to new and larger premises at Kilburn, Adelaide. For further information, contact Craig Barker.

People

Don McCarthy, an M.Sc graduate of the UNSW Hydrology course in 1991 and until recently, heavily involved in dryland salinity research with the then SA Department of Agriculture, has now joined Rust-PPK Consultants in Adelaide. Work includes remediation options at contaminated sites, landfill monitoring and environmental audits. He is still involved in dryland salinity work for Landcare groups.

Steve Barnett has returned to SADME after working in Chile for 6 months in 1993 with Water Management Consultants. He was supervising a drilling program at an altitude of 14 000 ft in the Andes of northern Chile to find a water supply for a copper mine. A supply of 600 l/sec was required for 60 years. It was found.

Don Armstrong has left SADME after many years of sterling service, formed Lisdon Associates and has been consulting to the Centre for Groundwater Studies on artificial recharge and sewerage effluent disposal. Don hopes to further his interest in the mine dewatering field.

Peter Smith has taken a separation package and finally left SADME after serving twenty years hard labour. He is spending most of 1994 in Chile with Water Management Consultants doing similar work in the high Andes as Steve Barnett.

Glen Walker recently found himself in hospital after returning from a recharge conference in Hyderabad, India - nothing gastric but instead, a blood clot in the lung! Good health has now been restored, probably as a result of increased alcohol consumption thinning the blood to normal viscosity levels.

WESTERN AUSTRALIAN BRANCH MEETINGS

7 February 1994

**Ken Davis: Envirocorp Services and Technology, Houston
Deep well practices in the United States**

**Richard Martin: Mackie Martin-PPK
Deep well injection of industrial wastes in the Perth Basin**

21 March 1994

**Chris Barber: CSIRO Division of Water Resources
Gwelup Wellfield contamination**

2 May 1994

**Kevin Morgan: K H Morgan & Associates
Dewatering of open pit mines in the Yilgarn Craton**

The Annual General Meeting is to be held on 27th June. Phil Wharton of Rockwater is to speak on applications of Modflow in mine dewatering, borefield assessment, and infiltration from dams.

AUSTRALIAN GEOSCIENCE COUNCIL

IAH is an Associate Member of the Australian Geoscience Council. AGC membership comprises representatives of nine major Australian geoscientific societies, and a further 19 earth science organisations have associate membership or observer status. The council has recently moved to Perth under the Presidency of Lee Ranford, Acting Director General of Mines, Western Australia.

General meetings are held twice yearly and among the items discussed at the February meeting were:

- AGC representation on the board of FASTS (Federation of Australian Scientific and Technological Societies)
- Commonwealth Government proposals concerning amalgamation of ANSTO and CSIRO
- The AusIMM survey of 26 tertiary institutions
- The Richards' Review of AGSO
- Registration of Geoscientists

For further information contact Philip Commander (222 3198)

NEW SOUTH WALES

IAH Meetings

The NSW Group of IAH holds professional meetings at two-monthly intervals, held at the University of Technology, Sydney in Room 1716 (Tower Building). Meetings are from 5.30 to 7.00 pm.

The program for this year started with a presentation from Kim McCallum on 22nd March on 'Remediation of Contaminated Land at Homebush Bay'. This is the site of the 2000 Olympics and a considerable amount of groundwater work has been carried out at the site to date. About 40 people turned up to listen to a very interesting talk.

Remaining meetings and speakers are:

19 May	Phil Mulvey (Iron in Groundwater)
21 July	Chris Kidd (Stage ICI Botany)
22 Sept	to be advised
Nov	Andrew Skinner*

- * Dr Andrew Skinner is the international Secretary of IAH. He will be in Australia in November for the 'Groundwater Down Under' Congress and has agreed to address the NSW Group meeting at a date to be determined in November.

Government

Mr Mike Williams takes over the position of Principal Hydrogeologist within the Department of Water Resources (DWR). Mike has had a long career with DWR including stints in Egypt, China and the UK.

The DWR continues to attract delegations from around the world to review management policies on groundwater and surface water. This year we have received groups from Malaysia, Iran and Sweden. Training of Libyan hydrogeologists from the Great Man Made River project is continuing. The second group are well underway with university course work at UTS.

Career Moves

John Ross has left DWR after 23 years service to join Groundwater Technology as NSW Manager.

