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Whodunnit?

Pin-pointing the perpetrators with environmental forensics



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UP FRONT ...

Whodunnit? Pinpointing the Perpetrators with Environmental Forensics

What is 'environmental forensics'? or should that be 'environmental forensic science'? Is it like the forensic science with which we have become familiar and which is popularised in the media, one where charges are laid and prosecutions are brought and fought in the courts?



For further details see the cover story article on page 2

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Whodunnit?

Pinpointing the Perpetrators with Environmental Forensics

Dr Harry van Enckevort, ESR: Environmental, Wellington Science Centre, P O Box 30-547, Lower Hutt

Forensic science. We have generally thought of it and heard of it in relation to police and criminal work. Perhaps we have followed crime and sleuth stories, seen forensic science used in television programs, followed court proceedings involving forensic evidence. We may have observed the scientist at the scene searching for evidence, attempting to reconstruct the events, examining items in the laboratory, providing assistance in the search for an offender. Answers are sought to questions such as "Has a crime been committed?", and if so, "Who did it?", "How?" and "Is there evidence to associate the person with the crime?"

If prosecution follows, we may have seen the scientist present the evidence in court, interpret the facts and provide their opinion of what they mean and their value. There may have been a challenge by cross examination to test the evidence, its limits, and even the 'expert'.

Then the verdict, which, if one of 'guilty', would typically involve some penalty – fines and/or imprisonment, and perhaps some form of restitution, compensation, and cost reimbursement.

The legal process in New Zealand follows that of our English heritage. It is an accusatory and adversarial process. The defendant, although accused and on trial, is innocent until proven guilty and the onus of proof lays with the prosecution. Evidence can be provided by either 'side', and is challenged in an attempt to gain advantage and credibility by 'exposing' failures or weaknesses to discredit the evidence and the person giving it. Alternative or contrary opinions will be presented as truth.

Forensic groups within ESR, and its predecessor DSIR, have provided the New Zealand Police and courts of law with forensic scientific services for many years. This has included scene examination and reconstruction, evidence sampling, laboratory analyses, appearance as expert witnesses and the provision of advice for the preparation of legislation.

But what is 'environmental forensics'? or should that be 'environmental forensic science'? Is it like the forensic science with which we have become familiar and which is popularised in the media, one where charges are laid and prosecutions are brought and fought in the courts?

Like the criminal forensic work, and analytical sciences in general, there is an element of sleuthing in environmental sciences which will generally be unrelated to any offence, or unlikely to lead to a prosecution. Instead of the questions "Has a crime been committed?", "By whom?" and "How?", analyses may be requested to determine "What is it?", "Where did it come from?" and "What has caused it?". Observation,

background knowledge and understanding, databases and the availability of an array of analytical chemistry techniques are useful to characterise, identify, trace and source materials.

ESR is regularly asked to apply its capabilities in analytical chemistry and undertake this type of sleuthing for industry and various authorities. A few of the examples that ESR has been involved in recently include:

1. Sourcing seepage entering a stream. The material from six possible underground sources was 'fingerprinted' by ICP-MS (Inductively Coupled Plasma-Mass Spectrometry) analysis of 61 of the elements and metals present in each. These 'fingerprints' were then compared with the 'fingerprint' of the seepage and the source identified.
2. Complaints from residents living near a factory site that dust accumulating in their homes was coming from the factory were shown to be unfounded. Analysis and 'fingerprinting' of the dust, again by ICP-MS, showed that the 'fingerprint' did not match that of the dust which could be coming from the factory but had the profile of typical urban dust.
3. A dairy company was experiencing problems with discoloration in one of their products. It was found to contain pockets of a grey coloured material. Conventional analyses did not identify a cause for the staining but it was subsequently found to be caused by the presence of only trace levels of metals. The origin of the metals? Those present and their relative proportions showed the contamination was very fine powder from type 316 stainless steel used in the plant.
4. A local authority was concerned that material entering its treatment facility contained a volatile material which might contribute to an explosive hazard. The material was identified as heavily weathered petrol but the amount present did not constitute a hazard.
5. An acrid odour was causing respiratory problems for staff in a building. Although the specific compounds responsible for the odour were not identified, air sampling and other tests showed the source of the odour to be burned wiring insulation in the air conditioning system.

Are these examples of forensic science? Does it really matter? It certainly is forensic science if we think of 'forensic' as the search for truth, certainly a goal of science.

The term 'forensic' is more commonly thought of as science pertaining to the law. In a broad definition it could describe

any discipline pertaining to, connected with or used in courts of law. Such courts can be criminal courts. However, they also include the forums of government ministries, entities such as district and city councils (referred to as territorial authorities under the Resource Management Act), regional and consent authorities, and the Environment Court (formerly the Planning Tribunal), all of which can result in the introduction of material into legal documentation.

The Resource Management Act became law in 1991 and is an area of particular interest in this respect. It is a means of planning the use, development and protection of our natural and physical resources. Such resources include not only the air, land and water, but their attributes, for example, rivers, soils, forests and ecosystems. They include the natural environment and the environment we have constructed – bridges, buildings, cities and towns.

Resource consents are used under the Act to give a person or organisation permission to use or develop a resource, and/or conduct an activity that affects the environment in some way for a stated period. The Act also describes sustainable management, which includes reference to social, economic and cultural well-being, health and safety, and avoiding, remedying or mitigating adverse effects of activities on the environment.

It is mandatory for all consent applications to include an environmental impact report. This is an assessment of the effects an activity will or could have and there must be sufficient detail to correspond with the scale and significance of the possible impact. The consent authority can commission a review of the information provided. Consents can be appealed if the information which influenced the original consent decision is later found to be inaccurate.

Expert evidence, which is factual information and/or opinion given under oath by people with particularly relevant knowledge, as in the criminal court system, can be called and considered in the application for resource consents. Scientific work will be required, for example: to establish background levels and for continued background monitoring; impact assessments; compliance monitoring; establishing non-compliance; assistance in establishing compliance, remediation and mitigation of adverse effects; assistance in the preparation of legislation and resource consents; and research and other investigations which do not arise from, or are unlikely to be used in, court action.

Examples of the work recently done by ESR in these areas include:

1. A local authority was concerned that fats and oils were passing through the sewage treatment plant to the ocean outfall and then being blown back onto a local beach. The origin of this material was unknown but there were three possible sources. FTIR (Fourier Transform Infrared Spectroscopy) and GC-MS (Gas Chromatography - Mass Spectrometry) techniques were used to analyse and characterise the material. This provided a 'fingerprint' which could be used for comparison with the products from the three possible local sources and a match obtained. This information was then used to assist the local authority and the industry determine the best way forward in future handling of their waste material.

2. A resource consent application was to be lodged for the disposal of sewage sludge on agricultural lands. Knowledge of the chemical background of the area, the sludge itself and prediction of the effects of disposal were required for assessment of the consent application.
3. Participation in the national Organochlorines Programme being run by the Ministry for the Environment to derive national environmental standards and guidelines for the management of persistent organochlorine compounds. The initial phase of the project is to collect information and data on the background and ambient levels of such compounds in air, water, soil sediment and biota samples from across the country. The second phase will assess human body burdens and dietary intake of organochlorines.
4. A similar project is an on-going Ministry of Health study programme assessing the potential for exposure to benzene and lead in urban areas from petrol-fuelled vehicles. The study was begun in anticipation of the removal of lead from petrol and monitoring is continuing to identify changes that are occurring. It has since been extended to include another combustion product suspected to be a carcinogen. Levels are being monitored to allow broad predictions of the possible levels of exposure under different exposure situations. They are also compared with overseas air quality standards and guidelines.

In an adversarial legal system, pre-trial discussions in an attempt to reach consensus between the opposing sides' experts are very rare. There is no mediation of conflicting results and opinions. However, some legal systems, for example those in a number of European countries, follow an inquisitorial rather than an adversarial system. A court magistrate leads and facilitates an investigation to its conclusion and verdict. (The merits of both systems continue to be argued!)

Clearly, under the Resource Management Act there are many opportunities for what I will call 'inquisitorial' environmental forensic science. The emphasis of the Act is on the effect an activity will or could have on the environment. It is not to prescribe activities which should not be allowed, or should be allowed, and it is therefore unlike, for example, the Crimes Act.

'Inquisitorial' environmental forensic science then becomes science which is used to assist the objectives of legislators and entities such as regional councils rather than that which is used to pursue prosecution.

The newly legislated Hazardous Substances and New Organisms Act also provides opportunities for 'inquisitorial' environmental forensic science. Parts of this Act will not come into force for some time, but it will eventually replace the Dangerous Goods, Explosives, Toxic Substances and Pesticides Acts, and those parts of the Animals and Plants Acts which have been carried forward in the transitional provisions of the Biosecurity Act of 1993.

Key areas covered by the legislation include: the determination of threshold and acceptable levels of exposure; requirements to stop a hazard occurring; specifying control systems; conditions to be met when disposing of a substance; discharging, as waste, into the environment; and, emergency management systems. And, substances may be 'eco-toxic', either through direct toxicity or as a result of interaction with other substances.

The Act provides for the set-up of the Environmental Risk Management Authority which will have responsibilities including the assessment and management of hazardous substances and new organisms. 'New organisms' includes animals, plants, microbes and genetically modified organisms. It will also provide advice on control and regulation.

The Environmental Risk Management Authority will also ensure compliance procedures, such as inspections, audits and prosecutions which can be brought under the Act, work. Enforcing the Act will generally be the responsibility of existing agencies such as local authorities, and the Occupational Safety and Health Service.

Both the Resource Management Act and the Hazardous Substances and New Organisms Act allow for prosecutions to be brought against those who contravene provisions of the Acts. Prosecutions might be brought, for example, for offences such as the discharge of pollutants or contaminants into water ways, on land or into the air. The penalties prescribed for contravention and continuing contravention of both Acts are severe. Both Acts also allow for remediation, mitigation and clean-up costs which again can be very large.

ESR has incidents under analysis where the objective of the presenting authority is prosecution. In the past we have provided analyses in many such cases but they have typically been settled out of the court arena.

Prosecution provides the opportunity for defence. Defending a prosecution must become increasingly attractive as the penalties for contravening provisions of either Act become increasingly severe. In that case, more prosecutions will be brought and fought on the results of environmental forensic science.

Given the adversarial style of our legal system, perhaps at this point I might be allowed to describe this type of work as 'adversarial' environmental forensic science – science in a system where there is an emphasis on identifying the harm done, of tracking down and identifying the perhaps unknown perpetrator, of proving culpability, of punishment, and of bringing to account and justice.

There is, of course, no difference in the nature of the science between the 'adversarial' and 'inquisitorial' investigations. The analytical methods used are the same although for many the approach and the use of the data may be different. The science will be familiar to and understood by all environmental scientists – they will be experts in its use within their particular scientific endeavours.

However, the adversarial approach used by our courts to consider the results and opinions presented is one which will not be familiar to many scientists. Indeed, they may well be wary of a style of questioning which can seem to be unnecessarily aggressive, critical, point scoring and belittling, perhaps openly hostile. Good data may be lost because of what can seem like trivial reasons on points of procedure. Worse, the 'truth' can seem to become clouded or lost in the process, those aspects of the truth which are convenient only to the prosecution or only to the defence may be addressed, and the witness be manipulated to appear partisan. And all without right of reply.

For those scientific disciplines where there is a greater requirement for interpretation, where there might be a call to predict what the possible effects of an event may be and how likely each may be, where expressions of certainty are not a reality, all this may appear even more daunting.

Regardless, environmental scientists who are prepared to act as expert witnesses, who know the process of the law, our court system, the requirements of expert witnesses and the laws of evidence, and who know the procedural requirements that laboratories will need to have in place for acceptance of their analytical results, will be necessary. Prosecutions can be sustained or otherwise fail despite perfectly valid and correct science.

There are clearly numerous opportunities for analytical and environmental chemists in relation to our environment. ESR has many years of experience in the traditional areas of forensic science, and now applies this experience to the area of environmental forensics. Apart from general sleuthing, both the adversarial and inquisitorial approaches to environmental forensic science are required. And both will be required to translate their science knowledge and ability into plain English!

For more information circle number 1 on the reader reply card

Dr Harry van Enckevort has recently joined the Environmental Health Program of ESR after 13 years as a criminal forensic scientist with ESR and DSIR. Harry will use his experience within the criminal forensic area to assist ESR in enhancing their role within the environmental forensic science area.

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LOCAL NEWS

SIGMA ALDRICH REACHES NEW ZEALAND SHORES

Sigma Aldrich Pty Ltd (Australia) is now offering a new service for all New Zealand customers. Since December 1996, New Zealand customers have been able to contact Sigma Aldrich directly via their new toll free fax and phone numbers.

Combined with the introduction of the toll free numbers Sigma Aldrich is concentrating efforts on improving delivery times. Already orders placed for ex-stock items are despatched from their Sydney warehouse on the same day as the order is received.

"Sigma Aldrich already has an excellent reputation of providing Australian customers with quality products and efficient service. We are looking to build that same reputation here in New Zealand," said Dr Felice de Jong, Managing Director of Sigma Aldrich Pty Ltd (Australia).

As the major supplier of Sigma, Aldrich, Fluka and Supelco products our product lines are diverse and involve most areas from biochemicals and diagnostic reagents (Sigma), fine, rare and specialty chemicals (Aldrich), high quality fine chemicals (Fluka) to chromatography accessories and supplies (Supelco). As well as laboratory equipment and supplies we also supply specialist products such as stains and dyes, flavours and fragrances, immunochemicals, plant cell culture products, radiochemicals and much more. Not only has the high standard of our products been proven time and again but our competitive prices (all in New Zealand dollars) and efficient service mean customers can get affordable, high quality products as and when they need them. Ordering directly from Sigma Aldrich (Australia) also gives New Zealand customers the advantage of access to the 40,000 plus items that our warehouse holds in stock."

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PUTTING SCIENCE INTO NEW ZEALAND'S BOARDROOMS: THE SATPAC FUTURE DIRECTORS AWARD

An award designed to "put science and technology into New Zealand's boardrooms" was presented recently to three scientists and technology professionals. The Science and Technology Promotion Advisory Committee (SATPAC) Future Directors Award gives recognition to the importance of science and technology to New Zealand's social, economic and environmental success by increasing the pool of science and technology decision makers available to hold directorships.

The successful award recipients were Graeme Robertson (CEO, Cawthron Institute), Tom Batchelor (Marketing Access Manager, ENZA), and Bill Dyck (Technology Manager, Forestry Division, Carter Holt Harvey).

The award, developed by SATPAC, offers three places on the Institute of Directors' Company Directors' Course to scientists, technologists or engineers who hold middle to senior positions within their organisations, and have both the capacity and interest in putting science and technology in the boardroom through directorship responsibilities. This residential five day course covers all aspects of directing. It is the Institute of Directors' premier course and provides the individual with an intensive study of the duties, responsibilities and personal liabilities which arise from the diverse day-to-day activities of a public company.

New Zealand lags behind other OECD countries in its level of private investment in research and technology as well as being considered a relatively "low-tech" country, partly, it seems, because directors with business backgrounds far outnumber those with science and technology skills in both the public and private sectors. SATPAC believes that this, in part, inhibits the development of a work-place culture that motivates and rewards innovation. Key decision makers do not always associate science and technology with innovation, competitive advantage and corporate strategy. Moreover, professionals with science and technology backgrounds are not always valued as directors. Some science and technology professionals also perceive themselves as "supporters" rather than leaders. Companies themselves tend to bias directorship appointments toward those people that have financial and legal backgrounds, particularly now that corporate governance is dominated by such issues. The Directors' Course is seen as an appropriate training of scientists and technologists as future directors.

Recipients have responded favourably to the scheme, and have indicated the policy mechanism will encourage a work-place culture that motivates and rewards innovation, by correcting the above imbalance.

"Experts from New Zealand and Australia provided 'inside' advice on a range of topics, including boardroom practice and conventions, trade practices, legal duties, CEO-board relationships, financial reporting and analysis, human resources and marketing, and strategic thinking. The extensive reading material was brought to life by highly interactive presentations, workshops and role playing which left rarely a dull moment and certainly no time to relax," Tom Batchelor said.

Bill Dyck remarked that "the five day Institute of Directors' Company Directors' Course is at first daunting, because of the amount of reading material provided, but quickly becomes stimulating because of the high quality of the other participants, most of whom are already company directors enrolled to improve their performance on various company boards. While I have been able to put many of the concepts and skills taught on the course into immediate use in my day job, my ultimate goal is to apply them in a director role and instil a greater commitment to research and technology in at least one boardroom!"

Graeme Robertson said that "the course has given me an excellent background which will enable me to discharge [my directorship responsibilities] more fully. I would never have dreamed that I could spend almost six straight hours listening to a lawyer explaining the legal duties of directors, thoroughly alert and almost perched on the edge of my seat for most of the time.

"A presentation by prominent scientist, manager and director, Dr Mervine Probine, not only very clearly demonstrated the critical role which technology could play in the development of successful business strategies, but was also a walking advertisement for the cause of greater recognition of science and technology."

No less than three places will be offered on the Course to be held in September 1997.

Criteria for the 1997 award will include:

- Scientists, technologists, or engineers who hold middle to senior positions within an organisation; and
- Practising science and technology professionals.

The Ministry is currently developing application forms and final criteria for the 1997 award. If you wish to receive information on the award,

Contact: Olga Berezovsky
Ph: (04) 4726400 or Email: olga@morst.govt.nz.

TECHNOLOGY PARK PLANNED FOR HAMILTON

The establishment of a technology innovation park in Hamilton has come a stage further with the thumb's up result of a feasibility study released by the Waikato Technology Foundation. The park is seen as a major part of the foundation achieving its vision "to create a superior environment for generating, accessing and transferring technology" in the Waikato.

The feasibility study was detailed to interested parties by foundation chairperson, and University of Waikato vice-chancellor, Bryan Gould and consultant John Jackman.

It calls for an innovation park on land adjacent to AgResearch and the University of Waikato at Ruakura on the outskirts of Hamilton. The park would provide facilities for firms, organisations or entrepreneurs to have close access to the best possible research facilities to develop ideas and provide an incubator facility to turn ideas into commercial reality. On-park accommodation for technology-based firms engaged in development and production is also envisaged.

The park will be self-funding in the long-term and the foundation is now seeking partnerships with science and technology organisations as potential residents in the park. As a lead-up to this it hopes to form clusters of projects around specific research facilities to be accommodated on site.

The Waikato Technology Foundation is a charitable trust with representation from the university, Waikato Polytechnic, AgResearch, Hamilton City Council, Tainui Trust Board and Environment Waikato.

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NEW ZEALAND R&D STATISTICS 1993/94 RELEASED

The *New Zealand Research and Development Statistics 1993/94* report has recently been released by the Ministry and reveals some interesting results. The report itself documents the fifth annual survey of research and development (R&D) undertaken in New Zealand.

Research and development statistics are collected to indicate the level of research carried out in New Zealand compared to reference countries in the OECD. Statistics are used to guide the Government's policies and priorities for science funding, which is aimed at improving the economy, society and the environment.

New Zealand's gross domestic R&D expenditure (total money spent on R&D carried out in New Zealand) in 1993/94 was \$825 million, or 1.02% of GDP. This is up just over 9% from \$754.5 million in 1992/93. The real growth rate of New Zealand's total expenditure on R&D since 1989 has now risen to the same level as that of six OECD reference countries and exceeds the rate of growth in the OECD as a whole. This means that New Zealand is now starting to catch up with OECD average R&D expenditures.

In terms of R&D funders, the Government funded \$452 million (including part of the Equivalent Full Time Student (EFTS) funding to universities), and universities funded \$57 million from their own funds (including student fees). Research funded by the Government sector increased overall by \$10 million in 1993/94, but due to strong economic growth this amounted to a small decrease in Government expenditure as a % of GDP, from 0.57% to 0.56%.

It is estimated that the business enterprise sector funded \$293 million for R&D (including \$14 million spent overseas). The amount of R&D funded by business enterprises increased by \$54.4 million, or 23%, with the R&D funding that the business sector reported as going to the Government and university sectors increasing by \$16 million, or 38%.

Of the total of \$825 million research carried out in New Zealand, \$15.5 million was paid for with funds from overseas and a further \$18 million with private non-profit funds.

Over the last three years, research directed towards primary production and processing increased at the same rate as the overall increase in business R&D, a 28% increase since 1991/92. Within this group, dairy and forestry research experienced a higher rate of growth at 55% and 53% respectively. In 1993/94, energy and environmental protection research showed the largest increases, but from a very small base, followed by information and communication, and commerce and trade each with just over 60% increase in R&D. Last year's report noted the large increase in R&D in the electronics industry. In 1993/94, research in this industry was levelling off with a growth of 15% versus 55% in the previous year. However, the related area of information and communications research, which includes software, increased by 61% in 1993/94. Together these industries showed an annual average increase of 29% from 1991/92 to 1993/94.

New Zealand businesses spent on average just under 0.4% of their sales revenue on R&D. This compares with an average of 2% in the reference countries. Even if the industry structure of the reference countries is adjusted to match that in New Zealand, the average expenditures on R&D in the reference countries would amount to an average of 1.2% of sales. In particular, the percentage of sales spent on R&D in the paper, paper products and chemical products industries in New Zealand are only one tenth of the level in other countries. The food and beverage industries in New Zealand invest at close to international levels. Textiles is the only one of ten industry groups where research in New Zealand is well above the reference average.

Government research in the processing of primary products increased by 21%, as did research for the environment, exploration and assessment of the earth. Fundamental research increased by 26%. This is in line with the Government's long term priorities for the Public Good Science Fund.

Sixty-nine percent of the funding for university research came from internal sources; it is estimated that 46% came from general university funds from Government and 23% from the universities' own funds, which include student fees. The remainder of the funding came from business, Government and other sources.

Research in the social sciences took 26% of university R&D expenditure, followed by medical sciences (22%), engineering and applied sciences (14%), then biological sciences (11%). The natural sciences (physics, chemistry, biological and earth sciences) taken together amounted to 23%.

The amount of R&D carried out in the private sector was \$248 million, 0.31 % of GDP (1.21% for OECD reference countries), or 30% of the total R&D (61.8%). The Government sector (Crown Research Institutes (CRIs) and operational research in Government departments) carried out R&D worth \$343 million, or 0.42% of GDP, while university R&D totalled \$234 million or 0.29% of GDP. Together, the latter two sectors carried out R&D expenditure of 0.71% of GDP, compared with an average of 0.73% for Government and university sectors in OECD reference countries.

Excluding universities, for whom gender data are not available from the survey, 5,960 (70.4%) of R&D personnel were male and 2,503 (29.6%) were female. Women make up 24.2% of R&D staff in the business sector, 33.4% in CRIs, and 38.4% in other Government departments.

Women, excluding those working in universities, account for 16.9% of researchers, 31.7% of technicians, and 56.8% of support staff. The highest proportion of women researchers are found in other Government departments, with 38%. The lowest proportion of women researchers are in business and the CRIs, with 15% and 14% respectively. The highest proportion of women technicians are found in CRIs (37%) and the lowest in other Government departments (18%). The highest proportion of women support staff are found in other Government departments, whereas the lowest is in the business sector.

The highest proportion of PhDs among R&D staff occurs in CRIs (21%). The lowest proportion occurs in business (7%). Excluding universities, women made up 13% of PhDs and 27% of bachelors degrees (while making up 30% of all staff).

AWARD FOR OUTSTANDING SCIENTIST

Professor Christine Winterbourn of the Christchurch School of Medicine was this year's recipient of the New Zealand Association of Scientists' Marsden Medal for Outstanding Service to Science, presented in Wellington on 14 November 1996.

Professor Winterbourn has researched the chemistry of free radicals for over 20 years. Initially it was thought that these havoc-causing chemicals occurred as a result of radiation and might explain radiation sickness. Professor Winterbourn and her group have contributed to the present understanding that the body routinely produces these chemicals, already has mechanisms for mopping them up and even harnesses their potential for harm by using them itself to attack invading organisms. Her work is increasing our understanding of a wide range of conditions such as cancer, arthritis and lung disease in premature infants.

As Chairperson of the Biomedical Committee of the Health Research Council, Professor Winterbourn has been a committed and effective advocate for biomedical research.

The Marsden Medal itself is offered each year to scientists and others as a recognition of a meritorious contribution to the cause and development of science.

Along with many other awards, the Foundation for Research, Science and Technology Science Communicator prize of \$1200, for communications concerning issues and benefits, was awarded. This was won by Clive Roberts, Chris Paulin and Andrew Stewart, collectively known as the Fish Team, of the Museum of New Zealand Te Papa Tongarewa. The award was given for their work in discovering, documenting and communicating fish research and the science of biosystems and biodiversity to the general public. In doing so they have clarified important issues pertaining to fish stocks, and fostered an understanding of these matters by public audiences.

The team has contributed to the spread of knowledge through books, magazine and newspaper items, lectures, seminars, collection tours, television, and the Internet, in addition to conducting personal dialogues with members of the public using the telephone, mail, fax and email.

A \$1200 prize for communications concerned with the principles, achievements and methods of science was won by John Campbell of the Department of Physics and Astronomy at the University of Canterbury, for his work debunking the mythology of fire-walking. His spectacular illustration of the principles of thermal diffusion serves to advance understanding across a diverse range of people. Lesley Frederikson of the Foundation for Research, Science and Technology said "John provided an opportunity for young people and the 'young at heart' to take a feet-on approach to physical science."

The New Zealand Association of Scientists Research Medal for outstanding research work, principally undertaken in New Zealand during the last three years, by a person less than 40 years of age, was also awarded. This was won by Michael Dragunow of the Faculty of Medicine at the University of Auckland for his studies of the mechanisms of regulating gene expression in neurons.

NEW CHIEF POLICY ADVISER

Dr Kathryn Garden has been appointed to the position of Chief Policy Adviser in the Ministry of Research, Science and Technology. Dr Garden, who was Acting Chief Policy Adviser, replaces Dr Buwalda, who was appointed to the position of Chief Executive in July of this year.

As the Ministry's first science fellow, Dr Garden joined the Ministry of Research, Science and Technology in February 1993 on secondment from her position as senior lecturer at the University of Canterbury. Dr Garden lectured in electrical and electronic engineering at Canterbury for seven years. She holds a PhD in Electrical Engineering from the University of Canterbury and was awarded the Hamilton Memorial Prize of the Royal Society of New Zealand in 1989 for her work in Computed Tomography. In 1985 she was awarded a Harkness Fellowship and spent time in the United States at both the Mayo Clinic in Minnesota and the Centre for Robotic Systems in Micro-Electronics in Santa Barbara.

"Dr Garden's extensive work on the Government's strategy for research, science and technology, *RS&T:2010*, and also her strong research background make her well placed to implement the goals of the strategy. She has been, and will continue to be, a key asset to the Ministry," Dr Buwalda said.

Dr Garden took up the Chief Policy Adviser position on 4 September 1996 and leads a group of ten policy staff, whose work for the Ministry includes policy advice relating to how public investment in science and technology can best be targeted and managed to contribute to national well-being and prosperity.

MEDIC CORPORATION APPOINTS NEW DIVISIONAL MANAGER

Mr Stephen Lee has been appointed Divisional Manager, Scientific & Industrial Division, for Medic Corporation Ltd.

Formerly marketing manager with Melco New Zealand, Mr Lee has 17 years experience in the sales sector, with a specific focus on sales marketing.

He is responsible for growing the Scientific & Industrial Division's share of the broad medical, science and industrial processes markets and for developing new business opportunities in previously untapped sectors.

Mainstream markets for Medic Corporation's Scientific & Industrial Division include sterilisation and decontamination systems, membrane separation technology and the fields of biotechnology, molecular biology and environmental sciences.

Mr Lee plans to use this core business base as a platform to explore new business opportunities, both in terms of products and new customer sectors.

"The Scientific & Industrial Division is a key player in a big market. We have the luxury of good corporate and brand



Stephen Lee

awareness and of having agency agreements with some of the best known names in the world," Mr Lee said.

"However, no organisation can afford to rest on its laurels and one of my chief goals will be to expand the size and scope of the Division's overall business activities."

