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FOCUS ON ENVIRONMENTAL CONTROL & WASTE MANAGEMENT

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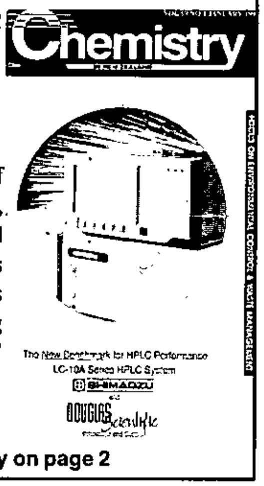
UP FRONT ...

SHIMADZU LC-10A SERIES HPLC CONTINUING TO IMPROVE YOUR CHROMATOGRAPHY CHOICE



The LC-10A system, the flagship of Shimadzu's analytical HPLC programme,. has now been available in New Zealand for a little over 3 years. The system has proven popular with chromatographers who have found its outstanding performance and flexible "modular" design very attractive.

For further details see the cover story on page 2

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COMING UP ...

March 1995 - Focus on Food and Beverage Manufacturing

May 1995 - Focus on the Petroleum and Oil Industry

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5th of the month of publication

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Cover Story

SHIMADZU LC-10A SERIES HPLC CONTINUING TO IMPROVE YOUR CHROMATOGRAPHY CHOICE

The LC-10A system, the flagship of Shimadzu's analytical HPLC programme, has now been available in New Zealand for a little over 3 years. The system has proven popular with chromatographers who have found its outstanding performance and flexible "modular" design very attractive.

The most popular modules remain the LC-10AD "pulseless" solvent delivery pump, which is especially useful with pulse sensitive detectors and for low flow and microbore gradient applications, and the SPD-10A UV detector with its exceptionally high sensitivity and stability.

The original choice of 25 modules has expanded to increase the systems ability to cater for every requirement of the chromatographer. Shimadzu continues to improve the choice of modules available this year with the release of new Windows based PC-Control software for the system (including GLP) and a new Bioinert series of modules for biotechnology applications.

The LC-10A system continues to form the centrepiece of Douglas Scientific's HPLC offer to chromatographers. Complementary to the Shimadzu systems are our range of other HPLC products which help us to support our customers in their ongoing requirements, regardless of the brand of system you use: Specialised detectors (Radioisotope, Electrochemical, Evaporative Light Scattering); Accessory units (Solvent Recyclers): FingerTight fittings; tubing; valves; plus a wide range of columns for standard and specialised separations. The highly skilled personnel at Douglas Scientific ensure your continued support in both product service and advice on applications. Customer training is also important to Douglas Scientific and we continue to support and be involved in chromatography training courses. A comprehensive product offering, a wealth of expertise and applications information, excellent connections with local and overseas authorities in separation science and a genuine interest in solving your separations requirements as well as suggesting appropriate solutions for your applications needs, make Douglas Scientific the people you should call for all your chromatography needs.

For more information contact:
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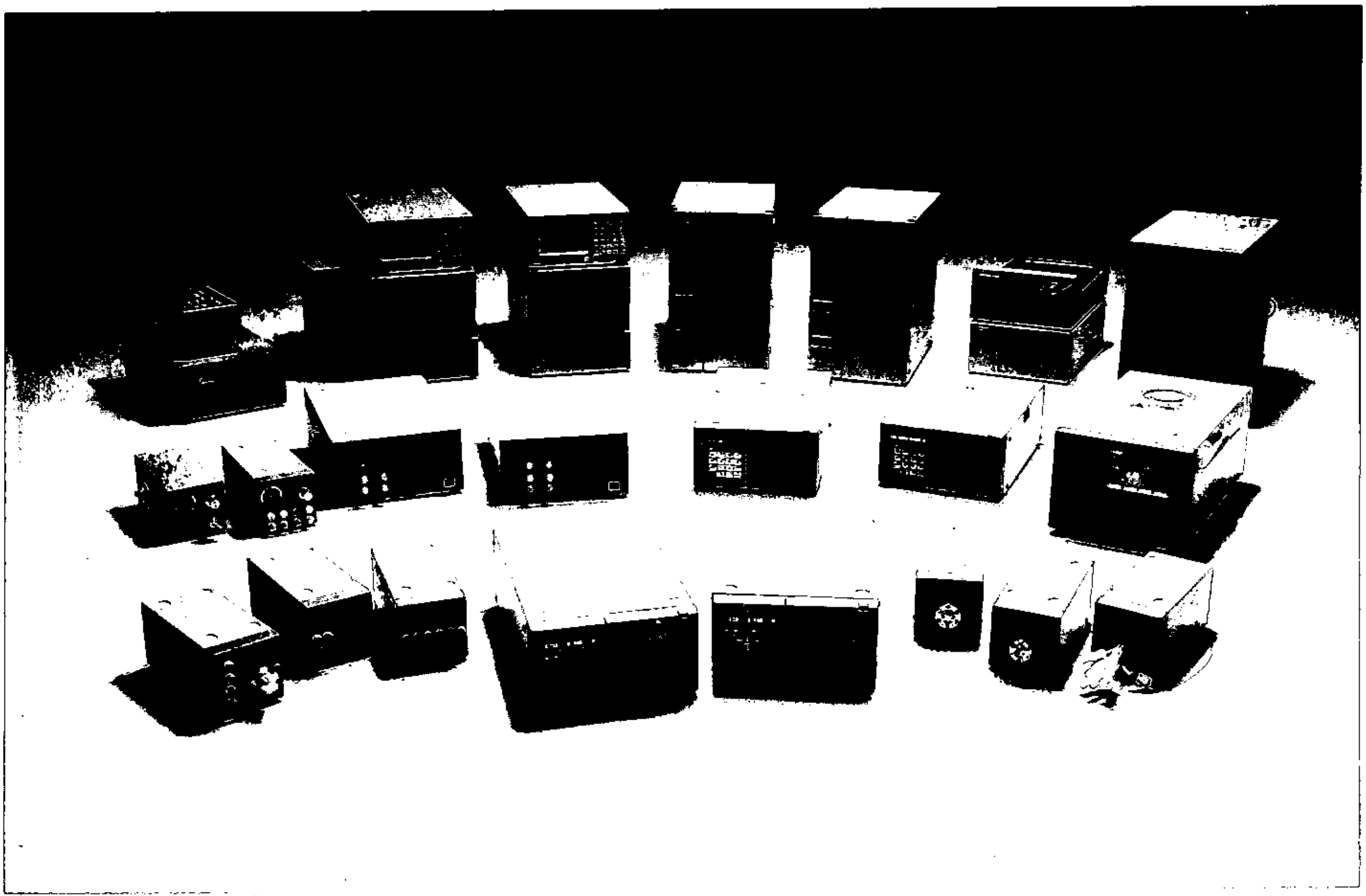

The LC-10A Range From Shimadzu

ENVIRONMENTAL ISSUES

SAFETY DATA SHEETS FOR CHEMICAL PRODUCTS.

Safety data sheets, or material safety data sheets (MSDS) as they are commonly known, are the documented means of transferring essential hazard information from the supplier of a chemical product to the recipient of that product. The responsible management of potentially hazardous chemicals ensures that such information is readily available. It can be expected that the availability of essential hazard information on chemicals will be required as part of an occupational health and safety (OSH) program, and resulting from the proposed Hazardous Substances and New Organisms legislation. The move by the International Standards Organisation to release ISO 11014-1, First Edition 1994-03-15 is therefore very timely.

ISO 11014-1 is entitled Safety Data Sheets for Chemical Products, Part 1: Contents and Order of Sections. As the title implies, the standard indicates what should be included in safety data sheets and the order in which the information should be provided. In order to comply with this standard a safety data sheet must provide the chemical product information under the following 16 headings, the wording, numbering and sequence of which must not be altered:

1. Product and company identification
2. Composition/information on ingredients
3. Hazards identification
4. First aid measures
5. Fire fighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure controls/personal protection
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal considerations
14. Transport information
15. Regulatory information
16. Other information

Under each of the 16 headings, relevant information must be stated. If the information is not available, then the reason why it is not available must be given.

It will be noted that the hazard information required to comply with this standard is not restricted to occupational health and safety issues but also includes ecological information and disposal considerations which are essential for the evaluation of potential environmental hazards.

This ISO document should be of interest to all who produce or use Material Safety Data Sheets, or who require hazard information relating to specific chemicals. It should be used at least as a check list to evaluate the contents and order of MSDS in general use. It is available in this country from Standards New Zealand, Wellington.

Norman Thom
Convenor, NZIC Environment Committee,
C/- Environmental Science, University of Auckland.

GREENHOUSE '94

Scientists, industrialists, economists and politicians met late last year in Wellington at the week-long Australia/New Zealand conference on climate change organised jointly by CSIRO and NIWA. Topics included: climate change science; impacts of global warming; adaptation to global warming; international and national perspectives and economics; energy options.

Climate change science

The speakers in this session brought the attendees up to date on the latest scientific opinions about the changing composition of the atmosphere and the latest IPCC pronouncements. A very interesting paper from G P Ayers of CSIRO summarised the effects of sulphate aerosols, which are now thought to be of comparable magnitude to greenhouse gases, but have the opposite effect. This is considered by many as the reason why projections of greenhouse warming have so far not correlated well with actual recorded temperatures.

Impacts of climate change

These papers were mostly pessimistic, concentrating on likely harmful effects of greenhouse warming. In a light-hearted editorial the *Evening Post* struck a contrary note by saying that, on the evidence presented at the Conference, global warming couldn't come fast enough for Wellington!

Adapting to climate change

This session seemed to be more positive, with a spirited call for an optimistic attitude to adapting to climate change by Ann Henderson-Sellers of Macquarie University. Among the papers on mitigating the effects of any climate change, Keith Joblin of AgResearch, Palmerston North discussed the prospects for reducing methane emissions from cattle and sheep.

Economics and politics

It was obvious from the two opening addresses given by Simon Upton and his Australian counterpart, John Faulkner, that New Zealand's policy is the more fully developed. Australia has a higher level of carbon-based energy production and little prospect of reaching emission reduction targets by forestry planting. Economists seemed to be about equally divided on the benefits of using carbon taxes to reduce CO_2 emissions. One group thought they would be beneficial and another, disastrous.

Energy efficiency

There were several excellent papers on how greenhouse gas emissions can be reduced by energy efficiency measures and voluntary agreements. Piers Maclaren of the Forest Research Institute gave a clear account of how plantation forestry can temporarily compensate for CO_2 emissions. A joint paper by Frank Topham of the New South Wales Coal Association and Wayne Hennessy of Coal Research outlined future prospects for the coal industry.

National responses

The contrast between Australia and New Zealand was most evident here. In Australia, most carbon emissions are from coal combustion, whereas in New Zealand nearly 50% of carbon emissions are from oil, mainly from transport. At least 80% of New Zealand's emission reduction targets will be achieved by plantation forestry.

LOCAL NEWS

AUSTRALASIAN CORROSION ASSOCIATION A. C. KENNETT AWARD

The NZIC, together with the Australasian Corrosion Association, are co-sponsors of the A. C. Kennett Award, an Award presented annually for the best paper presented during the preceding year on a subject dealing with corrosion and non-metallics. It was instituted in 1984 and has been presented annually since then, excluding 1990 when there was no suitable paper offered. It is judged by the President of NZIC and 4 judges from the Australasian Corrosion Association.

This year the Award was given to a paper presented at the 1993 NZIC Conference; "Natural and Artificial Weathering of uPVC", authored by Neil Trebilco of Building Research Association of NZ (BRANZ), Porirua.

Ray Osborne, Executive Officer, Australasian Corrosion Association presenting Neil Trebilco with the A. C. Kennett Award at the 1994 ACA Conference Dinner held 29 November 1994 in Adelaide, South Australia.

* * * * *

A NEW FUTURE FOR COAL RESEARCH

The Coal Research Association of New Zealand (CRANZ) has provided research and policy development for the New Zealand coal industry for over 25 years. But the coal industry is changing, and it has been widely recognised throughout the industry that CRANZ needs to modify its approach to meet the challenges to be faced in the next century.

Re-organisation at CRANZ

After an extensive process of consultation and reflection, the Coal Research Association of New Zealand is re-organising. January 1995 will see the birth of a new company, Coal Research Ltd - the offspring of a strategic alliance between CRANZ and the Australian coal industry research and development company, ACIRL. Coal Research Ltd will comprise the existing staff and facilities of CRANZ. The company will provide:

- research and development
- commercial analytical services
- consultancy services
- information products and services

The client base will mainly comprise the New Zealand coal industry, although the new structure will allow expertise to be provided to other organisations.

Expertise from ACIRL

ACIRL's participation in the new venture will complement the existing CRANZ expertise by providing specialist knowledge of:

- mining
- geotechnical engineering
- environmental management
- coke and combustion tests

New Role for CRANZ

CRANZ will continue to be responsible for the programme of research, science and technology funded by means of industry contributions, and the "public good" coal research contracts from the Foundation for Research, Science and Technology. These programmes will be sub-contracted to the new company by CRANZ; other clients will deal directly with Coal Research Ltd. CRANZ will also continue to provide strategic and policy advice and be an advocate for the industry.

Shareholders and Control

The shareholders of the new company will be (CRANZ) (70%) and (ACIRL) (30%); CRANZ thus maintains the controlling interest. Board members of Coal Research Ltd will be:

- Rex Byles (Glencoal Energy; currently chairman of CRANZ),
- Murray Bond (CoalCorp),
- Brent Francis (Francis Mining),
- Alan Broome (Managing Director, ACIRL), and
- one other still to be appointed.

* * * * *

VOLUNTARY AGREEMENTS ON CARBON TAXES

The Coal Research Association (CRANZ) has been assisting major coal users in the steel, cement, electricity, dairy and meat industries to set up Voluntary Agreements between the Government and other companies or sector associations to reduce greenhouse gas emissions.

A Voluntary Agreement for small scale industrial coal users in other sectors is also being set up by CRANZ with funding from the coal producers.

Organisations which sign up to the Coal Research Voluntary Agreement will undertake to reduce their energy use (and consequently their CO_2 emissions) per unit of output, by a certain amount by the year 2000. Annual progress statements will be sent to Coal Research, where staff will collate them into an annual progress report to the Ministry of Commerce.

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Introducing Hach's 2100N and 2100AN Lab Turbidimeters

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Built-in Printer. Provides a convenient time and dated measurement report or calibration record.

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Selectable Measurement Modes. Units of measurement include NTUs, Nephelos, EBC, "User Defined" for Custom Applications, %T, Absorbance and Colour (APHA Pt-Co colour units).

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Hach 2100AN Turbidimeter

CRANZ has taken the initiative, on behalf of the coal industry, by organising the comprehensive approach to Voluntary Agreements as a means of reducing greenhouse gas emissions without resorting to a carbon tax. The Government has threatened to introduce a carbon tax in 1997 if voluntary industry agreements, combined with energy efficiency measures, do not achieve sufficient reduction in CO_2 emissions.

* * * * *

STRATEGIC STATEMENT FOR THE PGSF

The Cabinet has released "Science and Technology: the Way Forward", a strategic statement to guide investment through the Public Good Science Fund (PGSF) over the period 1996-2001. The strategic statement is derived largely from the work of the Strategic Consultative Group on Research (SCGR) which completed its work and reported to the Hon. Simon Upton, Minister of Research, Science and Technology, in October 1994.

"The SCGR report provided an extremely useful input to the development of the Government's own Strategic Statement", Mr Upton said. "Science and Technology: the Way Forward" will set a context for a wider review of priorities for the Government's investment in the PGSF. It describes some broad goals and guidelines for the priority-setters to follow.

The SCGR was convened by Dr Alan Bollard, Chair of the Commerce Commission, and had eight other members drawn from science stakeholder communities. The group was asked to develop a perspective on the likely evolution of the New Zealand economy and society over the next 20 years and from this derive implications for the allocation of the PGSF. Copies of both the Government's Strategic Statement and the SCGR's report are available from the Ministry of Research, Science and Technology.

SECOND STAGE BEGINS

New panel

The next stage of the 1994/95 priority-setting process has begun with the Cabinet's appointment of a Science Priorities Review Panel (SPiR) which will be asked to provide advice to the Government on the optimal distribution of the PGSF across 17 different output classes (see below) over the five-year period from 1996/97 to 2000/01 and on the specification of key "science areas". The SPiR will also be expected to develop guidelines for development of science strategies and for the detailed allocation of the fund by the Foundation.

The SPiR will be convened by Dr Doug Wright (FNZIC), former Chief Executive of the Meat Industry Research Institute of New Zealand (MIRINZ) and currently convenor of the National Science Strategy Committee on Possum and Bovine Tuberculosis Control. Key terms of reference for the SPiR, and names and short resumes of its members, are given below.

Several members of the SCGR, which had responsibility for the first strategic phase of the overall process, have continued their involvement by becoming members of SPiR. This 'rollover' of membership had been planned from the beginning. "The overall process aims to ensure continuity and integration of the two stages by having overlapping membership of the panels", according to Dr Basil Walker, Chief Executive of the Ministry of Research, Science and Technology. "It is also important to make sure that the stages are distinct, so two separate panels have been convened" Dr Walker said.

Key factors

The SPiR will develop firm methodologies to be approved by the Minister of Research, Science and Technology. As an input to this, the Government has signalled in its Strategic Statement that there are six key factors which the Government will require to be considered in developing explicit priorities between outputs. These factors are:

- Strategic Importance
  The potential contribution of the output to achieving the Government's economic, environmental and social goals.

- Potential of Science in Each Output
  The likelihood that research will achieve results.

- Potential of Users to Capture Benefits
  The extent to which users of research in the output will capture its benefits, and their timeliness in doing so.

- Research Capacity
  The quantity and quality of resources available in New Zealand to support current and future research.

- Research Intensity
  The extent to which the sector is dependent on investing in research for its success.

- Appropriateness of PGSF Funding
  The extent to which research in the output should be funded from the PGSF compared to other sources.

The process

The SPiR will have a large degree of independence in determining its own process, but it will also be required to follow the directions set out in the Government's Strategic Statement, to consult widely and to issue a discussion document before formulation of its final report. The priorities phases will also need to flow smoothly into the Foundation's Research Strategy phase to follow, and Ministry and Foundation officials are working together to ensure that this happens. The following timetable showing key milestones, will therefore need to be adhered to :

14 December 1994
First meeting of SPiR; first call sent to key stakeholders for submissions and nominees to assist in compiling output based information.

15 February 1995
Initial submissions received.

9 March 1995
Discussion document circulated and second call to stakeholders for submissions. The Foundation's research strategy process will begin at about this time.

3 April 1995
Closing date for second round submissions.

26, 27 April 1995
SPiR to meet representatives of Sector Groups.

1 May 1995
SPiR report sent to Government.

31 May 1995
Cabinet approval of government priority statement.

For information about the process, contact Malcolm Menzies or Dave Cope at the Ministry of Research, Science and Technology.

Key terms of reference

The overall role of the panel will be to develop advice to the Government on the specific priorities to apply to investment of the PGSF for the five-year period beginning in the 1996/97 financial year. In doing so, it will be required to work within the context of the Strategic Statement approved by the Government.

NEW OUTPUT FRAMEWORK FOR THE PGSF	**1994/95 Allocations ($000)**
1. Animal Production and Processing Industries	36,990
2. Dairy Industries	10,747
3. Forage	21,162
4. Horticultural, Arable and Other Food and Beverage Industries	49,606
5. Forestry & Forest Product Industries	20,567
6. Fisheries and Aquaculture Industries	4,843
7. Manufacturing Industries	24,843
8. Tourism, Commercial and Other Services	185
9. Information & Communications Networks and Services	3,170
10. Construction	3,717
11. Energy	4,416
12. Transport & Distribution Systems	1,096
13. Society, Culture, Economy, Policy, History	4,224
14. Earth Resources and Processes	14,002
15. Land and Fresh Water Eco-Systems	29,102
16. Marine Environments, Climate and Atmosphere	19,035
17. Antarctic Research	1,876

The Panel will be required to:

- Develop a methodology for recommending quantitative science priorities, ie. allocation of funding into specific output categories.

- Report the proposed methodologies to the Minister of Research, Science and Technology for his approval.

- Apply the approved methodologies.

- Develop non-quantitative guidelines for the application of the PGSF investment.

- Identify key science areas to be overlaid on the quantitative science priorities. These areas are likely to be cross-sectoral, multi-disciplinary, long-term and opportunity driven.

The SPiR will be expected to:

- Operate within the goals and guidelines and in accordance with the priorities framework set out in the Government's Strategic Statement.

- Consult with key stakeholders (users, providers, funders and policy makers) as to the appropriate content of, and priorities within, the final report.

- Incorporate input from the complementary process of consultation with Maori being coordinated by the Ministry of Research, Science and Technology.

Membership of the Science Priorities Review Panel

CONVENOR
Doug Wright, science consultant. Recently retired as Director of the Meat Industry Research Institute of New Zealand (MIRINZ). In 1993, acted as a consultant to FRST to develop a Science Area Research Strategy for sheep and beef production and processing research. Current Convenor of the National Science Strategy Committee on Possum and Bovine Tuberculosis Control.

MEMBERS
Helen Anderson, director Earth and Ocean Sciences Research, Dunedin; Alan Bollard, chairman of the NZ Commerce Commission and chairman of the recent Strategic Consultative Group on Research; Murray Gough, former chief executive of the Dairy Board; Professor Peter Jackson, head of Mechanical Engineering, University of Auckland; Andrew Matthews, atmospheric scientist NIWA; Murray Milner, general manager, fundamental planning, Telecom; Wendy Nelson, botanical scientist, Museum of New Zealand; Papaarangi Reid, public health senior lecturer, Wellington Medical School; Neil Richardson, group managing director, Gallagher Group Ltd, Hamilton; Graeme Robertson, chief executive officer, Cawthron Research Institute, Nelson.

* * * * *

CALL FOR NZ/FRG GRANT APPLICATIONS

The Ministry of Research, Science and Technology administers the New Zealand/Federal Republic of Germany STC Agreement, including the administration of travel grants to New Zealand scientists and technologists wishing to establish or further collaborative projects with their German counterparts.

Equal priority is currently given to applications in all branches of science and technology. New Zealand applicants are expected to have an appropriate research or technology background.

Funding under this scheme is limited and is not intended to function as a primary source of funds (e.g. salary or equivalent). Grants are usually made to cover the cost of a return airfare.

Applicants should note that funding will be made available for activities which are scheduled to take place between 1 April 1995 and 30 June 1996. All applications must be with the Ministry by 28 February 1995.

For further information and application forms please contact Rick Petersen at the Ministry of Research, Science and Technology. Phone (04) 472 6400, Fax (04) 471 1284.

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MARSDEN FUND ANNOUNCED

The fund set up in the 1994 Budget to enhance New Zealand's scientific knowledge base and its research skill base has been named the Marsden Fund after one of New Zealand's most distinguished scientists, the late Sir Ernest Marsden.

In announcing the fund on 7 November 1994, the Minister of Research, Science and Technology Simon Upton also named the eight eminent New Zealand researchers who have been appointed to the Marsden Fund Committee which will administer the fund.

The Marsden Fund Committee Comprises

- Chairman - Professor Ian Axford, Director of the Max Planck Institute in Germany and Chairman of the Foundation for Research, Science and Technology.
- Dr Garth Carnaby, Managing Director, WRONZ, Christchurch.
- Dr C R (Roger) Slack of Crop and Food Research Ltd, Palmerston North.
- Dr Janet Davidson, Museum of New Zealand, Wellington.
- Professor Roy Kerr, Waiheki Island, Auckland.
- Professor Carolyn W Burns, Zoology Department, University of Otago.
- Professor R I (Dick) Walcott, Geology Department, Victoria University.
- Professor George Petersen, Biochemistry Department, University of Otago.

The Marsden Fund aims to support research which is not subject to the socio-economic criteria set for the Public Good Science Fund. It has funding of about $6 million for 1995/96, rising to about $11 million in 1996/97.

"The Marsden Fund has been established to support excellent research and researchers, regardless of whether or not the research contributes to the Government's socio-economic priorities," said Mr Upton.

The fund will be open to all individuals and providers equally. Each proposal will be judged on three prime criteria:

- Scientific merit of the proposal, incorporating originality, insight and rigour as judged by peer review.
- Potential of researchers to contribute to the advancement of knowledge.
- Contribution to development or broadening of research skills in New Zealand.

"In supporting excellent research for its own sake, we are ensuring that New Zealand is contributing to, and benefiting from, the advancement of knowledge globally, and is laying the foundations for strategically-oriented research of direct benefit to New Zealand,: said Mr Upton.

Mr Upton said that the scheme also provides for the long-term and sometimes-random aspects of research which may lead to profound or unexpected discoveries, or catalyse significant developments in previously-unrelated and strategically-important fields of science.

"In supporting excellent researchers, the Government is contributing to enhancing the quality of the research environment by creating increased opportunity for researchers to undertake research of their own choosing in New Zealand".