Ross McFarland has moved from Manager Contaminated sites with EPA to the position of Group Manager Site Assessment and Remediation with CH2M HILL.

Don Scott is leaving sunny Australia in June 94 for an extended holiday in Europe and the UK. He is leaving RUST-MACKIE AND ASSOCIATES and will look at opportunities abroad.

Consultants

Woodward-Clyde will be conducting a series of seminars in their Sydney Offices during May and June 1994 on topics of interest in environmental hydrogeology. The speakers at the seminars include in-house experts and world leaders from their international offices. Interested persons should call Victoria Pearce on (02) 436 4666.

Environmental Management 12th May 1994

**An Overview of Ecological Risk
Assessment and its Applications** 17th May 1994

Landfill Management 1st June 1994

The seminars are held in the evening (5.00 - 8.00 pm) so that people can come after work.

INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS

VICTORIAN CONTRIBUTION

MAY REPORT

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1. VICTORIAN BRANCH ACTIVITIES

Meetings - 1993

December 7 Depressurisation of the Latrobe Valley Coal Mines - Chris Daniels

1994

February 9 Mine Rehabilitation - Tony Pilkington and Doug Seymour

March 16 Groundwater Protection and Environmental Risk - Greg Hoxley, Ian Harris, Tony Lane, Leon Collett, Jene Waldock

April 12 Groundwater Resources of the Wandin Yallock Area - Karen Bamewell

2. 1994 COMMITTEE (ELECTED 12/4/94)

President	:	John Brumley
Vice President	:	Charles Lawrence
Hon Secretary	:	Greg Hoxley
State Liaison Member	:	Rick Evans
Treasurer	:	David Ife
Committee Members	:	Anthony Lane, Jeugen Schaeffer, Andrew Harrison, John Nolan
Flow Lines Sub-committee	:	Randall Nott, Alex Dimos

3. NATIONAL ACCREDITATION OF HYDROGEOLOGISTS

Discussion on this matter will be held at Water Down Under.

4. CLAUS GLOE AWARD

Nominations are being sought from Tertiary institutions for the highest quality thesis for 1993/94.

5. JOINT MEETINGS

The Committee has been very active in promoting joint meetings with other professional groups with the particular aim of broadening the knowledge of groundwater.

Joint meetings have been held with AWWA, IEAust - Geomechanics Group and IEAust - Environmental Branch.

6. WATER INDUSTRY RESTRUCTURING

The perpetual restructuring continues with no clear agreement yet concerning how groundwater will be managed in the future.

7. VICTORIA'S GROUNDWATER MANAGEMENT STRATEGY LAUNCHED

Geoff Coleman, the Minister for Natural Resources, launched Victoria's Statewide Groundwater Management Strategy on 9th December 1993.

In launching the strategy, Mr Coleman said that the document was the result of two years work, including wide ranging community consultation by the user based Statewide Groundwater Advisory Committee, which had worked closely with the Rural Water Corporation; that it was a practical document aiming to identify issues facing groundwater managers and users; that it was based on the fundamental principle that the resource must be managed in a sustainable manner to achieve economic benefits now and provide for future generations; and that its recommendations provided mechanisms for greater direct input by consumers with regard to local issues affecting their lifestyles and livelihoods.

Mr Coleman remarked that the development of the Strategy highlighted the scope local committees have for the management, given support and the goodwill of the community, and that it was important to separate groundwater from surface water management.

The Strategy explores a variety of issues ranging from bore construction, domestic and stock extractions, irrigation and large volume usage, monitoring and protection, stressed areas and urban use. Special consideration has been given to issues surrounding areas where groundwater is under stress. In particular, salinity problems that are driven by groundwater mechanisms. The Strategy also documents for the first time what the Corporation has been doing in the area of groundwater management for many years, and why.

Mr Coleman concluded by saying that the release of the Strategy would lead to a growing understanding of what the management of groundwater was all about and the ways in which its depletion might be prevented and its recharge protected.

Copies of the Strategy are available from the Diversions Section, RWC, 590 Orrong Road, Armadale Victoria, 3143.

8. SOME PROJECTS OF INTEREST

CMPS & F Environmental is involved in groundwater projects, particularly in relation to environmental assessment and auditing. Projects include investigations around the former Dept. of Defence works at Albion and the large RAAF bases at Point Cook and Laverton. Other projects relate to landfills, effluent disposal and hydrocarbon contamination.