Mr Lee intends some rationalisation of the Division's product lines, but says the net effect will benefit both customers and the company's core suppliers.

"There is a need to refocus our efforts on a more select product range. This will give us the resources to market those product lines as competitively as possible and to service and support them to optimum levels. "It's the usual – and tried and true – 80/20 approach to doing successful business," he said.

Key performing brands on which Mr Lee will specialise include Sanitech, Steris, Sartorius, Fujirebio, Nalgene, Barnstead, Ansell, Elkay, Thermolyne and Nuair.

PUBLIC 'MISLED' ABOUT SUNSCREEN PROTECTION

A leading Australasian skin cancer expert says New Zealanders are being dangerously misled about which sunscreens offer the best protection.

Sydney University skin cancer researcher, Gavin Greenoak, says the Cancer Society is wrong with its claims that SPF (Skin Protection Factor) 15 sunscreens can cope with New Zealand's harsh summer sun.

"There's no doubt that SPF-15 sunscreens are totally inadequate for all day protection in this part of the world," says Mr Greenoak, who is also a director of Australia's prestigious Melanoma and Skin Cancer Research Institute. "It's nonsense to believe you can't have better protection than SPF-15."

He says a person can receive up to 35 sunburning doses on a midsummer's day, so it's difficult to argue that SPF-15 is adequate.

"As we all get ready for the long summer holidays, a lot of people are confused about SPF protection, and it's vital that we get the simple message through," he says.

"The message is that the numbers mean exactly what they say: Factor 25 gives more protection than SPF-15. A product with an SPF-50 rating provides double the protection of SPF-25. But perhaps more importantly, people tend to apply an insufficient amount of sunscreen, so if they apply half the amount of an SPF-50, at least they will be getting SPF-25 protection.

"But," says Mr Greenoak, "the term 'sunblock' is a misnomer. Sunscreens are filters which let UV radiation through from the moment of application. An SPF-50 lets through half the amount of an SPF-25, therefore, if it's properly applied, the cumulative sunburning dose of an SPF-50 is half that of an SPF-25."

An Auckland company has developed and recently released an SPF-50 sunscreen specifically formulated to deal with New

Zealand's world-beating summer sun. Extreme Ultimate is aimed at the active outdoor sport and leisure market, as well as sunbathers.

Extreme Ultimate's managing director, Leicester Chatfield, points to this country's alarming rate of skin cancer as proof that high SPF factor sunscreens are vital.

He developed Extreme Ultimate SPF-50 after his son, who used a low SPF product, was badly sunburned last summer. "I thought there was a real need for a sunscreen that would do a better job.

"Many people think as long as they slip-slap-slop sunscreen, they're protected, but that's not so. Those of us who play sport or work outdoors need to take special care and protect ourselves to the best of our abilities," he says.

DUPONT PEROXIDE ACHIEVES INTERNATIONAL ENVIRONMENT ACCREDITATION

DuPont New Zealand's hydrogen peroxide plant at Morrinsville has become the multi-national's global environmental pace-setter by becoming the company's first site worldwide to achieve ISO 14001 certification.

The stringent ISO 14001 standard is based on a philosophy of continuing to minimise the way industry impacts on the environment.

It resulted from the introduction of the Resource Management Act which challenged industrial plants by making them reapply for various licenses including the licence to discharge. At the same time, environmental standards around the world were changing and being replaced by the international standard ISO 14001.

DuPont Peroxide Site Manager, Tom Barratt, says the accreditation process was an opportunity for the plant to become even more proactive in environmental leadership.

"With ISO 14001, the customer is the community. The system is a comprehensive environment management system which continually looks for a higher performance using clear, measurable targets," Mr Barratt says.

The road to ISO 14001 accreditation was led by DuPont Peroxide Chemical Process Technician, Leigh-Anne Cronin, who as a result of her work on the project has gained registration as an associate auditor with the Quality Society of Australasia.

The Morrinsville plant was established in 1991 and is one of only four DuPont hydrogen peroxide manufacturing plants in the world.

Designed as an industry model of responsibility, the plant was constructed with built-in environmental awareness and achieved an Environmental Award in 1992 from the Waikato Regional Council.

In 1994 the hydrogen peroxide plant won a Corporate Engineering Excellence Award from the parent DuPont Company. It was one of 267 nominations internationally for the Award, and the only winner in the Asia Pacific region.

SUPERCONDUCTOR TECHNOLOGY A WORLD FIRST

The first large-scale product using high-temperature superconductors (HTS) to go into full time service is due to be launched in New Zealand early this year, developed by New Zealand companies and their US partner.

Resulting from technology developed by Industrial Research scientists, an ion beam transport magnet using HTS has been built by New Zealand company Alphatech International and US company American Superconductor Corporation.

It was commissioned to replace a conventional magnet at the Institute of Geological and Nuclear Science's Lower Hutt laboratory. It will enhance the performance of the laboratory's accelerator mass spectrometer.

Managing director of Alphatech International, Richard Neale, says this is the first beam transport magnet produced anywhere in the world using high-temperature superconductors.



Above: Alphatech's Richard Neale with conventional magnets in Auckland

Alphatech supplies scientific and medical products, particularly for the physics communities in Australia, Japan, North America and Europe. Their primary export business is the design and manufacture of electromagnets for particle beam transport applications.

Richard Neale says the market potential for beam transport magnets is in the tens of millions of dollars worldwide. "There will be a lot of advantages to using the HTS material once it's developed a little bit further, so we see a very big potential for

it. We're already in discussion with groups from Europe and Australia about making the next generation of HTS magnet. The latest developments in HTS wire already assures us we can build magnets with significantly higher performance."

Industrial Research's superconductivity research leader Jeff Tallon says the research behind this development of HTS technology has been supported for 10 years by the New Zealand Government. He is pleased, therefore, that a New Zealand company is able to be involved at the forefront of the commercialisation and manufacture of HTS technology.

Superconductors are materials which at certain temperatures lose all resistance to electricity. Prior to 1986, the operating temperature had to be close to absolute zero. With the discovery of particular copper oxide ceramics which operated at the more economical, though hardly balmy, temperature of liquid nitrogen (minus 196 °C) the possibilities of 'high-temperature' superconductivity opened up.

The following year Americans Greg Yurek and John Vander Sande formed American Superconductor Corporation (ASC) to commercialise opportunities in HTS.

In New Zealand, a joint venture company, Superlink, owned by Industrial Research and ECNZ was formed. In 1992 Superlink in turn formed a relationship with ASC who manufacture wire under licence from Industrial Research.

A range of HTS-based components is now close to introduction. As many of these technologies will offer improvements for electrical power generation, transmission and efficiency, ECNZ has been a longterm supporter of New Zealand's research effort. The three-quarter million dollar magnet project was supported by the Technology for Business Growth Fund.

Coinciding with the expected launch of the ion beam magnet, Superlink is hosting a two day symposium on new lectrotechnologies for industry in March 1997. Topics will cover potential applications of high-temperature superconducting technologies, power quality and delivery.

CRL OPENS WEST COAST LABORATORY

A new CRL coal laboratory in Greymouth has been set up to help local producers meet the increasingly stringent requirements of their national and international markets. The laboratory, which was opened by Grey Districts Mayor Ron Hibbs on 1 November 1996, will give West Coast coal producers better access to the company's full range of services.

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Patent Proze

by Jane Calvert and Greg Lynch

LAW CHANGE FOR PHARMACEUTICAL PATENTS

In the last issue of Patent Proze we discussed the types of inventions which are patentable in New Zealand. Since that issue the Commissioner of Patents has issued a statement regarding a particular matter of patentability of importance to scientists. The statement creates a significant change to New Zealand patent law.

We previously stated that a new therapeutic use for a known pharmaceutical is not entitled to patent protection unless the actual pharmaceutical, or a composition containing it, is materially different from those previously known.

Historically under New Zealand law, it has been difficult to protect a compound having new therapeutic activity where the compound, or a composition containing it, is already known for some other pharmaceutical use. For example, a compound useful in the treatment of diabetes is not patentable if that compound has previously been known as some other therapeutic agent, such as a painkiller. In some countries, protection could be sought in the form of a patent directed to a method of treating the specified disease with that compound. However, the problem is exacerbated in New Zealand, as inventions involving the medical treatment of humans are generally not patentable.

The Court of Appeal in the Wellcome case of 1983 and the Commissioner of Patents in the MIT case of 1990 would not depart from this historical stance, leaving it up to the legislature to make any change.

Traditionally, this has meant that the only way a new therapeutic use for a known class of compounds or compositions could be protected in New Zealand was by limiting the invention claimed to a new dosage range or to a new method of manufacturing the medicament.

A somewhat unexpected review of this practice has been conducted by the Commissioner of Patents. The Commissioner indicated that the practice was reviewed because of "international trends" which were tending to "liberalise the definition" of what is considered inventive. The Commissioner has issued a statement to the effect that patent protection will now be allowed for an invention directed to the use of a known pharmaceutical for the manufacture of a pharmaceutical composition having a new therapeutic use.

A statement made to this aspect of an invention is known as a "Swiss-style" claim. These generally take the form:

The use, in the manufacture of a medicament of [a known active compound] as an active ingredient in a [newly invented activity] composition.

Claims of this type have been used for some years in other jurisdictions where inventions directed to methods of medically treating humans are not allowed.

The ability to use the Swiss-style claim in New Zealand means that effective protection for a new therapeutic use of a known pharmaceutical can now be obtained. This provides a key incentive for researchers to revisit existing compounds and to search for new types of biological activity associated with those compounds.

The change brings New Zealand more in line with the policies of many overseas jurisdictions.

The change also means that several patent applications, which contain Swiss-style claims, and which are pending at the New Zealand Patent Office will now proceed to acceptance.

The Commissioner has, however, reiterated that inventions directed to the medical treatment of humans would continue to be non-patentable. This issue is being addressed in a review of New Zealand's patent law. We anticipate new patent legislation to be introduced into Parliament within the next 2 or 3 years.

INTERNET

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Jane Calvert

Jane Calvert and Greg Lynch are both employed in the patent department of Baldwin, Son & Carey, Patent and Trademark Attorneys, and Solicitors, where they specialise in chemistry patents. Jane joined Baldwins after completing a PhD in chemistry at the University of Canterbury in 1994. Greg also joined Baldwins in 1994 after three years research at Industrial Research Ltd in Wellington. Following completion of a PhD in chemistry at the University of Otago in 1989, he spent a two year period as a post doctoral researcher at Oxford University.



Greg Lynch

Methyl Mercury in Rainbow Trout and the Trout Food Web in Lakes Okareka, Okaro, Tarawera, Rotorua and Rotomahana, New Zealand

Jonathan P Kim, Department of Chemistry, University of Otago, P O Box 56, Dunedin

Introduction

Globally, there has been concern for elevated levels of mercury (Hg) in fish, due to human health risks. In particular, the direct input of Hg to water bodies, due to societal usage, have resulted in bioaccumulation of Hg in the aquatic food chain and high Hg levels in fish. The most tragic occurrence of methyl Hg poisoning from this vector, through the consumption of contaminated seafood, was probably during the late 1950's at Minamata Bay, Japan (1).

Fish living in remote regions can also contain elevated Hg concentrations. More recently, investigations in North America and Europe have focused on processes responsible for high Hg levels found in fish living in lacustrine environments far from Hg sources due to human activities. Mercury, as elemental Hg (Hg^0), the predominant form in the atmosphere, is transported over long distances. Either through gas to particle conversion, or direct equilibrium of Hg^0 with rain droplets, Hg is deposited into the lake as dust or is washed out of the troposphere in rain (2-7). Once in the lake, inorganic Hg can be converted to methyl Hg by microbial mediation (8,9). For fish, methyl Hg can be subsequently bioaccumulated directly from the water through uptake across the gills (10,11) or ingestion through diet (12-14).

Here in "clean and green" New Zealand, we are fortunate to have a low population density compared to other industrialised nations, and therefore human pollution problems are less and restricted to a few areas. Hence human inputs of Hg to the environment are probably localised and small. There are, however, other natural inputs of Hg to our aquatic environment. These include Hg in rain, Hg in natural catchment drainage, and on the North Island of New Zealand, a potentially important Hg source is from geothermal emanations or hot springs, due to their relatively high Hg concentrations compared to other natural waters in New Zealand (Table 1).

This article summarises recent work concerning methyl Hg in rainbow trout (*Oncorhynchus mykiss*, 17) and in the trout food web; consisting of phytoplankton; zooplankton (*Daphnia carinata* and *Calamoecia lucasi*); trout prey: smelts (*Retropinna retropinna*), bullies (*Gobiomorphus cotidianus*), and koura (a fresh water crayfish, *Paranephrops planifrons*); in Lakes Okareka, Okaro, Tarawera, Rotorua, and Rotomahana. These lakes are impacted by varying degrees of Hg due to geothermal hot springs. The aims of these investigations were firstly, to examine the within-lake variation of methyl Hg with fish length and age for a given lake, and the between-lake differences of methyl Hg in fish due to geothermal emanations and also to further

investigate the bioaccumulation of methyl Hg in the trout food web, in order to further elucidate the mechanism(s) responsible for methyl Hg in fish at the top of the food chain.

Table 1. Mercury concentrations in some New Zealand natural waters.

Water Type	Mercury (ng L ⁻¹)	Reference
Geothermal discharge, Wairakei	80 - 160	15, 16
Champagne Pool, Waiotapu	2600	15
Ketetahi Hot Springs, Tongariro National Park	1140	17
Crater Lake, Mt. Ruapehu	800 - 1600	17
Rain, Tasman Sea	3.8 ± 0.8 sd	18
Lake Taupo	0.45, 0.51	17
Lake Aratiatia, Waikato River	2 - 6	16
Manuherikia River, South Island	0.05 - 0.90	19

Study Area

Five lakes near Rotorua (Figure 1) were selected to represent trout habitat impacted by varying degrees of mercury contamination from geothermal sources. These lakes; which lie on the central North Island plateau, are within the Taupo Volcanic Zone (TVZ), a region which encompasses volcanic and geothermal activity between White Island and Mt. Ruapehu, New Zealand. They provide a "natural" laboratory to investigate methyl Hg in trout and the bioaccumulation of methyl Hg in the trophic levels comprising the fish food web in lakes with a range of Hg inputs and Hg water concentrations.

Lakes Okareka and Okaro were selected as "clean" lakes, with little geothermal influence (ca. 6% of the total water was estimated as geothermal input, 20). Lakes Tarawera, Rotorua and Rotomahana were chosen as geothermally influenced lakes, with the percentage of total water inflow attributable to geothermal emanations as follows: Tarawera (37%), Rotorua (43%), and Rotomahana (53%). The Waimangu geothermal area lies adjacent to Lake Rotomahana and geothermal water from this source drains into the lake.

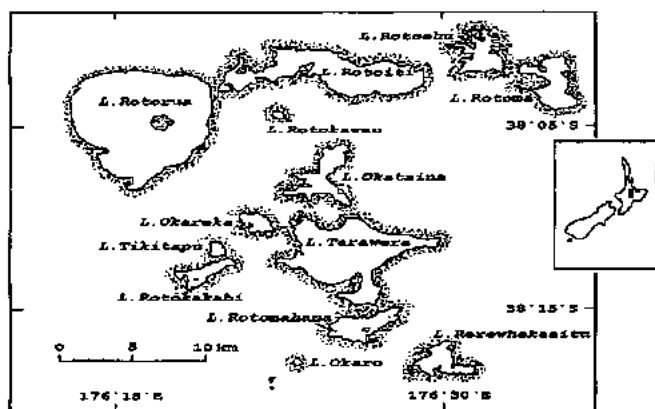


Figure 1. Locations of Lakes Okareka, Okaro, Tarawera, Rotorua and Rotomahana on the central North Island plateau, New Zealand.

The lakes were sampled during the Austral summer and autumn of 1993 and 1994. Four sampling trips were conducted. The first occurred on February 25, 1993, when samples for phytoplankton, zooplankton, smelts and bullies were collected. Not all of the biota were obtained for a given lake, due to their absence in some of the lakes. Trout were caught from Lakes Okaro and Rotomahana during the second sampling (March 22-23, 1993). During this time, water samples were also obtained. Water samples for the other 3 lakes were collected a week later (March 29, 1993).

Additional trout specimens from Lakes Okareka (January 27-29, 1993) Tarawera (April and May, 1993) and Rotorua (April 11 - May 16, 1993), were provided by the Eastern Fish and Game Council, New Zealand. Finally, during the following year (March 3-4, 1994), water and biota in the lower trophic levels were sampled from all five lakes.

Sample Collection

Mercury concentrations in water are very low, typically with values in the sub part per trillion (ng L^{-1}) range. Thus trace metal "clean" conditions were used to carefully collect a sample. Surface water for Hg was sampled in acid-cleaned teflon bottles by hand-dipping. This was accomplished wearing arm-length plastic gloves and sampling off the bow of an inflatable boat while moving into uncontaminated water (21, 22). Surface water was also obtained by snorkelling into "clean" water and filling an acid-cleaned teflon bottle while wearing disposable polyethylene gloves. A few water samples at depth were also obtained by SCUBA diving in a similar manner and sealed at depth. The Hg water samples were preserved in the field with 5 mL of mercury-free concentrated hydrochloric (HCl) acid.

Care was also applied to the collection of the phytoplankton and zooplankton to avoid contamination during sampling. Phytoplankton were collected by hand-dipping acid-cleaned bottles off the bow of a small boat, as described above. Back on shore, an aliquot (0.3 to 1.4 L), was filtered through a glass fibre filter held in an acid-cleaned polycarbonate filtering apparatus. The filter was previously blanked of Hg by heating to 450 °C for > 12 hours. The retentate was stored in an acid-cleaned glass vial with a teflon-lined lid and frozen. Chlorophyll a samples from the same site were also collected, filtered in the laboratory onto glass fibre filters and frozen for later analysis (23).

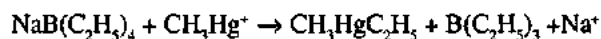
Zooplankton were captured with a nylon phytoplankton net with a sewn codpiece end. The mouth of the net was attached to a teflon sheathed aluminium hoop. The net was acid-cleaned in 2 % HCl and transported to the field doubly bagged (the inner polyethylene bag was also acid-cleaned, 15 % HCl). It was weighted with a diving weight hermetically sealed in 3 plastic bags and attached to plastic rope. Typically several vertical hauls were made. Upon retrieval, using a plastic-gloved hand, the net was turned inside out and the zooplankton contents transferred into an acid-cleaned glass beaker with nanopure water (resistivity: $18 \text{ m}\Omega \text{ cm}^{-1}$) and covered with polyethylene film. Back on shore, the contents were concentrated with a custom-built glass and teflon sieve, and stored in an acid-cleaned glass vial with a teflon-lined lid. These samples were placed on ice in the field and frozen back in the laboratory. A zooplankton subsample was also preserved with Lugol's solution for species identification and quantification.

Smelts (*Retropinna retropinna*) and bullies (*Gobiomorphus cotidianus*) were caught with a beach seine along the shore. To avoid Hg contamination from handling, specimens were taken from the net with a plastic-gloved hand and stored in a zip-locked bag. Koura (*Paranephrops planifrons*), were obtained by SCUBA diving. The smelt, bully and koura samples were also stored chilled in the field and frozen in the laboratory.

Rainbow trout (*Oncorhynchus mykiss*) from Lakes Okareka, Okaro, and Rotomahana were caught with (10 m long, 3 m deep) panel gill nets (mesh sizes: 110, 80, 60, 40 mm) set overnight. Trout from Lake Rotorua were procured by anglers and specimens from Lake Tarawera were captured from a fish trap operated by the Eastern Fish and Game Council, New Zealand, on a tributary stream feeding that lake. The trout specimens were stored in a freezer.

Sample Processing and Analytical Methods

Methyl Hg in water was measured by solvent extraction of methyl Hg chloride (CH_3HgCl) into dichloromethane, transfer of methyl Hg to nanopure water by evaporation and subsequent ethylation (24). Yield recoveries for methyl Hg were > 90%. This novel speciation method allows the determination of methyl Hg and other Hg^{2+} species by ethylation with sodium tetraethylborate:



Methyl Hg is converted to methylethyl Hg and the Hg^{2+} species to diethyl Hg. The ethylation reactions are pH dependant and optimal at pH 5. The volatile species are purged from aqueous solution, and trapped on a column packed with Carbotrap[®], a carbon substrate. Methylethyl and diethyl Hg are liberated from the column by ballistic heating to 400 °C and separated by gas chromatography (GC, 15% OV-3 on Chromosorb W, 1.5 m, 100 °C). Methylethyl Hg elutes first, followed by diethyl Hg, according to their boiling points. The ethylated Hg species are then pyrolysed to Hg^0 (700 °C) and detected by atomic fluorescence spectrometry (AFS; 24, 25). The detection limits were approximately 0.5-1 pg Hg.

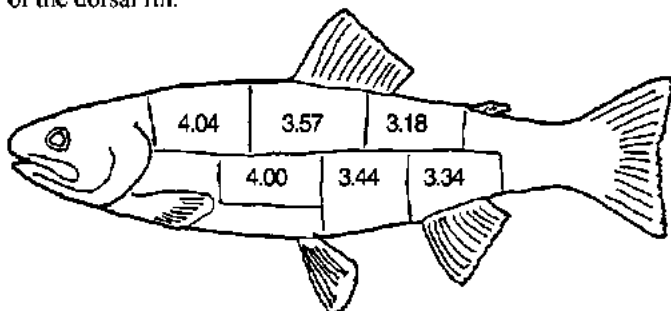
Total Hg in water (Hg_T) was determined by oxidation with mono bromine chlorine (26), followed by stannous chloride reduction and two-stage gold amalgamation and detection by AFS (27). Participation in a "blind" international-aqueous mercury speciation inter-comparison exercise for water from a Wisconsin lake yielded both accurate and precise results for methyl Hg and Hg_T (28).

Phytoplankton samples (torn filter samples) were placed in acid-cleaned screw capped teflon vials containing 25% w/v KOH in methanol. These were heated at 60 °C for > 12 h. An aliquot was then analysed by aqueous phase ethylation and the GC procedure described above. These seston samples, in addition to phytoplankton, possibly contained particles which retained on the filter could also contribute methyl Hg.

Methyl Hg in zooplankton was measured by weighing an amount of tissue (wet weight, ww), and subsequent digestion and analysis accomplished as were the phytoplankton samples. Smelts and bullies were processed with a stainless steel tissue grinder. Between 3-5 individuals of similar size were homogenised together in a composite sample. A portion of this tissue (ww) was analysed by the digestion, ethylation and analytical methodology (see above). For the koura, methyl Hg was determined in the muscle tissue extracted from each crayfish tail. Minced pieces of tissue (2-4 mm, ww) were subsequently processed and analysed. Lastly, methyl Hg in the trout was quantified as follows. A portion of trout muscle tissue was carefully dissected from each fish (29) and about 1 gram of minced sample (2-4 mm pieces, ww) was processed and analysed in a similar manner as the other biological tissues. Yield recoveries of methyl Hg for a DORM-1 fish standard were good ($102.7 \pm 17.8\%$).

Chemical Speciation and Hg Variability in Trout

The variability of methyl Hg concentration in muscle tissue from an individual trout is shown in Figure 2. Six sub-samples were dissected from a fillet and analysed for methyl Hg. Although these methyl Hg concentrations decrease posteriorly, this is only a minor reduction (ca. 20%). A mean value of $3.60 \pm 0.35 \text{ mg g}^{-1}$ (one standard deviation, sd) was calculated, which suggests that variability of methyl Hg in a trout muscle tissue is small. However, for the rest of the trout, methyl Hg concentrations were determined from the same area, which was above the lateral line and forward of the dorsal fin.



$$\bar{X}(6) = 3.60 \pm 0.35 \mu\text{g g}^{-1}$$

Figure 2. Variation of methyl Hg concentration in muscle tissue of an individual trout.

The relationship between methyl Hg (mg g^{-1}) and Hg_T (mg g^{-1}) in trout muscle tissue is presented in Figure 3. Only a few samples (4 to 7) were selected for the determination of Hg_T in trout from

each lake. The 1:1 equivalence line is also depicted in the figure. Linear regression analysis between methyl Hg and Hg_T yielded the following result:

$$Y = 0.963 X + 0.030, n=32, r^2=0.980$$

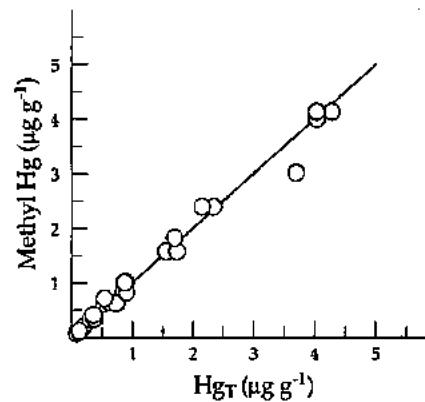


Figure 3. The proportion of methyl Hg to total Hg (Hg_T) in trout muscle tissue. The 1:1 equivalence line is also shown.

Most of the Hg in trout muscle tissue (>96%) was in the methyl form, confirming a previous result for New Zealand, which was accomplished with the Westoo method (30). Investigations in North America using the ethylation technique have also shown that most of the Hg in fish muscle tissue is methyl Hg (29, 31).

Methyl Hg and Trout Age

Mean methyl Hg concentrations ($\pm 1 \text{ sd}$) in trout from the five lakes are plotted against age (yrs) in Figure 4. The scale changes in methyl Hg concentration between the upper and lower portions of this figure. Fish ages were estimated from the sagittal otoliths from each fish and checked against ages from otoliths in captured hatchery-reared fish (tagged) from these lakes whose age was known.

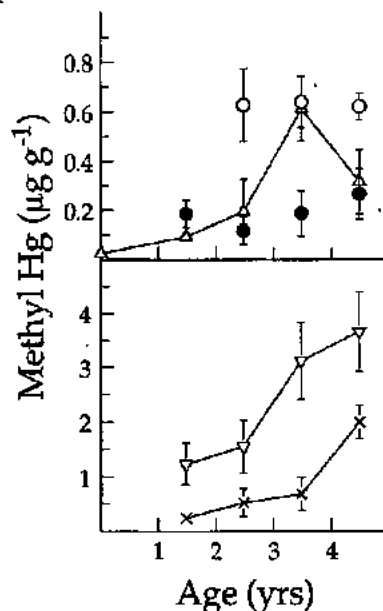


Figure 4. Mean methyl Hg concentrations and standard deviation in trout for different age groups from Lakes Okareka (closed circles), Okaro (open circles), Tarawera (triangles), Rotorua (crosses) and Rotomahana (inverted triangles).

Unfortunately, there is a paucity of data for certain age groups in some of the lakes. There are no methyl Hg data for the 1⁺ year old fish from Lake Okaro; and there is only one methyl Hg value for the 1⁺ and 2⁺ year old fish from Lake Okareka, the 3⁺ and 4⁺ year old Lake Tarawera fish, and the 4⁺ trout from Lake Rotorua. Given the data are limited, methyl Hg appears to vary little with age for trout living in the lakes with low geothermal input (Okaro and Okareka). There is a slight increase observed for methyl Hg with age for Lake Tarawera, and greater increases for the more strongly geothermal influenced Lakes Rotorua and Rotomahana. For example, the Lake Rotomahana trout in the 3⁺ and 4⁺ age groups (n=7) have higher methyl Hg concentrations than the younger 1⁺ (n=12) and 2⁺ (n=11) year old fish (t test, p<0.001).

Differences were observed between increases of methyl Hg concentration in trout with fish age for the geothermally influenced lakes (Rotomahana, Rotorua and Tarawera), which is probably partially due to different geothermal inputs to these lakes. Trout in Lakes Rotorua and Rotomahana increased in size in a similar manner with age (data not shown), however there was a greater increase in methyl Hg concentration with time for Lake Rotomahana than Rotorua (Figure 4). Lake Tarawera trout had smaller methyl Hg increases with age and grew to larger sizes than trout in Lakes Rotorua and Rotomahana (12-15 cm). Growth dilution of the methyl Hg concentration in trout may be an important factor in this lake. Similar increases of mercury in salmonoids with age has been observed in other studies (14, 32-34).