Mr Upton said it was particularly appropriate that the fund should be named after Sir Ernest Marsden. He was an early research associate of Lord Rutherford at Manchester University in pre-World War One days. His speciality was the behaviour of alpha particles.

On Rutherford's recommendation, in 1914 he was appointed Professor of Physics at Victoria University College in Wellington at the age 25. He was appointed Assistant Director of Education in 1922 and became the first Permanent Secretary of the Department of Scientific and Industrial Research in 1926.

From 1947 to 1954 he was the Government Scientific Officer in London. He retired in 1954 but continued an active life in scientific affairs both internationally and in New Zealand.

* * * * *

FESTIVAL OF SCIENCE AND TECHNOLOGY

A Science and Technology Festival is to be held in 1995 to celebrate achievements of New Zealand scientists and technologists and raise public awareness of science and technology in New Zealand. The festival, which runs from August 7-13, 1995, will be co-ordinated by the Royal Society with the support of the NZ Association of Science Educators (formerly called the NZ Science Teachers' Association). The festival aims to take a much higher profile than the biennial Science and Technology Week held in previous years. Besides enhancing awareness it aims to highlight science and technology issues, demonstrate that science and technology involves co-operative activity with people of many cultures, and seeks to introduce students to possible careers in science and technology. Support which could take the form of sponsorship, provision of activities, people or resources would be welcomed, says Peter Spratt, the Royal Society's Executive Officer - Education who is also Executive Officer of the Association of Science Educators'. He says the festival aims to have a range of activities for all age groups, and on a small, local or national scale, during the festival week.

* * * * *

NEW LITHIUM FROM SEA WATER PLANT

The world's first facility to extract and refine lithium from sea water is to be built in New Zealand within the next year, an Auckland company Pacific Lithium says. The 26 shareholders of the company have agreed to proceed immediately to establish the lithium extraction and refining facility which the company says will be in place by December 1995. Managing Director of Pacific Lithium, Robin Johannink, said the refinery would be able to produce 3000 tonnes of lithium carbonate a year and would cost just under $10 million. The extraction technique involves dangling pieces of fabric, covered on both sides with an absorbent solution, into sea water about 5m below the surface. The solution attracts lithium molecules into the porous fabric which is then lifted out of the water and taken to the refinery where the lithium is extracted. The resulting lithium carbonate, worth between $US3300 and $US4000 ($NZ5167 and $6260) per tonne, will then be exported. Lithium is usually mined out of the ground but extraction from sea water was much cheaper. Lithium was seen as a strategic mineral of the future, especially with the growth of lithium rechargeable batteries, Mr Johannink said. Pacific Lithium had also succeeded in extracting lithium from geothermal brines at the Wairakei geothermal power station and is continuing to develop that technology.

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IRL NOTES

(News From Industrial Research Limited)

Last July Dr Neil Milestone (Team Leader of the Inorganic Materials Team) together with Dr David Bibby (General Manager of IRL's CESIT) attended The Zeolite Workshop and Conference at Garmisch-Partenkirchen in Germany. The conference had 850 attendees and produce four volumes of proceedings! Neil then visited Shell in Amsterdam, and Unilever at Port Sunlight (yes Sunlight) in England to discuss projects on zeolites and catalysis. This was followed by visits to the University of Leeds, and Birbeck College in London to discuss cement chemistry. In November Neil presented an invited paper at a workshop in Singapore on high performance concrete. Dr Tim Kemmitt also of the Inorganic Materials Team presented a paper on polymer precursors and preceramics from geothermal silica at a Macrogroup conference on silicon containing polymers at the University of Kent in Canterbury. Tim then visited various groups interested in silicon chemistry at the University of Cambridge, and the University of Montpellier. The Inorganic Materials Team has also been involved in research on cementing in geothermal wells. There has been a resurgence of interest in this field with new wells being drilled at Ohaaki. Kevin Patterson of the Inorganic Materials team has resigned to take up a position with Allflex in Palmerston North.

Vaughan White of the Ceramics Team met Ms Nor Azmah Abdul Kadir and Ms Fazilah Fazan of the Ceramics Technology Centre, part of SIRIM in Malaysia, to initiate collaborative research projects. SIRIM is the equivalent of the old DSIR but will be restructured next year into a private enterprise form, similar to the CRI's in New Zealand. Joining the Ceramics Team for one Year as an IRL Post-Doctoral fellow is Dr. Peter Hines who has recently completed his PhD at the University of Queensland. Professor Thommy Ekstrom, an adjunct professor from Stockholm University will be at IRL with the Ceramics Team for one year, as a senior research fellow. As an adjunct professor in Sweden, Dr Ekstrom is mainly involved with research which is partly supported by industry and partly by the university. During his stay in New Zealand Dr Ekstrom will be speaking to groups around the country. Various members of the Ceramic Team attended the Australasian Ceramic Society conference in July and presented four papers on their work. A TBG (Technology for Business Growth) contract with Pyrotech has been awarded to the Ceramic group. Under the contract they will investigate SiN bonded SiC as an aluminium refractory material. A recent visitor from Japan was Professor Toshihiko Taki who is a professor of physics at Tokushima University. Professor Taki presented a seminar on solid state NMR studies of polycarbosilane ceramic precursors and agreed to collaborate with Dr Richard Meinhold, of the Spectroscopy Team, on NMR studies of boron nitride formation by pyrolysis of borazine.

During August Material Science and Processing General Manager Dr Don Smith attended a UN Meeting on methyl bromide. He also viewed a methyl bromide recovery plant in Germany. Neville Miller of Engineering Materials presented a paper in November at the Pacific Rim Biobased Composite symposium in Vancouver.

Professor E.J. Thomas of Manchester University visited Industrial Research Limited to give a presentation on remote asymmetric induction using allyl stannanes. Professor Thomas and the NPP Group Manager, Dr Doug Crump, were students together at Cambridge. Dr Michael Gretz from the school of Biological Sciences, Michigan Technological University visited IRL as part of a US/NZ cooperative science program with Dr Richard Furneaux. He participated in a colloquium with visitors from the Museum of New Zealand, Carina Chemical Laboratories and MAF Fisheries and gave a seminar on the extracellular adhesives of fouling diatoms. Drs Alison Gane from the Food Science Department of Otago University and Ian Sims from the Plant Cell Biology Research Centre at the University of Melbourne gave seminars on model cell wall polysaccharides from cell suspension cultures of *Nicotiana* and cell walls and secretions of the female sexual tissues of the ornamental tobacco. Dr Doug Mountfort and Dr Chris Molloy visited IRL to give a seminar on characteristics of alginase produced from the obligate marine anaerobe *Clostridium grantii.*

A large National Cancer Institute contract has been awarded to the Carbohydrate Chemistry Team for the resynthesis of compounds for screening as potential AIDS and cancer drugs. The contract, initially for three years, will be managed by Dr Barry Dent and will require the synthetic skills of three full-time organic chemists. The Carbohydrate Chemistry Team is collaborating with Professor Vern Schramm of Albert Einstein College of Medicine in New York on producing inhibitors of, and colorimetric tests for the presence of protozoan parasites in human and animal blood. Also this team with the assistance of the Business Development Team have initiated a research and development programme with the Malaysian Rubber Research Institute on looking at commercialising quebrachitol, a rubber collection by-product, similar to the compound pinitol found in large amounts in the heartwood of sugar pine. Sugar pine is rather unique in this respect and thanks to early plantings of sugar pine in New Zealand, IRL is now the owner of the world's major supply of pinitol, stored in 29 tonnes of sugar pine logs. If the pinitol project fails IRL will being moving into the firewood business.

Chemprocess Development Team have a number of contracts for the extraction of essential oils from seeds. They routinely extract evening primrose oil and there is now growing interest in oil from kiwi fruit seeds for cosmetic applications. The Bioprocess Development Team extracted a valuable drug from the mould used in the production of camembert cheese for an American pharmaceutical firm. The Plant Chemistry Team has won a contract from the Kiwifruit Marketing Board to examine the pigments in the red and yellow relatives of kiwifruit.

Dr Greg Lynch has resigned from IRL. He leaves the Carbohydrate Chemistry Team to train as a patent attorney with Baldwin, Son & Carey. Dr Gerritt Limberg has joined the Carbohydrate Chemistry Team as a Post-Doctoral Fellow. Gerritt gained his PhD from the University of Hamburg in Professor Joachim Theim's group working on chemoenzymatic synthesis. He is supported with a DFG fellowship from Germany. Also on a one month visit from the same group is graduate student Bernd Decker.

Dr Garry Harper has joined the Biochemical Science Team. Garry completed his PhD at Cambridge University on edible coatings of fruit, and then gained post-doctoral experience in surface interaction of charged polymers. Dr Rachel Shepherd, arriving from the Leatherhead Food Research Association in the UK, has joined the Biochemical Science Team to carry out research into the production of novel carbohydrates for food use.

Dr Tony Woolhouse of the Organic Chemistry Team has succeeded in developing a large scale synthesis of (+)-feline, an elusive urinary amino acid unique to male felids (cats). (+)-feline is believed to be the precursor to the catty odour in tom cats that we all know and love so much. He is collaborating with Professor Michael Tasttelin and Paul Moughan of the Monogastic Research Centre at Massey University in examining the effect of this compound in controlling cats. The effluvium from Tony's work can often be detected about the Gracefield campus. A New York law firm has approached Dr Yeap Foo, also of the Organic Chemistry Team, to serve as a consultant to a pharmaceutical company because of his international standing in the field of proanthocyanidins (tannins).

Mr Wilford Lie of AgResearch at Wallaceville has commenced a PhD at Massey University with Dr Craig Eccles in NMR spectroscopy. Drs Paul Atkinson of AgResearch and Herbert Wong, leader of IRL's NMR Spectroscopy Team, are joint supervisors.

Drs David Stevenson, Richard Furneaux and Roger Stanley gave a presentation at a Workshop organised by Tom Nicolle of IRL's Business Development Team to focus attention of the Meat, Rendering, and Fats and Oil industries on the need to add value to tallow.

And although IRL's research focus is in the applied science field, the scientists of the Natural Products and Processing Group still managed to produce 60 publications (published or submitted to journals), 77 internal reports and 65 papers delivered at conferences, for the 1994 year.

Keith Morgan

INTERNATIONAL NEWS

ICP-MS: HEWLETT PACKARD 4500 WINS "THE JAPAN SOCIETY FOR THE PROMOTION OF MACHINE INDUSTRY PRIZE"

Yokogawa Analytical Systems, Inc. has been awarded the "Japan Society for the Promotion of Machine Industry Prize" this year for the Hewlett Packard 4500 ICP-MS (Inductively Coupled Plasma Mass Spectrometer). The Japan Society for the Promotion of Machine Industry is a foundational organisation within the jurisdiction of the Ministry of International Trade and Industry (MITI). The chairman is Mr Shoichiro Toyota, also chairman of Toyota Motors Co. This society has been awarding the "Japan Society for the Promotion of Machine Industry Prize" to companies and researchers recommended by various industrial organisations since 1966. The award is sponsored by the MITI and Nihon Keizai Shimbun, Inc. (the most circulated paper of economy in Japan) with the fund of Promotion of Machine Industry subsidised from Japan Keirin Association. This prize has been awarded to those who made outstanding achievement in technical innovation, cost effectiveness, contributions to people's lives and development in the industrial equipment business within the last 3 years. As this prize requires such high level of criteria, it is very difficult to win the award, even for large companies.

Of the many companies that applied, 55 were nominated, and only 11 received the honour of the prize this year. The Hewlett Packard 4500 was nominated by JAIMA (Japan Analytical Instruments Manufacturers' Association), passed the document exam, the hearing exam, the field survey and became the winner. The Hewlett Packard 4500 was given high appraisal for it's technological characteristics and its contribution to the worldwide analytical industry.

* * * * *

AUSTRALASIAN CORROSION MEDAL FOR 1994

At the 34th Annual Conference of the ACA held in Adelaide, South Australia, from 26 November to 30 November 1994, the prestigious Australasian Corrosion Medal for 1994 was awarded to Mr Les Boulton, a Member for 22 years of the New Zealand Branch of the Association. Les Boulton, who is a Project Manager in corrosion at Industrial Research Limited in Auckland, is a past-President of the NZ Branch, past-Australasian President of ACA (1990) and has been Chairman of the Operations Committee for three years. He is the author of over 50 papers and articles published in New Zealand and international journals and the Medal award takes this contribution to the science and technology of corrosion into account. It is the first time that a New Zealander has received the Corrosion Medal at an Australian Branch Conference as the conferences rotate around the eight branches and the NZ Branch had the event in Auckland in 1990. In all six New Zealanders have now received the Medal over the past 34 years and four of these recipients are still active in the NZ Branch of the Association.

Alachlor
Aldicarb
Atrazine
Carbaryl
Benomyl/Carbendazim
Captan
Cyanazine
Chlorpyrifos
Chlorothalonil
Procymidone
Carbofuran
PCB
Pentachlorophenol
Metolachlor
2,4-D
PCB Sample Extraction Kit
Soil Extraction Kit I
Food Prep
Soil Extraction Kit II
Soil Collection Kit

NOBEL PRIZES AWARDED TO RESEARCH PIONEERS

The 1994 Nobel science prizes have gone to veteran researchers who laid the foundations for great advances. In each case the pioneering work dates back to the 1960s or earlier.

George Olah has been awarded the chemistry prize for his work on carbocations. Born in Budapest, Olah was associate director of the Central Chemical Research Institute of the Hungarian Academy of Sciences at the time of the Hungarian uprising in 1956. After the Soviet crackdown, Olah emigrated to Canada, where he joined Dow Chemical, moving with the company to the USA in 1964. Since 1977 he has been at the Hydrocarbon Research Institute of the University of Southern California, Los Angeles.

In 1962 Olah announced the first characterisation of a carboncation reaction intermediate, to general amazement, while still a virtually unknown industrial chemist. His breakthrough was to use a superacid (prepared from HF and SbF_5) to stabilise the elusive trivalent carbenium ion long enough for it to be studied by means of NMR and ESCA. Large numbers of carbocations have now been prepared and studied, including tri-, tetra-, penta-, and hexa- coordinated forms, together with 'hypercarbon' compounds containing these hypercoordinate carbon centres (*Chem. Br.*, 1983, **19**, 916).

The practical spinoffs of carbocation and hypercarbon chemistry have been significant. The basic knowledge of bond formation gained from this work is leading to new synthetic routes to important organic compounds. Small organic molecules with widespread uses as starting materials can be produced simply and inexpensively using Olah's methods. In addition, his work has led to new methods for isomerising straight chain hydrocarbons into branched hydrocarbons of high octane number and increased biodegradability.

The Nobel prize for physics has been shared between Clifford Shull of Massachusetts Institute of Technology, US, and Bertram Brockhouse of McMaster University, Canada, for their work with neutron beams. Shull joined Oak Ridge National Laboratory in 1946 to work on neutron diffraction. As a result of wave - particle duality, the effect of a beam of neutrons striking the atoms in a solid is to produce a series of scattering waves. The pattern of standing waves created by their interference (the scattering pattern) provides a fingerprint for the arrangement of atoms in that solid, but is also dependent upon the velocity of the neutrons.

Shull's contribution was to use prisms to separate a monochromatic beam of neutrons, all with the same velocity, from the jumbled flux of neutrons emitted by a fission reactor. He also extended this technique to prove the arrangement of magnetic atoms, which has been important to the electronics industry. Simultaneously, Brockhouse was working at Canada's Chalk River research reactor, using neutrons to examine thermal vibrations of atoms in solids. As neutrons pass through a crystal lattice they can exchange energy with the atoms. Brockhouse compared the speed of neutrons entering and leaving the sample to measure the lattice vibration (phonon) energy. Brockhouse was the first to measure the phonon dispersion curve of a solid - in effect a neutron spectrum to complement Shull's diffraction pattern.

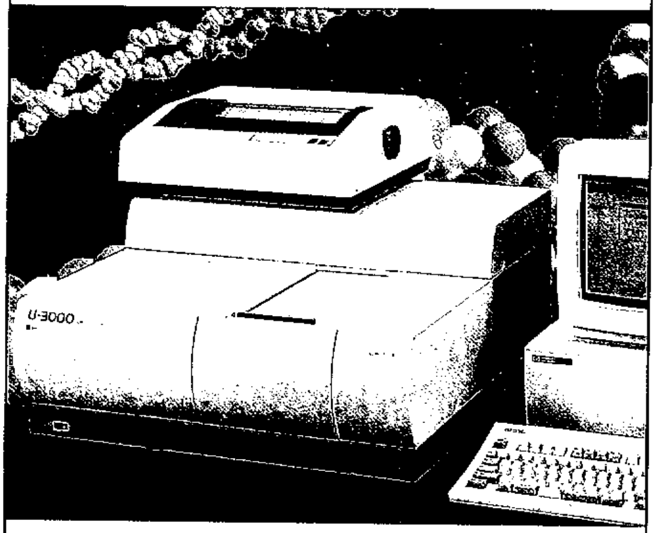
Pharmacologist Arthur Gilman of the University of Texas, Dallas, and biochemist Martin Rodbell of the US National Institute of Environmental Health Sciences, Maryland, share the Noel prize for medicine or physiology for their discovery of G-proteins. Beginning in the late 1960s, they unravelled the pathways that convey signals from intercellular chemical messengers - hormones, neurotransmitters, and growth factors - into the cells themselves.

These molecules are of critical importance in virtually every biological function. Chemical messengers (and most drugs) work by interacting with cell surface receptors; other molecules carry the message into the cell and bring about a response. Earl Sutherland received the 1971 Nobel prize for discovering the first of these 'second messengers', the compound cyclic adenosine-3', 5'-monophosphate (cAMP).

Rodbell discovered the existence of an enzyme in the cell wall that is actually responsible for synthesising cAMP when a receptor is activated. Gilman's work showed how energy-carrying compounds such as guanosine triphosphate (GTP) fuel the process. Because the active proteins (enzymes) in the cell membrane require GTP to work, they became known as G-proteins.

Working from this biochemical knowledge, Gilman's group set out to isolate a G-protein. The first one was finally discovered in 1980, and in the succeeding years the field has exploded, bringing a recognition that the plethora of receptors and intracellular processes implies the existence of thousands of different G-proteins. Gene researchers are now beginning to unravel this complexity.

Source: *Chemistry in Britain*, December 1994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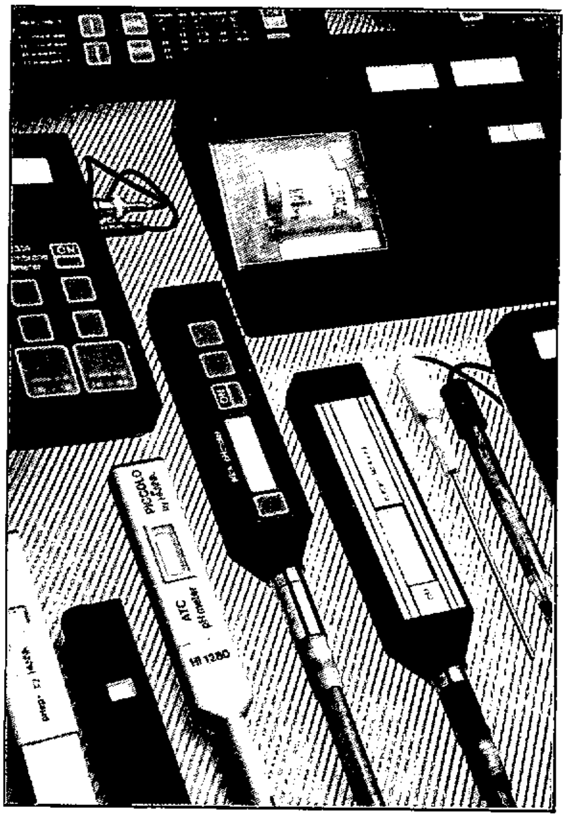
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ATC pH meter
HI 1280

CONFERENCES & SEMINARS

SPECIALIST GROUP MEETINGS AT MASSEY UNIVERSITY

30 January (evening) - 1 February, 1995 **Inorganic and Organometallic Specialist Group Meeting**

1 February - 3 February, 1995 **Physical Chemistry Specialist Group Meeting**
A special session to honour Professor Geoff Malcolm will be held during this meeting.

NZIC members should request registration forms and other information from Dr Tony Burrell (Inorganic and Organometallic Chemistry) or Dr Peter Gill (Physical Chemistry), Department of Chemistry and Biochemistry, Massey University, Private Bag 11222, Palmerston North, Ph (06) 356-9099, Fax (06) 350-5682.

1-3 February, 1995 **First Australian Conference on Vibrational Spectroscopy (ACOVS 1)**
Venue: University of Sydney, NSW, Australia
Contact: Professor Robert S. Armstrong
Chairman
Chemistry Department
The University of Sydney
NSW 2006, Australia
Ph +61-2-692 3104
Fax +61-2-692 3329
e-mail: armstrong_r@summer.chem.su.oz.au

2-4 February, 1995 **RACI Professors and Heads of Chemistry Departments Conference**
Venue: Canberra, ACT, Australia
Contact: Dr Susan Cumming
Executive Director, RACI
1/21 Vale Street
North Melbourne 3051, Australia
Ph +61-3-328 2033
Fax +61-3-328 2670
e-mail: raci@unimelb.edu.au

5-9 February, 1995 **20th Australian Polymer Symposium**
Venue: Quality Hotel, Adelaide, Australia
Contact: Dr Mark Fisher
SOLA International Holdings Research Centre
P O Box 244, Morphett Vale
SA 5162, Australia
Fax +61-8-3261037

5-10 February, 1995 **9th International Conference on Ion Beam Modification of Materials**
Venue: Canberra, ACT, Australia
Contact: ACTS
GPO Box 2200, Braddon
ACT 2601, Australia
Ph +61-6-257 3299
Fax +61-6-257 3256

12-16 February, 1995 **Australian Conference on Physical Chemistry Incorporating the 6th Australian Conference on Chemical Reaction Dynamics**
Venue: Australian National University
Canberra, Australia
Contact: Michael Collins
Research School of Chemistry, ANU
Canberra, ACT 0200, Australia
Ph +61-6-249 3637
Fax +61-6-249 0750

16-18 February, 1995 **Urban Habitat: The Environment of Tomorrow "Focussing on infrastructural and environmental limitations"**
Venue: Delft, The Netherlands
Contact: c/- Eindhoven University of Technology
P O Box 513, 5600-NB Eindhoven
The Netherlands
Ph +31-40473308
Fax +31-40452432

20-24 February, 1995 **Fundamentals of Polymer Synthesis and Characterisation. A 5 day intensive workshop for the Plastics Industry**
Venue: Department of Polymer Science
The University of New South Wales
Contact: A/Professor Rod Chaplin
Department of Polymer Science
University of New South Wales
Sydney 2052, Australia
Ph: +61-2-3854309
Fax: +61-2-3855966
Email: R.Chaplin@UNSW.Edu.Au

3-5 May, 1995 **3rd Australasian Symposium on Applied ICP - Mass Spectrometry**
Venue: Wallaceville House, Upper Hutt, New Zealand
Contact: Terry Manning or Pam Coulson
ESR
P O Box 12-444
Wellington
New Zealand
Ph: +64-4-4990540
Fax: +64-4-4990541

22-26 May, 1995 **6th Asian Chemical Congress**
Venue: Metro, Manilla, Phillipines
Contact: Dr Ishmael Ordoñez
Chairman
Media and Promotions Committee
6th Asian Chemical Congress
Fax +63-2-996868
or
Alan Turner
General Secretary/Executive Officer NZIC
P O Box 12-347, Wellington
Ph (04) 473-9444
Fax (04) 473-2324

22-26 May, 1995 **11th Philippine Chemistry Congress**
Venue: Manila, Philippines
Contact: 6ACC'95 Secretariat
c/- Philippine Federation of Chemistry Societies
U.P. NSRI Bldg, Diliman, Quezon City
1101 Philippines
Ph +63-2-945736
Fax +63-2-996868


BIO-RAD

9-14 July, 1995 **13AC/4EC**
Venue: Darwin, Australia
Contact: David Parry
NTU
P O Box 40146, Casuarina
NT 0811, Australia
Ph +61-89-466 666
Fax +61-89-466 712

10-13 July, 1995 **5th COMTOX Symposium on Toxicology and Clinical Chemistry of Metals**
Venue: Vancouver, Canada
Contact: F. William Sunderman Jr.
Dept Laboratory Medicine and Pharmacology
University of Connecticut Medical School
P O Box 1292, Farmington
Connecticut 06034-1292, USA

16-21 July, 1995 **ISMAR 95 "The next 50 years"**
Venue: Sydney, NSW, Australia
Contact: Dr Les Field
Chairman ISMAR - 95
Department of Organic Chemistry
The University of Sydney
NSW 2006, Australia
Ph +61-2-692 2060
Fax +61-2-692 3329
e-mail: ismar-95@biochem.su.oz.au

24-27 July, 1995 **14th International Chemistry Symposium**
Venue: Cambridge, United Kingdom
Contact: Dr John F Gibson
Secretary (Scientific)
The Royal Society of Chemistry
Burlington House, London W1V 0BN
Ph +44-71-437 8656
Fax +44-71-437 8883

11 August, 1995 **"Advances in Polymers II - Polymers in Communications and Electronics"**
Venue: CSIRO Division of Chemiscals and Polymers
Bayview Ave, Clayton, VIC
Contact: Bronwyn Fox
Ph: +61-3-5438160
Fax: +61-3-5438160
or
Marcus Zipper
Ph: 61-3-9054935
Fax: 61-3-9054940

14-19 August, 1995 **35th IUPAC Congress**
Venue: Istanbul, Turkey
Contact: Professor A R Berkem
35th IUPAC Congress
Halaskargazi Cad.No:53, D.8
80230 Harbiye, Istanbul, Turkey
Ph +90-212-240 7331
Fax +90-212- 231 7037

27 August-1 September, 1995 **10th International Conference on Fourier Transform Spectroscopy**
Venue: Budapest, Hungary
Contact: Mrs Klára Láng *or*
Mr Attila Varga
Conference Office
Roland Eötvös Physical Society
H-1371 Budapest, P O Box 433
Hungary
Ph/Fax +36-1-2018682

September, 1995 **Best-Best Engineering Science Technology Exposition**
Venue: Melbourne, Victoria, Australia
Contact: Best Secretariat
Oliver Scofield/Michael Clohesy
P O Box 191, Hawksburn
VIC 3142, Australia
Ph +61-3-804 3844
Fax +61-3-804 3855

3-5 September, 1995 **NSW Southern Highlands Conference on Heterocyclic Chemistry**
Venue: Milton Park, Bowral, NSW, Australia
Contact: Professor David St. C. Black
School of Chemistry, University of NSW
Sydney, NSW 2052, Australia
Fax +61-2-6622835
e-mail D.Black@unsw.edu.au.