AGC Woodward-Clyde has carried out numerous human health risk assessment studies involving contaminated groundwater. One such study involved a site with elevated concentrations of BTEX in a shallow groundwater system. A plume of contaminated groundwater associated with a leaking underground storage tank was assessed to be moving beyond the boundary of the property under investigation towards nearby residential dwellings. The risk assessment involved in the development of a conceptual site model that identified potentially significant exposure pathways to groundwater contamination. The primary route of exposure was subsequently assessed as being the inhalation of vapours by workers involved in subsurface activities beyond the site boundary, and the inhalation of vapours that may enter the indoor airspace of the local residences. Groundwater and vapour emission modelling were used to estimate exposure point concentrations of vapours for each of these receptors. As a consequence of this study, site specific, risk-based remediation criteria were developed. These criteria were significantly in excess of ANZECC water quality guidelines.

'Well someone has to do it !'

Brook Hill is a Senior Environmental Consultant with PPK Consultants in Adelaide. Since February, PPK has been part of the Rust Environment & Infrastructure Group head office in London. He is currently Project Manager for the Defence Department contamination assessment of the former Weapons Research Establishment (now DSTO) at Salisbury, South Australia. Brook was formerly with Environmental Engineering group Kinhill Metcalf & Eddy, based in Queensland, where he penned this story.

This story is not about contaminated sites but an interesting sojourn to a not-so-desolate tropical isle, where we examine an interesting challenge in groundwater chemistry. The story begins with a client request to provide advice on a 'mysterious' set of problems caused by circumstances unknown. Knowing the destination was twenty miles off the sunny north Queensland coast, and would involve field-work on coral sands and under swaying palm trees, Brook said " well, someone has to do it " and packed his equipment, complete with tropical shirt !

The island paradise was typical of many redeveloped at significant expense during the heady eighties and involved demolition of the existing sub-standard resort and filling of low lying swampy areas in the corners of the main resort beach. Early maps of the region coupled with anecdotal evidence from former employees, indicated that, prior to the original development in the 1950s, mangroves occupied channels which traversed parts of the island. These channels are now buried under lush tropical vegetation adjacent to the resort, and are believed to have been progressively filled with dead coral, quarry rubble and demolition material.

Nature of the assignment

In September 1993, Brook was contacted to assist in the identification and resolution of an *odour problem* at the resort which had become more obvious during the past twelve months. There was some confusion regarding the source and nature of the odour, with concerns that it may have been due to leakages in the sewer main, decaying coral or use of sewage effluent for irrigation.

Brook carried out a series of investigations over a two day period using a comprehensive selection of field equipment. Tests carried out included monitoring of air adjacent to the apparent source of the odour using a Draeger air pump and passing air through methane and hydrogen sulphide specific detector tubes. Thus the odour could be positively traced to hydrogen sulphide gas rather than mercaptans or other odorous substances from rotting vegetation or leaf litter.

Monitoring of groundwater using a portable TPS 90-FL field laboratory analyser was carried out at a number of sites. Parameters tested included pH, dissolved oxygen (DO), conductivity and REDOX potential.

Excavations to ground water were made at numerous low lying sites in the vicinity of what may have been early drainage channels, as well as in beachsand at the mid-tide shoreline, and at various intervals inland from the shore towards the resort in the mixing zone for fresh and saline water. Water used for irrigation was also tested. The results of the various preliminary tests carried out are summarised in the table.

Parameters investigated

Sample location	pH	DO (ppm) (26°C)	Conductivity (uS/cm)	REDOX (mV)
shallow borehole, old tip	6.97	0.26	n/a	-38.0
excavation to groundwater	6.93	0.44	1,725	-33.0
Secondary treated effluent at source	6.9	4.0	545	nd
Mixed irrigation water from tank	6.8	5.75	680	nd
Seawater at shoreline	8.3	-	35,000	nd
Beach shore excavation	8.2	3.7	33,000	+ 260
Beach 10m from shore	8.14	5.8	17,200	+ 252
Beach 20m from shore	7.9	-	8,500	-
Beach 30m from shore	7.7	6.75	535	+ 233

Hydrogen Sulphide

Hydrogen sulphide was identified at several locations using Draeger tubes capable of detecting levels of 0.2ppm H₂S in air. The presence of H₂S was registered after passing approximately two litres of ambient air through the pump, indicating airborne levels at this point many times greater than the low odour threshold for this gas.