Methyl Hg and Trout Length

Methyl Hg in trout muscle tissue (mg g⁻¹) increases with fish length (Figure 5). There were distinct patterns within each lake. Lake Rotomahana had the largest increase in methyl Hg with length. Next in the magnitude of methyl Hg increase with length was Lake Rotorua. Lake Okaro showed no distinct pattern of increasing methyl Hg concentrations in the trout. This may be due to the limited size range (ca. 35-50 cm) of the samples. There were lesser increases in methyl Hg concentration in trout flesh with length for Okareka and Tarawera.

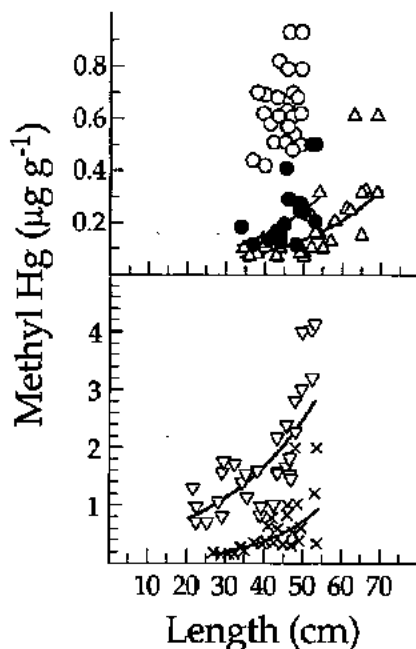


Figure 5. The relationship between methyl Hg concentration and length for trout from Lakes Okareka (closed circles), Okaro (open circles), Tarawera (triangles), Rotorua (crosses) and Rotomahana (inverted triangles).

For all lakes, except Lake Okaro, linear regression analysis indicated that the best monophasic fit relationship was log Hg versus length (p<0.02, Table 2), which is also indicated by the solid lines in Figure 5. The slopes for the four lakes were the same (f test, df=3, p<0.05), and an analysis of covariance (ancova) on the four lakes showed that the intercepts were significantly different from one another (p<0.001, df=99, r=0.936). Rotomahana had the highest intercept, followed by Rotorua, then Okareka and finally Tarawera (Table 2). This means the trout had different methyl Hg concentrations for each lake. The actual bio-accumulation mechanism of methyl Hg by the trout is uncertain at present. Methyl Hg could be accumulated directly from the water (possible, although methyl Hg water concentrations are low, see below) or through the trouts' food (more probable). However, because the slopes were statistically the same, this suggests that the same bio-accumulation mechanism is occurring in these lakes.

Although the changes in methyl Hg concentrations in trout as a function of length can be explained by an exponential model, it is most intriguing that methyl Hg concentrations increase in variability with fish size (Figure 5). For example, this occurs in Lakes Rotomahana (45 cm), Rotorua (40 cm), Tarawera (50 cm) and Okareka (45 cm). This may be due to changes in the diet of the larger trout. In oligotrophic lakes in the Rotorua region, such as Lakes Okareka, Rotomahana, and Tarawera, smaller trout feed predominantly on smelt (*Retropinna retropinna*), which are shoaling, pelagic fish (35). However, the larger trout greater than 40-50 cm in these lakes appear to feed more on epibenthic prey, such as bullies (*Gobiomorphus cotidianus*) and crayfish (*Paranephrops planifrons*). Lake Rotorua trout eat both smelts and bullies to a varying degree. In contrast, in eutrophic, turbid lakes, such as Lake Okaro, trout fed mainly on bullies (35). The epibenthic prey may contain higher methyl Hg concentrations than smelt, due to their proximity to the benthos, where methylation of Hg can readily occur (9). This may explain the high methyl Hg concentrations in trout for Lake Okaro compared to Lake Okareka.

Methyl Hg in Trout and Geothermal Emanations

A comparison of methyl Hg concentrations in trout between the lakes was accomplished by multivariate analysis using the first 11 univariate and bivariate data in Table 2, (36). A principal component analysis (PCA) was run with CANOCO, a canonical ordination computer program (37). The results of the PCA yielded two principal axes which accounted for 98 percent of the variance. The first axis was highly correlated (r=0.974, p<0.05) with estimated geothermal input to each lake (data from 20). The second axis was correlated with mean fish length (r=0.879, p<0.05). These results indicate there is a strong geothermal influence between lakes and a secondary effect of mean trout length. This suggests that Hg emanations from geothermal hot springs is important in determining methyl Hg levels of trout living in these lakes.

Relevance to Society

The methyl Hg data in trout reported here compare well with previous investigations in New Zealand assuming that all the Hg determined for trout in these investigations was methyl Hg (Table 3). The mean Hg values for Lake Rotorua trout appear to be decreasing with time, but this trend is difficult to substantiate because of the small sample size from the earlier studies.

Table 2. The methyl Hg data (mean, range and sd) and the fish length data (mean, range and sd) for trout from in each lake are summarized below. Also included is the slope, intercept, r^2 , and the number of samples for the log Hg-length regressions.

Lake	Okareka	Okaro	Tarawera	Rotorua	Rotomahana
MHg (mean), mg g ⁻¹	0.221	0.650	0.182	0.531	1.84
MHg (min), mg g ⁻¹	0.117	0.420	0.069	0.146	0.71
MHg (max), mg g ⁻¹	0.501	1.15	0.612	1.99	4.13
MHg (sd)	0.100	0.161	0.125	0.415	0.99
Length (mean), cm	45.5	44.1	52.4	41.8	39.2
Length (min), cm	34.0	34.8	34.5	27.0	21.7
Length (max), cm	53.0	49.4	69.0	53.5	52.9
Length (sd)	4.8	4.1	10.0	7.4	9.7
Slope	0.046	-0.004	0.043	0.065	0.040
Intercept	-3.69	-2.69	-4.17	-3.58	-1.07
r^2	0.297*	0.0002	0.542*	0.522*	0.582*
n	19	25	25	26	30

significant $p < 0.02$
Methyl Hg (MHg)
Standard deviation (sd)
Number of trout (n)

Table 3. Methyl Hg concentrations in trout from Lakes Okareka, Okaro, Tarawera, Rotorua and Rotomahana.

Lake	1995 (Ref. 17)	1976 (Ref. 38)	1973 (Ref. 30)
Okareka	Mean=0.22 sd=0.10 0.18<X<0.50 n=19	Mean=0.24 sd=na 0.10<X<0.63 n=13	Mean=0.35 sd=0.02 0.33<X<0.37 n=5
Okaro	Mean=0.65 sd=0.16 0.42<X<1.15 n=25	na	na
Tarawera	Mean=0.18 sd=0.13 0.07<X<0.61 n=25	na	na
Rotorua	Mean=0.53 sd=0.42 0.15<X<1.99 n=26	Mean=0.85 sd=na 0.06<X<2.10 n=11	Mean=1.68 sd=0.68 1.10<X<2.67 n=4
Rotomahana	Mean=1.84 sd=0.99 0.71<X<4.13 n=30	na	Mean=1.68 sd=0.58 1.52<X<2.92 *n=5
Not available (na)			

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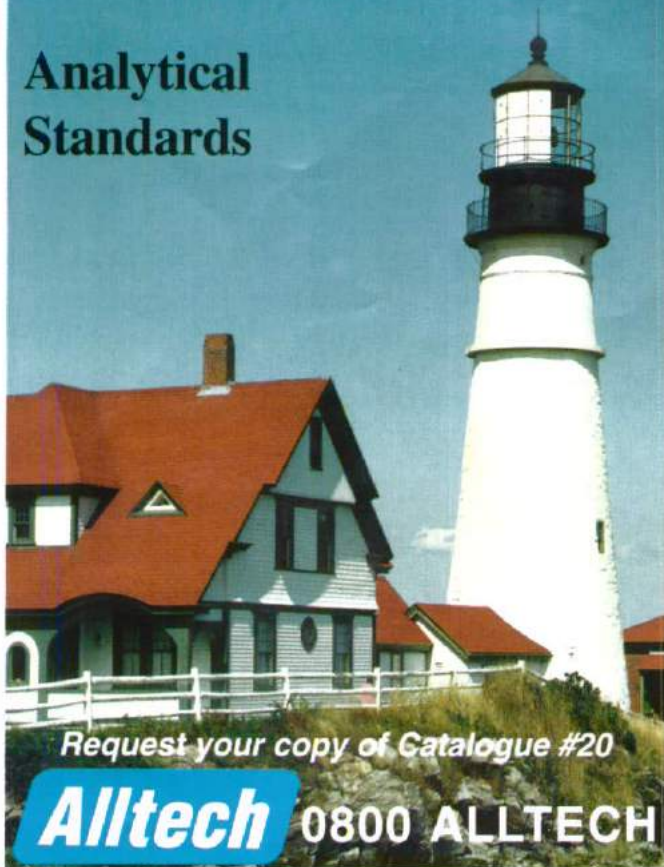
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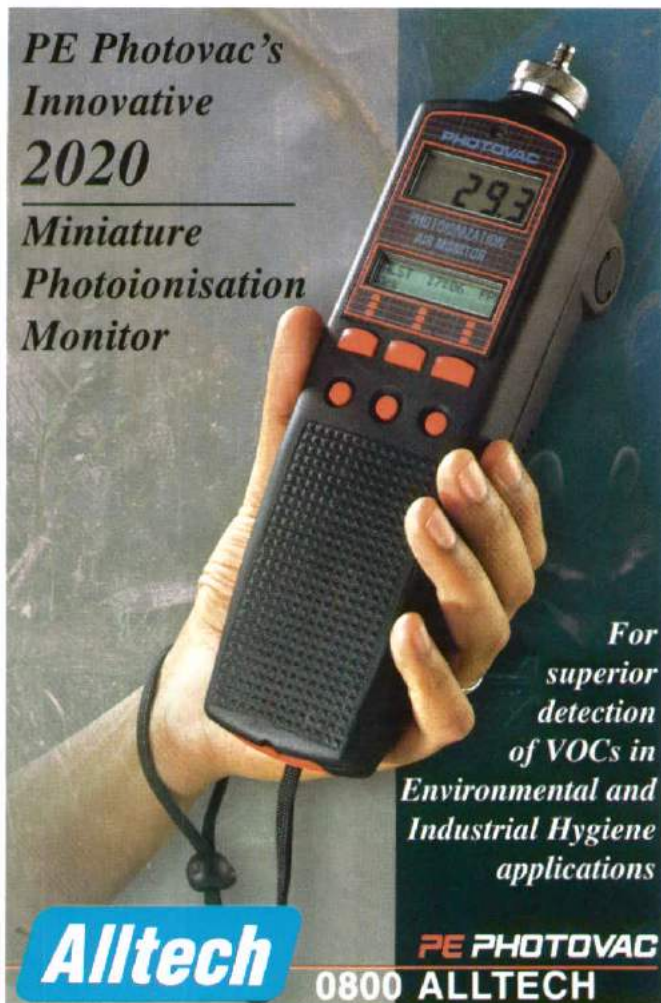
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The methyl Hg concentrations in trout from the lakes in this study also fall within the range of Hg values observed in trout in North America and Europe. Lower mercury values in rainbow trout, on the order of 0.07 mg Hg g⁻¹ (39) and 0.036 mg Hg g⁻¹ (40) have been observed for riverine systems. Mercury concentrations in trout for lacustrine habitats range between 0.04 and 3.2 mg Hg g⁻¹ for lake trout living in Lake Tadénac, Canada (14); 0.14 to 0.74 mg Hg g⁻¹ for brown trout and lake trout from Lake Ontario (41); and vary from 0.08 to 0.13 mg Hg g⁻¹ for brown trout in lakes in Norway (34). In addition, the mean methyl Hg concentrations for all the lakes, except Lake Rotomahana, are below the United States Food and Drug Administration level of 1 mg Hg g⁻¹.

Although the higher methyl Hg concentrations for rainbow trout from Lake Rotomahana are similar to concentrations reported for lake trout in Lake Tadénac (14), the trout in the latter lake were a lot older (>18 years) than the Rotomahana trout. This indicates that the trout are accumulating Hg at a fast rate in Lake Rotomahana, attaining up to 4 mg Hg g⁻¹ in four to five years.

These high methyl Hg concentrations in Rotomahana trout have potential human health implications. For example, an adult male human can safely eat one meal of trout from Lake Rotomahana every 3 weeks. This calculation used 4.0 mg Hg g⁻¹ as the methyl Hg concentration in the fish, the World Health Organisation tolerable methyl Hg uptake limit of 430 ng methyl Hg×kg human⁻¹×day⁻¹, a 70 kg human being, and a fish meal size of 150 g (42). For an adult female, weighing 50 kg, a similar calculation yields one meal per month. If this consumption rate is typical for recreational anglers fishing Lake Rotomahana, then there is probably no need for concern. However, for individuals with a greater consumption rate of trout from this lake, or for pregnant women, where prenatal effects of methyl Hg on human development may become important (43), caution is recommended. The Eastern Fish and Game Council has recently publicised the high methyl Hg levels in Lake Rotomahana trout and are considering, in conjunction with the Waikato Regional Council, whether to post warning signs at the access points of this lake (Pitketchley, *pers commun*).

Methyl Hg in the Trout Food Web

Water and Phytoplankton

Mean concentrations of Hg_T and methyl Hg in water for the lakes are listed in Table 4. The Hg_T means ranged from 0.57 to 4.81 ng Hg L⁻¹, while methyl Hg means varied between 0.09 and 0.51 ng L⁻¹. Methyl Hg comprised between 6-37 % of the Hg_T in water. There was no relationship observed between methyl Hg and Hg_T in water in the five lakes. These Hg levels are similar to that observed in other lacustrine systems in North America (6, 27, 44-47), but are lower than that found in Lake Onondaga, a polluted lake in New York (48).

Methyl Hg mean concentrations in phytoplankton are also shown in Table 4. The data are expressed as methyl Hg (ng) per cell volume (cv, mm⁻³). This was estimated by normalising methyl Hg to chlorophyll a and using an empirical seasonal relationship of chlorophyll a and cv derived for these lakes (49). Methyl Hg in the phytoplankton ranged from 0.6-5.2 ng mm⁻³. As previously mentioned, the possibly exists that the methyl Hg in the phytoplankton was overestimated as it was not feasible to separate the phytoplankton from other particulate material in these samples. In addition, the methyl Hg determinations (2-5 pg methyl Hg) were close to the limit of detection. Given these caveats, there was no apparent relationship between phytoplankton and Hg_T or methyl Hg in water.

Zooplankton

The relationship between mean methyl Hg in zooplankton and Hg_T in water for 4 of the lakes is depicted in Figure 6. There was no zooplankton caught in Lake Tarawera. The samples consisted primarily of one zooplankton species for a given sample. *Calamoecia lucasi* was the major species in Lakes Okaro, Rotorua and Rotomahana, while *Daphnia carinata* was dominant in lake Okareka. Methyl Hg in zooplankton varied between 0.004-0.036 mg/g (ww). These values are in the lower range of those observed for zooplankton in Wisconsin lakes (46, 50).

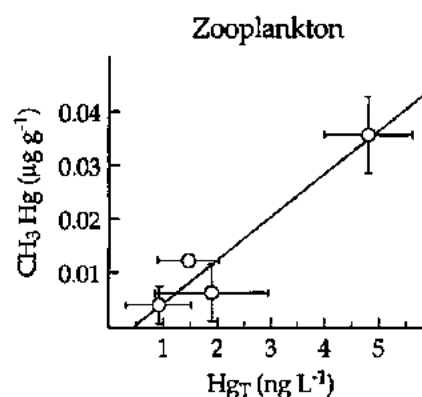


Figure 6. Mean methyl Hg levels and standard deviation in zooplankton versus Hg_T concentrations in Lakes Okareka, Okaro, Rotorua and Rotomahana. A linear regression line is also drawn.

Regression analysis between methyl Hg in the zooplankton and Hg_T in water yielded a linear relationship (Figure 6) that was statistically significant (n=4, r=0.9631, p=0.05). As with the phytoplankton, no relationship was observed with methyl Hg in water. An inverse relationship was observed between methyl Hg in phytoplankton and zooplankton (Figure 7). This is intriguing, as it appears the phytoplankton are accumulating methyl Hg differently than the zooplankton. Hg_T in the water

Table 4. Mercury concentrations in water and phytoplankton in Lakes Okareka, Okaro, Tarawera, Rotorua and Rotomahana.

Lake	Hg _T (ng L ⁻¹)	Methyl Hg (ng L ⁻¹)	Phytoplankton Methyl Hg (ng mm ⁻³)
Okareka	0.92	0.09	5.2
Okaro	1.90	0.51	4.7
Tarawera	0.57	0.21	0.8
Rotorua	1.47	0.23	1.1
Rotomahana	4.81	0.31	0.6

appears to affect the methyl Hg concentrations in the zooplankton, but not the phytoplankton.

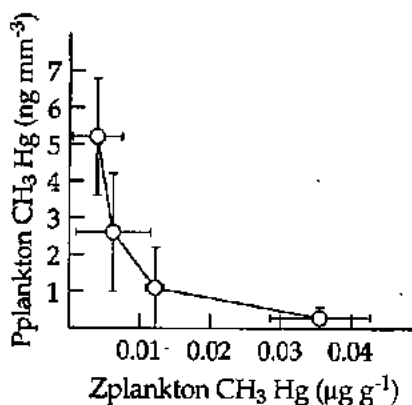


Figure 7. The relationship between methyl Hg in phytoplankton and zooplankton.

Smelts, Bullies, Koura and Trout

Mean methyl Hg in the trouts' prey (koura, bullies and smelt) in the lakes are plotted against Hg_T in water (Figure 8). There is a paucity of data for koura (top graph) because crayfish were only obtained in three lakes. Methyl Hg (0.024 to 0.156 $mg\ g^{-1}$) appears to increase with Hg_T in water. However, due to the limited data, no significant linear trend was found by regression analysis. Methyl Hg in bullies (middle graph) showed a linear increase with Hg_T in water ($n=5$, $r=0.9044$, $p=0.05$), ranging up to about 0.2 $mg\ methyl\ Hg\ g^{-1}$ in Lake Rotomahana. Methyl Hg in smelts (bottom graph) also exhibited a linear correlation with Hg_T in water ($n=5$, $r=0.9884$, $p=0.01$), and attained roughly twice as much methyl Hg than bullies in Lake Rotomahana. No trends were observed between methyl Hg in the prey species and methyl Hg in water.

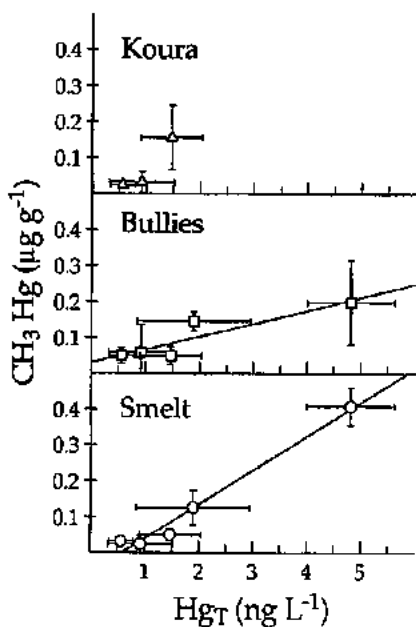


Figure 8. Mean methyl Hg concentrations and standard deviation in the prey species of trout (koura, bullies and smelt) in relation to Hg_T in water. Best fit linear regression lines are depicted for the bullies and smelt.

Lastly, the relationship between the mean methyl Hg concentrations in trout and Hg_T in water, along with the mean methyl Hg levels in the trouts' prey are depicted in Figure 9. The mean methyl Hg levels in trout ranged from 0.22-1.84 $mg\ g^{-1}$ and also linearly covaried with Hg_T in water ($n=5$, $r=0.9982$,

$p=0.01$). This result is different from that found for lakes in California (27), where Hg_T in fish was correlated with dissolved organic Hg in water. The results in the present work indicate that Hg_T in water is an important factor in determining the methyl Hg concentrations in the upper 3 trophic levels of the food web (phytoplankton being the exception). This may be because higher Hg_T water concentrations would result in more Hg in a labile form, available for microbial methylation and subsequent bioaccumulation of methyl Hg by the biota. As with the other lower trophic levels, no relationship with methyl Hg in water was evident.

Methyl Hg Bioaccumulation Model

A bioaccumulation model of methyl Hg for these lakes is presented in Figure 10. Regression analysis between the methyl Hg in trout and smelt indicated that methyl Hg is bioaccumulated about 4.1 times between these trophic levels ($n=5$, 0.9886 , $p=0.01$, see also Figure 9). Similar calculations yielded significant linear regressions between trout and koura ($n=3$, $r=0.9987$, $p=0.01$) and bullies ($n=5$, $r=0.8933$, $p=0.05$). The bioaccumulation factors for the smelts and bullies relative to zooplankton were calculated from the relationships of smelt, bullies and zooplankton to Hg_T in water. The bioaccumulation of methyl Hg between zooplankton and water (5.3×10^4) was estimated as the mean for Lakes Okareka, Okaro, Rotorua and Rotomahana.

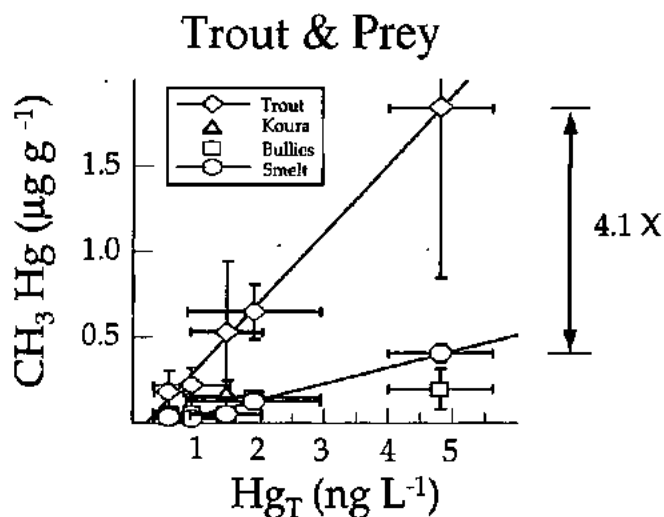


Figure 9. Mean methyl Hg levels in trout and their prey from the five lakes versus Hg_T in water. Linear regression lines are drawn for the trout and smelt. The trout have approximately 4.1 times more methyl Hg than the smelt.

Bioaccumulation Model

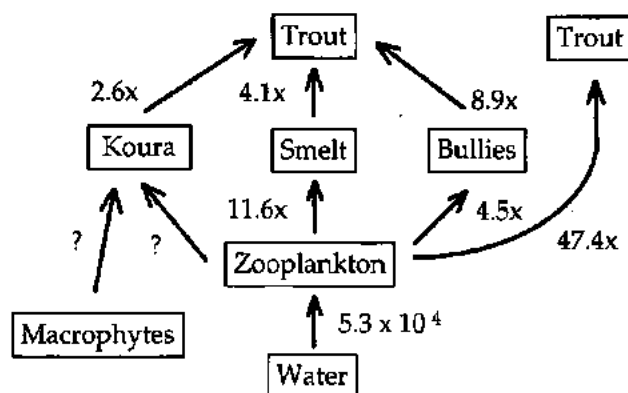


Figure 10. Bioaccumulation model for the trout food web.

It is most apparent that the greatest bioaccumulation of methyl Hg occurs at the lower trophic levels, for example, between zooplankton and water. This result has been observed in other lakes in Wisconsin (50). The bioaccumulation of methyl Hg to the next trophic level containing the trouts' prey, is less, with the smelt (11.6x) accumulating roughly twice as much as the bullies (4.5x). The uptake of methyl Hg for koura from the lower trophic levels is not known as they probably feed on macrophytes and detrital matter rather than zooplankton. The bioaccumulation of methyl Hg of trout from its' prey varies among the individual prey species. Trout consumption of bullies had the greatest bioaccumulation factor (8.9x), followed by smelt (4.1x) and koura (2.6x).

The bioaccumulation model indicates that koura (caught in only three lakes) would have the highest methyl Hg concentrations, followed by smelt and then bullies. From the discussion of methyl Hg and trout length above, it was suggested that elevated methyl Hg concentrations in larger trout in these lakes could be due to a change in diet from smelt, a shoaling, pelagic fish, to larger prey such as bullies or koura, which live on the benthos. These organisms could bioaccumulate more methyl Hg, and attain higher methyl Hg levels due to their proximity to the sediments, where microbial methylation could occur. If this conjecture is valid, then the larger trout with high methyl Hg concentrations are probably feeding on koura rather than bullies.

Conclusions

In summary, methyl Hg was the major form of Hg in trout muscle tissue in Lakes Okareka, Okaro, Tarawera, Rotorua and Rotomahana. Most of the variability in methyl Hg concentration in trout living in these lakes (>98%) can be explained by geothermal input and trout length. This indicates Hg from geothermal sources to particular lakes is an important factor for between-lake variability of methyl Hg in trout. Fish length, and to a lesser degree, age, was important in determining variability of methyl Hg concentrations within a given lake.

Due to wide spread geothermal emanations to the Rotorua lakes, more research is needed on the methyl Hg concentrations in trout living in other lakes not covered in the present work. This is important to New Zealand society, as there should be concern for human health due to the high methyl Hg concentrations in trout resident in lakes such as Lake Rotomahana.

Within the trout food web, methyl Hg concentrations in zooplankton, smelts, bullies and trout exhibited linear increases with Hg in water but not with methyl Hg. This may be due to rapid cycling of methyl Hg within these lakes. Hg appears to be an important factor in determining the methyl Hg concentrations of these organisms. Although Hg_T concentrations in these lakes were in the sub-parts per trillion range, it is apparent that even a minute concentration of 4.8 ng L⁻¹ is sufficient, through bio-magnification in the food web, to result in trout with up to 4 mg g⁻¹ methyl Hg!

Most of the bioaccumulation of methyl Hg occurred in the lower trophic levels of the trout food chain, as evidenced by the fact that methyl Hg was 5.3x10⁴ times greater in the zooplankton compared to water. The concentration factor from the zooplankton to the prey trophic level was 4.5x and 11.6x for the bullies and smelt respectively. The bioaccumulation factor between trout and their prey ranged between 2.6-8.9x, depending on the particular species.

As most of the biomagnification of methyl Hg occurs in lower trophic levels, more research is also necessary on this part of the food web. The differing behaviour of methyl Hg concentrations in phytoplankton and zooplankton is intriguing, and if real, points to a different mechanism(s) for methyl Hg accumulation at these trophic levels. More detailed *in situ* studies on the bioaccumulation of methyl Hg by phytoplankton and zooplankton in relation to Hg and its chemical speciation in the water are needed.

Acknowledgements

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A laboratory with over 25 years experience and expertise in analytical chemistry, particularly residue analysis.

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NEW PRODUCTS

SURFACE/INTERFACE ANNOUNCES A NEW BROCHURE ON UHV SAMPLE TRANSFER SYSTEMS WITH SPECIALISED HEATING AND COOLING STAGES

Hot/cold stages can be constructed to meet specific environmental, thermal, or temperature requirements for research or industry.

Surface/Interface, Inc. announces the availability of a new applications brochure for its customisable line of Hot/Cold Stages. Developed in response to the needs of customers in research and industry, the heating and cooling stages become versatile UHV-compatible sample transfer and experimental stations when combined with an Surface/Interface Inc. precision magnetic manipulator.

The new brochure gives descriptions, specifications, and applications for Surface/Interface Inc.'s wide range of heating and cooling stages. Customisable to fit particular needs, the stages heat and/or cool samples evenly over temperature ranges from -190 °C to 1600 °C. Both standard and custom systems are specially designed to eliminate hot or cold spots that could affect test results or process outcomes. The stages can also be used to provide an electrical bias or can be connected to a thermocouple to measure sample temperature.

Systems can be constructed from a variety of materials for specific needs. Sample platens can be constructed of stainless steel, copper, or molybdenum. Heater substrates can be of boron-nitride, graphite, molybdenum, ceramic, or glass, and heaters are constructed of tungsten and kanthal. Cooling of a sample can be done quickly and efficiently with water, liquid nitrogen, or gas. Standard stages are available that handle samples up to 3 inches in diameter.