3-8 September, 1995 **6th European Conference on the Spectroscopy of Biological Molecules**
Venue: Universite de Sciences et Technologies de Lille
Villeneuve d'Ascq
France
Contact: Professor J C Martin (Chairman)
ECSBM '95, LASIR, UST Lille
Bât. C5
59655 Villeneuve d'Ascq, Cedex, France
Ph +33-204-36988
Fax +33-204-36755
Email: ECSBM95@univ-lille1.fr +33-20434920

5-8 September, 1995 **WATER SOLUTIONS - AT WHAT COST?: The 1995 Annual Conference and Trade Display of the New Zealand Water & Wastes Association**
Venue: Auckland
Contact: David Ogilvie
P O Box 2009, Auckland
Fax +64-9-3761980

10-15 September, 1995 **45th RACI Cereal Chemistry Conference**
Venue: Adelaide, South Australia
Contact: Geoffrey Palmer
Conference Chairman
S.A. Research and Development Institute
21 Divett Place, Adelaide
SA 5000, Australia
Ph +61-8-226 7730
Fax +61-8-226 7722

10-15 September, 1995 **8th International Symposium on Marine Natural Products**
Venue: Santa Cruz de Tenerife, Canary Islands, Spain
Contact: Professor J D Martin
Instituto Universitario de Bio-Organica
38206 La Laguna, Tenerife, Canary Islands
Spain

27 September-1 October, 1995 **12th Medical and Agrigultural Chemical Division Conference**

Venue: Adelaide, South Australia
Contact: Dr Michael L West
Centre for Drug Design and Development
University of Queensland
Brisbane, QLD 4072, Australia
Ph +61-7-632 1271
Fax +61-7-365 1990

27 September-2 October, 1995 **10 NC**

Venue: Adelaide, South Australia
Contact: Des Williams
10NC Organising Committee
GPO Box 1906, Adelaide
SA 5001, Australia

14-16 October, 1995 **International Society of Magnetic Resonance Conference**

Venue: University of Sydney
Sydney, New South Wales, Australia
Contact: Dr L Field
Department of Organic Chemistry
University of Sydney
NSW 2006, Australia
Ph +61-2-692 2060
Fax +61-2-692 3329

16-18 October, 1995 **6th New Zealand Coal Conference "Clean Coal Technology"**

Venue: Park Royal Hotel, Wellington
Contact: The Conference Secretary
Sixth New Zealand Coal Conference
Coal Research Association of NZ
P O Box 31-244
Lower Hutt, New Zealand
Ph +64-4-5662289
Fax +64-4-5667737

3-6 November, 1995 **IUPAC 6th International Symposium on Macromolecule-Metal Complexes**

Venue: Beijing, China
Contact: Professor Ying-Yan Jiang
Institute of Chemistry
Academia Sinica, Zhongguancun
Beijing 100080
China

12-16 December, 1995 **4th Pacific Polymer Conference**

Venue: Kauai, Hawaii, USA
Contact: Professor Ray Otterbrite
Department of Polymer Chemistry
Virginia Commonwealth University
Richmond, Virginia 23204, USA
Fax +1-804-367-8588

17-22 December, 1995 **Pacifichem '95**

Venue: Honolulu, Hawaii, USA
Contact: Professor B Halton
Chemistry Department
Victoria University
P O Box 600, Wellington
Ph (04) 472 1000

Pacifichem '95 - Update

Have you been thinking of going to Pacifichem next December? Then you ought to book your flights soon as possible. The Auckland - Honolulu route only has direct flights with Air New Zealand. If you leave Honolulu on Friday December 22 after the congress you will arrive in Auckland on the morning of December 24. You can travel with Qantas but the route is via an Australian port.

Abstract forms for invited and submitted papers are to be in the Pacifichem office in Washington by March 31, 1995.

7-12 July, 1996 **Organometallic Chemistry XVII**

Venue: Brisbane, Australia
Contact: Eva Comino
Secretariat, International Conference on Organometallic Chemistry
Faculty of Science and Technology
Griffith University
Brisbane, QLD 4111
Australia
Ph: +61-7-8757564
Fax: +61-7-8755369

14-19 July, 1996 **RACI/SETAC/ASE International Conference on Environmental Chemistry and Toxicology**

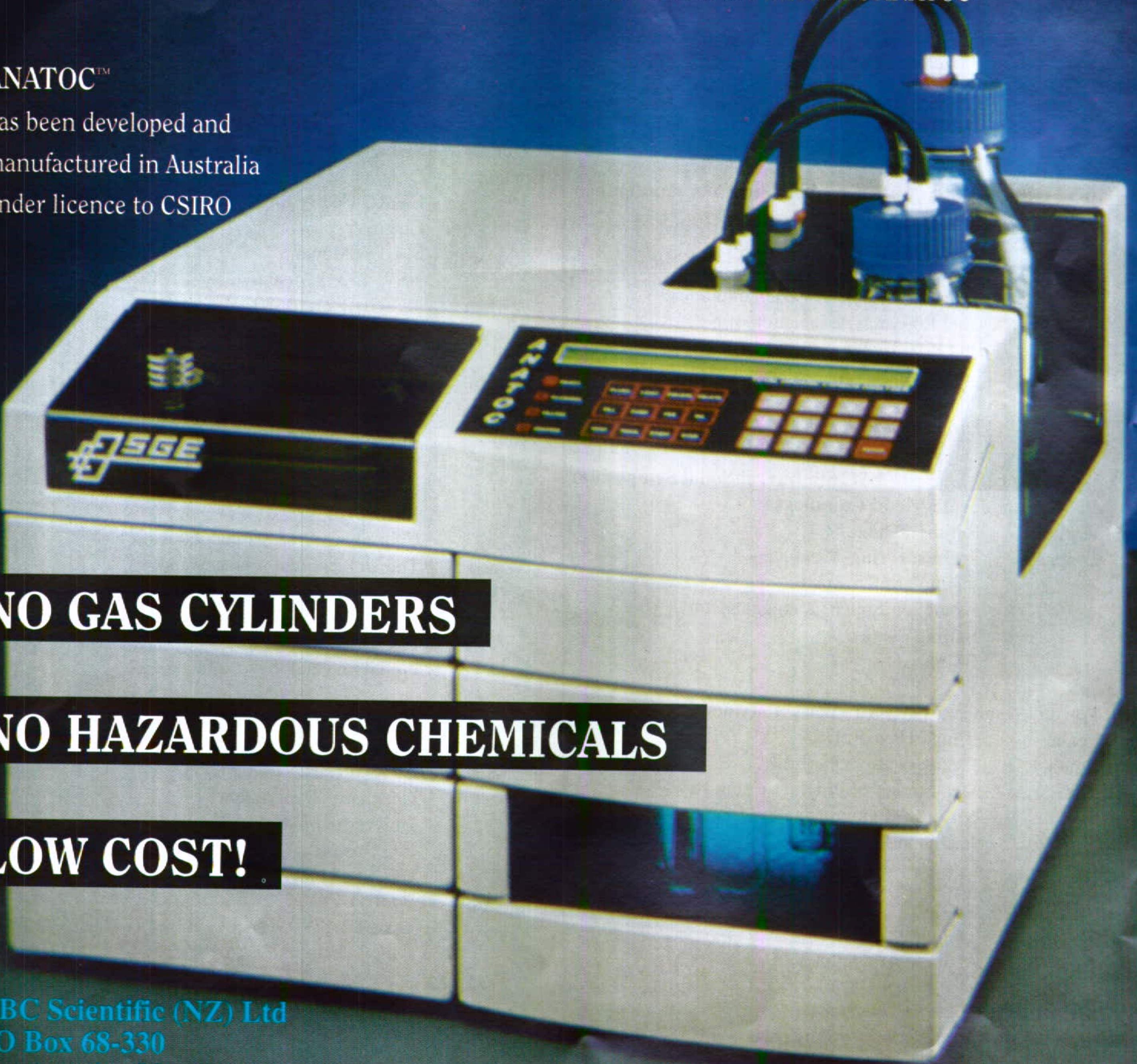
Venue: Sydney, NSW, Australia
Contact: Dr Graeme Batley
CSIRO Centre for Advanced Analytical Chemistry
PMB 7, Menai
NSW 2234, Australia
Ph +61-2-710 6830
Fax +61-2-710 6837

14-19 July, 1996 **14th International Conference on Chemical Education (14ICCE)**

Venue: Brisbane, Australia
Contact: Sally Brown
Conference Secretariat
14th ICCE
Continuing Professional Education
The University of Queensland
Brisbane, QLD 4072, Australia
Ph +61-7-365 6360
Fax +61-7-365 7099
e-mail:chemed96@ceu.uq.oz.au

December, 1996 **NZIC Conference**

Venue: University of Otago, Dunedin
Contact: Dr R M Carr
Chemistry Department
University of Otago
P O Box 56
Dunedin
Ph (03) 479 7932
Fax (03) 479 7906
e-mail:chemmail@otago.ac.nz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Gaseous Emissions from Aluminium Reduction Cells

**J B Metson, †M M Hyland †B J Welch and †J J J Chen*
**Department of Chemistry, †Department of Chemical and Materials Engineering, University of Auckland*

Introduction

The production of primary aluminium metal is carried out almost exclusively by electrochemical reduction using the Hall-Heroult process, a technology refined but essentially unchanged in principle over the past 100 years. The metal is produced by the electrolytic reduction of alumina Al_2O_3 dissolved in a bath of molten cryolite Na_3AlF_6 at around 960 °C. New Zealand has a major stake in this technology through the operation of the New Zealand Aluminium Smelters Ltd smelter near Bluff. This still ranks as one of the worlds ten largest smelters outside of Russia. However at a current nominal capacity of 270,000 tonnes/yr it is dwarfed by some smelters, for example Russian smelters at Bratsk and Krasnoyarsk of 850 and 760 kt/yr respectively.

The current generation of reduction cells use carbon cathodes, pre-baked carbon anodes and are point feed with alumina on an essentially continuous basis, at a series of locations along the central axis of the cell. Figure 1 provides a scheme of the typical materials balance in such a reduction cell. The principal emissions from these cells are carbon dioxide (70-80% of the gaseous component) and carbon monoxide (20-30%) produced in the alumina reduction reaction. As CO_2 is an accepted greenhouse gas, a challenge faced by smelters is to reduce these emissions in line with the relevant targets established by Governments in response to the Rio summit. In this respect, the method of generation of the electricity used in reduction cells becomes a major consideration. A Hall-Heroult cell working at 100% efficiency produces 1.22 tonnes of CO_2 per tonne of aluminium, but thermal generation of power for the smelter will produce several times this level [**1**].

However, there are a number of minor components in the gaseous emissions, as summarised in Table I, which are generally subject to regulatory control, principally gaseous hydrogen fluoride, particulate fluorides, sulfur dioxide and particulate carbon. Trace amounts of carbon tetra-fluoride and C_2F_6 produced during anode effects [**2,3**], are also emitted, and as both are potent greenhouse gases, are assuming increasing importance with concern over such emissions. The most important of these minor components are undoubtedly the gaseous fluorides, particularly HF.

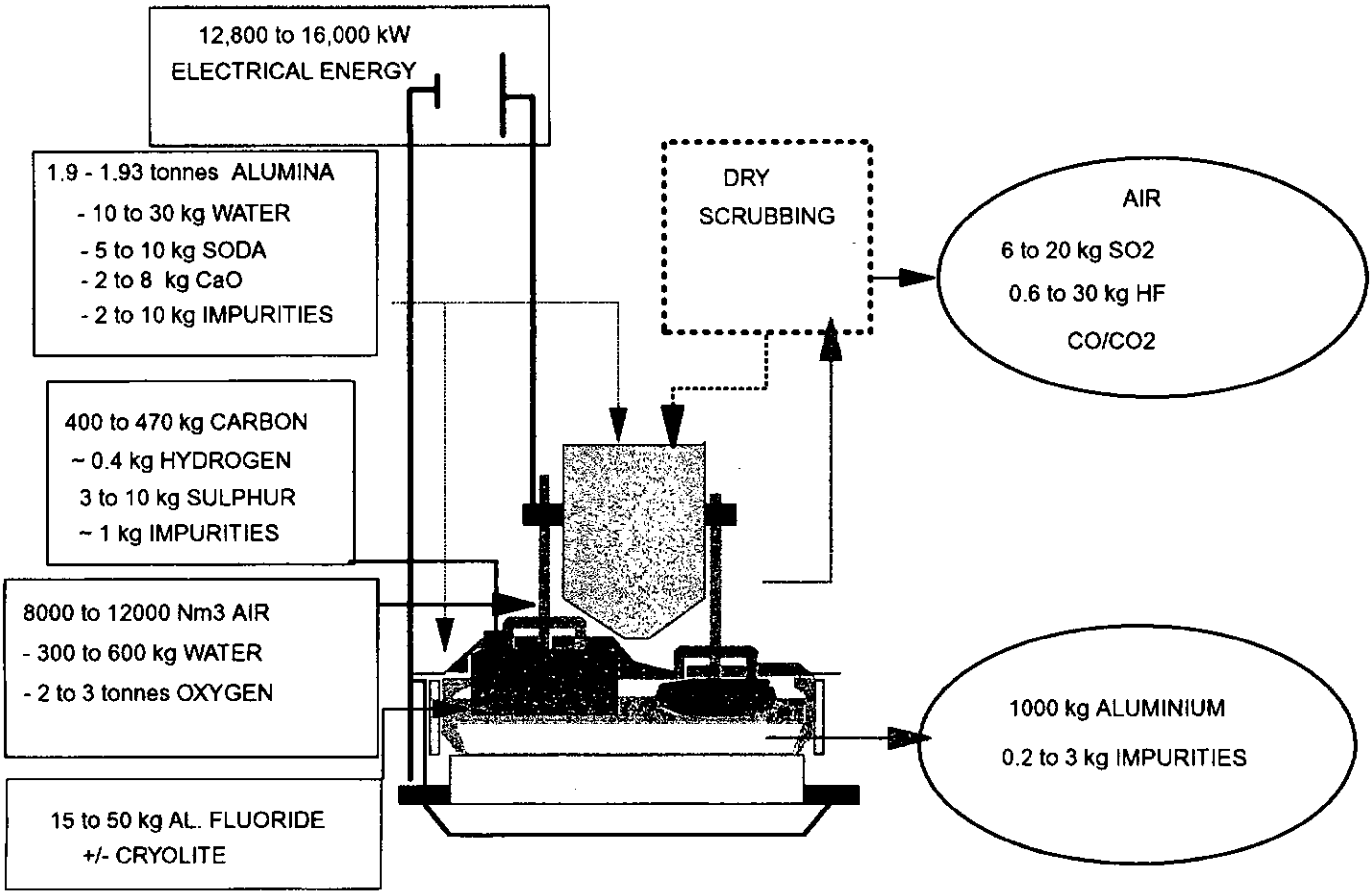

Figure 1: *Schematic of a pre-bake aluminium smelting cell with the major inputs and outputs.*

Potline emissions have steadily decreased over the history of utilisation of the Hall-Heroult process. The progressive move from Søderberg technology, where anodes are baked *in-situ*, to cells with pre-baked anodes has decreased and simplified the handling and matrix of emissions in the cell gases. With accompanying improvements in hooding and stability of cell operation, emissions of 0.4kg of fluoride per tonne of metal produced are now achievable [**1,4**]. This compares with 5.4 kg/tonne 30 years ago. The advent of scrubbing of cell gases by contact with the primary alumina, so called "dry-scrubbing", in the late 60s represented a major advance in both emission control of fluorides and in their recovery. The alumina from the scrubber, with its surface HF loading, is then feed to the reduction cell. If the HF is retained on the alumina surface during feeding and thus returned to the cell, this is economically important as it substitutes for AlF_3 additions which would otherwise be required to maintain a stable electrolyte composition. Dry-scrubbing has provided an effective means of capturing and entraining HF and particulate within the reduction/scrubbing cycle [**5**], although it does have consequences in metal purity because of the recycle of impurities which are also trapped or condense on the alumina surface [**6**].

TABLE I: Nature & Origin of Emissions from Al Smelting Cells

Species	Origin
<u>**Gaseous Emissions**</u>	
HF	- hydrolysis of Na_3AlF_6 and AlF_3 & oxidation of H_2 from anode
CO, CO_2	- consumption of anode
CF_4, C_2F_6	- anode effect
SO_2	- anode impurity
Polycyclic aromatic hydrocarbons	- coal tar pitch in cathode & anode, *esp.* Søderberg
<u>**Particulate Emissions**</u>	
$NaAlF_4$	- bath volatiles
Na_3AlF_6, Al_2O_3, CaF_2	- bath entrainment
Carbon	- anode
Polycyclic aromatic hydrocarbons	- coal tar pitch in cathode & anode

Countering this general decrease in emissions, is the cell efficiency driven movement toward more acid bath compositions, through excess aluminium fluoride additions. This lower bath ratio and also operation at lower alumina concentrations, results in higher fluoride emissions [**7**]. Capture and recycle of fluorides becomes more critical as losses must be compensated by further AlF_3 additions to maintain electrolyte composition. Higher fluoride emissions challenge the capacity of many scrubbing systems. It is not unusual, with for multiple pass systems, for dry-scrubber alumina demand to exceed that of the potlines, thus generating a demand for higher surface area and more active aluminas. This introduces the problem of higher levels of adsorbed water in the primary aluminas. Adsorbed water not only influences the behaviour of the alumina as a scrubbing medium, but more importantly, ultimately transports this water to the reduction cell. Subsequent reaction with the bath generates HF, thus contributing to higher emission levels entering the scrubbing system.

In parallel with the modifications to bath chemistry, the steady improvement in the working environment within potrooms and the regulatory requirement to achieve lower HF levels, has lead to much improved hooding of cells and higher draught rates. With such controls pot gas exhaust rates are typically between 100,000 and 200,000 Nm^3 per tonne of Al [**5**]. This effectively dilutes the HF and particulate concentration in the duct gas flow, increasing the gas volume the scrubber system must handle, but decreasing the HF concentration. This makes efficient capture of HF more difficult [**8,9**] and there is considerable debate as to what proportion of the HF is retained with the alumina during cell feeding, as opposed to recycling into the pot gas. Thus there are still significant challenges in understanding and improving the treatment of the gaseous emissions from smelting cells and these will be discussed below.

Fluoride emissions during 'normal' cell operation

During normal operation of a reduction cell, fluoride emissions are generated by the following processes [**7**]:

1. The hydrolysis of the molten electrolyte on contact with moisture, predominantly that introduced with the alumina feed.

2. Electrochemical formation of HF.

3. The entrainment of droplets of electrolyte in gas bubbles evolved at the anode.

4. Direct vaporisation, condensation and disproportionation of components from the electrolyte bath.

5. Subsequent reaction of fluorides from 3 and 4 with moisture in the fumes.

Thus the principal components produced are HF from 1, 2, and 5, and cryolite, sodium tetrafluoroaluminate $NaAlF_4$, its dimer $Na_2Al_2F_8$ and subsequently chiolite, $Na_5Al_3F_{14}$ from 3 and 4. The origin and specific mechanisms by which these species are produced have been reviewed by a number of authors [**7,10,11**]. What is of interest is how current practice within the aluminium industry and particularly modifications to bath chemistry, is affecting these emissions and how they are handled by the scrubbing system.

Hydrolysis reactions are dominant in producing fluoride emissions. Aluminas with higher surface area (60-90 m^2g^{-1}), as are demanded by dry-scrubbing systems, carry a correspondingly higher surface water load after storage and passage through a dry-scrubber and will clearly accelerate process (1). Thus HF emissions will effectively increase with BET alumina surface area. This simple correlation is complicated by the method of alumina feeding to the cell. For example, if the alumina is fed via dumping it on the crust along the central channel of the cell (figure 1) and subsequent crust breaking, then some dehydration will take place while the alumina is resident at elevated temperatures (typically 400-600°C) on the crust. This leads to disparity between HF emissions predicted from equations 1 and 2, and those observed in the duct gas [7].

$$2Na_3AlF_6 + 3H_2O \rightarrow Al_2O_3 + 6NaF + 6HF \qquad (1)$$

$$2AlF_3 + 3H_2O \rightarrow Al_2O_3 + 6HF \qquad (2)$$

The highest HF emissions via this mechanism should arise from point fed cells, where there is minimal pre-heating of the alumina. Ironically, the increased water load appears to improve the dissolution characteristics of such aluminas, through the agitation effect generated when the water is released on contact with the bath [**12**].

Grjotheim [**7**] has also suggested that significant quantities of HF could be generated by direct electrochemical production from H_2 contained in the anode (equation 3). The cell potential for this reaction (1.53V) is within normal operating conditions.

$$Na_3AlF_6 + 3/2H_2 \rightarrow Al + 3NaF + 3HF \qquad (3)$$

As demonstrated in figure 1, electrical energy is a major input into the cell. Thus current efficiency in the cell is crucial to viable operation and the focus of a considerable research effort. If cryolite is regarded as a mixture of NaF and AlF_3 the weight ratio of the two salts is termed the "bath ratio". The drive towards higher current efficiencies has lead to cell operation with Li salt additions (to lower the liquidus) in some smelters, and at lower bath ratios, i.e. higher AlF_3 (which also lowers the liquidus and has a number of other beneficial effects, but also decreases alumina solubility). This is accompanied by lower and more tightly controlled alumina levels. Both have been shown to increase the vapour pressure of species such as $NaAlF_4$, thus increasing the yield of volatile fluorides and their hydrolysis products from process 4. Vapour pressures of these components as a function of bath chemistry have been examined by Grjotheim *et al.*, [7] Figure 2. $NaAlF_4$ is not stable in the gas phase or as a solid and condenses and decomposes rapidly, either in the ducting, or frequently on the surface of other particulate material in the duct such as alumina fines [**13**]. In a dry-scrubber such particulates are predominantly captured in the baghouse which follows the reactor in which the alumina and cell gases are contacted.

Gaseous HF typically accounts for more than half of the total fluoride emissions of the cell. The principle of dry scrubber HF capture is deceptively simple. The HF is contacted with primary alumina through some type of counter current injection or fluid bed. HF is then adsorbed on the surface of the alumina, may [9] or may not [**14,15**] undergo subsequent chemical reaction with the surface, and the retained HF is then transported back to the pot in the secondary alumina. There is however, considerable debate as to the specific chemistry of interaction of HF with the alumina surface. The nature of this interaction is critical. If HF is strongly chemisorbed or reacts with the alumina surface, for example to form AlF_3, then it will be carried into the electrolyte during feeding of the secondary alumina. However if it is physisorbed, particularly with co-adsorbed water, as many models suggest, then the HF is rapidly flashed off by the thermal shock of addition to the pot, and simply forms a recycling load in the scrubbing system.

Hyland [**16**] has recently reviewed current understanding of the adsorption of HF on alumina based on both laboratory and plant studies. There are clearly major disparities in the way the results from these studies are reported, for example whether adsorption runs are taken to 0% efficiency (the completion of the adsorption isotherm) or 99% efficiency where most scrubbers will operate. However the maximum loadings achieved (normalised to the alumina surface area) correspond to 0.03 to 0.06 mass% F per m^2/g at 99% efficiency. Taking the adsorption to 0% efficiency (*i.e.* equilibrium) in laboratory studies, loadings up to 0.19 mass% F per m^2/g have been achieved, at gas concentrations above 90 mg/Nm^3 [**17**].