Methane

No methane could be detected using either Draeger tubes or a photoionisation detector and accordingly was not believed to be implicated in the odour problem. It is important to note that the odour normally associated with household natural gas, is due to added mercaptans with a low odour threshold, and not due to the gas itself, which is odourless. Mercaptans were not measured at the site, but can be expected to be present at low concentrations.

Groundwater parameters

Groundwater in areas of heavy irrigation were neutral to moderately acid with lower than

expected levels of dissolved oxygen ranging from 3.0 to 5.1% saturation. At one location, where groundwater was intercepted at a depth of approx 2.4m at low tide, the low DO of 0.4 mg/l was associated with a redox potential of -33mV and possible leachate from an old landfill. Salinity at this point was in the vicinity of 1725uS/cm. An interview with a former employee indicated that when the dump had operated, they had needed to fence it to prevent cans from floating away during 'king tides'. Although now isolated from the shore by several metres of additional coral and quarried fill, the high conductivity reflects the entry of seawater into this area in the past and limited entry through porous corals at the present.

On the shoreline water was, as expected, highly saline (pH 8.0-8.3). There was a steady if erratic change in pH further from the shore, believed to be due to sea water draining from the upper beach for some time after high tide. Ideally the tests need to be repeated at a very low tide, which would give the less saline upstream groundwater time to move into the saturated zone. Conductivity, a more reliable indicator of water salinity, dropped considerably from 33,000uS/cm at the shore line to 380uS/cm 30m from the shore, indicating natural freshwater seepage at this point of the beach. Erratic conductivity figures elsewhere are related to the presence of both salt and fresh water in pockets of the shore mixing zone and indicate high variability in the salinity at various points on the beach. They do indicate that at high tides, the salinity and pH of groundwater can be expected to be high, approaching that of seawater, within 30m of the high tide mark.

Irrigation water

Water was tested at the sewage treatment plant for a range of parameters including pH and salinity. The water was generally mildly acid (pH 6.5-6.9) with low salinity in the range 250 - 400 mg/L total dissolved solids (TDS). The pH of this water would be expected to reduce further after percolation through the heavily fertilized resort soils, due to accumulation of hydrogen ions and nutrients from horticultural practices. Other historical laboratory tests examined indicated that pH of irrigation water can drop to as low as 6.3 with calcium levels at 5mg/L whilst sodium is considerably higher at 63 mg/L. This was found to have implications for the most suitable means of controlling the pH of irrigation water, since most introduced species of vegetation on the island were both salt and alkali intolerant.

Natural geochemical processes on island

Swamps and low lying areas on these islands typically accumulate decaying vegetation, soil nutrients, runoff and general beach flotsam, creating a favourable, nutrient rich environment for mangroves. The aquatic environment in shallow waters is relatively devoid of oxygen, since much oxygen is consumed by bacteria in the process of decomposing the organic fractions, such as leaf litter. Under such anoxic conditions, any oxygen, including that attached to the natural sulphate (SO_4^{2-}) component of seawater, is consumed in these conditions resulting in the formation of sulphide (S^{2-}), which combines reversibly with any available metals and organic matter to give the characteristic black colour so typical of mangrove muds.

The rotting vegetation also produces a complex series of organic materials, which on exposure to air result in the production of thiols (or mercaptans), a group of chemicals typically associated with strong, disagreeable odours. The familiar odour of natural gas is the result of the addition of thiols to the gas, since the exceptionally low threshold of detection allows consumers to smell a gas leak long before the gas reaches dangerous levels. Hydrogen sulphide also has a very low odour threshold, being detectable as an odour in air at levels of approx 0.002 parts per million, but difficult to discern from other odours at this level.

Whilst these various materials remain submerged in a semi-saline environment, the dominant chemical reactions are reducing, since the available oxygen is in much demand by the various micro-organisms that have adapted to survive in these conditions.

Unstable finely divided metal sulphides exposed to seawater tend to establish an equilibrium with the formation of sulphide ions (S^{2-}). Under salt water, in a mildly alkaline environment, the production of H_2S gas is insignificant with HS^- and S^{2-} being the dominant ion species present.

The equilibria between these ion forms and hydrogen sulphide gas at various pH is shown below.