Contact: Judy Ackeret, Surface/Interface, Inc.
110 Pioneer Way, Ste D, Mountain View, CA 94041, USA
Ph: (+1-415) 9658205, Fax (+1-415) 9658207, E-mail: sii@aip.org
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NEW GENERATION ON-LINE ANALYSER

A.i. Scientific is proud to announce the release of a new on-line petroleum analyser that has been developed by Phase Technology. This new instrument employs state-of-the-art patented technology and proprietary know-how for accurate phase change detection.

The on-line analyser improves profits by reducing product giveaway and lowering process utilities and hydrogen costs. The technology allows fast and precise measurements of freeze and cloud point of jet fuels, diesels and their components.

An innovative design of the internal thermoelectric cooler completely eliminates the need for an external chiller. The analyser controls sample temperature down to -90 °F even when the plant cooling water is as warm as +90 °F. There is no CFC or refrigerant in any part of the analyser system. Thus, the intensive maintenance work required by cryogenic explosion-proof chillers is eliminated.

The analyser comes complete with a sample conditioning unit that removes all the elements that may interfere with the measurements. This low-maintenance conditioning unit has a patent-pending, self-cleaning feature that keeps the membrane filter free from plugging and extends the filter change-out interval to every six months.

Extensive research was conducted on the effect of free, dissolved and naphthalene-bound water on the reliability of freeze and cloud points. The analyser algorithm incorporates effective methods to prevent water interference in a full range of products including low sulfur diesels and hydrocracked streams.

The modular design allows convenient replacement of modules in the field, minimising downtime in the event of component failure. Apart from standard 4-20 mA and alarm outputs, the analyser has a built-in modem which allows remote monitoring through a telephone link. With this feature, factory personnel or refinery technicians can call up the analyser with a computer from any location having a standard telephone line and obtain information such as measurement quality, diagnostic messages and when to change a filter.

Contact: Kevin Moloney, A.i. Scientific
P O Box 35579 Browns Bay, Auckland
Ph: (09) 4781351, Fax (021) 788940
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KEYSTONE SCIENTIFIC HPLC COLUMNS

Keystone Scientific, of Bellefonte, Pennsylvania, USA, have just published their International Catalogue featuring their proprietary brands of phases - *BetaBasic*[™], *Betasil*[®], *Deltabond*[®] and *Prism*[®], plus the renowned Keystone range of small-bore (2 mm ID) and microbore (1 mm ID) HPLC columns.

A copy of this new publication, which includes an extensive chromatogram library, plus other application briefs, is available from Keystone's New Zealand distributor, GBC Scientific (NZ).

Other unique products available from Keystone include the new generation *Slipfree* column connector and the *Hot Pocket* wrap-around column heating enclosure.

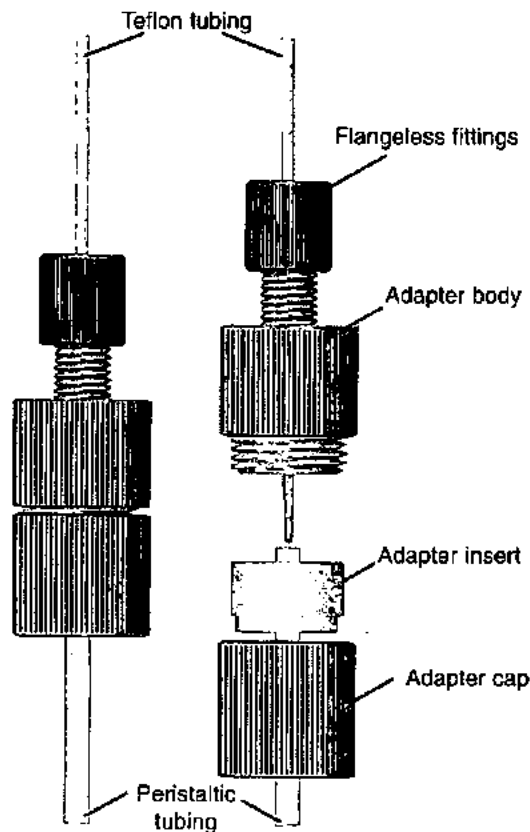
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CUT THE COST OF YOUR PERISTALTIC TUBING!

Upchurch Scientific, the leading manufacturer of HPLC and Fluid Transfer fittings, has developed a unique tubing adapter for connecting peristaltic tubing to other polymeric tubing. A barbed nose allows the peristaltic tubing to be pushed on and then sealed by both the small barbs on the nose, and by a press fit made with the nose, the tubing and the insert. Then by using a flangeless nut and ferrule, the PTFE tubing is coupled to the adapter.

NEW PRODUCTS

By using the adapters, which come in a pack of 2, as the stops for your pump, you will be able to drastically reduce your tubing costs. You only need to use a piece of tubing long enough to reach from one tubing stop around the roller to the other stop – this means the use of approximately one third the normal amount of expensive tubing.



Above: Peristaltic Adapter Assembly. P•757 Adapter comes with P•200/P•201 Flangeless Fittings, and 3 sizes of inserts to fit your application.

This inexpensive part is being used with great success in New Zealand, and is available from Upchurch's New Zealand distributor, GBC Scientific.

For more details on the Peristaltic Tubing Adapter, or a copy of the latest Upchurch Catalogue,

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MODEL 280 NOA NITRIC OXIDE ANALYSER

The Sievers Instruments Model 280 Nitric Oxide Analyser (NOA™) is a highly sensitive, selective detector for nitric oxide, designed specifically for medical and research applications. Based on the chemiluminescent reaction of NO with O₃, the 280 NOA™ permits sensitive measurement of nitric oxide (NO) in gas samples and headspace.

A specially designed gas purge system, the Radical Purger™, and reducing agents permit measurement of nitric oxide and its reaction products in liquid samples. This facilitates

measurements in sera, plasma, cell culture media, tissue homogenates and persulfates.

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P O Box 34-421, Birkenhead, Auckland
Ph: (09) 4791068, Fax: (09) 4791450
or visit the Sievers Website: www.sieversinst.com
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COLE PARMER MASTERFLEX BATTERY-OPERATED SAMPLER



Biolab Scientific introduces the Cole Parmer Masterflex L/S battery operated sampler. The system has a built-in battery which gives two and a half hours of continuous operation for complete portability. It also samples to depths of twenty-nine feet, which makes it ideal for pumping from wells, underground fuel tanks, and chemical storage tanks, and for sampling trace organics, pesticides and heavy metal pollution.

The Sampler includes a Masterflex variable-speed sampling pump (1 to 400 rpm), six feet of silicone tubing, 25 feet of teflon FEP tubing, teflon PFA filter holder and wrenches, one hundred cellulose nitrate membranes, teflon PFA trap, cigarette lighter adaptor and a line cord. The sample bottle is purchased separately.

Contact: Angela Renata, Biolab Scientific Ltd
Private Bag 36900, Northcote, Auckland
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AVAILABLE SOON: FLUKA 1997 CATALOGUE

Fluka has an outstanding reputation for producing high quality, fine chemicals for analytical, research, development and manufacturing applications. Their new 1997/98 Catalogue describes all the products available in the Fluka range with particular emphasis on chiral compounds, silylating agents, quats, crowns and polyethers (phase-transfer catalysts, complexation, extraction, titration and electrochemistry), ion pair chromatography, selectophores (ionophores for ion-selective electrodes and optodes), immobilised pH gradients, enzymes (for biochemistry, analytical chemistry, molecular

NEW PRODUCTS

biology and organic synthesis), microbiology (culture media for general microbiology, food analysis, environmental analysis and microbiology) and capillary electrophoresis.

For a free copy of the Fluka 1997/98 New Zealand Catalogue,

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MERCKOQUANT CHEMICAL TEST STRIPS



Available from Biolab Scientific, Merckoquant chemical test strips are ideal for all mobile analysis systems, they provide the simplest handling.

As a screening method, Merckoquant strips provide the user with a rapid overview of the problem, saving considerable time and reducing analysis costs.

Easy Handling

The handling of Merckoquant test strips is extremely easy: Either immerse the reaction zones or place a drop of sample solution on the reaction zones, and wait a minute. Then read the result by comparing against the colour scale provided.

The test strips are made of a biologically-degradable polyester foil, and the low reagent content in the reaction zones guarantee a problem-free waste disposal. There is a large selection of Merckoquant test strips available e.g. ammonium, lead and zinc.

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THE NEW EASY-TO-USE COLE PARMER TURBO-PROP FLOW METER

The new easy-to-use Cole Parmer Turbo Flow Meters are now available from Biolab Scientific. They are ideal for storm water runoff studies and measurement, and for monitoring the flow velocity of streams, rivers, canals and sewers. Other typical applications include monitoring flumes, effluents, and canals.

The new flow meters make measuring water velocity at depths of 3.8 mm to 1800 mm or 3.8 mm to 4500 mm, easy.

A magnet on the tip of the meter's propeller generates electrical impulses as it rotates past a pick up coil. The impulses are converted to instantaneous velocity, average velocity and maximum velocity in metres or feet per second and displayed on the LCD.



The meters feature a handle made of light-weight aluminium which is adjustable from 900-1800 mm or 1.5 m-4.5 m, depending on the model.

The turbo-prop rotates freely on a bearing shaft for minimal friction. The turbo-prop flow meter range operates on two 1.5 V batteries (included) and each flow meter includes a padded carry case and instructions.

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WATER ANALYSIS SYSTEMS FROM THE HACH COMPANY

The Hach Company, USA, specialise in the analysis and monitoring of water for a range of diverse applications.

The Hach Model DR/4000 Scanning Spectrophotometer outperforms other spectrophotometers in its class.

Both the DR/4000 U Spectrophotometer (UV-Visible) and the DR/4000 V Spectrophotometer (Visible) provides power and convenience for analysing samples, collecting data, and analysing the hardcopy results.

The DR/4000 provides digital readouts in direct concentration units, ABS, or %T. On-screen menus prompt you through each procedure and assist in generating reports, evaluating generated calibration curves and reporting instrument diagnostic checks.

Multiple spectra can be overlaid for comparison, subtraction or addition while sophisticated software tracks peaks and valleys

NEW PRODUCTS

in the scan. A "zoom-in" feature enables portions of the spectra to be enlarged for closer examination.

The time course measurement mode records readings at a single wavelength over a specified time period. Enabling the user to perform time-event studies with a sequence of samples.

Over 110 pre-programmed procedures for common water and wastewater parameters are installed in the DR/4000. The user can also create and store up to 200 custom calibrations in the non-volatile memory.

A range of cell holders, and flow through modules are available.

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NEW PRODUCTS FROM HACH DURING 1997

DR/2010 Portable Datalogging Spectrophotometer

A microprocessor-controlled, single beam spectrophotometer for use in the field or in the laboratory. Factory installed pre-programmed calibrations for over 120 common water quality parameters. The user can store up to 50 of their own calibrations in the memory. With a wavelength range of 400 to 900 nm, the DR/2010 provides results in concentration units, %T and ABS. This instrument is available now.

Manganese III Chemical Oxygen Demand Method

This patented method eliminates Hg, Cr, and Ag wastes resulting from the traditional COD procedure. A chloride cartridge removes chloride interference without the use of mercury. Pre-packaged reagents will be available to measure 20-1000 mg/L COD.

ProNetic Cryptosporidium Detection System

This system will be considerably easier and faster (results in less than eight hours) than current techniques for detecting oocysts in drinking water.

1900 WPC Process Particle Counter

Designed for the water treatment industry, this particle counter detects particles from 2-800 µm in size, concentration range of 0 to 20,000 particles/mL. The WPC sensor features a large 1 mm x 2 mm flow cell to reduce clogging. Specialised software packages are also provided.

Analig Lead and Mercury Methods

For detecting contamination in sludges, soils, wastewater, and drinking water. A proprietary analyte-specific membrane captures either acid soluble lead or mercury, allowing interferences to pass through. The methods eliminate the need for hazardous solvents for extraction. Measurement ranges are: lead 3-600 mg/L; mercury 1-150 mg/L.

Cold Vapour Mercury Method

Accurate method for drinking water, wastewater, and soils. Measurement range: 0.1 - 2.5 mg/L.

Visual Silver Method

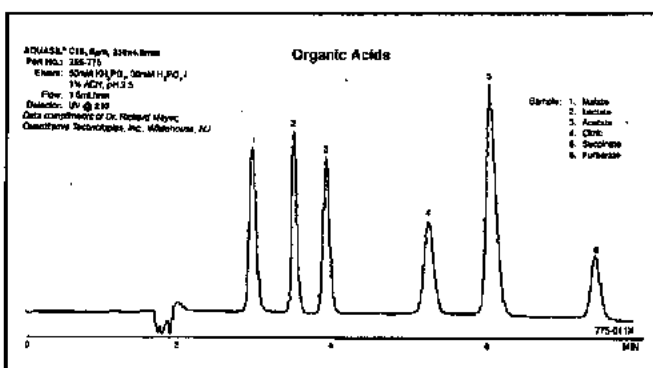
For monitoring wastewater, drinking water, pools, and spas. The RapidSilver™ Test Kit detects silver at ppb levels in five minutes. Range 0 - 50 mg/L.

Preview information about these new products and Hach's existing product range is in Hach's *Products for Analysis 1997* catalogue.

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INTRODUCING AQUASIL™ HPLC COLUMNS FROM KEYSTONE SCIENTIFIC

Complementing the existing range of unique Keystone phases (*BetaBasic*, *Betasil*, *Prism* and *Deltabond*), Aquasil™ has been introduced to provide a deactivated column suitable for both acids and bases. Designed with a high concentration of C₁₈ groups (12% carbon), while preserving hydrophilic sites on the surface to assist in retention and resolution of highly water soluble compounds, such as nucleotides, nucleosides, organic acids, catecholamines and many others. *Aquasil* is more stable in highly aqueous mobile phase, and allows rapid re-equilibration with 0-100% gradients. It is stable and reproducible in the silica range of pH 2.5-7.



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NEW ARC SPARK AND OIL ANALYSER INTRODUCED - BAIRD ANALYTICAL APPOINTS SCI TECH AS THEIR EXCLUSIVE DISTRIBUTOR IN NEW ZEALAND

Baird Analytical, a subsidiary of Thermo Optek, a Thermo Instruments company, has for over 50 years been known worldwide as the premier supplier of affordable, high performance, quality spectrometers and instrumentation. From their 1945 introduction of the first commercial direct reading optical emission spectrometer, to the recent introduction of the DV-6 and now the Foundrymate, the Baird name has been considered the standard for dependable and accurate metals analysis. The Foundrymate is the culmination of the joint development efforts between Baird, Hilger and Thermo Jarrell Ash, who together have over two centuries of combined

experience in supplying high performance quality spectrometers to the metal casting industry. With high performance and high instrument productivity that is so affordable, even the smallest foundries can realise a rapid payback.

Baird also produce the MOA – Multielement Oil Analyser which is a unique combination of an arc spark source and sampling system providing a specifically designed instrument to analyse lubricating oils, transmission fluids and hydraulic fluids for wear metals. Since 1971, Baird has been the official supplier of wear-metals analytical instruments to the United States Department of Defence Joint Oil Analysis Program, in use on every American aircraft carrier and in major United States military bases throughout the world. Baird has been a top supplier to commercial laboratories as well with more than 1000 oil analysis installations throughout the world.

The tremendous advantage of the MOA system over traditional AA or ICP torch systems is the simple yet effective sampling system where all oil viscosities are handled with ease, with no sample dilution or preparation, (and the ability to determine the presence of, and analyse, large particles), the high analysis speed of 60 or more samples in less than an hour, and the very low running costs as argon is not required.

Two models are available with up to a choice of 30 elements and the MOA-M being specifically designed for military applications to the rigid USA military specifications.

The instrument is very compact and can be easily installed in a van or small laboratory space.

Contact: Andrew Pearce, Sci Tech
P O Box 663, Dunedin
Ph: (03) 4777860, Fax: (03) 4777870, Email: scitech@scitech.co.nz
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FOCUSLINER™ – INLET LINER FOR AUTOSAMPLERS

Varian • Perkin Elmer • Hewlett Packard • Shimadzu

When troubleshooting reproducibility problems in split injection analysis the position of the quartz wool plug in the liner is often overlooked. The needle tip must penetrate and stop in the quartz wool to wipe any droplets that form on the needle tip. This is the key to good reproducibility.

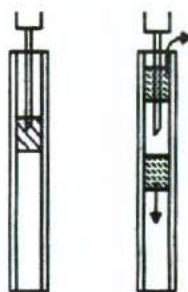


Figure 1. Conventional Split Liner where wool is easily dislodged either upward or downward.

There are no guarantees however that the wool will remain in place during multiple injections. Quite often the wool dislodges so that it does not sit in the position for optimal vapourisation or worse, it falls out completely during septum replacement in the injector, due to a sudden change in pressure (see Figure 1).

SGE has addressed this problem with a simple solution. The inlet port liner has been cleverly redesigned so that the quartz wool is held in place by tapering the glass above and below it (see Figure 2). The result is a secure wool plug which will provide RSD values of 0.3 - 0.7% for the most active compounds (see Figure 3). Even fixed-positioned sintered glass fritted liners cannot produce the precision of the SGE FocusLiner™.

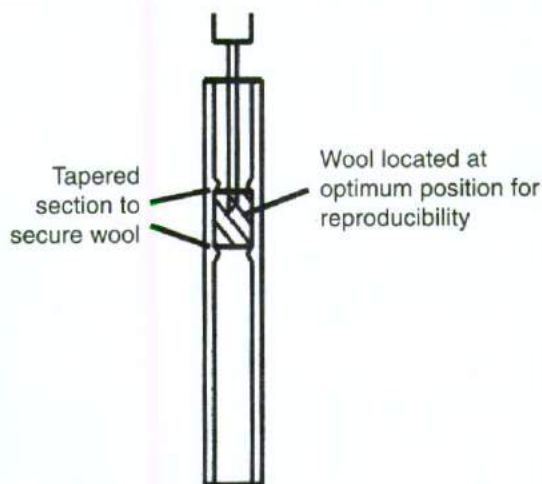
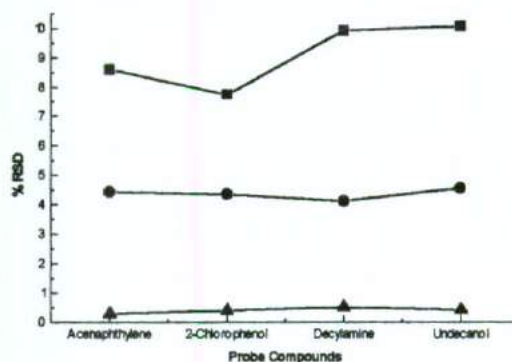


Figure 2. SGE Split FocusLiner



- ▲ SGE 4 mm FocusLiner™
- 4 mm ID liner with quartz wool in centre of liner
- 4 mm ID with fixed sintered glass frit

Figure 3

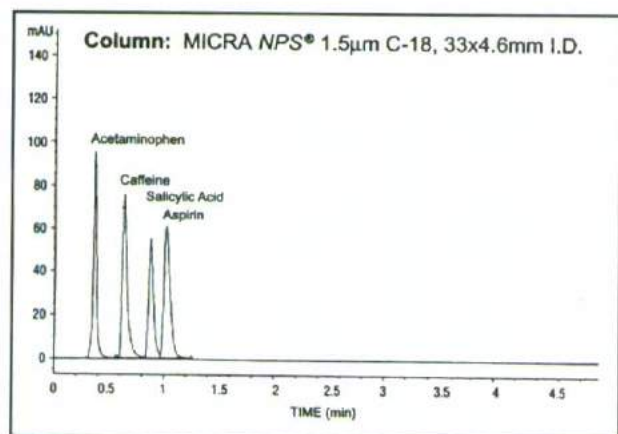
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NPS®: NON-POROUS SILICA – THE FUTURE OF FAST HPLC

MICRA Scientific revolutionary NPS® columns are packed with an ultra pure, highly uniform non-porous silica which allows faster analysis (seconds vs minutes; minutes vs hours), lower

NEW PRODUCTS

costs (up to 95% solvent savings) and improved detection (a 2-fold increase).



For details of this breakthrough HPLC column packing material, now available in column format only, through GBC Scientific (NZ),

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SUPELCO CHEMICAL STANDARDS FOR ENVIRONMENTAL ANALYSIS



With 30 years of experience in chromatography, Supelco is able to provide you with possibly the most extensive range of Environmental Organic Standards available. Our products feature accuracy, purity and lot-to-lot uniformity. Our range of standards includes:

- Calibration and quality control standards, quantitative and qualitative solutions.
- Thousands of single- and multi-component and pure chemicals in 1 mL and larger volumes.

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- Custom Standards – manufactured and tested to your exact specifications.

All Supelco standards are provided with manufacturing and testing documentation, including certificates of analysis. Free data packets are available upon request. For further information and a free copy of the 1997 Supelco catalogue,

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ALDRICH 1996/97 CATALOGUE NOW AVAILABLE IN NEW ZEALAND

What can you find in the Aldrich 1996/97 Catalogue? Besides our huge range of organic chemicals you'll find dyes, indicators and intermediates, stable isotopes, rare chemicals, flavours and fragrances, fluorinated products, high purity solvents, chiral products, inorganics, organosilanes, polymers as well as a full range of techware (equipment, books and supplies).

It would be easier to ask what you can't find. Not only can you choose from the thousands of chemicals in our catalogue but over 40,000 of these are held in stock in our Sydney warehouse. That means that when you place an order for an ex-stock item your order will be dispatched on the same day. For all your chemical and laboratory supplies you need only look in the Aldrich 1996/97 Catalogue.

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NEW US EPA METHOD 8260 STARTER KIT

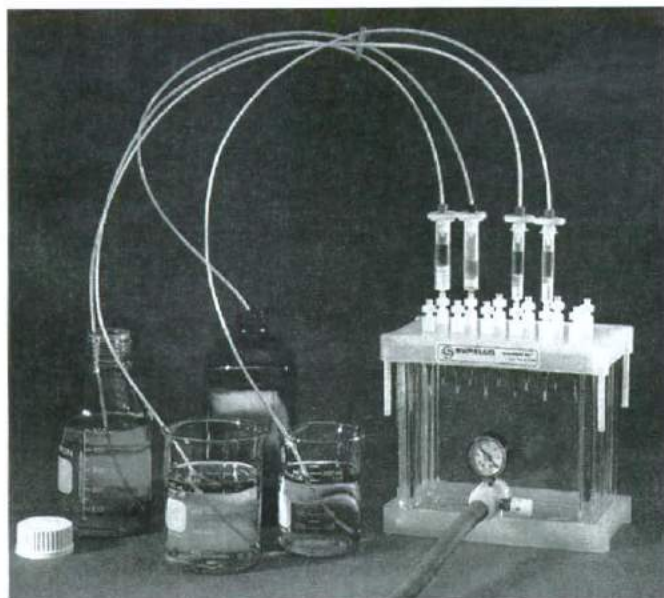
Don't spend valuable time searching to find everything you need to analyse samples according to US EPA Method 8260 – just order the new 8260 starter kit from Supelco.

This kit contains all the consumables you need to conduct your analyses – trap, capillary column, reference chemicals and internal standards, vials, and syringes – at significant cost savings compared to individual prices. Kits are configured for Tekmar LSC-2/2000 and HP5890 instrumentation. Kits for other purge and trap/GC configurations may be assembled upon request. For more information ask for your free copy of the 1997 Supelco catalogue,

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SPE OF 1 LITRE SAMPLES

Supelco's new Visiprep™ Large Volume Sampler enables the extraction of aqueous samples directly from 1 litre bottles to conventional SPE tubes, using our Visiprep™ SPE Vacuum Manifold. Each unit consists of four tube adaptors that fit standard 3 mL and 6 mL polypropylene SPE tubes. The adaptors have replaceable screw fittings and 1/8 inch teflon tubing. A reusable stainless steel weight holds the free end of the tubing at the bottom of the sample container. Both the screw fittings and the teflon tubing are colour-coded for easy sample identification.



Individually and accurately control the flow through each SPE tube by turning the flow control valves, which are built into the cover of the Visiprep SPE Vacuum Manifold. For more information regarding our comprehensive range of SPE products, please ask for your free copy of the 1997 Supelco catalogue.

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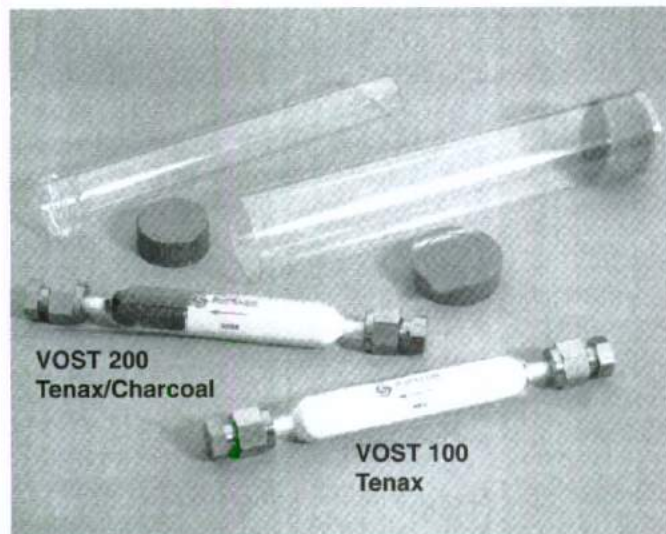
ANALYSIS OF STACK EMISSIONS USING VOST AIR SAMPLING TUBES AND CAPILLARY GC

Supelco's new VOST air sampling tubes have been designed to meet the specifications of the US EPA SW 846, Method 0030, Volatile Organic Sampling Train, for the sampling of volatile compounds emitted from incinerator stacks. The VOST tubes – VOST 100 and VOST 200 – trap these emissions for subsequent thermal desorption and GC/MS analysis.

The two VOST tubes are assembled in a sampling train in series, with the VOST 100 followed by the VOST 200 as a back-up to trap the more volatile compounds. With flow rates of 250-1000 mL/min, a total volume of 5-20 L of air is collected on each VOST pair.

Following collection, the VOST tubes are thermally desorbed by heating and purging with an inert gas. The effluent is

transferred and bubbled into organic-free water in a purge-and-trap system. Analysis is by GC/MS as described in US EPA Method 5041.



Supelco also has the capability of making VOST tubes to the specification of the customer. Choose your own type of tube material, dimensions and adsorbent. Quotations and prototypes are available upon request. For further details request your free copy of the 1997 Supelco catalogue .

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GILSON'S NEW ASPEC XL4

Gilson's new ASPEC XL4 offers high-throughput SPE for bioanalysis. Processing four SPE samples in parallel, ASPEC XL4 allows the extraction of up to 50 samples per hour. With a capacity for 108 samples, the instrument provides the ideal complement to bioanalytical techniques such as LC-MS and GC.

Manual SPE methods are easily transferred to ASPEC XL4. Standard 1 and 3 mL SPE columns, 9 solvents and 4 different sizes of sample vial are accommodated. Automation of sample pretreatment – dilution, mixing, internal standard addition and derivatisation – is also provided. The task-oriented software has been designed to facilitate protocol set-up.