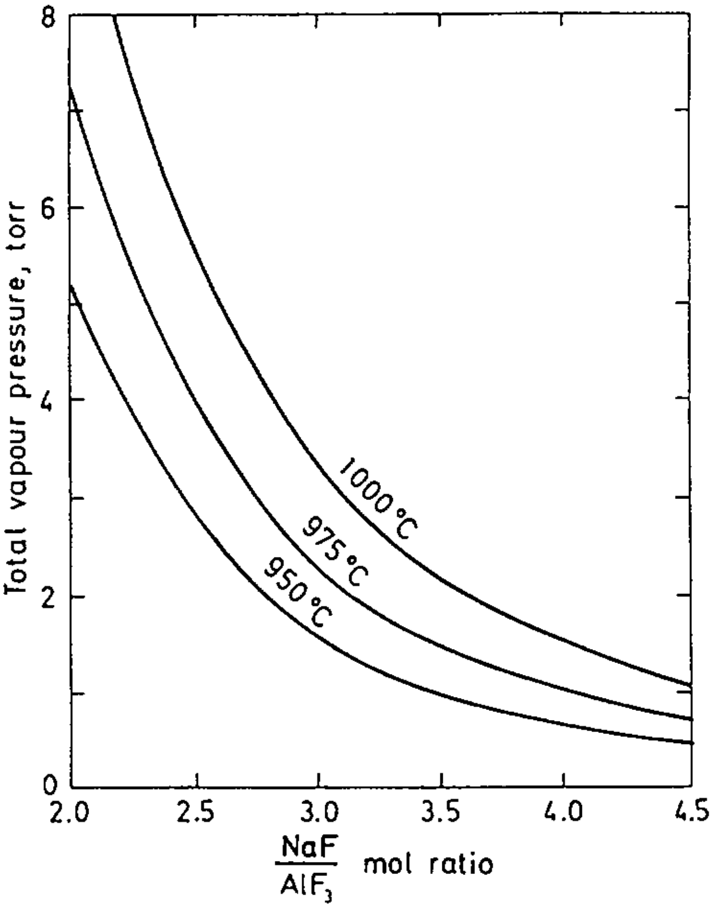

Figure 2: *Total vapour pressure over NaF-AlF$_3$ melts as a function of cryolite ratio (see text) for three temperatures, from [7].*

To compare HF adsorption data, the conditions under which the measurements were taken must be known. Ideally, one should generate a complete set of adsorption isotherms *i.e.*, using a fixed bed of alumina, loadings are measured when $[HF]_{inlet} = [HF]_{outlet}$ at a fixed temperature and humidity level, and a range of $[HF]_{inlet}$, as shown in Figure 3.

To optimise fluoride loadings in the dry-scrubber (secondary) alumina, it is essential to better understand how HF binds to the alumina surface and the course of any subsequent reaction between the adsorbent and the adsorbate. More than 20 years ago Cochran [**8,9**] reported the view that chemisorbed fluoride on the alumina forms AlF_3 on heating. However the thermogravimetric data is somewhat ambiguous and there is little evidence of any direct bonding between aluminium ions in the alumina surface and the fluoride. Such an interaction is observed between residual soda in the surface and fluoride [**14**], but this can only account for approximately one quarter of the total fluoride at typical dry-scrubber loadings.

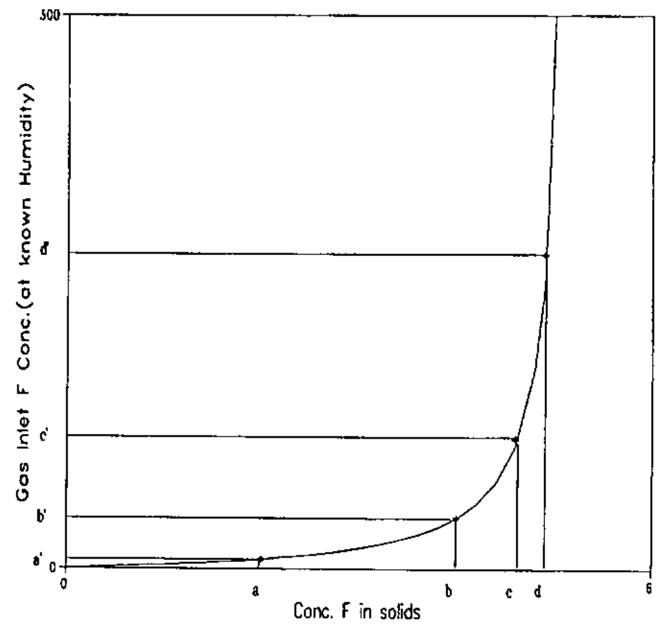

Figure 3: *Typical relationship between $[HF]_{inlet}$ and F loading on alumina for a given humidity condition and obtained by adsorption using a fixed bed of alumina until $[HF]_{outlet}$ = $[HF]_{inlet}$*

A more accepted view is that the majority of the HF is physisorbed in a multilayer sandwich structure, with intermediate layers of water [**17,18,19**]. There are several lines of evidence, including direct examination of the surface by photoelectron spectroscopy [**14**] which support this model. Without further treatment of the secondary alumina, desorption studies [**14,9**] suggest that the HF is then largely lost back into the scrubbing system when the alumina is added to the reduction cell.

Fluorocarbon emissions

When a cell is starved of alumina, a series of reactions commence which involve the formation of a gas film on the anode surface and ultimately electrolysis of the bath itself. This is accompanied by a rapid uncontrolled rise in cell voltage and is known as an "anode effect" (figure 4). Because of the difficulties in measuring dissolved alumina in the cell, the anode effect has traditionally been used as a control strategy to provide a reference point for alumina additions. The two major fluorocarbon emissions from aluminium reduction cells are CF_4 and C_2F_6 produced during such effects. Both are particularly unreactive species and are not captured in current scrubbing systems. A recent overview [**20**] attributes approximately 66% of the current atmospheric CF_4 (0.07 ppb) to emissions from the aluminium industry. Both are potent greenhouse gases [**21**] and although the amounts produced are small and declining, there is some concern over their emission. The amounts released are in decline because these gases are produced solely during anode effects [**2,3**] and the frequency of such events, and their use as a cell control strategy, is decreasing.

Roberts and Ramsey [2] have followed mass spectrometrically the evolution of CF_4 and C_2F_6 from a pilot cell and from a point-fed pre-bake potline. Their results indicate quite elegantly, that within current detection limits (0.1 ppm), no fluorocarbon emission occurs during normal operation of the cell. Emission is observed as the cell goes into anode effects and terminates as the anode effect is quenched. Results from Berge and Huglen [3], shown in figure 4, confirm this finding. Typical releases from an individual anode effect in the pilot cell gave up to 4000ppm CF_4 in the duct gas and potline trials indicated average releases of 0.2 kg CF_4 /tonne Al and 0.02 kg C_2F_6 / tonne Al. It is important to remember that this figure will vary widely depending on the frequency and duration of anode effects. For example, Berge and Huglen [3] report 0.06 kg CF_4 + C_2F_6/tonne Al.

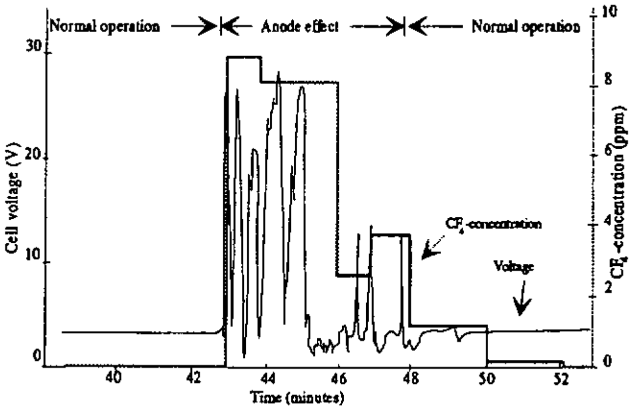

Figure 4: *Emission of fluorocarbon gases (heavy line) during anode effect in a Søderberg cell, from [3].*

Emission levels of the fluorocarbons were unchanged by passage through the dry-scrubber system. Although a number of decomposition paths are thermodynamically favourable [2 and references therein], the kinetic stability of the molecule prevents decomposition in the scrubber and essentially within the atmosphere. Asaksen *et al.*, [**21**] suggest an atmospheric lifetime of 100 years for CF_4 and C_2F_6. The difficulty in scrubbing these compounds and their environmental persistence, provides a strong argument for mitigation by improving cell operation procedure rather than gas treatment, principally by minimising the frequency and duration of anode effects.

Particulates in the Gaseous Emissions

Environmental concern is invariably heightened when emissions are visible, and there are several sources of potential particulate emission from the smelting operation. As already noted the electrolyte evolves sodium tetrafluoroaluminate (and its dimer) which disproportionates to chiolite as it cools, according to the following reaction

$$5NaAlF_4 \rightarrow Na_5Al_3F_{14} + 2AlF_3 \qquad (4)$$

Although it is well established that the vapours are tetrafluoroaluminate, because of its instability at lower temperatures this compound has never been detected as a solid. This reaction will give rise to extremely fine particle size material in the duct gas stream. It also results in further generation of hydrogen fluoride emissions through reaction of the fine particulate aluminium fluoride with the moisture content of the ducting air according to equation (2).

Whilst this disproportionation is the main source of the submicron particulates, the overall contribution to particulates arises from:

- hydrolysis of vapours in the gas stream
- entrainment of bath particles
- alumina dust
- carbon dust

Analysis of the particle size distribution of cell duct gas typically gives a bimodal distribution, as shown in Figure 5 [**13**]. Along with condensed volatiles, the fines fraction is also strongly enriched in impurities such as P, S, Ca, Ti, V, Mn, Fe, Ni etc. The other significant component of the fines is alumina. Nowadays the alumina refineries have better quality control, but still typically between 5 and 10% of the primary alumina is sub 45 micron, often with up to half of this being sub 20 micron. The alumina grains are agglomerates which during the various handling operations break down (attrition) and segregate, leading to an increase in the superfines and dust content. Particle breakdown can also occur during the dry scrubbing process especially if multiple passes are used. Aluminas that have a high proportion of crystalline water or absorbed volatiles can also undergo breakdown during feeding, generating a fine dust.

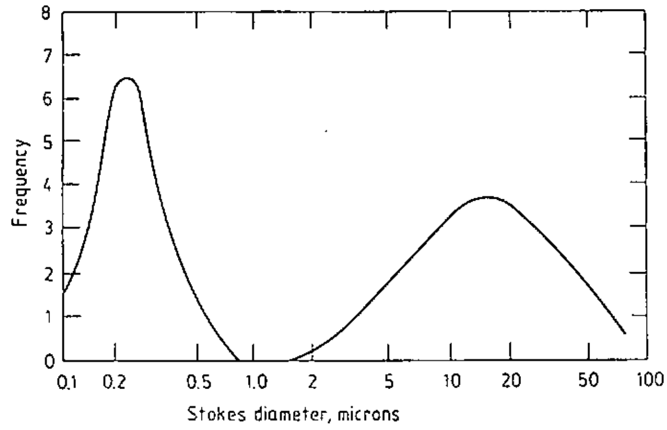

Figure 5: Typical size distribution of aluminium cell duct particulate, from [13].

Other Emissions

While the above sections have focused on the emissions of most environmental significance, it is important to recognise that other species, such as SO_2, polycyclic aromatic hydrocarbons (PAHs), hydrogen sulfide, carbon disulfide and carbonyl sulfide are also emitted [22]. At present, the levels are either not regulated or within regulated limits, but there is growing concern over the need to more strictly regulate SO_2 and PAH emissions in particular.

SO_2 is produced during the consumption of sulfur containing anodes. Depending on the sulfur content of the baked anode, SO_2 emissions range from 5-50 kg/tonne Al [**13**]. This gas can be effectively removed in wet scrubber systems when the pH of the absorbing solution is high. Dry scrubbers are less effective at trapping SO_2 which is preferentially displaced from the alumina surface by HF [**23**]. Some smelters with dry scrubber systems have installed auxiliary sea water scrubbers to remove SO_2 [**4**].

Polycyclic aromatic hydrocarbons are associated primarily with the use of coal tar pitch in anodes and cathodes. A wide variety of PAHs have been identified in cell emissions [**13, 24**], some of which are potential carcinogens. The emission of PAHs from smelting cells is highest for Søderberg cells, in which the anode is baked once it has been installed in the pot. Potroom PAH emissions from prebaked anodes are approximately 1/10th of their Søderberg counterparts [**24**]. However, compared to the total PAH present in the raw materials, only about 3% is emitted, the remainder decomposes or combusts at high temperatures [**24**]. PAHs are typically in the form of vapours, vapours adsorbed on particulate, or particulates, depending on their molecular weight.

Strategies to Reduce Emissions

The operation of modern pre-bake aluminium reduction cells in conjunction with dry scrubbing systems has substantially reduced emissions over previous generations of technology, whilst the shift away from Søderberg technology has also reduced the range of problems. In 1960 very few cells were enclosed and they relied on a good cover of alumina to minimise the emissions rate. Typically, a well run smelter emitted fluorides at the rate of about 5 to 7 kg of fluoride per tonne of aluminium produced. This contrasts with an industry average of 0.8 kg of fluoride per tonne of metal today. The emphasis on reducing emissions in the past (and for that matter in the future) have been focused on

- improved collection of the emissions to minimise direct release to the atmosphere
- operating procedures that minimise disturbances to the cell, especially to the alumina insulating cover
- process control to minimise the chance of anode effect onset
- operating at maximum Faradaic efficiencies
- use of efficient dry scrubbing systems with effective dust control systems.

The collection of emissions by hooding has been a challenge for the smelters because of the need to provide access to individual anodes for replacement, resetting and the like. Thus high pot exhaust gas flow rates (and hence operating at slightly reduced pressures) are used to ensure more than 99% efficiency in capture of the emissions. Typical duct flow rates range from 3 to 6 Nm^3/1000 amperes/hr.

In the last 20 years, resistance tracking process control strategies have been developed and these have reduced the anode effect frequency from more than 3 per cell per day to approximately 1 per cell per day. Cells fitted with point feeders and modern control systems can have anode effect frequencies below 0.1 anode effects per cell per day, with an industry average for point feeders of 0.5 anode effects per cell per day. This, as has been noted above, has reduced fluorocarbon emission rates to much more than compensate for increased metal production levels.

One of the adverse effects of point feeder technology (which gives better control and eliminates the anode effects frequency) is that most of the alumina fed to the cell has not been preheated. Therefore, physisorbed gases will be rapidly released. This not only leads to a higher recycle load but also to an increase in the hydrolysis because of the higher water content of the alumina feed. Thus the present feed and control strategy is a compromise between improved cell efficiency and stability, and higher emissions.

The electrolyte operating temperature and composition being used in modern smelters is also a compromise. With better control there have been endeavours to operate at lower temperatures for higher efficiencies. Whilst this should reduce vapour emissions, the lowering in temperature has usually been achieved by operating at a lower superheat and by lowering the bath temperature with aluminium fluoride. The lower superheat tends to lead to more operating instabilities whereas the adverse effects of high excess aluminium fluorides have already been noted.

Conclusions

Because smelter operators continue to push the cells to the limits of their performance there are still three problem areas in emissions control if the present process trends continue. These are the capacity of existing scrubber systems to handle increasing fluoride loads in the duct gas, the retention of adsorbed fluoride on the secondary alumina during cell feeding, and CF_4, C_2F_6 emissions which currently are not captured in the scrubbing circuit.

Although their entrainment is improving, emissions of gaseous fluorides from reduction cells are increasing due to cell operation at lower bath ratios and an increased water loading in the alumina feed. This must be compensated by increased loadings of fluoride on the alumina passing through the scrubber and retention of this fluoride load during cell feeding. The first problem can be addressed by using aluminas of higher and more active surface areas, however these feed increased adsorbed water loads back into the circuit, in turn generating higher HF emissions through bath and volatile fluoride hydrolysis. An alteration to alumina properties will also impact on its handling and dissolution properties.

The question of retention must be addressed by better understanding of the HF-alumina interaction. There is much conjecture and limited hard evidence as to the nature of this interaction in the scrubber but it is clear that reaction must extend beyond physisorption with co-adsorbed water to optimise fluoride loading and retention.

Acknowledgements

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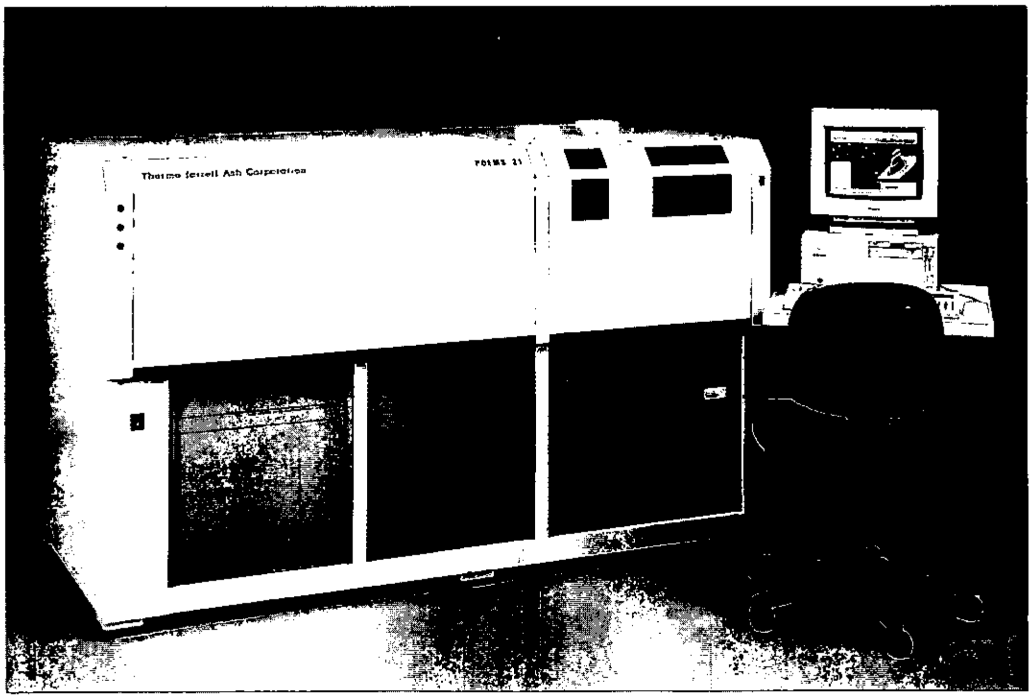

Thermo Jarrell Ash Corporation

THE RUTHERFORD BIRTHPLACE

John Campbell
Physics Department, University of Canterbury, Christchurch

Ernest Rutherford is New Zealand's most famous son, one of the most illustrious scientists the world has seen and the only New Zealander to have been awarded a Nobel Prize in Chemistry.

His work has ensured his immortality and so we should be using him to stimulate New Zealand children. We need to tell them that he had no more opportunity than they had, yet by hard work he achieved world fame. New Zealand needs such role models if it is to prosper.

In the 1960's overseas visitors trekking to Nelson, on a pilgrimage to the birthplace of their hero, were taken into the countryside and shown a pig sty - quite literally.

The house that once had stood on the site, and in which Ernest Rutherford had been born, had been demolished around 1921. Shortly after 1971, the centennial of his birth, the Rutherford relatives assisted the small local council to purchase the site in order to preserve it. For three decades a broken concrete slab on the roadside was a nation's monument to its most famous son.

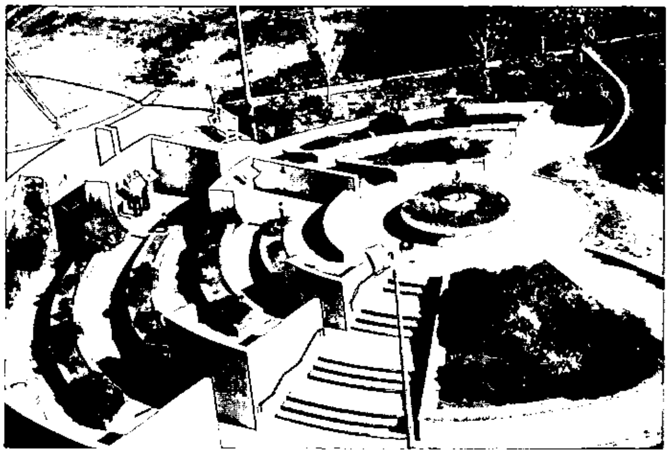
The Rutherford Birthplace - before 1987 (photo - John Campbell).

This appalled visitors. Even Australians were moved to approach the local newspaper to offer a small contribution towards a decent memorial.

The site also appalled New Zealanders. In 1987, at dawn on the 50th anniversary of his death, I visited the site. It was still a wasteland and a national disgrace. In the field behind, a cow raised its tail and spoke for me.

The Rutherford Birthplace project consisted of myself as convenor, Ross Moore, the Executive Officer of the Royal Society of New Zealand and Ken Shirley, the then local member of Parliament. Four hundred and fifty thousand dollars later, New Zealand and science had something it could be proud of.

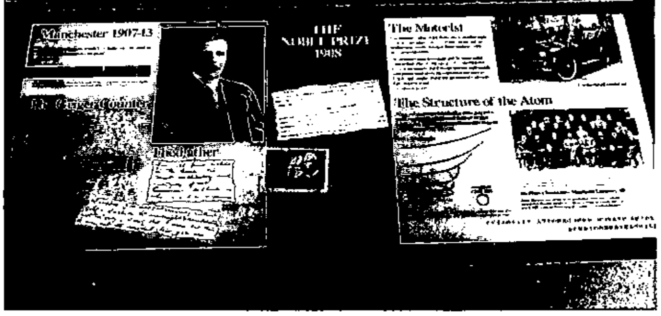
The Rutherford Birthplace is alongside State Highway 6, at Brightwater some 20km from Nelson towards the West Coast. It has been transformed into a tranquil haven where the story of his life and work is told using fourteen display panels and six sound stations in a garden setting. It is floodlit and open all hours, a little bit of science on our landscape. Tour operators list it on the itineraries of several local tours.



The Rutherford Birthplace - after 1994 (photo - Tasman Energy).

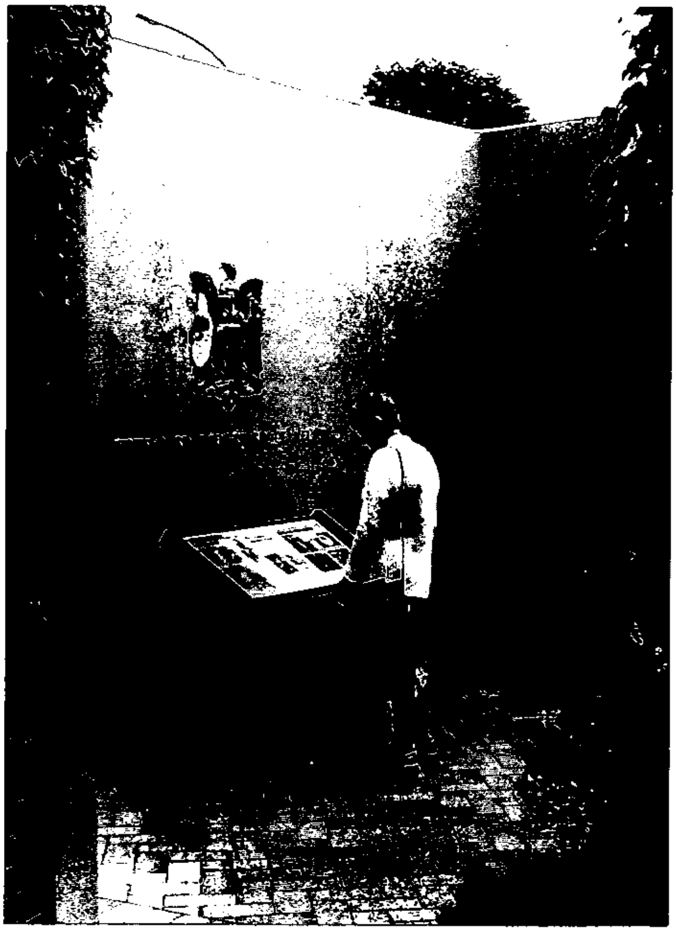
A mound is surmounted by a small bronze statue of a child - a New Zealand child stepping out into the future. Behind is a dairy farm representing his rural background. Descent off the mound is via a series of garden terraces along which six bays mark the turning points. Each bay is labelled with brass lettering and the coats of arms of the areas or universities featured.

The panels in the bays feature all manner of material, the school teachers who influenced him, cartoons of the science of the day, photos, ditties about him, snippets of his letters home ("The last fortnight has made me swear more than usual as my investigations have been wasted due to the cussedness of nature for things won't come off experimentally in the way theory points."), comments on science, his major and minor discoveries, events of the day, his support of industrial research and the stamps on which he has appeared. (Sweden, Russia, Canada and New Zealand). It should not be forgotten that he received the Nobel Prize in 1908, not for physics and splitting the atom as is so often assumed but for chemistry and explaining the nature of naturally occurring radioactive decay.