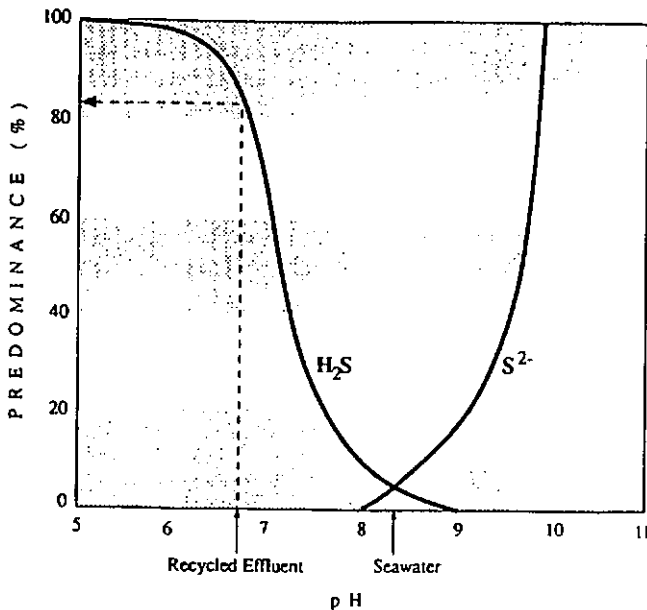


Figure 1
Effect of pH on hydrogen sulfide equilibrium (H_2S 32mg/L)

Source: Sawyer & McCarty, 1978

Changes to this environment, through accumulation of semi-porous sand and in particular, changes in groundwater pH, can result in significant changes to the geochemistry. These changes tend to favour the formation of hydrogen sulphide with its strong disagreeable odour.

As is common on islands not connected to mainland water supplies, secondary treated effluent from the wastewater treatment plant is used for irrigation of resort vegetation. The water when it leaves the wastewater treatment plant has a pH in the range 6.2 to 6.9, however it is spray and drip irrigated onto soils derived from composted leaf litter with added nutrients, which typically has a moderately acid pH in the range of 5.0 to 6.5. The percolation of mildly acid irrigation water through these soils is expected to result in groundwater exposed to mangrove muds in the range of pH 5.5 to 6.0. This represents a very significant increase over the H^+ ion concentration of seawater. Under such conditions, the change to the equilibrium shown in figure 1 results in the production of significant quantities of noxious smelling gas.

Brook recommended that the resort examine a range of issues, concentrating on groundwater pH control, in order to eliminate or curtail the odour problem at this particular site. These recommendations included:

- on predetermined occasions, coinciding with the onset of a series of low tides, to dose a dilute calcium hydroxide solution at pH 8.5 into the aquifer upstream of the main residential wing of the resort;
- to use high pH, but non-saline groundwater from elsewhere on the island for irrigation of ovals and other alkali tolerant species;
- to reduce the use of acidic fertilizers, such as ammonium sulphate, in irrigation of resort vegetation;
- to control the pH of recycled effluent within closer parameters to ensure that it does not fall below neutral.

Implementation of the first recommendation was achieved by installing a variable speed diaphragm pump, paddle mixer and ancillary equipment such as a series of 200 litre steel drums, which in turn enabled further dilution of the calcium hydroxide solution. A backhoe was used to excavate several entry points to the islands shallow aquifer. After a relatively short period of 24 hours the odour associated with hydrogen sulphide from the main section of the resort was largely eliminated. The other measures implemented also seem to be contributing to the overall reduction of odour at the resort.

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IAH PUBLICATION PRIZE

As announced last year, the National Executive has offered an incentive prize for publishing hydrogeological papers. The prize was for the purposes of encouraging our membership, and particularly our younger(!) membership to publish. Submissions for the present prize were received until December 31, 1993.

After consideration of the submissions, the IAH Australian Chapter Publication Prize for 1994 has been awarded to Chris Barnes, whose paper was sent in by the second author, Gerry Jacobsen. The full reference is:-

Barnes, C.J., Jacobsen, G. and Smith, G.D. (1992) "The origin of high-nitrate ground waters in the Australian arid zone", *Journal of Hydrology*, 137 ,pp181-197.

For their efforts the authors receive \$250, and the best wishes of the IAH membership. We look forward to further high quality papers relating to our unique Australian environment.

The prize is available annually for the best paper on hydrogeological matters for work carried out in Australia - we look forward to a strong set of submissions after the Congress!

Robert Carr

REMINDER TO ALL IAH MEMBERS

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