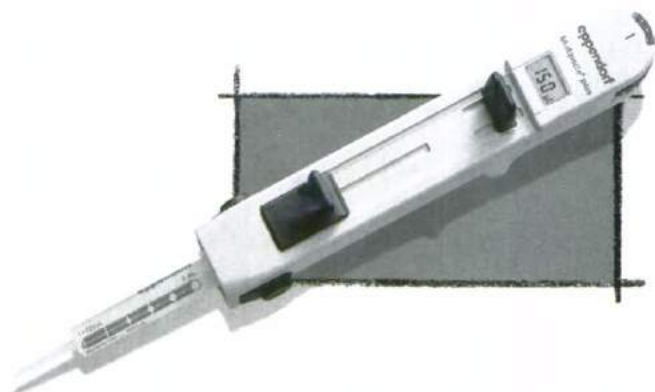
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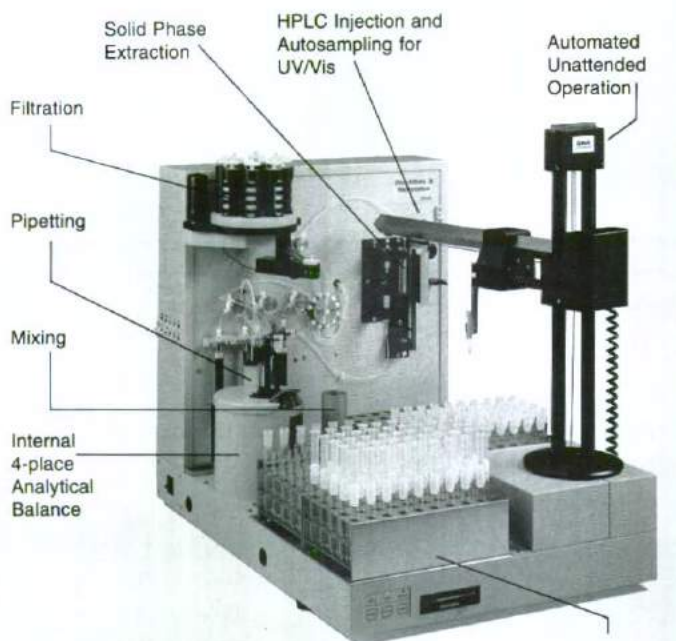
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SCIENTIFIC MARKETING

LETTER TO THE EDITOR



Dear Sir,

Two years ago, as a student studying for my NZCS Chemistry I decided to become a member of the institute. This was done primarily to get a copy of the *Chemistry in New Zealand* magazine. At the time of becoming a local member of the Waikato branch nobody from the institute contacted me to tell me of my acceptance (I read it in the magazine though), and since that time nobody has ever called to discuss the finer points of becoming a full member, let alone anything else. Also, I wasn't told that I could become a student member.

With interest I have read and studied the proposed change to the membership criteria for the NZIC. From the early days of the discussion it was decided that the falling membership was due to the prohibitive costs, and the "what do I get for my money?" attitude. There was some talk about trying to encourage more university students into the fold but this appears to have been cast aside in favour of making any students that do show an interest, full Members. This, on paper anyway, will have the effect of increasing the numbers of paid up Members (MNZIC).

During all this talk about what to do, nobody made any reference to polytechnic chemistry students. During my years of part-time study (5) at the Waikato Polytech nobody spoke to us or

even told us that the institute existed. Maybe these guys and girls aren't full on research scientists (yet), but they still have an active interest in chemistry. Surely this is another source of members?

What have I got for my money? Exactly what I originally wanted. But then no one thought to show me what else was available. Who knows, maybe there was more to the institute that I would have liked, but just didn't know about. I guess you can take heart from the fact that there are only 6 local members in New Zealand who have potentially had the same problem.

Being only a local member I can't vote to tell you that I want to stay with the status quo for membership. That way I won't get lumbered with higher fees, I'll still get my bimonthly magazine, and more importantly I'll get only what I want to pay for.

Regards

Greg Burtenshaw
NZCS (Chemistry)
Laboratory Manager
Convex Plastics Ltd, Hamilton
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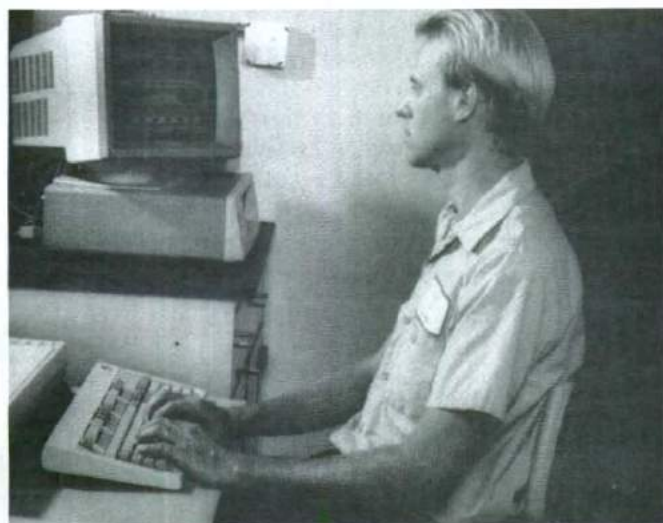
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ENVIRONMENTAL APPLICATIONS

WATER RECLAMATION PLANT MONITORS EFFLUENT CONTINUOUSLY

Since March 1994 the Fairborn Water Reclamation Center in Fairborn, Ohio, USA, has used an Endeco/YSI 600 to monitor the plants effluent automatically, 24 hours a day, seven days a week.

The EPA requires this 5.5 MGD plant to measure dissolved oxygen and pH levels three times a day. Laboratory analyst Dan Leavitt has installed an Endeco/YSI 600 in the effluent stream under the plant's process control building. The unit automatically takes readings every five minutes and sends the dissolved oxygen, pH, conductivity and temperature values to a PC. The data is stored on the PC's hard drive and is available on the monitor for viewing in real-time.

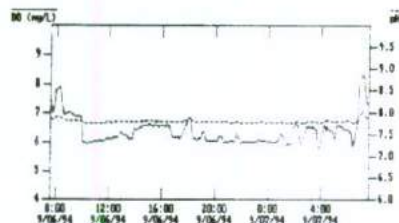


Above: Laboratory analyst Dan Leavitt uses the Endeco/YSI software to determine minimum and maximum values recorded during the previous 24 hours. He also uses the software to graph the data.

Three times a day the plant operator on duty checks the dissolved oxygen levels. If they're below 6.2 mg/L, he turns on the blowers.

Every morning Dan uses the Endeco/YSI 600 software's statistical analysis capability to determine the minimum and maximum values recorded during the previous 24 hours. He

also uses the software to graph the data, which he keeps on paper and disk for the EPA.



Above: One of the graphs of dissolved oxygen and pH levels that laboratory analyst Dan Leavitt creates every day.

Dan likes the YSI system because it's flexible and easy to use. Previously, the plant used another monitor that required a strip chart recorder which needed more attention. The Endeco/YSI monitor gives Dan more control over plant operations. For example, he can specify sample intervals to determine what needs adjusting in the treatment systems and assure compliance with NPDES permit requirements.



Above: Plant operator Steve Miller places the Endeco/YSI 600 monitor in the plant's effluent stream.

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SIGRIST PHOTOMETERS FOR QUALITY CONTROL AND PROCESS AUTOMATION IN THE WATER TREATMENT PROCESS

The problems involved in the supply and treatment of water make the need for accurate, continuous determination of dissolved and undissolved substances in water more pressing every day. As part of modern water and sewage treatment processes, a variety of different turbidity, absorption and fluorescence measuring instruments are used to monitor the safety and quality of the treated water before it is delivered to the consumer. At the same time many processes can be controlled optimally with these instruments, which can reduce costs.

Practical examples:

- Fully automatic monitoring and control of the water treatment process is possible based on turbidity measurements at various process stages.
- The addition of flocculants is controlled automatically, based on turbidity readings, because optimal metering is of the utmost importance for economic reasons.
- Back-washing of rapid gravity filters is controlled by turbidity instruments, thus saving large quantities of valuable treated water.

- UV absorption measurements provide knowledge of ozone concentrations after the generator, in the exhaust gas and following ozone annihilation, which makes it possible to reduce running costs of the ozone plant.
- Oil leakages into drinking or cooling water are instantaneously detected by the fluorescence monitor.
- The content of dissolved organic substances is determined continuously as a sum parameter in order to provide instant detection of the presence of these organic substances.

- Water quality regulations include limits with respect to the nitrate content of drinking water. Continuous photometric measurements allow immediate action (reduction by blending) whenever the nitrate content exceeds a certain level.
- In the treatment of sewage, turbidity measurements in the plant effluent are used to monitor the plant's efficiency.

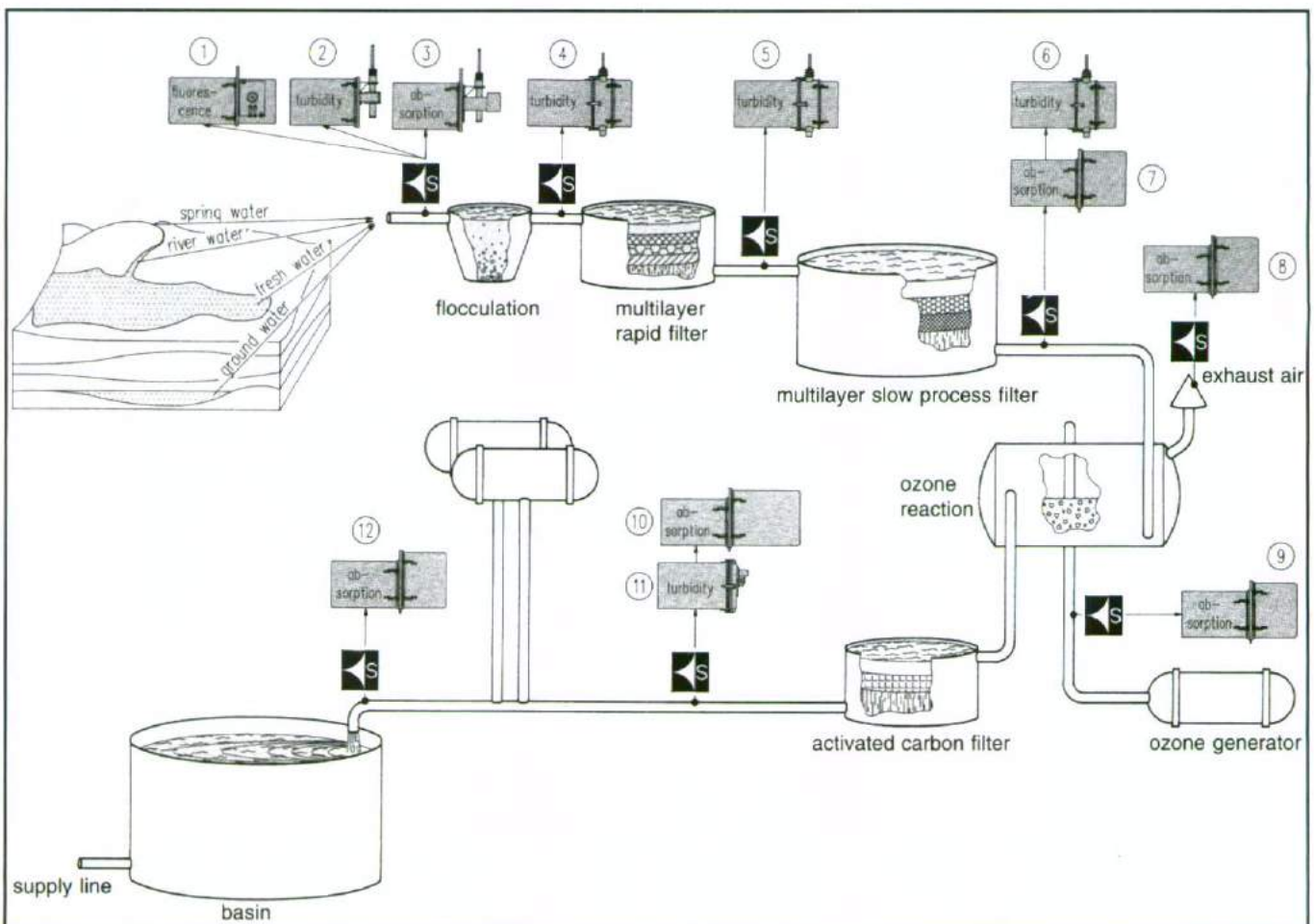
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Item 1: Hydrocarbons	
Measuring scope:	0-500 ppm quinine sulphate
Detection limit:	0.05 ppm quinine sulphate
Sample flow rate:	5 L/min.
Temperature:	max. 40 °C
Pressure:	pressure-less

Item 2: Suspended solids (turbidity)	
Measuring scope:	0-20,000 FTU
Detection limit:	0.01 FTU
Sample flow rate:	5 L/min.
Temperature:	max. 40 °C
Pressure:	pressure-less

Item 3/7/10:	Sum of hydrocarbons*	Dyes
Measuring scope:	0-500 Ext./m	0-200 Hazen
Detection limit:	0.01 Ext./m	0.1 Hazen
Sample flow rate:	approx. 0.2 L/min.	0.2 L/min.
Temperature:	max. 40 °C	max. 40 °C
Pressure:	max. 1 bar	max. 1 bar
* Extinction coefficient at 254 nm		

Items 4/5/6/11: Suspended solids (turbidity)	
Measuring scope:	0-100 NTU
Detection limit:	0.001 NTU
Sample flow rate:	0.1 to 5 L/min.*
Temperature:	max. 40 °C
Pressure:	pressure-less up to 6 bars*
*depending on instrument model	



Item 8: Ozone in exhaust air	
Measuring scope:	0-1000 mg/m ³
Detection limit:	0.5 mg/m ³
Sample flow rate:	approx. 0.2 L/min.
Temperature:	max. 40 °C
Pressure:	max. 1 bar

Item 9: Ozone production	
Measuring scope:	0-300 g/m ³
Detection limit:	0.15 g/m ³
Sample flow rate:	approx. 0.2 L/min.
Temperature:	max. 40 °C
Pressure:	max. 1 bar

Item 12: Nitrate	
Measuring scope:	0-200 mg/L
Detection limit:	0.2 mg/L
Sample flow rate:	approx. 0.2 L/min.
Temperature:	max. 40 °C
Pressure:	max. 1 bar

QUICK ION CHROMATOGRAPHIC DETERMINATION OF SULFATE ALONE IN SOIL EXTRACTS AND NATURAL WATERS

Abstract

In a typical ion chromatographic (IC) method for seven common anions, sulfate elutes last with a total run time of 8-10 min. Although the IC method is accurate and precise, it is deemed slow when samples are to be analysed for sulfate alone. We have developed a quick IC method for the determination of sulfate alone with a run time of 3 min. (20 samples/hr). The experiments were performed on Lachat's chemically-suppressed IC. An anion exchange column (4.6 mm ID x 50 mm long) was specifically designed that can resolve the SO_4^{2-} peak from Cl^- , NO_3^- , and HPO_4^{2-} peaks. The eluant used was 7.0 mM NaHCO_3 + 0.5 mM Na_2CO_3 at the rate of 1.8 mL/min. Using a 100 μL sample loop, the method has a dynamic range of 0.1 to 10 mg $\text{SO}_4^{2-}/\text{L}$, with a detection limit of 29.5 $\mu\text{g SO}_4^{2-}/\text{L}$. The IC method was applied for the determination of sulfate in drinking water and soil extracts. Sulfate was extracted from soil by equilibrating a 4 g soil sample for 30 min with 20 mL of 20 mM potassium phosphate solution. The IC method is accurate with a spike recovery of 92.8 and 101.7% of soil extract and drinking water, respectively, and precise with %RPD of 3.7 and 0.95 for soil extract and drinking water, respectively.

Introduction

Sulfate is one of the commonly monitored anions in soils and natural waters. Sulfate in soil extracts is a measure of the sulfur status of soils because plants absorb sulfate from soils. Twenty mM phosphate solution, either in Ca^{2+} or K^+ form, is typically used to extract water-soluble and adsorbed sulfate from soils (Watkinson and Kear, 1994). Sulfate is also determined in drinking and discharge waters for regulatory purposes. Under the Safe Drinking Water Act, the USEPA considers chloride and sulfate as secondary contaminants because they are organoleptic, i.e. they affect the smell, taste, or appearance of water (Romano and Krol, 1992).

A number of methods have been proposed for determination of sulfate in soils and natural waters. These include gravimetric, turbidimetric, colourimetric, and ion chromatographic (IC) methods (Ajwa and Tabatabai, 1993). Among these, the IC method is a preferred choice because it is relatively simple, the interferences are minimal, and it is accurate, precise, and yet sensitive. The available IC method for the seven anions is, however, deemed slow when the samples are to be analysed for sulfate alone. The long elution time, typically 8-12 min, results from the fact that the separator-column capacity and eluant conditions are optimised for chromatographic separation of seven anions including sulfate. In order to increase productivity of a laboratory performing routine analyses of samples for only chloride, nitrate, phosphate and sulfate, it is desired to have an IC method which is rapid and yet provides resolution of these four peaks.

To this end, Watkinson and Kear (1994) have reported an IC method, with a run time of 5 min, for the determination of sulfate in phosphate extracts of soils. Using phthalic acid at pH 4.0 as the eluant, phosphate eluted just after the solvent front and did

not interfere in the determination of sulfate. This method is non-suppressed and, therefore, lacks the advantage of suppressed IC: greater signal-to-noise (S/N) ratio. The greater S/N ratio in suppressed IC results from background suppression and signal enhancement reactions occurring in a suppression device (Karmarkar, 1995).

In suppressed IC, the retention time for phosphate and, therefore, the resolution between phosphate and sulfate could be effectively controlled by the pH of the eluant stream (Karmarkar and Tabatabai, 1992). In the suppressed IC method presented here, ratio HCO_3^- to CO_3^{2-} was optimised so that sulfate will be well resolved from phosphate used as the soil extractant. The method is rapid with a run time of 3 min. In addition, the method can also be used to determine chloride, nitrate, and phosphate in soil water extracts and natural waters.

Materials and Methods

Instrumentation

Lachat's chemically suppressed IC was used. It was equipped with an autosampler, a high pressure pump, a peristaltic pump, electronically actuated six-port sample valve and ten-port suppressor-regeneration valve, an analytical column (4.6 mm ID x 50 mm long) packed with macroporous anion exchange material, a suppressor cartridge 3.0 mm ID x 10 mm long) packed with high-capacity cation exchange material in H^+ form, a temperature-controlled conductivity detector, and Omnion IC data station.

Chemical Suppression

Referring to Figure 1, after a sample profiling is completed, six-port and ten-port valves go to load at the same time. The following events occur during the load state:

1. A 100 μL sample loop mounted on the six-port valve is filled with the sample;
2. Deionized (DI) water pushes a 300 μL loop filled with 0.25 N Na_2SO_4 , to the suppressor cartridge mounted on the ten-port valve. The DI water then removes Na^+ and SO_4^{2-} ions from the cartridge and the suppressor is fully regenerated.

The valves then go to inject at the same time, thereby a sample is injected onto the column, and a fully regenerated suppressor is in-line to perform chemical suppression.

R, Regenerant (H_2SO_4); E, Eluant; P1, Eluant Delivery Pump; P2 Peristaltic Pump; V1, 6-port sample valve; S, Suppressor column; FC, Conductivity-detector flow cell; V2, 10-port suppressor valve for off-line regeneration of suppressor column. During regeneration of the suppressor column, analytical column effluent entering port 6 of the valve goes directly to the detector via port 5. The DI water entering through port 2 carries the acid (in a loop placed in between ports 1 and 8) through port 7 to the suppressor column, and then washes out excess sulfate from the column.

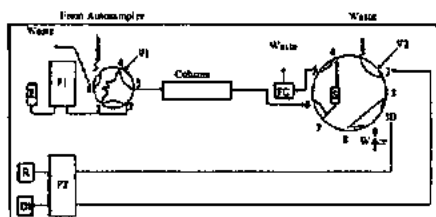


Figure 1. Schematics showing 6- and 10-port valves and other IC components.

Reagents and Standards

Experiments were performed to optimise the ratio of HCO_3^- to CO_3^{2-} in the eluant so that phosphate and sulfate will be well resolved. Increasing the HCO_3^- content lowers the pH so that phosphate exists mainly in divalent species HPO_4^{2-} , which then elutes away from sulfate. Short retention time for sulfate can be obtained by increasing the CO_3^{2-} concentration. The optimum eluant concentration was 7.0 mM NaHCO_3 + 0.5 mM Na_2CO_3 at the rate of 1.8 mL/min. Regenerant for the suppressor column was 0.25 N H_2SO_4 . The method was calibrated using the following standards: 0.1, 0.2, 0.5, 1.0, 2.0, 5.0, and 10 mg $\text{SO}_4^{2-}/\text{L}$.

Sample Preparation

A soil sample was air dried and passed through a 2 mm sieve. Sulfate was extracted by equilibrating a 4 g sample with 20 mM potassium phosphate solution for 30 min. The suspension was filtered through a 0.45 μm membrane filter diluted ten-fold with deionised water and analysed using the IC method. A tap water sample from Milwaukee, WI, USA was analysed without any sample preparation.

Results and Discussion

Chemical Suppression

The QuikChem suppressor cartridge used in this IC method is packed with a high capacity cation exchange material (2.5 meq/g) in H^+ form. Sample loading and suppressor regeneration are completed using a combination of six- and ten-port valves as shown in Figure 1. Table 1 summarises the sequence of events occurring after processing of a sample is completed.

All of these events are software-controlled. The suppressor column used in this work is much smaller than that used by Small *et al.* (1975). Being a small suppressor, it has enough capacity to process only one sample, but it can also be quickly regenerated. This unique suppression device provides several advantages. First, productivity is not impaired because regeneration of this suppressor is completed on-line in 40 seconds while sample is being loaded. Second, the results obtained are precise and accurate because during each regeneration the suppressor always comes to a steady state. Third, the dead volume is minimal (15 μL for the suppressor cartridge used in this work).

Table 1. Summary of events occurring after analysis of a sample

Event	Six-Port Valve	Ten-Port Valve
Sample processing is done, Omnicion IC software requests another sample.	Inject state. Eluant going through the loop to the column. Probe wash going to waste.	Inject state. Eluant going through the suppressor to the flow cell. Regenerant loop is filled with DI water going to waste.
Probe goes to a cup.	Inject state.	Inject state.
Sampling begins.	Load state. Loop is being filled. Eluant going directly to the column.	Load state. DI water pushing the regenerant through the suppressor, followed by wash-out of the suppressor with DI water.
Sampling is completed, probe goes back to wash.	Inject state. Eluant carries the sample to the column.	Inject state. Fully regenerated suppressor performing chemical suppression of the injected sample.

Eluant Concentration

Increasing the NaHCO_3 concentration from 5.2 to 7.0 mM, with Na_2CO_3 concentration held constant at 0.5 mM, resulted in increasing the resolution between phosphate and sulfate from 1.1 to 2.04 (Table 2). In the subsequent work, therefore, 7.0 mM NaHCO_3 + 0.5 mM Na_2CO_3 was used as the eluant. This eluant also provided well resolved peaks for chloride, nitrate, and phosphate (Figure 2).

Table 2. Effect of HCO_3^- concentration on retention times for anions and resolution between adjacent peaks¹

Anion	Retention time (min)		Resolution ²	
	5.2 mM HCO_3^-	7.0 mM HCO_3^-	5.2 mM HCO_3^-	7.0 mM HCO_3^-
Chloride	0.7	0.67	n.a.	n.a.
Nitrate	1.25	1.18	2.74	2.49
Phosphate	1.9	1.67	1.22	1.85
Sulfate	2.62	2.28	1.1	2.04

¹ The CO_2 concentration was kept constant at 0.5 mM. Eluant flow rate: 1.8 mL/min.

² Resolution (R) calculated as follows: $R = (T_2 - T_1) / 2 \times (W_2 + W_1)$, where T_2 and T_1 are retention times (min) for anions 1 and 2 and W_2 and W_1 are peak base widths (min) for anions 1 and 2. n.a.: not applicable.

The method therefore, could also be used to determine these four anions in soil-water extracts and natural waters.

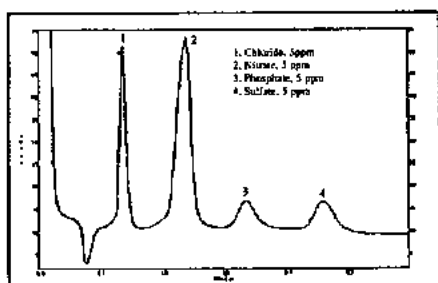


Figure 2. Chromatogram showing well resolved peaks for chloride, nitrate, phosphate and sulfate. Refer to Table 3 for chromatographic conditions.

Method Performance

A typical chromatogram obtained for a calibration standard is shown in Figure 3. The method calibrated well over two orders of magnitude (0.1 to 10.0 mg $\text{SO}_4^{2-}/\text{L}$) with a R^2 of 0.9991 (Figure 4). The MDL obtained was 29.5 $\mu\text{g SO}_4^{2-}/\text{L}$ using a 100 μL sample loop. The chromatogram obtained for the analysis of a soil extract is shown in Figure 5. As can be seen, the sulfate peak at 0.25 mg $\text{SO}_4^{2-}/\text{L}$ is well resolved from about 70 mg $\text{H}_2\text{PO}_4^-/\text{L}$. The method is accurate and precise for both soil extracts and drinking waters studied in this work (Table 3).

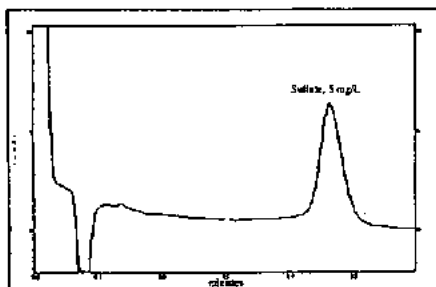


Figure 3. Chromatogram showing a calibration standard. Refer to Table 3 for chromatographic conditions.

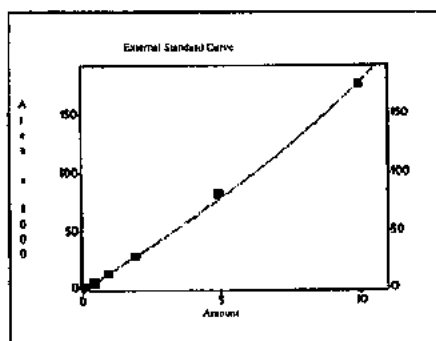


Figure 4. Calibration curve for a range of 0.1 to 10 mg $\text{SO}_4^{2-}/\text{L}$, $R^2 = 0.9991$.

Soil extracts contain humic and fulvic acid fractions which are strongly retained by the stationary phase of the column. The result is high backpressure and loss in column performance. The column used in this method has a guard disk which will retain these colour forming fractions. The guard disk can be easily replaced after injecting 50 soil extracts. These fractions could, also, be removed from a sample, on-line, using a hydrophobic membrane mounted onto a dialysis block. Further research is in progress on this approach.

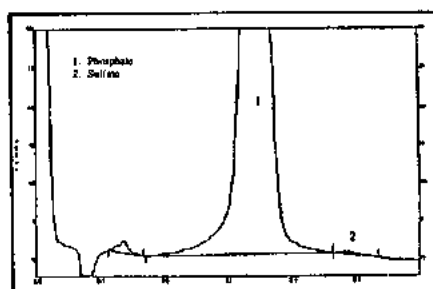


Figure 5. Chromatogram showing sulfate in a soil sample extracted with 20 mM phosphate solution and diluted ten-fold. Refer to Table 3 for chromatographic conditions.

Table 3. Performance of the IC method¹

Parameter	Value
Method Detection Limit (MDL) ²	29.5 $\mu\text{g SO}_4^{2-}/\text{L}$
Precision ³	
Soil extract	% RPD = 3.7
Drinking water	% RPD = 0.95
Accuracy ⁴	
Soil extract	% Recovery = 92.8 (n = 6)
Drinking water	% Recovery = 101.7 (n = 2)

¹ Eluant: 0.7 mM NaHCO_3 + 0.5 mM Na_2CO_3 at the rate of 1.8 mL/min; Column: 4.6 mm ID x 50 mm long; 100 μL sample loop.
² Seven replicates of a 100 $\mu\text{g SO}_4^{2-}/\text{L}$ solution were injected. Determined amount was 110 $\mu\text{g SO}_4^{2-}/\text{L}$ with a standard deviation of 0.0094. MDL = 3.142 x standard deviation.
³ RPD is replicate percent difference.
⁴ Amount found: 0.245 and 13.8 mg $\text{SO}_4^{2-}/\text{L}$, spiked amount: 0.4 and 0.8 mg $\text{SO}_4^{2-}/\text{L}$ for soil extract and drinking water, respectively.