Display panel number 10 details his work at Manchester. It is not widely appreciated that Ernest Rutherford is the father of the Gieger-Muller tube.

Each panel starts with a quotation about him, displays a portrait (thus illustrating him at all ages) and finishes with a two line summary in Japanese, to cater for the major group of non-English speaking tourists.



A visitor to Nelson contemplates the final bay at the Rutherford Birthplace.

In each bay a button activates a sound station. Two are of voice, two feature family letters relevant to him and two are reminiscences (his brother Jim recalling a boyhood adventure and Mark Oliphant recalling working with Rutherford.)

Tree clusters in three of the corners represent the countries which gained through his fame - the totara of New Zealand, the maple of Canada and oak of England. Flax represents his father's trade, The flora looks good. I find the visitors often spend as much time examining the plants as they do the display panels. The recently amalgamated Tasman District Council have since purchased the site next door and have merged it in as a picnic area.

The Tasman District Council maintains the Rutherford Birthplace as a treasured reserve and has given the Minister of Tourism written assurance that they will keep it up to international tourism standards. A group of locals, the Friends of the Rutherford Birthplace, roster themselves to keep a daily eye on the site. A national group, The Guardians of the Rutherford Birthplace, is in place ready to be activated whenever future changes are proposed at or near the site.

Some 40 seeding patrons, including the New Zealand Institute of Chemistry and groups as diverse as the Australian Academy of Science and the Osterreichsche Adademie der Wissenschaften, allowed the work to be initiated but it was the 16 Principal Patrons, those contributing NZ$20,000 or more, (see list below) who ensured the success of the project. If you can return the favour and support them then please do so. New Zealand science owes them all a round of applause.

This list is as it appears at the Birthplace, in strict order of amount given, and for equal amounts, the ease of extraction.)

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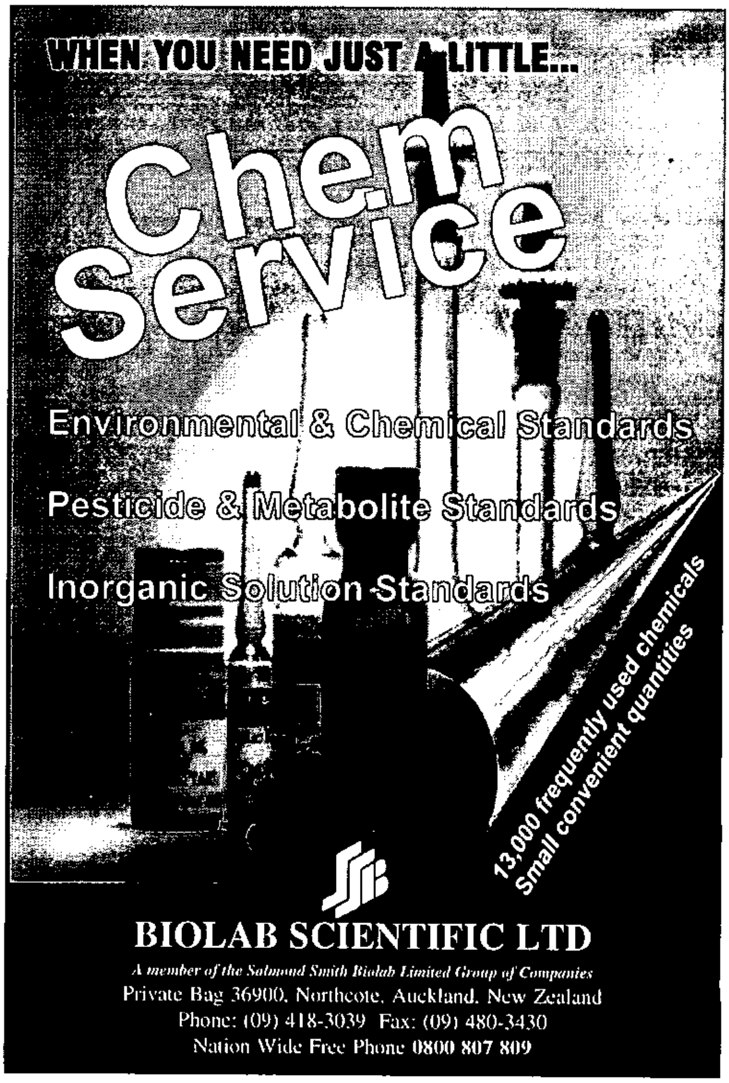

Aspects of Modern Environmental Analytical Chemistry

Lawrence J Porter, Simon J Buckland, Kevin Fellows, Donald J Hannah & Stuart W Glen
ESR:Environmental, P O Box 30 547, Lower Hutt

Modern standards of environmental and waste management increasingly demand the availability of versatile and high quality analytical chemistry. In practice, laboratories providing these services may vary greatly in size and capacity. Some operators may offer a strictly circumscribed suite of analyses, such as organics in water or pathogen testing, while large laboratories are able to offer a wide range of services. To the end user the success of the analysis provided by such laboratories must be judged on three main grounds: the quality and reliability of the data supplied; the appropriateness of the suite of analyses and their limit of detection to the particular problem being addressed; and response time.

These points will be discussed by reference to our own experience at the Institute of Environmental Science and Research Ltd (ESR) in carrying out work for a wide range of customers, both within New Zealand and internationally. ESR:Environmental is one of the largest analytical and consulting laboratories in Australasia and provides the complete range of consulting and analytical services needed by industry, commerce and government to meet a wide range of both statutory and voluntary environmental code requirements, including resource management and health and safety legislation. In addition to this, ESR:Environmental also offers a wide range of general analytical services for clients outside of the environmental arena.

Within ESR:Environmental, the Organic group has acquired an international reputation in the area of dioxin (PCDD & PCDF) analyses and in 1991 was recognised by the World Health Organisation (WHO) as one of the leading dioxin analysis laboratories in the world. This was achieved largely because of ESR:Environmental's traditional strengths in both organic and inorganic analysis, especially at low levels.

The Inorganic group of ESR:Environmental specialises in the determination of elements at ultra-trace levels in a wide range of matrices using Clean Room facilities and the latest in ICP-MS technology. The group works closely with a wide range of organisations, especially environmental consultants, and provides data that is routinely used for environmental impact and ecological baseline studies.

ESR:Environmental has been involved in major analytical contracts including the Sydney Water Board sewage sludge incinerators audit (one of Australasia's largest single environmental analysis projects), New Zealand Shellfish Biotoxin monitoring, and baseline environmental surveys. The latter work is typified by the recent investigation into the input and effects of organic and heavy metal contaminants in the Lake Rotorua catchment area (See CASE STUDY: LAKE ROTORUA GETS THE ALL CLEAR.).

ESR staff collect and prepare water samples under "clean" conditions.

The Sydney Water Board programme required the laboratory to carry out analyses on a wide range of complex matrices to determine the concentrations of an even wider range of environmental pollutants: inorganic (primarily heavy metals) and organic (including dioxins, polychlorinated biphenyls, polycyclic aromatic hydrocarbons, pesticides, and volatile organics). The data were used to calculate a mass balance of material entering and being emitted by a series of incinerators, thus providing disposal efficiency and environmental impact assessments.

Such a detailed assessment of an industrial facility and its operation is exceptional in the Southern Hemisphere. In general the requirements for multi-component analyses tend to arise predominantly from contaminated site work. The challenge in contaminated site investigations is to assess from necessarily limited sampling (to avoid prohibitive costs) the degree of contamination and potential future utilisation of such sites. Once again ESR:Environmental is well placed to carry out this work as such assessments usually require determination of a wide range of chemical types in a wide range of matrices including soil, water, air, and biota. Often this work is required to very low-detection limits in the parts per billion (ppb) or parts per trillion (ppt) range depending on the chemical type.

Low detection limits require two factors to be addressed in a laboratory: achievement of a low chemical background, which requires stringent attention to maintenance of clean areas (especially for heavy metal analyses), clean glassware (or plasticware) and apparatus and pure chemicals; modern instrumentation with emphasis on automation, quality assurance and advanced data processing.

How can an analytical laboratory be judged on the basis of appropriateness, quality and reliability of its data? Simply, a successful laboratory must employ the right staff, use the correct techniques, and have available the appropriate instrumentation and equipment. The laboratory must also be aware that it can make matters very confusing for the non-specialist by using a host of technical terms on the assumption that these terms are understood by all parties. Our experience shows that one of the most important functions of the analytical contracting laboratory is to take the customer through their requirements, explaining terms if need be, so as to arrive at a sensible set of analyses to address a particular problem. In this sense, every environmental situation must be considered to be unique. ESR:Environmental takes pride in being an environmental analytical and consulting laboratory which is able to advise its clients, in a clear and understandable manner, which analyses are required in each environmental situation.

By way of illustration, a customer commonly asks a laboratory to supply analyses for "Priority Pollutants" from a particular source, having somewhere read or been told this is a good starting point for addressing a problem. However, Priority Pollutants are a US EPA list of organic chemicals, often toxic, which reflect most of the possible sources of pollutants in North America.

In the New Zealand context, this is often inappropriate. One must first ask: why are the analyses required and what are the likely sources of pollution? It is likely that some of the required compounds may not be on the EPA list. It is quite possible therefore that a full EPA list, if properly analysed, would prove very expensive and inappropriate as some relevant compounds will not been reported as they do not appear on the EPA list. This concern is certainly not trivial. For example, the cost of a thorough assessment of a single large site may run to tens of thousands of dollars for analytical services alone. This could easily be considerably more costly for a full evaluation with environmental impact studies.

CASE STUDY:

LAKE ROTORUA GETS THE ALL CLEAR

ESR:Environmental has recently been involved in a major investigation into the input and effects of organic and heavy metal contaminants in the Lake Rotorua catchment, in the Bay of Plenty (BOP) region. The study was commissioned by Environment BOP which is based in Whakatane, and coordinated by the Forest Research Institute (FRI) in Rotorua. With some of New Zealand's most natural and unspoiled scenery next to sustainable forestry plantations for both local and export markets, Environment BOP is keen to see the vital water supplies kept as pristine as possible.

ESR:Environmental has a well-earned reputation as one of Australasia's leading experts in trace contamination analysis, particularly for the determination of the highly toxic polychlorinated dibenzo-*p*-dioxins and dibenzofurans (dioxins). The ESR:Environmental analytical laboratories at the Wellington Science Centre contain some of the most advanced technologies available today, which support its specialist expertise in baseline environmental surveys of this type.

The study assessed the entry of contaminants into Lake Rotorua and their concentration in the water column, sediment and biota. With a wood processing facility located within the catchment, particular emphasis was placed on the levels of contaminants associated with timber treatment chemicals.

Samples were collected by FRI scientists then passed on to ESR:Environmental for analysis for dioxins and a range of organochlorine and organophosphorus pesticides.

"The success of the study reflects the close collaboration we have with other Crown Research Institutes such as the Forest Research Institute and regional environmental monitoring organisations such as Environment BOP," says ESR:Environmental senior scientist, Dr Simon Buckland.

The major findings of the study indicated that levels of contaminants monitored were below ANZECC guidelines for the protection of aquatic life, and fell well within several international drinking water values. Low levels of contaminants were also found in lake sediments and biota.

"While there were slightly elevated levels of dioxins and pentachlorophenol at one site within the catchment area, these were consistent with the run-off from the wood processing complex contaminating the groundwater at this location," Dr Buckland says.

Environmental surveys of this type play an important part in monitoring the effects of human activities on the environment and organisations need to ensure that they have the knowledge and appropriate procedures in place to support the long term protection of our ecosystem.

ESR:Environmental is committed to assisting organisations in this regard with the analytical and consulting expertise necessary to ensure that we all become more aware of the need to actively protect our environment.

This leads to one of the commonest ways in which analytical laboratories may mislead clients. A common scenario is, for example, for a simple extraction of a sludge to be carried out and the analyte under study quantified by analytical techniques. Most frequently this is undertaken by GCMS which, due to its sensitivity and specificity, offers enhanced quality assurance to the analysis. Any organic pollutants whose spectra are detected are reported as positive, and those which are not, are listed as "not detected" with the implication that they are not present.


Automated GCMS facility at ESR's laboratory in Wellington

This can be misleading in many ways. As is common in analytical chemistry it is easy to say something is there, but it can only meaningfully be said something is not detected if detection limits are quoted. To do this an internal or surrogate standard must be added to the matrix and a recovery calculated. Only on the basis of such data, which provides detection limits for a compound or class of compound, can a result of "not detected" at a quoted level be given with any confidence. Also, it is important to note that unless a determination of recovery of standard(s) is made there is no guarantee the analysis would have detected the compound even if it was present. Similarly, unless there were duplicate and replicate analyses run for an acceptable number of samples, one can tell nothing about the reliability of the analyses.

As with any contractual arrangement, it must be a case of "buyer beware". The customer must question the contracting analyst on aspects of their methodology. What internal standards are used? Is an accepted analytical method used? What quality assurance protocols are in place? Unless the analyst can confidently answer these points one must have reservations about using their analytical services.

An old saying states "Quality is what is remembered when the sweetness of price is forgotten". It is all too easy for the customer to use a laboratory offering rock bottom prices. The penalty for this may be inferior data which is of little or no use to the customer. On the other hand, if there is trust and a good dialogue between the customer and analyst there are immense benefits for the customer who will have confidence that the job was done right the first time.

The final point that must be raised regards accreditation. Analytical laboratories should be accredited by a recognised laboratory accreditation organisation (eg. TELARC). It must be stressed that assessment is not the same as accreditation. If a laboratory has been assessed it simply means they have been visited by one of these organisations. Furthermore, the customer must be aware that TELARC (or similar) accreditation does not necessarily cover the full operation of the laboratory, as a laboratory may only be accredited for one aspect of its work. In the same vein, ISO9000 only means that documentation control is of a high standard, but does not address how well the laboratory is able to perform the analyses. To have any status a laboratory must be accredited and must be happy to supply documentary evidence to back it up.

In summary, the following points are considered to be fundamental requirements for a laboratory involved in environmental analytical chemistry:

- Proven experience in routine environmental monitoring and analysis of contaminants, especially to trace and ultra-trace levels;
- Qualified analysts to undertake the work and offer technical support to the customer in the way of interpretation of results, advice on sampling procedures, etc.;
- The highest level of quality assurance procedures to ensure accurate, reproducible results;
- Able to offer appropriate response (turnaround) times, and keep the customer informed at all stages;
- Accredited by a recognised laboratory accreditation organisation (such as TELARC) for the methodologies being employed.
- Suitable instrumentation and facilities for carrying out the required analyses;
- Able to act as a consultant on environmental issues relevant to the studies being undertaken e.g. resource management requirements.

3RD AUSTRALASIAN SYMPOSIUM ON APPLIED ICP-MASS SPECTROMETRY

The 3rd Australasian Symposium on Applied ICP-Mass Spectrometry will be held in Wellington, New Zealand from 3rd - 5th May 1995. The previous symposium was at the Animal Research Institute of the Queensland Department of Primary Industries in Brisbane in May 1993.

The programme will include at least three international plenary speakers who will describe new developments in ICP-MS and associated technologies. In addition to specialist papers selected for presentation there will be several practical workshops using the ESR ICP-MS.

Further details can be obtained from either:

Terry Manning or Pam Coulson
ESR
15-17 Murphy Street, Thorndon
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BOOK REVIEW

WRITING ORGANIC REACTION MECHANISMS: A PRACTICAL GUIDE

Michael Edenborough
Taylor and Francis: London, 1994, pp.420
ISBN 0 7484 0171 1 (paper) GB £15.95

The guidebook is presented in three distinct sections that cover Basic Principles, Mechanisms and Appendices (which occupy some 130 pages of the text). Part I (pp.1-113) is divided into seven short chapters (Introduction, Electron Counting, Covalent Bonding and Polarization, Shapes of Molecules, Stabilization of Charged Species, Thermodynamic and Kinetic Effects, and Acid/Base Characteristics). After a brief Introduction Part II (pp. 170) encompasses a further nine chapters each devoted to a specific reaction type (Nucleophilic Substitution, Electrophilic Substitution, Radical Substitution, Additions to Carbon-Carbon Multiple Bonds, Additions to Carbon-Oxygen Double Bonds, Eliminations, Sequential Addition-Elimination, Rearrangements and Fragmentations, and Redox Reactions). The Appendices cover a Glossary of Terms, Abbreviations, Molecular Notations, Stereochemical Terminology, Oxidation Numbers, and a Skeletal Index.

Michael Edenborough is now a practising barrister but he has provided a book which any student of organic chemistry will find valuable. While the contents of the introductory chapters are to be found in most general chemistry text books the author has gone to great pains to write simply and clearly, and to provide structural diagrams that are well sized and easy to follow. However, in comparison to most (more expensive) general texts, the publishers have elected for monochrome presentation. In today's market this is especially noticeable but it does provide a book that is affordable. Whilst the guide employs SI units, IUPAC nomenclature is not strictly followed and conventions such as italics letters for *N*, *N*-dimethyl and *R/S* for chiral centres appear only in the Glossary. The style of the text is to provide descriptive material and follow it by a question which is then answered. The approach is ideally suited to a guidebook and it should prove especially helpful to the beginning student. However, pagination problems emerge occasionally such that the answer at the bottom of p.71 is followed by its textual question at the top of p.72. There are other irritations such as the sectional sub-headings that give the designators for s and d orbitals in upper case (p.75/76). More important to the mechanistic organic chemist is the use and location of the essential "curved arrows". These are generally well handled, but the use of two distinct styles of "curve" on the same page (p.110) for the capture of an electrophile by NH_3 is curious and potentially confusing.

The critical Part II "Mechanisms" is appropriately divided into logically flowing chapters. Generally the layout is good and the syllabication scientific; flur-obenzene (p.153) represents an exception. The sections on nucleophilic and electrophilic substitutions are nicely handled. The inclusion of the less common electrophilic aliphatic substitution serves to illustrate the comprehensive coverage here, a feature which does not pertain to the growing and important area of radical substitution where captodative radical stabilization does not feature. 'Addition Reactions to Carbon-Carbon Multiple Bonds' includes all of the recognised reaction types. However, the sub-section on pericyclic reactions does not tell the reader what a pericyclic reaction is - a definition is included in the Glossary but there is no reference to the cyclic delocalization of electrons. Here the treatment is at the superficial 100-level without reference to orbital symmetry control and in marked contrast to other sections of this chapter. The remaining chapters are adequately handled. Although my personal preference is to retain classical descriptive acronyms such as S_N1, S_N2, etc. and avoid confusion by creating new ones (the subscript N appears as an in-line small capital), it is the use of an almost full circle arrow around an sp^2-hybridized heteroatom to depict an addition-elimination sequence, e.g. p.133, 154 and 221, that is not only curious and non-conventional but also potentially very misleading. It clouds the involvement of an all important tetrahedral intermediate.

Despite the criticisms raised above, I have little doubt that any student who takes the trouble to work through the book will be in an excellent position to rationalise unseen organic reactions. In this context the author's claim that a student "will be able to write a plausible mechanism for any organic reaction that you (may) meet on an undergraduate chemistry course" is fully justified.

In the context of text-book purchases the sum of GB £15.95 is not excessive. The "Glossary" with its *ca.* 800 entries, while not a replacement for the revised IUPAC "Terms for Physical Organic Chemistry" that the physical organic chemist should have, provides a better collection of pertinent definitions that most students would find in other common sources. This reason alone provides enough encouragement for me to recommend that they obtain a copy of this "Guide".

B. Halton, Chemistry Department, Victoria University

An Evaluation of the Place of ICP-OES and ICP-MS in the Environmental Laboratory

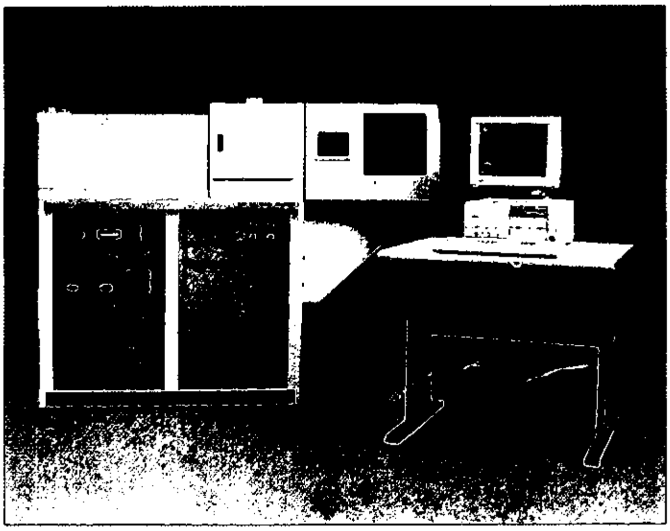
Thermo Jarrell Ash, USA

For the commercial environmental laboratory, looking to upgrade its metals analysis capability, it might appear that ICP-MS, with its superior detection limits, is the logical tool. This is especially so if the laboratory is upgrading from flame and graphite furnace AAS and is looking to decide between ICP-OES (Inductively Coupled Plasma - Optical Emission Spectroscopy) and ICP-MS (Inductively Coupled Plasma - Mass Spectrometry). Another factor which must now be considered is the inherent advantages of the axially viewed plasma recently made available on commercial ICP-OES instruments. In this discussion, a comparison between the two techniques will be presented from the viewpoint of the commercial laboratory, which is seeking to provide a service and make money. This is, of course, not the same as seeking the ultimate performance in terms of detection limits. Several questions must be addressed, and satisfactory answers found, in making this decision.

The first question that we must ask concerns performance differences, an ICP-MS can generally detect metals down to levels as low as 1 ppt in clean samples. This is about 100 to 1,000 times lower than a standard ICP-OES, or 10 to 100 times lower than the Thermo Jarrell Ash ICAP 61E Trace ICP-OES. However, depending on the anions present, some critical elements are detected very poorly or even not at all. An important example is As. In the presence of Cl^-, it is not possible to determine As. This is because As is a monoisotopic element, with the same m/z as $ArCl^+$. Other elements can have very poor detection limits (by ICP-MS standards), also because of isobaric overlaps, which prevent the major or, in the worst case, only, isotope from being used for analysis. Additionally, once real samples are introduced, the well-known inability of the instrument to tolerate high concentrations of dissolved solids becomes a problem. It is often necessary to dilute samples by 100 times or more in order to be able to run them. Now, of course, you are down to the levels of a normal ICP-OES instrument, although you still have all the difficulties of operating a mass spectrometer.

The second question addresses the operation difference between ICP-MS and ICP-OES. Basically, the important difference is that OES detects light, which does not degrade the detector or the "monochromator". That is, the photon strikes the PMT photocathode and is essentially "gone". Any stray light bounces around (hopefully on the light baffles where it does no harm), getting weaker and weaker until it too, is "gone". A mass spetrometer, on the other hand, detects the ions itself. The ions strike the detector, and stay there. The result is a build-up of ions, which causes a continuous gradual loss of sensitivity. Additionally, the ions that are not collected by the detector can cause buildup on the quadrupole filter and lenses, further increasing maintenance costs. The detector in an ICP-MS is typically replaced when the sensitivity falls to 30% of the original value. Detector replacement is not a trivial task, requiring very clean conditions, white cotton gloves and considerable manual dexterity.

Another operational difference is speed. ICP-MS is typically a slow technique, with real labs reporting throughputs of between 6 to 10 samples per hour. This is due to the fact that it is slow relative to OES, as well as the need for more frequent restandardization to compensate for drift. This is probably a lot slower than manufacturers claim, but it is what labs that are using the technique report. The ICAP 61E Trace ICP-OES, on the other hand, will run 25 samples per hour at detection limit levels.



The Thermo Jarrell Ash ICAP 61E Trace ICP-OES

The third question is whether you have the infrastructure needed to support an ICP-MS. This would include such things as a room that is clean enough to handle ppt-type samples, water and reagents that are clean enough to handle significant contamination, and even the availability of a method for checking the sample for major constituents prior to running on the MS. This is particularly important because of the potential for destroying the detector if a high concentration of material gets onto it. While modern instruments generally have safety features to minimize this possibility, they all depend on the detection of the rate of rise of the signal, which means that some of the major constituent has to get in just to be detected. In general, in the USA, no lab will run samples on an ICP-MS without checking by OES first.

Finally, we must ask whether a market exists for analysis at the levels of which an ICP-MS is capable. For environmental work today, OES using Trace Technology provides the fastest and most robust means of providing adequate levels of detection. It uses proven instrumentation, remarkably similar to the standard polychromatory systems that have been available for many years. The ICAP 61E Trace, with a large number of systems sold and running all the required elements in water, waste, sediments and soils has further proven the value of the Trace Technology. Several have been sold in the USA to customers who originally came to look at our POEMS combination CID Spectrograph and ICP-MS instrument. As stated earlier, while the MS may provide much lower ultimate limits, in the real world, the Trace does equally well at much lower acquisition, operating and maintenance cost. Also, given the specific inability to measure some critical elements, the ICP-MS has some serious problems for a commercial environmental lab.