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By S V Karmarkar, Lachat Instruments Inc., 6645 West Mill Road, Milwaukee, WI 53218, USA

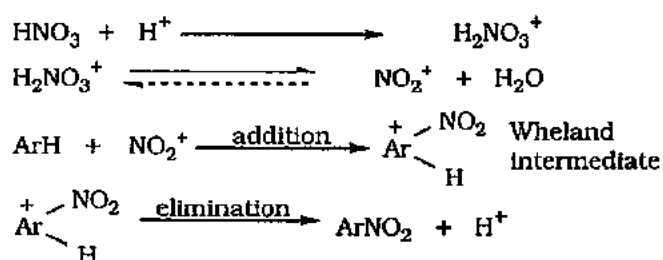
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A REACTION MECHANISM IS ONLY A POSTULATE

Michael P Hartshorn, Chemistry Department, University of Canterbury, Private Bag 4800, Christchurch

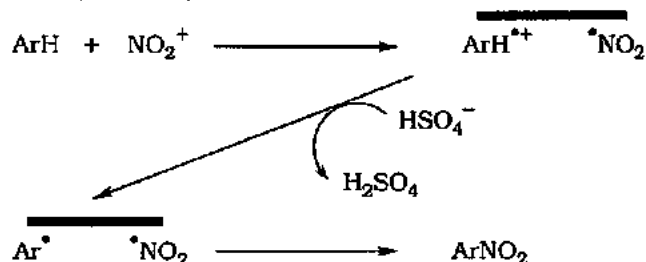
A reaction mechanism should be regarded as a rationalisation of established facts. The word rationalisation brings with it the status of a postulate, which is open to subjective judgement and on occasion to emotional display. The second key-word, established, raises questions of quality – or lack of it – in terms of respect or disrespect for the literature. The final matter, facts, involves the assessment of the quality of *apparent facts* in the literature, and perhaps the recognition of experimental defects in earlier experimental work. In the commentary which follows these issues will be raised in the context of the evolution of the mechanism(s) of aromatic electrophilic nitration.

In 1950 Hughes and Ingold and their collaborators¹ confirmed Euler's early proposal² that the nitronium ion, NO_2^+ , was the reactive electrophile in aromatic nitration, and outlined an addition-elimination reaction sequence involving what is now known as the Wheland intermediate (Scheme 1).



Scheme 1

Earlier Kenner³, against the background of a resurgence of interest in free radical chemistry led by D H Hey and W A Waters, had proposed a mechanistic sequence in which the first reaction step involved electron transfer between the electron-rich aromatic molecule and the nitronium ion to give an intimate radical pair of an aromatic radical cation, $\text{ArH}^{\bullet+}$, and nitrogen dioxide (Scheme 2).

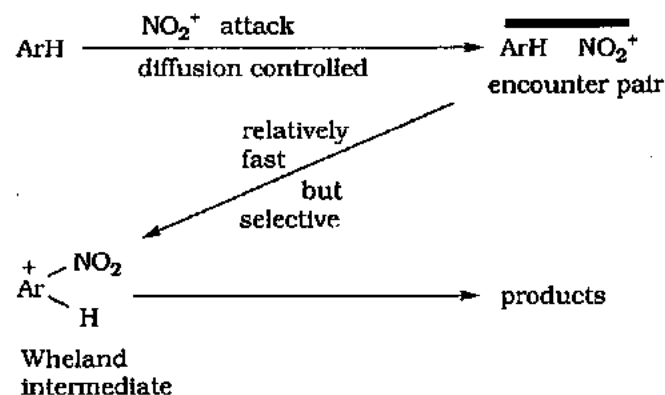


Scheme 2

The major short-coming in this proposal was the second step which involved proton abstraction from the aromatic radical cation to give an aryl radical. Also Ingold *et al.*⁴ pointed out

that the addition of nitrogen dioxide to a nitration mixture gave products not normally seen, with the implication that nitrogen dioxide was not present in the normal nitration reaction. However, whatever the deficiencies of Kenner's proposal, the possibility of electron transfer between the electron-rich aromatic molecule and nitronium ion was to become a recurrent theme over the next 50 years.

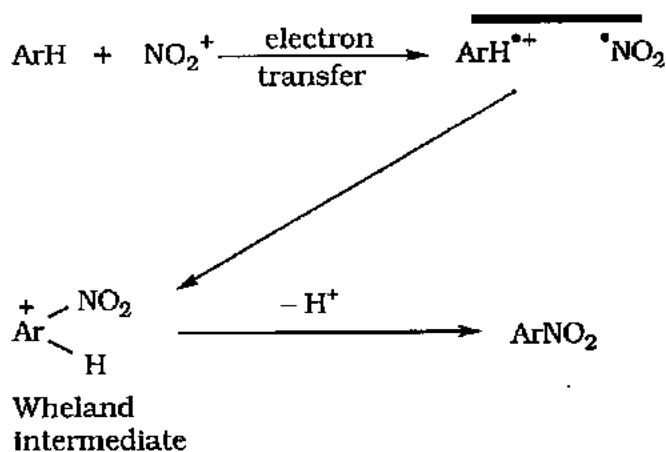
With the Hughes and Ingold addition-elimination nitration mechanism as the working postulate, several problems remained to be resolved. The first of these was the observation that the second order rate coefficients for aromatic nitration using nitric acid/sulfuric acid do not increase with the reactivity of the aromatic compound for compounds of greater reactivity than the xylenes, but yet the intramolecular selectivity for the position of substitution (*ortho*, *meta*, *para*) was still evident in those substrates. This *apparent* paradox was accommodated by a minor modification to the Hughes and Ingold mechanism. This involved a diffusion-controlled approach of nitronium ion to the aromatic substrate, ArH , to form the encounter pair, a pair of species not separated by the solvent but with no formal bonding (Scheme 3).⁵



Scheme 3

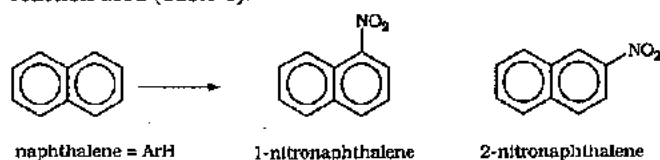
Within this encounter pair, (σ -bond formation could then occur relatively rapidly, but with positional selectivity, to give Wheland intermediate(s) as in the original Hughes and Ingold mechanism, above.

Subsequently, C L Perrin⁶ proposed an alternative nitration reaction mechanism involving electron transfer between the electron-rich aromatic substrate and the attacking nitronium ion, which did not suffer from the flaws seen in the Kenner electron transfer proposal.³ In this new electron transfer reaction scheme the first step was as originally proposed by Kenner i.e. electron transfer between the aromatic molecule and the nitronium ion to give the radical cation, $\text{ArH}^{\bullet+}$, and nitrogen dioxide. Radical coupling of $\text{ArH}^{\bullet+} / \bullet\text{NO}_2$, with σ -bond formation, would then yield the Wheland intermediate (Scheme 4).



Scheme 4

The experimental basis for Perrin's proposal was the electrochemical generation of the naphthalene radical cation, $\text{naphH}^{\bullet+}$, and $\cdot\text{NO}_2$, and the isolation of a product mixture of 1-nitro- and 2-nitro-naphthalene. The product ratio, 1-nitro- : 2-nitro-naphthalenes obtained by Perrin in this electrochemical experiment was 9.2:1, similar to that for the normal nitration of naphthalene by nitric acid/sulfuric acid 10.9:1. In the event, it transpired that the design of Perrin's electrochemical experiment was fatally flawed in a number of respects,⁷ but his paper provoked considerable activity in other research groups. For instance the 1-nitro- : 2-nitro-naphthalene product ratio was shown to be markedly dependent on the nitration reaction used (Table 1).

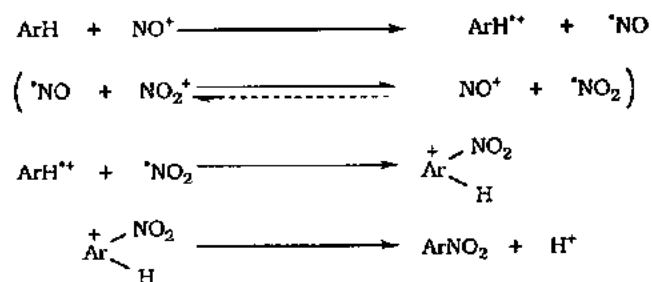


Reaction	1-nitro- / 2-nitro- naphthalene ratio
$\text{ArH}^{\bullet+} + \cdot\text{NO}_2$	50 - 60
$\text{ArH} + \cdot\text{NO}_2$	20 - 25
$\text{ArH} + \text{NO}_2^+$	11

Table 1

Thus, Perrin's 1-nitro- : 2-nitro-naphthalene ratio 9.2:1 was simply not compatible with that obtained in the reaction of pre-formed $\text{naphH}^{\bullet+}\text{PF}_6^-$ with $\cdot\text{NO}_2$ (50-60:1).⁸ Furthermore, if Perrin's mechanism were correct, ¹⁵N CIDNP experiments should show n.m.r. signal enhancements; in these experiments only weak enhancements were seen corresponding to the operation of < 9 % of the Perrin electron transfer mechanism in the nitration of naphthalene with nitric acid/sulfuric acid.⁹ Subsequently, even these minor enhancements have been shown to involve reaction of H_2NO_3^+ as the electron transfer reagent.¹⁰

Lurking in the background for much of the period since the publication of the Hughes and Ingold nitration mechanism, was the problem of how to account for the nitrous acid catalysed nitration reactions of relatively reactive aromatic molecules. The mechanism of this nitrous acid catalysed reaction was established, at least in broad outline, by Giffrey and Ridd in 1979.¹¹ The first, and crucial, step in the reaction scheme was the formation of the aromatic radical cation, $\text{ArH}^{\bullet+}$, by electron transfer to the nitronium ion, NO^+ (Scheme 5).

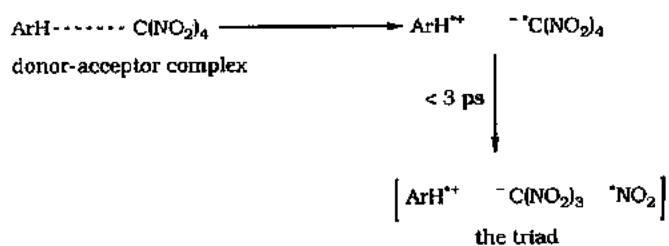


Scheme 5

The bracketed second step is uncertain, but represents the stoichiometry of the process. Again the Wheland intermediate is formed, but by radical coupling of $\text{ArH}^{\bullet+} / \cdot\text{NO}_2$, followed by rapid proton loss to give the nitro compound, ArNO_2 .

But the resolution of the problem of the mechanism of the nitrous acid catalysed nitration reaction poses a separate question. Why is it that nitronium, NO^+ , salts are known to be useful one-electron reagents for the preparation of aromatic radical cations,¹² but nitronium, NO_2^+ , salts can not be used in this way? If it is reasonably assumed that electron transfer between ArH and X^+ (NO_2^+ or NO^+) occurs via an only weakly bonded transition state, the process can be treated in terms of the Marcus theory of outer-sphere electron transfer.¹³ This leads to the realisation that the reorganisation energies (λ) of the NO^+/NO and $\text{NO}_2^+/\text{NO}_2$ redox pairs are vastly different, 295 and 590 kJ mol^{-1} , respectively.¹⁴ Simply, this difference can be ascribed to the severe distortion of the NO_2 bond angle that is necessary to reach the transition state for electron transfer; for the NO^+/NO system this issue does not arise. The implication is therefore that NO_2^+ should not engage in reactions leading to weakly bonded transition states (outer-sphere electron transfer), but instead in strongly bonded ones (inner-sphere electron transfer) such as the direct formation of the Wheland intermediate.

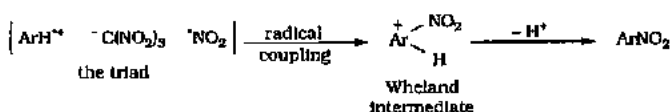
As a consequence of Perrin's revival of electron transfer in aromatic nitration, there were further attempts at generating an aromatic radical cation ($\text{ArH}^{\bullet+}$) in the presence of nitrogen dioxide. This was accomplished by a photochemical method. Aromatic molecules (ArH) and tetranitromethane form coloured donor-acceptor complexes in organic solvents, and on photoexcitation with light matching the absorption band of the donor-acceptor complex electron transfer occurs to give the aromatic radical cation, $\text{ArH}^{\bullet+}$, and tetranitromethane radical anion, $(\text{O}_2\text{N})_4\text{C}^{\bullet-}$. This tetranitromethane radical anion fragments rapidly (< 3 ps),¹⁴ thus preventing back-electron transfer, and gives trinitromethanide ion, $(\text{O}_2\text{N})_3\text{C}^-$, and nitrogen dioxide as the triad [$\text{ArH}^{\bullet+} (\text{O}_2\text{N})_3\text{C}^- \cdot\text{NO}_2$] (Scheme 6).



Scheme 6

Although there was already evidence that trinitromethanide ion was intimately involved in the recombination processes of the triad,¹⁶ Sankaraman and Kochi¹⁷ chose to describe the

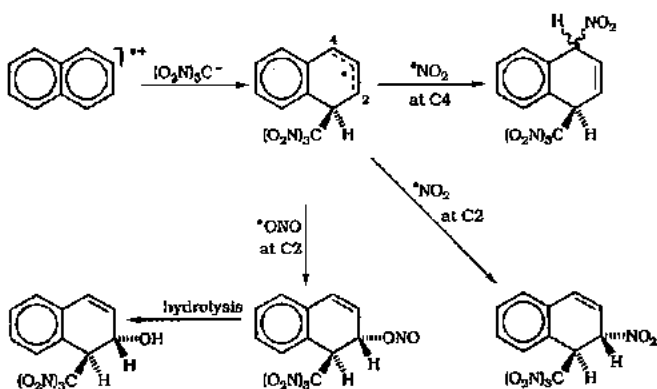
recombination mechanism for naphthalene (naphH as ArH) as being simply a radical coupling of naphH[•] and [•]NO₂ to give the corresponding Wheland intermediates, which on proton loss would give a mixture of 1-nitro- and 2-nitro-naphthalenes (Scheme 7).



Scheme 7

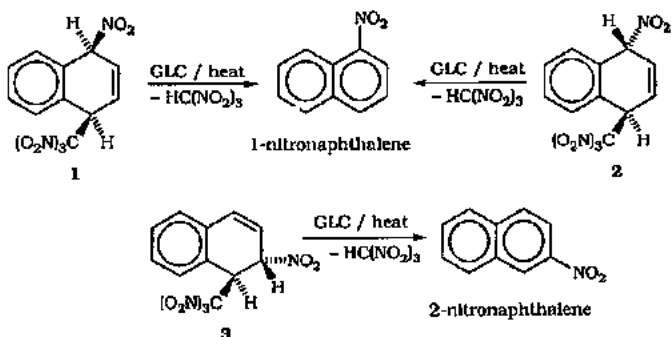
Furthermore, ignoring the earlier literature report⁸ that the 1-nitro-: 2-nitro-naphthalene product ratio from reaction of naphH[•] and [•]NO₂ was 50:60:1; they claimed that their 1-nitro-: 2-nitro-naphthalene ratio (7.4:1) obtained from the photolysis of the charge transfer complex of naphthalene-tetranitromethane was evidence for radical coupling of naphH[•] and [•]NO₂. In the event, this apparent discordance arose in part because the recombination of the triad was more complex, but also because of the analytical technique employed by Sankararaman and Kochi.¹⁷

Indeed, the major products (> 95 %) of the recombination of the triad from the photolysis of the charge transfer complex of naphthalene-tetranitromethane were adducts which arose by initial attack of trinitromethanide ion, (O₂N)₃C⁻, on the radical cation of naphthalene as shown in the reaction scheme below (Scheme 8).¹⁸



Scheme 8

How then did the 1-nitro-: 2-nitro-naphthalene ratio of 7.4:1 arise? Gas-liquid chromatography (GLC) of the nitro-trinitromethyl adduct **1** above 100 °C was shown to give pure 1-nitronaphthalene by loss of nitroform [HC(NO₂)₃] (Scheme 9).¹⁸ If the reasonable assumptions are made that the epimer **2** would behave similarly, and that the regioisomeric nitro-trinitromethyl adduct **3** would yield 2-nitronaphthalene on GLC, then a rational explanation emerges for the data reported by Kochi *et al.*¹⁷



Scheme 9

Although the study of the photochemical reactions of the donor-acceptor complex of naphthalene and tetranitromethane was initiated because of Perrin's proposed electron transfer mechanism of aromatic nitration, it is now clear that the photochemical experiments have no relevance to normal nitration processes.

In summary, the basic nitration mechanism proposed by Hughes, Ingold and co-workers² remains as the accepted description of the nitration reaction for relatively unreactive aromatic compounds such as benzene and naphthalene. For more reactive aromatic compounds, such as phenols, aryl amines and alkylbenzenes, the nitrous acid catalysed nitration mechanism proposed by Giffney and Ridd¹⁰ is normally operative.

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PACIFICHEM 2000

CHEMISTRY FOR THE MILLENNIUM

Honolulu, Hawaii, 14-19 December, 2000

An agreement to hold an International Chemical Congress of Pacific Basin Societies in 2000 – Pacificchem 2000 – was signed by Professors Ron Breslow (President, ACS), Larry Weiler (President-elect, CSC), Hiizu Iwamura (Representing CSJ), Graham Johnston (Representing RACI), and Brian Halton (representing NZIC) in mid-December in Hawaii. The signing ceremony was held during the first planning meeting for the congress, an event that you should mark in your diary now.

Pacificchem 2000 – *Chemistry for the Millennium* – will follow a similar format to the highly successful meeting held just over a year ago, but the irksome timing which ensured that some (NZIC representatives included) did not make it home for Christmas has been removed. The Congress will open on Thursday, December 14 and close at 5pm on Tuesday, December 19; attenders living to the west of the international date line have four days of flight schedules to select and still be home by Christmas Eve at the latest. The Congress will be held in the numerous meeting rooms of the Sheraton and Hilton properties along the Waikiki waterfront, a decision taken despite the opening of the Honolulu Convention Center next year. Use of the centre would mean significant transport problems for delegates and, more importantly, a change from the relaxed beach-front attitude that the current venues engender.

The programme will cover ten broad areas of the chemical sciences (listed below) that are not a simple repetition of 1995. There will be an enlarged "Young Scholars" programme to sponsor professionals from the Pacific rim developing countries, a redesigned "Student Paper" competition and a Congress Celebration Event to mark the millennium on the Saturday. *If you were there in '95 you will surely want to return for 2000!*

Pacificchem 2000 will focus on the following areas of the chemical sciences:

1. Agrochemistry – including agriculture, cellulose, carbohydrate, pulp and paper chemistry
2. Analytical Chemistry – including clinical, electrochemical and trace analysis
3. Bioscience and Technology – including microbial and pharmaceutical chemistry
4. Chemistry and the Community – including chemical education



Above: Pacificchem 2000, from left to right, B Halton (NZIC), L Weiler (CSC), R Breslow (ACS), H Iwamura (CSJ) and G Johnston (RACI).

(for chemists, non-chemists and the public), chemical economics and business

5. Environmental Chemistry
6. Inorganic Chemistry – including nuclear and geochemistry
7. Macromolecular Chemistry
8. Medicinal Chemistry
9. Organic Chemistry
10. Physical and Theoretical Chemistry

The organising committee will accept proposals from individuals in conjunction with TWO others, each from a different Pacific Basin country, to organise a symposium within any of these areas; Pacificchem '95 ran in excess of 150 different symposia. There will also be a range of general sessions for each area.

Proposals to run a symposium will follow:

- 15 September 1997 for consideration in the first round.
- 15 August 1998 for consideration in the second round.
- 15 January 1999 last date for receipt of a symposium proposal.

Further information and symposium proposal application forms are available from: Professor Brian Halton
Chemistry Department
Victoria University
P O Box 600, Wellington

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NEW ZEALAND INSTITUTE OF CHEMISTRY



NZIC COUNCIL NEWS

The last meeting of Council for 1996 was held in Dunedin to coincide with the joint conference organised by the New Zealand Institute of Chemistry and the New Zealand Society for Biochemistry and Molecular Biology. The Conference was held at the University of Otago, over the period 2-6 December 1996, and was designed to coincide with the 125th Anniversary of the Chemistry Department of the University of Otago. The Annual General Meeting of the Institute was held in Dunedin.

Regretfully our President, Mr Nath Pritchard, was unable to be present for business reasons, but the incoming President, Dr Rob Whitney, took the Chair.

Highlights of the Council Meeting included the following:

NZIC Prize Winners

The following were recipient of NZIC Prizes/Awards for 1996:

SGS Prize	Dr Alistair Wilkins (University of Waikato)
Chemical Education Award	Mrs Kath Fletcher (Central Hawkes Bay College)

Membership

Council is investigating the possibility of developing our own membership database on our own equipment instead of using the IPENZ model. A team headed by Dr Alastair MacGibbon of NZDRI is investigating all the options, but the objective is to better serve all our members. The membership report appears elsewhere.

Chemistry Exams/Quizzes

Currently the Institute offers three examinations/quizzes to the 450 secondary schools in New Zealand. These range from the RACI Australian National Chemical Quiz and the Canadian CHEM 13 Exam (adapted for the New Zealand curriculum) to the exam developed by Manawatu Branch largely for schools within their Branch. The interest in these exams is very high and thought is being given to offering a New Zealand written exam.

Education

NZQA has received an application from the National Standards Association to cover the field of Science and Technology which is not currently represented by an Industry Training Organisation (ITO). Submissions on our behalf have been made by Associate Professor John Packer and Council feels quite strongly there should be a chemist on the ITO.

Strategic Review

In connection with the Strategic Review a postal ballot of the corporate members was held on the proposed rule changes. The result indicated overwhelming support for the motion that an interest in chemistry be the criteria for acceptance to membership. Previously acceptance to membership was having a degree in chemistry or New Zealand Certificate of Science. The acceptance level for Fellowship has not changed.

The draft Business Plan, as promulgated in Vol. 60 No. 5 of *Chemistry in New Zealand*, was fine tuned by the Council to give the 1997 business plan against which our budget for the 1997/98 financial year will be set.

One interesting contribution received was from Glenn Johnson of Waikato Branch suggesting the concept of a "Vision Statement" – this will be developed in the review of membership requirements.

Code of Ethics

Recently legal advice was received that one of the Rules in our Code of Ethics, which proscribes cost cutting, may contravene the Commerce Act. A new Code of Ethics is being drawn up which will not contravene the Act.

Officers for 1997

The following were elected to Council for 1997:

President	Dr R S Whitney (Wellington)
1st Vice President	DR A K H MacGibbon (Manawatu)
2nd Vice President	Professor G R Clark (Auckland)
Treasurer	Mr D P Karl (Auckland)
Secretary	Mr A A Turner (Wellington)

Membership Report

The following have recently been elected to the various grades of membership indicated:

Member

Auckland Schollum, John B
Stewart, Carol

Otago Currie, Kim Irene

Associate

Auckland Land, Michael Vincent

Manawatu Yateman, Catherine Anne

Student

Auckland Stride, Angela

Waikato Kelly, Brian Devlin

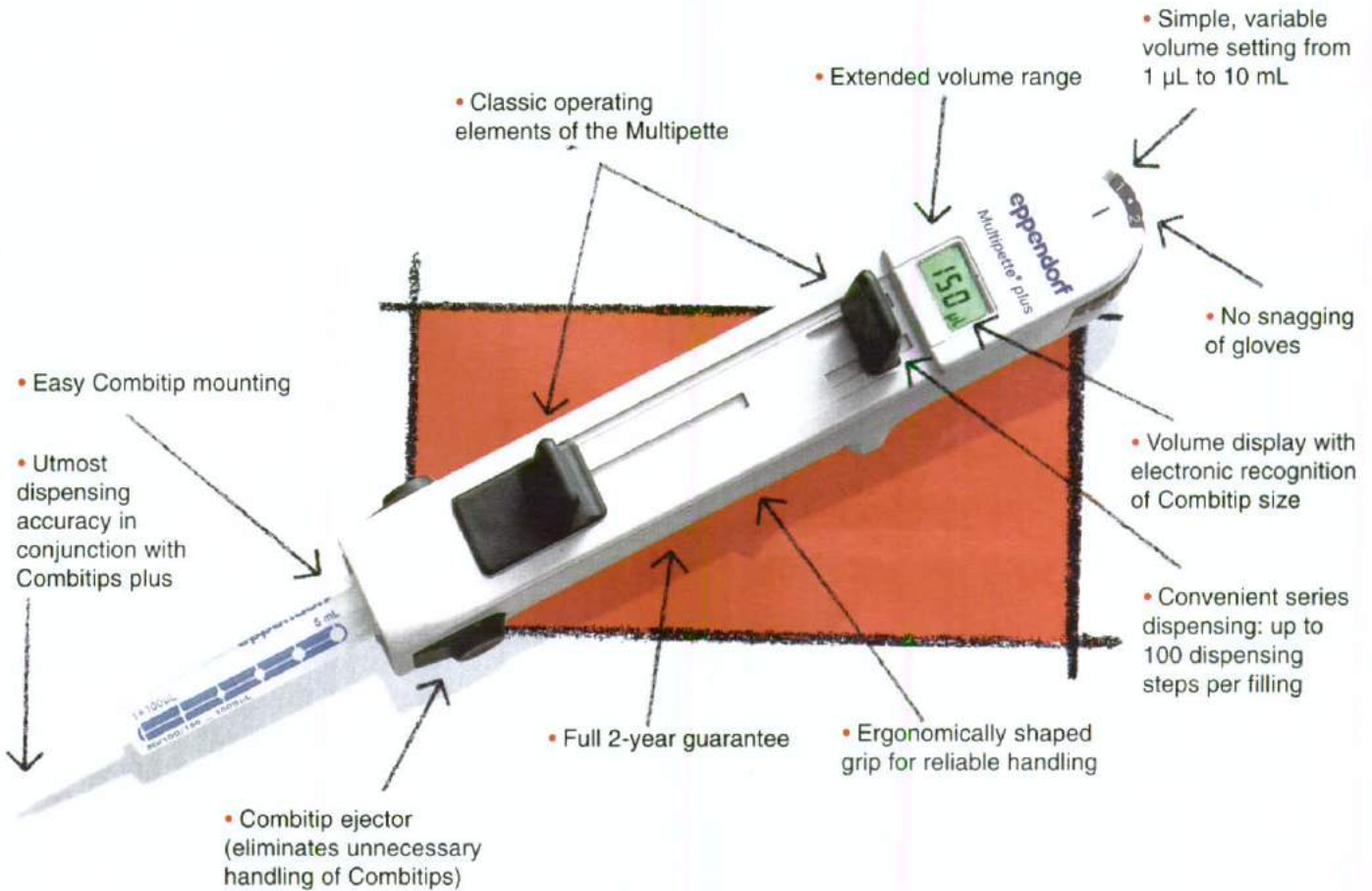
Wellington Bubendorfer, Andrea

Canterbury de Zwart, Icenius
Hu, Wan Ping (Sunny)
Moore, Michael
Phillips, Andrew
Prince, Barry
Ratcliffe, Maureen
Telfer, Shane

Otago Babaci, Ali
Bokern, Dirk G
Degenhardt, Jens
Halstead, Michael James
Lee, Kathy

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TREASURER'S REPORT

FINANCIAL YEAR 1995/1996

The annual Financial Statement of accounts of the Institute for the financial year 1995/1996 appear below.

There are a number of issues in the accounts that will need careful consideration before hasty conclusions are made with respect to the apparent surplus in income over expenses.

You will recall from the previous year's accounts that subscriptions in arrears for longer than two years were written off as being uncollectable. This caused an apparent large drop in income from the expected \$101,000 to \$76,566. The actual situation was that subscriptions of \$99,000 were received. It is of concern therefore that subscription income for this financial year has fallen to \$85,000 despite vigorous efforts by the secretariat to recover outstanding accounts from members.

All other items of income from members and member activities are in line with that expected.

The apparent large increase in Chemical Olympiad donations is an anomaly caused by the overlap (or out of synchronisation) of the financial years. The true net income shows a small increase over that of the previous year.

All expenditure items are approximately in line with that expected. An unbudgeted amount of \$2,656 labelled Secretarial Audit relates to the audit of the activities of the secretariat by Deloitte, Touche Tomahatsu in November 1995.