All of the above is not designed to suggest that these is no place for ICP-MS. We at TJA produce one which addresses several of the difficulties discussed above. However, in the light of these questions, which are aimed at the needs of a high throughput commercial laboratory, that presumably wants to go where there is present and foreseeable future need. An ICAP 61E Trace will provide excellent results, based on requirements, with much faster sample turnaround time and lower operating cost.

Thermo Jarrell Ash has developed the Trace Technology to offer the lowest detection limits available in the real world today. The ultimate OES instrument in this regard is the ICAP 61E Trace. This system has been fully optimized for low detection limits, coupled with the necessary IEC and background correction capabilities to ensure that these limits can be met with the types of samples the typical environmental lab encounters. These include waters, waste, sediments, soils and sludge. The technology has now been expanded to encompass the sequential Trace Scan and the uniquely versatile IRIS AP. These systems all give significant improvements in performance compared with their standard counterparts. However, due to the nature of the polychromator ICAP system, this lends itself better to the types of optimization needed.

One should not think that the development of the trace technology is trivial thing. As far back as the seventies, it was suggested that axial viewing of the plasma might be beneficial[1]. However, it took until 1993 for somebody to determine what was needed to make it work. TJA has sold a large number of ICAP 61E Trace systems worldwide. Virtually all of these were sold on the basis of demonstrations to very skeptical customers.

Philosophically, it is easy to understand where resistance to the Trace might come from. It is about the same price as a newer low-cost ICP-MS, yet seems to represent old technology. People might ask why it took so long to figure out how to make axial plasmas work and how come it has happened now. There are good answers to all these questions, but they are really not relevant. What is relevant is that this is an instrument that can provide the capability to do all the environmental work that is likely to be required over the next decade without having to relegate some elements to graphite furnace AAS, and it does so with the ease, speed and reliability of an ICP-OES. It is therefore much more likely to contribute to profitable operations than an ICP-MS.

[1] Koityorhan, R: FACSS Presentation, 1976

For more information on Thermo Jarrell Ash instruments contact: Andrew Pearce, Sci Tech, P O Box 663 Dunedin.
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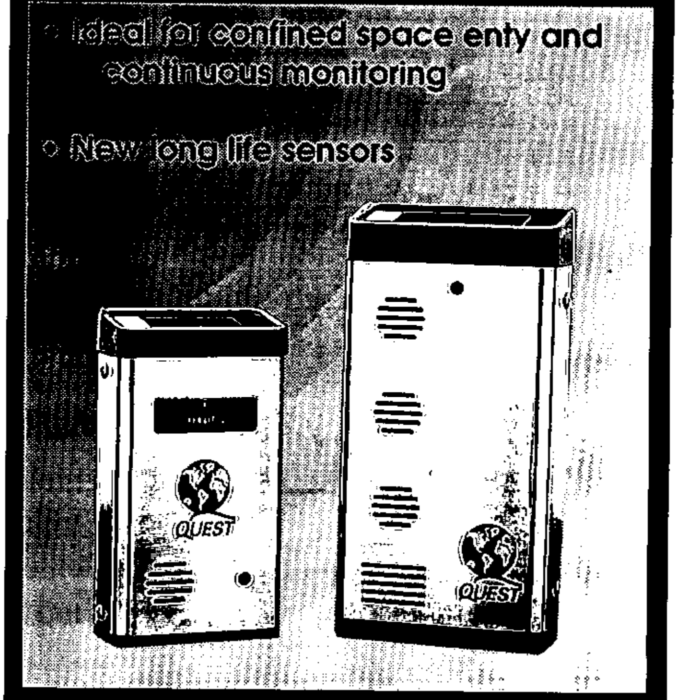

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The Derwent Drug File is a selective abstracting and monitoring service scanning over 1150 journals issued by publishers from over 40 countries. English-language abstracts are written by subject experts and each record is extensively indexed to provide excellent recall. Records additionally contain CAS Registry Numbers and Enzyme Commission Numbers, where applicable. A thesaurus is available. The Derwent Drug File contains worldwide information on all aspects of drugs, from drug design to post marketing surveillance. Coverage includes articles on drug analysis, biochemistry, chemistry, pharmacology, adverse effects, clinical studies, disease treatment, toxicology, animal studies, disease treatment, toxicology, animal studies, mechanism of action, drug interaction, etc. Dating back to 1983, the database contains presently 1.4 million records and is updated weekly.

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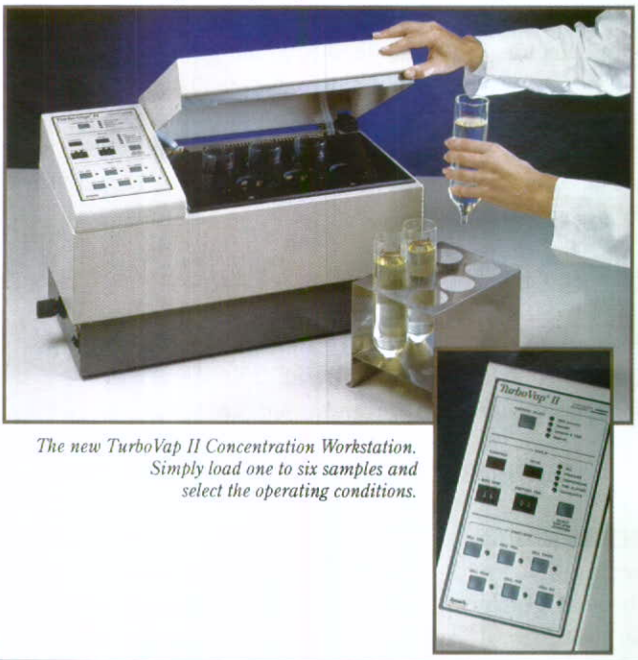

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or circle number 25 on your reader reply card.

ONE INJECTION TWO RESULTS: SIMULTANEOUS NITROGEN/SULPHUR ANALYSIS

The Antek Model 7000NZ Simultaneous Nitrogen/Sulphur analyser has both detectors installed for simultaneous determinations. This versatile instrument combines pyro-chemiluminescent nitrogen detection with pyro-fluorescent sulphur detection. Using one furnace for sample combustion and oxidation, the effluent from the furnace flows through both detectors for simultaneous quantitation of nitrogen and sulphur. The analytical range for each detector remains unchanged. The second detector does not lengthen analysis time. Typical analysis time for simultaneous nitrogen/sulphur is one minute for gases and liquids and 1 to 15 minutes for solid samples.

Contact: Chris Nipper, Douglas Scientific
P O Box 45-027 Auckland
Ph: (09) 8375447, Fax: (09) 8360668
Outside Auckland Ph: (0800) 735725
or circle number 26 on the reader reply card.

CHLORPHENOXY HERBICIDE ANALYSIS

RESTEK offer an optimised analysis for chlorphenoxy herbicides in a brief article which advertises gas chromatography columns and herbicide calibration standards for EPA 515, 615 and 8150. The method was optimised using the Pro ezGC™ software which they also offer in their catalogue. For your copy of this article, a RESTEK catalogue or an answer to your GC analysis questions contact:

Stuart, Alphatech Systems Ltd
P O Box 37583 Parnell, Auckland
Ph: (09) 3770392, Fax: (09) 3098514
or circle number 27 on your reader reply card.

PROGRAMMABLE SCANNING UV/VISIBLE HPLC DETECTOR

The Model LC-295 UV/Visible detector now forms a fully integrated part of the Perkin-Elmer 1022 LC Plus HPLC system. The new LC-295 detector can be programmed to change wavelengths during a run with an automatic AUTO ZERO function after each change. Up to 20 wavelength changes can be programmed over the range 195-600 nm. A total of 10 methods can be stored for recall later. This dual beam detector has extremely high sensitivity and baseline stability. A variety of flow cells are available - analytical, microbore, biocompatible and preparative.

Contact: Perkin-Elmer New Zealand
P O Box 38-833 Wellington Mail Centre, Wellington
Ph: (04) 5890451, Fax: (04) 5870380
or circle number 28 on the reader reply card.

NEW PRODUCTS

ANALYSING DRINKING WATER VOLATILES

In August 1992, EPA Method 524.4, Rev. 4.0 added 24 new compounds to the existing list of 60 volatiles in water. RESTEK offer an article describing an analytical method, column and standards for performing EPA 524.4 Rev. 4.0. The method was optimised using the Pro ezGC™ software which they also offer in their catalogue. For your copy of this article, a RESTEK catalogue or an answer to your GC analysis questions contact:

Stuart, Alphatech Systems Ltd
P O Box 37583 Parnell, Auckland
Ph: (09) 3770392, Fax: (09) 3098514
or circle number 29 on your reader reply card.

EUROSTAR - A NEW LINE OF LABORATORY STIRRERS FROM IKA

The basic operations of mixing, suspending, homogenising and the uniform distribution of temperature in open or closed containers are of great importance in production or research. In the laboratory small stirrers must meet high requirements for precision and reliability. IKA has built on its years of experience in producing "leading edge" stirring equipment with the release of the new EUROSTAR laboratory stirrers.

A major feature of the new EUROSTAR stirrers is electronic power control which allows a large stirring speed range to be set with a single speed controller; a gear-shift as formally required with mechanical stirrers is no longer necessary. The stirring speed range available with the new EUROSTAR stirrers is 50-2000 l/min. Safety features include automatic cut-out in the event of stirrer overload and "smooth start". "Smooth start" is an innovative feature that runs the stirrer slowly up to the set stirring speed. This overcomes the "spraying" of stirred media on start-up.

The modern design of the new stirrers means they occupy less of your valuable bench space, and totally enclosed drives and electronics give long-term maintenance free operation, even under the harshest conditions. Five models are available - two to stir volumes up to 10 L and three to stir volumes up to 40 L or highly viscous media.

Stirrer speed and torque can be monitored and controlled by PC. The user can easily programme the stirrer using a standard NAMUR software command set, or control software is available from IKA.

For more information on the range of new Eurostar stirrers available that will set new standards in reliability and performance contact: Labsupply Pierce (NZ) Ltd
P O Box 34-234 Birkenhead, Auckland
Ph: (09) 4435867, Fax: (09) 4447315
or circle number 30 on the reader reply card.

MONITORING UNDERGROUND STORAGE TANKS

RESTEK offer the highest concentration standards (50,000 µg/mL) available for performing LUST analysis. Produced under an ISO 9001 registered quality system, the standards are available in 1mL or 5mL ampoules and include screw cap vials for storage of unused portions. For your copy of the standards price list, a RESTEK catalogue or an answer to your GC analysis questions contact:

Stuart, Alphatech Systems Ltd
P O Box 37583 Parnell, Auckland
Ph: (09) 3770392, Fax: (09) 3098514
or circle number 31 on your reader reply card.

QUATERNARY DIODE ARRAY HPLC SYSTEM

Perkin-Elmer Nelson has announced an upgrade for the 1020 LC PLUS system which enables it to take full control of the 410 quaternary pump as well as upload and manipulate spectra from the LC235C diode array detector. The software can display upslope, apex and downslope spectra, perform overlays and calculate peak purity. Autosampler control from the 1020 integrator fully integrates all aspects of the system. Biocompatible systems are available.

Contact: Perkin-Elmer New Zealand
P O Box 38-833 Wellington Mail Centre, Wellington
Ph: (04) 5890451, Fax: (04) 5870380
or circle number 32 on the reader reply card.

RESTEK's NEW S/SL INJECTOR FOR HP GCs

After many years of using HP 5890 GCs RESTEK have re-engineered the HP Split/Splitless injector to offer many features not found in the original design. For your copy of an article describing the Improved Split/Splitless Weldment Assembly, a RESTEK catalogue or an answer to your GC analysis questions contact:

Stuart, Alphatech Systems Ltd
P O Box 37583 Parnell, Auckland
Ph: (09) 3770392, Fax: (09) 3098514
or circle number 33 on your reader reply card.

FOCUS ON ENVIRONMENTAL EXCELLENCE

We simply need that wild country available to us, even if we never do more than drive to its edge and look in for it can be a means of reassuring ourselves of our sanity as creatures a part of the geography of hope. WALLACE STEGNER

WATERS are producing advanced analytical tools for comprehensive environmental testing that provide more options in sampling, detection and information management. From field sample preparation to legally defensible LC/MS, WATERS' new Environmental Analysis brochure describes a world of capabilities for protecting our world. To request your copy contact: Steve Lawson , Alphatech Systems Ltd
P O Box 37583 Parnell, Auckland
Ph: (09) 3770392, Fax: (09) 3098514
or circle number 34 on your reader reply card.

NEW PRODUCTS

NEW GENERATION TOC ANALYSIS FROM SHIMADZU

This exceptionally compact and light Total Organic Carbon analyser has many advanced features which make it environment and user friendly.

The TOC-5000 uses an NDIR detector which combined with a large sample capacity combustion system ensures superior sensitivity with detection limits of less than 10ppb of TOC.

A large LCD provides high quality images minimising eye fatigue. The screen displays operating conditions, data, peaks, and other messages.

Precise and adjustable sample injection and automatic sparging produce repeatable results easily. The injection volume may be changed over a wide range in microlitre increments. This feature combined with the data processing functions provides accurate, reproducible data. Sample injection is automatic-set the sample in place and press the START key; all the analysis procedures, from sparging to data printout, are carried out in a completely automated sequence.

The performance proven low temperature combustion-NDIR method reduces operating costs by prolonging the life of the combustion tube and catalyst while also reducing power consumption. High salt samples such as sea water and brines may be analysed easily without salt artefacts or combustion tube devitrification. Total organic carbon substances are oxidised rapidly and effectively, regardless of their composition.

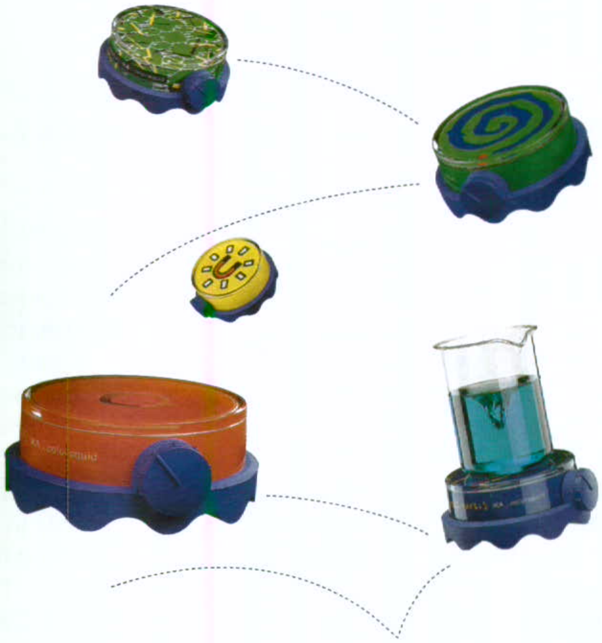
Other features include a simple keyboard and convenient function keys to provide easy operation for a wide variety of options, an expanded field of inorganic carbon measurement, a wide variety of convenient functions for automated operation as well as easy upgradability to an automatic sampling system, an on-line system and a solids/slurries sampling system.

Contact: Keith Lewis, Douglas Scientific
P O Box 45-027 Auckland
Ph: (09) 8375447, Fax: (09) 8360668
Outside Auckland Freephone: (0800) 735725
or circle number 35 on the reader reply card.

COLOURFUL, INDIVIDUAL AND RELIABLE NEW IKA "COLOUR SQUID" MAGNETIC STIRRERS BRING MORE FUN INTO THE LABORATORY

Individuality instead of anonmity, fun, colour and a lively working environment .... plus top performance to suit all laboratory applications. These were the basic concepts for the new range of SMALL magnetic stirrers from IKA. With 12 exciting new designs everybody can get their "personal" COLOUR SQUID stirrer.

ADIEU TRISTESSE..........



Suitable for mixing up to 800mL of thinly liquid media using a magnetic stirring bar up to 30mm long, the new COLOUR SQUIDS easily find a place in research, quality control, or school laboratories, or the pharmacy dispensary, or anywhere where small, efficient mixing is required. Mixing speed can be adjusted in the range 0-1500 l/min.

The 'two-component' construction combines the transparence and chemical resistance of a glass bonnet with the robustness and chemical inertness of a HYTREL plastic base. The precise fitting of the two components gives a dust-proof instrument protected against the penetration of aggressive vapours or liquid spills.

The stirrer is powered by a 0.5 W, electronically controlled EC-motor that is totally maintenance free. The small size (diameter 130mm, height 48mm) and lightweight design (480g) mean that your COLOUR SQUID is very portable - move it around the laboratory to where its needed, and it won't occupy much of your valuable working bench space.

For more information and a catalogue of the design choices in this exciting new range of low cost magnetic stirrers contact:

Labsupply Pierce (NZ) Ltd
P O Box 34-234 Birkenhead, Auckland
Ph: (09) 4435867, Fax: (09) 4447314
or circle number 36 on the reader reply card.

GC STATIONARY PHASE FOR VOLATILE ORGANIC COMPOUNDS

To meet the growing requirements of environmental monitoring laboratories J & W Scientific has specifically engineered a GC stationary phase DB-VRX for the analysis of Volatile Organic Compounds (VOCs) which can be used for the US EPA method 502.2. DB-VRX exhibits the fewest coelutions of any GC column commercially available for this method, enhancing peak identification for volatiles analysis. The selectivity of the DB-VRX phase has been "tuned" to provide adequate separation of the six "gases" included in the 60 compounds specified in EPA Method 502.2. This is done without sacrificing performance over the entire range, eliminating the added cost and hassle of cryogenics.

J & W Scientific assures column-to-column reproducibility of this new phase by individually testing every DB-VRX column specifically for VOC analysis. Partition ratio (*k*), resolution and retention index (*I*) values are maintained within narrow ranges. Cross-linked and bonded for extended life, DB-VRX can be solvent rinsed. The combination of these ingredients results in an easy-to-use column that requires no special expertise to achieve a high degree of confidence in results.

DB-VRX is available in several lengths, internal diameters and film thicknesses to suit virtually any GC system configured for volatiles analysis.

Contact: Clare Hodgson, Douglas Scientific
P O Box 45-027 Auckland
Ph: (09) 8375447, Fax: (09) 8360668
Outside Auckland Ph: (0800) 735725
or circle number 37 on the reader reply card.

ORGANIC SOLVENT WASTE BOTTLE LEVEL-MINDER

To prevent messy and dangerous spills of organic solvents in the laboratory, the new Jour Level-Minder monitors liquid levels and provides a visible indication of safe levels and an audible alarm when your waste bottle nears full. Equipped with two convenient waste connections Level-Minder can provide safe monitoring of dangerous solvent mixtures from two GPC sample preparation or HPLC systems. For more information, a Jour catalogue or an answer to your HPLC PEEK plumbing questions contact:

Stuart, Alphatech Systems Ltd
P O Box 37583 Parnell, Auckland
Ph: (09) 3770392, Fax: (09) 3098514
or circle number 38 on your reader reply card.

CHROMATOGRAPHIC PROFILE MATCHING

Deciphering the difference between complex chromatograms is difficult to do if you are unfamiliar with what to look for. Forensic scientists and flavour chemists have relied largely upon experience to assess the differences between samples.

Perkin-Elmer's Harwell MATCHFINDER pattern recognition software now provides a simple and automatic way of qualitatively analysing batches of chromatographic data. Typical applications include flavour and fragrance analyses, oil spillage identification, PCB profiling and fuel accelerants in fire debris.

MATCHFINDER is a Windows based package that provides three key approaches to chromatographic data comparison.

- An assessment of overall chromatogram similarity
- Detection of the standard chromatogram within the sample chromatogram.
- An assessment of commonality between two data sets.

A translation program is provided to convert Perkin-Elmer Nelson's TurboChrom data into MATCHFINDER. Other data formats can also be translated into MATCHFINDER.

Contact: Perkin-Elmer New Zealand
P O Box 38-833 Wellington Mail Centre, Wellington
Ph: (04) 5890451, Fax: (04) 5870380
or circle number 39 on the reader reply card.

MS WINDOWS BASED LIQUID SCINTILLATION COUNTER

Wallac's new 1414 WinSpectral liquid scintillation counter is fully controlled by MS Windows software. The first counter of its type in the world, WinSpectral makes computer-aided liquid scintillation counting a reality by employing the advanced features of MS Windows. Such features include Dynamic Data Exchange (DDE) to other Windows programs running concurrently with WinSpectral, hypertext help screens, report format generator, direct networking with optional network card, and ODBC (open database connectivity).

Automatic performance control and verification are standard features on WinSpectral. The basic stability is maintained continuously by ACSS (automatic continuous spectrum stabilization). ACSS is in operation at all times and ensures results validity, for example immediately after power failure. Easy GLP is a feature which automatically monitors, saves and analyses the values of critical performance parameters. Windows style GLP (good laboratory practice) reports can be printed automatically without any additional QC summary software.

WinSpectral has a maximum capacity of 1248 samples. It allows direct counting from Eppendorf tubes and microcentrifuge tubes without carrier vials. When performing single, dual or triple label DPC counting the user is not required to set counting windows, quench curves or spillover factors. Using the counter's Easy Count feature, counting of single label samples and calculation of DPM results is a single button operation.

Contact: SciTech, P O Box 663 Dunedin
Ph: (03) 4777860, Fax: (03) 4777870
or circle number 40 on the reader reply card.

PROGRAMMABLE GC INJECTORS

Two new temperature programmable injectors are now available for the Perkin-Elmer AutoSystem GC. The temperature programmable split/splitless mode of operation prevents non volatile material contaminating the column. Applications include trace level analysis, analysis of labile compounds and solvent purge injection mode. The programmable on-column injector operates in the on-column mode only. Both injectors can be programmed independently of the oven or programmed to track the oven temperature.

Contact: Perkin-Elmer New Zealand
P O Box 38-833 Wellington Mail Centre, Wellington
Ph: (04) 5890451, Fax: (04) 5870380
or circle number 41 on the reader reply card.

THE NEW VE1000 SIEVING MACHINE FROM RETSCH

The world's first, unique "self-adjusting" sieving machine features:

- All-electronic oscillation amplitude control independent of sieve stack mass and sample weight
- Maximum accuracy and reproducibility
- Equally suitable for both dry and wet sieving
- For use with test sieves of up to 203mm in diameter
- Sealed keypad, ergonomic layout
- Digital setting of all working parameters
- Time-controlled operation in 1 - 99 minute intervals and "continuous"
- Interval-controlled sieving option:
  10 - 99 seconds with 2 second OFF interval
- Oscillation amplitude variable between 0.2 - 3mm
- Quick-action clamping lid with "Autolift" feature as standard
- Simple operation, easy to clean
- Low-noise operation
- Electromagnetic power drive, minimum maintenance requirements
- Conforming to CE-requirements

Contact: Radiometer Pacific Ltd
P O Box 12-416 Penrose, Auckland
Ph: (09) 5731110, Fax: (09) 5731106
or circle number 42 on the reader reply card.

TURBOCHROM 4 CHROMATOGRAPHY SOFTWARE

Perkin-Elmer Nelson has released a new revision of its popular TurboChrom software, which controls Perkin-Elmer LC systems. It can connect up to eight LC or GC systems with unique buffered interfaces that control the instruments and store data. The TurboChrom Navigator screen gives you fast, easy access to any point in the software simply by clicking on an icon. Methods contain all instrument and data handling parameters. The software has been organised to deliver fast and convenient reprocessing in a Windows environment. Software options like Turbo Methods Development, Turbo Simulation, GPC, System Suitability, Turbo Gel, Turbo Enhanced Plot, Turbo Kovats Index, Simulated Distillation, Natural Gas and Turbo Peak Matcher are available to suit specific applications.

Contact: Perkin-Elmer New Zealand
P O Box 38-833 Wellington Mail Centre, Wellington
Ph: (04) 5890451, Fax: (04) 5870380
or circle number 43 on the reader reply card.

SUPERCRITICAL FLUID EXTRACTION (SFE) LEADS TO TIMELY PCB CLEANUP

Analysis of organic compounds in soils is most commonly done using time-consuming laboratory procedures that may take several days to weeks to complete. Seeing a need for a field method that would provide quick turnaround times and increase the efficiency of site assessments and remedial investigations, EPRI developed the supercritical fluid extraction (SFE) technique. The fast turnaround time achieved by using SFE with a gas chromatograph unit for rapid on-site analysis of PCBs in soil samples, allows the user to identify and excavate the contaminated soil quickly with little remediation contractor downtime.

The SFE technique is highly reproducible, has high recovery rates, and produces results similar to Soxhlet laboratory and microscale solvent field extraction techniques. SFE can be applied to materials frequently encountered by electric utilities, including soils containing coal tars, petroleum oil tars, PCBs, as well as fly ash and flue gas desulphurisation sludge.