General increases include the expense item under sundry publications which returns to a 'normal' level after the one-off expense of the careers brochure produced by the Manawatu branch is taken into account.

Others are in the area of travel as a consequence of the 'Denny Report' in assessing the future directions of the Institute, in the publication of *Chem NZ*, and in GST becoming a debit item rather than a credit item.

If the effect of the Chemical Olympiad funds are taken into account then the net result is that the overall operating activities of the Institute shows a deficit of \$8,919. This is a slight increase over the real deficit of \$7,800 for the previous year and could be attributed to the cost of the extra audit activities.

On a personal note, you may be aware that after ten years as treasurer I have stated I wish to resign from the position as treasurer to pursue other interests. I have enjoyed these years, especially for the opportunities offered to make new friendships and acquaintances, to enjoy the fellowship of people with similar interests and to even perhaps influence slightly the direction of chemistry in New Zealand.

Nominations, or even a volunteer, for the position is sought. I would give the incoming person every assistance that I could to enable a smooth transition.



Dennis Karl
Hon. Treasurer

NZIC BRANCH NEWS

WELLINGTON

The Wellington Branch held its annual prestigious Mellor lecture in November and Professor Leon Phillips (University of Canterbury) addressed us on the topic "What Gases Do at the Air-Sea Interface", a theme he developed further at the Dunedin conference. The dinner meeting received good attendance and the evening was enjoyed by all.

Victoria University

Under moves of devolution and association the Chemistry Department joins with Physics as a School early in 1997. However, the title of "School of Physical Sciences" or simply "School of Chemistry and Physics" has yet to be finally settled. It would seem that even in the university environment traditional identities are being questioned, but staff are adamant that the separate disciplines continue to be identifiable. Whether the current Chair of Chemistry or of Physics, or a different person, becomes Head of the School is also a matter for the future. The consoling feature of the changing environment is that unlike most of our counterparts elsewhere, we will not be bidding farewell to retiring staff for another year.

Professor Brian Halton continues in his role as the NZIC Pacificchem representative. He managed to get home for Christmas this year after attending the first planning meeting for Pacificchem 2000 (see announcements elsewhere).

BRANZ

Chris Kane has recently published in IPENZ Transactions the latest report on corrosivity in the New Zealand atmosphere. This reports the data from 6 years exposure of panels at sites throughout New Zealand; one final data set, after 10 years exposure, will be generated. Having dealt with the mesoclimatic effects, attention is now turning to microclimates. Chris and Guy Holcroft have a study running in an experimental building at Cable Bay, at the southern tip of the North Island, trying to unravel the very complex relationships between air flows (and consequent sea-salt deposition) and timber moisture content as determinants of corrosion rates of a range of metal fasteners and other metallic components used in the sub-floor structures of buildings.

Chris Kane has also been working with the Ministry of Foreign Affairs and Trade devising a programme for the ASEAN nations to help them define procedures to obtain greater durability of their physical infrastructures (bridges, pipelines, transmission towers, etc). The next stage is a workshop early in 1997 in Wellington that will involve people from the ASEAN countries meeting to define the steps that will be taken by each country.

The work which won Neil Trebilco the Arthur Kennett Award in 1994 (durability prediction methods for uPVC claddings) has been advanced several stages further. Neil has also developed procedures for assessment of the weathering performance of polycarbonate sheet materials. These methodologies become very important in making reliable predictions of the durability of cladding materials, which the New Zealand Building Code demands should survive 15 years.

Brian Halton

MANAWATU

Professor John Ralston, Ian Wark Research Institute, University of South Australia spoke to the Branch in the Aston 1 Lecture Theatre, Massey University, on Thursday 14 November 1996. Professor Ralston is the 1996 Royal Society of Chemistry Australasian Lecturer, and the title of his talk was "The Interaction Between Particles and Bubbles". He pointed out that the processes by which particles and bubbles interact capture most of the central concepts of colloid science and surface chemistry. This rich and deep area of research involves hydrodynamics, interfacial (including capillary) forces, particle and bubble behaviour and solution chemistry. Professor Ralston's work in this area has been both evolutionary and revolutionary, ranging from the preparation of model particle surfaces and the measurement of particle contact angles, through to the direct measurement of bubble-particle interaction forces.

The Manawatu Branch AGM of was held in The Russell Room, Wharerata Staff Club, Massey University on Thursday 28 November 1996. Twenty-three members attended the meeting and many stayed on for dinner afterwards. Branch Chairman Dave Harding reviewed another active year of scientific and social meetings and acknowledged the success of the chemistry quiz for secondary schools in the Manawatu and Wellington regions, which enabled \$1000 to be donated from the Quiz account to the Manawatu Education Trust. He also referred to the sad loss to the branch of long-term members Alan Furness and Stan White.

The following Officers and Committee for 1996/97 were elected by acclaim:

Chairman:

Mr Grant Boston, New Zealand Dairy Research Institute

Secretary:

Mr Mark Smales, Dept. of Chemistry, Massey University

Treasurer:

Dr Clyde Smith, Dept. of Biochemistry, Massey University

Branch Editor:

Dr Harry Percival, Landcare Research New Zealand Ltd

Committee:

The following committee members were reappointed:

Dr David Harding, Separation Science Unit, Massey University (Immediate past chairman)

Dr Gill Norris, Dept. of Biochemistry, Massey University

Mrs Kath Fletcher, Central Hawke's Bay College (Hawke's Bay representative)

Dr Mark Patchett, Dept. of Biochemistry, Massey University

Dr Alistair MacGibbon, New Zealand Dairy Research Institute

Dr Mike Boland, New Zealand Dairy Research Institute

Dr Tony Burrell, Dept. of Chemistry, Massey University

In addition three new committee members were elected:

Dr Gavin Hedwig, Dept. of Chemistry, Massey University

Dr Stephen Van Eyk, New Zealand Pharmaceuticals Ltd

(Ms) Charlotte Cutler, Dept. of Chemistry, Massey University (Student representative)

Dr Tony Wright will become Chairman of the Manawatu Chemical Education Trust at the end of the term of current Chairman Dr Eric Ainscough (Dept. of Chemistry, Massey University) who is retiring from the Trust. Dr Julian Lee (AgResearch Grasslands) was re-elected as a Trustee, and Dr Simon Hall (Dept. of Chemistry, Massey University) was elected as a new Trustee. In 1996 the Trust awarded a total of nearly \$2000 in grants to thirteen secondary schools for chemical education or laboratory materials.

The AGM was followed by the Dave Harding's talk on Commercialisation of Research at Massey University: The Genecorp Story To Date". He described contract research work with Genecor International, Palo Alto, California that has been going on at the Centre for Separation Science, in the Department of Chemistry at Massey University. The research started with two short periods of work in 1988 and 1989, but since mid-1993 there has been a continuous programme. There has always been the need for a tough, inexpensive chromatographic matrix for large-scale (truckload) protein purification. The chromatographic material must withstand many cycles which include sodium hydroxide washes of cellular debris. Simon Burton, a research officer in the Centre, has developed a chemistry system linking spacer arms and ligands to a tough beaded cellulose from Czechoslovakia that is strongly resistant to sodium hydroxide. He then developed protocols whereby proteins could bind to the neutral cellulose-spacer arm-ligand complex. After extensive washing, the protein can be eluted with a pH change that is often only 1 unit. A pKa "ladder" of weakly-basic organic amine ligands has been developed such that a matrix can be customised for a particular protein. A similar ladder is being developed for weak organic acids. In summary, the system works by binding the target protein with the matrix in the neutral hydrophobic mode and then "throws" the protein off with a pH change (usually small) that ionises the ligands.

Two students in the Department of Biochemistry, Massey University, won poster prizes at the 1996 National Conference of the New Zealand Institute of Chemistry and New Zealand Society for Biochemistry and Molecular Biology (NZIC/NZSBMB) in Dunedin. The NZIC poster prize was awarded to Farah Abu Bakar for the study "Pathogenicity factors of Malaysian isolates in the phytopathogen, *Colletotrichum gloeosporioides*" (Abu Bakar, F D, Omar, M, Mahadi, N M and Sullivan, P A), while the NZSBMB poster prize was awarded to Michelle Sullivan for the study "The Secreted Aspartic Proteinases of *Candida albicans*" (Sullivan, M E, Sullivan, P A and Tweedie, J W).

Harry Percival

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CHEMISTRY
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NOTES TO THE FINANCIAL STATEMENTS FOR THE YEAR ENDED 30TH APRIL 1996

STATEMENT OF ACCOUNTING POLICIES

1. GENERAL ACCOUNTING PRINCIPLES

The general accounting principles recognised as appropriate for the measurement and reporting of earnings and financial position on an historical cost basis have been followed by the business.

Accrual accounting is used to match revenue and expenses.

Reliance is placed on the fact that the business is a going concern.

2. PARTICULAR ACCOUNTING POLICIES

The following particular accounting policies which materially affect the measurement of earnings and the financial position have been applied:

- : Accounts receivable are stated at their estimated net realisable value.
- : Inventories have been stated at the lower of cost or net realisable value on a FIFO basis
- : Fixed assets are stated at cost less aggregate depreciation. Depreciation has been calculated using the maximum rates permitted by the Commissioner of Inland Revenue and these are considered appropriate.
The rates used are as follows:
Office Equipment 20% DV
- : These accounts have been prepared on a G.S.T. inclusive basis.
- : Investments are stated at cost or, where applicable, with the addition of interest compounded to date.

3. CHANGES IN ACCOUNTING POLICY

There have been no changes in accounting policies. All policies have been applied on bases consistent with those used in previous years.

AUDITORS REPORT

NEW ZEALAND INSTITUTE OF CHEMISTRY INC.

Audit Report:

To the members of New Zealand Institute of Chemistry Inc.
We have audited the financial report attached. The financial

report provides information about the past financial performance of the Institute and its financial position as at 30th April 1996. This information is set out in accordance with accounting policies attached.

Council Executive:

The Council Executive is responsible for the preparation of a financial report which fairly reflects the financial position of the Institute as at 30th April 1996 and the results of its operations for the year ended on that date.

Auditor's Responsibilities:

It is our responsibility to express an independent opinion on the financial report presented by the Council Executive and present our opinion to you.

Basis of Opinion:

An audit includes examining, on a test basis, evidence relevant to the amounts and disclosures in the financial report. It also includes assessing:

- the significant estimates and judgements made by the Executive in the preparation of the financial report; and
- whether the accounting policies are appropriate to the Institute's circumstances, consistently applied and adequately disclosed.

We conducted our audit in accordance with generally accepted auditing standards in New Zealand. We planned and performed our audit so as to obtain all the information and explanations which we considered necessary in order to provide us with sufficient evidence to give reasonable assurance that the financial report is free from material misstatements, whether caused by fraud or error. In forming our opinion we also evaluated the overall adequacy of the presentation of information in the financial report. In common with other organisations of a similar nature, control over income prior to it being recorded is limited and there are no practical audit procedures to determine the effect of this limited control, and our audit opinion below is subject to this comment. Our firm has no other interest in the Institute.

Unqualified Opinion:

We have obtained all the information and explanations we have required. In our opinion the Institute's financial report attached fairly reflects the financial position of the Institute as at 30th April 1996 and the results of its operation for the year ended on that date.

Our audit was completed on 28th November 1996 and our unqualified opinion is expressed as at that date.

MARKHAMS, Auckland

NEW ZEALAND INSTITUTE OF CHEMISTRY INC.

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 30TH APRIL 1996

		1995
INCOME		
Subscriptions from Members	84,979	76,566
Chem NZ-RSC Subs	8,750	—
Publication Sales	1,457	8,733
Conference Surplus	817	1,002
Chem 13 Exam Fees	3,402	3,434
Chem Education Subscriptions	277	1,125
I. U. P. A. C.	(441)	32
Chem 13 News	570	—
Interest – BNZ	4,313	3,084
Interest – Local Body Stock	31	31
Equiticorp Capital Repayment	3,676	7,048
Fees ANC Quiz	1,788	272
Conference Fees – I.M.M.	158	—
	<hr/>	<hr/>
	109,777	101,327
Chemical Olympiad Donations	43,314	15,106
Chemical Olympiad Expenses	24,128	24,007
	<hr/>	<hr/>
	19,186	(8,901)
	<hr/>	<hr/>
	128,963	92,426
 EXPENDITURE		
Accountancy & Audit Fees	2,649	1,984
Accommodation Expenses	1,171	1,210
Branch Expenses – Capitation Fees	11,411	11,635
Branch Expenses – Student Travel	3,000	3,000
Chem NZ Expenses	12,115	10,534
Chem 13 Expenses	1,907	1,120
Conference Expenses	140	428
Depreciation	30	30
Goods & Services Tax	3,978	(2,910)
Interest & Bank Charges	990	545
Journal – Publisher	10,150	10,391
Sundry Publications for Resale	1,757	15,445
Overseas Visitors Expenses	500	703
Printing, Stationery, & Postage	7,341	7,303
Prizes	400	2,650
Rent to I.P.E.N.Z.	2,565	2,565
Secretarial Services	41,883	41,908
Secretarial – Audit	2,656	—
Subscriptions	1,516	3,150
Telephone & Fax Charges	457	1,189
Travelling Expenses	12,079	9,486
	<hr/>	<hr/>
	118,695	122,366
	<hr/>	<hr/>
NET PROFIT (LOSS)	10,268	(29,940)
	<hr/> <hr/>	<hr/> <hr/>

NEW ZEALAND INSTITUTE OF CHEMISTRY INC.

BALANCE SHEET AS AT 30TH APRIL 1996

		1995
CAPITAL FUNDS		
Balance at the Beginning of the Year	5,694	35,634
Plus Net Income for Year	10,268	(29,940)
Development Fund	46,699	46,699
Easterfield Account	567	567
	<u>63,228</u>	<u>52,960</u>
REPRESENTED BY:		
CURRENT ASSETS		
Accounts Receivable	6,714	3,973
Prepaid Travel Account	—	1,936
B.N.Z. Current Account	1,912	—
B.N.Z. Autocall Account	17,131	21,256
B.N.Z. Term Deposits	<u>38,878</u>	<u>28,684</u>
	64,635	55,849
FIXED ASSETS		
Office Equipment	582	582
Less Accumulated Depreciation	<u>490</u>	<u>460</u>
	92	122
Presidential Chain	<u>360</u>	<u>360</u>
	452	482
INVESTMENTS		
Equiticorp \$21,000 Debenture	1	1
Lyttleton H.B. Stk. 6.25% 1998	<u>500</u>	<u>500</u>
	501	501
TOTAL ASSETS	<u>65,588</u>	<u>56,832</u>
CURRENT LIABILITIES		
B.N.Z. Current Account		1,872
Accounts Payable	<u>2,360</u>	<u>2,000</u>
	2,360	3,872
NET ASSETS	<u>63,228</u>	<u>52,960</u>

NZIC CONFERENCE

DUNEDIN, 3 DECEMBER 1996

The following is a transcript of the opening address given by Sir Neil Walters.

Professor Robinson, Ladies and Gentlemen:

It is a special pleasure to be with fellow chemists today – a relief to be away from the bureaucracy and back to where the real work is done and real progress is made. This conference, with its very pertinent and exciting title, "Molecules for the Future", is a beacon for all biochemists and chemists who may feel somewhat overwhelmed by the extent and speed of recent changes in the science and education sectors.

There is no doubt that scientists and science have been through unsettling times – to choose as neutral a word as I can. Those in the Government service have borne the immediate brunt of the changes and some scientists have lost their positions. The restructuring along output lines – agriculture, horticulture and so on – rather than on the basis of subjects has been particularly difficult for chemists who can be excused for thinking that they are felt to be no longer of much consequence. In the end, however, it is important to remember that administrators can restructure forever but that science itself will determine what is and what is not of consequence. Not that we want further restructuring – at least not as I see it. Rather, we want stability and a chance to concentrate on our science without the worry of facing yet another upheaval.

My own view is that the science reforms have been remarkably successful but they do depend, critically, on the sound administration of each science enterprise. I was interested to hear speakers at a recent Forum on science policy extolling the virtues of the reforms and the freedom and flexibility which they brought. I think that this is so, but it does depend on there being sound administration at home.

The new policy is designed, among other things, to keep politicians out of the administration of the country's science endeavours. Just as the previous policy was rooted in the philosophy of the day, in which the Government funded inputs into issues it wanted addressed, so today's policy owes much to the current market culture. It is a policy largely based on the purchase of outputs and just as the previous policy made spending accountable in the manner of the day, namely by placing it in the context of a Government department, so the new policy secures its accountability by placing the spending within a commercial context, especially within the Crown Research Institutes. Hence my stress on the need for good administration since the CRIs are under the Companies Act and must balance their books.

Not every chemist is in a CRI of course and many here this morning will be employed by a university. These institutions are not under the Act just mentioned although I have no doubt that there are those who would like to see this, or something akin to it. There may be attempts during the life of the new Parliament to move this process along but I suspect that the political moment has passed in New Zealand. For all that, universities also have to balance their books and, as well, they are no longer paid "to be", but are funded solely on the basis of their student numbers. This is not quite output purchasing but nor is it input funding. Like the CRIs they no longer get special grants for buildings or for equipment. So the two main employers of scientists in New Zealand, the CRIs and the universities, face similar situations. In many respects the universities are worse off since the eftis funding of science graduate students does not cover the expenses of their tuition and hence we hear the call from some university staff for the re-introduction of special grants, especially for equipment. My own strong view is that this is unlikely to succeed and that the real issue is to get the funding of science students properly met.

The point of all this is to say that I believe that scientists must now grasp the opportunities which they have. In particular, all chemists should apply to the two main funds, the Public Good Science Fund and the Marsden Fund. If past promises are kept they are both expanding to a significant degree although we should note that there are those in the financial bureaucracy who want to see these undertakings withdrawn. In addition there are Government departments which would like to get their hands on PGSF funds for their own spending. All scientists should be vigilant and be prepared to keep politicians to the promises which have been made.

In applying to the PGSF and to the Marsden Fund please take note of the purposes for which they have been established and of the guidelines which apply. Thus the Marsden Fund is for speculative, academic research, whereas the general areas of research funded by the PGSF are subject to overall Government direction. The current requirements are that the fund support research which is relevant to New Zealand – which means, when one examines the small print, that the spending must support the economic, social or environmental development of the country. There is also to be, as I am sure you know, an emphasis on adding value in industrial processing. I mention all this because it is surprising how many seem to overlook the rules and are then upset when their applications are declined.

But enough of all this bureaucratic stuff. This is a chemistry and biochemistry conference and we are here to celebrate these disciplines. The fact is that chemistry will go on regardless of administrators. I have always seen it as the basic science of the material world and therefore the underpinning of our understanding of our interaction with the environment we inhabit, whether we be concerned with living organisms, medicine, physical structures, plastics – you name it. In the sense that everything that has a concrete existence is made of atoms and molecules chemistry is at its core, even if, as is only too true, academic chemistry has often seemed removed from this reality. In a sense, then, the decision to disband the old Chemistry Division of DSIR and to place its chemists throughout the new science structure has merit so long as the chemists involved are clear that they are at the centre of their enterprises and not the periphery.

This new reality, regardless of how well it may be working for chemists in any particular circumstance, does, however, make the role of the Institute of Chemistry even more critical than in the past. It is important that chemists retain a strong sense of identity and encourage one another so that they are not, in the new set-up, relegated to minor roles of technical support. This is a time when all professional bodies are having difficulty recruiting members, particularly younger members. This is a fact of life which is more than a passing phase I fear, since it reflects changes in our social structure and our lifestyles. In a busy life who wants to go out at night to a meeting or who can find the time to serve on a committee, especially when there often seems to be little return for the effort? Who wants to pay a subscription to a collective in this day of individualism, not to say selfishness? Who looks to group support in this day of dependence on lawyers? What one hopes that a body like the Institute can provide is a sense of belonging and recognition, and an environment of learning and encouragement. I personally welcome the proposal that the Institute become a learned society rather than a professional accreditation body since I think that the change concentrates action where it is needed. This is not to say that we should not continue to promote and lobby as required but it emphasises the wonder and the importance of our subjects, and our need to come together to celebrate that wonder and importance. But if we make the change it is vital, in my view, that it is made to work. And this means time and effort, commodities which are not in oversupply in our pressured society. It seems especially important to capture the interest and the commitment of young graduates and I wish that I knew how this could be assured. We are certainly dealing with a new style of New Zealander, young people who are cosmopolitan,

consumer orientated and more individualistic than those of my own generation. That some students have recently begun legal proceedings against a University is no surprise to me as I have for some considerable time believed that students no longer see themselves as members of such an institution but as consumers of its products. And I do not condemn them for this. I think it is an inevitable consequence of the "massification" of tertiary education and of changes in society, not to be lamented but certainly to be understood. The same attitudes prevail with bodies such as the Institute. I know that much thought has been given to these matters by a succession of Presidents and committees over recent years so it would be presumptive of me to offer further comment other than to say that we ignore changes at our peril. Those of us who believe in chemistry, who believe that its wonders and its promises should be shared, who believe that there is strength and advantage in making common cause, who believe, in other words, in a body such as the Institute, have a duty to support our leaders as they face these challenges – not only with our time but, perhaps more importantly, with our money.

Ladies and Gentlemen I apologise for lecturing you. I am aware that that is not my role. I am here to fill the gap while the organising committee finds a bulb for the projector, puts on the kettle for morning tea and locates the guest speaker. My other task is the very pleasurable one of welcoming you and formally declaring open the 1996 National Conference of the New Zealand Institute of Chemistry and the New Zealand Society for Biochemistry and Molecular Biology.

Sir Neil Waters

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Safety Information for Laboratory Technicians

A major problem for those working in laboratory situations is the ready availability of safety information about the chemicals they are working with. Training in the safe use of chemicals is poorly done by universities, rather better by polytechs, especially with the old "Laboratory Technology" course and its successors.

An attempt to overcome this was the introduction of MSDS (Material Safety Data Sheets) which have to be supplied, on request, with any chemical which is sold to a consumer.

MSDS are often multi-paged, based on standard templates and contain much useless or unnecessary information which hides the valuable data which may be present - a case of the forest hiding the trees! This is typified by the MSDS of the "toxic" chemical, sodium chloride, which regularly does the rounds.

Hill Laboratories has approached this problem by developing a series of "Working With ..." (WW) sheets for the main chemicals our technicians use.

These are designed to be one page only, to contain all, and only, the necessary information for the safe use of the chemical and to outline what to do in the case of spillages.

A copy of the introduction to our WW sheets appears below (Figure 1) and a typical example is shown (Figure 2). Any feedback would be welcomed.

Anyone interested in joining an Email group for circulation of safety related comments should contact:

Nigel McCarter
Health and Safety Co-ordinator
Email: n.mccarter@niwa.cri.nz
Ph: (+64-7)-8561737
Fax: (+64-7)-856 0151

For further information, or to pass on comments, please contact
P G Robinson MSc(Hons) PhD FNZIC
Environmental Division Manager
Hill Laboratories
Ph: (+64-7)-8582000, Fax: (+64-7)-8582001
Email: peter@hill-labs.co.nz

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REQUEST FURTHER
INFORMATION,
PRICING DETAILS ETC.,
USING THE FREEPOST
READER REPLY CARD**

CHEMICAL SAFETY INFORMATION SHEET WORKING WITH... INTRODUCTION

A series of "Working With" sheets have been developed for daily reference for technicians working with hazardous chemicals. New sheets will be introduced from time to time.

The aim of these sheets is to offer technicians all of the information which they need to understand particular hazards of a chemical and to give a list of actions which should be taken in the case of a spillage or contact with a person.

Note that these sheets are not designed to replace full MSDS (Material Safety Data Sheets), which are available in the safety filing cabinet or via computer, but will present all pertinent information in an easily understood format and generally on only one page.

Other chemical safety information is contained in the books on the Safety Bookshelf in the staffroom.

Note that there have been compromises made between including a large amount of information, and making these useful working documents containing only immediately necessary information. Further information is available as above.

The WW sheets are printed on 'Pink' (one of our safety colours) paper to make them easy to find.

Use:

A technician **MUST** be given a copy of all relevant "Working With" sheets when they are first being shown a new test. They should initial and date the sheet after they have read it and discussed it with their trainer.

If they have already been using the chemical then they should re-read the sheet.

Their Staff Training Record sheet should be updated to show that they have been given the sheet and have read it.

All technicians should keep their WW sheets on their clipboards for rapid reference if required. Other copies will be available at various locations around the laboratories e.g. with safety warden vests.

References:

1. "NIOSH Pocket Guide to Chemical Hazards" (NIOSH Pub. No. 94-116), US Department of Health and Human Services, June 1994.
2. "Safe Practices in Chemical Laboratories", Royal Society of Chemistry, July, 1989.
3. "Hazards in the Chemical Laboratory", L Bretherick (Ed.), Royal Society of Chemistry, ISBN 0-85186-489-9.
4. "Hazardous Laboratory Chemicals Disposal Guide", M Armour, CRC Press, 1991, ISBN 0-8493-0265-X.

Figure 1. Introduction to 'Working With...' sheets

CHEMICAL SAFETY INFORMATION SHEET

Working With... **ACETONE**

Other Common Names: propanone
2-propanone
dimethyl ketone

Major Dangers: Flammability

Action List (Major spill): Evacuate area rapidly
Ventilate area if safe

HEALTH HAZARDS

Contact with eyes	Contact with skin	Ingestion	Inhalation
Wash with water for 10 minutes Get checked by a doctor as soon as possible	Wash with soapy water, rinse well	Do NOT induce vomiting Obtain IMMEDIATE medical assistance (ring ambulance)	Go to well ventilated area away from fumes. Visit a doctor as soon as possible if respiratory problems occur

ENVIRONMENTAL HAZARDS

Major Spill (e.g. broken winchester)	Minor spill (e.g. beaker tips over)	Splashes
Evacuate affected area rapidly If safe to do so then: (wear gas mask if necessary, PVC gloves) Ensure area well ventilated Turn off all electrical sources Remove all heat sources Cover liquid with sand to absorb, scoop into a metal bucket and allow to evaporate in a well ventilated area outside	Remove all heat/electrical sources Mop up with sand or tissues Dispose of in well ventilated outside waste bin	Wipe up with tissues Dispose of in well ventilated outside waste bin

COMMENTS

- The main danger from acetone is from explosive ignition and fire. Always use in a well ventilated area.
- Acetone is a "fat solvent" and so will attack the fats in skin. Avoid excessive exposure to fumes or liquid.
- Prolonged or excessive inhalation of fumes can lead to symptoms of intoxication (excitement, headaches, fatigue, loss of motor control).
- Acetone attacks many plastics.

Figure 2. A typical 'Working With...' example

CONFERENCES & SEMINARS

1-5 February 1997

The Miami Biotechnology Symposium on Biomolecular Design, Form and Function

Venue: Fort Lauderdale, Florida, USA
Contact: Tel: (+1-305)-233597

2-6 February 1997

The Australian and New Zealand Society for Mass Spectrometry 16th Conference (ANZSMS 16)

Venue: University of Tasmania, Tasmania, Australia
Contact: Mures Convention Management
Victoria Dock
Hobart, TAS 7000, Australia
Tel: (+61-002)-312121
Fax: (+61-002)-344464
Email: mures@hba.trumpet.com.au
<http://www.csl.utas.edu.au/ANZSMS/anzsms16.html>

3-7 February 1997

22nd Australasian Polymer Symposium

Venue: Auckland, New Zealand
Contact: Mr N R Edmonds
Faculty of Science and Engineering
Auckland Institute of Technology
Private Bag G P O, Auckland, New Zealand
Tel: (+64-9)-3079999 ext: 8181
Fax: (+64-9)-3079973

5-7 February 1997

WAGGA '97: The Combined New Zealand and Australian Institutes of Physics Annual Condensed Matter Physics Meeting

Venue: Pakatoa Island Resort, Hauraki Gulf, Auckland
Contact: Associate Professor Rod Lambert
or Professor Paul Callaghan
Massey University
Palmerston North
New Zealand
Email: wagga@massey.ac.nz
<http://www.massey.ac.nz/~wwphys/WAGGA/wagga.html>

5-8 February 1997

Fluorescence Spectroscopy in the Biosciences - A Workshop
This will run in tandem with the Lorne Conference on Protein Structure and Function.