Contact: Chris Nipper, Douglas Scientific
P O Box 45-027 Auckland
Ph: (09) 8375447, Fax: (09) 8360668
Outside Auckland Ph: (0800) 735725
or circle number 44 on the reader reply card.

CHROMATOGRAPHY INTEGRATOR FROM PERKIN-ELMER

The new Model 1022 Personal Integrator is a higher performance version of the Model 1020. The 1022 can collect up to two channels of synchronous data. The hardware features a 40 Mb hard disk, 1.44 Mb floppy drive, VGA graphics, mouse and DOS compatibility. The software is mouse driven and has on-line help for each screen. Advanced quantitation, reporting and batch reprocessing functions are included as standard. Optional control of Perkin-Elmer GCs and HPLCs is available.

Contact: Perkin-Elmer New Zealand
P O Box 38-833 Wellington Mail Centre, Wellington
Ph: (04) 5890451, Fax: (04) 5870380
or circle number 45 on the reader reply card.

ECONOMICAL MICROWAVE DIGESTION

At half of the cost of competitive systems QUESTRON Microwave Digesters can really speed up your sample processing. Truly the most economical range of purpose-built microwave digestion systems, QUESTRON Digesters incorporate all of the safety systems and include all the sample containers and the spare carousels you'll need for safe, reliable high throughput, top performance, sample extraction.

Contact: Steve Lawson, Alphatech Systems Ltd
P O Box 37583 Parnell, Auckland
Ph: (09) 3770392, Fax: (09) 3098514
or circle number 46 on your reader reply card.

NEW LOW-COST TITRATION SOFTWARE

In many laboratories, the endpoint of a potentiometric titration is calculated by tedious and time-consuming manual graphical methods. Although automatic titrators make this process much easier, many laboratories do not perform titrations frequently enough to justify the purchase of these expensive instruments.

McLeod Scientific has recently released EndPoint, a specialised titration spreadsheet program which is an alternative to manual graphical techniques. This program provides accuracy and speed at an extremely low price. EndPoint was developed for quality control laboratories in the pharmaceutical industry and has undergone extensive validation and is widely used in this field. The program uses a novel complex algorithm to calculate the endpoint volume from the titration data which is entered by the analyst. The results are presented in a neat, tabular report along with a graphical presentation of the titration data. In addition, EndPoint calculates the purity of the titration sample according to British Pharmacopoeia and United States Pharmacopeia standards.

The spreadsheet is available in versions for Microsoft Excel for Windows, Lotus 123 for Windows and Microsoft Excel for Macintosh. The EndPoint program disk includes worked examples which use actual titration data. The EndPoint manual describes the principle of the program, installation and write protection, worked examples and validation data. On the practical side, the EndPoint manual is rugged enough to withstand the bumps and spills of a laboratory environment.

The total cost of the EndPoint package is $95.00 including GST.

More information and a free EndPoint demonstration disk is available from the sole New Zealand distributor, McLeod Scientific.

Contact: McLeod Scientific
P O Box 24-465 Royal Oak, Auckland
Ph: (09) 624-2045
or circle number 47 on the reader reply card.

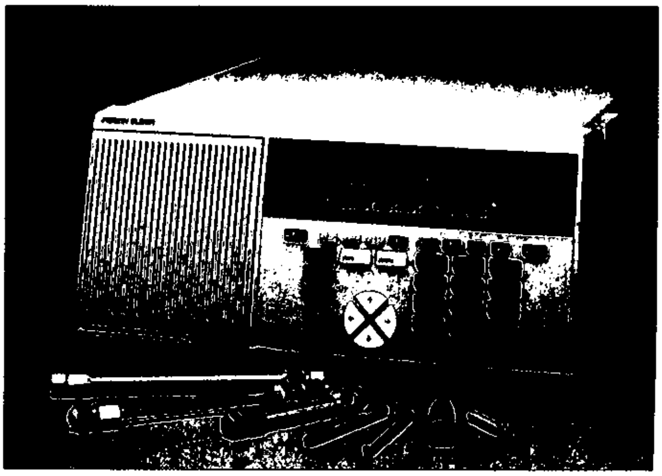
THE NEXT GENERATION OF GAS AND VAPOUR MONITORING

The UVIC portable gas and vapour detection system is for environmental monitoring of VOCs and other organic and inorganic compounds. The UVIC uses a photoionisation detector (PID) to provide high speed readout (0.2 secs) and high sensitivity (10ppb) of hundreds of hazardous compounds. The instrument can be pre-programmed with up to thirty multi-point calibration curves so that field calibration can be avoided and the anti-fouling configuration guarantees long-term calibration stability. A non-volatile memory can store a full days data including gas concentration, location, time etc.

Contact: Environmental Technology Ltd
P O Box 101-260, Auckland 10
Ph: (09) 444-5927, Fax: (09) 444 5755
or circle number 48 on the reader reply card.

NEW HPLC PUMP FROM PERKIN-ELMER

The new Series 200 HPLC Pumps are available in isocratic, binary and quaternary versions. The pump features a low pressure mixing design with an upgrade path from isocratic to quaternary systems. They have a low and high pressure cut out, idle time shut-off to stop the pump at the end of a run and an in-built system controller. A number of input/output signals and two timed events are available for interacting with other HPLC modules. Bio-compatible versions are available.



Contact: Perkin-Elmer New Zealand
P O Box 38-833 Wellington Mail Centre, Wellington
Ph: (04) 5890451, Fax: (04) 5870380
or circle number 49 on the reader reply card.

NEW PRODUCTS FROM UPCHURCH SCIENTIFIC

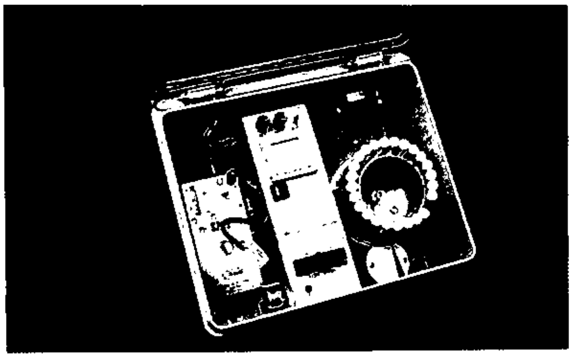
Injection Moulded Shut-off Valves: Upchurch Scientific now offers its injection moulded shut-off valves in Tefzel or PEEK. The new Tefzel valve is highly resistant to chemical attack, turns at a much lower torque, is very economical, and holds up to 1000 psi. This valve can also be used up to 500 psi in gas applications. Available for either 1/16" or 1/8" OD tubing, these valves are shipped complete with Upchurch flangeless fittings so you have everything you need to hook it directly into your system.

Colour Coded Teflon Tubing: Upchurch Scientific now extrudes colour coded, translucent FEP (Teflon) tubing to assist you in organising and maintaining your LC system; and giving you the ability to observe the flow of the mobile phase. For light sensitive applications, black Teflon tubing is also available. This highly inert tubing is extruded to the same high standards of quality as all of Upchurch Scientific's products. The 1/16" OD FEP tubing is pressure rated to 1000 psi and the 1/8" OD tubing is rated to 500 psi.

Contact: Clare Hodgson, Douglas Scientific
P O Box 45-027 Auckland
Ph: (09) 8375447, Fax: (09) 8360668
Outside Auckland Ph: (0800) 735725
or circle number 50 on the reader reply card.

SEQUENTIAL TUBE SAMPLER FOR COST-EFFECTIVE, AROUND-THE-CLOCK AIR MONITORING FROM PERKIN-ELMER

The Model STS 25 Sequential Tube Sampler from Perkin-Elmer provides around-the-clock monitoring of the changing concentrations of volatile organic compounds (VOCs) in workplace and ambient atmospheres. The Model STS 25, developed by Perkin-Elmer in collaboration with the U.S. Environmental Protection Agency (US EPA) Atmospheric Research and Exposure Assessment Laboratory, is a cost-effective alternative for an application that normally requires complex on-line air monitoring equipment.



The STS 25 sequentially samples air onto a series of up to 24 sorbent tubes. Once collected, the samples can be transported for thermal desorption - gas chromatography analysis in the laboratory. The system - a small, portable unit housed in a weather proof box, is operated via a 12 volt battery or mains electricity. When the tubes are not collecting samples, they are effectively sealed with diffusion limiting caps to prevent ingress of atmospheric pollutants.

The unit is compatible with most conventional monitoring pumps which can operate at a flow within the range 10-50mL/min. The STS 25 is designed for pumped air sampling onto Perkin-Elmer thermal desorption tubes.

Contact: Perkin-Elmer
P O Box 38-833 Wellington Mail Centre, Wellington
Ph: (04) 5890451, Fax: (04) 5870380
or circle number 51 on the reader reply card.

NEW TESTS FOR PETROLEUM CONTAMINATION IN SOIL

Medtec Products Ltd has introduced two new easy-to-use RaPID Assays from Ohmicron Environmental Diagnostics, Inc. Systems that are accurate, sensitive, faster and much less costly that traditional methods of testing for petroleum contaminants in soil.

The new kits extend Ohmicron's widely accepted magnetic particle technology to the detection of petroleum products.

One RaPID Assay System measures PAH or polynuclear or polycyclic aromatic hydrocarbon contamination in soil. The other, for total BTEX, measures the volatile organic compounds (VOCs), such as benzene, toluene, ethylbenzene and zylenes (BTEX) and other small aromatic hydrocarbons in soil and water. These compounds have been identified as priority pollutants by the US Environmental Protection Agency.

VOCs found in fuels and solvents, are the most common chemicals found at contaminated sites, and are major problems at service stations, fuel transfer facilities and refineries. PAHs are found at manufactured gas plants, coking operations, wood preserving sites and petrochemical waste disposal sites.

The RaPID Assays and RaPID Prep™ Sample Extraction Kits for PAHs and total BTEX can be used on-site or in the laboratory. They enable more efficient use of personnel and equipment, which helps speed remediation. Traditional technology for analysing PAHs and total BTEX in soil requires large samples and lengthy preparation and uses expensive instruments such as gas chromatographs or mass spectrometers.

Ohmicron's new easy-to-use immunoassay tests for PAHs and total BTEX can be completed in one hour after sample preparation and provide the same precision and sensitivity as complex laboratory instrument tests.

Ohmicron's PAH and Total BTEX RaPID Assays are available in 30- and 100- sample kits. The new tests double the number of RaPID Assay products for the environmental market. The range already includes tests used worldwide to detect polychlorinated biphenyls (PCBs) and pentachlorophenol (PCP) contamination and manage site remediation activities.

Ohmicron expects to introduce several new environmental tests during the coming year.

Contact: Wayne Sprosen, Analytical Equipment
Medtec Products Limited, P O Box 38-543, Petone, Wellington
Ph: (04) 567 0011, Fax: (04) 567 2821
or circle number 52 on the reader reply card.

AN UNRIVALLED RANGE OF MONITORING AND TESTING PRODUCTS

We all know that looking after our environment is vitally important. New and old regulations mean mandatory testing is increasing. Biolab Scientific Ltd is adding and improving the range of environmental monitoring and testing products available, particularly for waste and water. The following are a few of the companies we represent:

The Hach Company, USA
Hach manufacture systems to monitor and test watr quality (both potable and waste water). Products include test kits, systems and instruments for laboratory testing and process instruments.

Hach is the world's largest manufacturer of single-dose reagents, which contain the correct amount of reagent for one test. The package eliminates tedious time consuming mixing and measuring.

Released recently from Hach are the new laboratory turbidimeters. They are designed for regulatroy reporting, quality control and scientific research. (See advertisement on page xx).

Millipore, USA
Recognised leaders in the production of membranes and filtration apparatus. Millipore supply 0.45μm grided cellulosic membranes for the microbiological analysis of aqueous solutions. Also available are a wide variety of certified media as well as apparatus for laboratories involved in high throughput processing of aqueous samples.

Millipore are involved in the analysis of fluids for particulate contamination, using both the particle count and gravimetric methods.

ISCO Environmental, USA
A world leader in water and waste water monitoring - automatic samplers and open channel flow measurement.

New from Isco Environmental is the model 6000 VOC (Volatile Organic Compound) Automatic Sampler designed to meet EPA protocols.

ADC, England
Produce a range of gas analysers and support equipment. ADC analysers and systems are used in a wide variety of applications including testing of stack gases and landfill gases, leak detection, fermentation, exhaust analysis etc.

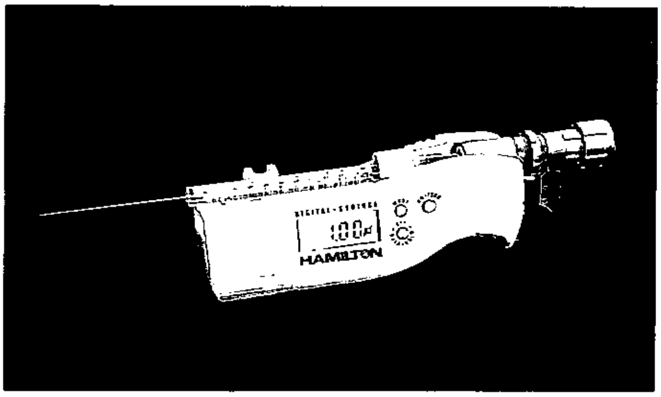
Varian Sample Preparation Products, USA
Varian's unique EnvirElut oil and grease extraction columns offer a fast, accurate and cost effective way to monitor water sources. The EnvirElut column provides efficient sample preparation for a variety of instrumental analysis and is totally freon-free.

EnvirElut provide the ability to use solid phase extraction for EPA/ASTM method 413.1 (gravimetry) and ASTM method 413.2 (IR). Whether your sample is waste water, aqueous effluent or surface/ground water, this oil and grease column can handle it.

Contact: Biolab Scientific Ltd
Private Bag 36900, Auckland
Freephone: 0800 806809
Fax: (09)4803430
or circle number 53 on the reader reply card.

NEW HAMILTON NIST TRACEABLE, CALIBRATED SYRINGE

As the world leader for over 40 years in precision fluid measuring devices, Hamilton Company, of Reno, Nevada, is pleased to introduce the only NIST traceable, calibrated syringe device available.



With the Hamilton Digital Syringe, the best accuracy and precision data possible is obtained from a manually operated syringe, with a certified accuracy below ±0.5% of the full scale volume of syringe.

Full details of this highly accurate device are in the new 1995 Hamilton Precision Fluid Measuring Catalog, available now from their authorised New Zealand dealer, Alltech Associates Inc.

Contact: Alltech Associates, Inc.
P O Box 100352 North Shore Mail Centre, Auckland 10
Ph: (09) 444-3230, Fax: (09)444-2399
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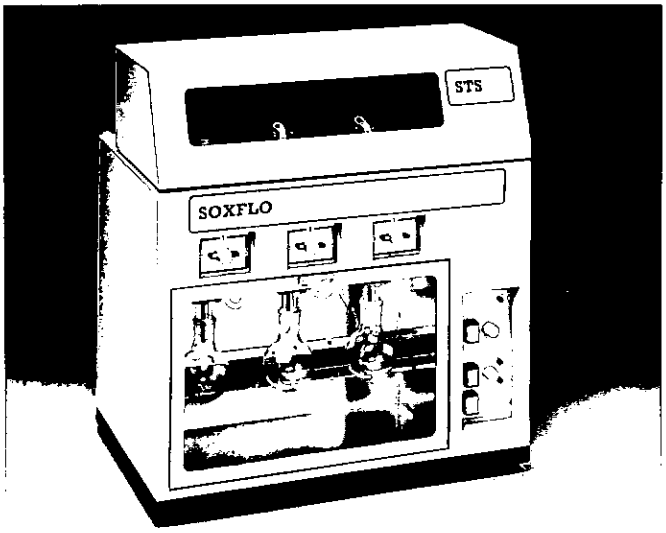


Contact: Analytical Technologies NZ Ltd
P O Box 37-472 Parnell, Auckland
Ph: (09) 366-0557, Fax: (09) 309-4001
or circle number 58 on the reader reply card.

LETTERS TO THE EDITOR

22.12.94

CANCER RESEARCH LABORATORY
School Of Medicine
University Of Auckland
Private Bag 92019, Auckland

Dear Sir,

In a letter to the Editor in the previous issue, I noted that a strategic review committee was being set up to collate member's comments and review the issues for Council. I now wish to inform members that the review committee comprises myself, the two Vice-Presidents (Mr Nath Pritchard, 159 Hakanoa St, Huntly and Dr Rob Whitney, Coal Research Assn. of NZ, P O Box 31-244, Lower Hutt), together with Dr D E Wright, 15 Perendale St., Hamilton and Dr G E Norris, Dept of Chemistry and Biochemistry, Massey University. Any members of the committee, or the Executive Officer, would be glad to receive written comments for the committee to consider. **Comments may also be forwarded through Branch Delegates at the February 1995 Council meeting, and to me during my lecture tour of the Branches in March 1995. Please have your say.**

Sincerely,

William A Denny
President, NZIC

16.12.94

120 MacLeans Road
Bucklands Beach
AUCKLAND

Dear Sir,

Recent correspondence concerning the administration of the Institute has involved comments which constitute an attack on the present Executive Officer. This is regrettable but inevitable since it appears that the appointment of the Executive Officer did not produce the expected improvement in the administration and other aspects of the affairs of the Institute.

Denis Hogan is certainly correct in pointing to the deficiencies in running the affairs of the Institute when these were handled on a voluntary basis by members. It was precisely because of these deficiencies that a decision was made to appoint the full-time Executive Officer with the payment of substantial remuneration. I participated in these discussions and supported the appointment in the anticipation that NZIC would reach the desired status of a growing professional body. This has not occurred and it appears that the Institute's malaise is, in fact, worsening. Probably the worst aspect has been the failure to implement a forceful campaign for attracting membership, In fact John Roger's letter emphasises the fact that membership is now about the level it reached some twelve years ago.

Apart from membership there surely can be no excuse for failure to give proper notice of the AGM or to distribute related reports. Similarly it is quite unreasonable that the auditor should find it necessary to tag the balance sheet with the statement "control over income prior to its being recorded is limited, and there are no practical audit procedures to determine the effect of this limited control."

In another matter, John Rogers and I have been seeking information on the activities and future of the Chemical Education Trust. We spent a good deal of time and raised a substantial sum of money to establish the Trust in 1987 and it has proved impossible to find out how these funds are to be used. We wrote to the Executive Officer on August 12 and received advice that the matter would be placed before the August meeting of Council with an undertaking that our letter and the response of Council would be published. The letter and response have not appeared in the November issue of the journal and one wonders whether the whole matter has been quietly pushed to one side. In addition we have made repeated unsuccessful requests for the publication of the annual reports of the trustees of CET. In this regard it should be noted that the CET is a statutory body and as such there is a legal requirement for NZIC to submit a report and accounts on an annual basis.

It is heartening to know that Bill Denny is forming a small committee to examine the role and direction of the Institute. One can only hope that this will lead to emphasis on the need for a fully professional body providing a basis for national acceptance of the qualifications of members. The duties of the Executive Officer must be examined and an understanding should be reached of what is expected from him by the Institute.

Finally, one can only deplore the suggestion by Denis Hogan that NZIC might cease its endeavours to be fully professional and comparable with RACI and RSC. The current economic picture must surely point to an increasing and unfulfilled demand for qualified chemists whose status should be underlined by membership of NZIC.

Yours faithfully

A W Mackney
Past President - NZIC

NZIC NEWS

NZIC CONFERENCE

In the last issue of *Chemistry in New Zealand* (Volume 58 No.6, November 1994), the date for the next NZIC Conference was given in error as December 1995. The next conference will actually be held in Dunedin in December 1996.

For Details Contact:
Dr R M Carr
Chemistry Department
University of Otago
P O Box 56 Dunedin
Ph: (03) 4797932
Fax: (03) 4797906
e-mail: chemmail@otago.ac.nz

NZIC COUNCIL NEWS

CHEMICAL EDUCATION TRUST

A review of the functions of the Chemical Education Trust has been undertaken, following discussion at the August 1994 Council Meeting. As reported in the September issue of "Chemistry in New Zealand", a request had been received from two Honorary Fellows, Mr A W Mackney and Dr J Rogers that the functions of the Trust should be re-evaluated - a copy of their letter follows this update (see opposite).

At the November 1994 meeting of Standing Committee of Council, the following recommendations were adopted and have been conveyed to the Trustees, who are:-

Professor B Halton
Professor G B Petersen
Professor A G Williamson (Chairman)

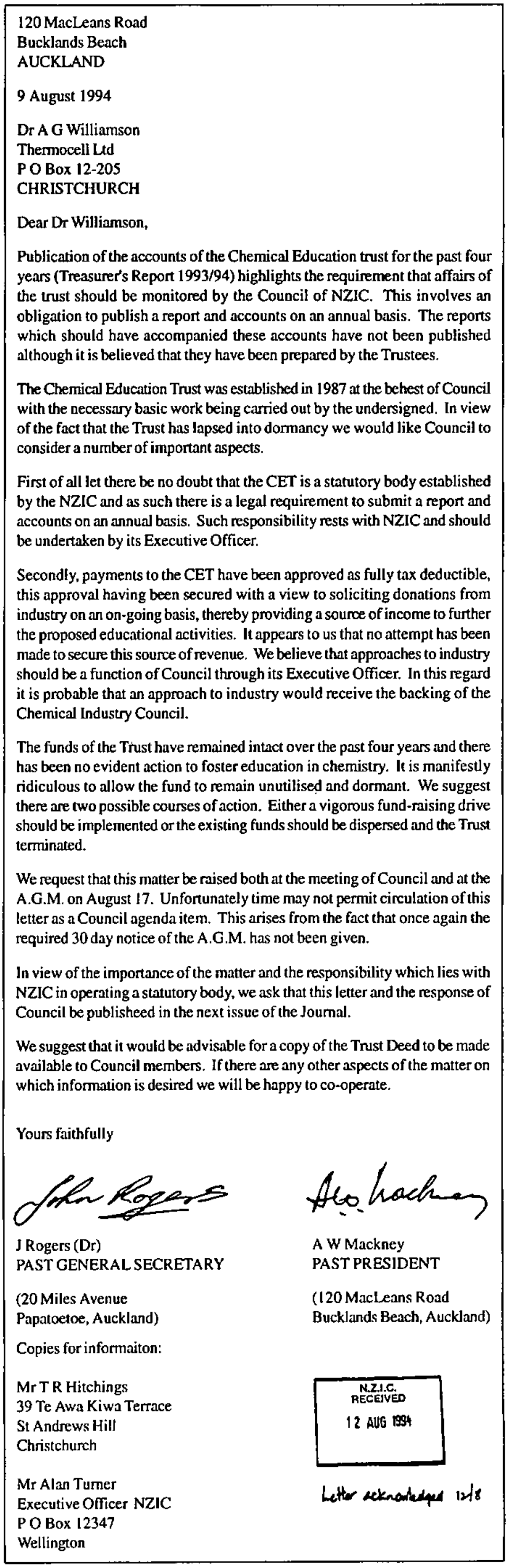
Philosophy
The basic philosophy will be the promotion of chemical education activities, with the emphasis, when required, on new initiatives. (An example was a donation to get the Chemical Olympiad Project underway).

Direction
The Trustees will act within the guidelines of the basic philosophy, but may from time to time be sympathetic to receive a direction from Council.

Finance
One function of the Trustees will be raising additional monies for the trust with the Secretariat assisting as necessary. Council may assist with monies if a request from the Trustees is considered worthy of merit.

Reporting
The Trustees will report to Council on a regular basis as required or needed, but at least yearly to the February meeting of Council. This is in addition to the Annual Report to be published with the Audited Accounts.

Accounting and secretarial services will be supplied by the Secretariat in Wellington. It should be noted that these are nominally three year appointments, with any vacancy being fillled by the Immediate Past President, subject of course to willingness.



120 MacLeans Road
Bucklands Beach
AUCKLAND

9 August 1994

Dr A G Williamson
Thermocell Ltd
P O Box 12-205
CHRISTCHURCH

Dear Dr Williamson,

Publication of the accounts of the Chemical Education trust for the past four years (Treasurer's Report 1993/94) highlights the requirement that affairs of the trust should be monitored by the Council of NZIC. This involves an obligation to publish a report and accounts on an annual basis. The reports which should have accompanied these accounts have not been published although it is believed that they have been prepared by the Trustees.

The Chemical Education Trust was established in 1987 at the behest of Council with the necessary basic work being carried out by the undersigned. In view of the fact that the Trust has lapsed into dormancy we would like Council to consider a number of important aspects.

First of all let there be no doubt that the CET is a statutory body established by the NZIC and as such there is a legal requirement to submit a report and accounts on an annual basis. Such responsibility rests with NZIC and should be undertaken by its Executive Officer.

Secondly, payments to the CET have been approved as fully tax deductible, this approval having been secured with a view to soliciting donations from industry on an on-going basis, thereby providing a source of income to further the proposed educational activities. It appears to us that no attempt has been made to secure this source of revenue. We believe that approaches to industry should be a function of Council through its Executive Officer. In this regard it is probable that an approach to industry would receive the backing of the Chemical Industry Council.