Venue: Melbourne, Australia
Contact: Professor Bill Sawyer
Department of Biochemistry and Molecular Biology
University of Melbourne, Parkville
Victoria, Australia 3052
Tel: (+61-3)-93445923
Fax: (+61-3)-93477730

9-13 February 1997

1997 Lorne Meeting on Protein Structure and Function

Venue: Lorne, Victoria, Australia
Plans for the meeting will be available on the WWW site:
<http://grimwade.biochem.unimelb.edu.au>
Contact: lorne_orgs@unimelb.edu.au

10-14 February 1997

Microscopy 97. Microscopy New Zealand Conference

Venue: Medical School, University of Auckland
Auckland, New Zealand
Contact: Dr Ian Hallett
HortResearch, Private Bag 92169, Auckland
Tel: (+64-9)-8493660
Fax: (+64-9)-8154201
Email: ihallett@hort.cri.nz

1-5 April 1997

4th International Symposium on 'Responses of Plant Metabolism to Air Pollution and Climate Change'

Venue: Egmond aan Zee, The Netherlands
Contact: Symposium Secretariat
Department of Plant Biology
University of Groningen
P O Box 14
9750 AA haren, The Netherlands
Fax: (+31-503)-632273
Email: g.stulen@biol.rug.nl

9-11 April 1997

Annual Conference of the New Zealand Biotechnology Association

Venue: Waipuna International Hotel and Conference Centre, Auckland
Contact: Professor Ian Maddox
Department of Process and Environmental Technology
Massey University
Palmerston North
Tel: (+64-6)-3505548
Fax: (+64-6)-3505654
Email: I.S.Maddox@massey.ac.nz

16-20 May 1997

Seventh Asian Chemical Congress

Venue: International Conference Centre Hiroshima
Hiroshima, Japan
Contact: Mr A Nakanishi
Head, Administration Office of 7ACC'97
Chemical Society of Japan
1-5, Kanda-Surugadai
Chiyoda-ku, Tokyo 101, Japan
Tel: (+81-3)-32926161
Fax: (+81-3)-32926318
Email: 7acc97@chemistry.or.jp
[www: http://www.t.soka.ac.jp/chem/csj/7ACC.html](http://www.t.soka.ac.jp/chem/csj/7ACC.html)

28 June - 2 July 1997

6th International Symposium on Perspectives on Protein Engineering

Venue: Norwich, England, UK
Contact: POPE6 Secretariat
Biodigm Ltd
64 Langdale Grove, Bingham
Nottingham NG13 8SS, England, UK
Fax: (+44-1949)-876156
Email: biodigm@dial.pipex.com
[www: http://www.cryst.bbk.ac.uk/CEC/pope6.html](http://www.cryst.bbk.ac.uk/CEC/pope6.html)

CONFERENCES & SEMINARS

7-10 July 1997

Chem Ed '97: Putting the Elements Together

Venue: Massey University, Palmerston North
The Biennial conference for chemistry educators focussing on everyday contexts, assessment and learning, industry.

Contact: The Secretary
Department of Chemistry
Massey University
Private Bag
Palmerston North
Tel: (06)-3699099

or: Kath Fletcher
Central Hawkes Bay College
P O Box 482
Waipukurau
Tel: (+64-6)-8589203
Fax: (+64-6)-8587003

20-24 July 1997

4th International Conference on Essential Fatty Acids and Eicosanoids

Venue: Edinburgh, Scotland, UK
Contact: Vicki Grant/Wendy Adegesun
c/o Meeting Makers, 50 George Street
Glasgow G1 1QA, Scotland, UK
Tel: (+44-141)-5531930
Fax: (+44-141)-5520511
Email: mm@meetingmakers.co.uk

27-30 July 1997

6th International Symposium on 'The Maillard Reaction'

Venue: London, England, UK
Contact: The Organisers (Maillard Symposium)
Department of Food Science and Technology
University of Reading
PO Box 226, Whiteknights
Reading RG6 6AP, England, UK
Fax: (+44-1734)-310080
Email: Maillard@afnovell.reading.ac.uk
www: <http://www.fst.rdg.ac.uk/people/aamesj/m/maillard.htm>

18-22 August 1997

**8th European Congress on Biotechnology,
70th Event of The European Federation of Biotechnology**

Venue: Budapest, Hungary
Contact: Professor Laszlo Nyeste
Department of Agricultural Chemical
Technology
Technical University
Budapest, H-1121 Budapest XI
Hungary
Tel/Fax: (+36-1)-463220

25-29 August 1997

5th International Conference on Amino Acids

Venue: Chalkidiki, Greece
Contact: Professor Dr M Liakopoulou-Kyriakides
Aristotle University of Thessaloniki
Department of Chemical Engineering
540 06 Thessaloniki, Greece

Fax: (+30)-31996193

Email: markyr@vergina.eng.auth.gr

28 August - 2 September 1997

Structure and Mechanism of Oxidases and Related Systems

This meeting will focus on recent advances on structure and mechanisms of oxidases and related iron-containing enzymes including peroxidases and catalase, di-iron enzymes, P-450 and oxygen-binding proteins

Venue: Devon, England, UK
Contact: Kelly Alderton
The Biochemical Society
59 Portland Place
London W1N 3AJ, England, UK
Tel: (+44-171)-5803481
Fax: (+44-171)-6377626
Email: meetings@biochemsoc.org.uk

21-26 September 1997

XXX Colloquium Spectroscopicum Internationale

Venue: World Congress Centre
Melbourne, Australia
Contact: The Meeting Planners
108 Church Street
Hawthorn, Victoria 3122
Australia
Tel: (+61-3)-98193700
Fax: (+61-3)-98195978

29 September - 3 October 1997

International Symposium on Biotechnology of Tropical and Subtropical Species

A symposium run by the Commission Biotechnology and the Commission Tropical and Subtropical Horticulture of the International Society for Horticultural Science

Venue: Brisbane, Australia
Contact: Organisers Australia
P O Box 1237
Milton, Queensland, Australia
Tel: (+61-7)-33697866
Fax: (+61-7)-33671471
Email: oa@bnec.design.net.au

15-17 October 1997

7th New Zealand Coal Conference

Venue: Park Royal Hotel, Wellington
Contact: The Conference Secretary
Seventh New Zealand Coal Conference
P O Box 31-244
Lower Hutt
Tel: (+64-4)-5703700
Fax: (+64-4)-5703701

26-30 October 1997

5th Pacific Polymer Conference

Venue: Hotel Hyundai, Kyongju, Korea
Contact: Professor Sung Chul Kim
Secretariat of PPC-5
Department of Chemical Engineering
KAIST
Yusong-gu
Taejon, 305-701

IUPAC-SPONSORED SYMPOSIA IN 1997-1998

19-23 May 1997

9th International Conference on High Temperature Materials Chemistry

Venue: Pennsylvania, USA

16-20 June 1997

International Symposium on New Approaches in Polymer Synthesis and Macromolecular Formation

Venue: St Petersburg, Russia

20-25 July 1997

9th IUPAC Symposium on Organometallic Chemistry Directed Towards Organic Synthesis

Venue: Göttingen, Germany

27 July - 1 August 1997

8th International Conference on Bioinorganic Chemistry

Venue: Yokohama, Japan

17-22 August 1997

36th IUPAC Congress

Venue: Geneva, Switzerland

18-22 August 1997

13th International Symposium on Plasma Chemistry

Venue: Beijing, China

24-29 August 1997

32nd International Conference on Coordination Chemistry

Venue: Santiago, Chile

25-28 August 1997

12th Bratislava IUPAC International Conference on Polymers - Modified Polyolefins for Advanced Polymeric Materials

Venue: Bratislava, Slovak Republic

21-26 September 1997

30th Colloquium Spectroscopicum Internationale

Venue: Melbourne, Australia

23-27 November 1997

International Conference on Biodiversity and Bioresources - Conservation and Utilisation

Venue: Phuket, Thailand

16-21 August 1998

14th International Conference on Physical Organic Chemistry

Venue: Florianópolis, Santa Catarina, Brazil

30 August - 4 September 1998

33rd International Conference on Coordination Chemistry

Venue: Florence, Italy

For further information, please contact:

The NZIC Secretariat
P O Box 12-347, Wellington
Tel: (+64-4)-4739444
Fax: (+64-4)-4732324
Email: nzic@ipenz.org.nz

PACIFIC OILS 2000

An International Conference
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25-28 November 1997

Venue:

The Conference Centre, University of Auckland, Auckland

Programme:

- The commercial environment for new materials and products – specifications, regulations and evaluation.
- Production and processing methods, and technology of plant oils.
- The manipulation of plant materials and crops before extraction to match product specification.
- Analysis, composition and evaluation of products from both essential oils and fixed oils.
- Pharmacological, nutritional and health aspects of plant oils.
- Composition, analysis and commercial aspects of marine lipids.
- Pharmacological effects of marine lipids.

Plenary and Keynote Speakers include:

- Dr Bob Ackman – University of Nova Scotia, Canada
- Mr Bryce Bell – Secretary, Oilseed Federation, Australia
- Prof. Carlo Bicchi – University of Turin, Italy
- Mr Tim Denny – Denny MacKenzie Associates, Australia
- Dr Bob Gibson – Dept. of Pediatrics, Flinders University, Australia
- Dr James Henderson – Stirling University, UK
- Dr David Horrobin – Director of Efamol, UK
- Dr Daniel Joulain – Director of Research, Robertet, France
- Prof. Julie Miller Jones – St Catherine College, Minnesota, USA
- Dr Colin Moffat – Food Science Laboratory, Aberdeen, Scotland
- Prof. John Ohlrogge – Michigan State University, USA
- Dr Noel Porter – Crop & Food Research Institute, Lincoln University, New Zealand
- Dr Siew Wai Lin – Porim, Malaysia
- Dr David Topping – CSIRO, Adelaide, Australia
- Dr John Volkman – CSIRO, Hobart, Australia
- Prof. Alistair Wilkins – Chemistry Dept., University of Waikato, Hamilton
- Mr Geoff Webster – Abels (NZ) Ltd, Auckland

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ppc5@cais.kaist.ac.kr

23-25 November 1997

6th Conference of the Society for Free Radical Research (Australasia)

Venue: Dunedin, New Zealand

Contact: Dr Mike Murphy

Biochemistry Department

University of Otago

P O Box 56, Dunedin, New Zealand

Tel: (+64-3)-4797871

Fax: (+64-3)-4797866

Email: murphy@sanger.otago.ac.nz

25-28 November 1997

Pacific Oils 2000: An International Conference on Plant Oils and Marine Lipids

Venue: Auckland, New Zealand

Contact: Professor Con Cambie, Conference Chairman

Chemistry Department

University of Auckland

Private Bag 92019

Auckland, New Zealand

Tel: (+64-9)-3737999 ext. 8259

Fax: (+64-9)-3737422

Email: c.cambie@auckland.ac.nz

2-5 December 1997

13th Symposium on Biological Macromolecules and Ligands: Structure, Interactions and Applications

Venue: Quezon City, Philippines

Contact: Dr Gisela P Concepcion

University of the Philippines

Marine Science Institute

Quezon City 1101

Republic of the Philippines

Tel and Fax: (+63-2)-9213799

13-17 July 1998

MACRO 98 AUSTRALIA

37th IUPAC International Symposium on Macromolecules

Venue: Gold Coast, Queensland, Australia

This forefront conference will bring together polymer-oriented scientists, technologists, educators and students from all areas of the scientific community: academia, industry and government. It will provide an international forum for the communication and discussion of general and specific contemporary topics of interest to the polymer community.

The conference will embrace both the fundamental and applied aspects of polymer chemistry, polymer physics, materials, technology and engineering. The program will focus on a number of broad themes which will incorporate a range of symposia, involving plenary and invited lectures, and contributed verbal and poster presentations. Plenary speakers will be Professor J Economy (USA), Professor J Feast (UK), Professor A Khokhlov (Russia) and Professor Y Tabata (Japan). A special International Symposium will be held in honour of the late

Professor Jim O'Donnell.

Contact:

MACRO 98 Secretariat

Chemistry Department, University of Queensland

Brisbane, Queensland 4072

Australia

Fax: (+61-7)-33654299

E-mail: macro98@chem.chemistry.uq.edu.au

Homepage:

<http://www.uq.edu.au/~cmawhitt/macro98.html>

2-7 August 1998

The 9th International Symposium on Novel Aromatic Compounds (ISNA-9)

Venue: The Hong Kong Convention and Exhibition Centre

Contact: Professor B Halton

Chemistry Department

Victoria University

P O Box 600

Wellington

Fax: (+64-4)-4955241

Email: brian.halton@vuw.ac.nz

6-11 February 2000

RACI 11th National Convention

Venue: Canberra, ACT, Australia

Contact: Dr W D Cook

Department of Materials Engineering

Monash University

Clayton VIC 3168, Australia

Tel: (+61-3)-99054926

Fax: (+61-3)-99054940

Email: WDCOOK@eng2.eng.monash.edu.au

14-19 December 2000

Pacificchem 2000

Venue: Waikiki, Honolulu, Hawaii

Contact: Professor B Halton

Chemistry Department

Victoria University

P O Box 600

Wellington

Fax: (+64-4)-4955241

Email: brian.halton@vuw.ac.nz

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NEW LITERATURE & MEDIA

OCCL'S WORLDCAT: THE WORLD'S LARGEST ON-LINE LIBRARY CATALOGUE NOW AVAILABLE ON STN INTERNATIONAL

STN International and the OCLC On-line Computer Library Centre, Dublin, Ohio, have agreed to provide access to WorldCat, the OCLC On-line Union Catalogue, to STN users through a Z39.50 gateway. FIZ Karlsruhe, the STN European Service Centre, and Chemical Abstracts Service (CAS), the STN North American Service Centre, are working in cooperation with OCLC to link STN and OCLC mainframe computers.

Implemented during the last quarter of 1996, this step provides STN users with the advantage of complementing their searches in scientific and technical databases with the contents of OCLC's WorldCat database. There will be a direct telecommunication line between the mainframes of STN and OCLC. Via this gateway (ANSI Z39.50 protocol), STN users will be able to search the WorldCat database using the familiar STN retrieval language, Messenger. Fees to STN users are charged by connect-hour and display.

WorldCat is the world's largest bibliographic database, containing more than 35 million records and more than 600 million location listings. It is a dynamic storehouse of knowledge, growing at the rate of a new record every 15 seconds. More than 23,000 libraries worldwide use or contribute information to WorldCat, including over 20,000 North American libraries, 774 European libraries and world renowned libraries such as the Library of Congress, the British Library, the National Library of Canada, and many other major libraries, as well as smaller special libraries of all types. The database contains information about books, journals, audiovisual media, maps, sound recordings, archives, manuscripts, music scores and computer files. Records in WorldCat contain bibliographic information including location data. Coverage spans 4000 years of recorded knowledge from 2,000 BC to the present.

The three partners are convinced that this cooperation will bring about further advances in the provision of fast, reliable and comprehensive information for science and education, research, business and administration.

"We are pleased to be able to provide the STN community with access to WorldCat," said John Hearty, Director, Reference Services Business Development Division, OCLC. "This is in keeping with OCLC's mission of furthering access to the world's information and reducing the costs of that information. STN customers will find that WorldCat is a valuable source of scientific bibliographic information, including which libraries hold the items."

"Providing access to OCLC's WorldCat constitutes an upgraded service for our customers, and not only for those from libraries," stated Professor Schultheiss, Scientific Director of FIZ Karlsruhe. Besides a fast on-line search for literature records, a direct reference to the worldwide locations is important to ensure

swift delivery of original literature. The retrieved literature can be quickly obtained also by on-line ordering from one of the 30 document suppliers linked with STN International. Already available on-line on STN is the TIBKAT catalogue of the holdings of the German Central Special Library for Technology and Science, Hanover.

STN EASY GIVES SCIENTISTS AND OTHERS EASY ACCESS TO COMPREHENSIVE, HIGH-QUALITY SCIENTIFIC INFORMATION

STN International has launched STN Easy, a new Web-based service that provides anyone with an interest in science and technology user-friendly access to the acclaimed STN scientific and technical information network.

STN Easy provides point-and-click World Wide Web access to selected databases on STN International, the leading on-line host for science and technology. More STN databases will be made accessible through STN Easy in the future. Without any knowledge of databases or search commands, anyone can use STN Easy to find and display information about chemistry, life sciences, patents, pharmaceuticals, physics, math/computer sciences, engineering, and general science. Material Safety Data Sheets are also available. "STN provides integrated access to the world's most important scientific information sources," said CAS Director Robert J Massie. "STN Easy will now bring these databases to the World Wide Web. STN Easy has an elegantly simple front end that will be instantly familiar to Web users."

STN Easy offers two levels of searching: a basic level that requires no experience in scientific searching or with the World Wide Web itself, and an advanced level for those with intermediate skills. A person using basic searching can simply select a subject category or database and enter a few words indicating the topic to be searched. Adding additional qualifying terms serves to focus the search more narrowly. Advanced searching allows a person to choose a subject category or database, select Boolean operators, and specify other qualifiers such as the name of the author or company. The results of a search can be organised chronologically or by relevance.

Existing STN customers have immediate access to STN Easy. New customers may establish accounts on the STN Easy Web page, which will assign an STN Easy user identification number and password. STN Easy has no monthly fee or hourly connect charges; searchers are charged a flat search fee and pay for each answer displayed.

Both a demonstration and the product itself can be accessed at one of three Web locations, depending on customer location. From Europe, contact <https://stneasy.fiz-karlsruhe.de>. From Japan, contact <http://stneasy-japan.cas.org>, and from North America, contact <http://stneasy.cas.org>. Other locations can choose the nearest access point. Although all questions must be entered in English and all answers are returned in English, users may display the STN Easy page in German, Japanese or English.

AEROSPACE: INTERNATIONAL DATABASE ON AEROSPACE RESEARCH AND DEVELOPMENT

Since the end of August 1996, AEROSPACE, an international aeronautics and astronautics database is offered through the on-line service STN International. The bibliographic database covers published literature on aerospace research and development in over 40 countries in the fields of aerospace and related sciences. Information on basic and applied research in aeronautics, astronautics, and space sciences, as well as technology development and applications in complementary and supporting fields can be found in the database.

AEROSPACE is the online equivalent of the printed *International Aerospace Abstracts (IAA)*, published by the American Institute of Aeronautics and Astronautics. It also contains reports issued by NASA, other US government agencies, international institutions, universities, and private firms.

The database contains more than 2 million records, and is updated monthly with approximately 3,000 new and updated records. The records contain bibliographic information, abstracts, and controlled terms. A detailed and sophisticated on-line thesaurus enables a comprehensive and specific search. All information is searchable.

STN uniquely offers a companion file, DELURA, the German aerospace database. DELURA represents the German contribution to the European Space Agency (ESA) database, containing 27,000 records in the fields of aeronautics and astronautics. Producer of the database is FIZ Karlsruhe.

A combined search in these two aerospace databases provides comprehensive search results.

* * * * *

For further information, please contact:
STN International c/o FIZ Karlsruhe
Electronic mailbox STNmail: HLPDESKK
Internet: hlpdeskk@fiz-karlsruhe.de
or WWW server of FIZ Karlsruhe: <http://www.fiz-karlsruhe.de>
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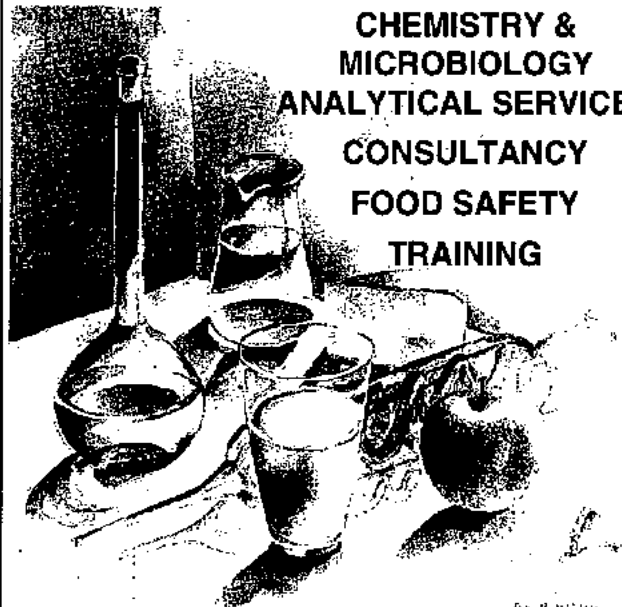
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- YSI 85 DO and Conductivity Meter: The new YSI 85 is a unique handheld field meter that simultaneously measures salinity, conductivity, dissolved oxygen and temperature. Screw-on dissolved oxygen cap membranes make field replacement quick and easy.
- YSI 55 Handheld DO Meter: The YSI 55 is a rugged meter for field work with a waterproof case and a weighted probe that sinks quickly. Probe cables come in lengths of 12, 25 and 50 feet.



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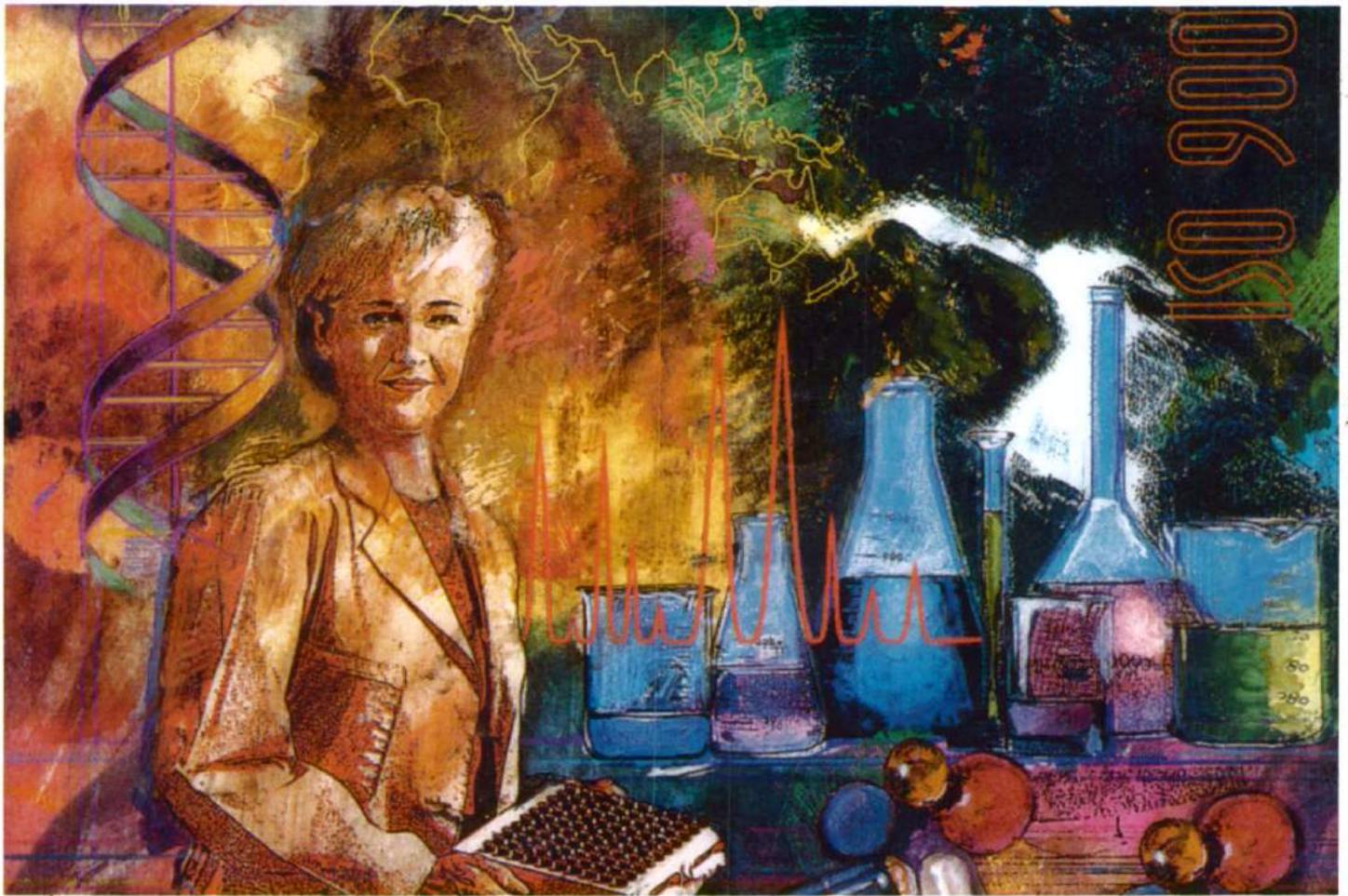
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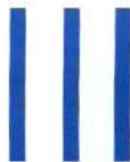
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<p>1. SURNAME: _____ INITIALS: _____ TITLE: _____</p> <p>INSTITUTION OR COMPANY: _____</p> <p>DEPARTMENT: _____</p> <p>ADDRESS: _____</p> <p>TEL: _____ FAX: _____</p> <p>EMAIL: _____</p>	<p>2. YOUR FUNCTION (please tick)</p> <p>MANAGEMENT <input type="checkbox"/></p> <p>RESEARCH/ <input type="checkbox"/></p> <p>DEVELOPMENT <input type="checkbox"/></p> <p>PRODUCTION <input type="checkbox"/></p> <p>QA/QC <input type="checkbox"/></p> <p>TEACHING <input type="checkbox"/></p> <p>PURCHASING <input type="checkbox"/></p> <p>CONSULTING/ADVISORY <input type="checkbox"/></p> <p>OTHER (please specify) <input type="checkbox"/></p>																																																												
<p>3. WHAT EQUIPMENT/TECHNIQUES DO YOU USE? (please tick)</p> <p>GC/GC-MS <input type="checkbox"/></p> <p>UV/VISIBLE SPECTROSCOPY <input type="checkbox"/></p> <p>AA SPECTROSCOPY <input type="checkbox"/></p> <p>NMR <input type="checkbox"/></p> <p>THERMAL ANALYSIS <input type="checkbox"/></p> <p>MICROSCOPY <input type="checkbox"/></p> <p>pH/ELECTROCHEMISTRY <input type="checkbox"/></p> <p>CENTRIFUGES <input type="checkbox"/></p> <p>XRF or XRD <input type="checkbox"/></p> <p><input type="checkbox"/> HPLC/LC</p> <p><input type="checkbox"/> FLUORESCENCE SPECTROSCOPY</p> <p><input type="checkbox"/> ICP, ICP-MS</p> <p><input type="checkbox"/> POLYMERASE CHAIN REACTION</p> <p><input type="checkbox"/> FTIR/IR SPECTROSCOPY</p> <p><input type="checkbox"/> ELEMENTAL ANALYSIS</p> <p><input type="checkbox"/> PARTICLE SIZE ANALYSIS</p> <p><input type="checkbox"/> MASS SPECTROSCOPY</p> <p><input type="checkbox"/> OTHER (please specify) _____</p>	<p>4. I WOULD LIKE TO KNOW MORE ABOUT BECOMING A MEMBER OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY. PLEASE SEND ME DETAILS.</p> <p>Please tick <input type="checkbox"/></p>																																																												
<p>5. I AM INTERESTED IN FURTHER INFORMATION ON THE FOLLOWING NUMBERED PRODUCTS. (CIRCLE THE CORRESPONDING NUMBER FROM THE BASE OF THE ADVERTISEMENT OR ARTICLE)</p> <table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td> </tr> <tr> <td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td> </tr> <tr> <td>31</td><td>32</td><td>33</td><td>34</td><td>35</td><td>36</td><td>37</td><td>38</td><td>39</td><td>40</td><td>41</td><td>42</td><td>43</td><td>44</td><td>45</td> </tr> <tr> <td>46</td><td>47</td><td>48</td><td>49</td><td>50</td><td>51</td><td>52</td><td>53</td><td>54</td><td>55</td><td>56</td><td>57</td><td>58</td><td>59</td><td>60</td> </tr> </table>		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
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