The funds of the Trust have remained intact over the past four years and there has been no evident action to foster education in chemistry. It is manifestly ridiculous to allow the fund to remain unutilised and dormant. We suggest there are two possible courses of action. Either a vigorous fund-raising drive should be implemented or the existing funds should be dispersed and the Trust terminated.

We request that this matter be raised both at the meeting of Council and at the A.G.M. on August 17. Unfortunately time may not permit circulation of this letter as a Council agenda item. This arises from the fact that once again the required 30 day notice of the A.G.M. has not been given.

In view of the importance of the matter and the responsibility which lies with NZIC in operating a statutory body, we ask that this letter and the response of Council be publisheed in the next issue of the Journal.

We suggest that it would be advisable for a copy of the Trust Deed to be made available to Council members. If there are any other aspects of the matter on which information is desired we will be happy to co-operate.

Yours faithfully

John Rogers

J Rogers (Dr)
PAST GENERAL SECRETARY

(20 Miles Avenue
Papatoetoe, Auckland)

A W Mackney
PAST PRESIDENT

(120 MacLeans Road
Bucklands Beach, Auckland)

Copies for informaiton:

Mr T R Hitchings
39 Te Awa Kiwa Terrace
St Andrews Hill
Christchurch

Mr Alan Turner
Executive Officer NZIC
P O Box 12347
Wellington

N.Z.I.C.
RECEIVED
12 AUG 1994

Letter acknowledged 12/8

NZIC BRANCH NEWS

Otago Branch

Dr Wayne Temple, Director of the National Toxicology Group at the Otago University Medical School attended a meeting in Sao Paulo, Brazil during June 1994 concerned with the Health Aspects of Chemical Accidents (and survived a shooting incident!). He presented papers on the response of Poison Control Centres during chemical emergencies and on communication with the public following chemical incidents. The meeting was sponsored by the International Programme on Chemical Safety (IPCS). IPCS is a jointly run operation of workshops for Brazilian Health authorities and a continuation to a meeting held last year in Wales. The Welsh meeting also discussed the health effects of chemical accidents and their follow-up. A training manual on this subject is currently being developed.

Dr Jim McQuillan presented a paper on infrared spectroelectrochemistry of titanium dioxide coated electrodes at Electrochem '94 which was held at Edinburgh University 12-16 September. This conference was the first occasion that the UK academic and industrial electrochemists had combined for a meeting and there was also a significant international presence. Electrochem '95 will be held at Bangor in September 1995. Jim also made visits to Imperial College, the University of Sheffield, York and Chulalongkorn (Bangkok).

Barbara Duncan

Manawatu Branch

Thirty people took advantage of a brilliant evening to meet in the courtyard of Options restaurant for the AGM. After a few drinks Alan Furness called the meeting to order and the following officers were elected:

Chairman	Mike Boland
Secretary	Grant Boston
Treasurer	Melanie MacDonald
Committee	Gill Norris, Alan Furness, Alastair MacGibbon, June Latham, Ces Johnston, Kath Fletcher, David Harding, Mark Patchett, David Richardson, Julia Reading, Mark Smales.

Andrew Brodie noted that as there was no NZIC conference planned until 1996 the Specialist Groups are holding meetings throughout next year. The first of these are the Inorganic and Organometallic Group on 30/1 - 1/2/1995 and the Physical Chemistry Group on 1/2 - 3/2/9/1995 at Massey University and he urged branch members to support these meetings.

Kath Fletcher, our able Hawkes Bay representative, proposed that a meeting next year be devoted to exploring the chemical and viticultural industries in Hawkes Bay. Everybody supported the idea - so watch the mail for details.

After the formal part of the meeting we moved to options for dinner and Alan Furness' Chairman's Address. Alan discussed the teaching of science and involved everybody in his "hands-on" talk.

Grant Boston

ROYAL SOCIETY NEWS

25 NEW FELLOWS ELECTED

Seven social scientists, 10 applied and technological scientists and eight scientists from the traditional discipline base were elected to the Fellowship of The Royal Society of New Zealand at the Fellows annual meeting on 7 December 1994. The Fellowship has broadened its scope as part of the Society's restructuring.

Philippa Black, President of the Society said that to speak with authority in all fields of sciences and technology the discipline base of the Fellowship needed to be broadened. The Fellowship now numbers 204.

Election to the Fellowship is an honour conferred on individuals for outstanding achievement and distinction in scientific research and the advancement of sciences. Among those elected were the following NZIC members and chemists:

CARRICK E DEVINE (*FNZIC*), meat quality section head, Meat Industry Research Institute, Hamilton, began his research career in basic muscle physiology and has since moved to apply this knowledge in the meat industry. He has particularly worked to improve tenderness, colour and flavour of export meat.

ROBERT A FRANICH (*FNZIC*), Senior Scientist at Forest Research Institute, Rotorua, is a chemist who has made an outstanding contribution to applied science. His highest achievement is a patented chemical process to greatly harden radiata pine wood. Dr Franich's scientific interests are widespread including authorship of patents on a possum lure and locked-in-boron wood preservatives.

KUAN MENG GOH (*FNZIC*), Professor of Soil Science at Lincoln University, is internationally recognised for his research into the fundamental chemistry of soil organic matter and nutrient cycling dynamics of nitrogen, phosphorus and sulphur in the plant/soil system. Kuan Goh has been adventurous in applying new techniques to old soil problems, particularly in the use of chemical isotopes.

PETER A MUNRO, distinguished research technologist, Dairy Research Institute, Palmerston North whose research has played a major role in helping New Zealand develop new export products and processes for the dairy industry, particularly in casein. He is a world authority on casein processing.

JOHN H WATKINSON (*MNZIC*), soil chemist at AgResearch, Hamilton, has made a major contribution to chemistry, soil chemistry and soil fertility, plant nutrition, animal health, agriculture and medicine. His greatest contribution was a method to detect minute amounts of selenium, now a standard worldwide, and a way of treating selenium deficiency in farm animals through topdressing pastures.

MURRAY H G MUNRO (*FNZIC*), Reader in Chemistry at the University of Canterbury, has conducted research focused on the isolation and characterisation of potential anti-bacterial and anti-cancer drugs from New Zealand's marine resources. The research is unique within New Zealand and has brought considerable international recognition.

* * * * *

DATES CHANGE FOR SOCIETY MEMBERSHIP

The membership year for members of the Royal Society is to be changed to a calendar year as from 1 January 1995. Previously the year ran from 1 July to 30 June. Members who joined in 1993-94 will continue to December 1994 without payment of any additional subscription. Members who joined between July 1 and December 31, 1994 will have their membership continued through to December 1995. Members joining now will be included in the foundation membership of the Society. Invoices for 1995 subscriptions will be sent out early next year and the subscription rates are unchanged.

* * * * *

ROYAL SOCIETY PRIZES AWARDED

The Hector Memorial Medal and Prize for 1994 for scientific work of great merit in the physical sciences has been awarded to Geoffrey E Stedman *FRSNZ*, Professor of Physics at the University of Canterbury for his work in the field of atomic and radiation interactions.

The Hamilton Memorial Prize for 1994 for the encouragement of beginners in scientific research has been awarded to Dr Michael Steel, Lecturer in Mathematics at the University of Canterbury, for his mathematics of phylogenetic trees.

The E R Cooper Memorial Medal and Prize for 1994 for the encouragement of scientific research in New Zealand in the fields of physics and engineering has been awarded to Dr Bill Robinson *FRSNZ*, Industrial Research Ltd, Dr Ivan Skinner *FRSNZ*, retired scientist from Industrial Research Ltd and Dr Graeme McVerry, Institute of Geological and Nuclear Sciences, for their book *An Introduction to Seismic Isolation.*

The Thomson Medal for outstanding contributions in the organisation, administration or application of science has been awarded to Dr Donald Llewellyn *Hon. FNZIC* and twice President of NZIC, the Foundation Vice-Chancellor of the University of Waikato. Dr Llewellyn was responsible for the establishment of the new university, and also was the driving force in the formation and development of the National Field Days Society which developed Mystery Creek into an internationally-recognised agricultural fair.

Dr Sylvia Rumball *FNZIC*, newly appointed Dean of Science at Massey University, was presented with a Science and Technology Medal at the annual meeting of the Society's Manawatu Branch on 15 November. Interim Board chairman Professor Neil Curtis, spoke of Dr Rumball's outstanding contribution in the establishment of the Science Centre in Palmerston North. Deputy-Mayor, Dr Bernard Forde conveyed greetings on behalf of the City Council.

Professor Neil Curtis *FNZIC*, Interim Board chairman and Vice President of the Royal Society, has received the 1994 Marsden Medal from the New Zealand Association of Scientists. The medal is awarded in recognition of a meritorious contribution to the cause and development of science. Professor Curtis has had a distinguished career as an academic inorganic chemist, the association's citation said. He joined the Victoria University staff in 1957, and was appointed to a personal professorship in 1972. He has published 120 scientific papers, and has undertaken pioneering work on inorganic nitrogen-containing macrocycles. This is of current interest both in the biochemistry of haemoglobin and chlorphyll, and in 'new material' studies. Professor Curtis has made a significant contribution to The Royal Society of New Zealand and the science fair movement over many years.

* * * * *

ROYAL SOCIETY OF CHEMISTRY 1995 AUSTRALASIAN LECTURER

Professor E N Baker of Massey University has accepted an invitation to be the Royal Society of Chemistry's 1995 Australasian Lecturer.

Photocatalytic oxidation - a safe and clean alternative in TOC analysis.

Peter A. Bennett
SGE International Pty. Ltd. 7 Argent Place, Ringwood, Australia 3134
and
David A. Payne
GBC Scientific (N.Z.), P.O. Box 68-330, Newton, Auckland

THE ROLE OF TOC ANALYSIS

Water analysis is a universal requirement with a wide variety of properties subject to measurement and control.

Of increasing importance is organic carbon. The measurement of organic carbon is useful on two counts:

Firstly, it is an indicator of the oxygen demand of waste water and therefore a measure of the competition for oxygen which will exist between pollutants and marine life.

Secondly, it is an "aggregate" measurement which determines the presence of any organic compound which may have entered the water, without specifically identifying it. It is therefore a valuable screening tool.

Apart from its value in monitoring the quality of water in various industrial, pharmaceutical and beverage production processes, the immediate measurement of organic carbon is generally gaining acceptance over the 5 day Biological Oxygen Demand (BOD) and the 2 hour Chemical Oxygen Demand (COD) tests which are commonly required by regulatory bodies on waste water discharge.

TITANIUM DIOXIDE - A WONDER CATALYST

For some time, titanium dioxide has been widely used as a harmless pigment and filler in paints and in pharmaceuticals. In its naturally occurring form (rutile), it is present in abundance as a mineral sand.

The form produced for use as fillers is generated from titanium chloride to produce highly dispersed oxides in the colloidal range (20 nm), exhibiting high surface to mass ratios and low compacted apparent densities.

The photocatalytic effect of titanium dioxide has been evidenced by the weathering of paints employing it as a filler - a problem which has been controlled in modern paints by the incorporation of UV absorbing agents.

More recently, the photocatalytic oxidation (PCO) process has been the subject of worldwide research and development as an effective and environmentally benign approach to waste water remediation using natural sunlight. Several companies now provide commercial processes for waste treatment using titanium dioxide based PCO technology and several international conferences revolve around the subject.

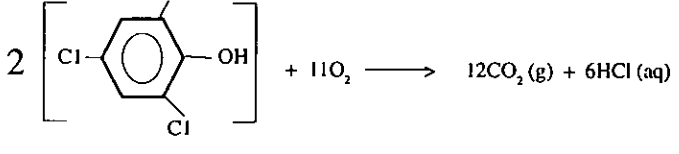
Titanium dioxide is a semiconductor where electron transitions from the valence band to the conduction band result from the absorption of light at wavelengths in the near UV, below 400 nm. Light energy is naturally available from sunlight in this region and is a component used in photosynthesis for plant growth.

In the waste treatment process, titanium dioxide is maintained in suspension in a treatment pond where the action of sunlight causes the semiconductor to generate positive holes which interact at the surface to produce hydroxyl radicals. These act as a strong oxidising agent on natural and synthetic organics in the water. Aeration provides the supply of oxygen for the oxidation process and the titanium dioxide remains unchanged as a catalyst for continued activity. The PCO process simply accelerates the photodegradation processes that occur naturally in waterways.

THE EFFICIENCY OF PHOTOCATALYTIC OXIDATION

Over recent years, the process of PCO and the effectiveness of its action on a wide variety of organic compounds have been studied in a number of research institutes. Notable among these is the work of Dr Ralph Matthews and his research group at CSIRO's Centre for Advanced Analytical Chemistry in Lucas Heights, Australia. This work has advanced the understanding of the process and, in particular, quantified the speed and degree of breakdown of chlorinated hydrocarbons including aliphatic and aromatic compounds. The effectiveness of this process is dramatic, with all organics rapidly decaying to carbon dioxide and inorganic molecules.

For example, 2,4,6-Trichlorophenol in solution reacts as follows:



In their studies, various compounds were systematically exposed to controlled levels of artificial sunlight from simple fluorescent "black-lights" normally used to promote growth of indoor plants. The oxidation process on each organic compound was measured by monitoring the carbon dioxide evolved from the process in a closed loop system. The evolved carbon dioxide was detected by bubbling the gas through a conductivity cell containing pure water. The observation that this apparatus was essentially a total organic carbon (TOC) analyser did not escape Matthews [1] and consequently world patents were obtained [2,3].

PCO ADVANTAGES FOR TOC ANALYSIS

Apart from its well demonstrated catalytic effectiveness, the use of titanium dioxide as a catalyst is particularly attractive as it is essentially innocuous compared to other oxidising agents (peroxidisulfate) used in conventional wet-oxidation TOC analysers. Not only is the operator hazard removed, but also waste disposal concerns are entirely eliminated. Consequently, an instrument based on this technology possesses the enviable qualities of being both "safe" and "clean".

Secondly, since the PCO process occurs at near UV wavelengths, borosilicate glass and inexpensive, long life "black-lights" can be used in the construction of the reaction chamber. This leads in turn to a lower cost instrument and reduced operating expenses.

The ultimate embodiment of this revolutionary technology in the SGE ANATOC™ Total Organic Carbon Analyser (Figure 1) further enhances the safety aspects of operation by eliminating the need for cylinders of compressed gases. This, in combination with the simplicity of the concept and the low power requirements, leads to a further benefit in terms of compact size and mobility allowing rapid relocation to critical sampling points, and hence timely results of maximum benefit can be obtained.

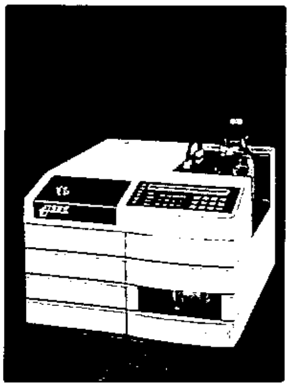


Figure 1: *SGE ANATOC™ Total Organic Carbon Analyser*

A NEW TOC ANALYSER

The ANATOC™ consists of a closed system containing air and catalyst solution (Figure 2).

A peristaltic pump circulates the solution and entrained air around the liquid loop indicated. The liquid path includes two glass coils surrounding the UV light sources where photocatalysis occurs. The entrained air ensures agitation of the sample and catalytic suspension and provides an excess of oxygen to support the oxidation process.

Oxidation is carried out by illumination of the sample with near-UV light (300 - 400 nm) in the presence of a catalyst. The catalyst is 0.2% w/v titanium dioxide in water adjusted to pH 3.5. The carbon dioxide generated by the degradation of organic compounds is transferred from the reaction loop to the gas detection loop at the gas-liquid separator. The carbon dioxide enriched gas stream then passes through to a conductivity cell, where it dissolves, forming carbonic acid. This dissociates to give the conducting species. Therefore, an increase in the conductivity of the high purity water in the cell is registered.

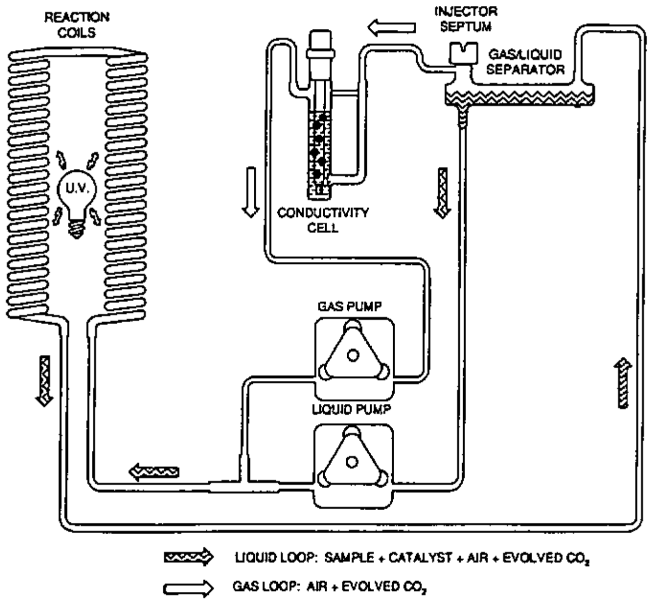


Figure 2: *Simplified flow diagram indicating separate gas and liquid paths in a closed system.*

After a few minutes of circulation and photocatalytic oxidation, the entire closed loop system reaches equilibrium where:

(i) all organic carbon present at background level has been oxidised,

(ii) balance has been established between the dissolved and gaseous phase of CO_2 and

(iii) the physical transfer of the CO_2 enriched air between the liquid and gas loops has been completed.

SAMPLE INTRODUCTION AND ANALYSIS

Water samples are typically prepared by acidification and sparging with air to remove inorganic carbon. The instrument conveniently provides a supply of air for this purpose.

The sample (from 10 µL to 10 mL) is introduced into the liquid loop via a septum in the gas-liquid separator.

The sample mixes with the catalyst in suspension as it is recirculated several times through the liquid loop by the action of the peristaltic pump. The pump also draws in air from the gaseous loop which creates bubbles in the liquid to provide an excess of oxygen to support the oxidation process in the glass coils surrounding the near-UV light sources. By continuing circulation, the sample is completely oxidised to carbon dioxide.

Within a few minutes, the conductivity stabilises, signifying complete oxidation and equilibrium of the closed system at its new carbon dioxide level. By relating the carbon equivalent of the conductivity at completion with that of the initial (baseline) conductivity, the dissolved organic carbon content of the sample is determined.

The carbon dioxide accumulated in the cell (and the closed system) is then removed by ventilating the system with filtered ambient air to re-establish a baseline level of carbon dioxide in the liquid and gas loops.

ONE STEP CALIBRATION

In ANATOC™, calibration is a single step process where the response of the conductivity cell is calibrated against the oxidation of a known standard. The conductivity signal has been found to follow a simple mathematical relationship with carbon content. Consequently a software algorithm is used which allows accurate and linear calibration to be achieved over a wide dynamic range using a single standard.

While a number of standard materials may be used, benzoic acid has been recommended since it is safe and readily available. Most importantly, it is stable in both the crystalline form and as a prepared aqueous standard. A single injection of 0.5 mL of 200 μgCmL^{-1} in the form of benzoic acid provides an accurate measure of the instrumental response over a wide working range. The effectiveness of this calibration is demonstrated (Figure 3) where a number of measurements both inside and beyond the calibrated range exhibited a regression coefficient of 0.9998. The entire single-injection calibration process is completed within 15 minutes. Calibration is typically performed every four hours.

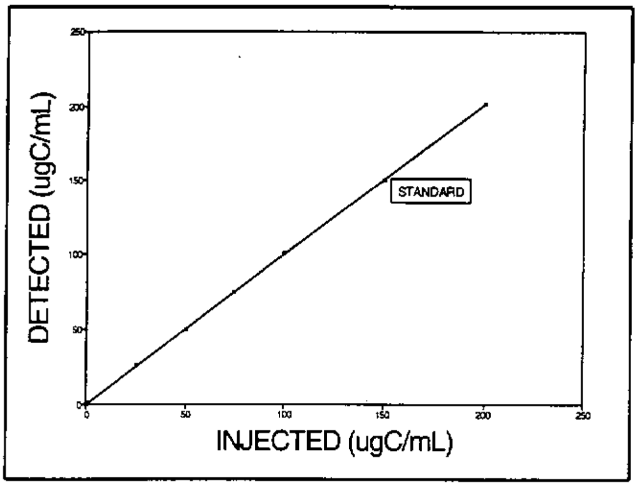


Figure 3: *Single point calibration at 150 μgCmL^{-1} exhibits linearity from 0 - 200 μgCmL^{-1}.*

OXIDATION OF VARIOUS ORGANIC COMPOUNDS

The breakdown of various organic compounds has been extensively reported in the literature [4,5]. All compounds studied, including persistent pesticides and traditionally difficult materials such as humic acids have been found to yield to the powerful PCO process. The only difference between an easily oxidised material (such as a sugar) and an intractable compound is the speed of oxidation. Even so, the difference is such that the slowest analysis is only twice as lengthy as the simplest. Because the instrument uses "end-point detection" to determine when oxidation is complete, the consequence of a variation in sample composition is simply a change in the analysis duration, not a loss of accuracy in the determination.

CONCENTRATION RANGE, PRECISION AND LOWER LIMIT OF DETECTION

Since the carbon in an injected sample is converted to carbon dioxide and collected in a conductivity cell of fixed volume, the instrument is essentially responding to absolute mass of carbon. By reducing or increasing the sample injection volume, higher or lower concentration levels can be accommodated.

When high levels of organics are encountered in samples, the instrumental carbon loading is simply reduced by decreasing the injected volume. For typical levels encountered in drinking water (2 - 10 μgCmL^{-1}) injections of 1 mL are usual.

The calibration process covers the range to 100 μgC absolute. Best precision may be expected in the range 20 - 80 μgC where it is better than 2% RSD.

The maximum injection volume is 10 mL, which would therefore provide the best available sensitivity for low levels of organics. The lower limit of detection is 0.05 μgCmL^{-1} (50 ppb) where the signal is 3.3 times the reproducibility of determinations at or near the blank level (Figure 4).

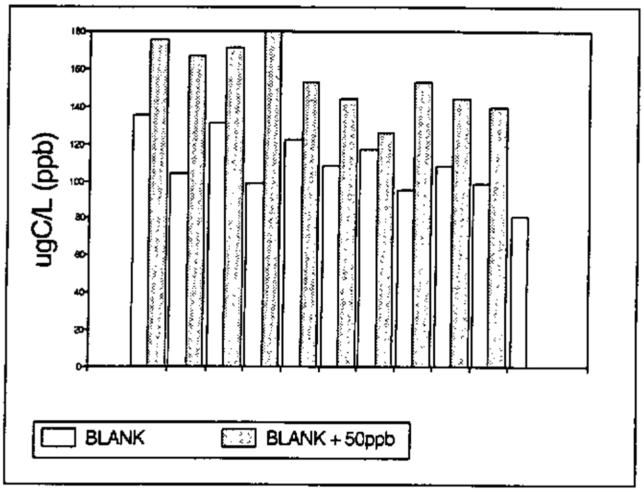


Figure 4: *Alternate determinations of blank alone and blank + 0.05 μgCmL^{-1} illustrate a lower limit of detection of 50 ppb.*

APPLICATIONS FOR TOC ANALYSIS

By their nature, wet oxidation and PCO techniques are generally limited to the determination of organics dissolved in the bulk of the sample. Organics present as solids, or present as occluded matter in particulates (e.g. silica), may not be available for oxidation and, in fact, may not be of interest to the water chemist as they are not readily leached in the natural environment.

The application of TOC analysis as a replacement or supplement to the long established and slow 5 day BOD or 2 hour COD test is common. Because all three tests are quite different, an absolute relationship between each does not generally exist. In individual processes or streams a degree of correlation is established for each and allows the use of TOC analysis as a virtually immediate indicator of the condition of the water. In these situations, TOC analysis is allowing process engineers to make timely decisions about the withholding or treatment of water with dramatic economic benefits.

In many industries, including the production of beverages and pharmaceuticals, the quality of water used in the process is benefiting from the security of broad spectrum screening that TOC provides over and above the analysis of specific water components. In process water control, TOC screening for organics is being accepted as an essential complement to conductivity screening for ionic compounds.

CONCLUSION

The use of titanium dioxide as a photocatalyst for the oxidation of organic compounds has permitted the design of a simplified total organic carbon analyser which achieves a breakthrough in terms of safety for the operator, cleanliness in waste disposal and mobility because of the absence of a compressed gas cylinder. The PCO technique has been found to be effective with even the most intractable organics. The ANATOC™ instrument is proving to be invaluable for sample screening for the presence of organic contaminants and for monitoring process and waste streams in real time for informed decision making in the plant. It is also of value in replacing or minimising BOD or COD analysis.

ANATOC™ is a trademark of SGE International Pty. Ltd.

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